Response to Comments Document

Tennessee Gas Pipeline, LLC

7650 Whites Creek Pike

Joelton, Tennessee

Response to Comments

The following pages compile the comments received during the Metro Public Health Department (MPHD), Air Pollution Control Division's (APC) public hearing and public comment periods. Comments were received at the hearing, by e-mail, and by hardcopy. Since this document is a compilation of several documents, page numbers in the Table of Contents refer to the electronic page number of the overall document.

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Important Dates

Date of Public Notice:	June 21-23, 2016
Date of Public Hearing:	July 27, 2016
Close of Comment Period:	August 3, 2016

Public Hearing Information

Hearing Officer:	Dr. William Paul, Director, Metro Public Health Department
Other MPHD Staff:	Dr. Sanmi Areola, Mr. John Finke, Mr. Blake McClain
Public:	Approximately 200

Overall Comment Summary

The following is MPHD APC's response to comments received during the public hearing and public comment periods regarding the draft construction and Part 70 (Title V) operating permits for the natural gas compressor station proposed by Tennessee Gas Pipeline, LLC, 7650 Whites Creek Pike, Joelton, Tennessee. The oral and written comments received are included in this document.

The public hearing was very well attended, with approximately 200 in attendance. At the hearing, there were approximately two hours of verbal comments recorded. Many of those in attendance also provided written comments. In accordance with MPHD regulations, the hearing remained open for an additional seven days to accept additional written comments.

In the "General Topics" section, MPHD addresses issues that were brought up by multiple commenters. Throughout the response document, corresponding "General Topics" are referenced when applicable. Specific, individual comments are addressed as appropriate. In some cases, comments were very lengthy and have been summarized in this document. The transcript from the public hearing is located in Appendix I. All written comments, in their entirety, are located in Appendix II of this document.

Not all of the comments addressed the subject of the public hearing and public comment period, the proposed construction and Part 70 Operating permits. However, as a part of the MPHD, APC has attempted to respond to all of the health-related concerns raised by the public. In some cases, APC has had to refer the commenter to a more appropriate agency, better suited to address the comment.

General Topics

As stated above, this section attempts to address some of the recurring themes that appeared throughout the public hearing and written comments. This section will be referenced throughout the response document.

Health Protection

The Clean Air Act (CAA) requires the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. These NAAQS are set for six "criteria" pollutants: ground level ozone, particulate matter, carbon monoxide, lead, sulfur dioxide, and nitrogen oxides. The CAA identifies two levels of NAAQS. ***Primary standards*** provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. ***Secondary standards*** provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. The Clean Air Act requires periodic review of the science upon which the standards are based and the standards themselves to ensure they provide the public with an adequate margin of safety. These reviews are conducted on five year intervals.

Air Pollution Control Agencies achieve and maintain the NAAQS by promulgating, implementing and enforcing regulations that impose emission restrictions, control techniques and work practices on different types of stationary sources. All facilities are going to be responsible, directly or indirectly, for some level of pollution. Any building, home, or vehicle that uses electricity or burns fuel has an effect on ambient air quality. By enforcing these air pollution-related regulations, the agency ensures that no one regulated source has a significant, adverse effect on the ambient air quality. Implementation of the regulations allows us to maintain the applicable NAAQS, and thus, protect the health of the public. When NAAQS are revised to more stringent levels that result in an area being designated "non-attainment," the agency undertakes additional rulemaking that applies throughout the area of concern to bring the entire area back into attainment with the NAAQS.

Potential emissions from the proposed facility were modeled using EPA-approved methods to ensure compliance with the NAAQS. The full modeling analysis can be found in Appendix III

Permitting Process

In order to receive an air permit in Davidson County, a facility must demonstrate that they can comply with all applicable air pollution regulations. By doing so, a facility should be able to operate without significantly impacting ambient air quality or interfering with attainment or maintenance of the NAAQS. To ensure this compliance, a permit may require the permittee to

meet a number of conditions, including but not limited to stack testing, periodic monitoring, monitoring of control devices, recordkeeping and reporting.

Throughout the permitting process, the permitting authority must focus on the applicable air pollution regulations in effect. Issuance of an air pollution permit is a ministerial function. If MPHD determines that the applicant meets all applicable air pollution–related requirements, it has no choice, under the law, but to issue the permit.

Zoning

Metro Code Section 10.56.020 (H) is preempted by federal law as it relates to this project. The Natural Gas Act preempts state and local governments from regulating the location and siting of natural gas facilities (*See AES Sparrows Point LNG, LLC v. Smith*, 527 F.3d 120, 125–26 (4th Cir.2008)). An exception to this federal preemption exists if the facility would violate regulations adopted pursuant to the Clean Air Act. Tennessee adopted a State Implementation Plan to bring Tennessee into compliance with the National Ambient Air Quality Standards of the Clean Air Act. On March 9, 2017, the Tennessee Air Quality Control Board denied the Metropolitan Government's request to include MCL §10.56.020(H) into Tennessee's State Implementation Plan. Recently, the Tennessee General Assembly amended TCA § 68-201-115 prohibiting a municipality or county from even requesting the Board to include land use or zoning requirements in the State Implementation Plan. Therefore, Code Section 10.56.020 cannot affect the siting of Tennessee Gas's compressor station.

Fugitive Emissions Monitoring

Estimated fugitive emissions from equipment leaks were included in the permit application submittal from September 15, 2015. The collection of fugitive emission components in natural gas service, accounted for in the permit application, include connectors, flanges, valves, open ended lines, pump seals, and other components. The estimated emissions were calculated using emission factors from the document "EPA Protocol for Equipment Leaks Emission Estimate" (EPA-453/R-95-017) while component counts were based on design data. Speciation of natural gas and condensate were also estimated in the application to provide a more accurate representation of volatile organic compounds (VOC), hazardous air pollutants (HAP), and greenhouse gas (GHG) fugitive emissions from components at the proposed facility.

Over time, leaks are expected from any system of piping. EPA recognized the potential for fugitive emissions from the connections mentioned above. When proposing and finalizing 40 CFR Part 60, Subpart OOOOa - *Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources*, EPA established a leak detection and repair program for natural gas compressor stations. The regulation is not intended to completely eliminate system leaks, but to formalize a program for defining, identifying and repairing leaks to minimize their impacts. EPA evaluated several scenarios regarding the monitoring frequency for the fugitive

emissions components at compressor stations. EPA assessed annual, semiannual, and quarterly monitoring frequencies for cost-effectiveness in reducing (GHG) and VOC emissions from fugitive emissions components. Based on their evaluation, EPA determined a quarterly monitoring frequency for the collection of fugitive emissions components at compressor stations was effective in ensuring the maximum amount of emission reductions. Additionally, EPA states the cost-effectiveness of controlling VOC emissions decreases as monitoring frequency increases. When factors such as cost-effectiveness, potential compliance burden, and resulting emission reductions are included in the evaluation of monitoring frequency, the quarterly monitoring requirement achieves meaningful reduction of both GHG and VOC emissions.

The proposed facility will be required to develop a leak detection and repair program in accordance with the above regulation that will be reviewed by the permitting authority. Quality assurance and quality control of the data will be a part of any approvable monitoring program. Under this approved plan, discovery of a leak would not be a violation, unless the permittee fails to respond to their findings in the appropriate manner, as it is addressed in the approved plan.

Site Selection

The evaluation of alternative sites for the proposed natural gas compressor station is not under the authority of the MPHD. MPHD is responsible for determining whether any proposed source within Davidson County, which makes application with the APC, will comply with the requirements of Chapter 10.56, "Air Pollution Control" of the Metropolitan Code of Laws and all other applicable local, state and federal air regulations.

As outlined in Section 3.5.4 of FERC's Broad Run Project Environmental Assessment (Pages 127-129) of Appendix IV, an assessment of 12 alternative sites (six within Davidson County) was performed in order to determine whether these locations provide any significant environmental advantages over the currently proposed site. FERC's evaluation of alternative sites includes the assessment of various environmental factors such as topography, farmland, site acreage, pipeline footprint, forested land, water sources, seismic activity, residential properties, and park and recreation areas. Based on an assessment of all of these environmental factors, FERC concluded "that none of the alternatives offer significant environmental advantages over the proposed site for Compressor Station 563."

Section 10.56.170

Section 10.56.170 of the Metropolitan Code of Laws states:

> "No person shall cause, suffer, allow or permit any emission of gases, vapors or objectionable odors beyond the property line from any source whatsoever which causes injury, detriment, nuisance or annoyance to any considerable number of persons or to

the public, or which causes or has a natural tendency to cause injury or damage to business or property."

As stated under **General Topics: Health Protection**, gases in the form of criteria pollutants are addressed through the National Ambient Air Quality Standards. By implementing regulations that keep ambient concentrations below these levels, gases that travel beyond the property line should not cause injury to the public or damage to property. In much the same way, hazardous air pollutants are addressed through National Emission Standards for Hazardous Air Pollutants. Please see **General Topics: Hazardous Air Pollutants**. Section 10.56.170 is intended to account for the remaining gases/odors that may leave a given property. MPHD will investigate active odor complaints to determine their source and take steps to ensure corrective actions are taken.

Hazardous Air Pollutants

A number of other pollutants, in addition to the "criteria" pollutants that have NAAQS, may be emitted from an emissions source. Pollutants such as benzene, formaldehyde, ethyl benzene, xylene and toluene are known as "hazardous" air pollutants. There are no ambient air quality standards for these pollutants. However, there are federal requirements that must be met for certain types of facilities expected to emit these pollutants in large enough amounts. National Emission Standards for Hazardous Air Pollutants (NESHAP) are federal regulations written for specific source types that are known to emit these pollutants which are known or suspected to cause cancer or other serious health effects.

The only NESHAP that applies to the proposed facility is 40 CFR Part 63, Subpart ZZZZ – National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines. This requirement will require a specific classification of engine for the emergency generator.

Although there are no other underlying requirements for Hazardous Air Pollutants, it was an area of great concern and one the MPHD wanted to address. To assess the potential health effects from exposure to hazardous or toxic air pollutants that may be emitted from the proposed source, air quality modeling was performed to identify the maximum 1-hour airborne concentration for each hazardous air pollutant. These concentrations were compared to the U.S. Environmental Protection Agency's (EPA) established Reference Concentrations (RfC) for non-cancer risks, and the EPA's Inhalation Unit Risk (IUR) for cancer risks, as applicable. The RfC is the concentration of a chemical that an individual can breathe every day for a lifetime that is not anticipated to cause harmful non-cancer health effects. The IUR is an estimate of the increased risk of cancer from an exposure to a concentration of 1 microgram per cubic meter for a lifetime. All of the modeled concentrations were well below the applicable RfC. Additionally, when compared with the IUR, the modeled concentrations of all compounds indicated no significant lifetime cancer risks.

Pipeline Safety

Section 2.10 of the Federal Energy Regulatory Commission (FERC) Broad Run Project Environmental Assessment (Docket No. CP15-77-000) in Appendix IV states the following, in part, regarding natural gas pipeline reliability and safety:

> "The compressor stations must be designed, constructed, operated, and maintained in accordance with the U.S. Department of Transportation (DOT) Minimum Federal Safety Standards in 49 CFR Part 192. The regulations are intended to ensure adequate protection for the public and to prevent facility accidents and failures.
>
> Part 192.163–192.173 of 49 CFR specifically addresses design criteria for compressor stations, including emergency shutdowns and safety equipment. Part 192 also requires a pipeline operator to establish a written emergency plan that includes procedures to minimize the hazards in an emergency.
>
> Additionally, the operator must establish a continuing education program to enable the public, government officials, and others to recognize an emergency at the facility and report it to appropriate public officials. Tennessee Gas Pipeline Company, LLC (Tennessee) would provide the appropriate training to local emergency service personnel before the facilities are placed in service.
>
> We received comments expressing concern about the safety of high pressure gas pipelines. Natural gas pipelines must be operated and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. The DOT specifies material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion. Any natural gas facility has some degree of risk and, although any structure will eventually degrade, the DOT rules require regular inspection and maintenance, including repairs as necessary, to ensure the pipeline has adequate strength to transport the natural gas safely.
>
> Under a Memorandum of Understanding (MOU) on Natural Gas Transportation Facilities dated January 15, 1993, between the DOT and the FERC, the DOT has the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of the FERC's regulations require that an applicant certify that it will design, install, inspect, test, construct, operate, replace, and maintain the facility for which a Certificate is requested in accordance with federal safety standards and plans for maintenance and inspection. Alternatively, an applicant must certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with Section 3(e) of the Natural Gas Pipeline Safety Act. The FERC accepts this certification and does not impose additional safety standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the Memorandum to promptly alert DOT. The MOU also provides for referring complaints and inquiries made by state and local governments and the general public involving

safety matters related to pipelines under the Commission's jurisdiction. The FERC also participates as a member of the DOT's Technical Pipeline Safety Standards Committee which determines if proposed safety regulations are reasonable, feasible, and practicable."

Noise

Section 17.28.090, "Noise" of Chapter 17.28, "Environmental and Operational Performance Standards," of the Metropolitan Code of Laws outlines the sound level requirements for continuous and intermittent noise from machinery or equipment as well as commercial and industrial activities. Section 17.28.090 also outlines the maximum sound level for properties zoned industrial and agricultural, which is 75 dBA at the property line at all times.

As outlined in FERC's Broad Run Project Environmental Assessment (Pages 107-110) of Appendix IV, EPA recommends "that in order to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed a day-night average sound level (L_{dn}) of 55 dBA." FERC has adopted this noise level recommendation for new compressor stations proposed in the Broad Run Project. Table 2-30 of FERC's Broad Run Project Environmental Assessment outlines the estimated noise levels of the nearest noise sensitive areas (NSA) around the proposed location of the facility. This table states the maximum estimated noise level at a NSA around Compressor Station 563 will have an L_{dn} of 51.7 dBA . The table also states the maximum estimated increase in ambient noise level at each NSA to be no more than 4.0 dB.

FERC's Broad Run Environmental Assessment continues by stating that the new compressor stations have been designed to comply with the FERC regulatory limits and local noise limits where applicable. The report also states the following regarding noise mitigation measures at the new compressor station: "The estimated noise impacts for the compressor stations incorporate mitigation measures. The turbines and turbine-driven compressors would be installed within acoustically designed buildings, including sound insulated metal roofs, walls, and roll-up doors. Building vent silencers and solar turbine inlet and exhaust custom silencers would also be incorporated. Above ground piping would include lagging, which is composite material used to reduce flow noise levels in pipes."

Finally, FERC states the following regarding noise at the proposed Broad Run Project facilities: "Based on the noise analyses above and our recommendation, we conclude that operation of the Project would not have a significant impact on the noise environment in the vicinity of the compressor stations." If residents believe there is a specific problem with the facility, people are encouraged to call the Kinder-Morgan Hotline at 1-800-231-2800 or the FERC Enforcement Hotline at 1-888-889-8030.

Venting

There were several comments received about the frequency and amount of pollution associated with "blowdowns," or the venting of process equipment within the compressor station facility. Venting within the facility happens for two reasons. Gas is vented to depressurize sections of pipe in the compressor station yard to allow for maintenance or under emergency situations. When gas is vented, it is done under controlled conditions that are specifically designed to allow depressurization to be performed safely. In either event, the amount of natural gas released is approximately the same. It is estimated that the venting process will take between five (5) and ten (10) minutes and will pass through "silencers" to minimize the noise at nearby residences. The majority of the natural gas is comprised of methane and ethane. These are not "criteria" or "hazardous" air pollutants. Emissions of volatile organic compounds or hazardous air pollutants from one of these events will be negligible (≈ 5 lbs.).

Area of Impact

FERC's Environmental Assessment states, in part, "[t]he region of influence considered for cumulative impacts on air quality is at least 50 km surrounding each compressor station." This means that they evaluated out that far. MPHD does not interpret this to mean that each compressor station will have a significant impact out 50 km. Some concerns have been voiced about the 50-kilometer "radius of impact" for each of the two proposed pipeline compressor stations in Davidson County. Particular concern was raised about the fact that, when plotted on a map, the circles around the two facilities overlap over downtown Nashville

The 50-kilometer "radius of impact" is the maximum range at which concentrations can be modeled using EPA's near-field dispersion model, AERMOD. This does not necessarily imply that the source will have an impact over the entire 50 km radius around the source. Dispersion characteristics and meteorology, as well as other factors determine the area of greatest impact at any given time. Due to prevailing winds, the emissions from two sources, one on each side of Nashville, would not likely converge over Nashville.

According to 40 CFR Part 51, Appendix W, "Guidelines for Air Quality Models", the selection of receptors at which to evaluate modeled impacts should give "sufficient detail to estimate the highest concentrations and possible violations of a NAAQS…" In the modeling analysis performed by the Pollution Control Division, a grid was used with receptors at 100-meter spacing, out to a distance of 5,000 meters from the source. The maximum modeled concentrations for each pollutant and averaging time generally occurred at or within a couple hundred meters from the facility property line. Modeled concentrations dropped steadily as the distance from the source increased, with concentrations at 5,000 meters (5 km) generally being no more than 1-5 percent of the maximum concentration. Results of MPHD's modeling can be found in Appendix III.

Environmental Justice

Concerns were raised with respect to Environmental Justice in minority and low income populations. One commenter felt FERC had improperly characterized the area surrounding the project and felt it was more appropriate to use the entire Davidson County Council District 1. This approach would have included land more than 13 miles from the proposed facility. Using EPA's Echo website and a five mile radius around an existing source, the commenter arrived at a population density of 742 people per square mile, 62 percent minority, and 42 percent low income. Through conversations with EPA Region 4, MPHD learned that EPA prefers to evaluate an area that encompasses approximately 3 miles from the proposed source. Using EPA's Environmental Justice Screening Tool (EJSCREEN), MPHD selected a square grid approximately 7 miles on a side (ensuring capture of at least 3 miles in every direction from the proposed source). The attached EJSCREEN Report (Appendix V) shows a population density of 131 people per square mile, 8 percent minority, and 24 percent low income. The minority and low income population statistics were below state, EPA Region and national averages. For these reasons, APC does not feel that Environmental Justice is an immediate concern for the proposed source.

RACT Analysis

The source has the potential to emit 100 tons per year or more of NOx and is, therefore, subject to MCL 14-2, "Emission Standards," which requires the use of Reasonably Available Control Technology (RACT) in controlling NOx emissions. EPA and Section 14-1, "Definitions" define RACT as the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. The facility will operate two gas-fired turbines, one process heater, and one natural gas-fired emergency generator, all of which are subject to the application of RACT.

In regards to the two natural gas turbines rated at 208 MMBtu per hour, each, and based on the RACT analysis submitted to the Metro Public Health Department (MPHD) on September 15, 2015, this office agreed that the use of dry low-NOx combustion that ensures a uniform air/fuel mixture as well as good operating practices should be considered RACT for this source. Additionally, the implementation of this technology is considered technically and economically feasible. These two control options, as proposed together, would have achieved compliance with the category-wide NOx emission limitation of 25 ppmv outlined in Subpart KKKK.

A RACT analysis was also performed to evaluate NOx control technology for one 1,500 kW natural gas-fired emergency generator as part of the permit application submitted to the Pollution Control Division on September 15, 2015. Based on the RACT analysis, it was determined that low-emission combustion, which involves air-fuel ratio adjustments, and good operating practices, which includes proper design, maintenance, and combustion techniques, met the RACT requirement.

The RACT analysis to evaluate NOx control technology for the natural gas-fired boiler rated at 4.6 MMBtu per hour was performed as part of the permit application submitted to the Pollution Control Division on September 15, 2015. Based on the RACT analysis, it was determined the use of a low-NOx burners and good operating practices, met the RACT requirement.

During the public comment period, MPHD received several comments pertaining to the application of NOx RACT to this source, in particular, the two proposed gas-fired turbines. Commenters claimed that gas-fired turbines around the country had been installed which are able to achieve a NOx emission rate of at least 9 ppmv. Commenters added that in some cases, the addition of SCR, which has the ability to achieve a NOx emission rate of 2.5 ppmv, was considered RACT. Each of the gas-fired turbines identified by commenters as capable of 9 ppmv were for smaller models than those being proposed. However, APC requested the source perform a new RACT analysis, using recently published EPA guidance, assessing the technical and economic feasibility of achieving lower emission rates.

Follow-up with the turbine manufacturer revealed a Titan 250 model turbine which could achieve a NOx emission rate of 15 ppmv using dry low-NOx technology which was commercial proven. As a result, the source was requested to include the feasibility of this option to the requested RACT analysis. In response to the request, the source committed to install two Titan 250 natural gas-fired turbines equipped with dry low-NOx technology with a manufacturer guaranteed NOx emission rate of 15 ppmv.

MPHD continued to receive additional input from the public regarding the proposed performance level of dry low-NOx and the final SCR cost analysis performed by the facility. As a result, Metro Government obtained the services of a third-party contractor to perform an independent RACT analysis (Appendix VI). The technical and economic feasibility of SCR, electric driven turbines, and various dry low-NOx performance levels were assessed.

Based on economic feasibility, SCR was eliminated as a NOx emission control. Based on collateral NOx emissions and significant high costs, electric driven compressor turbines were excluded from consideration. Titan 250 models with two warranted NOx emission rates were determined to be technically and economically feasible. One is warranted to meet exhaust concentrations of 15 ppmv at 15% oxygen over an operating range of 40% to 100%. The other is warranted to meet exhaust concentrations of 15 ppmv over an operating range of 40% to 80% and 9 ppmv over an operating range of 80% to 100%, both at 15% oxygen.

Since RACT is the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility, it was determined that the Solar Titan 250 equipped with dry low-NOx technology and warranted at NOx emission rates of 15 ppmv over an operating range of 40% to 80% and 9 ppmv over an operating range of 80% to 100% at 15% oxygen would be required to comply with Regulation No. 14.

Comments and Responses

Commenter:	Representative Bo Mitchell
Comment:	Thank you -- thank you, Dr. Paul. I'm just standing here before you as the representative of this community, and in a representative democracy I am proud of all these citizens who have taken time -- many have taken their -- time off of work to be here today to show that they care about their community. It's their public health that we're here talking about today, and they're making it very clear that they're concerned about their health and their air quality in the future if this is allowed to go forward. From my understanding, in other parts of the country precedent has been set by the health department in other cities and city governments in other parts of the country by not allowing this permit to go forward. It would circumvent any federal intervention on local ordinances if this department in the City protects these people from the potential risk of the air quality as well as the increased pressure that's being put upon this pipeline that's going to maybe create explosive activity along the pipeline. But my question to the committee today is ambient air monitors -- I think the nearest one to where this facility is going to be placed – the nearest ambient air monitor would be in the Trinity Lane area. And I'm just putting forth to the public health department: Will you commit to these citizens that you will put another monitor maybe at the Paradise Ridge Park, where this is being built near, where our children are going to be playing that we can monitor the air quality in the future if this is allowed to go forward? So I -- I request that from the public health department, that you address that issue in the future. Thank you.
Response:	Please see **General Topics: Health Protection and Permitting Process**. Additional monitoring may be considered in the future. However, any such study would be independent of the permitting process.
Commenter:	Senator Steve Dickerson
Comment:	Good evening. And, Dr. Paul, thank you for letting us speak today. And I would just sort of amplify and build on what Representative Mitchell said. The people here are concerned about air quality, quality of life, water quality. It goes -- the -- the list goes on and on. I come to this not only as a senator, but with my professional perspective as a

	doctor. And there are two things -- I want to sandwich this. First of all, one of the adages in medicine is first do no harm. And I'm concerned that if we move forward with this, we cannot guarantee the citizens of Joelton that this will do no harm to their quality of life and environment. Specifically, as I understand the federal demands or regulations, we have to monitor the release of things like volatile -- or volatile gases every three months or so, and I'm concerned that in the intervening time there can be significant releases at various points along the pipeline that actually will be releasing significant amount of toxic volatile organic gases into the environment. And so my second point about being a physician, to me, that would be like having a diabetic patient only monitoring their blood sugar every year or two. I think we need to have much more realtime capability so we can keep track of this and make sure that we are not missing a significant hazard to the air quality. So thank you for your time.
Response:	Please see **General Topics: Fugitive Emissions Monitoring.**
Commenter:	Mr. Bill Powers
Comment:	Very good. My name is Bill Powers, Powers Engineering, San Diego, California. I'm a consultant to Southern Environmental Law Center, commenting on the air permit emission -- And I will proceed. The -- quick context. There are many compressor stations going into this region. The Joelton station is the biggest. All of the other stations have lower emission limits on a unit basis than Joelton. Kinder Morgan in Pennsylvania -- almost the same day this permit application was filed, filed an application for a similar turbine, 70 percent less NOx emissions. Part of this permit is a reasonably available control technology analysis to put on the best controls for a reasonable amount of cost on these units. Kinder Morgan in this analysis ignored the same technology that was used in that Pennsylvania application that would reduce those emissions by 70 percent. They're just not in this application. They don't show up in that RAC analysis. Two of the four were eliminated by omission. Another catalytic control, which is the best, was included, but then it wasn't analyzed. What you end up with is the lowest common denominator, which is the emission limit that is proposed. This standard is based on cost. Yet no cost standard was put into the analysis by Tennessee Gas Pipeline Company nor was the -- did Metro insist on it. As a result, there's no point of reference to know what technology is cost feasible. The analysis that I put together which will be submitted as a written comment, any of these technologies would pass the reasonable -- reasonableness test on cost that other states that have set a number for it, $5,000 a ton, $3,000 a ton, have established. You can insist on the best technology for this station. It would reduce your emissions 90 percent, and it would still meet that cost test. And I would be happy to work with Metro Nashville to share the information that I've got to move this

	forward so that the best technology is put on these units. Thank you.
Response:	Please see **General Topics: RACT Analysis.**
Commenter:	Dr. William Robertson
Comment:	All right. My name is William Robertson. Oh, you want your card? My name is William Robertson. 1310 Roberts Road, Goodlettsville, Tennessee. My question -- my question is really not just a question. It's a comment, and it's something -- I'll be putting a written record in. The proposed site for the Joelton compressor station is invalid for engineering reasons. Okay. The Kinder Morgan representative said that they had evaluated 13 sites. If you look at that evaluation of the 13 sites on the metrics they gave, there are at least five sites that are better suited – alternate sites that are better suited. But more importantly, there are sites – the site chosen does not split the distance between the two compressor stations on either side. There's a station in Portland and a station in Centerville. The – it splits about one-third, two-thirds. From an engineering point of view, the most efficient way to put a compressor station is to put it in the middle. Okay. And so they have not chosen -- they have chosen something -- the Joelton site is not in the middle. It's about one-third of the way along. If you did change -- look at alternate sites that are -- that divide that line more evenly, you can reduce from the 60,000 horsepower Twin Titan 250 compressors that they are -- they're proposing to use, you could go down to Titan 130s. Those have 40 percent less emissions. Just -- and, you know, would have a 40 percent savings immediately just by moving to an alternate site. And so, as I said -- there are other issues. I also believe that -- and, again, I'll submit -- well, one of the other issues about the alternate sites is that Kinder Morgan's analysis was place property ownership and put that as a huge part of the cost of the analysis. If you look at it purely from engineering and environmental concerns, the proposed site is not – not the best. Okay. And I also think there's something to do with -- there's some EPA -- issues on EPA -- Executive Order 13045, protection of children, that I hope that you'll look at. I'll submit written comments on that.
Response:	Please see **General Topics: Site Selection**. Also, as stated in **General Topics: Health Protection**, protection of children is taken into consideration when establishing National Ambient Air Quality Standards.
Commenter:	Ms. Delta Anne Davis

Comment:	Hi. My name is Delta Ann Davis. I'm a lawyer with the Southern Environmental Law Center. Address is 2 Victory Avenue, Nashville, 37213. I'm here representing the Concerned Citizens for a Safe Environment. As Mr. Powers just said, Kinder Morgan has failed totally to comply with metropolitan laws and provide an adequate and complete analysis of the reasonably available ways it can control its harmful emissions. The control technologies that it has proposed which allow 25 parts per million of NOx to be emitted is the absolutely lowest and cheapest that you'll see anywhere these days. If this permit is issued as it is proposed with the 25 parts per million emission limit, Metropolitan Nashville will virtually stand alone in the country in allowing that level of emissions. And it is very distressing that Kinder Morgan did this at the same time it submitted a permit in another state where it committed to reducing those emissions by 70 percent. If this compressor station is to be built, Kinder Morgan must comply with industry standards and metropolitan laws and control its emissions in a way that will be protective of our citizens. It's the largest pipeline in the country, and it can -- it can afford to do so. And if it wants to be a good corporate citizen, which it says it does, it should come forward and commit to do so. Thank you.
Response:	Please see **General Topics: RACT Analysis.**
Commenter:	Mr. Gary Davis
Comment:	Good afternoon. Thank you, Dr. Paul. Thank you members of the Metropolitan Board of Health. My name is Gary Davis. I'm an attorney from Asheville, North Carolina, and I'm here representing CCSE tonight. And I'm going to take a slightly different approach by first saying that this pipeline or this compressor station for this pipeline should not be built in Davidson County. It's not a question of whether it has adequate controls. On July 6 the Metropolitan Council spoke on behalf of the people of Davidson County that – by amending the Code Section 10.56.020(h) and saying that no source -- new source of air pollution should be built in this county unless it complies with the metropolitan zoning ordinance. That -- that ordinance should be enforced. There's no reason not to enforce it. There's no legal reason not to enforce it. And there's certainly no political reason not to enforce it because the council has spoken. The EPA and the state do not have to approve this ordinance before it's enforced. It does not have to be part of your state implementation plan before it's enforced. And we have looked at the case law on preemption and we've presented this to your attorneys as well, that there's no federal preemption that is going to essentially knock out this ordinance that the will of the people -- Metro Nashville Davidson County has now enacted. I'm going to turn my attention to a couple of other minor points which we will provide in writing. First of all, there are other aspects of the pollutants from a compressor station such as this that have not been addressed in

	the draft permit. One of those is formaldehyde emissions. Formaldehyde is a carcinogen. Other states have included formaldehyde emissions in their permits for compressor stations. And secondly, leak detection. There are a lot of leaks that come from these types of facilities, and those provisions have been included in other permits as well in other states. Thank you, and we will submit written comments.
Response:	Please see **General Topics: Zoning.** With respect to formaldehyde, please see **General Topics: Hazardous Air Pollutants and Fugitive Emissions Monitoring.**
Commenter:	Mr. Alandis Brassel
Comment:	All right. My name is Alandis Brassel. I'm counsel for Congressman Jim Cooper. Office is located at 605 Church Street, Nashville, Tennessee 37219. So Congressman Cooper is unable to join tonight. So he asked me to read a statement on his behalf. He'll submit written questions before the August 3rd deadline. He's very concerned about how the proposed compressor station's emissions can affect our community. This is not a typical industrial zone. Homes and farms are at risk, and the proposed compressor station could impact the livelihoods of hundreds of community members. This division is responsible for protecting our community's air quality from contaminants and pollutants. It is in a unique position to undergo a thorough impact assessment on how emissions will affect the surrounding area. Simple numbers processed by computer models will not suffice. Beyond models, how has the division accounted for emissions' potential impact on the surrounding community's health and well-being? How have you accounted for the effect emissions will have on vegetation? Our community is growing rapidly. It's up to regulators like you to make sure we do it responsibly. This proposed compressor station, which threatens the surrounding area has very little, if any, positive economic impact on our city, is not an example of responsible growth. I respectfully ask you to consider the whole picture and protect Nashville. Thank you.
Response:	Please see **General Topics: Health Protection.**
Commenter:	Mr. Scott Banbury
Comment:	My name is Scott Banbury. I'm the conservation program coordinator for the Tennessee Chapter of the Sierra Club. We aren't just facing this issue here in Nashville. Sierra Clubs across the country are dealing with this issue,

	particularly in the eastern United States. We will be submitting written comments supporting many of the great opinions that came to floor with Ann Davis and Gary Davis and Bill Powers on the legal matters dealing with this permit, but I'd like to take this opportunity to dispel one of the myths that's been constantly put forth by the applicant, and that's that somehow this pipeline compressor station has anything to do with supplying gas to the people of Tennessee. Tennessee Gas Pipeline long before Kinder Morgan acquired it was already contracted to deliver gas to us here in Tennessee for power and home heating. This compressor station is solely about increasing the capacity of this pipeline so that it can deliver gas to the Gulf Coast for export markets. We've now sent three ships out of the Gulf of Mexico to other countries carrying natural gas that's fracked from the Marcellus and Utica shales and Pennsylvania and West Virginia and Ohio to other countries for their consumption. And I really just want to make that clear. Sierra Club also has some serious issues with this permit in terms of how it treats fugitive emissions. We were party to commenting on the rules that came out this last year. May 12, 2016, I believe it was they came out. And we believe that quarterly monitoring is insufficient for these type of facilities. We believe that the Metro Health Department has it within their authority to require 24/7 realtime monitoring both by optical gas image technology or for looking – infrared radar, infrared imaging, and to have sampling occurring on a regular basis immediately around the plant and in the community surrounding the plant. And we would ask that the permit incorporate that. Also, you guys have exempted the liquid tanks. They -- they condensate. We were just told that there's no impurities in this gas, that it's ready for consumption. Why would they need to have liquid condensate tanks on-site if there was not impurities in it? Thank you.
Response:	Please see **General Topics: Permitting Process and Fugitive Emissions Monitoring**. MPHD agrees that the liquid tank does not meet the exemptions outlined in MCL 10.56.050 and it has been added to the permits.
Commenter:	Mr. Nick Leonardo
Comment:	Good afternoon, Dr. Paul. Thank you for conducting this hearing. I'd also like to thank both of our elected officials here, Representative Mitchell, as well as Senator Dickerson for being here. I don't believe we have our council persons here today. But my name is Nick Leonardo. And one of the concerns that I wanted to address -- I'd like to, you know, just affirm what Attorney Davis says. I agree with him wholeheartedly. I'm also a lawyer. But according to the draft permit, Section 1.2, it says that any permit noncompliance, excluding locally enforceable only requirements, constitutes a violation of the act. So my comment is that I don't think that these locally enforceable only requirements -- that provision necessarily has to be in the draft permit, and I think it's just another attempt to

	undermine the two zoning ordinances that we have, BL2015-2010 that was passed by Councilman Matthews. And it was -- there was only three people that voted against that. And also the recent one that was passed by Councilman Bedne, which is 10956-170. The people have spoken and overwhelmingly have worked very hard to come up with this legislation, and that's been the pink elephant in the room all -- all the while. I know it's an air permit, but it's also one of the -- only time that there's a building permit that's issued that doesn't come from the codes administration. And so I have a feeling that this is the way that maybe this language is going to try to, you know, relieve Metro of any duty of having to amend the community plans, having to have a change in zoning and -- and the like. And so I would just say that I would like to have that removed. I don't think that that legally has to be in the draft permit. And, you know, the people have been talking that this is preemptive because it's federal. Well, tonight -- this afternoon it's local, and this is definitely a local issue. And either way, you know, Metro is going to be the defendant. The question is who's going to be the plaintiff and is the plaintiff going to be -- and the citizens in this room have already dug into their pockets to hire lawyers -- or is it going to be Kinder Morgan? And if it's Kinder Morgan, then the citizens in this room are going to get free lawyers, and that's what they deserve. And I think that we need to let this legislation that has moved to the council – I think that it needs to stand, and I think that they need to comply with Metro's own laws. Because, again, we're talking about Metro interpreting Metro's laws, and everyone else has to -- amend the community plan and NashvilleNext and apply for a change in zoning. And I think it's only fair that a bad corporate actor has to do the same. Thank you.
Response:	With respect to Section 1.2 of the proposed permit, 40 CFR Part 70.6(b)(2) and Section 13-4(b)(2) of Regulation No. 13 require that a permit, "…shall specifically designate as not being federally enforceable under the Act any terms and conditions included in the permit that are not required under the Act or under any of its applicable requirements." The language is not meant to imply that noncompliance with locally enforceable-only requirements does not constitute a violation, just not a violation of the Clean Air Act. With respect to the comment that this is the "only time that there's a building permit that's issued that doesn't come from the Codes Administration," Section 10.56.020H of the MCL states, in part, "The receipt of a construction permit from the metropolitan health department shall not be construed to indicate approval of the strength or safety of any equipment or to indicate compliance with the requirements of the Building Code of Metropolitan Nashville and Davidson County or any other ordinance thereof. Neither shall it relieve anyone from the responsibility to comply fully with the applicable provisions of this Code, nor any other requirement(s) imposed by statute, rule or regulation of the Metropolitan Government of Nashville and Davidson County, Tennessee, the State of Tennessee or the United States Government." A building permit is still required by the Codes Administration.

	Please also see **General Topics: Zoning**.
Commenter:	Mr. Matt Pritchard
Comment:	I'm Matt Pritchard, Tennessee State Naturalist and State Archeologist Emeritus. Civilizations have risen and fallen without realizing their impact on the land until it was too late. Congressman Cooper at our first meeting said there are more pipeline mileage in Tennessee than any other state due to our location. Therefore, the probability of such failures and such environmental disasters is just a matter of when. In my community, in Bordeaux, just up the road on Highway 41, a gas line blew up luckily under car lot a few years ago. So it didn't blow anybody with it. We have an -- and we have a pipeline now through Radnor Lake state natural area in violation of the intention of the legislation to keep that place pristine. Pipelines are everywhere. And unfortunately, in the little town of Mayflower, Arkansas, the Pegasus pipeline blew up. It was shipping high sulfur oil, and the people were sick for weeks before the community finally rallied and got some support. The Arkansas Game & Fish Commission was afraid it was going to flow into the Red River and Lake Conway. Now, there are all kind of stuff in these pipelines, and they're aging pipelines. The aging infrastructure in this country is the thing that really worries me the most. We have the opportunity to put this thing in an industrial place where it belongs. Well, we have the risk that someday it's going to blow up under them. The people were documented in This American Land on June the 4th, if you want to look that up. It's a documentary of the pipeline spill in Arkansas, and the people had no idea this was under them until it blew. And I'm afraid this is likely to be the case in -- in one of these instances. Thank you very much, and we appreciate your attention to this matter. The future belongs to those who anticipate all the results, all the environmental impacts and -- as well as the social. Thank you.
Response:	Please see **General Topics: Pipeline Safety**.
Commenter:	Mr. Mike Younger
Comment:	My name is Mike Younger. I'm a local resident here, part of this organization, CCSE. I'm here today to present some of my concerns about the project. I have with me here the Madison County New York Department of Health report that was submitted to the Federal Energy Regulatory Committee concerning a project infracture expansion

	compressor station that was happening up there. They as an institution take very seriously their mission to protect and serve the public interest, and they conducted a very thorough and exhaustive review of emissions and impact, all natures, environmental and human health. And the list of environmental pollutants that are present in emissions of this are very clearly defined in this and led ultimately to the governor of New York banning fracking and the expansion of infrastructures like we're talking about here anywhere close to human habitation. He deemed it something that was unworthy of being that close to human habitation because of the risks that it posed. And in addition to that, I would like to draw your attention to the fact that a 2008 publication of the International Association of Oil & Gas Producers acknowledged that the radioactive material during the process -- naturally-occurring radioactive material flows with the oil, gas and water mixture and accumulates it, scale, sludge and scrapings. And it's a very reasonable conclusion to come to that those scrapings and particles which – the byproduct of radon are lead and polonium. Polonium, highly cancerous chemical. It's very reasonable to assume that particles of that scale that is forming inside that pipe will be present in the blow-downs which myself and all of the people here will be subject to. And at the end it says there's no data that we can turn to in order to assess the risk of radioactive exposures in our community. And I'm wondering before this thing is green lighted what assurances are going to be given to this community that polonium won't be in the emissions that we're breathing in going forward.
Response:	With respect to Madison County, the state of New York has banned the practice of high-volume hydraulic fracking, but infrastructure expansion appears to continue. The Sheds Compressor Station that is the subject of the Madison County New York Department of Health's report was issued an air permit from the New York Department of Environmental Conservation that became effective January 1, 2017. With respect to naturally occurring radioactive material (NORM), The International Association of Oil & Gas Producers' "Guidelines for the Management of NORM in the Oil & Gas Industry" only discusses the presence of NORM at the extraction site, in the waste streams, and in the gas processing facility. There is no mention of higher concentrations of NORM being found in transmission lines. Tennessee Gas Pipeline has data that shows radon levels in the pipeline near New Jersey to be 17 pCi/L. These levels would be further diluted upon any potential release to the atmosphere. Therefore, the levels and frequency of exposure, if any, is not expected to present a significant risk.
Commenter:	Mr. William Smith

Comment:	My name is William Smith. I live at 7736 Greenbrier Road in Joelton, and I come to voice some health concerns for my family. We -- our property is -- well, actually our -- the side door on our house is about a hundred feet from the property that is the subject of this hearing. My property adjoins that property by a couple hundred feet or more. So we're close by. We have concerns for our health. My wife has asthma, and she is affected by, you know, environmental things. My father and uncle died with emphysema which they contracted just a few years older than I am right now. So we have concerns about the air quality. We live there because -- we moved out of Nashville for only one reason. For peace, quiet and fresh air. Well, okay. Those are three reasons. But they're all the same color. And we've had them there for 17 years. We'd like to keep having them there. Some people say, Well, why don't you just move if that's going to happen? Well, just the threat of this coming into the community has torpedoed our property values. We can't afford to move. And so we're going to live or die there, whatever happens. And I hope you'll take that into consideration. Thank you.
Response:	Please see **General Topics: Health Protection.** With respect to property values, under the Natural Gas Act, only the Federal Energy Regulatory Commission ("FERC") considers the proposed natural gas compressor station's potential impact on adjacent property values when siting a compressor station. The issue raised by this comment is outside the scope of MPHD's authority.
Commenter:	Mr. Mac Wilson
Comment:	Good afternoon, Dr. Paul, and members of the health board. My name is Mac Wilson. Page 102 of the environmental assessment released March 11th includes this startling statement: Operational emissions would permanently affect the ambient air quality as a result of this project. And I'd like to bring to -- your attention to the word "permanently." By Kinder Morgan's own – own admission, the region's air quality will be permanently affected. Given what I have just quoted, it is hard to believe that the Metro Health Department which exists to protect the health of the citizens -- health and welfare of the citizens of Davidson County would ever consider supporting the building of this compressor station. Thank you very much.
Response:	Please see **General Topics: Health Protection.**
Commenter:	Richelle Deharde

Comment:	(Playing audio.) That is the sound of a compressor station. It was taken from a man's front porch buffered by woods just like this proposed site would be, and I listened to that recording for 15 minutes and developed a migraine. This man listens to it 24/7. And I'm afraid that's what my friends are going to hear for those people that border their properties. So it's -- it's much louder than a normal conversation. It is much more significant than Kinder Morgan would like to have us believe. In addition, as the gentleman mentioned earlier about moving here for his peace and enjoyment, the United States Constitution guarantees each and every property owner and tenant the right to the peaceful enjoyment of their property. Tennessee law also gives each of us the civil right to the peaceful enjoyment of our property. Tennessee law goes even farther to say that a public official does not have the right to give someone else permission to take away our civil rights to enjoy our property. So I would like to present to you that this would be one heck of a civil rights lawsuit if this company is allowed to come in and take away our air quality. In addition to the air quality, I come from Louisiana where gas and oil is rich in the economy, and I know first hand what it does to the body. I had seizures. I had chronic fatigue syndrome. I had a multitude of issues that only went away when I moved to rural Middle Tennessee, and now those issues may very well be following me here. So I am begging you. Please put an end to Kinder Morgan's plans for our community.
Response:	Please see **General Topics: Noise**. The issue of potential civil suits against the federal, state, or local government is outside the scope of the MPHD review.
Commenter:	Mr. Rueben Dockery
Comment:	Hello, Dr. Paul and to the elected officials here. My name is Reuben Dockery, and I am a candidate in the current election for Council District 1. Joelton is a vital part of that district, and I'm here as a matter of record in support of their will to protect their quality of life and to let you know as the health department that we will look forward to -- continue to assist them in that fight. Thank you very much. I'm 2276 Gilmore Crossing Road.
Response:	Please see **General Topics: Health Protection.**
Commenter:	Martha Collins
Comment:	Thank you for hearing this. Because this facility has the potential to negatively impact -- thank you for hearing us.

	Because this facility has the potential to negatively impact health due to the fact that it is a Title 5 hazardous air polluter, shouldn't there be a public health notice mailed to those within a 30-mile radius of the compressor station warning them of the possible exposure to the toxins emitted on a daily basis and the damages they can cause? Thank you
Response:	The source is subject to the Part 70 (Title V) permitting program as a major source of criteria pollutants. The proposed facility will not be a major source of hazardous air pollutants. Section 13-5(h) of Regulation No. 13, "Part 70 Operating Permit Program," provides for a 30-day public comment period, the opportunity for a public hearing, and a 45-day EPA review of the proposed permit and all public comments.
Commenter:	Ms. Kathy Rogers
Comment:	My name is Kathy Rogers. I live at 4060 Bernard Road, Joelton, Tennessee. I have done much research as a private citizen on the kinds of toxins these stations can emit into the air, soil and water. Toxins like formaldehyde, benzene, hexane, methane, you name it, it goes on. Toxins that can produce immediate and chronic symptoms and can cause cancers and diseases of nearly every organ in the body, toxins that in most cases the EPA would have severely restricted as it has done so in the past based on the widespread damages they cause. My family and I have been directly impacted by chemical exposure to toxins, and I know first hand what physical ailments I have had to endure as a result. My father was in the pest control industry for over 35 years before his death in 1994. He and my family were exposed directly and indirectly to such things as DDT, 1080, chlordane and thallium sulphate, to name a few chemicals, that were later banned or severely restricted by the EPA because they're cancer causing with toxicant properties. My father developed severe tremors, COPD and cardiovascular disease when he was 50. My brother has tremors and has psoriatic arthritis and heart disease. Two of my sisters have died. One at 31 from liver failure and the other at 41 from ovarian cancer. My mother died of cardiovascular disease in 1998. My older sister has cardiovascular disease, rheumatoid arthritis. And I am battling severe systemic lupus. In my hand is a research paper that I have done with 105 citations from various journals and government agencies like the EPA, Environmental Health, CDC, World Health Organization and so on. Citations that back up the research that proves natural gas compressor stations are emitters of toxins that can cause physical harm to humans and that -- my family and I have been exposed to. I have only one question to ask you, and that is: With all the evidence at hand, why would you, the Metro Health Department, allow the issuance of a permit that would allow such a facility to be built, one that can and will cause so many -- so much harm to so many people? Thank you.

Response:	Please see **General Topics: Hazardous Air Pollutants.**
Commenter:	Ms. Lori Birckhead
Comment:	My name is Lori Birckhead. I live at 7721 Whites Creek Pike. I'm the president of CCSE. First I'd like to say how much I appreciate having the opportunity to have this public hearing. We have been asking Kinder Morgan for the last year and a half to please have a public meeting, and we have been denied that. So at least we have the opportunity to speak our concerns. So I thank you for that. FERC says that the broad run project is constructed for the public convenience and necessity. I can't imagine that this phrase has any merit, though. Federal powers like preemption of local zoning and eminent domain were instituted to ensure that large projects for the good of the nation could move forward, projects like construction of interstates or schools or hospitals. However, this project's sole purpose is to transport gas to the Gulf Coast to be turned into liquified natural gas for the export to Asian markets. This process does not serve the public good at all. In short, it's neither convenient nor necessary. In fact, it is anticonsumer and against the interest of the U.S. -- of U.S. businesses because if a -- if a robust export market develops, it will cause natural gas prices in domestic markets to skyrocket. Thank you for allowing me to speak.
Response:	Please see **General Topics: Permitting Process.**
Commenter:	Dr. Sharon Felton
Comment:	My name is Sharon Felton. I live in Goodlettsville, Tennessee. My question is with regard to environmental justice. If you will look at Executive Order 12898 which is entitled Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations -- that's what it's called. The proposed Joelton compressor station should be evaluated for this kind of impact. In Kinder Morgan Tennessee Gas Pipeline's filings with FERC the Joelton area was erroneously connected to Pleasant View as being the nearest community by which to evaluate population and demographics. You forgot to start my two minutes, by the way. Pleasant View is not in the same county as Joelton. It is not even the nearest community to Joelton. Joelton is better categorized by its existence within Davidson County District 1, Council District 1, which has one of the highest minority populations in the entire county. Using the EPA echosystem -- and I can give you the website for that if you want to explore it – to generate a five-mile radius -- I -- I looked at it and found one of the nearest sites that is -- that is currently giving out

	emissions. If I generate a five-mile radius around this, the population density comes back at 742 per square mile. In that -- in that area, that is 62 percent minority and -- I'll give you a few numbers here -- 24,284 out of 58,399, i.e., 42 percent, live below the poverty line. So I'm looking at Joelton and thinking, Yeah, why is it coming here? Thank you.
Response:	Please see **General Topics: Environmental Justice.**
Commenter:	Ms. Patricia Miller
Comment:	Hi. My name is Patricia Miller. I'm retired Wildlife Resources Agency Statewide Aquatic Education program coordinator. I am here -- I don't live in Joelton, but I'm here because I live in Cane Ridge. And you may know already that we have gas a compressor station proposed for them -- for our area. So I'm here to support these wonderful people that have been helping us in our process to learn how to deal with this proposal, and so I have a question for you. Many of the health studies -- indeed, many of the protests made in other states have based their findings on compressor stations of 11,000 horsepower or 14,000 horsepower. The compressor proposed for Joelton is among the largest in the entire nation, coming in at five and six times more powerful than the majority of other sites. I believe we have lost sight of how large a monstrosity this compressor will be. One stack will be eight and a half stories tall, 85 feet. We don't want that eyesore in their community or in our community. Thank you. Thank you for this opportunity.
Response:	Please see **General Topics: Permitting Process.**
Commenter:	Mr. Brent Miller
Comment:	Hi. My name is Brent Miller, and I live in Cane Ridge, in the area, Old Hickory Boulevard. And I, too, am from an area across town. But as we all know, air pollution and things coming from compressor stations, pipelines, so forth, escaping is not limited to any one area. It will move with the air. So not only do we want to support the Joelton group, but also concerns about air pollution coming from that compressor and also being – possibly being caused -- if we ever have a compressor station in our area, combining together with theirs to make it -- make it even worse. It narrows a question that I wanted to also pose. Appreciate the opportunity to ask these questions tonight. The tons-per-year figures given in Kinder Morgan's specifications do not account for what's commonly called fugitive

	emissions, and I'd like to know how are fugitive emissions determined. Thank you very much.
Response:	Please see **General Topics: Fugitive Emissions Monitoring.**
Commenter:	Mr. Steve Geny
Comment:	I'm Steve Geny. I represent Paradise Produce Farm located at 7721 Whites Creek Pike in Joelton. My family works on the farm and also employees. It's an organic farm. We moved out there for that reason, to get away from the pollution of other areas and to be able to grow healthy food for our community. My -- my wife, my daughter, my son, my grandson, my daughter-in-law, myself, we all work on the farm, you know, at different times. I'm an asthmatic since I was two years old. I have good times and bad times, but most of the time when I work on the farm I already have to wear a respirator to work. So -- not because of pollutants, but just because of -- you know, at times when we're plowing and dust, that kind of thing. But if we had gas line leaks in the area and they were close to the -- the farm there, it could send me into a fatal asthma attack, for example. I also have some questions here that I wanted to pose. One is how often are emissions checked at the proposed compressor station? After they're checked, who -- who validates the figures for accuracy at this site? What happens if the numbers are exceeded? If numbers are exceeded, are these violations communicated to the residents? And lastly, do violations result in fines levied against the company? These are -- these are just a few of our concerns. Thank you for this opportunity to ask them.
Response:	Please see **General Topics: Fugitive Emissions Monitoring**. In accordance with 40 CFR Part 60, Subpart KKKK, the source will be required to conduct annual emissions testing on the turbines. The regulations do allow for less frequent testing if initial results are low enough or alternative monitoring. All stack testing is done by an independent contractor and observed by APC staff. Any violation of applicable requirements or permit conditions would be evaluated to determine the proper enforcement action. Typically, violations are not communicated to nearby residents. However, all of MPHD's records are public documents and available for review upon request.
Commenter:	Ms. Susan Shann
Comment:	Hello. My name is Susan Shann. I live at 5476 Old Hickory Boulevard, just down the street from Joelton/Scottsboro area. I have a question. Mac Wilson had a cited a quote from the environmental assessment, and I'm going to cite

	that same quote but in relation to sulphur dioxide. On Page 102 of the environmental assessment, FERC declares that the operational emissions from this facility would permanently affect ambient air quality in Joelton as we've heard. FERC follows this comment with a statement that an air dispersion model was not performed for sulfur dioxide because the impact of CS563 on sulfur dioxide concentrations was assumed to be negligible. Assumed. However, in a review of health impacts from compressor stations published in Science Direct in 2015, sulfur dioxide is one of the criteria pollutants emitted by compressor stations. Exposure to this toxin causes immediate irritation of the mucous membranes. Thereby inducing asthma-like symptoms at 20 parts per 15 million. Exposure over that limits -- I'm sorry. Exposure over that limit without a respirator can cause permanent lung damage and even death, with the possibility of a negative health impact from exposure to this possible toxin. And as FERC is dealing with a mere assumption regarding the impact of said toxin and did not perform an air dispersion model, wouldn't it be more prudent for the Nashville Health Department to ask that one be performed anyway since the health and well-being of many people of this county should take precedence over an assumption? Thank you.
Response:	MPHD performed air dispersion modeling for sulfur dioxide. The modeling results are in Appendix III of this document and were found to be below the NAAQS.
Commenter:	Ms. Joy Boykin
Comment:	Hello. My name is Joy Boykin. I live at 7433 Bidwell Road in the Joelton area. I am a real estate agent there and make my living selling homes in that area and have for 36 years. So that being said, not only am I here to let you know that the tax revenue for that area for – for us is great in the near future for Metro, but if we let something like this happen to the area, then the growth of the area will die. And not only will Metro lose lots of money getting the revenue that they could get from future growth of the area, but we -- we are concerned about the air quality. And one of the questions that I have and that we propose is if the -- how does the Nashville Air Quality Division plan to monitor the particular matter that can be captured -- that can only be captured by hourly data due to fluctuations in the air speed and the temperature and the blow-downs? The -- the matter spikes, for those of you that may not know, are the tiny little particles that are floating around in the sky, and sometimes you can't -- they're not even visible, but we breathe them. And how do the people of Davidson County know that the data reported is without bias? Thank you.
Response:	Please see **General Topics: Health Protection and Permitting Process**. MPHD continuously monitors fine particulate matter throughout Nashville, based on an EPA-approved monitoring network. Additional monitoring

	may be considered in the future. However, any such study would be independent of the permitting process.
Commenter:	Ms. Nancy Winters
Comment:	Hi. My name is Nancy Winters. In a published statement by the State of Colorado Air Quality Division, the current state of science could not assess the potential risk of combinations of different chemicals people are exposed to from natural gas compressor stations. Studies performed on workers in the gas, oil industry who have been exposed to toxic mixtures like BTEX have experienced mental and behavioral problems, a range of health problems and some changes in color vision and perception. Together with toxic pollutions have the potential to dramatically impact every organ in the human body and can act together and to increase the potential -- the toxic potential of other chemicals like prescription medications. With that being said, would it be wiser to delay the air permit until such a study can be performed as these toxins are not admitted one at a time but comprehensively? Thank you.
Response:	Please see **General Topics: Hazardous Air Pollutants.**
Commenter:	Ms. Tara Fetherling
Comment:	My name is Tara Fetherling. I'm a resident in Joelton at 7470 Whites Creek Pike. I have two properties in Joelton that are within the zone that will be affected by emissions, both of air pollution, admittance into the aquifer that serves my property. And I just want to speak to you tonight -- I'm going to extend with written comments, but I'd like to speak to you tonight about your somber duty. Apparently you're our last -- our last hope or wall to stop a project that has not had a complete and adequate environmental assessment or environmental impact statement. And this is local now. It needs to remain local. You guys are here. You know what the Joelton area is like. It's supposed to be the air filter for Nashville. We shouldn't be approving projects where we're going to cut down acres and acres of trees that are the air filters for all of this metropolitan area in order to place an industrial project that is going to emit large tonnages of particulates over not just Joelton but down the hill where the air is always dirtier and hangs in the basin. So it's really not just an impact on the Joelton residents, although we're going to feel it. I could have moved anywhere when I came home to Tennessee after a career, but I chose Joelton because it's zoned rural. It's zoned agricultural. I've done nothing but plant trees and try to grow clean food for people in Nashville, and that's how the community needs to remain. Nashville is going to be missing -- or really ruining the last area it

	has to become and be a green community. It really matters, and you guys -- you guys are the last place to stop this fossil fuel madness. I mean, I understand why the federal government presumes it needs preemption over some issues, but this is local. And I hope you'll give it all due consideration.
Response:	Please see **General Topics: Permitting Process and Zoning.**
Commenter:	Ms. Gloria DiMeola
Comment:	Hello. My name is Gloria DiMeola. I am a resident in Joelton at 7721 Whites Creek Pike. I'm here today on behalf of myself, my eight-year-old son and many of my neighbors from the Joelton community. I do not support Kinder Morgan's proposal to establish a massive compressor station in our agricultural semirural neighborhood. Kinder Morgan has no intention to support our local economy. Instead resources exploited will be shipped overseas, offering locals nothing more than pollution, byproducts and an unsafe environment. There has been many independent surveys conducted proving the pipeline to be unsafe and eroding in many areas. Joelton is a beautiful town full of biodiversity and clean important watersheds. I feel the air in Joelton is much cleaner in comparison to Nashville where I once -- where I was born and raised. Areas like Joelton play an important role as a buffer between cities that have been overdeveloped and industrialized. Many here today have played important rules of protectors and preservers of the land on which we live. None of us want our good air quality compromised by a corporation who's out for nothing more than financial gain. Kinder Morgan's sneaky and noncooperative tactics have appalled us all. The emission pollution from the compressor station will surpass your EPA standards by an unacceptable percentage, putting all of our air and health at risk many miles beyond the proposed site for this project. We should all be granted a right to breathe clean air, for it is a necessity to all life forms. This is why I oppose. And I sincerely ask you to listen to the voices of the people around me and do not grant Kinder Morgan -- Morgan the permit to go through with this project.
Response:	Please see **General Topics: Health Protection.**
Commenter:	Ms. Christina Wright
Comment:	Thank you for hearing us tonight. I'm Christina Wright. I'm a resident of Joelton and a long-time resident of Nashville. I've always lived here. And I have several questions for you. I will start with: How many orange alerts

	have been issued for Davidson County in 2015? How many so far have been issued for 2016? Is Davidson County currently in attainment of national ambient air quality standards? How often have those standards been checked? If Davidson County falls out of attainment, what steps are taken and what fines levied as a non- --as a result of nonattainment? I am concerned about the air quality in Nashville, and I have in my hand a testimony from a resident of Carroll County, Ohio. I'd like to read a portion of it to you. This is a resident, Harry Booth. Says that he believes his dogs gave him an early indication something was wrong with the air when the pipelines, wells and compressor stations started sprouting up around his home in 2013. The dogs would stick their nose in the air when they went to the door and turned around and come right back in the house. The next day he went to get his wife a cup of coffee, and he fainted. She came to his help. And the next thing that he knew, that she was on the floor, too, feeling nauseated and dizzy. This was because of the air quality in the house because of the air compressor that was nearby. My husband and I run Town & County Farm & Pet Sitter. We board horses, dogs and cats at our house. We are less than a mile of the proposed site. Should this come into our area, it will put us out of business. I ask you to please protect our environment and the health of Nashville residents. Nashville already has an air quality problem in the summer as per the signs that we see that you're cautioning us about breathing problems. So, please, I ask you to do your duty and protect Nashville. Thank you.
Response:	The Air Quality Index (AQI) is an index for reporting daily air quality. It reflects the current quality of the air and what health effects may be experienced as a result. An "Air Quality Alert" results from an AQI forecast. These forecasts help local residents protect their health by alerting them to plan their strenuous outdoor activities for a time when air quality is better. However, the forecasts are not always correct. In 2015 (when the NAAQS for ozone was 0.075ppm), there was one Air Quality Alert day forecasted. No exceedance of the standard was recorded on the day in question. In 2016 (after the NAAQS for ozone had been lowered to 0.070ppm), there were seven Air Quality Alerts issued. Five were predicted for ozone and two for fine particulate matter. The two days for fine particulate matter were a result of the wildfires in East Tennessee. Of the five ozone alert days, only one resulted in an exceedance of the standard. However, there were three other days during the year that we monitored ozone exceedances that were not predicted by the forecasters. Despite the exceedances outlined above, the Nashville area remains in attainment with all National Ambient Air Quality Standards and expects to remain in attainment when EPA issues their final designations for the more stringent ozone standard in 2017. A future non-attainment designation would be a regional issue that could not be traced back to one specific facility.
Commenter:	Mr. Gary Moore

Comment:	Hello. I'm bending over. So I'm going to raise this up. My name is Gary Moore. I live at 2946 Morgan Road, Joelton, Tennessee. Less than a mile from the compressor station, proposed compressor station. And I'm going to start by saying you have a choice, and I hope that you choose to protect the citizens that you serve. I'm going to talk – and there's been a lot of talk about the different carcinogenics, but I'm going to talk about one specifically. That's benzene. Benzene is another known volatile organic compound emitted by compressor stations. It is a carcinogenic that can linger in the atmosphere for days, particularly after blow-down events. Under TGP's resource report Page 9 through 39, TGP states that their vision is that this facility conservatively include 150 startups and 150 shutdowns per unit per year. That will conservatively produce a total of 15.5 tons per year of VOC emissions. However, TGP -- it's estimated that this data based on emissions data, Solar -- the compressor turbine manufacturer. So they're basing it on the manufacturer's statement, not facts. I know that the favorite saying of the lawyer is trust and verify. We have many lawyers in this room, and I'm sure they will attest to that. So how do we know that we can trust those numbers? What quantity is this assumed 15.5 tons per year does benzene compromise? According to the World Health Organization, there are no safe exposure level to benzene. We've done extensive research on our health effects that result from living near a compressor station. One of the first studies I examined was a woman who lived 780 feet from a compressor station. When she started to feel ill, her doctor checked her blood and determined that she had an unusual high level of benzene in her system. I live very near to the proposed site. I can trust and verify that a two year -- or two from now -- that a year or two from now that I won't have the same excessive level of benzene in my blood. It's incumbent upon you-all to make sure that I do not have. I implore you to do so. Thank you.
Response:	The use of manufacturers' certifications is very standard practice for the review and development of air pollution permits. If the facility reaches its full potential-to-emit associated with the 15.5 tons per year of VOC outlined above, the source would emit approximately 55 pounds of benzene. Please see **General Topics: Hazardous Air Pollutants.**
Commenter:	Ms. Norma Harvison
Comment:	My name is Norma Harvison. I live at 7177 Bidwell Road in Joelton. I'm a lifelong -- born and raised in Joelton. And we have fought very hard to keep our community safe, and we've heard all of these things that are going on, all these things that are wrong. But we've just built a nice park out there for our children. My niece has just built a

	beautiful home and has three beautiful little boys, one of them with asthma. Her father with cancer. So I'm asking you as a citizen of our beautiful community to please don't do it. Just take care of us, and let this be the place that people can live and be happy. Thank you.
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Ms. Melanie Leslie
Comment:	My name is Melanie Leslie. I live at 5543 Dividing Ridge Road. Kinder Morgan is starting the -- is stating that the only air monitoring they will be performing is right at the station and not -- and it does not take into account the vent blowouts that will disperse pollutants in a much wider plume than these, quote, normal operations. However, these vent blowouts are regularly-scheduled events that frequently occur. So I don't see how they can say that they are not part of the normal operations. This air -- air monitoring program that they're doing has -- does it have a quality assurance, quality control check to ensure that they are monitoring according to state guidelines? Do they have guidelines for data validation? There is no mention in Section 1.3(a) that there will -- of any data validation in there. Without adequate results how do we know that they're judging properly and monitoring correctly and protecting our environment? Kinder Morgan also has a -- says that the air monitoring stations will be around the plant only and not scattered throughout the affected area. Why not? It should be scattered throughout the entire area. How will they know that the volatile organic compounds, the benzene, toluene, et cetera, and other pollutants of the natural gas liquid they're transporting is not spreading off their property? Section 1.21 states that nothing objectionable will go beyond the property line. How will Kinder Morgan know this is true without air monitoring stations placed off their property or do they simply expect these emissions to magically drop at the property line? Section 1.24 and 1.25 speak of the permitting -- not allowing emissions beyond certain limits. How will they be sampling to ensure those limits are not exceeded? What will they do if they are exceeded? Kinder Morgan states they don't have to monitor because their station doesn't fall under the EPA guidelines for facilities that do require a monitoring. However, the state often does have more stringent guidelines. Will Kinder Morgan be forced to meet these more stringent guidelines? The gas compressor plant is not operating -- thank you.
Response:	Please see **General Topics: Fugitive Emissions Monitoring, Venting and Permitting Process.** With respect to Section 1.21, please see **General Topics: Section 10.56.170**. Compliance with Section 1.24 and 1.25 is demonstrated during the application process, based on the fuels being combusted and the manufacturers' emissions certifications.

Commenter:	Mr. Fred Lieb
Comment:	Good afternoon. I'm Fred Lieb. 7421 Bidwell Road in Joelton. I live less than a mile from the site of the compressor station, and I live three building lots away from the pipeline itself. Needless to say, I have seen the news stories. I was born and raised in Oklahoma. I know a little bit about the oil business. I've chased for cap (phonetic) and sulfides all through the Mid-Continent DX Refinery in Tulsa. So I know a little bit about what those guys can do. They form sulfuric acid when they combine with water. Have anybody done some mechanical studies -- I'm an ME by trade. So we want to know -- the existing pipelines was tested, and I believe that they are increasing the working pressure by two and a half times. If that is true, then -- the normal guidelines in the mechanical engineering world are two and a half times the operating pressure is the test pressure. So it seems to me that what they're going to be doing is taking the operating pressure to whatever the test pressures were on those pipelines. Plus over the years -- those lines are 50, 60 years old now -- there has been erosion caused by just the particulates flowing through the pipeline. They increase the velocity. It's like sandblasting from the inside of the pipe out. So there's -- there's about three or four different things that are going on. Also let me make a comment about the storage tanks. So we used to call it drip, and it is roughly 125 octane fuel. We used to go out to the pipelines and drain the -- drain the expansion lubes to get the drip to run our race cars on. So it's nasty stuff. Thank you.
Response:	Please see **General Topics: Pipeline Safety.** With respect to the condensate tank, as stated earlier in the comments, MPHD agrees that it should be added to the permit.
Commenter:	Ms. Alice Demetreon
Comment:	Hi. I'm -- can you hear me yet? I'm Alice Demetreon of 229 North Elm, Whitwell, Tennessee, which is not in this district. But I'm here as a concerned citizen for all of Tennessee, especially our future generations. I have one question for Kinder Morgan. If you want to be the FedEx of America's energy structure, why are you investing all this money on dangerous fossil fuel technology when renewable energy is the clear choice for the future of our planet? My question -- my question to the board is: How will water quality of the wells and streams be affected? How can wells, ponds and streams be monitored for toxic chemical contamination? And what is the risk of long-term soil contamination in this area that has a significant agricultural population? Also, I've heard a lot about the

	noise pollution. And I'm wondering how will that be monitored and how will you enforce it if it's found to be over? My last question also was for the board. Will you please consider making your vote for the people as opposed to big business? Thank you.
Response:	In the Environmental Assessment published by the Federal Energy Regulatory Commission (FERC), FERC concluded that, "the Project would not result in any significant longterm or permanent impacts on groundwater resources based on Tennessee's implementation of appropriate minimization and mitigation measures." With respect to soil contamination, FERC states, "The Project would not result in more than negligible impacts on geology and soils." As these are areas beyond the scope of the MPHD's Air Pollution Control Division, we would defer to FERC or the Tennessee Department of Environment and Conservation. With respect to the comment on noise, please see **General Topics: Noise**.
Commenter:	Ms. Hannah Maloney
Comment:	Good evening. My name is Hannah Maloney. I live at 8440 Whites Creek Pike. My question is this. I'm a nurse practitioner, and I work in a neurointensive care unit at Vanderbilt. So I have a firm understanding of the healthcare system. Does the health department -- if they decide to go against the wishes of the people and the health of the people have a plan for monitoring the health of the people? We now know that 42 percent of the people that are going to be affected by this live under the poverty level. That's a lot of people who are going to depend on public health and public assistance. I think that having a post-implementation plan for monitoring the health of these toxins or the health problems created by these toxins would be prudent. Thank you.
Response:	Please see **General Topics: Permitting Process**, **Health Protection and Hazardous Air Pollutants.** Additional monitoring may be considered in the future. However, any such study would be independent of the permitting process.
Commenter:	Ms. Lindsay Pace
Comment:	Thank you for this opportunity to speak today. My name is Lindsay Pace. I am the Tennessee field coordinator for Moms Clean Air Force. I live at 1713 West 56th Street, Chattanooga 37409. Children are especially sensitive to air pollution because their bodies are still developing. They breathe more rapidly when compared to an adult, and

	they are more likely to be playing outside at their homes and at Paradise Ridge Park on days where there are high emissions. Of the pollutants that gas compressor stations -- stations emit we know that volatile organic compounds impact the health of those who live nearest the compressor station. Toxic pollutants such as benzene and formaldehyde can be found around compressor stations from fugitive leaks, blow-downs and accidents. Benzene is a potent neurotoxin that is linked to childhood leukemia, and formaldehyde has been associated with childhood asthma, as well as causing cancer. When looking through existing data collected from families living near compressor stations, you see that the youngest respondents who are under the age of 16 report higher rates of throat irritation and severe headaches. They also have the highest occurrence of frequent nosebleeds and experience conditions not usually associated with children, such as severe headaches, joint and lumbar pain and forgetfulness. Under the Environmental Protection Agency's Executive Order 13045, protection of children from environmental health risks and safety risks, this proposed gas compressor facility should receive special EPA scrutiny because the property is immediately adjacent to Paradise Ridge Park, which is a Metro Nashville public park. This park is not only a recreational spot for the community, it also hosts a variety of programs for children, including structured after-school activities. As a parent, you do everything you can to protect your children. You put your child in your car seat. You buy them healthy food to eat. You stay up with them all night when they're sick. But what you can't do is buy them clean air to breathe when they're playing at Paradise Ridge Park and there's a compressor station less than a mile away. Given the lack of substantive data on hazardous air pollutants from the proposed – proposed facility, at the very least this air permit should be withheld until the long-term cumulative effects of hazardous air pollutants on the adjacent park population can be sufficiently evaluated.
Response:	Please see **General Topics: Health Protection and Hazardous Air Pollutants.** Executive Order 13045 is considered when establishing NAAQS.
Commenter:	Ms. Lillian Hawkins
Comment:	My name is Lillian Hawkins, and I'm at 5127 Sonoma Trace from Cane Ridge. And I represent the Oak Highlands/Deer Valley Homeowners Association. I am curious what the mechanism to enforce 10.56.280 which is entitled "Startups, shutdowns and malfunctions" -- it requires the source to take all reasonable measures to keep emissions to a minimum during startups, shutdowns and malfunctions. Failures that are caused entirely or in part by poor maintenance, careless operation or other preventable upset condition or preventable equipment breakdown shall not be considered a malfunction and shall be considered a violation of the applicable emission

	standards. In addition to that question -- I'm a little curious. How many is too many? It looks to me after everything that I've researched and read that one of these compressor stations, especially this large one in Joelton, is too many, at least in that location with that environmentally sensitive area and population being affected. And I look, going, Okay, if all the compressor stations meet the federal guidelines, okay -- let's just say that they do. Is one okay? How about two? What about 20? Is 20 okay? Would they all get approved because they all meet the guidelines? To give a carte blanche is illogical, and it's also immoral. We expect and we trust that you guys will do what you were elected to do or got your job to do, which is to serve the people, the health and well-being of the citizens of Nashville. Thank you.
Response:	The facility will be required to notify MPHD of any permit deviation. APC conducts an investigation to determine whether an exceedance was unavoidable or unforeseeable. As stated above, permit exceedances that result from poor maintenance, careless operation or other preventable condition shall be considered a violation.
Commenter:	Ms. Kelley Lewis
Comment:	My name is Kelley Lewis. I live on Sycamore Creek Road in Joelton, Tennessee. The Tennessee State Wildlife Agency's mission is to preserve the state's endangered wildlife and manage its woods and waters. They warn that, quote, the reduction of forest lands can negatively impact water quality and quantity the health and diversity of habitats and other land values such as recreation, timber and forest products. They declare that upland forests are a benefit to each citizen of Tennessee by reducing soil runoff, thereby maintaining higher water quality and other water bodies from the ephemeral streams to lakes and waters across the state. Quote, forests also filter pollutants and improve water absorption and retention, which increases groundwater recharge. Forest cover influences local temperatures, improves air quality and may play an important role in mitigating climate change, end quote. The environmental assessment on Table 210, FERC states that the TGP will temporarily impact 34.6 acres and permanently impact 20.5 acres of upland forest to construct this Compressor Station 563. My question is: How can a local metropolitan jurisdiction override the intent and wishes of a major state agency such as the Tennessee Wildlife Resources who sees it necessary and vital to the citizens of the state to protect these lands for the health and well-being of all Tennesseeans? Thank you.
Response:	Please see **General Topics: Health Protection and Permitting Process.**

Commenter:	Mr. Chris Tooley
Comment:	Hi. My name is Chris Tooley. I live at 912 Morning Road, and that's in Cane Ridge. I'm also the vice president of a group called Keep Southeast Nashville Healthy. We're fighting our own compressor station battle, as you've heard. Most of my technical questions have been answered by the people of Joelton. They've done an awesome job. My question really is about Nashville and Davidson County as a greater whole. I mean, we're the center of a very large populated area that goes to Murfreesboro, Joelton. I mean, you're almost really bordering really technically Clarksville as far as this emissions cloud is going to go. So really -- I mean, beyond -- we're also topographically in a bowl, as you-all know. So the air doesn't necessarily move out like most cities. I'm from southern Indiana. Same situation. Pollutants just collect there because they're heavier than most lighter air, and they just sit. So not only do you have this technical question you have to answer and decide on, you also have a moral and ethical obligation for the greater Middle Tennessee area that's nearing a million people, if not exceeding it. So -- My parents always taught me growing up with a decision -- any decision you have to make, you have two options. You can do what's easy or you can do what's right. So I'm just going to ask that you guys do what's right. Thank you.
Response:	Please see **General Topics: Area of Impact and Permitting Process.**
Commenter:	Ms. Sarah Todd
Comment:	Good evening. My name is Sarah Todd. I live at 5026 Clarksville Highway, Whites Creek, Tennessee. I also own other property in this area. My Cherokee name, because I am Cherokee, is Butterfly. And I have -- wearing -- I am wearing a over 200-year-old shale necklace that was presented to me and -- as I was proclaimed the Cherokee grandmother for the state of Tennessee. I consider part of my duty for that is to tell you how the Cherokee started living at Fort Negley in that area, which most of you are aware of. And the Trail of Tears happened, and some of them moved to Oklahoma. Some of us stayed here, and the people here hid us out. They loved us. They merged with us. So I am representing all grandchildren from all cultures. When I say please, please keep Paradise Ridge like it once was. Thank you
Response:	Please see **General Topics: Permitting Process.**
Commenter:	Ms. Rebecca Armstrong

Comment:	I had already made up my mind not to talk tonight. Said, No, not doing it. My name is Rebecca Armstrong. I live in Joelton, not far from the proposed station. My husband and I began this fight with Lori and Gary and so many others you see in this room. I know you think this is just part of your job. And it is, but it's your job to do what's right. And our job is to make sure that you have all the information you need to do what's right as far as we feel. We -- you heard all the statistics. You've heard person after person speak on behalf of us. And when Lori and I and some of us began this fight, my husband was part of it. He's not here tonight because he was killed in an automobile accident last September 30th of 2015. He was one of those that walked the pipelines. And I have a question to Kinder Morgan. How can you say you're a good neighbor when you've let these pipelines deteriorate to the condition that they are today? You're only now going out and doing anything because we're raising holy hell. I mean, honestly, we are, because this is us. It's a job for you. This is what we have to live with. And I'm sorry. I'm going off board. But I can hear my husband saying, Why are you shutting up now? You know, you need to step up, and you need to finish this fight and -- And I've just got one thing to say. There is a country saying, When does the fox guard -- when do you start letting the fox guard the henhouse? So we need to stop letting the fox guard the henhouse. Step up and do it. Thank you.
Response:	Please see **General Topics: Pipeline Safety and Permitting Process.**
Commenter:	Rev. Jim Wright
Comment:	Good evening. I'm Jim Wright, the other half of Christina Wright. We have the kennel, Town & Country Pet Sitter. And, yes, we're concerned about that. And I also know -- I mean, let's be real. A lot of it is to do with the lobbying. But every year and every administration, including the current one, they've signed legislation that's supposed to speed up the approval process of these projects. And I understand it's supposed to be – to keep America rolling, but I also realize that even though their efforts limit it to some ability, you're -- you know, like you have guidelines. We have to approve this or disapprove this. But I also know that you have certain rights. And, see, we live here, and we know -- we're concerned because of reports of other people who have these compressors in their area and what it's doing to their lives. But I also know that there are some things -- because legislation has been passed here through the council -- that you have more to stand on than you had before, and so all we're asking is for you to do your full job. And, see, we all do it in the Nashville – in our business if somebody brings their baby Yorkies when they're on vacation and, say, we have a Great Dane at the same time, if we find out that side by side that little

	Yorkie is scared to death, it's in our interest for the customer and for that dog, of course, to move them to proper places so that they get along. We don't make them go home, but we put them to where they belong. And so what we're asking here is put this compressor where it belongs. Take into account and do what you rightfully can do. See, in addition to having this business, I'm also a minister of the gospel. And, you know, God gave us dominion. And, you know, man has messed up a lot. We've done a lot of things to destroy what is rightfully ours. In fact, you all heard this. People were signing up to go to Mars. They want to have a colony there. And they're buying one-way tickets. But the difference is we don't have a one -- you know, if you make this decision for us without doing what's fully in your power to do in our interest, we're signing up for it, too, against our own will. The people that are going to go to Mars, they're choosing that. So just choose right, and God bless you.
Response:	Please see **General Topics: Zoning.**
Commenter:	Mr. Joseph Maloney
Comment:	Good evening. I'm Joseph Maloney, and my question is: How will compliance with maximum noise levels, i.e., a maximum of 55 decibels be guaranteed? What happens if residents observe even one instance of noise exceeding the 55 decibel level? What steps should a resident take in such cases? Is calling the police the appropriate response? Thank you.
Response:	Please see **General Topics: Noise.**
Commenter:	Ms. Nora Harvey
Comment:	My name is Nora Harvey. My daughter lives at 8440 Whites Creek Pike in Joelton. My question is: On Page 118 of the environmental assessment, FERC states that the region of influence for cumulative impacts on air quality is at least 50 kilometers or 31 miles surrounding each compressor station. This compressor station will upon beginning operations dramatically add to the increased NOx or nitrous oxide and particulate matter counts in the atmosphere of Davidson County. Thereby increasing the level of ozone around the Nashville area. Ozone exposure harms delicate lung tissue, respiratory systems, and contributes to heart disease in otherwise healthy people. It can easily spread past the 30-mile radius of FERC -- FERC's region of influence to cover hundreds of miles, thus increasing the range of influence dramatically. Therefore, shouldn't the Metro Health Department launch a study of its own to

	look at the potential for increased ozone and toxic exposure to protect all the Davidson -- citizens of Davidson County? Thank you very much for listening to our questions.
Response:	Please see **General Topics: Area of Impact and Hazardous Air Pollutants.**
Commenter:	Ms. Paulette Miller
Comment:	Hi. Good afternoon. My name is Paulette Miller. I live at 3572 Baxter Road, Joelton, Tennessee. I live less than a mile from the proposed compressor station. I have lupus, which is a serious health concern, and the different chemicals that will be let out by the compressor station will greatly affect my health. I also have a six-year-old grandson that loves playing at the Paradise Ridge Park. But unfortunately, he has asthma. So I worry about that also. My husband also has asthma, and we worry about his health in Joelton. We moved from the middle of Nashville because we wanted to get to a higher elevation and a safer place to live. I'm proud to be a Nashvillian. I'm proud that we're called the "it" city. I hope you have seen the pictures of the pollution -- of the pollution coming downtown where they showed on the TV station that will not only be in Joelton or Cane Ridge, it would also go down to downtown Nashville. It will affect all of us. The biggest one in the USA. And this same company has exposed gas lines, which I won't go over because they just said that. But they've been there for numerous years, since the 2010 flood. Stand up for Joelton. Stand up for Nashville. Stand up for the state of Tennessee. Thank you very much.
Response:	Please see **General Topics: Health Protection and Area of Impact.**
Commenter:	Mr. Roger Senechal
Comment:	Hi. My name is Roger Senechal. I live at 7601 Harper Road in Joelton. And I'm going to be brief. We've all heard the expression a picture is worth a thousand words. I have here -- and it's available on the CCSE Now website. The areas of environmental impact that we have been talking about all night -- we've heard a lot of talk about Joelton, with good reason, in Kinder Morgan's design for us. Aren't we lucky? The environmental impact between this and the Cane Ridge project go as far north as Russellville, Kentucky, to the northwest, to Clarksville, to the southeast, to Columbia -- excuse me, southwest to beyond Murfreesboro on the southeast and Franklin, Kentucky, to the northeast. This is not just a Joelton problem. Who's in the cross hairs of this -- this diagram? N-A-S-H-V-I-L-L-E it

	says. It's not just, you know, a bunch of hillbillies in the hills of Joelton that are impacted. A lot of people. A lot of people will be impacted, and so I beg you, ladies and gentlemen, who are -- have the authority to -- to just look at this objectively and -- and hold Kinder Morgan's feet to the fire. I don't think they're going to be able to sustain that when you do. But please remember that it's hundreds of thousands of people that will be impacted by your decision. Thank you very much.
Response:	Please see **General Topics: Area of Impact.**
Commenter:	Ms. Catherine Curry
Comment:	Good evening. My name is Catherine Curry, and I live here in Nashville. And I don't have anything planned to say. I barely made it here today. But I really want to say that we need you to speak for us, the people of Nashville, and that Tennessee -- I've lived in Tennessee for a long time, since I was eight years old. And I lived near the chemical plants down near the farm and Summertown, and so many people have gotten cancer from them pumping toxins into the water table down there. And this is the same kind of thing. And this is 2016, and we have -- we ought to be able to do it better now. And we have a huge influx of people coming from all over the country and the world to Nashville and we're saying we want to be the green city. Well, this isn't green. This is not green. This is not healthy. It's not green. It's really not going to support us in any way. And fracking isn't supporting our country, and it's not going to support the world to be sending fracking stuff through our country to other countries. It just really -- please, let's -- let's get it together. Anyway, thank you very much.
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Ms. Michelle Carratu
Comment:	I'm Michelle Carratu, and I wasn't going to say anything either. However, I've been in Tennessee for 40 years and on the board of directors of the Whites Creek Watershed Alliance and the chairperson. And you have to realize the headwaters come from Joelton, and they all go all down to Bordeaux, down into our river, and everybody drinks that water. We want to keep the air and water clean. A fence around the compressor station will not contain the air for 50 miles all around, and actually it will move all across the country. We get air from the west. It goes in all directions. You cannot contain the air. We don't want this to spread. Nashville is in a basin. It's essential basin. I

	used to live in California at one time, and in the LA basin the pollution is so bad that sometimes you did not go out 'til after lunch. When I lived in southern Tennessee, there was a chemical plant in the nearby town, and there were days when I opened the door to go outdoors and I shut the door, shut the storm door, the outside door, and just stayed inside because you couldn't breathe. It was so bad. And that can happen here. We don't need that to be here. I worry because you look at Beijing and you see their air pollution. You look at the people in Japan, and sometimes they're outdoors wearing masks. We don't want to be outdoors wearing masks. We want to be able to live and breathe freely. If you think back to Chief Joseph, who was one of the great leaders of his – his people, he said, How can you sell the air? How can you buy air? I have heard that in the past in some segments of Japan they were buying air. We don't want to have to buy air. Air should be everybody's right to be clean and breathe freely. So please err on the side of caution, do your job and please help keep our air clean. Thank you.
Response:	Please see **General Topics: Health Protection.**

Written Comments

Commenter:	Ms. Anna Ortiz
Comment:	I have been a resident of the greater Nashville area since 1995. I have heard about both the Joelton & Cane Ridge community's fight against a proposed gas compressor station. It seems that these projects would overlap across Nashville posing a serious health risk to those in this great city. What steps are being taken to determine the environmental impacts these projects will have over a long period of time? With the recent surge in population growth and added vehicles & other emissions in the air, will the bi-products of these stations interact or add to the volume already going up into the air? My concerns are primarily on the health & environmental impacts these proposed stations will have on generations of Nashvillians to come.
Response:	Please see **General Topics: Health Protection.**

Commenter:	Ms. Katherine Correa
Comment:	I would like to voice my concern about the pollution and dangers that this propose station would bring to Nashville and the surrounding area. Please don't allow this to happen. It's not good for our area it, it won't help with jobs, and it supports franking in general which is terrible for the areas where that is happening. We need to protect the environment and our air-quality here. Nashville has a rapidly growing population with very poor air quality so why would we want to do something that would make such a huge negative impact? If we want to be green, will that be the right direction? I don't think so, and neither does anybody I've spoken with about the matter. Please stand with the people, and read up on the facts which show that this station is both dangerous and toxic. If you do allow the station to happen, you should demand state of the art infrastructure, Including realtime monitoring of emission, not what's proposed at this time. I lived near a chemical plant as a child and I have seen huge numbers with cancer. Tennessee is a hotspot for cancer already. I don't know if you seen the map that shows where cancer is more prevalent but I have. And pollution does matter. We want to keep our economy strong in the area we shouldn't allow things of this nature. We should protect The people.
Response:	Please see **General Topics: Fugitive Emissions Monitoring and Hazardous Air Pollutants.**
Commenter:	Mr. Gary Davis
Comment:	**Summary of the comments that can be found in Mr. Davis' letter:** **I.A. Section 10.56.020H of the Metro Air Pollution Code, as amended, requires compliance with the Metro zoning code of new sources, and the proposed use of the TGP property does not comply.** **I.B. Metro can immediately enforce the Amendment to Section 10.56.020H.** **I.C. Metro can enforce the Amendment to Section 10.56.020H of the air pollution code without approval by the Tennessee Air Pollution Control Board.**

	I.D. Metro can enforce the Amendment to Section 10.56.020H of the air pollution code without approval by the U.S. Environmental Protection Agency. **I.E. The Metro Ordinance is not preempted by the Natural Gas Act or the Federal Energy Regulatory Agency.** **II. The proposed facility will not be able to comply with 10.56.170.** **II.A. Formaldehyde and other hazardous air pollutant emissions cause injury, detriment, nuisance and annoyance at natural gas compressor stations.** **II.B. Other jurisdictions have addressed formaldehyde emissions from Solar combustion turbines.** **II.C. Health impacts have been documented for residents near large compressor stations.** **II.D. Fine particulate matter emissions and their associated health effects have not been adequately addressed** **II.E. The Joelton compressor station will add significantly to NOx and VOC emissions in Metro Nashville threatening attainment and maintenance of the new ozone standard.** **III. The operating permit should not exclude enforcement of "locally-enforceable only requirements."**
Response:	**I.** Please see **General Topics: Zoning.** **II.** Please see **General Topics: Permitting Process and Section 10.56.170.** **II.A.** Please see **General Topics: Hazardous Air Pollutants.** **II.B.** Please see **General Topics: Permitting Process.** Nashville/Davidson County does not have a regulation that specifically addresses formaldehyde from the proposed facility. Formaldehyde emissions are included as part of the total estimated VOC mass emission standard for each emission source, as applicable.

	II.C. Please see **General Topics: Health Protection.** **II.D.** MPHD has taken a conservative approach in assuming that all PM10 emissions are also PM2.5. MPHD has also evaluated secondary PM2.5 formation. Using the approach recommended by EPA and the National Association of Clean Air Agencies (found in the commentor's attachments), secondary PM2.5 formation was found to have very little impact. Even this estimate is overly conservative as it is assumed that the formation takes place in the immediate vicinity when, in actuality, secondary PM2.5 forms after hours or even days. The modeling results can be found in Appendix III. **II.E.** APC feels it is inappropriate to compare the potential emissions of the proposed facility to actual emissions from a small subset of stationary sources to draw conclusions about future non-attainment. Based on the updated RACT Analysis, the proposed potential NOx and VOC emissions from the turbines will be 103 and 13.3 tons per year, respectively. The actual emissions of NOx and VOC sources within Davidson County was estimated to be over 22,000 and 17,000 tons per year, respectively. At full potential, the proposed source would account for less than one half of one percent of NOx emissions in the county and less than one-tenth of one percent of VOC emissions in the county. **III.** With respect to Section 1.2 of the proposed permit, 40 CFR Part 70.6(b)(2) and Section 13-4(b)(2) of Regulation No. 13 require that a permit, "…shall specifically designate as not being federally enforceable under the Act any terms and conditions included in the permit that are not required under the Act or under any of its applicable requirements." The language is not meant to imply that noncompliance with locally enforceable-only requirements does not constitute a violation, just not a violation of the Clean Air Act.
Commenter:	Mr. Gary Moore
Comment:	Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TGP/KM # 563. Specifically: The Federal level specified for Prevention of Significant Deterioration is, I believe, 100,000 tons per year

	for greenhouse gas emissions. Yet the compressor station proposed for Joelton will emit over twice that amount: almost 219,000 tons per year. Why has this facility been exempted from having to meet PSD standards? Based on TGP/KM exceeding the 100,000 TPY, I respectfully request that the Metro Health Department deny the application for TGP/KM compressor station # 563.
Response:	On June 23, 2014, the U.S. Supreme Court issued its decision in Utility Air Regulatory Group v. EPA, 134 S. Ct. 2427 (2014) ("UARG"). The Court held that EPA may not treat GHGs as an air pollutant for purposes of determining whether a source is a major source required to obtain a PSD or title V permit. The Court also held that PSD permits that are otherwise required (based on emissions of other pollutants) may continue to require limitations on GHG emissions based on the application of Best Available Control Technology (BACT). In accordance with the Supreme Court decision, on April 10, 2015, the D.C. Circuit issued an amended judgment in Coalition for Responsible Regulation, Inc. v. EPA, Nos. 09-1322, 10-073, 10-1092 and 10-1167 (D.C. Cir. April 10, 2015), which, among other things, vacated the PSD and title V regulations under review in that case to the extent that they require a stationary source to obtain a PSD or title V permit solely because the source emits or has the potential to emit GHGs above the applicable major source thresholds.
Commenter:	Rev. Jim Wright
Comment:	I want to thank you for devoting so much time to this issue. As a resident of Joelton living less than 1 mile from proposed site noise and air pollution is a real concern to me. My 90 year old mother moved in with us 2 years ago. She has been having trouble with noise bleeds. I'm concerned that the pollution from this Gas compressor will only add to the frequency. Please do all that is in your power to protect the citizens of Nashville.
Response:	Please see **General Topics: Health Protection, Permitting Process and Noise.**
Commenter:	Mr. Gary Davis
Comment:	Mr.Finke, Can you confirm you received the email from me with attachments? Thanks, Gary Gary A. Davis Davis & Whitlock, PC

Response:	Receipt was confirmed
Commenter:	Ms. Delta Anne Davis
Comment:	Thank you for the opportunity to comment on the two permits the Metropolitan Government of Nashville and Davidson County is proposing to issue to Tennessee Gas Pipeline Co., LLC for the construction and operation of Compressor Station 563 in Joelton, Tennessee. Southern Environmental Law Center submits these comments, together with the attached technical comments of Bill Powers, P.E. ("the Powers Report"), on behalf of Concerned Citizens for a Safe Environment. The Joelton Compressor Station, as proposed by Tennessee Gas Pipeline (TGP), will be one of the very largest compressor stations in the Unites States, with two turbine engines of 29,766 horsepower each that will operate 24 hours a day, 7 days a week. It will be located in in a rural area of the county, on a parcel that is zoned for agricultural use, and adjacent to a park that provides afterschool activities for children. The two turbines will emit 167.4 tons per year of NOx and 11.52 tons per year of VOC. As discussed in the Powers Report, as proposed the Joelton Compressor Station has the highest permitted NOx emissions by far of any similar compressor stations that have applied for air permits over the last two years.1 It will add a significant quantity of additional NOx and VOC emissions from point sources of fuel combustion in Davidson County—an increase of 22% for both NOx and VOC2--and in a region that is on the cusp of non-compliance with ambient air standards.3 The additional emissions from the Joelton Compressor Station may influence health outcomes in the area, as NOx and VOC emissions are associated with a range of negative health impacts alone and when they combine to form ozone.4 Applicable law requires that both permits be denied. First, issuance of the construction permit would violate the laws of Metropolitan Nashville and Davidson County because the Joelton Compressor Station, as proposed, violates local zoning ordinances. Second, issuance of the construction permit, as well as of the Part 70 Operation Permit, as drafted, would violate the standards in the applicable regulations because they fail to apply adequate Reasonably Available Control Technology to reduce toxic NOx emissions. 1. The Construction Permit Must be Denied because its Issuance Would Violate the Law First, issuance of the construction permit for the Joelton Compressor Station must be denied because it violates the recently passed Second Substitute Ordinance No. BL2016-234.5

	That ordinance, in pertinent part, provides: No new source shall be granted a construction permit unless the new source complies with the Metropolitan Zoning Code for the use of the property on which the new source is to be constructed.6 The property at 7650 Whites Creek Pike on which Compressor Station 563 is proposed to be located is zoned for agricultural use.[7] Metropolitan zoning requires that compressor stations be located only in areas zoned for industrial use.[8] Thus, on its face, the construction application violates Metropolitan Nashville and Davidson County law. Governmental authorities, such as Metropolitan Nashville and Davidson County, have a duty to enforce properly enacted laws such as the Second Substitute Ordinance.[9,10] Therefore, the application for the construction permit for the Joelton Compressor Station must be denied. 2. Both the Construction Permit and the Draft/Proposed Part 70 Operation Permit Violate Applicable Law Because They do not Require that Toxic Emissions be Minimized by Reasonably Available Control Technology. Because of the toxic nature of the NOx emissions form the Joelton Compressor Station, applicable regulations require that Reasonably Available Control Technology (RACT) be applied to reduce NOx emissions.11 The owner or operator—here TGP—must submit the RACT analysis, which is then evaluated by the Metropolitan Nashville/Davidson County Health Department.12 The 25 ppm of NOx proposed by the RACT analysis for these permits would be the highest in the nation for similarly situated compressor stations. As discussed in the Powers Report, TGP totally failed to provide a complete and accurate RACT analysis, and the Metropolitan Nashville/Davidson County Health Department erred in accepting that analysis and failing to conduct a robust independent analysis. The attached Powers Report describes in detail how TGP's—and Metropolitan Nashville/Davidson County Health Department's -- RACT analysis is insufficient: 1. There is an almost exclusive reliance on the EPA's limited RACT/BACT/LAER Clearinghouse to evaluate NOx limits and controls for gas turbines. 2. There is no identification or discussion of the three different dry low NOx (DLN) control levels offered by the manufacturer for the Titan turbine: 25 ppm, 15 ppm, and 9 ppm, or of NOx limits in contemporaneous Titan (or smaller) gas turbine compressor station air permit applications.

	3. It relies on generic and obsolete selective catalytic reduction and DLN cost data from 1990. 4. There is no identification of an appropriate $/ton cost-effectiveness ceiling by which to compare the cost feasibility of available RACT options. Most disturbingly, among other issues, the Powers Report demonstrates that TPG failed to disclose in its RACT analysis technology that TPG proposed almost contemporaneously in another state to lower the NOx emissions to 9ppm—a 70% reduction from the 25 ppm it is proposing for the Joelton Compressor Station.13 Where, as here, the RACT analysis fails to comply with the applicable law, the permits must be denied. 3. Conclusion Based on the Powers Report, and for the foregoing reasons, CCSE respectfully asks that the Metropolitan Nashville/Davidson County Health Department deny the Permit to Construct or Modify Air Pollutant Source, Tennessee Gas Pipeline Company, LLC, Compressor Station 563, Permit No. C28XX and the Draft/Proposed Part 70 Operation Permit, Tennessee Gas Pipeline Company, LLC, Compressor Station 563, Permit No. 70-0XX.
Response:	APC feels it is inappropriate to compare the potential emissions of the proposed facility to actual emissions from a small subset of stationary sources to draw conclusions about future non-attainment. Based on the updated RACT Analysis, the potential NOx and VOC emissions from the turbines will be below 103 and 11.5 tons per year, respectively. The actual emissions of NOx and VOC sources within Davidson County was estimated to be over 22,000 and 17,000 tons per year, respectively. At full potential, the proposed source would account for less than one half of one percent of NOx emissions in the county and less than one-tenth of one percent of VOC emissions in the county. 1 – Please see **General Topics: Zoning.** 2 – Please see **General Topics: RACT Analysis.**
Commenter:	Ms. Lynn Stenglein

Comment:	As residents of (1202 Walker Road, Goodlettsville, our home is within 2 miles of the proposed compressor station at Joelton and less than ½ mile from the existing pipeline. Succulently, we are at the intersection of the circle-area that will be adversely impacted by the proposed Joelton compressor and the Cane Ridge compressor. We have the following questions and concerns: 1. What will be the impact of ground water on the area? My neighbors and I have wells and are very concerned about the water quality of these wells that supply our drinking water. 2. What will be the impact on the air quality for the people and animals in the area, especially when the compressor gases are released into the air during shutdown, start up, blow out? There are many schools, churches, parks in the area, not to mention residences. 3. How does this station benefit anyone other than the Kinder Morgan, TN Pipeline, and their stockholders? Kinder Morgan has plenty of resources to put the compressor in an industrial area instead of the convenient White's Creek location. 4. What will happen, given the atrocious condition of a decades-old pipeline, with the increased pressure? The pipeline is on the property adjacent to ours. And many residences, churches, schools and businesses are much closer to it. 5. What is the impact on the wildlife and trees in the area? This area includes Bells Bend, Beaman Park, Paradise Ridge Park. It is one of the last areas of Davidson County that such natural areas. Why should this area be sacrificed? 6. What benefit will this compressor bring to the people of Tennessee or to the USA for that matter? We heat with propane; in the winter when we have needed deliveries of gas, the price of the gas has dramatically increased because the gas was being shipped overseas. Our local gas provider confirmed this. Kinder Morgan's and the other companies' scheme will decrease internal supply.
Response:	In the Environmental Assessment published by the Federal Energy Regulatory Commission (FERC), FERC concluded that, "the Project would not result in any significant longterm or permanent impacts on groundwater resources based on Tennessee's implementation of appropriate minimization and mitigation measures." Please also see **General Topics: Health Protection, Venting, and Pipeline Safety.**
Commenter:	Ms. Richelle Deharde
Comment:	Please protect my air - Donald 14years old
Response:	Please see **General Topics: Health Protection.**
Commenter:	Ms. Kaye Bentley

Comment:	My name is Kaye Bentley. I'm a resident of Joelton and live within 1,100 feet of the proposed gas compressor station. My family has lived here since 1889, six generations have lived on this land passing it down from one generation to the next. Two years ago we spent over $30,000 dividing the land between my sons and my nieces and nephews. Now with the possibility of a gas compressor station going in they are reluctant to build on the property. If families with this history and free land are reluctant to invest in this community why would anyone else want to move here? This would kill any growth in the Joelton community. My second question is about the bat population. I know Kinder Morgan had to pay off the Tennessee Wildlife Resources because of the known bat population on this property. I have seen the number of bats in our area dwindle over the past years, however, the mosquito population is still fairly low compared to other areas in Davidson County. We don't have any testing or spraying from Metro that I know of for mosquito's. With the rising concern over the Ziki virus you would think reducing the number of bats would be a real concern for the Health Dept. Kinder Morgan keeps saying the facility only covers 26 acres, but did they tell you they are clear cutting over 40 acres of mature trees that are documented bat nesting trees? With the noise from the compressor station the bats will likely not come back to this area. How does the Health Dept./Metro plan on compensating for this loss? My third concern is the noise. It's my understanding the frequency not governed by the Federal Government is the very low frequency. I have a documented hearing loss in the higher register, but the low frequency is way above normal. How will this effect my hearing? Will my hearing be consumed by the steady noise from the station? I guess my biggest concern is the air quality. I've heard Kinder Morgan say the gas is clean, but I have also read in their reports that the gas will be sent to the gulf to refineries before being sent overseas. That just doesn't make sense to me, if the gas is clean when it's going through the pipeline here, why would it need to be refined there? Also, there have been so many documented reports of the public who live near compressor stations getting sick from the known chemicals in the gas, how could you expose us to this health hazard? Thank you, Kaye Bentley
Response:	See **General Topics: Health Protection, Permitting Process and Noise.** MPHD does not expect this potential project to have any impact on mosquito activity.
Commenter:	Mr. Gary Moore – Same as letter 5 outlined above.
Comment:	This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TGP/KM # 563. Specifically, how often are emissions checked at the proposed compressor station? Given the recent exposer of TGP/KM inadequate maintenance and self-regulation of their pipes, will they also self-regulate their

	emissions? If not, who validates the figures for accuracy at the site? What happens if the numbers are exceeded? If numbers are exceeded, are these violations communicated to residents? Do violations result in fines levied against the company? Based on TGP/KM unwillingness to properly maintain and inspect their existing equipment, I respectfully request that the Metro Health Department deny the TGP/KM application for compressor station # 563 in Joelton. Thank you, Gary Moore
Response:	Please see **General Topics: Fugitive Emissions Monitoring**. In accordance with 40 CFR Part 60, Subpart KKKK, the source will be required to conduct annual emissions testing on the turbines. The regulations do allow for less frequent testing if initial results are low enough or alternative monitoring methods. All stack testing is done by an independent contractor and observed by APC staff. APC staff will conduct on-site inspections, review test reports, review monitoring reports, and review emission inventories. Violations will be addressed on a case-by-case basis and enforcement action will be taken, as appropriate.
Commenter:	Ms. Rebecca Armstrong
Comment:	Questions for John Finke: 1. Why is the financial responsibility of the citizens of Joelton and Antioch as well as other concerned citizens to prove why the compressor stations would not be a safe option for Davidson County? The pipelines are old and clearly showing signs of stress and damage from the lack of maintenance from Kinder-Morgan/TGP. 2. How can the Health Department issue a permit knowing very real possibility of the pipelines and/or the compressor station releasing toxins into the environment resulting in health issues? 3. Once the permit allows compressor stations to be built in our county, how an you 'shut the doors' or limit the size or limit the number of additional stations being built? 4. History shows Kinder-Morgan/TGP aren't able to prevent or maintain their pipelines and they are a multi-billion dollar company. So how will the Metro Health Department be equipped and manned to monitor and ensure the standards are being maintained? My husband and Mike Younger were two of the Joelton residents that went out to personally see if the pipelines were maintained. They were disappointed to see them in such bad condition. My husband would still be fighting against the compressor station, but he was killed in a car wreck on Whites Creek Pike on September 29, 2015. The Armstrong's have owned land in Joelton for many generations; we were hoping to continue that tradition with our children and grandchildren. Unfortunately, with the compressor station C30being proposed, the decline in the property value and possibility of the environment and air being polluted with toxins, they may never build their homes on their land. As a long time resident of Joelton, I'm worried about so many of the health issues associated

	with the pipelines and compressor stations. Thank you for listening to my/our concerns, Rebecca Armstrong (CCSE member)
Response:	Please see **General Topics: Hazardous Air Pollutants and Pipeline Safety.**
Commenter:	Dr. Sharon Felton
Comment:	I am certain that Bill Powers, the air expert from California, has submitted his comments to you. However, on the tiny OFF chance that he hasn't, I learned one important bit of advice from him: Make sure that you demand that a catalytic control system be included if the permit goes forward. Ideally, of course, the permit should be denied, and I feel confident you have enough evidence by this point to deny this permit. It takes a village, and this village clearly rejects this compressor. --Sharon Felton
Response:	Please see **General Topics: RACT Analysis and Permitting Process.**
Commenter:	Mr. Gary Moore
Comment:	Mr. Finke, Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TPG/KM # 563. Specifically, if a citizen has pre-testing done, such as an annual physical, before the compressor is constructed and receives a clean bill of health, and sometime later undergoes post-testing that confirms they have developed an illness related to exposure to toxic substances – such as BTEX (benzene, toluene, ethylbenzene and xylene). C33Who will bear the burden of responsibility such as medical expenses and or disability or even worse death? Will it be the Metro Health Department if the department allows the facility to be built? Thank You, Gary Moore
Response:	Please see **General Topics: Health Protection and Hazardous Air Pollutants**.
Commenter:	Mr. Scott Banbury

Comment:	On behalf of the 1082 members of the Tennessee Chapter of the Sierra Club that live in Davidson County, I respectfully ask that you deny the pending air permit for the Tennessee Gas Pipeline Compressor Station in Joelton, TN. Compressor stations are known to emit and or release Volatile Organic Compounds and EPA listed Hazardous Air Pollutants. Sierra Club believes that emissions from the proposed facility will have chronic impacts on human health and the surrounding natural environment. We know that emissions will contribute to ground level ozone formation, as well as greenhouse gases. For these reasons, we believe the permit for this facility, which serves no local need, and offers little economic benefit to the community, should be denied. Continuous fugitive emissions are poorly documented but under increasing scrutiny. They occur as a result of intentional engineering, including pneumatic controllers and, in some cases, the type of seals used on the compression turbines. Other fugitive emissions originate from poorly sealed joints on pipes and other equipment, as well as the venting of condensate tanks. While we are happy to see that the Health Department is incorporating EPA's new fugitive emissions rules issued May 12, 2016, we believe that quarterly monitoring is insufficient to protect the public health. Should this permit be issued, we believe that Metro Health should invest in Optical Gas Imaging (OGI) equipment and monitor fugitive emissions on a much more frequent and randomly scheduled basis, or preferably by permanently installed, continuously recording OGI equipment and air sampling stations. We note that emissions from pipeline liquids storage tanks have been specifically exempted from monitoring. These tanks pose a serious threat as a source of fugitive emissions, several components of which may pose both acute and chronic health risks, including cancer. We believe that fugitive emissions from these tanks must be included in fugitive emission monitoring. Blowdowns, whether planned as part of routine maintenance or a result of accidents or emergency situations, are a source of enormous releases of methane and the Volatile Organic Compounds and Hazardous Air Pollutants present in Natural Gas. Since the enormous emissions released during blowdown events are released in a very short time period they often exceed concentrations that would be safe for human health, particularly for sensitive populations. Should this permit be issued, we believe it should require monitoring of all scheduled blowdowns using OGI equipment as well as air sampling at various distances around the facility. Permanently installed OGI and

	air sampling equipment should be installed and designed to automatically sample and record when unscheduled blowdowns occur. Particulates: the permit lists only PM10 in the list of pollutants to be monitored. Sierra Club believes that the facility should also be subject to monitoring for PM2.5. Lastly, the Sierra Club believes that the combination of Metro Ordinance No. BL2015-1210, enacted in August, 2015, which established "natural gas compressor station" as a use permitted only in industrial zoning districts, and Metro Ordinance NO. BL2016-234, enacted on July 5, 2016, which established that conformity to Metro Zoning be a condition of Metro Health Department New Source permits, prohibits the Health Department from issuing this permit. For this reason alone, the permit should be denied.
Response:	Please see **General Topics: Health Protection, Venting and Fugitive Emissions Monitoring.** Whether Metro invests in OGI equipment or performs frequent/unannounced inspections would be independent of whether a permit can or cannot be issued. MPHD agrees that the condensate storage tank is not exempt from permitting and has been added to the permit. There is no underlying regulatory emission limit for PM2.5, applicable to the source. MCL 10.56.080 establishes fees based on allowable emissions. PM2.5 emissions are a subset of PM10 emissions and, thus, are already accounted for in the permit. Please see **General Topics: Zoning**.
Commenter:	Ms. Wendy Bullington
Comment:	I do not want the compressor in joelton. It's dangerous and will ruin our quality of life. It's a terrible idea and I don't know why it'd being considered. I live at 2830 union hill rd.
Response:	Please see **General Topics: Permitting Process.**
Commenter:	Mr. & Mrs. Dan and Glenda Kirby
Comment:	I have the following concerns about the proposed gas compressor proposed for Joelton. My mother used to live in Springfield which is well within the 30 miles affected area for the proposed Joelton compressor. She has many friends who still live in that area and we are concerned for their health. In addition, my

	cousin, his wife, and their children and grandchildren live in Roberson County within the affected zone. The air quality in Davidson County where my family now lives may also be affected. I have to take two medications that can potentially compromise my lungs. It is my understanding that the compressor will affect air quality with a 30-mile radius of the unit. I do not want to be exposed to methane and other toxins, including benzene, toluene, sulfuric oxide, and formaldehyde that may further put my lungs at risk. Will this compressor emit nitrous oxide? I am not a chemist, but I have read that nitrous oxide would put local crops at risk because it interacts with other organic compounds to create ozone. Will that ozone also affect the quality of the air we breathe? A compressor is also being proposed in Antioch, TN. How will Davidson county's air quality be affected since most of the county will be within 30 miles of both compressors? The owner of the proposed compressor says that air quality will be safe because it is monitored and will not exceed certain levels. Who monitors the emissions once it is up and running? How often is it checked? What happens if the dangerous emissions level is exceeded? Will they be shut down or will they just be fined? I don't believe a fine is sufficient deterrent because they can just pay the fine and continue to pollute the air--causing damage that cannot be undone. Thank you for your careful consideration of this matter. We ask that their permit be denied unless they can prove beyond a doubt that there will be no harm to Davidson county residents.
Response:	Please see **General Topics: Area of Impact and Health Protection**. In accordance with 40 CFR Part 60, Subpart KKKK, the source will be required to conduct annual emissions testing on the turbines. The regulations do allow for less frequent testing if initial results are low enough or alternative monitoring methods. All stack testing is done by an independent contractor and observed by APC staff. APC staff will conduct on-site inspections, review test reports, review monitoring reports, and review emission inventories. Violations will be addressed on a case-by-case basis and enforcement action will be taken, as appropriate.
Commenter:	Ms. Joan Sullivan
Comment:	I am writing to urge you to reject Tennessee Gas Pipeline's request for a permit to build and operate a high-pressure gas compressor station in Joelton. 1) The pollution expected to emanate from this facility during normal operation is projected to spread out for a 50 km radius, thus making this a health hazard throughout Davidson County, much of TN, up beyond Clarksville into KY. So this is clearly not a "NIMBY" issue; it covers a large chunk of TN and beyond. And that is under "normal

	operating conditions." 2) They are planning to use existing pipelines, many of which are 60+ years old. We have seen evidence of exposed pipes which are corroded and unsafe under normal pressure. How long will it take for these areas to explode under high pressure??? PHMSA records indicate that TGP C32experienced 92 "significant incidents" (i.e. fires and explosions) between 2006-2014. This resulted in $88,144,152. in property damage and 19 federal enforcement actions. 3) Another potential problem increasing the likelihood of leaks and explosions is their plan to reverse the flow of gas through these old pipes. The flow currently is south to north, but when the compressor station is built it will be used for north to south flow. Therefore, the pipe connections with one pipe sliding into the next pipe will also be reversed---and now will unfortunately result in a narrowing of the pipe's capacity within the overlap area. This resulted in a temporary reduction in pressure when the flow was from south to north, but will increase the pressure once the flow is reversed to north to south. Combine this with the 60-year old corroded pipes and we have a major explosion waiting to happen. 4) PLEASE deny this risky permit as part of your role in "Protecting, Improving, and Sustaining Health" for residents of Metro and far beyond. Thank you, Joan M. Sullivan 7601 Harper Rd. Joelton TN 37080.
Response:	Please see **General Topics: Area of Impact and Pipeline Safety.**
Commenter:	Ms. Kaila Sewell
Comment:	Mr. Finke, My name is Kaila Sewell and I am a life-long resident of Joelton. (at 3429 Binkley Road). I am writing this email to let you know that I absolutely do not support the addition of the Gas Compressor station to my community for a variety of reasons. First, much like the growing city of Nashville, with the Compressor, Joelton will see rapid growth, and will likely lose its small town charm--- the charm that the residents of this town have fought valiantly to save. Second, the noise pollution produced by this compressor is enough to ruin the residents' quality of life. I am sure that you, much like me, and the rest of the occupants of Joelton who are fighting against this monstrosity, have no desire to live with what will sound essentially like a giant bumble bee buzzing in your yard, home, and head at all hours of the day and night. Third, there is a safety issue with this compressor. Apparently compressor stations such as this one have the potential to spontaneously combust, leaving the people of Joelton homeless, jobless, and perhaps without their lives. Finally, there is a wildlife rehabilitation center called Walden's Puddle that is very close to the proposed compressor site. If the compressor is placed in our rural, residential area, then Walden's Puddle will be forced to close, leaving an unknown number of animals without the help that they need. As a life-long

	member of the Joelton community, I am asking you to please fight against this compressor to make the future for my little town safer, quieter, and more charming for generations to come. Thank you, Kaila Sewell
Response:	Please see **General Topics: Noise, Pipeline Safety and Health Protection.**
Commenter:	Marisab2001@yahoo.com
Comment:	I live at 2830 union hill in Joelton and I am fully against the compressor being put in. I don't know a single person that thinks it's a good idea to have it here
Response:	Please see **General Topics: Permitting Process.**
Commenter:	Mr. & Mrs. Bob and Sharon Litts
Comment:	Mr. Finke, As a resident of Southeastern Davidson County , our family is very concerned about the proposed gas compression station in Joelton. It will change the air quality in this growing urban area, and with the possibility of another station being built nearby, the threat to the environment will be much greater. We appreciate anything you can do to stop the Joelton plant from happening. Bob & Sharon Litts Cane Ridge, TN 37013
Response:	Please see **General Topics: Health Protection.**
Commenter:	Mr. Jonathan Ramirez
Comment:	As a farmer in Joetlon TN, I care about the quality of the earth around me. If I care for it, it returns its gifts to me with the abundance of life and health. Our beautiful land is under threat. Kinder Morgan and other colluding parties wish to exploit the people of Nashville and the people of this country for a massive profit. They do this with no true regard for the peoples health and safety nor for the health and well being of the land that gives us life. The community is fully aware of the criminal collusion occurring between big business and the Federal Energy Regulatory Commission (FERC) all around the county, and the community has pledged that it will not be another victim of this so-called "progress". We ask you to stand with the residents of Joelton in your position of sacred

	responsibility and hold true to your intention to protect the health of our beautiful neighborhood. The community did not want it many years ago when the pipes first came in and we do not want it now. We know that it is unsafe and polluting and our community refuses its presence. Thank you for your service,
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Mr. Gary Moore
Comment:	Mr. Finke, Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/comment regarding the air/construction permit for the Joelton compressor station TPG/KM # 563. You have heard a brief, two minute, report from Bill Powers regarding the proposed TGP/KM gas compressor station for Joelton. I am sure by now you have taken the opportunity to read the full report. There are two points I would like to make regarding the TGP/KM application dated September 15, 2015. That is, in my opinion, TGP/GM were one, incompetent or two, were intentionally trying to deceive members of the Metro Health Department. I say this because in the Powers report he states: "The Tennessee Gas Pipeline Company, L.L.C.1 (TGP) has submitted a Reasonably Available Control Technology (RACT) analysis that uses outdated and incomplete information to incorrectly conclude that an oxides of nitrogen (NOx) limit of 25 ppm is RACT for the two Titan 250 turbines at the proposed Joelton Compressor Station. The Metro Nashville/Davidson County Air Pollution Control Division erroneously accepted the TGP RACT analysis with essentially no critical or independent review." Regardless of whether their actions were a mistake or intentional, I think, it would be incumbent upon the Metro Health Department to assume that the individual submitting the application for a company that submits applications on a routine basis would have, or should have, known the information was outdated. I am of the opinion they knew better, but knew this was a first for the Metro Health Department and thought they would get away with it. Who knows, maybe they would have had it not been for the Powers report. Is this the only fallacy in their application? As I have requested in previous emails, I respectfully ask that the application for the proposed compressor station # 563 in Joelton be denied. Thank you, Gary Moore
Response:	Please see **General Topics: RACT Analysis.**
Commenter:	Ms. Sharon Litts

Comment:	As residents of Southeast Davidson County, my family is very concerned about the planned gas compression plant in Joelton. It will affect our air quality in this growing urban area, and with the possibility of a second station being built close by, there is even more of a threat to the environment. We appreciate any effort you can give to stopping this.
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Mr. Gary Moore
Comment:	Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/comment regarding the air/construction permit for the Joelton compressor station TGP/KM # 563. The following mission statement was taken directly from the Metro Nashville Health Department website: "The mission of the Metro Public Health Department is to protect, improve, and sustain the health and well-being of all people in Metropolitan Nashville." In addition, the Metro Code of Law is very clear as it states in 10.56.170; "10.56.170 - Emission of gases, vapors or objectionable odors. No person shall cause, suffer, allow or permit any emission of gases, vapors or objectionable odors beyond the property line from any source whatsoever which causes injury, detriment, nuisance or annoyance to any considerable number of persons or to the public, or which causes or has a natural tendency to cause injury or damage to business or property." (Prior code § 4-1-10) Given the forty documented ill effects sited below regarding compressor stations that give a clear indication of what to expect with compressor station 563 and 10.56.170 of the code; how can the Metro Health Department be expected to protect, improve, and sustain the health and well-being of all people in Metropolitan Nashville and see that no person shall cause, suffer, allow or permit any emission of gases, vapors or objectionable odors beyond the

	property line from any source whatsoever which causes injury, detriment, nuisance or annoyance to any considerable number of persons or to the public, or which causes or has a natural tendency to cause injury or damage to business or property? It is my hope, that given the potential of serious ill effects of the proposed TGP/KM compressor station # 563, you will take time to open each link below and read firsthand the illnesses caused by compressor stations that are much smaller in size than the proposed Joelton station. Not only do I think the right thing to do would be to deny the permit application, I also think it is incumbent on the Metro Health Department to adhere to their on mission statement and comply with the Metropolitan Code of Law. Based on the afore mentioned, I respectfully request the Metro Health Department deny TGP/KM application for compressor station # 563 in Joelton.
Response:	Please see **General Topics: Section 10.56.170.**
Commenter:	Mr. Geoff Collins
Comment:	Mr. Finke, I urge you to consider the health effects of the gas compressor stations and deny the permit for Joelton station. The two natural gas pipeline compressor stations proposed in Davidson County will affect much more than just the people who live in Joelton and Southeast Nashville. According to the Federal Energy Regulatory Commission (FERC), the cumulative effect of these large compressor stations will impact residents up to a 30-mile radius from each location. Emissions from these two facilities would also contribute to ground level ozone formation and may threaten Davidson County's attainment for National Ambient Air Quality Standards on ozone, jeopardizing economic growth in sectors that promise much greater employment opportunities. Thank you, Geoff Collins 2626 Bowwater Lane Antioch, TN 37013
Response:	Please see **General Topics: Area of Impact and Health Protection.**
Commenter:	Mr. Gary Moore
Comment:	Mr. Finke,

	Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TPG/KM # 563. Specifically, how can the Metro Health Department issue an air/construction permit in direct violation of not one, but two sections of the Metro Code of Law? As you will recall, substitute ordinance no. BL2015-1210 by Councilman Lonnell Matthews passed the Metro Council and is now in the Metro Code of Laws. You will further recall, the second substitute ordinance no. BL2016-234 by Councilman Fabian Bedne also passed the Metro Council and is now law. 1) SUBSITUTE ORDINANCE NO. BL2015-1210 An ordinance to amend various sections of Title 17 of the Metropolitan Zoning Code related to natural gas compressor stations. (Proposal No. 2015Z-014TX-001). WHEREAS, Natural gas compressor stations are operationally and physically similar to an industrial use; WHEREAS, Industrial uses are incompatible with many other land uses and are not sensitive to the environment; and WHEREAS, Because of the similarity to industrial uses, natural gas compressor stations are only appropriate in industrial zoning districts. NOW, THEREFORE, BE IT ENACTED BY THE COUNTY OF THE METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY: Section 1. Section 17.04.060 (Definitions of general terms) of the Metropolitan Code is hereby amended by inserting the follow definition of "Natural Gas Compressor Station": Natural Gas Compressor Station means a facility designed and constructed to compress natural gas that originates from an Oil and Gas well or collection of such wells operating as a midstream facility for delivery of Oil and Gas to a transmission pipeline, distribution pipeline, Natural Gas Processing Plant or underground storage field, including one or more natural gas compressors, associated buildings, pipes, valves, tanks and other equipment. Section 2. Section 17.08.030.F (District land use tables) of the Metropolitan Code is hereby amended by adding "Compressor Station" as a permitted use (P) in IWD, IR and IG zoning districts. Section 3. Table 17.20.030 (Parking requirements) of the Metropolitan Code is hereby amended by inserting the following row for "Compressor Station" under Industrial uses: Natural Gas Compressor Station 1 space per employee Section 4. This Ordinance shall take effect five (5) days from and after its passage and such change be published in a newspaper of general circulation, the welfare of The Metropolitan Government of Nashville and Davidson County requiring it. Introduced by: 2) SECOND SUBSTITUTE ORDINANCE NO. BL2016-234 An ordinance amending various sections of Chapter 10.56 of the Metropolitan Code of Laws to allow additional information requirements under section 10.56.020.A.1, and to add Metropolitan Zoning Code compliance to the provisions of section 10.56.020H. BE IT ENACTED BY THE COUNCIL OF THE METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY:

	Section 1. That Chapter 10.56 of the Metropolitan Code of Laws shall be and the same is hereby amended by deleting Section 10.56.020.A in its entirety and substituting in lieu thereof the following new Section 10.56.020.A: 10.56.020 - Construction permits. A. 1. It is unlawful for any person to install, erect, construct, reconstruct, alter, or add to, or cause to be installed, erected, constructed, reconstructed, altered or added to, any fuel-burning equipment, incinerator, process equipment, control device, or any equipment pertaining thereto, or any stack or chimney connected therewith, or to make or cause to be made any alteration or repairs which increases the amount of any air contaminant emitted by such source or which results in the emission of any air contaminant not previously emitted until application for a construction permit has been filed with the metropolitan health department and plans and specifications applicable to the work have been submitted to the director and a construction permit issued by him for such construction, installations, alterations or repairs. Applications for a construction permit shall be filed in duplicate in the offices of the director on forms adopted by the director and supplied by the metropolitan health department along with a copy of plans and specifications. The director shall not grant a construction permit to any source which does not comply with the provisions of the New Source Review Regulations as adopted by the board. If the director determines, on the basis of information available to him, that such source does, or in all likelihood will, operate in violation of this chapter, or that the source will operate so as to prevent attainment or maintenance of any national ambient air quality standard, he shall either impose conditions on the face of the construction permit that in his opinion will promote compliance with this chapter, and/or attainment and maintenance of any national ambient air quality standard, or he shall deny the application for the construction permit. At the request of the director, the applicant shall provide information necessary for the director to make the determination of whether the source does, or in all likelihood will, operate in violation of this chapter, or whether the source will operate so as to prevent attainment or maintenance of any national ambient air quality standard. For a major source, such information required may include a source impact analysis and air quality analysis as set out in regulations adopted by the Board. This section shall not apply to fuel-burning equipment used exclusively for heating less than three dwelling units, or to gas, or fuel oil equipment of five hundred thousand BTU input or less or to internal combustion engines. 2. In addition to any other remedies available on account of the issuance of an order prohibiting construction, installation, or establishment of any fuel-burning equipment, incinerator, process equipment, or control devices, and prior to invoking any such remedies, the person aggrieved thereby shall, upon request in accordance with the provisions of this chapter and the rules and regulations adopted by the board be entitled to a hearing. Such hearing shall be conducted pursuant to the contested cases provisions of the Uniform Administrative Procedures Act, Tennessee Code Annotated, Title 4, Chapter 5, Part 3 (T.C.A. § 4-5-

	301 et seq.). 3. The absence or failure to issue a rule, regulation or order pursuant to this section shall not relieve any person from compliance with any emission control requirements or with any other provision of law. Section 2. That Chapter 10.56 of the Metropolitan Code of Laws shall be and the same is hereby amended by deleting Section 10.56.020.H in its entirety and substituting in lieu thereof the following new Section 10.56.020.H: H. No new source shall be granted a construction permit unless the new source complies with the Metropolitan Zoning Code for the use of the property on which the new source is to be constructed. For purposes of legal nonconforming uses, in accordance with Tenn. Code Ann. §13-7-208, this requirement shall not apply. The receipt of a construction permit from the Metropolitan Health Department shall not be construed to indicate approval of the strength or safety of any equipment or to indicate compliance with the requirements of the Building Code of Metropolitan Nashville and Davidson County or any other ordinance thereof. Neither shall it relieve anyone from the responsibility to comply fully with the applicable provisions of this Code, nor any other requirement(s) imposed by statute, rule or regulation of the Metropolitan Government of Nashville and Davidson County, Tennessee, the State of Tennessee or the United States Government. Section 3. This Ordinance shall take effect from and after its enactment, the welfare of The Metropolitan Government of Nashville and Davidson County requiring it. Sponsored by: Fabian Bedne, Jacobia Dowell, Karen Johnson, Tanaka Vercher LEGISLATIVE HISTORY Introduced: May 3, 2016 Passed First Reading: May 3, 2016 Referred to: Codes, Fair, and Farmers' Market Committee Health, Hospitals, and Social Services Committee Substitute Introduced: May 17, 2016 Passed Second Reading: May 17, 2016 Deferred to July 5, 2016: June 7, 2016 Second Substitute Introduced: July 5, 2016 Passed Third Reading: July 5, 2016 - Roll Call Vote Approved: July 6, 2016 By: Requests for ADA accommodation should be directed to the Metropolitan Clerk at 615/862-6770. Based on the two aforementioned Metro laws, I respectfully request that the Metro Health Department enforce the laws that were duly passed by two separate Metro Council bodies and deny the application for TGP/KM compressor station # 563. Thank you, Gary Moore
Response:	Please see **General Topics: Zoning**.
Commenter:	Dr. William Robertson
Comment:	Comment 1: The proposed Joelton compressor station is overbuilt. Comment 2: EPA should require a more thorough review of alternate sites.

	Comment 3: The permit application appears to underestimate formaldehyde emissions. Comment 4: The opening paragraph of Section 1.2 of the draft Air Permit Comment 5: Environmental Justice Comment 6: Children's health review by EPA because of proximity to Paradise Ridge Park Comment 7: Was notice given to the state of Kentucky?
Response:	Comment 1: Business models and consumer demands of a company are not part of the permitting process. APC evaluates the requested facility to ensure compliance with all applicable air pollution requirements Comment 2: As stated in **General Topics: Site Selection**, network design and site selection are beyond the purview of the MPHD and left to FERC for their analysis. Comment 3: The compressor stations, mentioned in the comment, utilize thirteen and twenty-two natural gas-fired engines, respectively. The proposed facility will use natural gas-fired turbines. EPA estimates formaldehyde emissions from natural gas-fired engines to be 70-80 times higher than natural gas-fired turbines, on a Btu by Btu basis. Comment 4: Condition 1.2 merely states that non-compliance with locally enforceable-only requirements is not a violation of the Clean Air Act. It does not state that they are not violations. Comment 5: Please see **General Topics: Environmental Justice** Comment 6: As stated above, the protection of children is an important factor in the development of NAAQS as outlined in **General Topics: Health Protection.** Comment 7: Yes, in accordance with 40 CFR 70.8, Tennessee Department of Environment and Conservation and Kentucky Division for Air Quality were given notice of the draft permits.

Commenter:	Mr. Alandis Brassel for Congressman Jim Cooper
Comment:	I am writing in opposition to the proposed Tennessee Gas Pipeline compressor station. I am deeply concerned about the proposed compressor station's emissions, and that the pipeline operator is knowingly taking advantage of weaker emission standards and using weaker emission controls just to save money. If allowed to continue as proposed, the construction and operation could harm the Joelton community. Homes, farms, property values and neighbors' livelihoods are at risk. I trust that you will thoroughly review the permit application, but worry that long-term health risks are unnecessary and avoidable. Under what circumstances, if any, could the proposed compressor station emissions make Davidson County noncompliant under the National Ambient Air Quality Standards? What safeguards, if any, will the Pollution Control Division put in place to make sure that the compressor station adheres to these standards? Please include in your response any alternative cost-benefit analyses conducted by the Pollution Control Division with stronger, currently available emission controls for the proposed turbines. If no alternative controls have been reviewed, please give a detailed explanation as to why they were excluded. Please explain how your review accounted for emissions' potential effects on surrounding vegetation and the health of citizens in the area. What assurances do you have that the proposed compressor station's emissions will not harm the surrounding community?
Response:	Please see **General Topics: Health Protection, Permitting Process and RACT Analysis.**
Commenter:	The Andersons
Comment:	I would like to a moment of your time to express my feelings about the compressor pipeline that may be installed in the Joelton/ Whites Creek area. This community is a quiet and peaceful area where many choose to raise families and farm animals. This addition is not welcome. The level of noise and the potential hazards are too risky. Please

	consider how much the negatives outweigh the positives. The Andersons @ 3005 Union Hill Rd. Nashville, TN 37207
Response:	Please see **General Topics: Noise and Health Protection.**
Commenter:	Ms. Benita Bullion
Comment:	Joelton and Metro Nashville are in danger of being environmentally poisoned by toxic emissions from a proposed compressor station. Your help is essential to stop this construction. Many toxic gases will be released into our air via blow-downs, fugitive releases, poor maintenance (well documented), and accidents. These emissions are known to cause major adverse health effects in humans and animals. Blow-downs are just one of the many major concerns I have to the threats our community would face. A blow-down, according to research reports, is a complete venting of the gas within a compressor/pipeline into the atmosphere. Planned blown-downs typically occur 8 to 10 times a year with multiple blow-downs occurring per month. A single blow-down from a much smaller station than this one is proposed to be releases a gas plume 30 to 60 meters upward of 15,000 cubic feet plus of methane and other VOCs into the atmosphere. The first 30 to 60 minutes of the blow-down is the most intense, but the entire blow-down may last up to three hours or more. This can sound like a jet taking off. Consider the health risks to Joelton---its citizens, parks, schools, churches, businesses---and that of our larger Metro Nashville community...just a breeze away. Please deny this permit. Respectfully submitted, Benita Bullion 7474 Whites Creek Pike Joelton, TN 37080 (0.9 mile from the proposed site)
Response:	Please see **General Topics: Hazardous Air Pollutants and Venting.**
Commenter:	Ms. Diane Butler
Comment:	The proposed compressor station in Joelton is inappropriate, damaging, and probably illegal. The area in question is a residential one and the quality life for those living there will be adversely impacted in ways most harmful to them - health, property values, etc. - and without their consent. This station will benefit no actual people who live there. Tennessee is a beautiful state blessed with abundant natural resources. Water is our most precious resource and should be protected for it's life-essential benefits; it may well be the most valuable asset that our future depends on. Please consider the future well being of our state and its citizens and understanding for the people of Joelton.

	Thank you for your consideration. Sincerely, Diane Butler Nashville, TN 37220
Response:	FERC's Environmental Assessment states, "The Project, in combination with past and future projects, is not anticipated to result in significant cumulative impacts on waterbodies and wetlands."
Commenter:	Ms. Martha Sanford
Comment:	I am gravely concerned for the environmental welfare of not just Joelton but the entire Metro Nashville area. The health impact of potentially living near one of the largest gas compressor stations in the United States is terrifying. Chemical emissions from blow-downs, fugitive releases, and accidents of nitrogen oxides, carbon monoxide, particulate matter, and other volatile organic compounds are all major components of smog. These emissions are known to cause significant health effects in exposed populations. These dangerous emissions along with others you are familiar with are toxic, carcinogenic or neurotoxic - highly associated with health impacts on respiratory, neurological and cardiovascular body systems. Know that these emissions will not only affect the park and citizens living within one mile as I do of the proposed site, but also the children attending the elementary and middle schools approximately two miles away, the three church congregations, community ball park, businesses and citizens living here. Consider, also, the collection of these emissions in the Cumberland bowl area of nearby Nashville---Joelton being above Nashville. Please do the right thing for Joelton and Nashville. Put our health/air quality and safety first above the export profits of an industry giant. Sincerely, Martha S.Sanford
Response:	Please see **General Topics: Health Protection and Hazardous Air Pollutants.**
Commenter:	Ms. Vanessa Paz
Comment:	Mr. John Finke; I moved to Nashville almost 2 decades ago and now it has become my home. I have seen growth and I have been part of the growth with work and the way I use my capital. I made a decision to move to the rural area investing on land and creating with others a community that cares about the food, water, air and quality of life that is closer to nature. We are a strong and vibrant community and many more are joining and investing on rural Davidson and Cheatham County. When you have a company like Kinder Morgan that have only financial interest planning on moving into our community, We are going to speak out !! What are they bringing for us and for you ? I

	have read and listened about what this gas compressors do, noise, air and water pollution, no jobs, no end product for our community. This is the kind of investment that will bring a vibrant and strong community to decay and fail, people will start selling their land moving away and leaving desolated rural areas, a weak economy and a sick and impoverish population; please see what has happened in other parts of the county when you start granting permits to big polluters!! Please see the 2 possibilities and remember that public service is to serve the people. Stop TGP. Thank you Vanessa Paz
Response:	Please see **General Topics: Permitting Process.**
Commenter:	Mr. Roger Kanies
Comment:	Dear Mr. Finke, I am against the proposed compressor stations. They are a loud, industrial intrusion into rural areas and neighborhoods where the locals don't want them. There are questions about the safety about existing pipelines some of which are old. Why should we endanger our citizens for the gas companies when one of the main purposes of these stations is to enable the companies to export to other countries. Roger Kanies, Hermitage, TN
Response:	Please see **General Topics: Noise and Pipeline Safety.**
Commenter:	Mr. & Mrs. Randy and Renee Alexander
Comment:	Our farm is only 1.25 miles from the site where Tennessee Pipeline, LLC/Kinder Morgan plans to put a gas compressor station the size of two football fields combined. My husband and I have only lived in the Joelton area for 15 years but we both are life long Davidson County residents. Both born in this county, I am in my late 40's and my husband late 50's. We have two daughters; the youngest 10 years of age, was born with two major heart defects. She is our biggest concern with this compressor station. Studies have shown that the gasses that are emitted into the air (by-products of the natural gas that are not needed to ship to the gulf for export) cause heart problems for otherwise healthy people. So what does this mean for our daughter who has the right side of her heart missing? She has only been hospitalized twice in her 10 years for illness. She participates in any studies that help with medical advances. Part of her staying healthy is exercise and fresh air thatshe gets running around our farm and riding her pony. We do not own an X-Box. As my girls pointout to friends or relatives who say they should

	get one, we have the farm to play on and farm animals to care for, we don't need an X-Box. Now my 10 year old miracle is anxious that when they put this compressor station so close to our farm that she will no longer be able to play outside or ever ride her pony again. I heard the representative for Tennessee Pipeline, LLC/Kinder Morgan say at the Health Department Public Hearing that this station will not adversely effect the residents, yet the FERC report shows that they admit it will permanently effect our air quality. I filled out a card about our daughter and farm animals that was sent to the FERC and they returned a generic letter with a "book" regarding the proposed station. No specifics on how this will directly impact her or our animals. Our animals are another concern regarding the air and noise pollution. We have chickens and we raise a calf for our own organic food to keep our family as healthy as possible, especially, our 10 year old. We also have dogs, cats, fish, horses, ponies, and mini donkeys including a mini donkey that is 18 months old and one that is only 3 months old. We have a quarter horse that may be expecting also. The noise and air pollution will affect her pregnancy and her foal in a very negative way. The 2 mini donkeys will be effected in a very negative way. Horses and donkeys are growing and maturing for 5 years. Any noise and air pollution of the quantities that will be produced by this compressor station will cause their growth to be effected in a very negative way. Joelton has the largest concentration of organic farms that supply food to a large portion of Nashville. I want to know what the USDA says regarding these farms keeping their organic status once this station is operational. One farm is directly across the street. If their organic status is lost, how does that not translate into this station being a detriment to our community pollution wise? This proposed station has already negatively impacted our property values so that those of us with mortgages are stuck here. We have no choice but to stay even with this giant station polluting our farms and families. This lifelong Davidson County family doesn't want to give up our farm, but we have to make sure our children and animals are kept healthy. We are asking the persons who have the ability to keep our citizens and animals safe to please do so. Sincerely, Randy and Renee Alexander 7631 Bidwell Road Joelton, TN
Response:	Please see **General Topics: Health Protection and Noise**. With respect to the organic status of farms and the USDA, they should be contacted directly.
Commenter:	Mr. Matthew Beadlecomb
Comment:	This pipeline project is really not wanted in this area. Please help us in anyway possible to keep it from coming to fruition. Thank you, Matthew Beadlecomb
Response:	Please see **General Topics: Permitting Process.**

Commenter:	Jeremy (jlek24@gmail.com)
Comment:	To Whom It May Concern, I am writing to express my concerns over the gas compressor stations that are trying to be built in Joelton and Cane Ridge (and potentially Ashland City I have heard). The evidence confirming the ill health effects from these gas compressor stations is overwhelming. That alone should prevent these compressors from being built. The people of Nashville have spoken up loudly and it is very clear that the people of this city do not want these stations here. I have full confidence too that if the rest of Nashville was polled about these stations, you would find almost no one who would support it. So, with this as such, why are the people of Nashville continuing to have to fight to keep this from happening? Why is Kinder Morgan even trying to continue this? Also, do any Kinder Morgan executives live in Joelton and Cane Ridge? Thank you, Jeremy
Response:	Please see **General Topics: Health Protection.**
Commenter:	Ms. Lori Birckhead
Comment:	Dear Mr. Finke, When first learning that Kinder Morgan planned to construct a gas compressor station on land 1000 feet from my farm, I searched online to understand what this was and what type of an impact it would have. I had to read through countless articles and research papers that consisted of personal experiences and scientific data. Then I researched Kinder Morgan. This company and its subsidiary Tennessee Gas Pipeline, as I found out are not the "good neighbors" they profess to be. I quickly came to realize that there was no way TGP would or could ensure the safety of its neighbors here in our area. On March 5, 2015, I was told by the Kinder Morgan's land access agent that this was a done deal and there was nothing I could do about it. I asked why wasn't there a public meeting and was told it was not necessary as they had put an announcement in the newspaper. At that time, I made it my personal mission to encourage my neighbors to do the same as I did and do their own research. I reached out to local political representatives. Then one day while researching, I came across a document online that was from the Madison County Health Department in a response filing to the FERC. This report was my first bit of hope. In response to a 10,880 HP gas compressor station being proposed for their county, Madison County Health Department wrote a very comprehensive report to the FERC detailing their concerns and the detailed medical research they had compiled on the adverse health effect of the compressor station's emissions to the public. I have

	attached this document with my comment. MCHD also hired a consultant to help individuals file their comments with the FERC and they recommended setting up a regional health registry so that long-term health effects from natural gas infrastructure, including the Sheds compressor station, could be adequately assessed and addressed. Ideally, this registry would be part of a larger state and/or national level registry, since the infrastructure for natural gas energy is increasing across the USA. I felt sure that our own health department would be just as proactive in it's concern for its citizens, particularly with the threats we now face. My question to you is have you read the attached documents? If not, would you please? After reading the Madison County Health Department reaction to a proposed compressor station in their county, as well as all the other scientifically based and researched comments from people like Dr. Bill Robertson, and others in our community, what are your concerns for the public health should this compressor station be built despite all the evidence at hand to the contrary? If there is absolutely no way for the Metro Nashville Health Department to deny the air permit and stop this atrocity, would you at least, based on all the evidence you have received recommend to the EPA a baseline health analysis or health screening for the people of Joelton who live in close proximity to this station? If there is any legal possibility to deny the Title V permit would you do this? Thank you for your time and I look forward to your answering my questions, Sincerely, Lori Birckhead
Response:	Please see **General Topics: Hazardous Air Pollutants and Health Protection**. Additional monitoring may be considered in the future. However, any such study would be independent of the permitting process.
Commenter:	Mr. & Mrs. Mark and Julie Sloan
Comment:	Mr Finke, I am writing concerning the proposed gas compressor station in Joelton, our farm being less than 2 miles from the site. After much research and attendance at many meetings listening to the experts speak, and Kinder Morgan, it would seem that no reasonable person would willingly allow this polluting station to be built here. Your office holds the power to stop it, and it seems unthinkable that this office would forgo its duty to protect the health of its citizens, and vote to allow it. ESPECIALLY in the way it's being proposed, which is the cheapest and most polluting way it could possibly be built. Please do what's in your power to protect us. We have worked all our lives to build our place by hand, from home to barn. And now will be forced to leave to protect our health. And even in doing that, our property value will be SEVERELY impacted. Please. The majority of our council did not buckle to KM. Please stand up for us also. Mark and Julie Sloan

Response:	Please see **General Topics: Permitting Process.**
Commenter:	Ms. Hannah Maloney
Comment:	Dear Mr Finke, I am writing with my concerns about the natural gas compressor station proposed for Joelton. 1) How does the Health department plan to monitor the public for health issues caused by the emissions from the compressor station? 2) Is there definitive evidence that the combination of chemicals emitted in the quantity they are emitted from compressor station which burn fracked gas are safe for the public? Are they safe for vulnerable populations-children, citizens with chronic illnesses, the elderly, and pregnant women? 3) If the answer the previous question is not known why allow TGP to build? Why not require safety evidence? 4) How are the emissions from "blowdowns" measured? When are the measured? During the event? After the event? If so how long after the event? 5) Who is responsible for monitoring emissions from the compressor station? Is it possible to revoke the permit and stop the compressor station from functioning if it violates emissions? If future studies suggest/prove the emissions are harmful? 6) If a citizen has pre/post testing that confirms they have developed an illness related to toxic substances emitted from the compressor station will it be the health department that is held accountable since the permit was issued by them? 7) Does the health department have a plan to provide care for the 42% of people that live below the poverty line whos health will very likely be negatively effected by the compressor station? 8) Why is the onus on the people to prove that the emissions from compressor stations are harmful rather than on the company emitting to prove that they are safe? Hannah Maloney MSN, ACNP-BC Assistant in Anesthesiology Division of Anesthesiology Critical Care Medicine Vanderbilt University Medical Center
Response:	Please see **General Topics: Health Protection, Permitting Process and Hazardous Air Pollutants.**
Commenter:	Mr. Brian Kirkpatrick
Comment:	My name is Brian Kirkpatrick. My son Daniel, age 40, and I own and principally occupy a home on 4 plus acres, 3 of which are wooded, at 2679 Morgan Road in Joelton. We purchased this property in August of 2015 not only for the excellent dwelling itself but primarily for its quiet, beautiful, and healthy rural agriculturally zoned location.

	At the time we had never heard of a pipeline compressor having never experienced circumstances to stimulate such awareness. However, we are most certainly no longer uninformed as to what these monstrosities are and the formidable dangers they present to heath, environment, and life itself not to mention the indisputably documented immediate damage they do without question to the day to day quality of life in any vicinity in which they are operated. Having attended the public hearing at Metro Public Health Department on July 27 I see no need to restate any of the information so thoroughly and clearly presented there by the many speakers representing not only the immediately located areas to be impacted by this atrocity but all of the Nashville area itself because it seems quite reasonable to assume that you are now, if not previously, all well informed and therefore fully aware of the many and, again, documented risks and hence clearly indisputable dangers presented by these installations. Adding insult to injury is the intended destination for the gas itself the result being that no benefits whatsoever are to be enjoyed by those who stand only to lose. Therefore, with all concerned also knowing full well that permitting such requires that existing zoning ordinances as well as mandated air quality standards legislation already in place be violated, my concerns, opinions, and related questions to you are simply as follows: 1) How could it even be considered to disregard such ordinances in order to permit this abomination into our neighborhoods of Joelton and Cane Ridge? In other words, if such ordinances do not apply when a threat of this mind boggling magnitude is proposed when, precisely, ARE they intended to apply? Until some entity has enough money to introduce into the equation as to simply eclipse the science behind the reasons why they were put in place? 2) How could any elected or appointed public servant or entity whose designated and mandated duty is to protect the environment for the well being of its citizenry entertain for a moment allowing such a blatantly perilous installation to be placed in such proximity to not only a residential and rural agriculturally zoned area but, as is the case in Joelton, directly adjacent to a public recreation park against which particular circumstance even exists additionally prohibitive ordinance? The only logical answer is they could not and would not unless pressured and/or actually intimidated or otherwise mysteriously motivated to do so. (Could we actually be expected to conclude otherwise?) 3) If so “motivated” what, pray tell, could the source of that motivation possibly be that could lead you to vote

	"yes" on this obviously horrendously destructive installation? 4) Are you able and willing to articulate this "motivation" clearly and in no uncertain terms and post same publicly for all to see and evaluate and if not why not? 5) It is maintained by Kinder Morgan that as "good corporate citizens" they assure this facility presents no risks to the health of the surrounding population or environment. This claim would be laughable were it not so tragically absurd but, be that as it may, one thing that is absolutely certain is that it undeniably presents a perceived risk that will, without question, I repeat... without question have one definite and easily documented result and that result is the guaranteed devaluation of all property in proximity. Without due compensation what is this but oppression and backhanded theft? Even with due compensation it is still, quite simply stated, wrong. These are our homes and, in some cases, our businesses. No one should be forced to experience unwanted circumstances of any kind at the hands of any form of for profit only entity. I eagerly await any rebuttal on this point. Therefore my question here is what is being demanded by any faction of our government from city to county to state, if the morality and integrity is lacking in FERC to properly regulate these people, to at the very least demand that Kinder Morgan be obligated by law to establish policy to quantify and justly compensate all adversely impacted property owners for these losses should this ridiculous affair tragically end in approval? I strongly urge all involved in this decision to carefully consider whether you are prepared to live with the responsibility for the predictably certain negative consequences of an approval and I assure you that, should you rule in favor of the "good corporate citizen" Kinder Morgan and against the good private citizens of your jurisdiction and allow this grotesque violation of our rights to go forward, you will not see anything good come of it and you will be anything but proud of the legacy you leave. It is your responsibility to the people of the entire Nashville area whose health and safety it is your duty to protect to force this project to be appropriately relocated and it is in your power to do so. You will find a very interesting and pertinent story if you Google "lightening strike gas plant Powell County Ky". You all need to read of this event that took place this past Monday BEFORE you make your decision. Keep in mind as you read the elevation level of the Joelton area.
Response:	1 – Please see **General Topics: Zoning.** 2, 3 & 4 – Please see **General Topics: Health Protection and Permitting Process.** 5 – With respect to property values, under the Natural Gas Act, only the Federal Energy Regulatory Commission

	("FERC") considers the proposed natural gas compressor station's potential impact on adjacent property values when siting a compressor station. The issue raised by this comment is outside the scope of MPHD's authority.
Commenter:	Ms. Jessy Karns
Comment:	Dear Mr Finke, I am a lifelong Joelton resident and I implore you to please read this linked article below. https://www.washingtonpost.com/news/energy-environment/wp/2016/05/12/obamaadministration-announces-historic-new-regulations-for-methane-emissions-from-oiland-gas/?utm_term=.7a68517a27eb The EPA with our President Obama himself signed a bill in May of THIS year to limit methane emissions due to health and environmental reasons. This proposed station is SO close to homes; anywhere from 900-1100 feet away. Homes with children and elderly. Crops are grown in this community. In the article a FEDERAL government official, an EPA employee states that methane emissions are angerous for all citizens and the environment. This air permit does not promote the care that Davidson County requires for all citizens. We are better than this. This compressor could be put in a MUCH MORE rural area north of here but this company has chosen to compromise our health for convenience. I truly hope you read this and put yourself in our shoes. My son is 2 years old; he plays outside daily. We live in the country for clean air and PEACE & QUIET for happy mental health as well as physical health, this project does NOT make this a place I want to raise my child. My husband is contemplating moving further north over this. Please listen and read SCIENCE from government officials on this matter AND the president HIMSELF. Joelton and Antioch communities do not need our health compromised. Thanks for your civil service to our community.
Response:	Please see **General Topics: Health Protection and Fugitive Emissions Monitoring.**
Commenter:	Ms. Christina Wright
Comment:	Dear Mr. Finke, This is what you need to protect us from. The health effects of an explosion like this are still unknown. Please do your job and protect Nashville! Sincerely, Mrs. Christina Wright Lightning Hits Gas Plant In Powell Co., Residents May Leave
Response:	Please see **General Topics: Permitting Process.**

Commenter:	Ms. Virginia Team
Comment:	Dear Mr. Finke, Why do the citizens of Joelton have to prove the compressor station is dangerous rather than Kinder Morgan having to prove it is safe? I would very much appreciate a response to this. Thank you, Virginia Team
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Ms. Stephanie Dennis
Comment:	Good afternoon I would like to express my concern and general disapproval of the operating permit under consideration for Tennessee Gas Pipeline Company, LLC. This land is some of the last 'pristine' land we have near Nashville and a wonderful community. I have serious concerns about the potential impact on water and air quality near and around my home in Nashville (already suffer from breathing issues and inexplicable headaches on bad air quality days and I'm a normal weight and of good health). I can't imagine if I actually had asthma or some other diagnosed breathing issue. I do not agree that this would fit within national or local goals for air quality considering the emissions are not consistent throughout the year and the potential pathways are of serious concern not only in the immediate area but also since Nashville, itself, sits in a basin that already tends to hold a lot of smog on the many stagnant days we have throughout the year. Couldn't we instead focus not on high paying, low payoff fossil fuel/gas industries and move toward a more progressive platform of solar energy which can produce many more jobs in production/installation? Thank you for your time, we appreciate your consideration, -- Stephanie Dennis
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Mr. Brant Miller
Comment:	Dear Mr. Finke, Thank you for the opportunity to comment regarding the proposed Kinder Morgan gas compressor station in Joelton. My comment pertains to the fact that the tons per year figure given in Kinder Morgan's specifications do not account for what's commonly called fugitive emissions, which are leaks in the system. The EPA states that "leaks can be a significant source of methane and VOC emissions in the oil and gas industry" (see below, from EPA's Air Rules for the Oil & Natural Gas Industry, https://www3.epa.gov/airquality/oilandgas/may2016/nsps-

	gas-transmissionfs.pdf). These air pollutants adversely affect the surrounding human and non-human population, and indeed, the EPA has adopted new regulations this year requiring careful monitoring of these emissions from gas compressor stations (see below). I strongly believe that Kinder Morgan should be required to include fugitive emissions in its tons-per-year figures, as there are certain to be leaks that will occur and that will emit pollutants before they are discovered and sealed, over the course of the life of the proposedJoelton compressor stations.Thank you for your attention to this matter. Sincerely, Brant Miller, Chair Friends of Mill Creek Greenway The following is from the above-referenced EPA document: Finding and Repairing Leaks (Fugitive Emissions) •Leaks, also known as "fugitive emissions," can occur at a number of points at a compressor station when connections are not properly fitted or when seals and gaskets start to deteriorate. Leaks can be a significant source of methane and VOC emissions in the oil and gas industry. •The updated NSPS requires that owners/operators of compressor stations develop and implement a leaks monitoring plan. Owners/operators must use a technology known as optical gas imaging to conduct a leaks survey. Optical gas imaging equipment uses a special camera to "see" emissions of methane and VOCs. o Owners/operators may use "Method 21" as an alternative to optical gas imaging. Method 21 is an EPA method for determining VOC emissions from process equipment. The method is based on using a portable VOC monitoring instrument, such as an organic vapor analyzer (sometimes referred to as a "sniffer"). • For new and modified compressor stations, owners/operators must conduct the initial survey within one year after the final rule is published in the Federal Register or within 60 days of the startup of a new or modified compressor station, whichever is later. Monitoring must be repeated quarterly following the initial survey. • The survey covers a number of components, including valves, connectors, pressure-relief devices, open-ended lines, flanges, compressors, and thief hatches on controlled storage tanks, among others. • Any leaks found during the surveys must be repaired within 30 days, unless the repair would require shutting down. In that case, owners/operators are required to fix the leak at the next scheduled shutdown, or within two years. o Equipment that vents natural gas as part of normal operation is not considered to be leaking and is not be covered by this requirement; however, leaks surveys can also help operators detect malfunctions in these devices, such as pneumatic controllers. • The final rule also creates a path for EPA to allow use of alternative leaks monitoring technology, which is developing rapidly. The rule outlines the information owners/operators must submit to show that using the alternative technology is capable of achieving equivalent methane and VOC reductions that can be achieved by using optical gas imaging or Method 21 to find leaks, and then repair them.
Response:	Please see **General Topics: Fugitive Emissions Monitoring.**

Commenter:	Ms. Julie Sloan
Comment:	Wonder what the fire dept. has to say about this . One engine with about 15 min response time on help if something did explode. Also there are some wells in the area , what about poisoning well water?
Response:	Please see **General Topics: Pipeline Safety**. In the Environmental Assessment published by the Federal Energy Regulatory Commission (FERC), FERC concluded that, "the Project would not result in any significant longterm or permanent impacts on groundwater resources based on Tennessee's implementation of appropriate minimization and mitigation measures."
Commenter:	Mr. Chris Tuley
Comment:	Dear Mr. Finke, My question regarding the Joelton compressor station concerns the overall air quality to middle Tennessee. If this permit were to be issued, it would greatly affect the air quality in the counties surrounding Davidson county. Does that go into the decision making process? I ask that you and the Health Department do your civic duty and deny this permit. Sincerely, Chris Tuley Vice President Keep Southeast Nashville Healthy
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Ms. Lindsay Pace
Comment:	Dear Mr. Finke, Thank you again for the opportunity to speak last week at the Metro Nashville Public Health hearing on the proposed Gas compressor station in Joelton, Tennessee. As I reminder, I am the Tennessee Field Manager for Moms Clean Air Force, a national organization with over 700,000 members who fight against air pollution for our children's health. The development of unconventional natural gas has pollution emitted throughout the entire process. And Gas compressor stations are constant emitters of toxic pollution since they operate all hours of the day, every day of the year. Of the pollutants they emit, we know that Methane is a potent greenhouse gas that contributes to climate change and VOCs impact the health of those who live nearest the compressor station. Toxic pollutants such as benzene and formaldehyde can be found around compressor stations from fugitive leaks, blowdowns, and accidents. Benzene is

	a potent neurotoxin that is linked to childhood leukemia and formaldehyde has been associated with childhood asthma as well as causing cancer. We know that children are especially sensitive to air pollution because their bodies are still developing, they breathe more rapidly when compared to an adult, and they're more likely to be playing outside at their homes and at Paradise Ridge Park on days with high emissions. Even under normal operating conditions gas compressor stations have been shown to not emit uniformly. This causes periods of high exposure of toxic pollutants to individuals living nearest the compressor station. The "ton per year" measurement, while appropriate for C62measuring and determining regional air quality, lacks the ability to determine individual health risks during these periods of high exposure. When looking through existing data collected from families living near compressor stations you see that the youngest respondents (1.5-16 years of age) report higher rates of throat irritation and severe headaches. They also have the highest occurrence of frequent nosebleeds and experience conditions not usually associated with children: such as severe headaches, joint and lumbar pain, and forgetfulness. Under EPA Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks – the proposed gas compressor facility should receive special EPA scrutiny because the property is immediately adjacent to Paradise Ridge Park, which is a Metro Nashville public park. This park is not only a recreational spot for the community, it also hosts a variety of programs for children, including structured after-school activities. Given the lack of substantive data on Hazardous Air Pollutants from the proposed facility, the air permit should at the very least be withheld until the long-term cumulative effect of HAPs on the adjacent park population can be evaluated. In rejecting this permit from Tennessee Gas Pipeline Company for Compressor Station 563 you will be protecting the residents of Joeltons health, and their children's health. 1. Compressor Station Emissions and Health Impacts http://www.environmentalhealthproject.org/files/Summary%20Compressor-stationemissions-and-health-impacts-02.24.2015.pdf Sincerely, Lindsay Pace Tennessee Field Manger Moms Clean Air Force
Response:	Please see **General Topics: Health Protection and Hazardous Air Pollutants**. Executive Order 13045 is considered when establishing NAAQS.
Commenter:	Ms. Nancy Winters
Comment:	I would like to propose to delay the air permit until a study can be performed on the toxics that will be emitted into

	the air, not one at the time , but comprehensively! In a published statement by the State of Colorado Air Quality division, "the current state of science cannot assess the potential risk of combinations of different chemicals" people are exposed to from natural gas compressor stations. Studies performed on workers in the gas/oil industry who have been exposed to toxic mixtures like BTEX (benzene,toluene, ethylbenzene and xylene) have experienced mental and behavioral problems, a range of health problems, and some changes in color vision and perception. Together, these toxic pollutants have the potential to dramatically impact every organ in the body,and can act together to increase the toxic potential of other chemicals like prescription medicines. Sincerely, Nancy Winters
Response:	Please see **General Topics: Hazardous Air Pollutants.**
Commenter:	Mr. Thames Jackson
Comment:	Air and Water Quality Concerns With the amount of traffic that we already get from the airline industry, I do not believe that we need to compound the air/noise pollution by adding this station. I also understand that there is a water quality concern and with the growth that Nashville and surrounding areas are experiencing today, we do not need additional water quality issues that may affect our health in the Nashville surrounding areas. Thx, tj Thames Jackson
Response:	In the Environmental Assessment published by the Federal Energy Regulatory Commission (FERC), FERC concluded that, “the Project would not result in any significant longterm or permanent impacts on groundwater resources based on Tennessee’s implementation of appropriate minimization and mitigation measures.”
Commenter:	Ms. Richelle Deharde
Comment:	I was physically affected by toxins released from the oil and gas industry. Before moving to Mid-TN, I had two seizures, Chronic Fatigue, difficulty focusing, and recurring burning throat. These health issue are real. Please protect my neighbors and friends from:

	HEALTH IMPACTS Reported by People Living 50 feet to 2 miles from Compressor Stations and Metering Stations. Wilma Subra- ex-Vice-chair of EPA National Advisory Council for Environmental Policy and Technology http://www.earthworksaction.org/files/publications/SUBRA_3_Shale_Gas_Plays-Health_Impacts_sm.pdf Frequent Nausea* Throat Irritation* Eyes Burning* Nasal Irritation* Sinus Problems* Bronchitis* Persistent Cough Weakness* Tiredness* Chronic Eye Irritation* Shortness of Breath Muscle Aches* Dizziness* Ringing in Ears Sores & Ulcers in Mouth Urinary Infections Depression* Decreased Motor Skills* Falling, Staggering* Frequent Irritation* Brain disorders* Severe Headaches* Frequent Nose Bleeds Sleep Disturbances Difficulty Concentrating Joint Pain Nervous System Impacts Forgetfulness Irregular/Rapid Heart Beat Strokes Allergies Easy Bruising Severe Anxiety* Excessive Sweating Abnormal EEG* Spleen Lump in Breast Pre-Cancerous Lesions* Amnesia Thyroid Problems *61% of Health Impacts Associated with Chemicals present in Excess of Short and Long Term Effects Screening Levels in the air Additional Resources with extensive reports: http://www.environmentalhealthproject.org/wp-content/uploads/2012/03/Compressor-station-emissions-and-health-impacts-0 http://www.otsego2000.org/wpcontent/uploads/2012/08/Madison_County_DOH_Comments_-_Docket_No._CP14-497-000.pdf
Response:	Please see **General Topics: Health Protection and Hazardous Air Pollutants.**
Commenter:	Ms. Richelle Deharde
Comment:	Photo attached – List of other organizations opposing gas compressor stations
Response:	Please see **General Topics: Health Protection.**

Commenter:	Ms. Sheryl Evans
Comment:	No pipeline please
Response:	Please see **General Topics: Permitting Process.**
Commenter:	Ms. Richelle Deharde
Comment:	Mr. Finke we are not alone here:
Response:	Please see **General Topics: Permitting Process** .
Commenter:	Mr. Mike Younger
Comment:	Me. Finke, I am writing you today in the hope that your office may yet come down on the side of the community in regards to the safety of the proposed compressor station in Joelton and its impact on the air quality for all Metro Nashville residents. Although I did not work alone, I have spent the last year and a half photographing and documenting the dilapidated and disgraceful pipeline infrastructure this company in question "maintains" here in Middle Tennessee. Although our local and state government officials were ambivalent or even defiant about what our study uncovered, we have been able to secure primary and secondary inspections from the federal regulators that oversee interstate pipeline infrastructure(PHMSA) and those inspections raised serious questions about local pipeline infrastructure. Congressman Jim Cooper has also reviewed the study and found it prudent to call for congressional hearings on pipeline safety. The tide is turning on this company and the undue influence it has exerted on public policy. The public safety issues brought to light by the pipeline study raise even more questions about the coziness of the relationship between industry and regulators under current policy. I offer you this context for your current review of the compressor station review because it has come to my

	attention that your office has been disseminating misleading information to the public regarding the size and scale of the project proposed for Joelton. Officials from your office have falsely claimed that a natural gas compressor of the same scale has already been constructed and operating safely at Vanderbilt University. Although I will not get into the specifics, a gas compessor pushing through 4-6" distribution lines is an entirely different proposition than a gas compressor transporting the volume of gas that move through 30" interstate transmission lines. For officials fom Metro Health Dept to equate the two is both disingenuous and dishonest. There are, at this time, numerous written testimonies from callers who have been given false and misleading information about this compressor station from officials in your office over the past year that would tend to indicate a predisposition to downplaying the concerns of the community and promoting the narrative of the operator. This is very troubling to the community and an unfortunate and pervading part of the current regulatory environment in the State of Tennessee. Again, our local situation raises these much bigger and deeper public policy questions which may also need to be subject to more public scrutiny. I have attached below the comprehensive report that the New York Dept of Health entered into FERC proceedings in 2014 on the emissions from Gas Comoressor Stations that was one of the preliminary studies that led to the outright rejection of Natural Gas infrastructure expansion in the state of New York based on the public health risks involved. The New York Department of Health takes it'smission of protecting the public interest seriously enough to conduct thorough and transparent studies into these matters, which I would point out has not happened in the Joelton case. Air modelling, while a component of such a comprehensive study, is no substitute for a real multi-level analysis of the emissions, the health impacts in the near and long-term etc. Taking the operator's word at face-value about the emissions and safety protocol is hardly worthy of any regulatory agency paid for by the tax-paying public. Don't feel singled out. Tennessee and Metro Nashville's other regulatory agencies have also shrugged with ambivalence at situations that federal regulators find unacceptable. I would like to ask you how you plan to assuage the people of Metro Nashville that the long list of toxins documented by the New York Dept of Health to cause another long list of health impacts in the surrounding community are of no concern to the Davidson County Dept of Health? Please take the time to fully appreciate the gravity of the deliberations before you at this time. The community needs their Health Department to take a stand in their defence. Thanks, Mike Younger Author, 2015 Field Study Of Gas Pipeline Safety in Tennessee PS I have also attached an e-copy of the 2015 pipeline study and a photo of the preliminary pipeline inspections conducted by PHMSA on May 3rd 2016.
Response:	Throughout this process, the Metro Public Health Department has communicated with many people. If there have been any miscommunications or misunderstandings, they have been unintentional. MPHD strives at all times to be

	responsive and transparent throughout the entire permitting process. During the permitting process, information available to the department was constantly being updated based on input from the applicant, the public, and other stakeholders.
Commenter:	Ms. Kathy Rodgers
Comment:	Under the DOE CEQ NEPA regulations, section 1508.27, the word 'significantly' "requires considerations of both context and intensity". Referring to context, "the significance of an action must be analyzed in several contexts, such as society as a whole, the affected region, the affected interests, and the locality". "Both short-term and long-term effects are relevant". And with regard to intensity, "this refers to the severity of impact". "The degree to which the proposed action affects public health or safety", "unique characteristics of the geographic area such as...ecologically critical areas", the "degree to which the effects on the quality of human environment are likely to be controversial", and "the degree to which the possible effects on the human environment are highly uncertain or involve unique risks" are all poignantly relevant and of the highest importance when considering the potentially harmful impacts of TGP's proposed CS563 will have not only affect Joelton, but Nashville and areas beyond, as well. A leak at this station has the capability of negatively impacting the drinking water of an entire area, as it sits atop karst-ridden geology permeated by underground streams. This station will "permanently changing the ambient air", and has the capability of harming the citizens of an entire town with its polluting toxicants for decades. This station will also impact the soil by removing forest areas and allowing for increased runoff that will also pollute streams that feed major water sources like the Cumberland River. However, you, the Health Department could use "the degree to which the action may establish a precedent for future actions" for Nashville's good, by denying the Title V air permit TGP is requesting, thus negating all the negative impacts before they are established. But if you decide to proceed, you may wish to check Section 1508.18, Major Federal Action, "actions that include the circumstance where the responsible officials fail to act". Because if something catastrophic should happen, and you were warned ahead of time but failed to act, "that failure to act is reviewable by courts or administrative tribunals under the Administrative Procedure Act". Thank you for your attention to this matter. Kathy Rodgers
Response:	The National Environmental Protection Act (“NEPA”) only applies to Major Federal Actions and The Federal Energy Regulatory Commission (“FERC”) has concluded “that approval of the Broad Run Expansion Project would not

	constitute a major federal action significantly affecting the quality of the human environment." See, FERC Environmental Assessment p. 131 of Appendix IV. FERC is responsible for insuring that the compressors are safely constructed and installed. The United States Department of Transportation's Pipeline and Hazardous Pipeline Materials Safety Administrator is responsible to see that the compressors are safely operated. MPHD APC's only authority in the permitting process is limited to enforcing the Clean Air Act, specifically carrying out Tennessee's State Implementation Plan.
Commenter:	Rev. & Mrs. James and Christina Wright
Comment:	Dear Mr. Finke, I am writing you today because I am a concerned citizen and lifetime resident of Nashville. I am concerned about the future of our city and the health of the residents. The following statements I have pulled from the Environmental Assessment from FERC regarding the proposed Joelton Gas Compressor. Thank you for your time and attention to these matters. Our area, where the proposed site for the Compressor Station 563 is, we are called, "sparsely populated, rural area." In reality we are a residential community with only a few small farms scattered through out the neighborhoods. This compressor station would have a road frontage on to Tennessee Route 65/US Highway 431, which is a major thoroughfare from Springfield, TN to Nashville, TN. This highway is heavily traveled especially during rush hours. The current traffic is already too much for this 2-lane highway. According to Tennessee Department of Transportation (TDOT) website the Annual Average Daily Traffic count from 2013 was 11,390 and 2014 was 11,241. This is hardly what I call a rural area. This highway has frequent wrecks often with fatalities. This added construction traffic has a great potential for grave disaster on an already over crowded highway. When compared to the other sites which include Compressor Station 118A and 875, both are stated to be on an unpaved, one-lane roads. It does not seem logical to consider this site for a compressor station at all. I appreciate the fact that I can appeal to the local assessor's office if I feel I have overpaid my property taxes. However, what if I choose to sell my property and no one wants to buy it? Who will compensate me then? Would Tennessee Gas be willing to buy my property at "fair market value" as valued before the gas compressor's construction? States "Operation of Compressor Station 563 would exceed the Title V major threshold for Nox. Cumulative actions within Davidson County would be required to comply with federal, state, and local air regulations…" Due to the bowl shape topography of Nashville, we already have a problem with air quality in the summer. The air pollution lingers over

	the city. It is in unreasonable to think this problem is one that Davidson County needs to bear when a location to another site, that is not bowl shaped, would solve this problem. Also, once built, Compressor 563 will produce no jobs for the area. The presence of this Compressor will prohibit another industry from coming here, which will provide jobs for local people, because we will have exceeded the pollution level. Bats: On page 70 the EA states: "Due to habitat loss, we conclude the Project would likely adversely affect northern long-eared bats in Tennessee. In a letter dated December 15, 2015, the Tennessee Field Office of the FWS agreed with this conclusion and stated that consultation under Section 7 of the ESA is complete for the northern long-eared bat in Tennessee." Also, on page 69 it states, "The FWS listed the northern long-eared bat as threatened under the ESA on April 2, 2015 due to dramatic population declines attributed to white nose syndrome, a funguscaused disease affecting hibernating bats. White nose syndrome has caused extensive mortality of northern long-eared bats, especially throughout the northeast where the species has declined by up to 99 percent from pre-white nose syndrome levels at many hibernation sites (FWS, 2015g). The FWS has identified counties where white nose syndrome is known to exist as part of an interim rule under Section 4(d) of the ESA. All compressor station sites are within counties with verified occurrences of white nose syndrome (FWS, 2015c)." With the emergence of the Zika virus and the danger it poses to humans, why is it all right to reduce the bat population further when a mosquito born illness is on the rise? Currently, the CDC has issued an alert that the Zika Virus is spreading.
Response:	Please see **General Topics: Health Protection and Permitting Process.** MPHD does not expect this potential project to have any impact on mosquito activity. With respect to property values, under the Natural Gas Act, only the Federal Energy Regulatory Commission ("FERC") considers the proposed natural gas compressor station's potential impact on adjacent property values when siting a compressor station. The issue raised by this comment is outside the scope of MPHD's authority.
Commenter:	Ms. Kathy Rodgers
Comment:	In its filings to FERC, Tennessee Gas Pipeline/Kinder Morgan only devoted eight (8) pages to "Reliability and Safety" with regard to CS563. It is supposed to, according to 18 CFR 380 Regulations, discuss "the environmental impact" that could ensue from failure of plant - TGP does not do this. TGP is supposed to "describe measures used to exclude the public from hazardous areas" - it does not, except for stating the building of a fence topped with razor wire. However, once this compressor station is built, the bearing of a Title V classifies the whole station area as a

	"hazardous air polluter" capable of having a negative impact on the air for up to thirty miles from the plant. How then do we the people of Joelton avoid this hazard? What TGP does state are the following: "Natural gas transmission facilities are designed and maintained in accordance with USDOT regulations and industry standards and have an excellent record of public safety and reliability. For the Project, Tennessee will employ all applicable system design, construction, operation, and maintenance practices in order to maintain this excellent record." Yet, from 1994 to 2013, there were 2,120 "incidents" that resulted in fatalities. TGP admits that "The greatest hazard of a natural gas transmission line is a major pipeline leak or pipeline rupture that results in a fire or explosion." Most of these "incidents" involved explosions. TGP then states, "Minimum standards are established" for their pipelines – not maximum, only minimum. TGP states that CS563 will be equipped with "system monitoring equipment, unit/station shutdown protection, and a number of “fail-safe” systems". Yet, if they are as failsafe as TGP claims, why 2,120 "incidents"? "USDOT regulations (49 CFR Part 192) specify that compressor stations must have an emergency shutdown system that can be manually operated from at least two points". Yet, TGP states in their EA that there is only going to be one person hired for CS563, and unless that person plans to live there year-round, there will be no one 24-7 at this station to handle a manually operated shutdown. TGP states that "If an emergency situation requires depressurization of the piping to and within the compressor station, venting of the gas would take less than ten minutes", however in the EA, these emergency blowdowns only last a minute. But what toxicants are vented with this 'gas' and at what quantities? Are these emissions counted in your air control studies? "Stations will be equipped with standard fire protection (dry chemical fire extinguishers), first aid, and safety equipment. Personnel will be trained in proper first aid application, as well as proper use of fire protection and safety equipment". Yet, again, as there may be no one there at the station, what happens then? Who takes ultimate responsibility for this, TGP or Metro? And lastly, TGP states that its pipelines are "designed to safely handle the additional gas volumes that Tennessee proposes to transport through the system", and "will continue to operate and maintain its belowground pipeline facilities in accordance with USDOT regulations". But several questions have been raised as to the safety of the old pipelines and the pressurized high speeds that TGP plans to use - what happens if these old pipes that are "minimal' at best can't handle the high speeds placed on them? Also, TGP has many exposed pipes in the area that they have been made aware of and still haven't repaired, one in Portland that was aired on channel 17 news - the lady said she'd called TGP three years ago and they still hadn't repaired the hole and exposed pipe. TGP isn't the good neighbor they profess to be - this should prove it. I hope that you will look into the above questions and consider carefully when weighing your decisions about this massively important Title V permit. Thank you. Kathy Rodgers

Response:	Please see **General Topics: Permitting Process, Area of Impact and Pipeline Safety.** There are also hotlines available for both FERC and Tennessee Gas Pipeline that can be found in **General Topics: Noise**.
Commenter:	Ms. Kathy Rodgers
Comment:	Dear Mr. Finke, According to a Tennessean article Monday, August 17, 2015 on the fears of a leg of the same TGP line running through Kentucky and close to Mammoth Cave, it states "While natural gas used in homes is methane, natural gas liquids are separated at the well site and can include a variety of hydrocarbons, including ethane, propane and butane...Under the plan, Kinder Morgan would move natural gas liquids from fracking zones in OH and PA more than 900 miles through a repurposed pipeline to...Louisiana and Texas." This is the same pipeline that runs through Joelton. KM/TGP also tells Kentucky the same thing it told us Wednesday, in that they are "committed to public safety, protection of the environment", yet they clearly want to do the opposite by pushing this unnecessary pipeline through KY and TN to export our natural resources overseas. We in Joelton have the same karst geology as KY, which is porous limestone with sinkhole potential, and contains many clean underground streams that many families pull their drinking water; the streams on the Joelton property at CS563 meet to form headlands to the Cumberland River where Nashville gets their drinking water. The Mammoth Cave park superintendent states that "The National Park Service is concerned about the potential for a catastrophic failure of the pipeline" which would endanger many fragile, rare species. The park service recommends using "intensive groundwater dye-trace studies to determine potential harm" for waterways, for if there is a leak, it can quickly spread for miles and threaten valuable, irreplaceable water sources, and our water cannot be replaced. There are several local and one state park of "regional interest and value" that the FERC EA left out - it mentioned Mammoth Cave, but totally ignored the smaller Dunbar Cave in Clarksville (about 34 miles from CS563), Beaman Park (not 8 miles from CS563) and local fishery Marrowbone Lake (about 8 miles from CS563). This compressor station not only has the potential to ruin our local water supplies, but to also "permanently change our ambient air" as stated in FERC's EA. Before issuing the Title V air permit that would allow this nightmare to become a reality, perhaps now is the time to look at this with a new set of objective eyes and consider what this station and all its toxicants will really do to this area of our great state. Thank you. Kathy Rodgers 4060 Bernard Rd. Joelton, TN PS, Kinder Morgan/TGP claimed to be a good neighbor in Wednesday night's meeting, yet, in the same article mentioned above states this about the 70 year old pipeline they're planning on using to send this mess through: "For its part, Kinder Morgan promised 'to review data and records' to find 'unacceptable' imperfections in the pipeline and would 'where necessary' upgrade sections to

	bring them up to current code". They won't replace all the old pipe, but only a bit of it...I wonder how long that old pipe will hold out when they increase the speeds of the gas with the 60,000HP machinery they're planning on using at CS563? How safe do you believe that to be? And do you still think of them as 'good neighbors'?
Response:	Please see **General Topics: Permitting Process and Pipeline Safety.** Tennessee Gas Pipeline will only be transporting natural gas through the pipeline, including the section that will pass by proposed CS563. They will not be transporting natural gas liquids.
Commenter:	Ms. Kathy Rodgers
Comment:	My name is Kathy Rodgers. I was in attendance at the Lentz public hearing on Wednesday and turned in a report I compiled of research studies done on the health effects associated with unconventional natural gas facilities, including compressor stations. I was unable to fully explain my interest in doing such an undertaking because of time constraints, so I will do this now. My family has lived in Joelton for over a hundred years, so you might say I have a vested interest in what goes on in my town. That is one reason why I became involved in fighting this proposed compressor station planned for Joelton. I have done much research as a private citizen on the kinds of toxins these stations can emit into the air, soil and water, toxins like formaldehyde, benzene, hexane, methane, sulfur dioxide, nitrogen dioxide, etc. These toxins can produce immediate and chronic symptoms that involve nearly every system in the body. These toxins can cause cancers and diseases of nearly every organ in the body. In other normal circumstances, these toxins would have already been either severely restricted or banned from use by the EPA based on the widespread damage they can cause. When the local citizens group, CCSE asked me to look into the health effects that exposure to compressor station toxins produce, I gladly accepted, because I and my family have been impacted by chemical exposure to toxins and I know first-hand what physical ailments they can cause. My father was in the pest control industry for over forty-five years before his death in 1994. Unintentionally through his work, my family were exposed directly and indirectly to such poisons as DDT, 1080, chlordane, pentachlorophenol, and thallium sulfate to name a few, chemicals that were later banned or severely restricted by the EPA because of their cancer-causing and toxicant properties. While chlordane and DDT were known carcinogens, they, like the others also caused cardiovascular, neurological, immunological, respiratory,

	gastrointestinal and endocrine damage. By the time he was fifty, my father had developed severe tremors, COPD, and cardiovascular disease. Two of my sisters died, one at 31 from liver failure, the other at 41 from ovarian cancer. My mother died of cardiovascular disease in 1998. My brother has tremors, lost his leg to bone cancer, and has psoriatic arthritis and heart disease. My oldest sister has cardiovascular disease, COPD and rheumatoid arthritis, and I am battling severe systemic lupus. I, my other two living sisters, and a niece have had complete hysterectomies by the age of 40 (I was the youngest at 29). And no one in our family histories has ever had cancer, COPD, or autoimmune problems. So I guess you might understand my concern about a Title V hazardous air emitter coming to my hometown and the reason behind the report I produced. As I stated, you will find in the bibliography 105 citations from various respected health journals and government agencies like the EPA, Environmental Health, the CDC, the World Health Organization and so on, citations that back up the research that proves natural gas compressor stations are emitters of toxicants that cause physical harm to humans, toxicants similar to those my family and I have been exposed to, toxicants that can harm and even kill. I have only one question to ask again, and that is with all the evidence at hand, why would the Metropolitan Health Department allow the issuance of a permit that would allow such a facility to be built that can and will cause so much harm to so many? Thank you for your time.
Response:	Please see **General Topics: Permitting Process and Hazardous Air Pollutants.**
Commenter:	Ms. Lillian Hawkins
Comment:	How many compressor stations would be too many to permit in Davidson County? If all of these stations "are within federal guidelines" does that mean that Davidson County could theoretically end up with dozens, or even hundreds of natural gas compression stations? How many is too many? Based on the estimated toxins that will be emitted by this compressor station, will this prevent other types of future development such as single family homes, apartments and businesses, particularly businesses that may have some level of emission? What is the mechanism to enforce Davidson Co. TN Local Implementation Plan, SECTION 10.56.280, which is entitles "Start-ups, Shutdowns, and Malfunctions," which requires the source to take all reasonable measures to keep emissions to a minimum during start-ups, shutdowns and malfunctions. Failures that are caused entirely or in part by poor maintenance, careless operation, or other preventable upset condition or preventable equipment breakdown shall not be considered a malfunction and shall be considered a violation of the applicable emission standards. Will the NOx,

	carbon monoxide (CO), and CO2e (greenhouse gases) from the proposed Joelton gas compression station exceed Title V maximum thresholds, as indicated by the NOx Dispersion Study conducted by Dr. William Robertson? (http://media.wix.com/ugd/719f5a_a479988a4d114fb681ae073eee790252.pdf) Emissions from gas compressor stations will include methane, nitrogen oxides, formaldehyde, methylene chloride, and volatile organic compounds, collectively called BTEX (benzene, toluene, ethylbenzene, and xylenes). Radon-222 and formaldehyde are other chemicals emitted, and a State University of New York (SUNY) at Albany study reports that formaldehyde is a known carcinogen (http://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-13-82) Carnegie Mellon University published a study on methane gas emissions from compressor stations (http://media.wix.com/ugd/719f5a_3bf568a2c86c4273a754861459a01817.pdf) The Madison County, New York Health Department filed concerns with the Federal Energy Regulatory Commission (FERC) in regards to a proposed compressor station project. The Madison County Department of Health's concerns were based in part on the report from the United States Environmental Protection Agency (USEPA) Inspector General that documents a lack of emissions data from oil and gas facilities which, in turn, casts doubt on the accuracy of projected air quality impacts. This brings into question the appropriateness of using the National Ambient Air Quality Standards to establish health safety risk near the compressor station. There are also documented correlations between health impacts and residential proximity to unconventional natural gas development facilities, including compressor stations. Research published in the journal Environmental Health includes formaldehyde emissions at compressor stations in five states. (https://sape2016.files.wordpress.com/2014/01/env_health_air_quality_unconvetional_oil_gas-2.pdf) Southwest Pennsylvania Environmental Health Project did both an extensive study and a briefer summary on the health effects associated with gas compressor stations (http://www.environmentalhealthproject.org/healthcare-providers/resources/research-factsheets & http://www.environmentalhealthproject.org/files/Summary%20Compressor-station-emissions-andhealth- impacts-02.24.2015.pdf). We, the citizens of Davidson County, Tennessee, are being put in a position where we must rely on our Health Department protect our right to breath. We expect the Nashville Health Department to do the right thing for the people that live in Davidson County and deny the air permit for the proposed Joelton gas compressor station. -- All the best, Lillian Hawkins Hawkins Management for Oak Highlands/Deer Valley HOA PO Box 455 Antioch, TN 37011
Response:	With respect to 10.56.280, the facility will be required to notify MPHD of any permit deviation. APC conducts an investigation to determine whether an exceedance was unavoidable or unforeseeable. As stated above, permit exceedances that result from poor maintenance, careless operation or other preventable condition shall be

	considered a violation. Title V thresholds are applicability benchmarks, not emission limits. Please see **General Topics: Permitting Process and Hazardous Air Pollutants.**
Commenter:	Ms. Catherine Sikes
Comment:	Mr. Finke, With the possibility of two gas compressor stations being built, one in Joelton and the other in Cane Ridge, I am extremely concerned about the air quality and health for all citizens in the Nashville/Davidson county area. Please see that your department does all it can concerning the proposed gas compressor stations to ensure the health and well-being of us all. Sincerely, Catherine Sikes
Response:	Please see **General Topics: Health Protection.**
Commenter:	Ms. Carolyn Kennedy
Comment:	Each summer Nashville has days that the air quality is unsafe for persons with health issues, if the gas compression station in Joelton (and Cain Ridge) is built will that increase these days? Our air quality is important to all Nashville. Thank you for your attention to this issue. Carolyn Kennedy
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Ms. Susan Jata
Comment:	Dear Mr. Finke, Just a short note to express my opposition to the proposed gas turbine and compressor project in Davidson County/Joelton area. I voice my opposition along with my friends who live in that vicinity i.e. Whites Creek and Joelton. I would have attended the hearing last week if I could, however my job responsibilities prevented me from doing so. Thank you for your time. Susan Jata 3920 Oxbow Dr. Nashville TN 37207
Response:	Please see **General Topics: Permitting Process.**

Commenter:	Mr. Scott Webb
Comment:	Regarding the proposed pipeline compressor station in Joelton: I attended the public hearing last Wednesday evening and was somewhat shocked at how articulate and wise the people were who gave public testimony regarding the dangers surrounding this generally ill-conceived venture. If such a thing were to come to your neighborhood, I would imagine you would articulate the identical concerns, and in fact, IT IS coming to YOUR neighborhood because an 8-story smokestack will spew these chemicals directly across the Nashville land basin, measurable, specific, known, dispersed into the winds, and unacceptable. I note that Nashville is experiencing a huge spike in growth, and popularity, and once this news fully gets out, why taint our reputation as a wonderful place to live? Why risk our air quality to this degree for a private venture with zero benefit to the people living here: fracked gas from elsewhere passing through to somewhere else for private gain and in our air. Clearly all win, all lose. And if one listens to the residents of other previous locations where such compressor stations have gone in, what sorrow, grief, regret, loss. These people were fooled once; must we be? They have no recourse, nowhere to turn, because the violators of that public trust now say: we have done no wrong and whatever harm has been done, can't be proved in court nor in a lab. In fact, there is no lab that can measure damages from chemicals in combination because there are just too many deadly chemical combinations to replicate for testing in a lab for how it affects human tissue and internal organs like the lungs and the liver, brain and blood. What's been done to those people, is done. Suckers! That's what those now ill American citizens receive for thanks, for nothing. This is a form of new silent terrorism and the people of Joelton have done their research and filled a room full of informed residents warning the health department to be equally as informed now, not later, because the reversal of these damages are not undone. The people who have suffered from these type of (smaller) compressor stations cannot undo what should be stopped now here while we have the power to stop the public's harm from the calculated, blind-eye of all-private gain. That 8-story smokestack is not for nothing because it blows something out the top into the prevailing winds like a silent bio-attack projectile launcher. If such a thing were proposed by an anti-American terrorist state, spewing known toxic poisons across high density populations, it would be the perfect insidious silent killer. Just because Americans are willing to subject other Americans to such a thing does not reduce the implied evil of it. Those who were previously fooled, beg us not to be! Their stories are in the news. It's real. It's a specific reduction in the quality of life for those within a 30 to 50 mile radius. With an epicenter. And it spreads outward, silently, people coughing. Live next door to it? Forget it! Play in a Joelton park? Not you! So where does such a

	compressor station go? Who has a neighborhood ready and willing to pay such a costly price? Nobody. Not one person, not one child is willing on any level. Why must there be collateral damage anywhere for anybody -- who otherwise gains nothing for the certainrisks? If the current technology cannot not eliminate the poisons emitted from the smokestack, shame on them for not inventing a way to clean up their toxic contribution to society before it happens. Shame on us for not holding them accountable in every way possible to protect ourselves from their disregard. This is a new problem facing us, the transportation of fracked gas within our borders, and it is upon all of us, to be paying attention, counting the costs, now. The public is merely a feedback loop for private venture requiring neighborhoods to bend to the profit-motive. We might suggest, humbly so, that citizenship comes with rights of protection. The wake-up call from around America is that such projects are being stopped from going forward because American citizens are demanding reasonable protections. For every one letter you receive, there are one thousand more local citizens who would write you if they understood what is happening, like the people of Joelton do. There is nothing special about the people who live here. Joelton residents are just like those who also live in the surrounding towns and across Davidson County. For every letter your receive, there are ten thousand children also nearby who beg for your protection. For Nashville to ignore the dangers to air quality on the brink of such (perpetual, silent) disaster is in stark contrast to other places in America who have woken up and stopped it. This is not like Nashville, to be behind the green-trend and the times in which we live, to be caught unaware. Even for the short term: unacceptable and not like Nashvillians to just be stupid, ever. Forget the bike trails if we can't safely breathe the air! And what is the distance between that smokestack and a packed Titan's stadium during a compressor station blow-out? Lots of important questions were asked during the recent public hearing regarding this pending matter. In answering them, I trust you will fully get what the people of Joelton understand. And you already know what that is. No sense in repeating it over and over and you know exactly what that is, smart like us, so God be with you! And God be with Kinder- Morgan, because they are people like us too and know we have good cause for concern and so are gaining in respect because they have families too, children, grandchildren, pets, neighbors, etc. and care about their health and air quality impacts too. They can invent a safe way to get their job done, not anything like this current methodology. Surely they can! Complex issues though. And super serious. The future waits in the balance. No rubber stamp for this one! Sincerely, Scott W. Webb 8440 Whites Creek Pike Joelton, TN 37080
Response:	Please see **General Topics: Health Protection, Permitting Process and Area of Impact.**
Commenter:	Mr. Kevin Sykes

Comment:	I live in the Joelton area and work both as a naturalist at Beaman and Bells Bend Park as well as manage a small organic farm. I think that the pipeline and compressor would be an awful addition to the neighborhood, both from a health standpoint (including air pollution) as well as noise, potential decreased property values, etc. The proposed location of the station is not in an industrial or even commercial area, but rather a residential and agricultural area, so it is completely unsuitable for the proposed use. Please listen to the public who will be negatively impacted rather than private interests. Thanks. Kevin Sykes
Response:	Please see **General Topics: Health Protection, Permitting Process, Zoning and Noise.** With respect to property values, under the Natural Gas Act, only the Federal Energy Regulatory Commission ("FERC") considers the proposed natural gas compressor station's potential impact on adjacent property values when siting a compressor station. The issue raised by this comment is outside the scope of MPHD's authority.
Commenter:	Dr. Sharon Felton
Comment:	I know that the focus of your division, John Finke, is air pollution. However, I have a concern to be sent to the appropriate Health Department official. What cautions are in place to prevent those of us who utilize well water from having our water supply contaminated if the compressor station is constructed? My husband and I have lived on our property for 21 years -- and we do not welcome having to plug into a municipal water supply..... We like our well water.
Response:	In the Environmental Assessment published by the Federal Energy Regulatory Commission (FERC), FERC concluded that, "the Project would not result in any significant longterm or permanent impacts on groundwater resources based on Tennessee's implementation of appropriate minimization and mitigation measures."
Commenter:	Dr. Sharon Felton
Comment:	I have talked with Mr. Fred Lieb, a pipeline engineer who spoke at the Health Department public meeting, at some length. He's worked in this industry for some 35 years, so he has a substantial amount of knowledge of the potential dangers. What studies have been done to determine whether flow reversal is damaging to pipelines? Does flow reversal impact aging pipelines more traumatically? Have the existing pipelines (60+ years old) been tested to

	ensure that they can handle a) flow reversal; b) increased gas pressure, c) a greater quantity of gas flowing through, and d) all three changes at once? The pipeline runs through my backyard. My home, indeed our master bedroom, lies about 60 feet from the pipeline, so I am especially concerned about the safety of clearly-deteriorated, badly maintained pipelines.
Response:	Please see **General Topics: Pipeline Safety.**
Commenter:	Dr. Sharon Felton
Comment:	The tons-per-year figures for NOx, CO, VOCs, and other toxins stated in Kinder Morgan's specifications do not account for what's commonly called "fugitive" emissions. How are fugitive emissions determined? Because fugitive emissions are variable -- and hence are not counted in the quantities of known toxins to be emitted - - how can the air permit possibly be approved? Let me present an analogy. I want to keep my monthly budget to $2,000. I spend $1,500 on my mortgage, $300 on my car payment, and $199 on my student loan. I *know* an electric bill will be coming in (i.e., fugitive emissions), but the amount of that bill varies each month. It should be a surprise that my anticipated budget is regularly exceeded. My understanding is that there are new EPA guidelines on fugitive emissions. How will these new guidelines impact this proposed project? How often and by what method will fugitive emissions from valves, etc. be measured? Who is responsible for these measurements, and how will Metro Health Department verify their accuracy?
Response:	Please see **General Topics: Fugitive Emissions Monitoring.**
Commenter:	Dr. Sharon Felton
Comment:	The Federal level specified for the Prevention of Significant Deterioration (PSD) is, I believe, 100,000 tons per year for greenhouse gas emissions. Yet the compressor station proposed for Joelton will emit, by Kinder Morgan's own statements, over twice that amount: at almost 219,000 tons per year. Why has this facility been exempted from having to meet PSD standards?
Response:	On June 23, 2014, the U.S. Supreme Court issued its decision in Utility Air Regulatory Group v. EPA, 134 S. Ct. 2427 (2014) ("UARG"). The Court held that EPA may not treat GHGs as an air pollutant for purposes of determining whether a source is a major source required to obtain a PSD or title V permit. The Court also held that PSD permits

	that are otherwise required (based on emissions of other pollutants) may continue to require limitations on GHG emissions based on the application of Best Available Control Technology (BACT). In accordance with the Supreme Court decision, on April 10, 2015, the D.C. Circuit issued an amended judgment in Coalition for Responsible Regulation, Inc. v. EPA, Nos. 09-1322, 10-073, 10-1092 and 10-1167 (D.C. Cir. April 10, 2015), which, among other things, vacated the PSD and title V regulations under review in that case to the extent that they require a stationary source to obtain a PSD or title V permit solely because the source emits or has the potential to emit GHGs above the applicable major source thresholds.
Commenter:	Dr. Sharon Felton
Comment:	Within the Clean Air Act, the Environmental Protection Agency establishes three class distinctions to prevent the deterioration of air quality. Class I areas are those defined as having "special national or regional value due to their natural, scenic, recreational, and/or historic worth, where almost no change from the current air quality is allowed." The nearest cited Class I entity to the 37080 zip code seems to be Mammoth Cave in Kentucky, which would likely be deemed a "natural" site. But how about the other kinds of sites mentioned in the EPA definition? We realize that the park adjoining the proposed compressor site, Paradise Ridge Park, would likely not be reconfigured as a Class I site. But because all of Nashville is included within the 50 km range of the Joelton site, why not reclassify the Parthenon, the Ryman Auditorium, Riverfront Park, Bicentennial Mall, or a thousand other "natural, scenic, recreational, and/or historic worth" sites as being embraced within the Class I restrictions? The Parthenon, the Ryman, for instance, certainly boast "historic worth." What procedure might we follow to get, for instance, the Parthenon reclassified as a Class I site, a step that would necessarily prohibit this compressor station from being constructed?
Response:	Under the PSD program, all international parks, national wilderness areas and national memorial parks that exceed 5,000 acres, and national parks that exceed 6,000 acres are designated as mandatory federal Class I areas in order to preserve, protect and enhance air quality. All other areas that attain the NAAQS are initially designated as Class II. Section 164 of the CAA, gives states and tribes the ability to request redesignation from Class II to Class I called “non-federal” Class I areas.
Commenter:	Mr. Chris Strong

Comment:	Dear Mr. Finke, As an acute asthmatic, and the mother of asthmatic children, I am very concerned about the present air quality in Metropolitan Davidson County where we live. I suspect that it is soon to be negatively impacted by the pending approval of the operation of a gas compression station in the Joelton area. Not only will this affect the already poor air quality in Nashville, but will certainly be compounded with the proposed station that is seeking approval for the Cane Ridge area in South Nashville. I hope you will agree that these types of installations are completely unsuitable for such densely populated urban areas such as Nashville. In addition to the high population density, as a Nashville resident, you most certainly know that due to the natural topography of the area we already experience poor air quality days during the year. I am not sure what your role is regarding this installation or the approval of it, but I am fairly certain that you do not wish to impose this adverse health burden on the citizens of Davidson County. I have faith in our government and I believe that when faced with the facts that people will do the right thing. The right thing in this case is to deny this permit and not allow this compressor station to be build and operated on this site. Thank you for your time and for your kind consideration. Sincerely, Chris Strong 6323 Pettus Road, Cane Ridge, TN 37013
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Mr. Mike Roberts
Comment:	Dear John: I have been living in Joelton for nearly 15 years and loved it. The reason I moved into Joelton was primarily for health concerns. I have suffered with breathing problems caused by pollutants in the air. Nashville, it being in a geographical "bowl" was hard on me. The difference was dramatic when I moved into Joelton on the ridge. I really thought I was safe from industrial pollution; now I learn that arrogant Tennessee Gas Pipeline and Kinder-Morgan could care less about my health or the welfare of Joelton area residents THE FACTS ARE UNDENIABLE - THIS PROJECT MUST BE STOPPED! Respectfully, Mike Roberts The facts are undeniable, this project should be stop
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Ms. Heather Hixson

Comment:	Good afternoon! I am a Cane Ridge resident who lives in the Stanford Village complex which sits directly across from the proposed CPG Gas Compressor Station in our area. Due to the two proposed stations in Joelton and Cane Ridge being in such an unprecedentedly densely populated area of Nashville which already contains many businesses and sits in a bowl, I am extremely concerned about what this will do to our already compromised air quality. Saying yes to even one of these stations in an area such as Nashville seems risky but to then approve two? I am very concerned about how this will not only affect the air quality of those who are currently residing in Nashville and the surrounding areas but how it will affect future business coming in to the area. How will we be able to guarantee that the pollutants coming from these Stations will not elevate the level to such heights that we will have to say no to potentially many other businesses that would like to build in Nashville and would subsequently bring hundreds of jobs to our local community but are unable to build because of these two stations which will provide less than twelve jobs between the two total? Thank you for your time and for hearing our voices and for addressing our concerns- Heather L. Hixson Keep Southeast Nashville Healthy
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Ms. Richelle Deharde
Comment:	Mr Finke. I am from Lousiana, where oil and gas are processed and transported regularly. During the years before I moved to TN, I began to experience dizziness, had 2 seizures, and developed Chronic Fatigue Syndrome (I had to nap, in my workplace every 2 hours just to have the strength to make it through a regular workday) The doctors, at MY EXPENSE, did a multitude of tests and studies but could not find anything wrong with me physically. I was 27-30 years old at that time. Today, I am 53 and am healthier today than I was 23 years ago before I moved to rural Middle Tennessee. I have not changed anything in my lifestyle other than moving from that very toxic environment, and I am now enjoying excellent health. Please do not put my friends, neighbors, and myself through the health horrors that I experienced in Louisiana.
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Ms. Richelle Deharde

Comment:	Mr. Finke. Kinder and Morgan would like for us to believe that the sound of the compressor station is like a 2 person conversation. Even if that were true, conversations don't drone on for 24 hours a day and 7 days a week. People stop talking to breathe, sleep and eat. The compressor won't stop talking, ever. In your own home you can say 'QUIET' when everyone is talking and you need peace. How many times do you go home and just want a few minutes of silence? We won't have that opportunity with the compressor station. It will run incessantly. Please take a moment to listen to a compressor station for just 15 minutes. I promise, you will be miserable in just a few minutes. Please consider the folks who have to hear that noise 24 /7. No matter how low the sound, even the sound of a dripping faucet will eventually drive a homeowner nuts. https://www.youtube.com/watch?v=WtSH5V1YQvQ
Response:	Please see **General Topics: Permitting Process and Noise.**
Commenter:	Mr. & Mrs. Roger and Elizabeth Williams
Comment:	We have lived in our home for 28 years. When we built we knew we would have to dig a well. Yes, even in today's times houses are still using well water. In fact, there are 40+ houses on Huffman Rd using well water. I feel that if the Pipeline Compressor is built, it could affect our water supply. Then what would be do for water? We have been unsuccessful in getting city water. We get electricity, phone and mail from Metropolitan Nashville. We live in Robertson County and pay only taxes to them. We have been told our water would come from the White House district. They would have to cross metro water to get to us. We have metro water at each end, within a two mile stretch of road we live on. Can Metro Nashville connect those two ends to give us city water? I'm in my 70's and fear should my husband die before me, I would be at a disadvantage in taking care of the well and the process that he does to keep the water drinkable and fit to use. Our neighbor at this very time has sulfur in his water. He is unable to use it for drinking or cooking. Within the last two years, Kinder-Morgan dug a well next to this house to put in test rods to stop the rust on the pipes. These rods are placed about every 5' in about 100' well. As a result, the stream which supplies his water was affected by this well and now he is unable to use it for personnel use. When getting water from the faucet, there is a black ring around the top of the glass. Last year, Kinder-Morgan came across the front of our property to get to the back. We live on 17 acres. They needed to replace a portion of pipe that was defective. They said it was put in place in 1944. I remember

	because that is when I was born. Now, if that pipe is 72 years old, then the rest of the pipes are at least that age. It the new pipeline compressor is put in place then that will put much stress on the already aging pipes. Also, we purchased additional property to put our driveway in on the upper side of the gas line, hoping that if the pipeline needed to be dug up it wouldn't affect our driveway. We knew when we purchased this property a gas line ran through it. We knew we would be on a well, even in this day and time. But we didn't know that Kinder-Morgan would want to put a major compressor station within miles of our house. These fragile pipelines are just that Frail gas lines. PLEASE DO NOT GRANT KINDER-MORGAN A HEALTH PERMIT TO CONTINUE WITH THIS PROJECT.
Response:	In the Environmental Assessment published by the Federal Energy Regulatory Commission (FERC), FERC concluded that, "the Project would not result in any significant longterm or permanent impacts on groundwater resources based on Tennessee's implementation of appropriate minimization and mitigation measures." Please also see **General Topics: Permitting Process and Pipeline Safety**.
Commenter:	Ms. Staci Bishop
Comment:	My husband and I have been looking at property in Joelton. We really think the area has great potential in the next 5 years. Once we learned more about the compressor station, we have curbed our search until a decision is made. I have huge health concerns about placing such a facility in a residential area and we are unwilling to buy in an area that would subject it's residents to this type of air pollution and noise. It seems that KM has found some type of loophole but there has to be a way to prevent them from building so close to families. I look forward to seeing the outcome and hope that we can resume our search soon. Otherwise, I fear that property values are going to quickly decline and all of the potential for this city will be wasted. Thanks. Staci
Response:	Please see **General Topics: Health Protection and Noise.** With respect to property values, under the Natural Gas Act, only the Federal Energy Regulatory Commission ("FERC") considers the proposed natural gas compressor station's potential impact on adjacent property values when siting a compressor station. The issue raised by this comment is outside the scope of MPHD's authority.
Commenter:	Mr. Durwood Edwards

Comment:	Dear Mr. Finke, As a resident of Davidson County, I am very concerned about the impact which the proposed gas pipeline compressor will have on the air quality not only in the immediate area around the compressor site but also the impact on downtown Nashville as the pollutants settle into the basin containing our city. I understand that in order to cut costs, a model of compressor is proposed that is minimally effective at controlling the release of toxic air pollutants, even though there are much better choices that could be made to radically reduce these emissions. I believe Kinder-Morgan should be required to install the best pollution controls available and not simply the cheapest. Thank you, Durwood Edwards 6324 Lake Road Joelton, TN 37080
Response:	Please see **General Topics: Health Protection and RACT Analysis.**
Commenter:	Dr. Brenda Butka
Comment:	As a pulmonologist, I am very concerned about the prospect of these compressors anywhere near human habitation. There have been documented releases of significant air pollutants and unknown radiation risks, plus, as you know, concerns about poor pipeline maintenance, noise and many other issues. Thank you. Brenda Butka, M.D.
Response:	Please see **General Topics: Health Protection, Pipeline Safety and Noise**.
Commenter:	M. Theroux
Comment:	I am worried that the proposed Tennessee Pipeline compressor station will pose a very real threat of the release of VOCs and other harmful atmospheric contaminants during blow-downs and leaks. Kinder Morgan is employing the cheapest available technologies on this project. This fracked gas will not be used by people in the US. The people of Nashville should not be put at risk in order for Kinder Morgan to make money by providing their 50 year old corroded pipeline to send gas to the gulf coast where it will be shipped to Asia. Please continue to help protect the health of the people of Nashville. Thanks for all you do! Sincerely, M. Theroux 5200 Eatons Creek Rd. Nashville TN 37218

Response:	Please see **General Topics: Health Protection and Venting.**
Commenter:	Ms. Kelley Lewis
Comment:	The Tennessee State Wildlife agency is a state agency whose mission is to preserve the state's endangered wildlife and manage its woods and waters. They warn that the "reduction of forestlands can negatively impact water quality and quantity, the health and diversity of habitats, and other land values such as recreation, timber, and forest products." They declare that upland forests are a benefit to each citizen of Tennessee by reducing soil runoff, thereby maintaining higher water quality in other waterbodies from ephemeral streams to lakes and rivers across the state. "Forests also filter pollutants and improve water absorption and retention, which increases groundwater recharge. Forest cover influences local temperatures, improves air quality, and, may play an important role in mitigating climate change." The Environmental Assessment, on Table 2-10, FERC states that TGP will 'temporarily' impact 34.6 acres and 'permanently' impact 20.5 acres of upland forests to construct CS563. My question: How can a local metropolitan jurisdiction override the intent and wishes of a major state agency such as the Tennessee Wildlife Resources who sees it necessary and vital to the citizens of the state to protect these lands for the health and well-being of all Tennesseans? Kelley Lewis 8410 Sycamore Creek Rd Joelton, TN
Response:	Please see **General Topics: Permitting Process.**
Commenter:	Mr. Eric Lewis
Comment:	Mr. Finke, I attended the public hearing on the Joelton compressor station last night but did not speak. I appreciate your department's willingness to hear everyone out. Though I live in Bellevue, some 20 miles from the proposed station, I am still worried. I have seen the map depicting the spheres of air pollution influence with overlapping circles from the Joelton and Cane Ridge proposed stations. My family lives in the double shaded area. I have several relatives with respiratory conditions living in this blast zone, including my 90-year old father, a daughter-in-law, and two grandchildren. Nashville already has several days every summer where it is not safe for them to be outside. How much worse will it be if these industrial facilities are allowed to be built here? Please do the right thing and turn down Kinder Morgan's application. Thank you, Eric Lewis 7978 Highway 100 Nashville, TN 37221

Response:	Please see **General Topics: Health Protection, Permitting Process and Area of Impact.**
Commenter:	Mr. Lyle Harvey
Comment:	Dear Mr. Finke, I urge you to help block the approval of the Kinder Morgan compressor in Joelton. The more I have learned about the environmental and public health impact of the project, I am horrified and outraged that this huge compressor will be put in the backyard of Nashville (which already had a very poor air quality rating.) As may already know here are some facts about the compressor station: -The compressor station engines burn the natural gas emitting the fracking chemicals, which do not burn, into the air. - serious health concerns surrounding the chemicals. The safety of chemicals such as: formaldehyde, methylene chloride, benzene, toluene, ethylbenzene, and xylenes (the last four are collectively called BTEX). These pollutants can result in serious health impacts such as cancer, respiratory disease, reproductive problems (in humans and animals), neurologic disorders (Alzheimer's and Parkinson's diseases), and birth defects to name a few. -The compressor station will be one of the largest in the country (its in the top 5%) -It is equal to >900 average cars running ALL THE TIME (but with worse emissions) -Nashville has an "F" rating for air quality -The compressor station is unmanned thus creates NO jobs or income (other than land tax) -All of the gas is going to be exported (this is not for public good although the company is using the rules for public utilities for obtaining permits) -There are other more suitable places where the compressor station can be built. These places are much more rural. Although my hope is Kinder Morgan scraps the whole project. I urge you to do everything in your power to stop this compressor and protect the health of the community and our precious children. We already live in a world with too many toxins; we do not need another giant environmental polluter and health risk in our backyard. Thank you for your consideration. Sincerely, Lyle Harvey Lyle Cates Harvey, M.S.OM, L.Ac Licensed Acupuncturist and Chinese Medicine Practitioner The Nesting Place Acupuncture and Wellness 3112 Lakeland Drive Nashville, TN 37214
Response:	Please see **General Topics: Health Protection, Permitting Process and Hazardous Air Pollutants.**
Commenter:	Ms. Lori Rochelle
Comment:	Mr Finke, I live in the Joelton/ Whites Creek area. We do not want this gas pipeline/compressor in our area. This will

	damage air quality for a 50 mile radius, including downtown Nashville. Please stop this company from coming to our precious Nashville! Lori Rochelle
Response:	Please see **General Topics: Permitting Process and Area of Impact.**
Commenter:	Ms. Elizabeth Garber
Comment:	Dear Mr. Finke, I would like to write in opposition to granting air pollution permits for the Joelton compressor station. Not only has Kinder Morgan failed to use available technology to decrease the amount of pollution released, it has also chosen an inappropriate location. The thriving Metropolitan Nashville is no place for a compressor station. Thank you, Elizabeth C. Garber 1327 Otter Creek Road Nashville, TN 37215
Response:	Please see **General Topics: RACT Analysis and Site Selection.**
Commenter:	Mr. Joseph Maloney
Comment:	How will compliance with maximum noise levels (i.e., a maximum of 55dBA) be guarenteed? What happens if residents observe even one instance of noise exceeding 55 dBA level? What steps should a resident take in such cases --is calling the Police the appropriate response? Very respectfully, Joseph Maloney Joseph.maloney@live.com
Response:	Please see **General Topics: Noise.**
Commenter:	Ms. Jennifer Mayo
Comment:	My name is Jennifer Mayo. I am a 5th generation resident of Joelton and reside at 2887 Morgan Road in Joelton. I live approximately ½ mile from Paradise Ridge Park. I am speaking to you today as a citizen that is concerned about the potential for damage to the air quality in my neighborhood. In November of 2011, my father, also a resident of Morgan Road, was diagnosed with Stage 4 lung cancer. In addition, I have a 4 year old son with breathing issues. He has had to undergo breathing treatments since he was 6 weeks old, and has been diagnosed with asthma. Given our medical conditions, we have to monitor the air quality very carefully. I have never been overly concerned about this given where we live, and would never have dreamed

	that something like a compressor station could be located in our rural setting. When I learned of this venture, I was devastated given the potential health risks for my family members and the fact that I was only a few weeks into the construction of our new home. On Kinder Morgan's own website, they have listed potential hazards associated with pipeline leaks. The possible leaks of those chemicals range from harmful to fatal if inhaled. According to the Environmental Protection Agency, "VOCs (Volatile Organic Compounds) are released during the production of oil and natural gas. The chemicals in VOCs can form ground level ozone (smog) which can cause breathing difficulties, especially with those who are young, elderly, or have existing respiratory problems such as asthma". While I am sure that Kinder Morgan can cite many instances of safety and emissions that meet guidelines and standards, I do not feel comfortable with the "What if?" gamble some are willing to take on the lives of my father, son, or other residents of the Joelton community that are highly impacted by any changes to the air quality. People choose where they live for many reasons. For some it is convenience or preference, but for many, factors like air quality play a significant role in that choice. I am asking you to protect that choice. Thank you. Please read my attached concerns about how the proposed compressor station affects the potential health of my family!
Response:	Please see **General Topics: Health Protection.**
Commenter:	Ms. Rhonda Trent
Comment:	Good afternoon, Mr. Finke. I sent an email last night to the Dept. of Health (not knowing exactly where to send it). I think it finally made its way to you, but just in case, I have copied my email below with my concerns about the purposed compressor station. Also, I'm not sure that the embedded photo in the first email sent correctly, so I have attached the photo of me from 2014 when I discovered health conditions in my body. I can't describe it as well as I can show you. I can tell you that when I went to my doctor's office and the dermatologist that the nurse and nurse practitioner gasped when they saw me. Thank you so much for your help in the matter of our health concerns and the environment in our neighborhood. Original email sent... Good evening. Unfortunately, I will be unable to attend tomorrow night's meeting. But, I want to voice my concern about the proposed compressor station in Joelton, TN. This is located about two-tenths of a mile from my home and even closer to our cattle (grass-fed organic beef) located on By Faith Farm. My concern is from a health standpoint. I am 48 years old and found out two years ago I

	had a mixture of health issues. I was diagnosed with an autoimmune disease, Sjogren's Syndrome, as well as MTHFR, which means my body doesn't detox itself like it is supposed to. I have included a photo of what happened to my body in Sept. 2014 when all these things came to light in my body. From then, I changed to organic foods, drinking fresh juice every morning. We raise our own beef, organically grown. I also must periodically soak in an Epsom salt bath to help detox my body due to swelling. If the compressor station is allowed to build that close to our home (of 24 years), it will force us to leave. I recently wrote a research paper on natural gas compressor stations. The health effects and testimonies of those currently living near these stations is just astounding. It will literally force us from our home. I ask you, please, to consider those who live near this site and help us keep these pollutants out of our neighborhood. Rhonda Trent - September 2014 (this lasted for more than 8 weeks, under a doctor's care)....SEE ATTACHED PICTURE Sincerely, Rhonda Trent 7834 Whites Creek Pike Joelton, TN 37080
Response:	**Please see General Topics: Health Protection and Permitting Process.**
Commenter:	Ms. Alicia Bequette
Comment:	Hi John, I have a vested interest in the pipeline decision because, as you can see by the attached map, all pipeline and pipeline compressor decisions affect me and my family TEN FOLD. My house sits just yards away from the pipeline on BOTH sides of my house. My dream house, out in the country, that I thought would be exceptional for raising two young boys - with ample woods and creeks has now become a possible target for the worst news possible. Last year, I walked and drove to all my neighbor’s houses to make them aware of what was happening in our area, and do you know how many knew Kinder Morgan plans? Zero. I drove down my driveway this morning to find full crews of pipeline men, trucks and large equipment getting ready to repair corrosion on what I now know as VERY OLD, over 50 years, very corrosive pipes that didn’t use the same technology for interior coating as they would today. Specifically they are trying to fix the one that runs through our creek, because we all know what will happen once it starts leaking, if it hasn’t already. Once this compressor goes in, not only will it affect our air quality, our water (my neighbors are still on well water), our creeks, our fish & wildlife, our personal health, our soil for our gardens, our quiet peaceful location, our property values, but also COULD EXPLODE! Exploding pipelines affect areas up to 5 miles or more. If one of these 50-80 year old pipeline seams is not able to handle the newly reversed flow (a flow direction that has not been implicated for decades) under newly increased pressure that is has never been tested on these lines, then my kids and I, and my house and property, are gone. DEAD gone. And

	Kinder Morgan is fine with apologizing later. But as you know, later is too late. Please help me and my family continue to have the quality of life you would want for your own, by making the right moral decision for our neighborhood. Thank you, Alicia Bequette 245 Yates Lane Joelton, TN 37080 615-948-0668
Response:	Please see **General Topics: Permitting Process and Pipeline Safety.** With respect to property values, under the Natural Gas Act, only the Federal Energy Regulatory Commission ("FERC") considers the proposed natural gas compressor station's potential impact on adjacent property values when siting a compressor station. The issue raised by this comment is outside the scope of MPHD's authority.
Commenter:	Ms. Wendy Wilson
Comment:	I stand in opposition to the proposed Joelton compressor station and the compressor station proposed for Antioch for health, environment and zoning reasons. I am concerned about the emotional and physical health effects of the noise and the air pollution. The noise especially from the blowdowns will increase stress levels and health consequences related to increased stress. Well documented consequences to air quality are also of great concern as these can increase respiratory distress, asthma and other respiratory illnesses. I am also concerned about the health consequences of increased air pollution to those who are living with compromised respiratory and compromised immune systems. I am concerned about the potential for catastrophic accidents related to poorly maintained infrastructure/pipelines. I am concerned about the potential for increased costs to metro budget related to the health consequences from this compressor station. I am asking I am asking that the Metro Health Department refuse the air-quality permits that would allow construction of the compressor stations. Wendy K Wilson 4898 Bull Run Rd. Ashland City TN 37015
Response:	Please see **General Topics: Health Protection, Permitting Process, Pipeline Safety, Zoning and Noise**.
Commenter:	Ms. Rhonda Trent
Comment:	Good evening. Unfortunately, I will be unable to attend tomorrow night's meeting. But, I want to voice my concern about the proposed compressor station in Joelton, TN. This is located about two-tenths of a mile from my home and even closer to our cattle (grass-fed organic beef) located on By Faith Farm. My concern is from a health

	standpoint. I am 48 years old and found out two years ago I had a mixture of health issues. I was diagnosed with an autoimmune disease, Sjogren's Syndrome, as well as MTHFR, which means my body doesn't detox itself like it is supposed to. I have included a photo of what happened to my body in Sept. 2014 when all these things came to light in my body. From then, I changed to organic foods, drinking fresh juice every morning. We raise our own beef, organically grown. I also must periodically soak in an Epsom salt bath to help detox my body due to swelling. If the compressor station is allowed to build that close to our home (of 24 years), it will force us to leave. I recently wrote a research paper on natural gas compressor stations. The health effects and testimonies of those currently living near these stations is just astounding. It will literally force us from our home. I ask you, please, to consider those who live near this site and help us keep these pollutants out of our neighborhood. Rhonda Trent - September 2014 (this lasted for more than 8 weeks, under a doctor's care) Thank you for your time, Rhonda Trent 7834 Whites Creek Pike Joelton, TN 37080
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Ms. Melanie Leslie
Comment:	Mr. Finke, It may be too late to provide questions on the air permit. I mistakenly thought the day of the hearing (July 27) was the deadline for the questions. If it is not too late, may I present my comments on the air permit request for Kinder-Morgan Gas Compressor Plant in Joelton, TN. Kinder-Morgan is stating the only air monitoring they will be performing is right at the station and does not take into account the vent blowout events which will disperse pollutants in a much wider plume than during "normal" operations. Yet this vent blowout is a regularly scheduled event that occurs every 24 hours, as part of the "normal operations". Does their air monitoring program have a quality assurance/quality control check to ensure they are monitoring according to state guidelines? Do they have guidelines for data validation? There is no mention of it in Section 1.3(a), will data validation be required? Without results that are trustworthy, how can proper monitoring and protecting the surround environment be accomplished. Will Kinder-Morgan have air monitoring stations around the plant only or will they be scattered throughout the affect area? How will they know the Volatile Organic Compounds; Benzene, Toluene, Ethylbenzene, and Xylenes; and other pollutants in the natural gas liquid they are transporting are not spreading off their property. Section 1.21 states nothing objectionable will go "beyond the property line". How will Kinder-Morgan know this is true without air monitoring stations placed throughout their property or do they simply expect the emissions to "magically" drop out of the air at the fence line? And if this happens what about the soil, surface

	water, and eventually groundwater? Sections 1.24 and 1.25 speak of the permittee not allowing emissions beyond certain limits. What are these limits? How will they sampling to ensure those limits are not exceeded? What will they do if the limits are exceeded? Kinder-Morgan states they don't have to monitor because their station does not fall under EPA headings for facilities that do require air monitoring. However, the state can and often does have more stringent guidelines, will Kinder-Morgan be meeting those requirements? The Compressor Station will not be operating in a vacuum. Its everyday operations which includes the vent blowout events will affect the community in multiple ways - none of them beneficial to the community. Thank you and I truly hope it is not too late to include these questions, Melanie Leslie Geologist
Response:	Please see **General Topics: Fugitive Emissions Monitoring, Venting and Permitting Process.** With respect to Section 1.21 of the permit, please see **General Topics: Section 10.56.170**. Compliance with Section 1.24 and 1.25 is demonstrated during the application process, based on the fuels being combusted and the manufacturers' emissions certifications. The pipeline is transporting natural gas, not natural gas liquids. Natural gas liquids are a byproduct of the production process and transported separately for use in other industrial processes, such as plastics manufacturing.
Commenter:	Ms. Richelle Deharde
Comment:	Mr. Finke, Please watch the Youtube clip from a gentleman who lives near a compressor station: You will be able to hear what he hears, see the dead trees on his property and possibly smell the air pollution. https://www.youtube.com/watch?v=tA5cnlJCyBA We need desperately for you to protect our community from this: Thank you for your time. Richelle Deharde Joelton, TN
Response:	Please see **General Topics: Noise.**
Commenter:	Ms. Virginia Team

Comment:	Dear Mr. Finke, I can not be at the Lentz on Wed. afternoon, but wanted to share my deep concern and opposition to the Kinder Morgan proposed Compressor Station in Joelton. WHO will benefit from it? Kinder Morgan, and the people that sold the land to Kinder Morgan?? Who will suffer and have toxic pollution of our air quality and ill health because of it? The residents, environment, animals, and agriculture of the Joelton and surrounding areas! "The safety of chemicals such as: formaldehyde, methylene chloride, benzene, toluene, ethylbenzene, and xylenes (the last four are collectively called BTEX). These pollutants can result in serious health impacts such as cancer, respiratory disease, reproductive problems (in humans and animals), neurologic disorders (Alzheimer's and Parkinson's diseases), birth defects. " How such a toxic situation could have even been considered for anything less than an industrial area is just unbelievable and inconceivable !!! Please … Do NOT issue this permit!!! The degradation of air quality in the this area is just NOT Acceptable! Thank you, Virginia Team Virginia Team 5596 Higdon Road Joelton, TN 37080
Response:	Please see **General Topics: Permitting Process and Hazardous Air Pollutants.**
Commenter:	Mr. Martin Holsinger
Comment:	Dear Mr. Finke, If somebody moved into Joelton and started poisoning random citizens, occasionally dumping oil into waterways, and creating a constant very loud noise, we would call the police on them as quickly as possible. That is exactly what this pipeline compressor station is going to to do, and its emissions wouldn't just hurt people in Joelton, they would affect people all over northern Davidson County. It would be difficult to trace these health effects directly back to the compressor station, so it would bear no financial responsibility for the medical expenses of those it harmed. Why should we, the citizens of Davidson County, pay such a high price so this company can "make a profit"? Furthermore, the whole business the company is in, the fossil fuel industry, is one that the best scientific minds of our time tell us we must shut down as soon as possible, or we will make life on this planet very difficult for our children and grandchildren. Encouraging more fossil fuel infrastructure is very bad from a longterm public health standpoint. I am a 67-year old retiree, with a heart condition. One of the reasons I live in NW Davidson County is because it's less polluted--air pollution is hard on my system. The recent "Nashville Next" county plan recognizes the special nature of NW Davidson County, and states Metro's intention to preserve the rural character of the area. Let's not screw it up by locating a noisy, heavily polluting industrial facility up here. Thank you very

	much for your attention in this matter. Martin Holsinger 5155 Drake's Branch Rd. Nashville 37218
Response:	Please see **General Topics: Health Protection, Permitting Process and Noise.**
Commenter:	Ms. Tristan Charles
Comment:	Mr. Finke, I write to you today to express my opposition to the TGP natural gas compressor station. As you've no doubt heard several times already, the construction and use of such a facility raises a variety of legitimate health concerns (and some illegitimate ones - I doubt noise pollution causes Alzheimer's) related to the release of known carcinogens into the air we breathe. At best, contact with those carcinogens should be accidental. Kinder Morgan's deliberate use of them, then, should be considered a manifestation of a flagrant disregard for the health and welfare of Middle Tennessee. I humbly and respectfully urge you to do your part in preventing such irresponsible behavior, as I am doing mine. Sincerely, Tristan Charles
Response:	Please see **General Topics: Health Protection, Permitting Process and Hazardous Air Pollutants.**
Commenter:	Ms. Eva Green
Comment:	Mr. Finke, I wanted to write and request that you consider the negative consequences that we all face if this compressor station (the largest in the U.S.) is built in the middle of a growing community in Davidson County, (Joelton). I know your office is receiving a lot of pressure from lobbyist for Kender Morgan and others who have lots of influence. However, all of Davidson County will be effected by this air pollution, water contamination and loss of life if there is an explosion. The families that live directly around (we are 1.5 miles) are at the greatest risk. There is a new community Park, Paradise Ridge that is less than a mile. After school programs for middle school & elementary students spend the afternoons there waiting for their parents to get off work. If you have seen the report of the corroded exposed pipes (50+ years old) they intend to use (I hope you have) there is sure to be a major catastrophe happen. PLEASE DO NOT ALLOW THIS PROJECT TO BE BUILT. Respectfully, Eva Green 7456 Bidwell Rd. Joelton, TN. 37080

Response:	Please see **General Topics: Permitting Process and Pipeline Safety.**
Commenter:	Mr. Jay Rummage
Comment:	Hello Mr. Finke, I am writing you today regarding the proposed compressor station in Joelton. 8189 people live in Joelton, 29% of them under the age of 20. Studies have been done on the air quality around these stations and I don't think we should take a chance on our health. Below I have an excerpt from one study in 2014. RESEARCH OPEN ACCESS OPEN PEER REVIEW Air concentrations of volatile compounds near oil and gas production: a community-based exploratory study Environmental Health 2014 13:82 DOI: 10.1186/1476-069X-13-82 © Macey et al.; licensee BioMed Central Ltd. 2014 Received: 16 July 2014 Accepted: 10 October 2014 Published: 30 October 2014 Community-based monitoring near unconventional oil and gas operations demonstrates elevations in concentrations of hazardous air pollutants under a range of circumstances. Of special concern are high concentrations of benzene, hydrogen sulfide, and formaldehyde, as well as chemical mixtures linked to operations with observed impacts to resident quality of life. Please act in the best interest of the population. This station is not in the best interest of the Joelton or Nashville population and needs to be denied. Please consider the impact of the kids. Jay Rummage Nashville
Response:	Please see **General Topics: Health Protection and Hazardous Air Pollutants.**
Commenter:	Ms. Melinda Perricone
Comment:	I am extremely concerned for the air quality in the Nashville area and the health consequences from the operation of a Gas Compressor Statation if the Construction Permit and Operating Permit from Tennessee Gas Pipeline for the construction of a Gas Compressor Station is granted. I urge the Metro Public Health Department to protect our air quality and our public health by dening this request. The cumulative impact it will have is a great concern for our community. The possibilities for health, safety or environmental harm resulting from natural gas compressor stations are many and serious. The toxic emissions released by this massive industrial facility will have grave affects both long and short term on the families surrounding it. The most prevalent, by far, is the intentional (routine) “blow-downs”. Accidental releases of VOCs and NOx also occur. Compressor stations are loud. “Blow-downs” can

	last from 20 minutes to 2-3 hours, from 12 to 40 times a year. The noise is comparable to a commercial jet taking off. They often occur in the middle of the night. The sound of regular compressor station operation has been compared to four diesel locomotive engines running 24/7. Residents as far as a mile away can hear the racket. There is a Metro Public Park less than half a mile away from the proposed site that children use for daycare camps and outdoor family recreations. Our community prides itself on our rural setting and the benefits of a peaceful, environmentally safe environment. The health of the citizens of this county will be at risk if these permits are granted. Please deny the application by Tennessee Gas Pipeline for a Construction Permit and Operating Permit for the Gas Compressor Station. Thank you, Melinda Perricone 7349 Bidwell Road Joelton, TN 37080
Response:	Please see **General Topics: Noise, Permitting Process, Hazardous Air Pollutants and Venting.**
Commenter:	Ms. Christina Wright
Comment:	Dear Mr. Finke, I am writing you today because I am a concerned citizen and long time resident of Nashville. I am concerned about the future of our city and the health of the residents. At first no one, not even Kinder Morgan or Columbia Gas, knew the effects of living near a gas compressor however, now, there is evidence that it's presence is detrimental to people living nearby. Gas compressors emit chemicals such as ethyl benzene, formaldehyde, methylene chloride, benzene, toluene, and xylenes. All have been shown to cause cancer, respiratory problems, neurological disorders and/or birth defects. I am appealing to you to do your job and protect the residents of our city. Nashville's topography is unique in the fact that it is bowl shaped. The air pollution hangs over the city in the summer like a thick gray blanket. Breathing warnings already appear on the interstate signs to warn the sensitive. It is a known fact, that people that never had breathing or sinus problems move to Nashville and start having problems. My 90-year-old Mother-in-Law has lived in Massachusetts, Upstate New York, and Vermont. She never had nosebleeds in her entire life. Since moving to Nashville in May 2014, her nose has bled frequently. The doctors we have seen are totally unhelpful. This tells me that Nashville's air quality is already bad and the doctors do not know what to do to help the patients. The presence of a gas compressor(s) will only make it worse.

	I beg you, do your job and protect the citizens of Nashville by not allowing them to build here! Sincerely, Mrs. Christina Wright
Response:	Please see **General Topics: Health Protection, Permitting Process and Hazardous Air Pollutants.**
Commenter:	Mr. Bill Collier
Comment:	Thank you for advising what is going on with this compressor pipeline. I am very concerned after reading what these compressor stations omissions being released into the atmosphere- volumes of contanimants such as methane, foraldehyde-carbon monoxide, particulate matter and cancer causing viotatile organic compounds. Metro government spent a lot money a few years ago, for a metro park in Joelton. The location of this park called Paradise Ridge Park on Morgan Rd, is just a mile from this proposed compressor station. This park is providing after care from Joelton Elem. also summer day camp for children. All the contaminants listed above is such a danger not only to children but all the Joelton area. This pipeline/compressor station will be to close for the childrens safety. Please consider not NO PERMITS for the TGP. Thank you for your help Bill Collier 7626 Bidwell Rd Joelton TN 37080
Response:	Please see **General Topics: Health Protection, Permitting Process and Hazardous Air Pollutants.**
Commenter:	Mr. & Mrs. Eva and Wayne Green
Comment:	Mr. Finke, We are contacting you regarding the requested permit by Tennessee Gas Pipeline to build a compressor station in Joelton, less than a mile from our new Paradise Ridge Community Center. We live in the Joelton Community and are opposed to the building of this compressor station and are very worried about the hazards that it brings to Joelton and All of Davidson County. We have seen the conditions of these 60 year old pipes they intend to use and it's not in the best interest on anyone living in or around them. Please do not issue this permit. Eva & Wayne Green 7456 Bidwell Rd. Joelton, TN. 37080
Response:	Please see **General Permits: Pipeline Safety and Permitting Process.**

Commenter:	Ms. Lainie Marsh
Comment:	As regards the request by Kinder-Morgan (KM), in the guise of the Tennessee Gas Pipeline Company, LLC (TGP), for a permit to begin construction in Joelton of a 60,000 hp compressor station, I beseech you and all persons functioning authoritatively as agents in the Metropolitan Nashville Health Department to deny such request. There is a preponderance of evidence that the proposed operations of TGP will place the public's health at risk. Whereas, you may find a plethora of stipulations allowing or disallowing this evidence, e.g. evidence from court cases against KM in cities all over the United States, evidence from field studies, evidence from expert analyses, and the evidence suggested by the governing bodies of other cities and states across the country that have denied KM a green light, you nonetheless are charged with the ethical responsibility to protect the citizens of Davidson County from ANY potential public health risk, and therefore, must take this evidence into consideration. It is obstructionist for the Health Department to present hurdle after hurdle for the residents of Joelton and the surrounding areas to overcome in their efforts to preserve the environmental integrity of their communities. To their credit, however, the members of those communities, known together as Concerned Citizens for a Safe Environment, have done an astonishing job of delivering the goods demanded of them by the governing bodies of Nashville and the State of Tennessee at every juncture for nearly two years now. As a result, it is clear that the clean air and water of this longstanding agricultural zone will certainly, without any doubt, regardless of whatever chicanery has been, or may be, employed to manipulate the truth, be jeopardized by a fracked gas compression and pipeline operation in the midst of its farmlands. You know there is truth is that statement, John. A five-year old would immediately reason that the picture of an industrial operation like the TGP is not compatible with the picture of rolling acres of crop rows. WHY DO PEOPLE HAVE TO GET SICK FIRST? This story is not new. It goes back to the beginnings of the coal industry, of which the TGP and its kind are latter-day extensions, and has been continuously running in the theaters of the American judicial system for over a century. Miners dying of black lung have met with the same type of company rhetoric that we hear from the TGP: it cannot be proven that the damages to your health are connected to the mining industry. This moment in time will not come again. If the Health Department grants this construction permit, it will have issued a death certificate for northwest Davidson County, i.e. tacit approval for a big energy bully to ravage the eco-system of one of the State of Tennessee's most pristine and agriculturally valuable landscapes strictly for its own profit. Moreover, the issuance of this construction permit will set a dangerous precedent for such permits to be issued elsewhere. For a Health Department of a major metropolitan area to take such self-destructive action makes no sense. Rural areas MATTER and for Nashville to sacrifice the health of its

	outlying rural communities to corporate greed would be tantamount to dismemberment of its whole self. PLEASE, PLEASE do the right thing. The future health of tens of thousands of Davidson County residents is on you. Lainie Marsh 3891 Knight Drive Whites Creek, TN 37189
Response:	Please see **General Topics: Health Protection, Permitting Process and Hazardous Air Pollutants.**
Commenter:	Mr. William Smith
Comment:	I wish to submit the following comment on the draft air permit for Tennessee Pipeline Company. My wife and I have lived for 17 years adjacent to the property now proposed for construction of a pipeline compressor station. Our property is on Greenbrier Road in Joelton. My wife has asthma. We moved out of the city to rural Joelton not simply for peace and quiet, but also to find clean, healthy air to breathe. We have heard that the compressor station, as proposed, will put significant toxins into the air, affecting a radius of many miles. So we have tremendous concern for how this polluting facility right next to our house will impact our health. We do not have resources that allow us to simply sell and move. Besides, just the threat of a compressor station has created a real estate bust in the area. We are trapped in a potential future environment that will likely shorten our lives. And, so, for the sake of our very survival, we oppose this permit. William Smith Resident and property owner 7736 Greenbrier Road Joelton 37080
Response:	Please see **General Topics: Health Protection and Hazardous Air Pollutants.**
Commenter:	Mr. Martin Holsinger
Comment:	Dear Mr. Finke, I am extremely concerned about the possibility of not one but two gas compressor stations bracketing Davidson County. I live somewhat close to the proposed Joelton plant and have cardiopulmonary issues that are exacerbated by poor air quality. Living in the NW quarter of Davidson County has helped me deal with these issues, but approval of this proposal will bring the pollution to me. Why should Tennessee Gas Pipeline Company's desire for profit trump my need for clean air? At a broader level, Nashville is, geologically speaking, a basin, and pollution tends to "pool" in that basin. The overlap zone of these two plants' pollution footprint will lie directly over downtown Nashville, and detract seriously from everybody's quality of life, increasing medical

	expenses that the gas companies will not be liable for. Why should the citizens, and the city, of Nashville have to pay for this "externality" so the pipeline companies can profit? I am not just concerned with the aromatic hydrocarbons that these plants will emit. Natural gas is a fossil fuel, and its production and use releases carbon dioxide into the atmosphere, raising the planet's temperature and creating a whole host of other, mostly negative, effects. The best scientific minds of our time are telling us that we need to leave most, if not all, of our planet's "fossil fuel reserves" in the ground, or we are at serious risk of making the planet very inhospitable to the likes of us. Creating infrastructure that will facilitate the extraction and use of more fossil fuels seems, in that light, like a very ill-advised move. Thank you for taking the time to consider my comments. Martin Holsinger 5155 Drake's Branch Rd. Nashville TN 37218
Response:	Please see **General Topics: Health Protection and Area of Impact.**
Commenter:	Mr. & Mrs. David and Angie Robertson
Comment:	We strongly oppose the construction of the proposed Kinder Morgan/Tennessee Gas Pipeline LLC Gas Compressor Station at 7650 Whites Creek Pike, Joelton Tennessee. This is a commercial facility proposed at a location zoned as rural/residential within 1000ft of an organic farm, less than a mile from a park/community center, and close to a Wildlife Rehabilitation Center. The construction of this facility will destroy 86 acres of pristine woodlands, potentially pollute air and water in the area, and, produce noise pollution. This facility will serve no purpose for residents of Joelton, or of Tennessee. It is our understanding that the increased capacity is contracted to another company and will be exported overseas. The pipeline infrastructure is poorly maintained and Kinder Morgan/Tennessee Gas Pipeline LLC has a poor record of maintenance and safety. There is no reason to build this facility at this location other than it is most likely the lowest cost and most profitable location for Tennessee Gas Company LLC. Please do not let the greed of a corporation ruin the idyllic setting and peaceful lifestyle of the Joelton area. Thank You, David Robertson Angie Robertson 1342 Roberts Road Goodlettsville TN 37072
Response:	Please see **General Topics: Health Protection, Zoning, Pipeline Safety, and Noise**. In the Environmental Assessment published by the Federal Energy Regulatory Commission (FERC), FERC concluded that, “the Project would not result in any significant longterm or permanent impacts on groundwater resources based on Tennessee’s implementation of appropriate minimization and mitigation measures.”

Commenter:	Mr. Dan Lain
Comment:	The compressor station is bad for Joelton and all of Davidson County. Please do what you can to protect our community and the air we breathe. Letters
Response:	Please see **General Topics: Permitting Process.**

Mailed Written Comments

Commenter:	Lorraine Guth Parker
Comment:	Please be advised that I now have uncovered the fact that I am not the only resident of Davidson County subdivisions who could be affected by your two proposed pipelines, if they are approved by the authorities. It has come to my attention that in one subdivision alone, most of the residents still have not been notified of any of your impending meetings. It is my understanding that these procedures and meetings have been on-going for months without all of the residents in these subdivisions even being told about it. This is "Dirty Tricks"! Tennessean and websites are not sufficient. We did not receive letters or notifications of these meetings or proceedings. As far as the Joelton Project, it is also my understanding that pipes owned by them that were damaged in the 2010 flood, still have not been taken care of. Further, in the recent 15 year study of gas pipeline explosions, it appears there were 408 accidents in 15 years (45 were from natural gas pipelines) and many, many times Kinder Morgan was named as the owner. So far I have uncovered 3 due to Columbia; however, I am still researching. It should be known here that 45 natural gas pipeline accidents over a 15 year period of time amounts to 3 accidents per year. Many were with injuries. Even one is too much! As far as the Columbia Pipeline Project, I have received a 2 page letter from Columbia officials recently telling me they would be back in touch with me and of course they have not. They tell me how they try to keep a good safety record and own a 90 acres buffer to protect the public; however, on July 19, 2016 I had to contact the Davidson County Public Works Department due to the fact that the property owned by Columbia Pipeline (or have they already sold it to a Canadian company?) at the intersection of Barnes Road and Old Hickory Boulevard, in Cane Ridge, Tennessee appeared to be a danger to drivers and passengers alike due to the overgrown and apparently unattended condition the grass, weeds, etc. were in. This prevented a good view of oncoming traffic on Old Hickory Boulevard. I thought these 2 pipeline companies stated they were going to keep the public safe. How many accidents have

	already occurred at the Barnes Road/Old Hickory Blvd. Already? We need to check the public records! These companies appear to not care about public safety at all and should be kept from our very large population community of Cane Ridge and Joelton, Tenn. I gave the County the name, address and phone number of Columbia so they could get their money back. This should not be the taxpayers expense. Apparently the Green- way also was a waste of the taxpayers funds, as it cannot be enjoyed with the noise from trucks coming in and out, trees being torn down, as well as even a non-stop threat to the neighborhood of an explosion at any time. Again, both of these pipeline projects within the Davidson County area need to be rejected and no more time wasted. No permission needs to be granted here to them! The following is part of a recent letter to Robert Skagg, CEO of the Columbia Pipeline Group. This letter shows part of the results of my recent study: "As a follow-up to my letter to you under date of June 21, 2016, I have done some research concerning the accident rates of gas pipeline problems over the last 15 years and 4 months in the United States. It appears that there were approximately 408 accidents, which includes all types of gasoline accidents such as pipeline worker related accidents, tornadoes, lightning strikes, negligence, old pipelines, as well as other type of pipeline accidents. It also appears that approximately 45 of these pipeline accidents were related to natural gas pipelines. There appeared to be 89 fatalities; 223 + injuries. It would appear that Columbia was responsible for some of these problems. That is if Columbia Transmissions is one and the same as Columbia Pipeline Group. Perhaps I need to do a further study to unravel any information that I have missed during my first research of the problem. What is also shocking is the fact that there appears to be only 14 fines, 3 citations, 2 consent orders, and 1 criminal complaint against any of those responsible for the deaths, human injuries, as well as damage to properties. Most of the study that I did does not give names of the pipeline owners who caused the problem; however, I have to-date located at least 3 apparently attributed to Columbia. One 2009, 2011, and February 13, 2014. Even one accident would be too much for my backyard! The following is also another copy of my letter to you dated June 21, 2016, with no response to date:

	"On Tuesday, June 21, 2016 I received a call from a neighbor asking if I would like to attend a FERC scoping meeting concerning the Columbia Pipeline (Gulf Express) project @ 6:00 P.M. At the Cane Ridge High School in Cane Ridge, Tenn. Needless-to say I was shocked at this message as I, as an 87-year old recent TSU Master's Degree recipient, had never received any type of information or literature concerning this imminent danger to health, property value, Green-way tranquility, or quiet enjoyment of property in my neighborhood. As a retired real estate agent in another state, I am floored at this news as well as the fact that I obviously was deliberately singled out (due to my age) from being notified. This is a serious breach of my rights as a taxpayer in Davidson County and as a United States citizen. The meeting appeared to be nothing more then a "done deal" being pushed before poor unsuspecting public, and with the guise of attempting to allay fears of the community and as a good future partner. It all appeared to be nothing more then "contrived" and I did not believe a word of it either from the staff of the FERC or the representatives of the Columbia Pipeline, who I talked to after the meeting. The Columbia Pipeline representatives were not apparently available during the meeting but only in the foyer afterwards. The only conclusion that could be reached is that the Green-way project built around Davidson County appears to be nothing but a waste of taxpayers monies as it will be worthless to the residents after your project enters our area. Noise pollution alone would ruin tranquility not to mention environmental harm. The homeowners attending the meeting the other night, were painted a "pretty picture" of no harm; however, the information given was from areas not affected by your pipeline project due to the fact that they were in very low population areas, and not like Davidson County that has a very large population. The Cane Ridge area alone probably represents at least 200,000. This whole meeting appeared to be a deliberate cover-up of a deal already "done". The only comment I will have about my suspicions being true, would be that if I were the CEO of a large pipeline company, I would not want to subject myself, my personnel, representatives, employees, or any or all entities that would help or provide help to start or run my project to the possible future hostility, or even perhaps legal actions against them. Am I right? As the owner and officer of a former chemical corporation for years, I am aware of these pitfalls.

	Further, the literature indicates that the pipeline project can even bring about condemnation with eminent domain against our properties. This means that wecould end up receiving only a small portion of what our properties are worth. At almost 88 years of age, this would be devastating, as well as having to pack up and make a move. Please be advised that I have already been faced with a move to work on my doctorate; however, will not do so due to the moving. As you are probably aware if you follow the news around the world, my graduation from TSU on May 6, 2016 with my Master's went around the world and it was viral on almost every station inclnding the BBC. I am also already well known for being the lead singer, (opening all the shows for the Atlanta County Music Hall of Fame) in Atlanta, Georgia for the past 24 years. I was voted "Entertainer of The Year 2006" for Georgia. I was inducted into Phi Kappa Phi National Honor Society on April 17, 2015; was inducted into Alpha Lamba Delta at Georgia State University; National Honor Society at Greenwich High School in Greenwich, Conn.; attended law school 2 years maintaining a 104 grade on a cite test@ age77; received an 80-hour Private Investigator Certificate from college; and a real estate license in Georgia. I am told by the media that I had one of the highest scores in the Master's program. I still maintain a 4bedroom home by myself; detail my Lexus myself; and 2 weeks ago traveled to Georgia by myself to open a show in Macon, Georgia for the Atlanta Country Music Hall of Fame, and will open the "Entertainer of the Year Show" in Atlanta, Ga. on August 21, 2016 at age 88. I also formerly owned 2 aircraft. I have filed actions against doctors (settled one of the first malpractice suits in the U.S. in 1958) collecting from Lloyds of London; filed against insurance companies; utility companies; lawyers; credit reporting companies; dishonest auto mechanics; dishonest contractors; and even dishonest new car dealers, so now you know part of my background. I was a paralegal for 15 years also. I am shocked and appalled that the Mill Rnn Homeowners as well as other homeowner associations have not notified the homeowners of the problems that I have related above, as well as having not attempted to put a STOP to the project before it ever escalated to the level it now has. Now it is like "locking the barn door after the horse has escaped". It apparently already is too late to stop it. The pictures in the literature that I have been given at the June 21'' meeting, shows a very ugly landscape with your pipes and buildings on the property. It is a disaster ready to happen apparently!

	I have no choice but to copy the FERC, Governor Haslam, Nashville, Tennessee Mayor, the President of the Tennessee Board of Realtors, the Chamber of Commerce, the CEO of the Management company for the Mill Run Homeowners Association and will request to know the exact time they were informed of this apparent disaster to our area. If they knew prior to my being notified, then there obviously should be consequences as a result of any possible harm to me or my finances. Correct?" It has come to my attention that Columbia is sold or being sold to a Canadian company. Is that apparently in order to avoid any or all types of legal action?
Response:	Please see **General Topics: Health Protection, Permitting Process, and Pipeline Safety.** With respect to property values, under the Natural Gas Act, only the Federal Energy Regulatory Commission ("FERC") considers the proposed natural gas compressor station's potential impact on adjacent property values when siting a compressor station. The issue raised by this comment is outside the scope of MPHD's authority.
Commenter:	Roger Senechal
Comment:	To Whom it May Concern: I wish to make three points, plain and simple: 1) It should go without saying that you exist to serve and protect the people who pay your salaries. According to your letterhead you are all about "Protecting, Improving, and Sustaining Health." This proposed Gas Compressor Station is a serious, hazardous, and life- threatening matter. We need you to advocate for us; therefore, your loyalty should be to protecting the citizens of Metro Nashville, and not succumbing to Kinder Morgan's willful deception, bullying, and pressure tactics. 2) Research has shown that the level of toxic emissions from C02E alone is more than double the Title V Air Permit Maximum Threshold!! Would you want your family breathing this stuff? And dying from it?! And that's just for starters! So why is Kinder Morgan's proposal even being seriously considered? What right do they have to put our safety at risk, for no good reason other than their own profits? Please do not allow yourself be an accomplice to their unscrupulous schemes! 3) Kinder Morgan's lamentable safety record should also certainly be a huge red flag. Just on this basis alone, how

	could any responsible Metro government agency allow them free rein to put the people of Metro Nashville at further health risk? Please do the right thing and say "NO!" to Kinder Morgan!! If after all you have heard and read, this serious situation is still no big deal to you, I have a house here in Joelton to sell you for real cheap [No one else will buy it!] Come live with us and - take a DEEP breath!!
Response:	Please see **General Topics: Health Protection and Permitting Process.**
Commenter:	Lynn Dwyer
Comment:	I write you to oppose the pipeline compressor station proposed for 7650 Whites Creek Pike by the Tennessee Gas Pipeline Company. That project would be within 1.5 miles of my home and would definitely affect me adversely. Thirty years ago, I bought 2.5 acres of land on Ridgewood Rd. and built a house there. I chose that plot because of its clear, quiet rural character and its abundant wildlife (goldfinches, bluebirds, turkeys, deer, coyotes, etc.). Now, the compressor station proposes to ruin all of that. It would pollute the air with unacceptable levels of NOx, CO and CO2e, all higher than the Clean Air Act allows. Not only does this destroy clean air I presently enjoy, but it adds tto the greenhouse gases which threaten our environment generally (global warming). They may have adverse effects on local farmers. Wildlife and human life too would be affected by the noise generated by such a compressor station. It is estimated that normal operation causes the noise of 4 railroad locomotives 24/7. That would certainly reach my property and would make it difficult for birds and other wildlife to find one another for mating purposes. Besides these problems gas compressor stations and pipelines are explosive. Recently, Pacific Gas & Electric was fined $1.6 billion for blowing up 38 homes in San Bruno, CA, killing 8 people. Fairly recently, a compressor station near Castillian Springs, TN, blew up when a tornado hit it. Besides being explosive, natural gas installations are dangerous due to massive leaks – witness Porter Ranch, CA's experiences! What can Metropolitan Government do to prevent Tennessee Gas Pipeline Company from polluting the air and water with noxious gases and noises? For example, can Metro force Tennessee Gas Pipeline Company to soundproof nearby homes to protect people from the 24/7 noise as has been done near the Nashville airport? Will Metro constantly monitor water and air quality in the local neighborhoods and at Joelton Middle School? I do not trust Tennessee Gas Pipeline Company to do the monitoring since they do not maintain their pipelines now.
Response:	Please see **General Topics: Health Protection, Permitting Process, Noise, and Pipeline Safety.**

Commenter:	Paulette Miller
Comment:	I am Paulette Miller and I live at 3572 Baxter Road, Joelton, Tennessee. I live less than a mile from the proposed compressor station. I have Lupus, which could be greatly affected by all these bad chemicals. Our six-year-old grandson loves playing at the Paradise Ridge Park next door but he has asthma. My husband also has asthma and will be adversely affected. We moved to Joelton from near downtown Nashville 40 years ago for our air here is purer than it was there, partly due to higher elevation. I'm proud to be a Nashvillian and being referred to as the IT city. I hope you saw the TV coverage showing our pollution from Joelton will overlap downtown Nashville if the plant is allowed to proceed. "The biggest one in the USA" The IT city is going to add this to our accolades. Do you think this will improve tourism? This same gas company has several pipelines exposed since the 2010 flood and has been cited numerous times. Stand up for Joelton! Stand up for Nashville! Stand up for our grand state of Tennessee!
Response:	**General Topics: Health Protection, Permitting Process, Pipeline Safety and Area of Impact.**
Commenter:	Diana Senechal
Comment:	I am impressed with your beautiful building. Congratulations on your LEED Silver Award and your decision to have a healthy smoke-free campus! After Wednesday night's gas compressor station permit hearing, I assume you will continue your efforts to keep our city healthy by deciding to revoke your draft air and construction permit. Either this was the first time you heard of the dangers of toxic particulates settling in Nashville's geological bowl from both the Joelton and Cane Ridge stations (if so, SHAME on you for not doing your homework before issuing the draft permit) or you have known about these dangers to human health, animal health, the two creeks on the property in question which lead to our drinking water (not to mention wells in surrounding residences) and the many nearby farms (farms, not just backyard gardens) where our food is now grown in healthy air. If you already knew about the health hazards caused or exacerbated by routine emissions from gas compressor stations·, then DOUBLE SHAME on you for issuing a draft air and construction permit.

	You are faced with a difficult decision and I understand that it would be embarrassing to revoke a permit whose draft edition has already been issued. However if you weigh the health of the community you are being paid to protect against the pressure of a greedy corporate giant, I don't see how you can justify this permit. Kinder Morgan is WRONG to irresponsibly endanger the millions of Americans living above their old and poorly maintained pipe infrastructure just to get richer by selling their gas to foreign markets. And I have to say Metro Health would be WRONG to partner with them by granting this permit. If you are honest, courageous and devoted to your responsibilities, YOU CAN STOP THIS at least in Metro Nashville and thereby set an example to encourage other cities to do the right and healthy thing. Did you know the mayor of Weymouth, Massachusetts refused $45 million to keep away an unhealthy 7,700 hp compressor station that was to be linked a year later with a 10, 320 hp compressor yielding only a total of 18,020 hp? By the way, Kinder Morgan's proposed Joelton compressor station will be 60,000 hp!!! I chose not to question your due diligence publicly on Wednesday because I am trusting you when you say that you will read all submitted comments. I am challenging you to do your job conscientiously and protect the air we must all breathe from any unnecessary pollutants. Very likely all of you live within these blue circles on the enclosed map below taken from p. 118 of the Environmental Assessment for Kinder Morgan's proposed gas compressor station in Joelton. Thank you for listening to us. Thank you for being interested in healthy air for all of Metro to breathe. Rejecting this permit would be much more difficult if the gas in question were needed to heat our homes or to generate additional electricity for our new buildings. Still not an easy choice for you, I pray you will have the integrity to stand up for our good health. I can promise you that you Will sleep better at night and breathe better by day,
Response:	Please see **General Topics: Health Protection, Permitting Process, and Area of Impact.**

Appendix I

Public Hearing

Tennessee Gas Pipeline Company, LLC

Public Hearing on Air Permit Application

July 27, 2016 at 4:30

Lentz Health Center, 2500 Charlotte Avenue

Nashville, Tennessee

CLMS: R14-174170

DR. PAUL: Good afternoon. Thank you for coming today. My name is Dr. Bill Paul. I'm director of the Metro Public Health Department, and I am acting as the hearing officer appointed by the Metropolitan Board of Health for this public hearing.

I would like to welcome Board of Health member Carol Etherington who's seated on my -- on my right. Also welcome elected officials, Representative Bo Mitchell and Senator Steve Dickerson.

For the audio recording, today's date is July 27, 2016. The time is approximately 4:30 p.m. We are here today to receive your comments regarding an application to build a natural gas compressor station at 7650 Whites Creek Pike, Joelton, Tennessee, by Tennessee Gas Pipeline, LLC.

The sole purpose of this meeting is to receive comments. No decisions will be made this evening, and no responses will be provided to any specific comments this evening. The Metro Public Health Department will be providing written responses to all comments received during the comment period.

There are handouts available explaining the purpose of the hearing, how you can submit written comments and how the responses will be made available. I will start actually by taking comments from -- from

our two elected officials who are present. Then we'll take comments from the applicant or the representative of the applicant for the permit. Then if there are any in the audience that wish to speak, I will call -- I will open up the floor.

Anyone who wishes to speak today -- you were hopefully given a card that were made available as you came in. Please print your name on the card along with the name of your organization if you represent one. Hand the card to us once you conclude your remarks.

I'm giving the applicant five minutes to speak. All other speakers will have two minutes to present their comments. Please remember, if you run out of time, you can submit your comments in writing as well.

I will also ask that if someone has made the same comment that you are going to make, that you please consider yielding your time to someone else. When we get to the public portion of the comments, I'm going to ask you to form a short line behind the podium so that we can hear from as many people as possible and spend as little time waiting for people to come and go from the podium.

We don't need everybody to get in line right away, but let's keep the line at about four or five

people so that it can keep moving. At the beginning of your comments please state -- clearly state your name and address for the record.

All right. So with no further ado, I guess we'll start by opening up for comments from Representative Bo Mitchell.

MR. MITCHELL: Thank you -- thank you, Dr. Paul. I'm just standing here before you as the representative of this community, and in a representative democracy I am proud of all these citizens who have taken time -- many have taken their -- time off of work to be here today to show that they care about their community.

It's their public health that we're here talking about today, and they're making it very clear that they're concerned about their health and their air quality in the future if this is allowed to go forward.

From my understanding, in other parts of the country precedent has been set by the health department in other cities and city governments in other parts of the country by not allowing this permit to go forward. It would circumvent any federal intervention on local ordinances if this department in the City protects these people from the potential risk of the air quality as well as the increased pressure that's being put upon

this pipeline that's going to maybe create explosive activity along the pipeline.

But my question to the committee today is ambient air monitors -- I think the nearest one to where this facility is going to be placed -- the nearest ambient air monitor would be in the Trinity Lane area. And I'm just putting forth to the public health department: Will you commit to these citizens that you will put another monitor maybe at the Paradise Ridge Park, where this is being built near, where our children are going to be playing that we can monitor the air quality in the future if this is allowed to go forward? So I -- I request that from the public health department, that you address that issue in the future. Thank you.

MR. DICKERSON: Good evening. And, Dr. Paul, thank you for letting us speak today. And I would just sort of amplify and build on what Representative Mitchell said. The people here are concerned about air quality, quality of life, water quality. It goes -- the -- the list goes on and on.

I come to this not only as a senator, but with my professional perspective as a doctor. And there are two things -- I want to sandwich this. First of all, one of the adages in medicine is first do no harm. And

I'm concerned that if we move forward with this, we cannot guarantee the citizens of Joelton that this will do no harm to their quality of life and environment.

Specifically, as I understand the federal demands or regulations, we have to monitor the release of things like volatile -- or volatile gases every three months or so, and I'm concerned that in the intervening time there can be significant releases at various points along the pipeline that actually will be releasing significant amount of toxic volatile organic gases into the environment.

And so my second point about being a physician, to me, that would be like having a diabetic patient only monitoring their blood sugar every year or two. I think we need to have much more realtime capability so we can keep track of this and make sure that we are not missing a significant hazard to the air quality. So thank you for your time.

DR. PAUL: Thank you, Senator Dickerson. Do we have a representative from the applicant who's prepared to speak?

MS. KINDREGAN: Good afternoon. My name is Stephanie Kindregan. I am the director of public affairs for Kinder Morgan. Thank you so much for your time this afternoon and for allowing me to speak about

our broad road expansion project as well as the air permit under your consideration.

First I'd like to share some brief information about Kinder Morgan. We're the largest energy infrastructure company in North America and own and operate approximately 84,000 miles of pipeline and approximately 180 terminals. Think of us as the FedEx of the energy world. We transport, store and handle energy products, but we do not typically own the commodities that we ship.

Tennessee Gas Pipeline or TGP is a wholly-owned subsidiary of Kinder Morgan. For the last 70 years TGP has been an active and important part of the state of Tennessee's business community, growing into the system that it is today.

We serve major local distribution companies like Piedmont Natural Gas. TGP also serves two of the TVA's power plants. We are proud to have an active presence in this community, employing over 130 Tennesseeans with 10.6 million in salaries and contributing nearly $4 million to state and local taxing authorities.

Our broad run expansion project will increase the natural gas transportation service on our existing TGP system. As part of this project, we will be

constructing four new compressor stations, including Compressor Station 563, which is located here in Joelton. In January 2015 we filed an application with the Federal Energy Regulatory Commission, also known as FERC. The FERC certificate of public convenience and necessity.

FERC issued our environmental assessment in March 2016, and we are currently awaiting the issuance of our FERC certificate. Pending receipt of all permits, construction would begin this December and the project would be in service by June 2018.

The proposed Joelton compressor station will be located on 80 acres of land. However, the operational area of this facility will only be 26 acres at this site. It will be surrounded by a fence and also surrounded by forest and vegetation on all sides. This will provide a natural buffer for nearby residents from air, noise and visual impacts.

We evaluated a total of 13 sites for this station, and an analysis of these sites was submitted as part of the environmental assessment to FERC. The parcel in Joelton was selected for a variety of reasons, including the parcel's proximity to our existing system, pipeline hydraulics, the willingness of a landowner to sell, proximity to existing roads and

environmental and constructability factors.

FERC also examined the proposed site and the alternative locations and concluded in its EA that the proposed location for this station did not present any significant environmental health or safety issues and that none of the alternative sites offered significant environmental advantages over the proposed site.

In addition, FERC requires that the noise level can be no greater than 55 decibels at the closest residence. That is the equivalent of two people having a typical friendly consideration. Our compressor station will be designed and operated in accordance with best industry practices and federal safety, environmental and operational regulations for interstate natural gas pipelines.

EPA has promulgated rules -- promulgated air standards to protect human health and the environment. These standards apply to this station. Our station is also subject to the New Source Review permitting process administered by the Board of Health with oversight from EPA. This NSR permitting process ensures that current air standards are not exceeded for certain criteria pollutants.

Finally and most importantly, the natural gas that we transport and that will be transported through

this compressor station is pipeline quality. What that means is that it is ultimately consumed by the public, including homes, businesses and schools. It is no different than the gas that you cook with on your stove and that you heat your home with in the winter. Hazardous air pollutants that may have been present at the wellhead are removed prior to their entry into the system.

In summary, we are committed to being a good corporate citizen and conducting ourselves in an ethical and responsible manner. We spend hundreds of millions of dollars each year on system integrity and maintenance in order to protect the public, our employees, neighbors and the environment.

Operationally we continue to perform better than our industry peers relative to environmental health and safety measures. We look forward to continuing to work with you on this important project and sincerely appreciate your time today at this hearing.

DR. PAUL: Thank you. Now we'll proceed with others who may wish to provide comments. And is this the line at the -- at the podium? The idea is to form a short line.

So comments will be limited to two minutes,

and the timer is obviously here for everyone to see. So one thing to remember is -- with the time limit is if you had planned on more minutes of speaking, the written -- the written record is no different in terms of our response or our receipt of information.

So I'm -- so we'll --

UNIDENTIFIED SPEAKER: May I ask a question? There's a few people that were signed up to speak who are willing to give their time to Bill Powers or Ann Davis and Gary Davis. Is that permissible, they give up their time?

DR. PAUL: We've decided that each person would get two minutes.

MR. POWERS: I'm watching the clock.

DR. PAUL: Oh. After you introduce yourself and give your address, then we'll start.

MR. POWERS: Very good. My name is Bill Powers, Powers Engineering, San Diego, California. I'm a consultant to Southern Environmental Law Center, commenting on the air permit emission --

And I will proceed. The -- quick context. There are many compressor stations going into this region. The Joelton station is the biggest. All of the other stations have lower emission limits on a unit basis than Joelton.

Kinder Morgan in Pennsylvania -- almost the same day this permit application was filed, filed an application for a similar turbine, 70 percent less NOx emissions. Part of this permit is a recently available control technology analysis to put on the best controls for a reasonable amount of cost on these units.

Kinder Morgan in this analysis ignored the same technology that was used in that Pennsylvania application that would reduce those emissions by 70 percent. They're just not in this application. They don't show up in that RAC analysis.

Two of the four were eliminated by omission. Another catalytic control, which is the best, was included, but then it wasn't analyzed. What you end up with is the lowest common denominator, which is the emission limit that is proposed.

This standard is based on cost. Yet no cost standard was put into the analysis by Tennessee Gas Pipeline Company nor was the -- did Metro insist on it. As a result, there's no point of reference to know what technology is cost feasible.

The analysis that I put together which will be submitted as a written comment, any of these technologies would pass the reasonable -- reasonableness test on cost that other states that have

set a number for it, $5,000 a ton, $3,000 a ton, have established.

You can insist on the best technology for this station. It would reduce your emissions 90 percent, and it would still meet that cost test. And I would be happy to work with Metro Nashville to share the information that I've got to move this forward so that the best technology is put on these units. Thank you.

DR. PAUL: Thank you.

MR. ROBERTSON: All right. My name is William Robertson. Oh, you want your card? My name is William Robertson. 1310 Roberts Road, Goodlettsville, Tennessee. My question -- my question is really not just a question. It's a comment, and it's something -- I'll be putting a written record in.

The proposed site for the Joelton compressor station is invalid for engineering reasons. Okay. The Kinder Morgan representative said that they had evaluated 13 sites. If you look at that evaluation of the 13 sites on the metrics they gave, there are at least five sites that are better suited -- alternate sites that are better suited.

But more importantly, there are sites -- the site chosen does not split the distance between the two compressor stations on either side. There's a station

in Portland and a station in Centerville. The -- it splits about one-third, two-thirds.

From an engineering point of view, the most efficient way to put a compressor station is to put it in the middle. Okay. And so they have not chosen -- they have chosen something -- the Joelton site is not in the middle. It's about one-third of the way along.

If you did change -- look at alternate sites that are -- that divide that line more evenly, you can reduce from the 60,000 horsepower Twin Titan 250 compressors that they are -- they're proposing to use, you could go down to Titan 130s. Those have 40 percent less emissions. Just -- and, you know, would have a 40 percent savings immediately just by moving to an alternate site.

And so, as I said -- there are other issues. I also believe that -- and, again, I'll submit -- well, one of the other issues about the alternate sites is that Kinder Morgan's analysis was place property ownership and put that as a huge part of the cost of the analysis.

If you look at it purely from engineering and environmental concerns, the proposed site is not -- not the best. Okay. And I also think there's something to do with -- there's some EPA -- issues on EPA --

Executive Order 13045, protection of children, that I hope that you'll look at. I'll submit written comments on that.

DR. PAUL: Thank you.

MS. DAVIS: Hi. My name is Delta Ann Davis. I'm a lawyer with the Southern Environmental Law Center. Address is 2 Victory Avenue, Nashville, 37213. I'm here representing the Concerned Citizens for a Safe Environment.

As Mr. Powers just said, Kinder Morgan has failed totally to comply with metropolitan laws and provide an adequate and complete analysis of the reasonably available ways it can control its harmful emissions.

The control technologies that it has proposed which allow 25 parts per million of NOx to be emitted is the absolutely lowest and cheapest that you'll see anywhere these days. If this permit is issued as it is proposed with the 25 parts per million emission limit, Metropolitan Nashville will virtually stand alone in the country in allowing that level of emissions.

And it is very distressing that Kinder Morgan did this at the same time it submitted a permit in another state where it committed to reducing those emissions by 70 percent.

If this compressor station is to be built, Kinder Morgan must comply with industry standards and metropolitan laws and control its emissions in a way that will be protective of our citizens. It's the largest pipeline in the country, and it can -- it can afford to do so.

And if it wants to be a good corporate citizen, which it says it does, it should come forward and commit to do so. Thank you.

MR. DAVIS: Good afternoon. Thank you, Dr. Paul. Thank you members of the Metropolitan Board of Health. My name is Gary Davis. I'm an attorney from Asheville, North Carolina, and I'm here representing CCSE tonight.

And I'm going to take a slightly different approach by first saying that this pipeline or this compressor station for this pipeline should not be built in Davidson County. It's not a question of whether it has adequate controls.

On July 6 the Metropolitan Council spoke on behalf of the people of Davidson County that -- by amending the Code Section 10.56.020(h) and saying that no source -- new source of air pollution should be built in this county unless it complies with the metropolitan zoning ordinance. That -- that ordinance

should be enforced. There's no reason not to enforce it. There's no legal reason not to enforce it. And there's certainly no political reason not to enforce it because the council has spoken.

The EPA and the state do not have to approve this ordinance before it's enforced. It does not have to be part of your state implementation plan before it's enforced. And we have looked at the case law on preemption and we've presented this to your attorneys as well, that there's no federal preemption that is going to essentially knock out this ordinance that the will of the people -- Metro Nashville Davidson County has now enacted.

I'm going to turn my attention to a couple of other minor points which we will provide in writing. First of all, there are other aspects of the pollutants from a compressor station such as this that have not been addressed in the draft permit.

One of those is formaldehyde emissions. Formaldehyde is a carcinogen. Other states have included formaldehyde emissions in their permits for compressor stations. And secondly, leak detection. There are a lot of leaks that come from these types of facilities, and those provisions have been included in other permits as well in other states. Thank you, and

we will submit written comments.

DR. PAUL: Thank you. We've got a comment that it's very difficult to hear in the back of the room. So if those people who are making comments could please speak -- speak directly into the microphone and speak up a little bit. Then maybe the whole room can hear.

MR. BRASSEL: All right. My name is Alandis Brassel. I'm counsel for Congressman Jim Cooper. Office is located at 605 Church Street, Nashville, Tennessee 37219.

So Congressman Cooper is unable to join tonight. So he asked me to read a statement on his behalf. He'll submit written questions before the August 3rd deadline. He's very concerned about how the proposed compressor station's emissions can affect our community.

This is not a typical industrial zone. Homes and farms are at risk, and the proposed compressor station could impact the livelihoods of hundreds of community members. This division is responsible for protecting our community's air quality from contaminants and pollutants.

It is in a unique position to undergo a thorough impact assessment on how emissions will affect

the surrounding area. Simple numbers processed by computer models will not suffice. Beyond models, how has the division accounted for emissions' potential impact on the surrounding community's health and well-being? How have you accounted for the effect emissions will have on vegetation?

Our community is growing rapidly. It's up to regulators like you to make sure we do it responsibly. This proposed compressor station, which threatens the surrounding area has very little, if any, positive economic impact on our city, is not an example of responsible growth.

I respectfully ask you to consider the whole picture and protect Nashville. Thank you.

MR. BANBURY: My name is Scott Banbury. I'm the conservation program coordinator for the Tennessee Chapter of the Sierra Club.

We aren't just facing this issue here in Nashville. Sierra Clubs across the country are dealing with this issue, particularly in the eastern United States. We will be submitting written comments supporting many of the great opinions that came to floor with Ann Davis and Gary Davis and Bill Powers on the legal matters dealing with this permit, but I'd like to take this opportunity to dispel one of the

myths that's been constantly put forth by the applicant, and that's that somehow this pipeline compressor station has anything to do with supplying gas to the people of Tennessee.

Tennessee Gas Pipeline long before Kinder Morgan acquired it was already contracted to deliver gas to us here in Tennessee for power and home heating. This compressor station is solely about increasing the capacity of this pipeline so that it can deliver gas to the Gulf Coast for export markets.

We've now sent three ships out of the Gulf of Mexico to other countries carrying natural gas that's fracked from the Marcellus and Utica shales and Pennsylvania and West Virginia and Ohio to other countries for their consumption. And I really just want to make that clear.

Sierra Club also has some serious issues with this permit in terms of how it treats fugitive emissions. We were party to commenting on the rules that came out this last year. May 12, 2016, I believe it was they came out.

And we believe that quarterly monitoring is insufficient for these type of facilities. We believe that the Metro Health Department has it within their authority to require 24/7 realtime monitoring both by

optical gas image technology or for looking -- infrared radar, infrared imaging, and to have sampling occurring on a regular basis immediately around the plant and in the community surrounding the plant. And we would ask that the permit incorporate that.

Also, you guys have exempted the liquid tanks. They -- they condensate. We were just told that there's no impurities in this gas, that it's ready for consumption. Why would they need to have liquid condensate tanks on-site if there was not impurities in it? Thank you.

MR. LEONARDO: Good afternoon, Dr. Paul. Thank you for conducting this hearing. I'd also like to thank both of our elected officials here, Representative Mitchell, as well as Senator Dickerson for being here. I don't believe we have our council persons here today.

But my name is Dave Leonardo. And one of the concerns that I wanted to address -- I'd like to, you know, just affirm what Attorney Davis says. I agree with him wholeheartedly. I'm also a lawyer.

But according to the draft permit, Section 1.2, it says that any permit noncompliance, excluding locally enforceable only requirements, constitutes a violation of the act. So my comment is

that I don't think that these locally enforceable only requirements -- that provision necessarily has to be in the draft permit, and I think it's just another attempt to undermine the two zoning ordinances that we have, BL2015-2010 that was passed by Councilman Matthews.

And it was -- there was only three people that voted against that. And also the recent one that was passed by Councilman Bedne, which is 10956-170. The people have spoken and overwhelmingly have worked very hard to come up with this legislation, and that's been the pink elephant in the room all -- all the while.

I know it's an air permit, but it's also one of the -- only time that there's a building permit that's issued that doesn't come from the codes administration. And so I have a feeling that this is the way that maybe this language is going to try to, you know, relieve Metro of any duty of having to amend the community plans, having to have a change in zoning and -- and the like.

And so I would just say that I would like to have that removed. I don't think that that legally has to be in the draft permit. And, you know, the people have been talking that this is preemptive because it's federal. Well, tonight -- this afternoon it's local, and this is definitely a local issue. And either way,

you know, Metro is going to be the defendant. The question is who's going to be the plaintiff and is the plaintiff going to be -- and the citizens in this room have already dug into their pockets to hire lawyers -- or is it going to be Kinder Morgan?

And if it's Kinder Morgan, then the citizens in this room are going to get free lawyers, and that's what they deserve. And I think that we need to let this legislation that has moved to the council -- I think that it needs to stand, and I think that they need to comply with Metro's own laws.

Because, again, we're talking about Metro interpreting Metro's laws, and everyone else has to -- amend the community plan and NashvilleNext and apply for a change in zoning. And I think it's only fair that a bad corporate actor has to do the same. Thank you.

MR. PRITCHARD: I'm Matt Pritchard, Tennessee State Naturalist and State Archeologist Emeritus. Civilizations have risen and fallen without realizing their impact on the land until it was too late.

Congressman Cooper at our first meeting said there are more pipeline mileage in Tennessee than any other state due to our location. Therefore, the

probability of such failures and such environmental disasters is just a matter of when.

In my community, in Bordeaux, just up the road on Highway 41, a gas line blew up luckily under car lot a few years ago. So it didn't blow anybody with it.

We have an -- and we have a pipeline now through Radnor Lake state natural area in violation of the intention of the legislation to keep that place pristine. Pipelines are everywhere. And unfortunately, in the little town of Mayflower, Arkansas, the Pegasus pipeline blew up. It was shipping high sulfur oil, and the people were sick for weeks before the community finally rallied and got some support.

The Arkansas Game & Fish Commission was afraid it was going to flow into the Red River and Lake Conway. Now, there are all kind of stuff in these pipelines, and they're aging pipelines. The aging infrastructure in this country is the thing that really worries me the most.

We have the opportunity to put this thing in an industrial place where it belongs. Well, we have the risk that someday it's going to blow up under them. The people were documented in This American Land on June the 4th, if you want to look that up. It's a

documentary of the pipeline spill in Arkansas, and the people had no idea this was under them until it blew.

And I'm afraid this is likely to be the case in -- in one of these instances. Thank you very much, and we appreciate your attention to this matter. The future belongs to those who anticipate all the results, all the environmental impacts and -- as well as the social. Thank you.

MR. YOUNGER: My name is Mike Younger. I'm a local resident here, part of this organization, CCSE.

I'm here today to present some of my concerns about the project. I have with me here the Madison County New York Department of Health report that was submitted to the Federal Energy Regulatory Committee concerning a project infracture expansion compressor station that was happening up there.

They as an institution take very seriously their mission to protect and serve the public interest, and they conducted a very thorough and exhaustive review of emissions and impact, all natures, environmental and human health. And the list of environmental pollutants that are present in emissions of this are very clearly defined in this and led ultimately to the governor of New York banning fracking

and the expansion of infrastructures like we're talking about here anywhere close to human habitation. He deemed it something that was unworthy of being that close to human habitation because of the risks that it posed.

And in addition to that, I would like to draw your attention to the fact that a 2008 publication of the International Association of Oil & Gas Producers acknowledged that the radioactive material during the process -- naturally-occurring radioactive material flows with the oil, gas and water mixture and accumulates it, scale, sludge and scrapings.

And it's a very reasonable conclusion to come to that those scrapings and particles which -- the byproduct of radon are lead and polonium. Polonium, highly cancerous chemical. It's very reasonable to assume that particles of that scale that is forming inside that pipe will be present in the blow-downs which myself and all of the people here will be subject to.

And at the end it says there's no data that we can turn to in order to assess the risk of radioactive exposures in our community. And I'm wondering before this thing is green lighted what assurances are going to be given to this community that polonium won't be in

the emissions that we're breathing in going forward.

MR. SMITH: My name is William Smith. I live at 7736 Greenbrier Road in Joelton, and I come to voice some health concerns for my family.

We -- our property is -- well, actually our -- the side door on our house is about a hundred feet from the property that is the subject of this hearing. My property adjoins that property by a couple hundred feet or more. So we're close by.

We have concerns for our health. My wife has asthma, and she is affected by, you know, environmental things. My father and uncle died with emphysema which they contracted just a few years older than I am right now. So we have concerns about the air quality.

We live there because -- we moved out of Nashville for only one reason. For peace, quiet and fresh air. Well, okay. Those are three reasons. But they're all the same color. And we've had them there for 17 years. We'd like to keep having them there.

Some people say, Well, why don't you just move if that's going to happen? Well, just the threat of this coming into the community has torpedoed our property values. We can't afford to move. And so we're going to live or die there, whatever happens. And I hope you'll take that into consideration. Thank

you.

MR. WILSON: Good afternoon, Dr. Paul, and members of the health board. My name is Mac Wilson. Page 102 of the environmental assessment released March 11th includes this startling statement: Operational emissions would permanently affect the ambient air quality as a result of this project.

And I'd like to bring to -- your attention to the word "permanently." By Kinder Morgan's own -- own admission, the region's air quality will be permanently affected.

Given what I have just quoted, it is hard to believe that the Metro Health Department which exists to protect the health of the citizens -- health and welfare of the citizens of Davidson County would ever consider supporting the building of this compressor station. Thank you very much.

UNIDENTIFIED SPEAKER: (Playing audio.) That is the sound of a compressor station. It was taken from a man's front porch buffered by woods just like this proposed site would be, and I listened to that recording for 15 minutes and developed a migraine.

This man listens to it 24/7. And I'm afraid that's what my friends are going to hear for those people that border their properties. So it's -- it's

much louder than a normal conversation. It is much more significant than Kinder Morgan would like to have us believe.

In addition, as the gentleman mentioned earlier about moving here for his peace and enjoyment, the United States Constitution guarantees each and every property owner and tenant the right to the peaceful enjoyment of their property. Tennessee law also gives each of us the civil right to the peaceful enjoyment of our property.

Tennessee law goes even farther to say that a public official does not have the right to give someone else permission to take away our civil rights to enjoy our property. So I would like to present to you that this would be one heck of a civil rights lawsuit if this company is allowed to come in and take away our air quality.

In addition to the air quality, I come from Louisiana where gas and oil is rich in the economy, and I know first hand what it does to the body. I had seizures. I had chronic fatigue syndrome. I had a multitude of issues that only went away when I moved to rural Middle Tennessee, and now those issues may very well be following me here.

So I am begging you. Please put an end to

Kinder Morgan's plans for our community.

MR. DOCKERY: Hello, Dr. Paul and to the elected officials here. My name is Reuben Dockery, and I am a candidate in the current election for Council District 1.

Joelton is a vital part of that district, and I'm here as a matter of record in support of their will to protect their quality of life and to let you know as the health department that we will look forward to -- continue to assist them in that fight. Thank you very much. I'm 2276 Gilmore Crossing Road.

UNIDENTIFIED SPEAKER: Thank you for hearing this. Because this facility has the potential to negatively impact -- thank you for hearing us. Because this facility has the potential to negatively impact health due to the fact that it is a Title 5 hazardous air polluter, shouldn't there be a public health notice mailed to those within a 30-mile radius of the compressor station warning them of the possible exposure to the toxins emitted on a daily basis and the damages they can cause? Thank you.

MS. ROGERS: My name is Kathy Rogers. I live at 4060 Bernard Road, Joelton, Tennessee. I have done much research as a private citizen on the kinds of toxins these stations can emit into the air, soil and

1 water. Toxins like formaldehyde, benzene, hexane,
2 methane, you name it, it goes on. Toxins that can
3 produce immediate and chronic symptoms and can cause
4 cancers and diseases of nearly every organ in the body,
5 toxins that in most cases the EPA would have severely
6 restricted as it has done so in the past based on the
7 widespread damages they cause.
8 My family and I have been directly impacted by
9 chemical exposure to toxins, and I know first hand what
10 physical ailments I have had to endure as a result. My
11 father was in the pest control industry for over 35
12 years before his death in 1994. He and my family were
13 exposed directly and indirectly to such things as DDT,
14 1080, chlordane and thallium sulphate, to name a few
15 chemicals, that were later banned or severely
16 restricted by the EPA because they're cancer causing
17 with toxicant properties.
18 My father developed severe tremors, COPD and
19 cardiovascular disease when he was 50. My brother has
20 tremors and has psoriatic arthritis and heart disease.
21 Two of my sisters have died. One at 31 from liver
22 failure and the other at 41 from ovarian cancer. My
23 mother died of cardiovascular disease in 1998. My
24 older sister has cardiovascular disease, rheumatoid
25 arthritis. And I am battling severe systemic lupus.

In my hand is a research paper that I have done with 105 citations from various journals and government agencies like the EPA, Environmental Health, CDC, World Health Organization and so on. Citations that back up the research that proves natural gas compressor stations are emitters of toxins that can cause physical harm to humans and that -- my family and I have been exposed to.

I have only one question to ask you, and that is: With all the evidence at hand, why would you, the Metro Health Department, allow the issuance of a permit that would allow such a facility to be built, one that can and will cause so many -- so much harm to so many people? Thank you.

MS. BIRCKHEAD: My name is Lori Birckhead. I live at 7721 Whites Creek Pike. I'm the president of CCSE.

First I'd like to say how much I appreciate having the opportunity to have this public hearing. We have been asking Kinder Morgan for the last year and a half to please have a public meeting, and we have been denied that. So at least we have the opportunity to speak our concerns. So I thank you for that.

FERC says that the broad run project is constructed for the public convenience and necessity.

I can't imagine that this phrase has any merit, though. Federal powers like preemption of local zoning and eminent domain were instituted to ensure that large projects for the good of the nation could move forward, projects like construction of interstates or schools or hospitals.

However, this project's sole purpose is to transport gas to the Gulf Coast to be turned into liquified natural gas for the export to Asian markets. This process does not serve the public good at all.

In short, it's neither convenient nor necessary. In fact, it is anticonsumer and against the interest of the U.S. -- of U.S. businesses because if a -- if a robust export market develops, it will cause natural gas prices in domestic markets to skyrocket. Thank you for allowing me to speak.

MS. FELTON: My name is Sharon Felton. I live in Goodlettsville, Tennessee. My question is with regard to environmental justice. If you will look at Executive Order 12898 which is entitled Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations -- that's what it's called.

The proposed Joelton compressor station should be evaluated for this kind of impact. In Kinder Morgan

Tennessee Gas Pipeline's filings with FERC the Joelton area was erroneously connected to Pleasant View as being the nearest community by which to evaluate population and demographics. You forgot to start my two minutes, by the way.

Pleasant View is not in the same county as Joelton. It is not even the nearest community to Joelton. Joelton is better categorized by its existence within Davidson County District 1, Council District 1, which has one of the highest minority populations in the entire county.

Using the EPA echosystem -- and I can give you the website for that if you want to explore it -- to generate a five-mile radius -- I -- I looked at it and found one of the nearest sites that is -- that is currently giving out emissions. If I generate a five-mile radius around this, the population density comes back at 742 per square mile.

In that -- in that area, that is 62 percent minority and -- I'll give you a few numbers here -- 24,284 out of 58,399, i.e., 42 percent, live below the poverty line. So I'm looking at Joelton and thinking, Yeah, why is it coming here? Thank you.

MS. MILLER: Hi. My name is Patricia Miller. I'm retired Wildlife Resources Agency

Statewide Aquatic Education program coordinator. I am here -- I don't live in Joelton, but I'm here because I live in Cane Ridge. And you may know already that we have gas a compressor station proposed for them -- for our area. So I'm here to support these wonderful people that have been helping us in our process to learn how to deal with this proposal, and so I have a question for you.

Many of the health studies -- indeed, many of the protests made in other states have based their findings on compressor stations of 11,000 horsepower or 14,000 horsepower. The compressor proposed for Joelton is among the largest in the entire nation, coming in at five and six times more powerful than the majority of other sites.

I believe we have lost sight of how large a monstrosity this compressor will be. One stack will be eight and a half stories tall, 85 feet. We don't want that eyesore in their community or in our community. Thank you. Thank you for this opportunity.

MR. MILLER: Hi. My name is Brent Miller, and I live in Cane Ridge, in the area, Old Hickory Boulevard. And I, too, am from an area across town. But as we all know, air pollution and things coming from compressor stations, pipelines, so forth,

escaping is not limited to any one area. It will move with the air. So not only do we want to support the Joelton group, but also concerns about air pollution coming from that compressor and also being -- possibly being caused -- if we ever have a compressor station in our area, combining together with theirs to make it -- make it even worse.

It narrows a question that I wanted to also pose. Appreciate the opportunity to ask these questions tonight. The tons-per-year figures given in Kinder Morgan's specifications do not account for what's commonly called fugitive emissions, and I'd like to know how are fugitive emissions determined. Thank you very much.

MR. GENY: I'm Steve Geny. I represent Paradise Produce Farm located at 7721 Whites Creek Pike in Joelton. My family works on the farm and also employees. It's an organic farm. We moved out there for that reason, to get away from the pollution of other areas and to be able to grow healthy food for our community.

My -- my wife, my daughter, my son, my grandson, my daughter-in-law, myself, we all work on the farm, you know, at different times. I'm an asthmatic since I was two years old. I have good times

and bad times, but most of the time when I work on the farm I already have to wear a respirator to work. So -- not because of pollutants, but just because of -- you know, at times when we're plowing and dust, that kind of thing.

But if we had gas line leaks in the area and they were close to the -- the farm there, it could send me into a fatal asthma attack, for example. I also have some questions here that I wanted to pose.

One is how often are emissions checked at the proposed compressor station? After they're checked, who -- who validates the figures for accuracy at this site? What happens if the numbers are exceeded? If numbers are exceeded, are these violations communicated to the residents? And lastly, do violations result in fines levied against the company?

These are -- these are just a few of our concerns. Thank you for this opportunity to ask them.

MS. SHANN: Hello. My name is Susan Shann. I live at 5476 Old Hickory Boulevard, just down the street from Joelton/Scottsboro area.

I have a question. Mac Wilson had a cited a quote from the environmental assessment, and I'm going to cite that same quote but in relation to sulphur dioxide. On Page 102 of the environmental assessment,

FERC declares that the operational emissions from this facility would permanently affect ambient air quality in Joelton as we've heard.

FERC follows this comment with a statement that an air dispersion model was not performed for sulfur dioxide because the impact of CS563 on sulfur dioxide concentrations was assumed to be negligible. Assumed.

However, in a review of health impacts from compressor stations published in Science Direct in 2015, sulfur dioxide is one of the criteria pollutants emitted by compressor stations. Exposure to this toxin causes immediate irritation of the mucous membranes. Thereby inducing asthma-like symptoms at 20 parts per million.

Exposure over that limits -- I'm sorry. Exposure over that limit without a respirator can cause permanent lung damage and even death, with the possibility of a negative health impact from exposure to this possible toxin.

And as FERC is dealing with a mere assumption regarding the impact of said toxin and did not perform an air dispersion model, wouldn't it be more prudent for the Nashville Health Department to ask that one be performed anyway since the health and well-being of

many people of this county should take precedence over an assumption? Thank you.

MS. BOYKIN: Hello. My name is Joy Boykin. I live at 7433 Bidwell Road in the Joelton area. I am a real estate agent there and make my living selling homes in that area and have for 36 years.

So that being said, not only am I here to let you know that the tax revenue for that area for -- for us is great in the near future for Metro, but if we let something like this happen to the area, then the growth of the area will die. And not only will Metro lose lots of money getting the revenue that they could get from future growth of the area, but we -- we are concerned about the air quality.

And one of the questions that I have and that we propose is if the -- how does the Nashville Air Quality Division plan to monitor the particular matter that can be captured -- that can only be captured by hourly data due to fluctuations in the air speed and the temperature and the blow-downs?

The -- the matter spikes, for those of you that may not know, are the tiny little particles that are floating around in the sky, and sometimes you can't -- they're not even visible, but we breathe them.

And how do the people of Davidson County know that the data reported is without bias? Thank you.

MS. WINTERS: Hi. My name is Nancy Winters. In a published statement by the State of Colorado Air Quality Division, the current state of science could not assess the potential risk of combinations of different chemicals people are exposed to from natural gas compressor stations.

Studies performed on workers in the gas, oil industry who have been exposed to toxic mixtures like BTEX have experienced mental and behavioral problems, a range of health problems and some changes in color vision and perception.

Together with toxic pollutions have the potential to dramatically impact every organ in the human body and can act together and to increase the potential -- the toxic potential of other chemicals like prescription medications.

With that being said, would it be wiser to delay the air permit until such a study can be performed as these toxins are not admitted one at a time but comprehensively? Thank you.

MS. FETHERLING: My name is Tara Fetherling. I'm a resident in Joelton at 7470 Whites Creek Pike. I have two properties in Joelton that are

within the zone that will be affected by emissions, both of air pollution, admittance into the aquifer that serves my property.

And I just want to speak to you tonight -- I'm going to extend with written comments, but I'd like to speak to you tonight about your somber duty. Apparently you're our last -- our last hope or wall to stop a project that has not had a complete and adequate environmental assessment or environmental impact statement.

And this is local now. It needs to remain local. You guys are here. You know what the Joelton area is like. It's supposed to be the air filter for Nashville. We shouldn't be approving projects where we're going to cut down acres and acres of trees that are the air filters for all of this metropolitan area in order to place an industrial project that is going to emit large tonnages of particulates over not just Joelton but down the hill where the air is always dirtier and hangs in the basin.

So it's really not just an impact on the Joelton residents, although we're going to feel it. I could have moved anywhere when I came home to Tennessee after a career, but I chose Joelton because it's zoned rural. It's zoned agricultural. I've done nothing but

plant trees and try to grow clean food for people in Nashville, and that's how the community needs to remain. Nashville is going to be missing -- or really ruining the last area it has to become and be a green community. It really matters, and you guys -- you guys are the last place to stop this fossil fuel madness.

I mean, I understand why the federal government presumes it needs preemption over some issues, but this is local. And I hope you'll give it all due consideration.

MS. DIMEOLA: Hello. My name is Gloria DiMeola. I am a resident in Joelton at 7721 Whites Creek Pike. I'm here today on behalf of myself, my eight-year-old son and many of my neighbors from the Joelton community.

I do not support Kinder Morgan's proposal to establish a massive compressor station in our agricultural semirural neighborhood. Kinder Morgan has no intention to support our local economy. Instead resources exploited will be shipped overseas, offering locals nothing more than pollution, byproducts and an unsafe environment.

There has been many independent surveys conducted proving the pipeline to be unsafe and eroding in many areas. Joelton is a beautiful town full of

biodiversity and clean important watersheds. I feel the air in Joelton is much cleaner in comparison to Nashville where I once -- where I was born and raised.

Areas like Joelton play an important role as a buffer between cities that have been overdeveloped and industrialized. Many here today have played important rules of protectors and preservers of the land on which we live. None of us want our good air quality compromised by a corporation who's out for nothing more than financial gain.

Kinder Morgan's sneaky and noncooperative tactics have appalled us all. The emission pollution from the compressor station will surpass your EPA standards by an unacceptable percentage, putting all of our air and health at risk many miles beyond the proposed site for this project.

We should all be granted a right to breathe clean air, for it is a necessity to all life forms. This is why I oppose. And I sincerely ask you to listen to the voices of the people around me and do not grant Kinder Morgan -- Morgan the permit to go through with this project.

MS. WRIGHT: Thank you for hearing us tonight. I'm Christina Wright. I'm a resident of Joelton and a long-time resident of Nashville. I've

always lived here. And I have several questions for you.

I will start with: How many orange alerts have been issued for Davidson County in 2015? How many so far have been issued for 2016? Is Davidson County currently in attainment of national ambient air quality standards? How often have those standards been checked? If Davidson County falls out of attainment, what steps are taken and what fines levied as a non- -- as a result of nonattainment?

I am concerned about the air quality in Nashville, and I have in my hand a testimony from a resident of Carroll County, Ohio. I'd like to read a portion of it to you.

This is a resident, Harry Booth. Says that he believes his dogs gave him an early indication something was wrong with the air when the pipelines, wells and compressor stations started sprouting up around his home in 2013. The dogs would stick their nose in the air when they went to the door and turned around and come right back in the house.

The next day he went to get his wife a cup of coffee, and he fainted. She came to his help. And the next thing that he knew, that she was on the floor, too, feeling nauseated and dizzy. This was because of

the air quality in the house because of the air compressor that was nearby.

My husband and I run Town & County Farm & Pet Sitter. We board horses, dogs and cats at our house. We are less than a mile of the proposed site. Should this come into our area, it will put us out of business. I ask you to please protect our environment and the health of Nashville residents.

Nashville already has an air quality problem in the summer as per the signs that we see that you're cautioning us about breathing problems. So, please, I ask you to do your duty and protect Nashville. Thank you.

MR. MOORE: Hello. I'm bending over. So I'm going to raise this up. My name is Gary Moore. I live at 2946 Morgan Road, Joelton, Tennessee. Less than a mile from the compressor station, proposed compressor station.

And I'm going to start by saying you have a choice, and I hope that you choose to protect the citizens that you serve. I'm going to talk -- and there's been a lot of talk about the different carcinogenics, but I'm going to talk about one specifically. That's benzene.

Benzene is another known volatile organic

compound emitted by compressor stations. It is a carcinogenic that can linger in the atmosphere for days, particularly after blow-down events.

Under TGP's resource report Page 9 through 39, TGP states that their vision is that this facility conservatively include 150 startups and 150 shutdowns per unit per year. That will conservatively produce a total of 15.5 tons per year of VOC emissions.

However, TGP -- it's estimated that this data based on emissions data, Solar -- the compressor turbine manufacturer. So they're basing it on the manufacturer's statement, not facts.

I know that the favorite saying of the lawyer is trust and verify. We have many lawyers in this room, and I'm sure they will attest to that. So how do we know that we can trust those numbers? What quantity is this assumed 15.5 tons per year does benzene compromise?

According to the World Health Organization, there are no safe exposure level to benzene. We've done extensive research on our health effects that result from living near a compressor station. One of the first studies I examined was a woman who lived 780 feet from a compressor station.

When she started to feel ill, her doctor

checked her blood and determined that she had an unusual high level of benzene in her system. I live very near to the proposed site. I can trust and verify that a two year -- or two from now -- that a year or two from now that I won't have the same excessive level of benzene in my blood.

It's incumbent upon you-all to make sure that I do not have. I implore you to do so. Thank you.

MS. HARVISON: My name is Norma Harvison. I live at 7177 Bidwell Road in Joelton. I'm a lifelong -- born and raised in Joelton. And we have fought very hard to keep our community safe, and we've heard all of these things that are going on, all these things that are wrong.

But we've just built a nice park out there for our children. My niece has just built a beautiful home and has three beautiful little boys, one of them with asthma. Her father with cancer. So I'm asking you as a citizen of our beautiful community to please don't do it. Just take care of us, and let this be the place that people can live and be happy. Thank you.

MS. LESLIE: My name is Melanie Leslie. I live at 5543 Dividing Ridge Road.

UNIDENTIFIED SPEAKER: Can't hear you. Pull the microphone --

MS. LESLIE: My name is Melanie Leslie. I live at 5543 Dividing Ridge Road. Kinder Morgan is starting the -- is stating that the only air monitoring they will be performing is right at the station and not -- and it does not take into account the vent blowouts that will disperse pollutants in a much wider plume than these, quote, normal operations.

However, these vent blowouts are regularly-scheduled events that frequently occur. So I don't see how they can say that they are not part of the normal operations.

This air -- air monitoring program that they're doing has -- does it have a quality assurance, quality control check to ensure that they are monitoring according to state guidelines? Do they have guidelines for data validation? There is no mention in Section 1.3(a) that there will -- of any data validation in there.

Without adequate results how do we know that they're judging properly and monitoring correctly and protecting our environment? Kinder Morgan also has a -- says that the air monitoring stations will be around the plant only and not scattered throughout the affected area. Why not? It should be scattered throughout the entire area. How will they know that

the volatile organic compounds, the benzene, toluene, et cetera, and other pollutants of the natural gas liquid they're transporting is not spreading off their property?

Section 1.21 states that nothing objectionable will go beyond the property line. How will Kinder Morgan know this is true without air monitoring stations placed off their property or do they simply expect these emissions to magically drop at the property line?

Section 1.24 and 1.25 speak of the permitting -- not allowing emissions beyond certain limits. How will they be sampling to ensure those limits are not exceeded? What will they do if they are exceeded?

Kinder Morgan states they don't have to monitor because their station doesn't fall under the EPA guidelines for facilities that do require a monitoring. However, the state often does have more stringent guidelines. Will Kinder Morgan be forced to meet these more stringent guidelines? The gas compressor plant is not operating -- thank you.

MR. LIEB: Good afternoon. I'm Fred Lieb. 7421 Bidwell Road in Joelton. I live less than a mile from the site of the compressor station, and I

live three building lots away from the pipeline itself. Needless to say, I have seen the news stories. I was born and raised in Oklahoma. I know a little bit about the oil business.

I've chased for cap (phonetic) and sulfides all through the Mid-Continent DX Refinery in Tulsa. So I know a little bit about what those guys can do. They form sulfuric acid when they combine with water.

Have anybody done some mechanical studies -- I'm an ME by trade. So we want to know -- the existing pipelines was tested, and I believe that they are increasing the working pressure by two and a half times. If that is true, then -- the normal guidelines in the mechanical engineering world are two and a half times the operating pressure is the test pressure.

So it seems to me that what they're going to be doing is taking the operating pressure to whatever the test pressures were on those pipelines. Plus over the years -- those lines are 50, 60 years old now -- there has been erosion caused by just the particulates flowing through the pipeline. They increase the velocity. It's like sandblasting from the inside of the pipe out.

So there's -- there's about three or four different things that are going on. Also let me make a

comment about the storage tanks. So we used to call it drip, and it is roughly 125 octane fuel. We used to go out to the pipelines and drain the -- drain the expansion lubes to get the drip to run our race cars on. So it's nasty stuff. Thank you.

MS. DEMETREON: Hi. I'm -- can you hear me yet? I'm Alice Demetreon of 229 North Elm, Whitwell, Tennessee, which is not in this district. But I'm here as a concerned citizen for all of Tennessee, especially our future generations.

I have one question for Kinder Morgan. If you want to be the FedEx of America's energy structure, why are you investing all this money on dangerous fossil fuel technology when renewable energy is the clear choice for the future of our planet?

My question -- my question to the board is: How will water quality of the wells and streams be affected? How can wells, ponds and streams be monitored for toxic chemical contamination? And what is the risk of long-term soil contamination in this area that has a significant agricultural population?

Also, I've heard a lot about the noise pollution. And I'm wondering how will that be monitored and how will you enforce it if it's found to be over? My last question also was for the board.

Will you please consider making your vote for the people as opposed to big business? Thank you.

MS. MALONEY: Good evening. My name is Hannah Maloney. I live at 8440 Whites Creek Pike. My question is this. I'm a nurse practitioner, and I work in a neurointensive care unit at Vanderbilt. So I have a firm understanding of the healthcare system.

Does the health department -- if they decide to go against the wishes of the people and the health of the people have a plan for monitoring the health of the people? We now know that 42 percent of the people that are going to be affected by this live under the poverty level. That's a lot of people who are going to depend on public health and public assistance.

I think that having a post-implementation plan for monitoring the health of these toxins or the health problems created by these toxins would be prudent. Thank you.

MS. PACE: Thank you for this opportunity to speak today. My name is Lindsay Pace. I am the Tennessee field coordinator for Moms Clean Air Force. I live at 1713 West 56th Street, Chattanooga 37409.

Children are especially sensitive to air pollution because their bodies are still developing. They breathe more rapidly when compared to an adult,

and they are more likely to be playing outside at their homes and at Paradise Ridge Park on days where there are high emissions.

Of the pollutants that gas compressor stations -- stations emit we know that volatile organic compounds impact the health of those who live nearest the compressor station. Toxic pollutants such as benzene and formaldehyde can be found around compressor stations from fugitive leaks, blow-downs and accidents. Benzene is a potent neurotoxin that is linked to childhood leukemia, and formaldehyde has been associated with childhood asthma, as well as causing cancer.

When looking through existing data collected from families living near compressor stations, you see that the youngest respondents who are under the age of 16 report higher rates of throat irritation and severe headaches. They also have the highest occurrence of frequent nosebleeds and experience conditions not usually associated with children, such as severe headaches, joint and lumbar pain and forgetfulness.

Under the Environmental Protection Agency's Executive Order 13045, protection of children from environmental health risks and safety risks, this proposed gas compressor facility should receive special

EPA scrutiny because the property is immediately adjacent to Paradise Ridge Park, which is a Metro Nashville public park.

This park is not only a recreational spot for the community, it also hosts a variety of programs for children, including structured after-school activities. As a parent, you do everything you can to protect your children. You put your child in your car seat. You buy them healthy food to eat. You stay up with them all night when they're sick. But what you can't do is buy them clean air to breathe when they're playing at Paradise Ridge Park and there's a compressor station less than a mile away.

Given the lack of substantive data on hazardous air pollutants from the proposed -- proposed facility, at the very least this air permit should be withheld until the long-term cumulative effects of hazardous air pollutants on the adjacent park population can be sufficiently evaluated.

MS. HAWKINS: My name is Lillian Hawkins, and I'm at 5127 Sonoma Trace from Cane Ridge. And I represent the Oak Highlands/Deer Valley Homeowners Association.

I am curious what the mechanism to enforce 10.56.280 which is entitled "Startups, shutdowns and

malfunctions" -- it requires the source to take all reasonable measures to keep emissions to a minimum during startups, shutdowns and malfunctions.

Failures that are caused entirely or in part by poor maintenance, careless operation or other preventable upset condition or preventable equipment breakdown shall not be considered a malfunction and shall be considered a violation of the applicable emission standards.

In addition to that question -- I'm a little curious. How many is too many? It looks to me after everything that I've researched and read that one of these compressor stations, especially this large one in Joelton, is too many, at least in that location with that environmentally sensitive area and population being affected.

And I look, going, Okay, if all the compressor stations meet the federal guidelines, okay -- let's just say that they do. Is one okay? How about two? What about 20? Is 20 okay? Would they all get approved because they all meet the guidelines?

To give a carte blanche is illogical, and it's also immoral. We expect and we trust that you guys will do what you were elected to do or got your job to do, which is to serve the people, the health and

well-being of the citizens of Nashville. Thank you.

MS. LEWIS: My name is Kelley Lewis. I live on Sycamore Creek Road in Joelton, Tennessee. The Tennessee State Wildlife Agency's mission is to preserve the state's endangered wildlife and manage its woods and waters.

They warn that, quote, the reduction of forest lands can negatively impact water quality and quantity the health and diversity of habitats and other land values such as recreation, timber and forest products.

They declare that upland forests are a benefit to each citizen of Tennessee by reducing soil runoff, thereby maintaining higher water quality and other water bodies from the ephemeral streams to lakes and waters across the state.

Quote, forests also filter pollutants and improve water absorption and retention, which increases groundwater recharge. Forest cover influences local temperatures, improves air quality and may play an important role in mitigating climate change, end quote.

The environmental assessment on Table 210, FERC states that the TGP will temporarily impact 34.6 acres and permanently impact 20.5 acres of upland forest to construct this Compressor Station 563. My question is: How can a local metropolitan jurisdiction

override the intent and wishes of a major state agency such as the Tennessee Wildlife Resources who sees it necessary and vital to the citizens of the state to protect these lands for the health and well-being of all Tennesseeans? Thank you.

MR. TOOLEY: Hi. My name is Chris Tooley. I live at 912 Morning Road, and that's in Cane Ridge. I'm also the vice president of a group called Keep Southeast Nashville Healthy. We're fighting our own compressor station battle, as you've heard.

Most of my technical questions have been answered by the people of Joelton. They've done an awesome job. My question really is about Nashville and Davidson County as a greater whole. I mean, we're the center of a very large populated area that goes to Murfreesboro, Joelton. I mean, you're almost really bordering really technically Clarksville as far as this emissions cloud is going to go.

So really -- I mean, beyond -- we're also topographically in a bowl, as you-all know. So the air doesn't necessarily move out like most cities. I'm from southern Indiana. Same situation. Pollutants just collect there because they're heavier than most lighter air, and they just sit.

So not only do you have this technical

question you have to answer and decide on, you also have a moral and ethical obligation for the greater Middle Tennessee area that's nearing a million people, if not exceeding it. So --

My parents always taught me growing up with a decision -- any decision you have to make, you have two options. You can do what's easy or you can do what's right. So I'm just going to ask that you guys do what's right. Thank you.

MS. TODD: Good evening. My name is Sarah Todd. I live at 5026 Clarksville Highway, Whites Creek, Tennessee. I also own other property in this area. My Cherokee name, because I am Cherokee, is Butterfly. And I have -- wearing -- I am wearing a over 200-year-old shale necklace that was presented to me and -- as I was proclaimed the Cherokee grandmother for the state of Tennessee.

I consider part of my duty for that is to tell you how the Cherokee started living at Fort Negley in that area, which most of you are aware of. And the Trail of Tears happened, and some of them moved to Oklahoma. Some of us stayed here, and the people here hid us out. They loved us. They merged with us. So I am representing all grandchildren from all cultures. When I say please, please keep Paradise Ridge like it

once was. Thank you.

MS. ARMSTRONG: I had already made up my mind not to talk tonight. Said, No, not doing it. My name is Rebecca Armstrong. I live in Joelton, not far from the proposed station.

My husband and I began this fight with Lori and Gary and so many others you see in this room. I know you think this is just part of your job. And it is, but it's your job to do what's right. And our job is to make sure that you have all the information you need to do what's right as far as we feel.

We -- you heard all the statistics. You've heard person after person speak on behalf of us. And when Lori and I and some of us began this fight, my husband was part of it. He's not here tonight because he was killed in an automobile accident last September 30th of 2015. He was one of those that walked the pipelines.

And I have a question to Kinder Morgan. How can you say you're a good neighbor when you've let these pipelines deteriorate to the condition that they are today? You're only now going out and doing anything because we're raising holy hell. I mean, honestly, we are, because this is us. It's a job for you. This is what we have to live with.

And I'm sorry. I'm going off board. But I can hear my husband saying, Why are you shutting up now? You know, you need to step up, and you need to finish this fight and --

And I've just got one thing to say. There is a country saying, When does the fox guard -- when do you start letting the fox guard the henhouse? So we need to stop letting the fox guard the henhouse. Step up and do it. Thank you.

MR. WRIGHT: Good evening. I'm Jim Wright, the other half of Christina Wright. We have the kennel, Town & Country Pet Sitter.

And, yes, we're concerned about that. And I also know -- I mean, let's be real. A lot of it is to do with the lobbying. But every year and every administration, including the current one, they've signed legislation that's supposed to speed up the approval process of these projects.

And I understand it's supposed to be -- to keep America rolling, but I also realize that even though their efforts limit it to some ability, you're -- you know, like you have guidelines. We have to approve this or disapprove this.

But I also know that you have certain rights. And, see, we live here, and we know -- we're concerned

because of reports of other people who have these compressors in their area and what it's doing to their lives.

But I also know that there are some things -- because legislation has been passed here through the council -- that you have more to stand on than you had before, and so all we're asking is for you to do your full job.

And, see, we all do it in the Nashville -- in our business if somebody brings their baby Yorkies when they're on vacation and, say, we have a Great Dane at the same time, if we find out that side by side that little Yorkie is scared to death, it's in our interest for the customer and for that dog, of course, to move them to proper places so that they get along.

We don't make them go home, but we put them to where they belong. And so what we're asking here is put this compressor where it belongs. Take into account and do what you rightfully can do. See, in addition to having this business, I'm also a minister of the gospel. And, you know, God gave us dominion. And, you know, man has messed up a lot. We've done a lot of things to destroy what is rightfully ours.

In fact, you all heard this. People were signing up to go to Mars. They want to have a colony

there. And they're buying one-way tickets. But the difference is we don't have a one -- you know, if you make this decision for us without doing what's fully in your power to do in our interest, we're signing up for it, too, against our own will. The people that are going to go to Mars, they're choosing that. So just choose right, and God bless you.

MR. MALONEY: Good evening. I'm Joseph Maloney, and my question is: How will compliance with maximum noise levels, i.e., a maximum of 55 decibels be guaranteed? What happens if residents observe even one instance of noise exceeding the 55 decibel level? What steps should a resident take in such cases? Is calling the police the appropriate response? Thank you.

MS. HARVEY: My name is Nora Harvey. My daughter lives at 8440 Whites Creek Pike in Joelton. My question is: On Page 118 of the environmental assessment, FERC states that the region of influence for cumulative impacts on air quality is at least 50 kilometers or 31 miles surrounding each compressor station.

This compressor station will upon beginning operations dramatically add to the increased NOx or nitrous oxide and particulate matter counts in the atmosphere of Davidson County. Thereby increasing the

level of ozone around the Nashville area. Ozone exposure harms delicate lung tissue, respiratory systems, and contributes to heart disease in otherwise healthy people.

It can easily spread past the 30-mile radius of FERC -- FERC's region of influence to cover hundreds of miles, thus increasing the range of influence dramatically. Therefore, shouldn't the Metro Health Department launch a study of its own to look at the potential for increased ozone and toxic exposure to protect all the Davidson -- citizens of Davidson County? Thank you very much for listening to our questions.

MS. MILLER: Hi. Good afternoon. My name is Paulette Miller. I live at 3572 Baxter Road, Joelton, Tennessee. I live less than a mile from the proposed compressor station.

I have lupus, which is a serious health concern, and the different chemicals that will be let out by the compressor station will greatly affect my health. I also have a six-year-old grandson that loves playing at the Paradise Ridge Park. But unfortunately, he has asthma. So I worry about that also. My husband also has asthma, and we worry about his health in Joelton.

We moved from the middle of Nashville because we wanted to get to a higher elevation and a safer place to live. I'm proud to be a Nashvillian. I'm proud that we're called the "it" city. I hope you have seen the pictures of the pollution -- of the pollution coming downtown where they showed on the TV station that will not only be in Joelton or Cane Ridge, it would also go down to downtown Nashville. It will affect all of us. The biggest one in the USA.

And this same company has exposed gas lines, which I won't go over because they just said that. But they've been there for numerous years, since the 2010 flood. Stand up for Joelton. Stand up for Nashville. Stand up for the state of Tennessee. Thank you very much.

MR. SENECHAL: Hi. My name is Roger Senechal. I live at 7601 Harper Road in Joelton. And I'm going to be brief. We've all heard the expression a picture is worth a thousand words. I have here -- and it's available on the CCSE Now website.

The areas of environmental impact that we have been talking about all night -- we've heard a lot of talk about Joelton, with good reason, in Kinder Morgan's design for us. Aren't we lucky? The environmental impact between this and the Cane Ridge

project go as far north as Russellville, Kentucky, to the northwest, to Clarksville, to the southeast, to Columbia -- excuse me, southwest to beyond Murfreesboro on the southeast and Franklin, Kentucky, to the northeast.

This is not just a Joelton problem. Who's in the cross hairs of this -- this diagram? N-A-S-H-V-I-L-L-E it says. It's not just, you know, a bunch of hillbillies in the hills of Joelton that are impacted. A lot of people. A lot of people will be impacted, and so I beg you, ladies and gentlemen, who are -- have the authority to -- to just look at this objectively and -- and hold Kinder Morgan's feet to the fire.

I don't think they're going to be able to sustain that when you do. But please remember that it's hundreds of thousands of people that will be impacted by your decision. Thank you very much.

MS. CURRY: Good evening. My name is Catherine Curry, and I live here in Nashville. And I don't have anything planned to say. I barely made it here today.

But I really want to say that we need you to speak for us, the people of Nashville, and that Tennessee -- I've lived in Tennessee for a long time,

since I was eight years old. And I lived near the chemical plants down near the farm and Summertown, and so many people have gotten cancer from them pumping toxins into the water table down there. And this is the same kind of thing. And this is 2016, and we have -- we ought to be able to do it better now.

And we have a huge influx of people coming from all over the country and the world to Nashville and we're saying we want to be the green city. Well, this isn't green. This is not green. This is not healthy. It's not green. It's really not going to support us in any way.

And fracking isn't supporting our country, and it's not going to support the world to be sending fracking stuff through our country to other countries. It just really -- please, let's -- let's get it together. Anyway, thank you very much.

MS. CARRATU: I'm Michelle Carratu, and I wasn't going to say anything either. However, I've been in Tennessee for 40 years and on the board of directors of the Whites Creek Watershed Alliance and the chairperson.

And you have to realize the headwaters come from Joelton, and they all go all down to Bordeaux, down into our river, and everybody drinks that water.

We want to keep the air and water clean.

A fence around the compressor station will not contain the air for 50 miles all around, and actually it will move all across the country. We get air from the west. It goes in all directions. You cannot contain the air. We don't want this to spread.

Nashville is in a basin. It's essential basin. I used to live in California at one time, and in the LA basin the pollution is so bad that sometimes you did not go out 'til after lunch.

When I lived in southern Tennessee, there was a chemical plant in the nearby town, and there were days when I opened the door to go outdoors and I shut the door, shut the storm door, the outside door, and just stayed inside because you couldn't breathe. It was so bad. And that can happen here. We don't need that to be here.

I worry because you look at Beijing and you see their air pollution. You look at the people in Japan, and sometimes they're outdoors wearing masks. We don't want to be outdoors wearing masks. We want to be able to live and breathe freely.

If you think back to Chief Joseph, who was one of the great leaders of his -- his people, he said, How can you sell the air? How can you buy air? I have

heard that in the past in some segments of Japan they were buying air. We don't want to have to buy air. Air should be everybody's right to be clean and breathe freely. So please err on the side of caution, do your job and please help keep our air clean. Thank you.

DR. PAUL: Do we have one more? Okay. Well --

UNIDENTIFIED SPEAKER: She's both.

DR. PAUL: She's both. Okay. And she's giving a card. Okay. Just as a reminder, there is a sheet that hopefully you've gotten. And if you'd like, in addition to your spoken comments, to submit them in writing, they'll be accepted.

If you were not able to speak and -- or chose not to speak and still want to submit comments or questions on the air permit in writing, this gives you instructions on that. And the deadline for that is 4:30 p.m. on August 3rd.

So this piece of paper is really important for that. Did you have a question or concern about that?

UNIDENTIFIED SPEAKER: Yeah. Will it be limited to two paragraphs?

DR. PAUL: Is there a limitation on written comments?

MR. AREOLA: No.

DR. PAUL: I don't think there's a limitation on written comments, and our staff -- you know, our staff have been working hard on this issue for a long time, and I -- and I want to recognize the staff of our -- of our air pollution control division that really have taken this -- and take their job very seriously, and we at the health department do take our job very seriously.

I want to take this opportunity to thank each person who -- who made the time, took the energy to come and -- and participate in this public hearing. And I guess with that and with the reminder about the written comments, we -- we can adjourn. So thank you again.

(Proceedings adjourned at 6:12 p.m.)

C E R T I F I C A T E

I, Rhonda Nicholson, Registered Court Reporter and Notary Public, State of Tennessee at Large, do hereby certify that I recorded to the best of my skill and ability by machine shorthand the excerpt of proceedings contained herein, that same was reduced to computer transcription by myself, and that the foregoing is a true, accurate, and complete transcript of the excerpt of proceedings heard in this cause.

I further certify that I am not an attorney or counsel of any of the parties, nor a relative or employee of any attorney or counsel connected with the action, nor financially interested in the action

This 29th day of July, 2016.

_____
Rhonda Nicholson
LCR No. 160, Exp: 6/30/18

My Commission Expires:
9/10/2018

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Appendix II

From:	Anna Ortiz
To:	Finke, John (Health)
Subject:	TGP-Public Comment
Date:	Wednesday, August 03, 2016 9:06:53 PM

Hi,

I have been a resident of the greater Nashville area since 1995. I have heard about both the Joelton & Cane Ridge community's fight against a proposed gas compressor station. It seems that these projects would overlap across Nashville posing a serious health risk to those in this great city.

What steps are being taken to determine the environmental impacts these projects will have over a long period of time? With the recent surge in population growth and added vehicles & other emissions in the air, will the bi-products of these stations interact or add to the volume already going up into the air?

My concerns are primarily on the health & environmental impacts these proposed stations will have on generations of Nashvillians to come.

Thank you for your time & consideration of my comments.

Thank you,
Anna Ortiz
Mill Run subdivision

Sent from my iPhone

From:	Katherine Correa
To:	Finke, John (Health)
Subject:	Compressor station in Joelton
Date:	Thursday, August 04, 2016 7:01:20 AM

To the Davidson County government,

I would like to voice my concern about the pollution and dangers that this propose station would bring to Nashville and the surrounding area. Please don't allow this to happen. It's not good for our area it, it won't help with jobs, and it supports franking in general which is terrible for the areas where that is happening. We need to protect the environment and our air-quality here.

Nashville has a rapidly growing population with very poor air quality so why would we want to do something that would make such a huge negative impact? If we want to be green, will that be the right direction? I don't think so, and neither does anybody I've spoken with about the matter. Please stand with the people, and read up on the facts which show that this station is both dangerous and toxic.

If you do allow the station to happen, you should demand state of the art infrastructure, Including real-time monitoring of emission, not what's proposed at this time.

I lived near a chemical plant as a child and I have seen huge numbers with cancer. Tennessee is a hotspot for cancer already. I don't know if you seen the map that shows where cancer is more prevalent but I have. And pollution does matter. We want to keep our economy strong in the area we shouldn't allow things of this nature. We should protect The people.

Thank you for opposing the compressor station,

Kath Correa

From:	Gary Davis
To:	Finke, John (Health)
Subject:	TGP Public Comment
Date:	Wednesday, August 03, 2016 4:25:47 PM
Attachments:	CCSE Permit Comments TGP Compressor Joelton.pdf CCSE Cover Letter.pdf Attach 16.pdf Attach 18.pdf Attach 19.pdf Attach 20.pdf Attach17.pdf

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Mr. Finke,

Just in case the earlier email was too big for your inbox, I am attaching the CCSE comments with the new attachments that were not submitted earlier today by Fed Ex.

Thanks,

Gary

Gary A. Davis
Davis & Whitlock, PC
21 Battery Park Avenue
Suite 206
Asheville, NC 28801
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August 3, 2016

John Finke
Metro Public Health Department
Pollution Control Division
2500 Charlotte Avenue
Nashville, TN 37209
Via email: john.finke@nashville.gov

Sent via Electronic Mail

Re: TGP Draft Air Permits: Proposed Joelton Compressor Station No. 563

Dear Mr. Finke:

I am writing on behalf of Concerned Citizens for a Safe Environment. Please find attached Comments of Concerned Citizens for a Safe Environment ("CCSE") on Draft Construction and Title V Operating Permits for Tennessee Gas Pipeline Company, LLC ("TGP") Compressor Station 563, 7650 Whites Creek Pike, Joelton, Tennessee.

I have attempted to include all of the 20 attachments with this email, but if they do not go through, I will just attach the 5 new attachments that were not sent via FedEx yesterday and received by your office today. Please ensure that all of these attachments together with our written comments are reviewed by your staff in their consideration of the permit applications and that the attachments are made part of the record.

Thank you for your assistance.

Sincerely,

Gary A. Davis

GAD/pf
Enclosures

COMMENTS OF CONCERNED CITIZENS FOR A SAFE ENVIRONMENT ("CCSE") ON DRAFT CONSTRUCTION AND TITLE V OPERATING PERMITS FOR TENNESSEE GAS PIPELINE COMPANY, LLC ("TGP") COMPRESSOR STATION 563 7650 WHITES CREEK PIKE, JOELTON, TENNESSEE

I. THE ISSUANCE OF A CONSTRUCTION PERMIT TO TGP IS PROHIBITED BY THE METRO AIR POLLUTION CODE, BECAUSE THE TGP PROPERTY IS NOT ZONED INDUSTRIAL.

A. Section 10.56.020H of the Metro Air Pollution Code, as Amended, Requires Compliance with the Metro Zoning Code for New Sources, and the Proposed Use of the TGP Property Does Not Comply.

The proposed construction permit for the Tennessee Gas Pipeline Company, LLC, ("TGP") compressor station should be denied, pursuant to Section 10.56.020H of the Metro Air Pollution Code, as amended, because the use of the TGP property as a compressor station does not comply with the Metro Zoning Code.

Ordinance No. BL2016-234, passed on July 5, 2016, amended Section 10.56.020H of the Metro Air Pollution Code and prohibits a new source from being "granted a construction permit unless the new source complies with the Metropolitan Zoning Code for the use of the property on which the new source is to be constructed." The TGP property on which the compressor is proposed is zoned AR2a, as are the surrounding properties. Immediately adjacent to the TGP property is the Paradise Ridge Park, a Metro Park and Neighborhood Community Center.

"Natural gas compressor station" is defined in Section 17.04.060 of the Metro Zoning Code as "a facility designed and constructed to compress natural gas that originates from an oil and gas well or collection of such wells operating as a midstream facility for delivery of oil and gas to a transmission pipeline, distribution pipeline, natural gas processing plant or underground storage field, including one or more natural gas compressors, associated buildings, pipes, valves, tanks and other equipment." The proposed TGP compressor station clearly fits this definition. Pursuant to Section 17.08.030 (District land use tables) of the Metro Zoning Code, a natural gas compressor station is a permitted use in the three industrial zones, and is excluded from all other zones, including agricultural and residential zones. The Joelton area where the compressor station is proposed is clearly rural residential, and there is no industrial zoning anywhere near the property. TGP could apply for rezoning of the property, but the area is totally unsuitable for such an intense industrial use.

B. Metro Can Immediately Enforce the Amendment to Section 10.56.020H.

Metro can immediately enforce Section 10.56.020H, as amended by Second Substitute Ordinance No. BL2016-234. Ordinance No. BL2016-234 took effect upon its enactment and can be applied to the pending TGP construction permit application. Nothing in the Air Pollution Code or in Metro air pollution regulations gives an applicant for a construction permit a vested right in the Air Pollution Code provision as it existed at the time of the original application for construction and operating permits. Nothing in the Tennessee Air Quality Act or in the Tennessee Air Pollution

regulations gives an applicant a vested right to have a permit application considered under the ordinances and regulations as they existed at the time of the application. Tennessee courts are also clear that there are no vested rights in existing ordinances unless a final permit has been issued coupled with substantial expenditures or liabilities incurred that relate directly to construction. *See e.g. State ex rel. SCA Chemical Waste Services, Inc. v. Konigsberg*, 636 S.W.2d 430, 436-37 (Tenn. 1982); *Wright v. City of Shelbyville Bd. of Zoning Appeals*, No. M2011–01446–COA–R3–CV, 2012 WL 5378267 at *5 (Tenn. Ct. App. Oct. 31, 2012), *perm. to appeal denied* (Tenn. 2013).

C. Metro Can Enforce the Amendment to Section 10.56.020H of the Air Pollution Code Without Approval by the Tennessee Air Pollution Control Board.

Tenn. Code Ann. § 68-201-115(b) provides the means by which Metro can operate its own air pollution regulatory program as long as the program is not less stringent than the standards adopted for the state pursuant to the Tennessee Air Quality Control Act. Metro must have an approved "certificate of exemption" from the Tennessee Air Pollution Control Board ("Board"), which is for a fixed term, not exceeding two (2) years. The most recent certificate of exemption was filed on February 26, 2016, and approved by the Board on May 11, 2016, prior to the amendment to Section 10.56.020H.

There is no requirement that any amendments to Metro's ordinances be approved by the Board during the two-year life of the certificate of exemption in order for Metro to enforce these amendments. The Tennessee Department of Environment and Conservation ("TDEC") is directed by Tenn. Code Ann. § 68-201-115(b)(7) to "frequently determine whether or not any exempted municipality or county meets the terms of the exemption granted and continues to comply with this section," which would allow TDEC to "suspend the exemption in whole or in part until such time as the municipality or county complies with the state standards."

The recent amendment to Section 10.56.020H of the Metro Code does not make the Metro program less stringent than the state standards for issuance of construction permits. To the contrary, it reinforces state standards. For instance, Tenn. Code Ann. § 68-201-106(3), factors to be considered by the Board prior to exercising powers to prevent, abate and control pollution, directs the Board to consider "[t]he suitability or unsuitability of the air pollution source to the area in which it is located." The Board, however, has not adopted any regulations based on this consideration.

Similar to Tenn. Code Ann. § 68-201-106(3), the Metro Air Pollution Code at Section 10.56.100 directs the Board of Health, to consider, among other factors, "[t]he suitability or unsuitability of the air pollution source to the area in which it is located," which the amendment to Section 10.56.020H implements. This nexus between the regulation of air pollution and land use has been in the Air Pollution Code since at least 1989.

Furthermore, Part 2 of the Tennessee Air Quality Act, § 68-201-202, provides Metro with an additional basis for enacting and enforcing air pollution ordinances which does not require a certificate of exemption or any approval from TDEC or the Board. Subsection (a) states:

> (a) Any city, town or county having a population of six hundred thousand (600,000) or more, according to the federal census of 1960 or any subsequent

> federal census, is authorized to enact, by its chief legislative body, ordinances or regulations not less stringent than part 1 of this chapter.

According to the U.S. Census Bureau, the population of Davidson County was 626,681 in the 2010 census. Again, Section 10.56.020H, as amended, is not less stringent than the provisions of Part 1 of the Tennessee Air Quality Act, §§ 68-201-201, *et seq*.

D. Metro Can Enforce the Amendment to Section 10.56.020H of the Air Pollution Code Without Approval by the U.S. Environmental Protection Agency.

Section 10.56.020 is currently referenced as part of the Tennessee State Implementation Plan ("SIP"). 40 C.F.R. § 52.2220, Table 5, as are all the other sections of the Metro Air Pollution Code, including those which focus more on local measures than implementation of federal regulations. For instance, Section 10.56.100, which directs the Board, to consider, among other factors, "[t]he suitability or unsuitability of the air pollution source to the area in which it is located," is part of the SIP, as is Section 10.56.170, which prohibits the "emission of gases, vapors or objectionable odors beyond the property line from any source whatsoever which causes injury, detriment, nuisance or annoyance to any considerable number of persons or to the public, or which causes or has a natural tendency to cause injury or damage to business or property."

Although the United States Environmental Protection Agency ("EPA") is responsible for approving the Tennessee State Implementation Plan ("SIP"), including the Metro portion of the SIP, Metro can enforce the amendment to Section 10.56.020H of the Air Pollution Code prior to or without approval by the EPA where the amendment does not affect the enforcement of federal regulations by Metro. If Metro has not already provided the amendment to EPA Region 4, it should include it in its Local Implementation Plan as part of the SIP and submit it to EPA to determine whether EPA needs to approve it.

Finally, the definition of "legally enforceable" in Section 10.56.010 states:

> "Legally Enforceable" means all limitations and conditions which are enforceable by the Director and the Administrator, which includes all provisions of this Chapter, any provisions of the State Implementation Plan, and any permit requirements.

The Director can enforce the provisions of Chapter 10.56, including the recent amendments.

E. The Metro Ordinance is Not Preempted by the Natural Gas Act or the Federal Energy Regulatory Agency.

TGP has argued that any Metro Ordinance which would restrict the proposed compressor station would be preempted by FERC's authority under the Natural Gas Act, 15 U.S.C.A. §§ 717, *et seq*. Although the Natural Gas Act does not explicitly preempt state and local regulation that would apply to natural gas pipelines and compressor stations, federal courts have found that Congress intended to occupy the field to the exclusion of state and local law with regard to certain aspects of the regulation of pipelines. *Schneidewind v. ANR Pipeline Co.*, 485 U.S. 293, 305-10 (1988) (state regulation of sale of securities for natural gas pipeline). Neither the U.S. Supreme Court nor

the Sixth Circuit Court of Appeals has determined the extent of field preemption under the Natural Gas Act as applied to traditional local powers, such as air pollution and land use regulation. We believe the Sixth Circuit would not find preemption of Section 10.56.020H, as amended, even if the savings clause in the Natural Gas Act does not apply. 15 U.S.C. § 717b(d)(2).

The Sixth Circuit, which would ultimately hear any preemption appeal of Metro's denial of the TGP applications, recently decided a preemption case finding that the federal Clean Air Act does not preempt state nuisance law applied to air emissions. The Court first stated the principle that "there is a strong presumption against federal preemption of state law, one that operates with special force in cases 'in which Congress has legislated ... in a field which the States have traditionally occupied.'" *Merrick v. Diageo Americas Supply, Inc.*, 805 F.3d 685, 694 (6th Cir. 2015) (citations omitted). The Court found that the field of air pollution control was one which the states have traditionally occupied.

Although the Clean Air Act's savings clause explicitly preserves state standards, the Court did not rely on the savings clause in holding:

> even if the express language of the states' rights savings clause here did not preserve state common law claims, principles of federalism and respect for states' rights would likely do so in the absence of a clear expression of such preemption.

Finally, the Court found that "[t]he fact that a state has more stringent regulations than a federal law does not constitute conflict preemption." *Id*.

Based on the Court's preemption analysis in the *Merrick* decision, it is likely that Section 10.56.020H would survive a preemption challenge. The Sixth Circuit's reasoning would apply with even more force where Metro is regulating air pollution by the use of its traditional land use authority.

Even if the Court would find preemption of Section 10.56.020H under traditional preemption analysis, the Natural Gas Act ("NGA"), like the Clean Air Act, contains a "savings clause," at 15 U.S.C. § 717b(d)(2), which states:

> Except as specifically provided in this chapter, nothing in this chapter affects the rights of States under--
> (1) the Coastal Zone Management Act of 1972 (16 U.S.C. §§ 1451, *et seq*.);
> (2) the Clean Air Act (42 U.S.C. §§ 7401, *et seq*.); or
> (3) the Federal Water Pollution Control Act (33 U.S.C. §§ 1251, *et seq*.).

Because the proposed ordinance is part of the State of Tennessee's "rights" under the federal Clean Air Act, the ordinance would not be subject to preemption if applied to a natural gas compressor.

The Sixth Circuit Court of Appeals has not been called to rule on the applicability of the savings clause in the NGA to local air pollution statutes adopted under the Clean Air Act. The D.C. Circuit Court of Appeals decision in *Dominion Transmission, Inc. v. Summers*, 723 F.3d 238 (D.C. Cir. 2013), however, makes it clear that the NGA savings clause for state Clean Air Act regulation

saves a state statute from preemption despite the fact that it requires compliance with local zoning ordinances, as long as the statute is part of the SIP. Just as the Maryland statute in *Dominion*, the amendment to Section 10.56.020H would not be preempted by the NGA if it is applied to a natural gas compressor station, because it is part of the state's Clean Air Act regulatory program and is included in the Local Implementation Plan which is part of the State Implementation Plan ("SIP"). The *Dominion* Court found the Maryland statute to be part of the SIP, even though it was not specifically listed in the Code of Federal Regulations, because it was incorporated by reference. 723 F.3d at 243-44.

For the Tennessee SIP, Section 10.56.020 of the Metro Air Pollution Code is specifically listed in 40 C.F.R. § 52.2220, Table 5. Because these provisions are included in the Tennessee SIP, the amendment to Section 10.56.020H is saved from preemption by the NGA's savings clause. 15 U.S.C. § 717b(d)(2). The applicability of the savings clause will be even clearer once Metro and the State of Tennessee submit the amendment to EPA as part of the SIP.[1] This should be done as quickly as possible.

II. THE CONSTRUCTION AND OPERATION PERMITS SHOULD BE DENIED, OR THE DIRECTOR SHOULD REQUIRE ADDITIONAL INFORMATION NECESSARY TO DETERMINE WHETHER THE SOURCE WILL OPERATE IN VIOLATION OF THE AIR POLLUTION CODE OR PREVENT ATTAINMENT OR MAINTENANCE OF AIR QUALITY STANDARDS.

For construction permits Air Pollution Code Section 10.56.020A.1., as amended, states:

> If the director determines, on the basis of information available to him, that such source does, or in all likelihood will, operate in violation of this chapter, or that the source will operate so as to prevent attainment or maintenance of any national ambient air quality standard, he shall either impose conditions on the face of the construction permit that in his opinion will promote compliance with this chapter, and/or attainment and maintenance of any national ambient air quality standard, or he shall deny the application for the construction permit. At the request of the director, the applicant shall provide information necessary for the director to make the determination of whether the source does, or in all likelihood will, operate in violation of this chapter, or whether the source will operate so as to prevent attainment or maintenance of any national ambient air quality standard. For a major source, such information required may include a source impact analysis and air quality analysis as set out in regulations adopted by the Board.

Similarly, for operating permits, Section 10.56.040A. states:

[1] Similar to the D.C. Circuit, the Fourth Circuit Court of Appeals would have upheld a county zoning requirement against NGA preemption as part of the savings clause for the state's authority under the Coastal Zone Management Act ("CZMA") had the zoning requirement been included in the states Coastal Zone Management Plan by being presented to NOAA for approval as required by the CZMA. *AES Sparrows Point LNG, LLC v. Smith*, 527 F.3d 120, 126 (4th Cir. 2008).

> If the Director determines that the source does or will operate in violation of this Chapter, or if the source will operate so as to prevent attainment or maintenance of any lawful national ambient air quality standard, he shall either impose conditions on the face of the operating permit that, in his opinion, will promote compliance with this Chapter, or he shall deny the application for an operating permit.

One of the provisions of Chapter 10.56 is Section 10.56.170: Emission of Gases, Vapors or Objectionable Odors, which states:

> No person shall cause, suffer, allow or permit any emission of gases, vapors or objectionable odors beyond the property line from any source whatsoever which causes injury, detriment, nuisance or annoyance to any considerable number of persons or to the public, or which causes or has a natural tendency to cause injury or damage to business or property.

There is ample information available concerning large natural gas compressor stations for the Department to conclude that the operation of the proposed TGP compressor station in Joelton will violate Section 10.56.170 by causing the emission of gases and vapors beyond the property line which will cause injury, detriment, nuisance and annoyance to a considerable number of persons living nearby and using the adjacent Paradise Ridge Park and Community Center. Based on this information, the Department should either deny the construction and operating permits, pursuant to Section 10.56.020A.1 and Section 10.56.040A, or should at least require the applicant to demonstrate that the proposed compressor station will not emit gases and vapors in sufficient amounts so as to cause injury, detriment, nuisance and annoyance. TGP has not provided sufficient information to demonstrate compliance with Section 10.56.170, particularly for expected emissions of hazardous air pollutants ("HAPs"), such as formaldehyde and benzene, and for $PM_{2.5}$.

In addition, there is ample information available that the Joelton compressor station, as proposed, will add significantly to NOx and VOC Emissions in Metro Nashville, threatening attainment and maintenance of the new ozone standard. It is incumbent on the Department to require the applicant to demonstrate that the emissions will not prevent the attainment and maintenance of the new ozone standard, particularly when evaluated in conjunction with the other major compressor station proposed. If this demonstration can't be made, the permit should be denied.

A. <u>Formaldehyde and Other Hazardous Air Pollutant Emissions Cause Injury, Detriment, Nuisance and Annoyance at Natural Gas Compressor Stations.</u>

Formaldehyde is known to be emitted from natural gas compressor stations, yet neither TGP nor the Department evaluated the potential impacts on the community around the proposed Joelton facility. The negative effects of airborne formaldehyde occur at very low levels. Nasal and eye irritation, neurological effects, and increased risk of asthma and/or allergy have been observed in humans breathing 0.1 to 0.5 ppm. Eczema and changes in lung function have been observed at 0.6 to 1.9 ppm. The Department of Health and Human Services (HHS) determined in 2011 that formaldehyde is a known human carcinogen based on sufficient human and animal inhalation studies.[2]

[2] ATSDR Fact Sheet: Formaldehyde, CAS 50-00-0, May 2015, Attachment 1.

Recent studies show levels of formaldehyde near natural gas compressor stations that exceed recommended exposure levels for cancer risk. For instance formaldehyde levels as far as 355 meters (1,165 feet) from a compressor station in Arkansas exceeded levels predicting a 1-in-10,000 risk of cancer. Formaldehyde also exceeded health-based risk levels near compressor stations in Pennsylvania and Wyoming. [3] The science of childhood exposure to formaldehyde is progressing rapidly. State agencies and international organizations continue to lower exposure limit values and guidelines for formaldehyde. The study results exceed those guidelines. Symptoms reported by community members near the compressors studied mirror the effects of acute formaldehyde exposure, which causes irritation of the eyes, nose, throat, and skin.[4]

These studies and others are summarized in *Hazardous Air Pollutants from Oil and Gas Development in the United States: A Systematic Review of the Peer-Reviewed Literature from 2012-2015*.[5] See also, *Warning Signs Toxic Air Pollution Identified at Oil and Gas Development Sites* by Coming Clean,[6] and *An exploratory study of air emissions associated with shale gas development and production in the Barnett Shale*.[7]

Other studies of emissions of hazardous air pollutants, including formaldehyde and benzene, from compressor stations and their health effects are summarized in the article, *Human Exposure to Unconventional Natural Gas Development: A Public Health Demonstration of Periodic High Exposure to Chemical Mixtures in Ambient Air*.[8] Benzene is another human carcinogen emitted from compressor stations, which has been found in significant levels in air monitoring near natural gas compressor stations.

B. <u>Other Jurisdictions Have Addressed Formaldehyde Emissions from Solar Combustion Turbines.</u>

Other jurisdictions have addressed formaldehyde emissions of proposed Solar combustion turbines by requiring control technologies to reduce emissions. For instance, when TGP submitted its air permit applications to the Pennsylvania Department of Environmental Protection for the Supply Path Head Compressor Station in November 2015, for a Solar Titan 250-30000S Combustion Turbine and a Solar Titan 130 - 20502S Combustion Turbine, it provided estimated formaldehyde emissions, based on data supplied by Solar, and included an oxidation catalyst as a control technology for reduction of VOC and formaldehyde emissions.[9] The application stated:

> The Solar Titan 130 and Solar Mars 100 combustion turbines will be equipped with an oxidation catalyst designed for 90% removal of CO and 40% removal of VOC. Therefore, the CO emission limit will be 2.5 ppmvd corrected to 15% O2. The use of oxidation catalyst may also be effective in reducing organic HAPs; it has also

[3] Macey, et al. Environmental Health 2014, 13:82. Air concentrations of volatile compounds near oil and gas production: a community-based exploratory study. Attachment 2.
[4] *Id*.
[5] Garcia-Gonzales, D. and Shonkoff, S. 2016, PSE Healthy Energy, Oakland, CA. Attachment 3.
[6] Breach, et al. 2014, Coming Clean, Brattleboro, VT. Attachment 12.
[7] Rich, et al. 2014. Journal of the Air & Waste Management Association, 64(1), 61-72. Attachment 16.
[8] Brown, et al. 2015. Journal of Environmental Science and Health Part A, 50, 460–472. Attachment 11.
[9] Excerpt from permit application, Attachment 14.

> been conservatively assumed that the oxidation catalyst will provide 40% control of formaldehyde, although the actual control efficiency may be much higher.

Similarly, when Dominion Resources submitted its permit application for the Buckingham Compressor Station to the Virginia Department of Environmental Quality on September 16, 2015, which is proposed to include four Solar combustion turbines of various sizes, it included formaldehyde emissions data and a formaldehyde emissions control strategy, again using an oxidation catalyst.[10]

Although TGP provided estimated formaldehyde emissions data to the Metro Health Department, the Health Department has not evaluated the accuracy or the potential health impacts of these estimated emissions. Unless TGP can demonstrate that the formaldehyde emissions from the proposed compressor will not result in injury, detriment, nuisance and annoyance, the Department should deny the permit. The Department has also failed to require any controls to reduce formaldehyde emissions, as other recently proposed Solar turbine compressors have been required to include. The permits should be denied or modified after further evaluation.

The Health Department should also address benzene and other HAPs in this permitting process, and unless TGP can demonstrate that HAP emissions from the proposed compressor will not result in injury, detriment, nuisance and annoyance, the Department should deny the permit.

Finally, if the permits are granted, there should be a monitoring requirement for formaldehyde and other HAPs, such as benzene, in the community near the compressor station.

C. Health Impacts Have Been Documented for Residents Near Large Compressor Stations.

Health impacts have been documented for residents near large compressor stations, but TGP did not submit any of these studies for consideration by the Health Department. For instance, the Southwest Pennsylvania Environmental Health Project documented the following health findings for people living near the Minisink Compressor Station in Minisink, New York.[11]

The predominant health impacts reported were:

- Respiratory problems
- Neurological problems
- Dermatological problems
- Overall "quality of life" levels were below normal for half of the respondents when compared to a national standard (SF36).

Residents reported symptoms associated with odors they observed, such as burning eyes and throat, skin irritation, and headaches.[12]

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[10] Excerpt from permit application, Attachment 15.

[11] Southwest Pennsylvania Environmental Health Project 2015. *Summary of Minisink Monitoring Results*. Attachment 4.

[12] Southwest Pennsylvania Environmental Health Project 2015. *Summary on Compressor Stations and Health Impacts*. Attachment 7.

Wilma Subra, an environmental chemist and consultant, compiled information on health symptoms experienced near compressor stations in Texas.[13] Subra reported that 90% of individuals living and working within 2-3 miles of compressor stations experienced odor events and health impacts. The health symptoms reported to be associated with compressors were: burning eyes, nausea, headaches, running nose, sore throat, asthma, sinus problems and bronchitis. Odors experienced by residents near compressor stations were described as: sulfur smell, odorized natural gas, burnt wire, strong chemical-like smell and ether.[14]

When a large compressor station was proposed for Madison County, New York, that county's health department researched the potential health effects of emissions and provided comments about these potential health effects to FERC.[15] Among other things, the Madison County Health Department pointed to a peer-reviewed article, *Investigating Links Between Shale Gas Development And Health Impacts Through A Community Survey Project In Pennsylvania*, as one of the few publications that explicitly addresses health impacts from compressors. The article found:

> In the Pennsylvania study, distance to industrial sites correlated with the prevalence of health symptoms. For example, when a gas well, compressor station, and/or impoundment pit were 1500-4000 feet away, 27 percent of participants reported throat irritation; this increased to 63 percent at 501-1500 feet and to 74 percent at less than 500 feet. At the farther distance, 37 percent reported sinus problems; this increased to 53 percent at the middle distance and 70 percent at the shortest distance. Severe headaches were reported by 30 percent of respondents at the farther distance, but by about 60 percent at the middle and short distances.[16]

Given its authority to deny these air pollution permits, to require the applicant to demonstrate no health impacts, and to impose more stringent permit conditions, the Metro Health Department can and should do much more to protect the health of the residents of Joelton.

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[13] Subra, Wilma. 2009. *Health Survey of Current and Former DISH/Clark Texas Residents*. Earthworks' Oil and Gas Accountability Project. Attachment 17.

[14] See also, Subra, Wilma. *Potential Environmental and Human Health Impacts Associated with the Minisink Compressor Station Millenium Pipeline Company*. Attachment 13.

[15] Madison County, New York Department of Health. 2014, *Comments to the Federal Energy Regulatory Committee Concerning Docket No. CP14-497-000, Dominion Transmission, Inc.*, Attachment 9.

[16] Steinzor, et al. 2013, New Solutions, Vol. 23(1) 55-83. Attachment 18.

D. Fine Particulate Matter Emissions and Their Associated Health Effects Have Not Been Adequately Addressed.

$PM_{2.5}$ health effect thresholds have not been identified. Therefore, there does not appear to be a safe level of exposure below which no health effects occur.[17] Given that there is a substantial interpersonal variability in $PM_{2.5}$ exposure and subsequent harmful effects, it is unlikely that any standard or guideline value will lead to complete protection for everyone against all possible adverse health effects. Population subgroups that may be more sensitive to the effects of $PM_{2.5}$ exposure include infants; older adults (65+ years); individuals with asthma, chronic obstructive pulmonary disorder (COPD) or cardiovascular disease; diabetics; individuals with lower socioeconomic status; and, those with certain genetic polymorphisms. Mortality, and cardiovascular and respiratory morbidity have been associated with both short-and long-term exposure to $PM_{2.5}$.

Acute Exposure

Epidemiologic studies that examined the effect of $PM_{2.5}$ on cardiovascular emergency department (ED) visits and hospital admissions reported consistent positive associations (predominantly for ischemic heart disease and congestive heart failure), with the majority of studies reporting increases ranging from 0.5 to 3.4% per 10 $\mu g/m^3$ increase in $PM_{2.5}$. These effects were observed in study locations with average 24-hour $PM_{2.5}$ concentrations ranging from 7-18 $\mu g/m^3$. Recent epidemiologic studies also report consistent positive associations between short-term exposure to $PM_{2.5}$ and respiratory ED visits and hospital admissions for chronic obstructive pulmonary disease (COPD) and respiratory infections. Positive associations were also observed for asthma ED visits and hospital admissions for adults and children combined.

Chronic Exposure

Long-term health studies have shown that when annual mean concentrations $PM_{2.5}$ are in the range of 11–15 $\mu g/m^3$, health effects can be expected. There is evidence that long-term exposure to $PM_{2.5}$ can cause an increase in mortality (i.e., all cause and cardiovascular) with long term average concentrations of 10–32 $\mu g/m^3$; for respiratory symptoms and incident asthma, as well as respiratory hospitalizations, at long-term average $PM_{2.5}$ concentrations of 9.7–27 $\mu g/m^3$; for developmental outcomes, specifically reductions in birth weight, at long-term average $PM_{2.5}$ concentrations of 11–19.8 $\mu g/m^3$; and pre-term birth at concentrations as low as 5.3 $\mu g/m^3$.

Monitoring studies near large compressor stations have found high levels of $PM_{2.5}$ and have found high variability in ambient air concentrations making modeling based on annual and even 24-hour averages inaccurate for predicting health effects. For instance, the Southwest Pennsylvania Minisink Compressor Study using 5 monitors around a compressor station found:

- The average hourly values for the monitors ranged from 4 to 20 ug/m^3. The monitor that recorded the lowest average $PM_{2.5}$ value was separated from the compressor station by 2 valleys, likely showing the effect of topography.

[17] This discussion of $PM_{2.5}$ health effects is based on the ATSDR Health Consultation, Brooklyn Township $PM_{2.5}$, Brooklyn Township, Susquehanna County, Pennsylvania, April 22, 2016. Citations are omitted. Attachment 10.

- There were times when more than one monitor showed unusually high $PM_{2.5}$ values.
- One home had one 24-hour period with an average of 64 ug/m^3. This shows how the standard 24-hour averaging time can mask peak exposures.
- Periods of low wind speed and nighttime (especially early morning hours) were found to increase potential exposures to $PM_{2.5}$, and any associated chemicals, at residences near the compressor station. Values during these periods ranged between 31 and 426 ug/m^3.
- Episodic high levels of $PM_{2.5}$ outside multiple homes occurred within similar time frames seven times over 59 days based on hourly averages.

The Agency for Toxic Substances and Disease Registry reviewed $PM_{2.5}$ monitoring levels collected at residences near the Williams Central natural gas compressor station in Brooklyn Township, Susquehanna County, Pennsylvania, and came to the following conclusions:[18]

- Conclusion 1: (Short-Term Exposures) Exposure to maximum levels of $PM_{2.5}$ may be harmful to unusually sensitive populations, such as those with respiratory or heart disease, but are not at levels that are a concern to the general population.
- Conclusion 2 (Chronic Exposures) The estimated annual average $PM_{2.5}$ concentration of 15 to 16 μg/m^3 may be harmful to the general population and sensitive subpopulations, including the elderly, children, and those with respiratory or heart disease.

TGP has not provided data on $PM_{2.5}$ emissions from its proposed compressor station in Joelton. Instead, the applicant lumped all PM together in its emissions estimates. There is a separate NAAQS for $PM_{2.5}$, which takes into account the more serious health effects of fine particulate matter. The NAAQS for $PM_{2.5}$ is 35 μg/m^3 for a 24-hour averaging time and 12 μg/m^3 for an annual averaging time.

The information provided by TGP does not allow the Metro Health Department to adequately assess the potential health impacts of $PM_{2.5}$ emissions or whether the TGP compressor station will prevent the attainment and maintenance of the NAAQS in the area. The evaluation of $PM_{2.5}$ emissions performed by the Department and discussed in the "TGP Modeling Summary Document," was inadequate for the following reasons:

- The Department relied upon "Significant Impact Levels," ("SIL") for $PM_{2.5}$, citing 40 C.F.R. § 61.165. First, this is the wrong citation. The SIL rule still remaining after the U.S. D.C. Court of Appeals vacated exemptions from PSD review where the SIL was not exceeded is found in 40 C.F.R. § 51.165(b). *See Sierra Club v. EPA*, 705 F.3d 458 (D.C. Cir. 2013), which vacated 40 C.F.R. §§ 51.166(k), 52.21(k). Second, EPA is in the process of modifying its SIL approach and has issued a *Draft Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program* on August 1, 2016, (Attachment 19), which has SIL numbers for PM2.5 of 1.2 μg/m^3 for 24 hour averaging and 0.2 μg/m^3 for annual averaging. The annual averaging number proposed is reduced from 0.3 μg/m^3.

[18] ATSDR Health Consultation, Brooklyn Township PM2.5, Brooklyn Township, Susquehanna County, Pennsylvania, April 22, 2016. Attachment 10.

- The Department did not follow EPA guidance in its modeling of $PM_{2.5}$ and comparison to the SIL or to the NAAQS. *See, Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance for $PM_{2.5}$ Permit Modeling," May 20, 2014* (Attachment 20). Most importantly, the guidance requires the inclusion of both primary and secondary $PM_{2.5}$ emissions. Secondary emissions include SO_2 and NO_x, which contribute to $PM_{2.5}$.[19]
- The PM emissions projected by TGP are based on the AP-42 emissions factor for Natural Gas Fired Turbines. TGP did not submit any actual emissions data for PM_{10} or $PM_{2.5}$. The emissions factor in AP-42 is for a source controlled by water stream injection and is only for PM_{10}. TGP should be required to submit actual emissions data for $PM_{2.5}$, instead of using the AP-42 emissions factor. The permits should limit $PM_{2.5}$ instead of only PM_{10}.

The Department should evaluate $PM_{2.5}$ emissions using actual emissions data instead of the AP-42 PM_{10} emission factor and should comply with the EPA Guidance by including SO_2 and NO_x. Furthermore, given that health effects in sensitive populations exist at levels lower than the NAAQS, and the background levels in Davidson County are already quite high, the Health Department should be concerned about increases contributed by the proposed TGP compressor station even if they are not shown to cause an exceedance of the NAAQS.

E. The Joelton Compressor Station Will Add Significantly to NOx and VOC Emissions in Metro Nashville Threatening Attainment and Maintenance of the New Ozone Standard.

CCSE adopts and incorporates by reference the comments submitted by the Southern Environmental Law Center from Bill Powers, P.E., *Review of Reasonableness of NOx Emission Limits for Two Titan Turbines at Proposed Joelton, Tennessee Compressor Station*, July 26, 2016. In Section III of his report Mr. Powers points out that the primary and secondary ozone standards were lowered to 0.070 ppm in 2015, a decrease from the 2008 ozone standard of 0.075 ppm. The 2008 standards will be revoked in 2018-2019, and the 0.070 ppm standard will be incorporated into State Implementation Plans shortly thereafter. Although Davidson County remains in attainment based with the 2008 ozone standard, 8-hour ozone levels have been exceeded 0.070 ppm five times in the past two years, indicating that Davidson County faces challenges achieving continuous compliance with the 0.070 ppm ozone standard, even at the current emissions rate.

Mr. Powers also points out that the Joelton Compressor Station would add a significant quantity of additional NOx and VOC emissions from point sources of fuel combustion in Davidson County. NOx and VOC emissions from point sources of fuel combustion would both increase 22 percent.

Despite the fact that a single natural gas compressor station does not automatically trigger PSD review for ozone unless NOx and VOC emissions exceed 250 tons per year, the proposed significant increase in NOx and VOC emissions from a readily controlled stationary source should be fully evaluated for its impact on attainment and maintenance of the new ozone standard before any action is taken on the construction permit. The need to conduct such evaluation is heightened by the proposal for the Cane Ridge compressor station in Davidson County, which would also significantly increase emissions of NOx and VOCs.

[19] Under the Department's Regulation 3-1(zz), "Regulated NSR pollutant" includes SO_2 and NO_x as precursors to $PM_{2.5}$.

The amendment to Section 10.56.020.A.1 provides the Department with the authority to require the applicant to conduct an evaluation of the impact of the new source emissions on the attainment and maintenance of air quality standards. The Department should require this evaluation for the proposed TGP compressor station and evaluate its effects on attainment and maintenance of the new ozone standard together with the proposed Cane Ridge compressor station.

III. THE OPERATING PERMIT SHOULD NOT EXCLUDE ENFORCEMENT OF "LOCALLY-ENFORCEABLE ONLY REQUIREMENTS."

The Operating Permit should not exclude enforcement of "locally-enforceable only requirements" and, in particular, should not exclude Section 1.21, implementing Section 10.56.170 of the Air Pollution Code.

Section 1.2(a) of the Operating Permit states:

> The permittee must comply with all conditions of this permit. Any permit noncompliance, excluding locally enforceable-only requirements, constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation, and reissuance, or modification; or for denial of a permit renewal application (emphasis added).

Section 1.21 of the Operating Permit incorporates the text of Section 10.56.170 of the Air Pollution Code for Emission of Gases, Vapors or Objectionable Odors, and contains the statement "[t]his condition is locally enforceable only." It is the only condition of the Operating Permit designated as "locally enforceable only."

Section 10.56.170 is part of the State Implementation Plan approved by EPA. See 40 C.F.R. § 52.2220, Table 5. It was not designated as "locally enforceable only" at the time of EPA's approval in 1996. See 61 FR 47055 (Sept. 6, 1996).

Even if Section 10.56.170 is not "federally enforceable," it still must be enforceable in an Operating Permit issued by the Department. It is clearly one of the provisions of Chapter 10.56 that is defined as "legally enforceable:"[20]

> "Legally Enforceable" means all limitations and conditions which are enforceable by the Director and the Administrator, which includes all provisions of this Chapter, any provisions of the State Implementation Plan, and any permit requirements.

Section 10.56.040A. for Operating Permits requires the Director to deny or modify an operating permit if a source will operate in violation of Chapter 10.56, which includes Section 10.56.170.

[20] The definition of "legally enforceable" was also approved as part of the SIP by EPA. See 40 C.F.R. § 52.2220, Table 5.

There will be only one Operating Permit for the compressor station, and it must be enforced by Metro in its entirety. There is no legal basis in the Air Pollution Code or regulations for excluding enforcement of “locally-enforceable only requirements” from the Operating Permit.

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TECHNICAL PAPER

An exploratory study of air emissions associated with shale gas development and production in the Barnett Shale

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*Information regarding air emissions from shale gas extraction and production is critically important given production is occurring in highly urbanized areas across the United States. Objectives of this exploratory study were to collect ambient air samples in residential areas within 61 m (200 feet) of shale gas extraction/production and determine whether a "fingerprint" of chemicals can be associated with shale gas activity. Statistical analyses correlating fingerprint chemicals with methane, equipment, and processes of extraction/production were performed. Ambient air sampling in residential areas of shale gas extraction and production was conducted at six counties in the Dallas/Fort Worth (DFW) Metroplex from 2008 to 2010. The 39 locations tested were identified by clients that requested monitoring. Seven sites were sampled on 2 days (typically months later in another season), and two sites were sampled on 3 days, resulting in 50 sets of monitoring data. Twenty-four-hour passive samples were collected using summa canisters. Gas chromatography/mass spectrometer analysis was used to identify organic compounds present. Methane was present in concentrations above laboratory detection limits in 49 out of 50 sampling data sets. Most of the areas investigated had atmospheric methane concentrations considerably higher than reported urban background concentrations (1.8–2.0 ppm_v). Other chemical constituents were found to be correlated with presence of methane. A principal components analysis (PCA) identified multivariate patterns of concentrations that potentially constitute signatures of emissions from different phases of operation at natural gas sites. The first factor identified through the PCA proved most informative. Extreme negative values were strongly and statistically associated with the presence of compressors at sample sites. The seven chemicals strongly associated with this factor (*o*-xylene, ethylbenzene, 1,2,4-trimethylbenzene,* m- *and* p-*xylene, 1,3,5-trimethylbenzene, toluene, and benzene) thus constitute a potential fingerprint of emissions associated with compression.*

Implications: Information regarding air emissions from shale gas development and production is critically important given production is now occurring in highly urbanized areas across the United States. Methane, the primary shale gas constituent, contributes substantially to climate change; other natural gas constituents are known to have adverse health effects. This study goes beyond previous Barnett Shale field studies by encompassing a wider variety of production equipment (wells, tanks, compressors, and separators) and a wider geographical region. The principal components analysis, unique to this study, provides valuable information regarding the ability to anticipate associated shale gas chemical constituents.

Introduction

With advances in horizontal drilling and hydraulic fracturing techniques, production of natural gas from hydrocarbon-rich shale formations, or shale gas, is bringing drilling and production operations to regions of the United States that have seen little or no similar activity in the past (Lev-On and Levy, 2012). Over the last several years, natural gas drilling and production have become commonplace in several U.S. shale formations: the Marcellus Shale in Pennsylvania; the Barnett and Eagle Ford shales in Texas; and the Niobrara Shale in Colorado. In particular, exploration and production of unconventional natural gas in the Texas Barnett Shale increased dramatically in the last decade, with the number of shale gas wells increasing from 726 in 2000 to 14,886 in 2010 (Texas Railroad Commission, 2012). Shale gas extraction and production in the Texas Barnett Shale has generated considerable interest in potential environmental impacts.

Shale gas extraction and processing involves numerous processes, including well development (pad preparation, well drilling, and well completion, which includes hydraulic fracturing and flowback); gas production; gas processing (separation, dehydration, desulfurization); condensate storage; gas compression; and gas transmission (Armendariz, 2009; McKenzie et al., 2012). In terms of air pollutants, potential compounds of concern associated with these processes include

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- criteria air pollutants (particulate matter, nitrogen oxides, sulfur oxides, and carbon monoxide), due to compressor engines (Armendariz, 2009; Bar-Ilan et al., 2008; Eastern Research Group, 2011);
- volatile organic compounds, many of which are precursors of ground-level ozone formation, as well as hazardous air pollutants, including benzene and formaldehyde (Boyer, 2010; Eastern Research Group, 2011; Hendler et al., 2009; Olaguer, 2012; Pring et al., 2010; Safitri et al., 2011; XTO Energy, 2010);
- methane, a greenhouse gas (Dedikov et al., 1999; Eastern Research Group, 2011; U.S. Environmental Protection Agency [EPA], 1996, 2006; Hendler et al., 2009; Howarth et al., 2011; Pring et al., 2010; Safritri et al., 2011; XTO Energy, 2010); and
- odor-causing compounds, such as hydrogen sulfide and other reduced sulfides (Coward and Barron, 1983; Dawodu and Meisen, 1989; Eapi et al., 2013; Mazumdar et al., 1974; Kunkel, 1977; Tuan et al., 1995; Yuhua et al., 2006).

Previous studies of natural gas development and production on air quality

With the recent increase in natural gas production volume, more studies are examining the impact of natural gas operations on air quality. Katzenstein et al. (2003) conducted two intensive surface air discrete sampling studies over the Anakarko Fossil Fuel Basin in the southwestern United States, and found substantial regional atmospheric methane and nonmethane hydrocarbon pollution over parts of Texas, Oklahoma, and Kansas attributed to the oil and gas industry. The study suggested that total U.S. natural gas emissions may have been underestimated. This study was conducted prior to production volume in the Barnett Shale increasing substantially. Schnell et al. (2009) observed high wintertime ozone levels near the Jonah-Pinedale Anticline natural gas field in western Wyoming. Petron et al. (2012) analyzed daily air samples collected at a tall-tower monitoring site, as well as on-road survey data, for the Denver-Julesburg Fossil Fuel Basin in the Colorado Northern Front Range, which contains over 20,000 active natural gas and condensate wells. They found that a mix of natural gas venting emissions and flashing emissions from condensate tanks can explain observed alkane ratios. McKenzie et al. (2012) found that residents living <½ mile from shale gas wells in Garfield County, Colorado, were at greater risk for health impacts, due to subchronic exposure to trimethylbenzenes and xylenes, and cumulative cancer risk due to benzene. Stephenson, Valle, and Riera-Palou (2011) compared greenhouse gas emissions from conventional natural gas and shale gas production. They estimated that shale gas typically has a well-to-wheel emission intensity 1.8–2.4% higher than conventional gas, arising mainly from higher methane releases during well completion. Burnham and Clark (2012) compared life-cycle greenhouse emissions from use of shale gas and conventional natural gas. Their base case found that shale gas life-cycle emissions are 6% lower than conventional natural gas. However, the range in values for shale and conventional gas overlapped, so there was statistical uncertainty whether shale gas emissions were indeed lower than conventional gas.

Within Texas, Burklin and Heaney (2006) of Eastern Research Group conducted a field survey of natural gas compressor engine sizes and types in the eastern part of Texas for the Houston Advanced Research Center. They found that 50–73% of the well-head engine capacity in East Texas is composed of engines greater than 500 hp, depending on the region. In a project conducted for the Texas Environmental Research Consortium, Hendler of URS Corporation and colleagues (2009) measured emissions from oil and condensate storage tanks in East Texas by directly monitoring the flow rates of gases escaping from storage tank vents and sampling the vent gases for chemical composition. The study included measurements from 11 condensate tank batteries in Denton County and 2 in Parker County in North Texas.

Armendariz (2009) estimated emissions of volatile organic compounds (VOCs), nitrogen oxides, hazardous air pollutants (HAPs), methane, carbon dioxide, and nitrous oxide from natural gas drilling and production in the Barnett Shale. His study assimilated information from a variety of previous studies (EPA AP-42 emission factors, the URS study, and a Gas Research Institute/EPA study) in order to estimate emissions from compressor engines; condensate tanks; well drilling, hydraulic fracturing pump engines, and well completions; and production, process, and transmission fugitives. Among the natural gas sources, compressor engines and condensate tanks were found to be the largest sources of smog-forming compounds and hazardous air pollutants. Compressor engines and fugitive emissions from all source types were found to be the largest sources of greenhouse gas emissions.

The Fort Worth Natural Gas Air Quality Study (2011), conducted by Eastern Research Group under contract to the City of Fort Worth, surveyed 388 sites including 375 well pads, eight compressor stations, one gas processing plant, a saltwater treatment facility, a drilling operation, a fracking operation, and a completion operation. Repeat visits were conducted at two sites. At these 388 sites, measurements were conducted using an infrared (IR) camera (detects large emission sources with concentrations of methane, ethane, propane, and butane >10,000 ppm) and a toxic vapor analyzer that measures hydrocarbons with concentrations as low as 0.5 ppm. If the IR camera identified high levels of emissions, then a high-flow sampler was used to capture gas emitting from a component. At 164 locations, Summa Passivated Stainless Steel Canisters were used to collect gas samples from selected emission points for methane, VOC, and HAP analysis. The study found that low-toxicity pollutants (e.g., methane, ethane, propane and butane) accounted for approximately 98% of the citywide emissions. However, several pollutants with relatively high toxicities (e.g., benzene) were also emitted, although in considerably lower quantities. For the relatively few sites with multiple large compressor engines, the modeling analysis found some locations beyond the city's required 600-foot setback distance to have estimated acrolein and formaldehyde concentrations greater than protective health-based screening levels published by the Texas Commission on Environmental Quality.

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This study encompasses a wider variety of production equipment (wells, tanks, compressors, and separators) than several of the previous studies, and a wider geographical region (seven counties) compared with the Fort Worth study. The principal components analysis (PCA) is unique to this study and provides preliminary information regarding the ability to anticipate associated chemical constituents.

Study objectives

The objectives of this exploratory study were to answer the following questions:

(1) What chemicals are present at what concentrations in ambient air samples in residential areas in the DFW Metroplex near shale gas wells?
(2) Are concentrations of chemicals associated with methane, the primary product of shale gas production?
(3) Is there a relationship among the various chemicals present in residential ambient air samples near shale gas wells?
(4) Do patterns of correlation among particular compounds provide signatures of emissions associated with different technological equipment or processes of shale gas well extraction and production operations?

Experimental Methods

Field sampling

Ambient air monitoring in residential areas near natural gas production facilities was performed using certified sterilized evacuated stainless steel 6-L Summa canisters with 24-hr flow regulators (certified mass-flow 24-hr meter). The flow valves were regulated to allow for continuous sampling over a 24-hr period.

Fifty ambient air sampling events occurred in residential areas where shale gas extraction and production was occurring in six counties in the Dallas/Fort Worth (DFW) Metroplex from 2008 to 2010. In all, 39 separate locations were sampled, resulting in 50 sets of monitoring data. Nine locations were sampled more than once during the time period, with seven locations monitored twice and two were monitored three times during the time period. Typically, multiple sampling events at the same location were performed at different times of the year and therefore allowed for seasonal comparison of air composition. The locations were identified by clients that requested monitoring. Twenty-four-hour passive samples were collected using summa canisters.

Figure 1 identifies general location of sampling sites in DFW Metroplex. Of the 39 locations, 20 locations were identified as being in low-density residential areas (5–10-acre lots) with minimal potential for any other confounding source emissions other than light transportation emissions; 8 monitoring locations were in higher-density residential areas with little, if any, potential for confounding source emissions other than light transportation emissions; and 2 of the monitoring locations were in residential areas with potential confounding sources present. One of the locations was in the general location of a landfill, which was possibly a contributing factor for presence of methane; however,

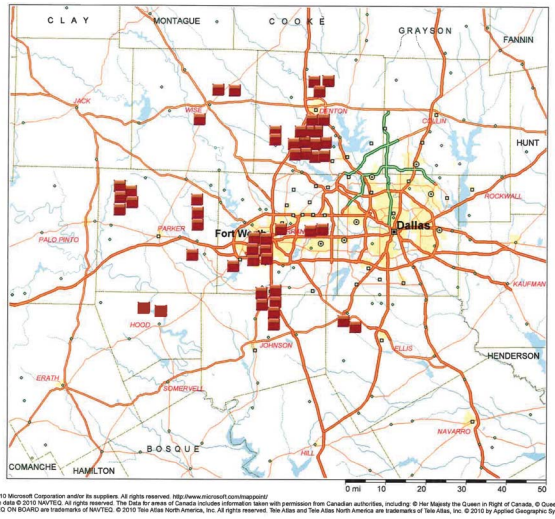

Figure 1. Sampled locations in DFW Metroplex.

this particular location was the single instance of no methane detected. The other location was in the general vicinity of an airport (within 2 miles). To quantity potential methane emissions from an airport, fuel type, aircraft type, engine type, engine load and altitude of aircraft, and air traffic must be known. Detailing of emission sources to this degree was outside the scope of this paper.

Sampling procedures followed American Society for Testing and Materials (ASTM) Method D-1357-95 (2011), *Standard Practice for Planning the Sampling of the Ambient Atmosphere.* Canister locations were verified with global positioning system (GPS) coordinates. A certified laboratory (GD Air, Plano, TX) conducted three analytical tests on the canister samples using a Hewlett-Packard (Agilent; Santa Clara, CA) gas chromatograph/mass spectrometer: EPA Compendium Method Toxic Organics (TO-14A), Light Hydrocarbons, and Tentatively Identified Compounds (TICs). The TO-14A test is performed to capture a broad range of volatile organic compounds that have been determined to be stable when stored in pressurized canisters; however, it is not effective for lower-chain hydrocarbons C1–C6. The Light Hydrocarbon test is able to detect lower-chain hydrocarbons (C1–C6). This would include compounds of ethane, methane, propane, and butane, which are smaller hydrocarbons. Identification of Tentatively Identified Compounds allows reporting of compounds that the instrumentation can detect but that the analysis is not targeting specifically.

Equipment at natural gas production sites can vary widely. In order to evaluate potential emission sources, equipment at pad sites nearest each residential sampling site and also present in the general area was inventoried at the time of monitoring or shortly thereafter. To determine the proximity of the equipment to each sampling location, three circular zones were established at radii of 61 m (200 feet), 610 m (2000 feet), and 1.6 km (1 mile). Equipment was inventoried within the radii, and any potential major contributing source related to natural gas was noted. Equipment inventoried included the number of wells, tanks, compressors, and separators present within each radius. Table 1

Table 1. Equipment and zones of influence

			Equipment within 61 m of Sampling Site				Equipment within 610 m of Sampling Site				Equipment within 1.6 km of Sampling Site			
County	Site	Times Sampled	No. of Wells	No. of Tanks	No. of Comp.	No. of Sep.	No. of Wells	No. of Tanks	No. of Comp.	No. of Sep.	No. of Wells	No. of Tanks	No. of Comp.	No. of Sep.
Parker	A	1	0	0	0	0	4	6	9	1	14	18	18	3
	B	1	0	0	0	0	4	6	9	1	14	18	18	3
	C	1	0	0	0	0	0	0	9	1	10	12	18	3
	D	2	0	0	0	0	0	0	0	0	8	6	2	1
	E	1	0	0	0	0	0	0	0	0	8	6	2	1
	F	1	0	0	0	0	0	0	0	0	8	6	2	1
	G	1	0	0	0	0	0	0	0	0	2	4	1	2
	H	1	1	0	0	0	1	0	0	0	1	0	0	0
		9												
Tarrant	A	2	0	0	0	0	0	0	0	0	2	2	0	0
	B	2	0	0	0	0	0	0	0	0	2	2	0	0
	C	2	0	0	0	0	0	0	0	0	2	2	0	0
	D	1	1	0	0	0	5	10	3	2	21	40	11	8
	E	1	1	0	0	0	1	0	0	0	3	4	1	1
	F	1	1	0	0	0	1	0	0	0	2	2	1	1
	G	1	1	0	0	0	4	2	1	1	4	4	2	2
		10												
Johnson	A	1	0	0	4	2	1	4	4	2	1	4	4	2
	B	1	0	0	4	2	1	4	4	2	1	4	4	2
	C	1	0	0	0	0	1	2	0	0	8	14	4	2
	D	2	0	0	0	0	1	2	0	0	8	14	4	2
	E	1	2	12	2	2	2	12	2	2	5	12	2	2
	F	1	1	2	0	0	1	2	0	0	1	2	0	0
		7												
Denton	A	1	0	0	0	0	4	4	9	6	4	4	9	6
	B	1	0	0	0	0	4	4	9	9	4	4	9	6
	C	2	0	0	0	0	0	0	0	0	3	4	9	6
	D	3	0	0	0	0	2	2	6	1	4	4	9	6
	E	1	0	0	0	0	2	2	6	1	4	4	9	6
	F	1	0	0	0	0	2	2	4	6	4	4	9	6
	G	1	0	1	1	1	2	4	5	6	4	4	9	6
	H	1	0	0	0	0	2	0	0	0	2	0	0	0
	I	1	0	0	0	0	2	0	0	0	2	0	0	0
	J	1	0	0	0	0	0	0	0	0	5	6	4	2
	K	1	4	4	1	1	6	6	1	1	24	24	4	6
	L	2	0	0	0	0	2	0	0	0	6	6	0	1
	M	3	0	0	0	0	2	2	0	0	22	14	5	8
	N	1	2	2	0	0	6	0	1	1	12	12	12	4
		20												
Somer-ville	A	1	0	0	0	0	0	0	0	0	4	6	2	0
		1												
Wise	A	1	2	4	0	0	2	4	0	0	4	8	2	0
	B	1	0	0	0	0	0	0	0	0	4	8	2	0
	C	1	2	4	0	0	2	4	0	0	4	8	2	0
		3												

Notes: Comp. = compressors; Sep. = separators.

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summarizes the equipment found within each radius for each sampling location.

Meteorological conditions on the dates of testing were retrieved from the National Climatic Data Center Quality Controlled Local Climatological Data Web site (www.ncdc.noaa.gov), using the airport closest to each sampled locations. Ambient air monitoring occurred throughout the year and thus included seasonal variations. Temperatures varied from 26 to 104 °F, and wind speeds varied from 0 to 26 mph. Although variations in wind speed and atmospheric turbulence would have impacted the magnitude of concentrations measured, these variations would not have impacted the ratios of compounds measured, because molecules of different kinds would have been diluted and dispersed similarly. For example, if the concentration of benzene was twice that of toluene at a given location on a day with high wind speeds and high atmospheric turbulence, the concentration of benzene would still be twice that of toluene at that same location on a day with low wind speeds and low levels of atmospheric turbulence, assuming that the source was still emitting benzene at double the rate of toluene. The magnitude of the concentrations would differ on the days with high and low wind speeds and turbulence, but the ratio of the benzene to toluene concentration would still be 2. This means that the correlation relationships found between chemicals in this study would have been the same even if the meteorology on the days sampled had been different.

Statistical analysis

As discussed above, there are few data sets documenting the potential air emissions of shale gas development and production. Given the logistical difficulties of obtaining representative samples, this paper presents an exploratory analysis that raises hypotheses to be explored in further work. In keeping with this exploratory approach, a well-understood analytical approach was applied to generate hypotheses, in part because alternative approaches mostly require larger data sets to be effective.

Summary statistics were calculated to determine basic information related to chemical constituents. The minimum value, maximum value, median value, mean value, and standard deviation for each chemical were determined. The minimum value for each compound is its gas chromatograph detection limit.

Further statistical analysis was performed using a Pearson's product-moment correlation coefficient (Pearson's correlation coefficient or Pearson's r) to determine the strength of relationship between the concentration of methane and the concentration of other volatile organic compounds. For this analysis, all nondetect observations were coded to the detection limit. The concentration data were not normally distributed for many chemicals, so all concentrations were transformed to natural logarithms prior to calculating correlations, and prior to other analyses.

To provide a more in-depth analysis of the relationships of chemicals to methane and chemicals to each other, a principal components analysis (PCA) was performed using a statistical software package. With PCA, data are transformed from a large set of related variables to a smaller set of uncorrelated variables. The newly created variables are called principal components (PCs), or factors. These factors are interpreted as indicating latent, unmeasured variables that explain linearly correlated patterns in the original variables. As such, factors can then be analyzed in relation to other measured variables that are potential predictors of variation in the original variables. The PCA was performed on data that were edited to contain only chemicals measured above detection limits in at least 10% of samples (i.e., at least five detectable measurements). The average number of detected values in the edited set of 36 chemicals was 19, and the median was 14. The PCA was performed on the correlation matrix of the selected data.

An analysis of variance (ANOVA) F test was then performed to test the null hypothesis that sample site scores for PCA factor 1 and factor 2 are independent of particular phases and equipment associated with nearby gas well operations.

Results and Discussion

Air sampling confirmed the presence of methane and 101 other chemicals in the atmosphere in and around sampled residential sites in the DFW Metroplex where unconventional shale gas extraction and production was the predominant emission activity. Table 2 provides summary statistics for the chemical compounds measured. Approximately 20 of the 101 (20%) chemicals identified are listed as HAPs according to the EPA, including benzene, 1,3-butadiene, carbon disulfide, carbonyl sulfide, chloromethane, tetrachloroethane, toluene, and xylene.

Methane was present in concentrations above laboratory detection limits in 98% of the sampling events where methane was sampled. Most of the areas investigated had atmospheric methane concentrations considerably higher than urban background concentrations (1.8–2.0 ppm_v) (National Oceanic and Atmospheric Administration [NOAA], 2006).

Benzene was identified as present in 38 of 50 sites sampled (76%). Many of the other chemicals had a high number of nondetects: many of the high maximums corresponded to a single sampling event where a natural gas well was experiencing a pressure malfunction, causing an uncontrolled emission event to the atmosphere. Trimethylbenzene specifically had several high-concentration observations recorded; however, the maximum value corresponded to the same ambient air sampling event with the pressure malfunction.

Table 3 compares maximum, median, and mean values for this study with those for three other studies from Colorado (McKenzie et al., 2012; Petron et al., 2012) and the U.K. (Hopkins et al., 2005). For methane, values from this study were higher than for the Petron study, which reported median methane levels from 1.81 to 1.89 ppm, which are typical background levels. For the alkanes ethane, propane, butane, pentane, and hexane, mean values from this study are generally comparable to values from the three other studies. For the other compounds, which include a number of aromatics (benzene, ethylbenzene, toluene, xylenes, trimethylbenzenes), maximum, median, and mean values from this study were generally higher than for the other studies. The right-hand-most column in Table 3 gives ambient average values for six of the compounds for California (because data were not available for Texas), to provide a rough idea of what background concentrations may be. The

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Table 2. Summary statistics

CAS No.	Chemical	Min (ppb_v)	Max (ppb_v)	Median (ppb_v)	Mean (ppb_v)	*SD*	No. of ND
74828	Methane (ppm_v)	1.9	457	2.7	11.99	63.58	1
71432	Benzene	0.6	592	0.89	18.53	83.75	11
67663	Chloroform	0.2	2.58	0.3	0.45	0.46	46
74873	Chloromethane/Methyl chloride	0.25	5.33	0.6	0.68	0.71	17
75718	Dichlorodifluoromethane (F12)	0.25	1.13	0.45	0.48	0.17	9
76142	Dichlorotetrafluoroethane (F114)	0.2	1	0.3	0.36	0.17	47
107062	1,2-Dichloroethane (EDC)	0.2	1	0.3	0.34	0.15	49
75092	Dichloromethane/Methylene chloride	0.2	1	0.3	0.34	0.15	49
100414	Ethylbenzene	0.2	113	0.53	4.42	16.03	23
87683	Hexachlorobutadiene	0.25	2.6	0.7	0.73	0.46	42
100425	Styrene	0.2	43.4	0.37	1.91	6.22	26
79345	1,1,2,2-Tethrachloroethane	0.2	2.06	0.3	0.37	0.28	49
127184	Tetrachloroethene (PCE)	0.2	2.43	0.3	0.33	0.39	47
108883	Toluene/Methylbenzene	0.34	276	2.55	19.45	48.77	3
108678	1,3,5-Trimethylbenzene	0.2	9.95	0.59	1.43	2.12	25
95636	1,2,4-Trimethylbenzene	0.2	60.4	0.4	3.45	10.79	27
120821	1,2,4-Trichlorobenzene	0.28	13.5	0.67	1.12	1.93	10
79016	Trichloroethene (TCE)	0.2	60.9	0.3	1.58	8.48	47
75694	Trichlorofluoromethane (F11)	0.2	1	0.3	0.34	0.15	45
1330207	*m*- and *p*-Xylene	0.25	221	1.68	15.69	43.1	7
95476	o-Xylene	0.2	39.4	0.85	3.19	6.7	15
75150	Carbon disulfide	0.7	103	4	11.75	20.5	22
463581	Carbonyl sulfide	0.3	36.7	1.41	4.22	7.1	40
624920	Dimethyl disulfide	0.3	200	1.93	15	31.56	29
20333395	Methyl ethyl disulphide	0.3	145	1.78	11.18	24.27	31
611143	Ethylmethylbenzene	0.3	42.8	1.4	3.15	6.74	47
2179604	Methyl propyl disulfide	0.3	41.6	1.4	2.59	5.71	49
110816	Diethyl disulfide	0.3	32.7	1.5	3.15	5.92	43
53966362	Ethyl, methylethyl disulfide	0.3	46.7	1.4	3.68	8.87	46
3658808	Dimethyl trisulfide	1.2	46.3	1.52	8.02	14.86	37
30453317	Ethyl *n*-propyl disulfide	0.3	25.2	1.4	2.25	3.48	48
95636	Trimethylbenzene	0.3	366	1.4	15.18	58.39	46
11020214	Undecane	0.3	72	1.4	3.05	9.88	49
2082613	1-Methyl propenylbenzene	0.3	51	1.4	2.63	6.96	49
112403	Dodecane	0.3	29	1.4	2.19	3.91	49
767599	1-methyl-1H Indene	0.3	79	1.4	3.19	10.86	49
768490	2-Methyl propenyl benzene	0.3	95.9	1.4	3.53	13.22	49
103651	Propylbenzene	0.3	23.5	1.4	2.08	3.16	49
25340174	Diethylbenzene	0.3	93.4	1.4	4.14	13.56	48
19876	Methyl-methylethylbenzene/methylcumene	0.3	84.7	1.4	3.31	11.65	48
110189	Tetramethylbenzene	0.3	36.4	1.4	2.76	5.69	48
91203	Napthalene/Trimethylbicyclo[2.2.1]heptane	0.3	30.3	1.4	2.5	4.27	47
109068	Methylpyridine	0.3	210	1.4	5.81	29.18	49
108485	Diemethyl pyridine/Aldrich	0.3	48.2	1.4	2.56	6.43	49
100710	Ethylpyridine	0.3	69.4	1.4	3	9.52	49
78784	2-Methylbutane	0.3	3620	1.4	88.04	507.51	44
109660	Pentane	0.3	198	1.4	7.73	28.59	45
108087	2,4-Dimethylpentane	0.3	50	1.4	2.61	6.82	49
963772	Methyl cyclopentane	0.3	22	1.4	2.4	3.75	48
561764	2-Methylhexane	0.3	35.3	1.4	2.71	5.44	48
565693	2,3-Dimethylpentane	0.3	98	1.4	3.57	13.51	48
589344	3-Methylhexane	0.3	2300	1.4	49.02	321.63	46

(*Continued*)

Table 2. (Cont.)

CAS No.	Chemical	Min (ppb_v)	Max (ppb_v)	Median (ppb_v)	Mean (ppb_v)	*SD*	No. of ND
108872	Methylcyclohexane	0.3	38	1.4	2.42	5.15	48
540841	2,2,4-Trimethylpentane	0.3	17	1.4	1.95	2.29	49
	C3 Hydrocarbon	0.3	51.4	1.4	5.57	9.7	42
	C4 Hydrocarbon	0.3	137	1.4	6.6	21.61	44
	C5 Hydrocarbon	0.3	6780	1.65	145.24	947.97	28
	C6 Hydrocarbon	0.3	294	1.6	18.06	51.83	30
	C7 Hydrocarbon	0.3	2390	1.5	56.64	333.96	38
	C8 Hydrocarbon	0.3	1420	1.5	39.44	199.78	36
	C9 Hydrocarbon	0.3	761	1.41	19.78	106.43	42
	C10 Hydrocarbon	0.3	191	1.5	11.75	30.7	37
	C11 Hydrocarbon	0.3	53.6	1.4	3.92	9.51	46
	C12 Hydrocarbon	0.3	395	5	23.81	59.1	22
	C13 Hydrocarbon	0.3	231	1.57	10.88	35.03	40
76641	Acetone	0.3	20.7	1.4	2.04	2.81	49
74986	Propane (ppm_v)	1	62.9	1.4	2.97	8.65	48
106978	Butane (ppm_v)	1	69	1.4	2.95	9.45	48
74840	Ethane (ppm_v)	1	34.6	1.4	2.24	4.66	49
75285	Isobutane	0.3	34	1.5	3.95	6.38	38
79925	Camphene	0.3	5.2	1.4	1.65	0.81	49
592574	Cyclohexadiene	0.3	7.1	1.4	1.76	1.1	49
103651	Propynylbenzene	0.3	7.2	1.4	1.74	1.13	49
226666	Diethyl trisulfide	0.3	8.23	1.41	2.14	1.62	43
513359	Methylbutane	0.3	16	1.4	1.93	2.16	49
2511957	Dimethylcyclopropane	0.3	29	1.4	2.19	3.91	49
75832	Dimethylbutane	0.3	15	1.4	1.91	2.03	49
107835	Methylpentane/Isohexane	0.3	199	1.4	6.1	27.79	48
110543	Hexane	0.3	35	1.4	2.46	4.81	48
138863	Limonene	0.3	12.9	1.4	2.14	2.15	47
	Dimethylpentatnone	0.3	42.8	1.4	2.47	5.82	49
	Bromohexene	0.3	5.2	1.4	1.69	0.84	49
3728550	Ethylmethylcyclohexane	0.3	6.1	1.4	1.82	1.15	48
4316658	Trimethylhexene	0.3	11.9	1.4	1.85	1.64	49
1072168	Dimethyloctane	0.3	20.4	1.4	2.02	2.74	49
7785708	1-*R*-alpha-pinene/2-Pinene/ 2.6.6Trimethylbichyclo[3.3.1]hept-2-ene	0.3	29	1.4	2.18	3.91	49
496117	Indane	0.3	15.2	1.4	1.9	2.06	49
590738	2,2,-Dimethylhexane	0.3	168	1.4	4.97	23.3	49
251412	Thieno[3,2] thiopene	0.3	56.5	1.5	5.18	10.7	43
78853	Methacrolein	0.3	1710	1.4	35.74	239.18	49
106467	1,4-Dichlorobenzene	0.2	4.43	0.3	0.55	0.66	45
591764	Methylhexane	0.3	25	1.4	2.11	3.66	46
75694	Trichlorofluoromethane	0.3	5.2	1.4	1.64	0.79	49
75456	Difluorochloromethane	0.3	45	1.4	2.51	6.12	48
137631	Tetramethylcyclopentane	0.3	9.24	1.4	1.79	1.33	49
4926787	Ethylmethylcyclohexane	0.3	5.68	1.4	1.78	1.04	48
6069983	Methylmethylethylcyclohexane	0.3	6.17	1.4	1.73	1.01	49
543599	Chloropentane	0.3	5.2	1.4	1.65	0.8	49
592574	1,3-Cyclohexadiene	0.3	5.8	1.4	1.73	0.98	49
60779240	Methyl *n*-butyl disulfide	0.3	15.5	1.4	1.92	2.1	49
72437640	Propyl *n*-butyl disulfide	0.3	14.6	1.4	1.9	1.98	49
629196	Dipropyl disulfide	0.3	23.1	1.4	2.07	3.11	49

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Table 3. Comparison with other studies

Chemical	This Study			Garfield County, Colorado[a]		Birmingham, UK[b]	Weld County, Colorado[c]	State of California[d]
	Max (ppb_v)	Median (ppb_v)	Mean (ppb_v)	Max (ppb_v)	Median (ppb_v)	Range of Means (ppb_v)	Range of Medians (ppb_v)	Ambient Average (ppb_v)
Methane (ppm_v)	457	2.7	11.99				1.81–1.89	
Benzene	592	0.89	18.53	4.39	0.30	0.25–0.7	0.02–0.1	4.6
Chloroform	2.58	0.3	0.45					0.006–0.13
Dichloromethane/ Methylene chloride	1	0.3	0.34					1.1–2.4
Ethylbenzene	113	0.53	4.42	1.87	0.04			
Styrene	43.4	0.37	1.91	0.80	0.035			10
Tetrachloroethene (PCE)	2.43	0.3	0.33					0.71
Toluene/Methylbenzene	276	2.55	19.45	21.0	0.48	0.7–1.9		
Trichloroethene (TCE)	60.9	0.3	1.58					0.22
1,3,5-Trimethylbenzene	9.95	0.59	1.43	0.25	0.024			
1,2,4-Trimethylbenzene	60.4	0.4	3.45	0.63	0.037			
m- and *p*-Xylene	221	1.68	15.69	2.28	0.20			
o-Xylene	39.4	0.85	3.19	0.83	0.05			
Propylbenzene	23.5	1.4	2.08	0.14	0.02			
Pentane	198	1.4	7.73	21.1	3.09	0.2–0.5	0.01–0.48	
Methyl cyclohexane	38	1.4	2.42	5.98	0.92			
Propane (ppm_v)	62.9	1.4	2.97			0.8–2.8	0.1–3.0	
Butane (ppm_v)	69	1.4	2.95			0.9–2.8	0.04–1.24	
Ethane (ppm_v)	34.6	1.4	2.24			2.2–6.3		
Isobutane	34	1.5	3.95			0.8		
Methylpentane/ Isohexane	199	1.4	6.1			0.15–1.1		
Hexane	35	1.4	2.46	7.11	1.14	0.1–0.2		

Notes: Values are reported by California Air Resources Board for California, except for benzene, which was reported for the South Coast Air Basin of California (Los Angeles metropolitan area).[a]McKenzie et al. (2012). [b]Hopkins et al. (2005). [c]Petron et al. (2012). [d]Seinfeld and Pandis (1998).

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maximum values measured in this study are higher than the California ambient average values, except for methylene chloride. The mean values measured in this study are higher than the California ambient average values for three of the six compounds. Median values for this study were lower than the California values for four of the six compounds, likely due to the large number of nondetects in this study.

Correlations among concentrations of chemicals in ambient air samples

Further statistical analysis was performed using a Pearson's product-moment correlation coefficient to determine the strength of relationship between nonmethane volatile organic compounds (NMVOCs) in ambient air samples. To minimize the impact of missing measurements, compounds detected in fewer than 50% of the sites were excluded.

The correlation matrix for nonmethane compounds present at detectable levels in at least 50% of the sampling events identifies a relationship among various chemicals present and several strong correlations, as shown in Table 4. Notable correlation coefficients include those between benzene and toluene at $r = 0.89$, and between benzene to *m*- and *p*-xylene at $r = 0.86$. Toluene (methylbenzene) was also highly correlated to *m*- and *p*-xylene (1,3-dimethylbenzene and 1,4-dimethylbenzene) with $r = 0.95$. The BTEX compounds (benzene, toluene, ethylbenzene, and xylene) are often found together in petroleum derivatives, such as natural gas and gasoline.

Concentrations of numerous chemical constituents were significantly correlated to those of methane, as shown in Table 5. Given the sample size ($n = 50$), any correlation exceeding 0.2788 was significant at $\alpha = 0.05$. 3-Methylhexane, the constituent with the strongest correlation to methane, is confirmed to be a constituent of natural gas condensate, according to a permit application submitted to the Texas Commission on Environmental Quality for a site in the Barnett Shale (XTO Energy, 2010). Chemicals significantly correlated to the presence of methane and identified as HAPs by EPA included hexachlorobutadiene, tetrachloroethene, 1,2,4-trichlorobenzene, and chloroform.

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Table 4. Pearson's correlation nonmethane volatile organic compounds

	Benzene	Chloromethane	Dichlorodifluoromethane	Toluene	*m*- and *p*- Xylene
Benzene	**1.0**				
Chloromethane	0.0723	**1.0**			
Dichlorodifluoromethane	−0.0791	−0.0999	**1.0**		
Toluene	**0.8927**	0.1292	−0.1324	**1.0**	
m- and *p*-Xylene	**0.8658**	0.0686	−0.1368	**0.9543**	**1.0**
C12 hydrocarbon	0.1823	−0.1746	0.2925	0.1744	0.257

Table 5. Correlation of methane to chemical constituents

Chemical	Correlated to Methane
Methane	1.0
3-Methylhexane	0.81
C5 Hydrocarbon	0.68
C9 Hydrocarbon	0.68
2-Methylbutane	0.64
C7 Hydrocarbon	0.55
C8 Hydrocarbon	0.55
Trichlorofluoromethane (F-11)	0.53
Hexachlorobutadiene	0.36
Tetrachloroethene (PCE)	0.35
C4 hydrocarbon	0.34
Methylhexane	0.33
C6 Hydrocarbon	0.33
1,2,4-Trichlorobenzene	0.33
Diethyl trisulfide	0.29
Chloroform	0.29

Principal components analysis—Chemical constituents

To further examine the relationships among the chemical constituents, a principal components analysis (PCA) was performed with the goal of determining whether potential signatures could be identified for gas well emissions, or emissions associated with particular well operations. Data on 36 chemicals that were measured with detectable concentrations in at least 10% of samples were included in the PCA. However, this means that a compound may not have been detected in 90% of the samples. PCA assumes normal distributions, which may not hold with a large number of nondetect values. It is thus recommended, as mentioned later, that follow-up study be conducted with a larger sample size.

Table 6 shows eigenvalues determined for the chemical constituent data. According to Table 6, the first 3 PCA factors express almost half (49%) of the variance of these data, with the first 10 expressing 80% of the variance.

Further analysis focused on the first two factors. Tables 7 and 8 indicate chemicals that contributed strongly to PCA factors 1 and 2, respectively (coefficients >0.7 in absolute value).

Table 6. Eigenvalues

	Eigenvalue	% total variance	Cumulative eigenvalue %	Cumulative %
1	8.13	22.57	8.1	22.57
2	6.12	16.99	14.24	39.56
3	3.27	9.07	17.51	48.63
4	2.69	7.47	20.20	56.11
5	1.98	5.49	22.17	61.60
6	1.77	4.92	23.94	66.51
7	1.53	4.26	25.48	70.77
8	1.27	3.52	26.75	74.29
9	1.18	3.28	27.93	77.57
10	1.06	2.94	28.98	80.51

Table 7. Chemicals associated with factor 1

Chemical	Coefficient
o-Xylene	−0.90
Ethylbenzene	−0.87
1,2,4-Trimethylbenzene	−0.82
m- and *p*-Xylene	−0.81
1,3,5-Trimethylbenzene	−0.80
Toluene	−0.76
Benzene	−0.74

Table 8. Chemicals associated with factor 2

Chemical	Coefficient
Trichlorofluoromethane	0.75
Methane	0.72
C5 hydrocarbons	0.72
C8 hydrocarbons	0.71

Principal components analysis—Sample site scores

Further PCA evaluation was performed analyzing the scores of sample sites for the first two PCA factors. Figure 2 shows sample site scores plotted in relation to factors 1 and 2. We examined the distributions of sample site scores for their

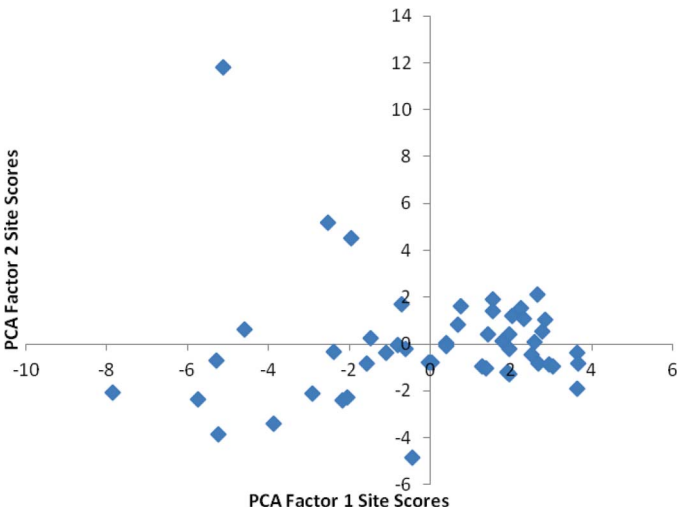

Figure 2. PCA sample site scores factor 1:factor 2.

associations with aspects of well site operation. Nineteen sites had scores less than −0.5 on factor 1. These sites had up to 12 compressors per site. The 31 sites with scores higher than −0.5 on factor 1 had fewer compressors. Six of these 31 sites had nine compressors, and the remainder had two compressors per site. One site stands out by virtue of its high score (almost 12) for factor 2. This is the same site previously noted for maximum values for a number of chemicals, due to the well experiencing a pressure malfunction causing an uncontrolled emission event to the atmosphere.

The PCA suggested that a multivariate signature of nearby gas well compression operations may be present in patterns of chemical concentrations found in ambient air samples (appearing as patterns associated with factor 1), and suggested that blown wells or other operations venting natural gas might also have a distinct signature (patterns associated with factor 2). An analysis of variance (ANOVA) F test was performed to test the null hypothesis that sample site scores for PCA factor 1 and factor 2 are independent of particular phases and equipment associated with nearby gas well operations. Based on the equipment observed at the nearest gas well to each sampling site, these sites were classified for five processes: (1) flaring versus not flaring; (2) hydraulic fracturing versus not hydraulic fracturing; (3) wells present versus absent; (4) compressors present versus absent; and (5) tanks or tank batteries present versus absent. The ANOVA tests results, conducted with a significance level of $\alpha = 0.05$, are given in Table 9.

As shown in Table 9, the null hypothesis was accepted in all cases except in the case of compressors for factor 1. There is a significant difference in factor 1 in relation to compression, with more negative scores for factor 1 characterizing sites on which compressors are present. Operation of compressors is identified by a signature or fingerprint of chemicals in air masses known to be products of combustion and which contribute to differences among sites along factor 1 of the PCA (Table 7). Moreover, there was a quantitative relationship between number of compressors and scores for factor 1 (linear regression, two-tailed t test, $P < 0.05$), although it explained only 9% of the variation in factor 1 scores. Although the association of factor 2 with the well with the pressure malfunction suggests that there might also be a signature for well operations that vent large amounts of raw natural gas, ANOVA did not detect a statistically significant association of factor 2 scores with any of the well operations characterized here. It is possible that a larger sample size, with temporally repeated monitoring, would be necessary to detect emission signatures resulting from the episodic phases of well operation that risk large emissions of raw natural gas.

Table 9. ANOVA tests to determine whether factors 1 and 2 are independent of gas well operation phases and equipment

ANOVA Test	Accept Null Hypothesis for Factor 1?	Accept Null Hypothesis for Factor 2?
Flaring	Yes	Yes
Fracking	Yes	Yes
Wells	Yes	Yes
Compressors	No	Yes
Tanks	Yes	Yes

Study limitations and recommendations for future work

Limitations of this study include the small sample size and the fact that a positive correlation of contaminants with a common source does not rule out other sources. As mentioned above, PCA assumes normal distributions, which may not hold with a large number of nondetect values. It is thus recommended that follow-up study be conducted with a larger sample size.

Sampling was performed in primarily residential areas with few potential emission sources unrelated to natural gas extraction and production, other than light traffic; however, it is possible that some transportation emissions or other combustion sources may have contributed somewhat to some chemical concentrations recorded. Future studies may evaluate to what degree traffic emissions contribute to overall atmospheric conditions in areas with and without natural gas emission sources. Future work should include collecting 1-hr samples along with field meteorological data, to determine whether the well sites are upwind, downwind, or crosswind during the sampling period. This would indicate whether the drilling/production sites are likely sources of the pollutants. In addition, carbon isotope analysis, which can distinguish among various sources of organic compounds, should be used to provide evidence that the methane is from natural gas sites, rather than wetlands, landfills, wastewater treatment plants, or other potential sources.

The assumption should not be made that all airborne chemicals can be found in the tests performed. In fact, numerous chemicals may exist that are not properly identified through the methodology and laboratory analysis performed in this study, as it is specific to chemicals identified on the target list of analytes (TO-14A), light hydrocarbons and tentatively identified compounds.

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Summary

This exploratory study found methane and 101 other chemicals to be present in the atmosphere in and around shale gas well sites located in residential areas in the DFW Metroplex. Methane was present in concentrations above laboratory detection limits in 49 out of 50 sampling events. Most of the areas investigated had atmospheric methane concentrations considerably higher than reported urban background concentrations (1.8–2.0 ppm_v). Other chemical constituents were found to be correlated with presence of methane.

A principal components analysis identified multivariate patterns of concentrations that potentially constitute signatures of emissions from different phases of operation at natural gas sites. The first factor identified through the PCA proved most informative. Extreme negative values were strongly and statistically associated with the presence of compressors at sample sites. Aromatics in particular contributed to the factor associated with compressor stations. An extreme positive value on factor 2 suggest that there may also be a signature of operations that release large amounts of natural gas, but this singular association was not statistically significant in these data.

A follow-up study with a larger sample size and more rigorous analysis is recommended.

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Health Survey Results

of Current and Former DISH/Clark, Texas Residents

EARTHWORKS' OIL AND GAS ACCOUNTABILITY PROJECT

EARTHWORKS

Texas Oil & Gas **Accountability** Project

Results of Health Survey of Current and Former DISH/Clark, Texas Residents

December 2009

by Wilma Subra
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On behalf of EARTHWORKS'
Oil and Gas Accountability Project

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Executive Summary

The following health survey for DISH, Texas residents was complied by Wilma Subra on behalf of Earthworks' Oil & Gas Accountability Project. The health survey was completed by a total of 31 individuals between the ages of 4 and 69 during October and November of 2009. Participants consisted of 30 current residents and one previous resident of DISH, Texas.

Of the population surveyed 19% considered themselves to be sick, or both healthy and sick. 81% considered themselves to be healthy. However, 39% of the population reported frequency of illness on average of three days per week and five days per month with a maximum of seven days per week and all days of the month. Participants reported 130 medical conditions and of the conditions the survey identifies 23 most prevalent medical conditions. 71% of participants reported having respiratory ailments.

Notable results from the survey include:

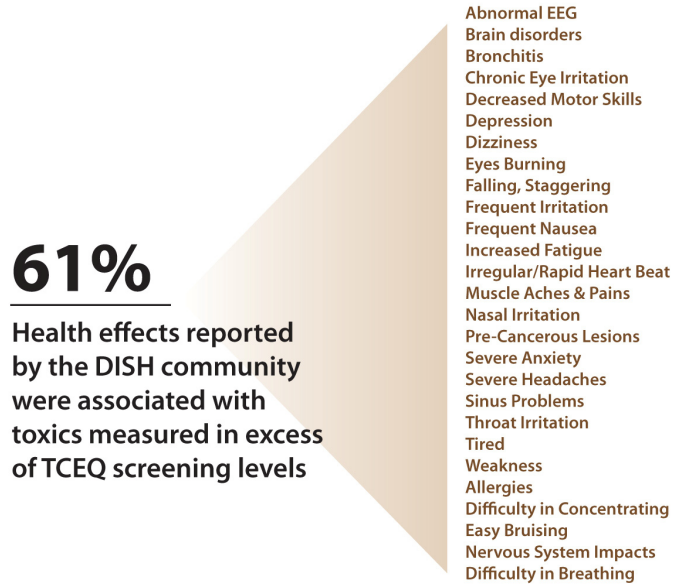
1. A summary of odor events experienced by participants, odor frequencies and possible odor sources, and
2. A comparison of health effects reported by the community with the known effects of chemicals found in the DISH area by Wolf Eagle Environmental in August of 2009.

First, 28 of the 31 individuals surveyed experienced odor events. Frequency of odor events ranged from one to two times per day to 24 days per month. Participants associated odors with specific facilities in the DISH area including, compressor stations, gas processing plants and metering stations, natural gas pipelines, gas wells, sewer systems and pastures.

Second, the human health impacts reported during the survey were compared to the health impacts associated with toxic air emission chemicals detected in the ambient air of DISH in August 2009, in excess of TCEQ screening levels. 61% of the health impacts reported by participants are known health effects of chemicals detected in the air by Wolf Eagle Environmental in August 2009. These chemicals include

- Volatile Organic Chemicals,
- Hazardous Air Pollutants, and
- Tentatively Identified Compounds.

The health effects associated with these chemicals and reported by the survey participants are included below.



Recommendations based on this survey include:

- Community health investigation and long-term tracking by the Texas Department of State Health Services,
- Community-based documentation and tracking of odors and symptoms by Texas Commission on Environmental Quality,
- Increased tracking of operational upsets, spills, releases and permit violations of oil and gas infrastructure by both the Texas Commission on Environmental Quality and Texas Railroad commission, and
- The continuous monitoring of area emissions by Texas Commission on Environmental Quality.

Odors Associated with Sources in the DISH Area

Individuals responding to the health survey reported odors associated with specific types of facilities in the DISH area:

gas wells

Natural gas smell

REPORTED EFFECTS
headaches
nausea
sinus problems
asthma

natural gas pipelines

Odorized natural gas

REPORTED EFFECTS
headaches
nausea
sinus problems
asthma

compressor stations

Sulfur smell
Odorized natural gas
Ozone
Burnt butter

REPORTED EFFECTS
burning eyes
nausea
headaches
running nose
sore throat
asthma
sinus problems

gas processing plants / metering stations

Sulfur smell
Odorized natural gas
Burnt wire
Strong chemical like smell
Ether

REPORTED EFFECTS
burning eyes
nausea
headaches
running nose
sore throat
asthma
sinus problems
bronchitis

sewer

Septic odors

REPORTED EFFECTS
infection of airways
irritation of sinus and throat

pastures

Hay and grass smells

Duration of Health Impacts

Associated with odor events

Airway Infection	1-3 weeks
Allergies	24 hours after odors dissipates
Bronchitis	1 week
Burning and Irritated Throat	Until smell goes away
Chest Congestion	1-3 days
Hard to Breathe	2-3 days
Headache	4 hours to one week
Irritated Eyes	1-2 days
Nasal Irritation	1 week
Nausea	Until smell goes away
Respiratory Irritation	24 hours after odor dissipates
Sinus Irritation	1-3 days
Sinus with Plugged Ears	10-20 days

Odor events were reported to be as often as twice per day.

Introduction

A health survey instrument for current and former DISH/Clark, Texas residents was compiled by Wilma Subra of Subra Company on behalf of EARTHWORKS' Oil and Gas Accountability Project. The health survey instrument was distributed to current and former DISH/Clark residents. The health survey forms were filled out during the months of October and November 2009. The results of the health survey were evaluated by Wilma Subra of Subra Company.

Health Survey Participants

A total of 31 individuals between the ages of 4 and 69 participated in the health survey. The individuals consisted of 30 current residents of DISH/Clark and one previous resident of DISH/Clark. Fourteen households were surveyed. The individuals participating in the survey consisted of 15 females and 16 males.

Participant Ages

31 Total Participants between the ages of 4 and 69
15 Females between the ages of 19 and 67
16 Males between the ages of 4 and 69

Age Range	Number of Females	Number of Males
0-5	0	2
6-10	0	2
11-15	0	1
16-20	1	0
21-30	1	1
31-40	3	2
41-50	4	3
51-60	4	3
61-70	2	2

Years Lived in DISH/Clark

The 31 participants in the survey lived in DISH/Clark an average of 8.5 years and ranged from three months to 25 years. One of the 31 individuals surveyed had lived in DISH for four years but had relocated 5 months prior to the survey.

General Health of Individuals Surveyed

Of the total of 31 individuals surveyed, 21 considered themselves healthy, 4 individuals considered themselves sick and one individual, both healthy and sick. Five individuals did not respond to this question.

General Health

21 Individuals between the ages of 4 and 69	Healthy	81%
4 Individuals between the ages of 5 and 59	Sick	15%
1 individual age 49	Healthy and Sick	4%

Females

11 Individuals between the ages 19 and 64	Healthy	92%
1 Individual age 26	Sick	8%

Males

10 Individuals between the ages of 4 and 69	Healthy	72%
3 Individuals between the ages of 5 and 59	Sick	21%
1 Individual age 49	Healthy and Sick	7%

Frequency of Illness

The four individuals who reported their general health as sick, reported the frequency of their illnesses as three to seven days per week, and one day, two days and every day per month. The individual who reported his general health as healthy and sick, reported the frequency of his illness as one day per week and three days per month.

Six of the 21 individuals who reported their general health as healthy, reported their frequency of illness as seven days per week and one, two and four days per month. Two of the five individuals who did not report their general health as healthy or sick, responded to the frequency of their illness as two days per month and up to five days per month.

Thus, even though 21 of the 31 individuals surveyed reported their general health as healthy, six individuals reported their frequency of illness as much as four days per month and seven days per week. Two of the five individuals who did not report the condition of their general health, reported their frequency of illness as two to five days per month. Thus 12 of the 31 individuals survey (39% of the population surveyed) reported frequency of illnesses on average of three days per week and five days per month with a maximum of seven days per week and all days per month.

Access to Doctors and Health Care Providers

Of the 31 individuals responding to the survey, 30 individuals (97%) had access to doctors. Twenty-six of 31 individuals (84%) had access to other health care providers, four individuals did not and one individual did not respond.

Occupational Exposure

Four of the 31 individuals surveyed reported occupational exposure. None of the individuals surveyed reported exposure to chemicals from family member work places transported into their homes.

Two individuals employed as air craft mechanics (68 year old male and 37 year old male) reported exposure to jet fuel (25 years and 13 years), ammonia (23 years), acetone (23 years) and MEK (3 years). One individual, employed as a truck driver (49 year old male), reported exposure to creosote (1 year) and hydrochloric acid (1 year). The fourth individual (36 year

old female) reported occupational exposure to anesthetics - Isoflurene and cleaners - Rocal and Parvosal for 11 years.

One air craft mechanic reported his general health as healthy, the other did not respond to the general health question. The truck driver reported his general health as both healthy and sick. The female reported her general health as healthy.

Smoking History

A total of 14 households were surveyed. Seven of the 14 households were nonsmoking households. Four households were occupied by smokers and three households were occupied by past smokers.

Twenty of the 31 individuals surveyed have never smoked. Seventeen of the twenty individuals did not have any other member of the household that smoked. Three individuals, who have never smoked, have other members of the household who are smokers eight individuals currently smoke, two individuals had smoked in the past and one individual did not provide information on smoking history.

The eight individuals who are current smokers have smoked for two to 34 years with an average smoking history of 23 years. Six of the current smokers are long term smokers who have smoked for 20 to 34 years. The smokers currently smoke a half to two packs of cigarettes per day.

The eight current smokers consist of five males and three females. The five males range in age from 22 to 59 and have smoked from two to 30 years. The three females who are current smokers range in age from 50 to 55 and have smoked for 20 to 34 years.

The two past smokers are 48 and 68 year old males who had smoked a pack to a pack and a half of cigarettes per day for 15 and 20 years.

Odors and Associated Health Impacts

Odor Events

Twenty-eight of the 31 individuals surveyed experienced odor events. Three individuals did not report experiencing odor events.

Frequency of Odor Events and Number of Individuals Experiencing the Odor Events

Frequency of Odor Events	Individuals Experiencing Events
1-2 times per day	6
1 day per week	5
2 days per week	7
3 days per week	4
6 days per week	1
7 days per week	4
2 days per month	4
3 days per month	4
5 days per month	3
10 days per month	4
12 days per month	2
20 days per month	3
24 days per month	1

Note: Odors are more predominant when the wind is out of the south.

Number of people experiencing odor events and the frequency of the events.

Odors Associated with Sources in the DISH Area

Individuals responding to the health survey reported odors associated with specific types of facilities in the DISH area.

Compressor Stations

Sulfur
Odorized Natural Gas Smell
Ozone
Burnt Butter Smell

Gas Processing Plants/Gas Metering Stations

Sulfur
Odorized Natural Gas Smell
Burnt Wire
Strong Chemical Like Smell
Ether

Natural Gas Pipe Lines

Odorized Natural Gas

Gas Wells

Natural Gas Smell

Sewer System

Septic odors

Pastures

Hay and Grass Smells

Health Impacts Associated with Odor Events

Sulfur, Rotten Egg Smell

Burning Eyes
Nausea
Headaches
Runny Nose
Sore Throat
Asthma
Sinus Problems

Odorized Natural Gas

Headaches
Nausea
Chronic Sinus Infections
Asthma
Hypertension
Indigestion

Burnt Wire

Burning Throat

Ether

Bronchitis

Sewer Smell

Infection of air ways
Irritation of sinus and throat

Duration of Health Impacts Associated with Odor Events

Health Impact	Duration of Health Impacts
Airway Infection	1-3 weeks
Allergies	24 hours after odors dissipates
Bronchitis	1 week
Burning and Irritated Throat	Until smell goes away
Chest Congestion	1-3 days
Hard to Breathe	2-3 days
Headache	4 hours to one week
Irritated Eyes	1-2 days
Nasal Irritation	1 week
Nausea	Until smell goes away
Respiratory Irritation	24 hours after odor dissipates
Sinus Irritation	1-3 days
Sinus with Plugged Ears	10-20 days

Distance from Surveyed Households to Compressor Stations and Gas Processing Plants/Gas Metering Stations

Distance	Number of Households
50 Feet	1
100 Feet or less	3
600 Feet	1
1,000 Feet	2
0.5 miles	3
Less than 1 mile	1
1 to 2 miles	1

Note: Two households surveyed did not report distances.

Medical Conditions Reported in the DISH/Clark Health Survey

In addition to the requested information concerning odor events and related health impacts, the health survey requested information on specific medical symptoms and diseases from each individual completing the survey. The symptoms reported in the odor events and related health impacts section of the survey were specifically requested to be included in this section of the survey.

A total of 165 medical symptoms and diseases were reported by the 31 individuals who completed the DISH/Clark Health Survey forms. Twenty-three medical conditions were the

most prevalent conditions reported by the 31 individuals surveyed in the DISH/Clark Health Survey.

Medical Condition	# of Individuals Surveyed	% of Individuals Surveyed
Sinus Problems	18	58
Throat Irritation	17	55
Allergies	17	55
Weakness and Fatigue	17	55
Eye Irritation	16	52
Nasal Irritation	15	48
Joint Pain	14	45
Muscle Aches and Pains	13	42
Breathing Difficulties	13	42
Vision Impairment	13	42
Severe Headaches	12	39
Sleep Disturbances	12	39
Swollen and Painful Joints	12	39
Frequent Irritation	10	32
Skin Irritation	10	32
Wheezing	9	29
Frequent Nausea	9	29
Ringing in Ears	9	29
Decreased Motor Skills	8	26
Loss of Sexual Drive	8	26
Bronchitis	7	23
Easy Bruising	7	23
Difficulty in Concentrating	7	23

In addition to these 23 most prevalent medical conditions, the survey identified more than 130 medical conditions and medical symptoms each occurring in a small number of individuals. Two females have neurological conditions - neuromuscular disorder, dystonia and muscular/skeletal disorder. Additional medical conditions occurring in a small number of individuals range from lung, liver and kidney disorders, brain disorders, strokes, thyroid problems, internal bleeding, frequent nose bleeds, and bone conditions, to high blood pressure, depression, anxiety, tremors, and behavioral changes.

A preliminary review of the first initial group of health surveys obtained on October 12, 2009, resulted in the following health conditions being reported by individuals completing the health survey. The results of the preliminary review were consistent with the medical conditions identified by the entire 31 individuals completing the survey.

Health Effects Reported by DISH Community as of October 12, 2009

Abnormal EEG*	Abnormal Mammogram	Allergies
Amnesia	Brain Disorders*	Bronchitis*
Chronic Eye Irritation*	Decreased Motor Skills*	Depression*
Difficulty in Concentrating	Dizziness*	Easy Bruising
Endometriosis	Enlarged Spleen	Excessive Sweating
Eyes Burning*	Falling, Staggering*	Forgetfulness
Frequent Irritation*	Frequent Nausea*	Frequent Nose Bleeds
Increased Fatigue*	Irregular/Rapid Heart Beat*	Joint Pain
Lump in Breast	Muscle Aches & Pains*	Nasal Irritation*
Nervous System Impacts	Persistent Cough	Pre-Cancerous Lesions*
Ringing in Ears	Severe Anxiety*	Severe Headaches*
Shortness of Breath	Sinus Problems*	Sleep Disturbances
Sores & Ulcers Mouth	Strokes	Throat Irritation*
Thyroid Problems	Urinary Infections	Weakness* & Tired*

*Health Impacts Associated with Chemicals present in Excess of TCEQ Short and Long Term Effects Screening Levels in the air of DISH

Respiratory Impacts

Twenty-two of the 31 individuals surveyed (71%) reported having respiratory ailments.

Sinus Problems	18/31	58%
Throat Irritation	17/31	55%
Breathing Difficulties	13/31	42%
Wheezing	9/31	29%
Bronchitis	7/31	23%
TOTAL	**22/31**	**71%**

Respiratory Impacts as it Relates to Smokers and Non-Smokers

Of the 22 individuals that had respiratory ailments, 12 never smoked, 8 were current smokers, one had smoked in the past, and 1 individual did not respond to the smoking request for information. Overall, 20 individuals of the 31 individuals surveyed had never smoked.

Therefore 60% of the nonsmokers surveyed had respiratory problems. Overall 8 individuals were current smokers; therefore 100% of the current smokers had respiratory problems. Overall 2 individuals had smoked in the past. Thus, 50% of the previous smokers had respiratory problems.

Individuals with Most Medical Conditions

The 31 individuals surveyed had an average of 20.5 medical conditions reported in the Health Surveys (range 0 to 46). The individuals with the largest number of reported health symptoms were a 49 year old male and a 55 year old female. They each reported 46 medical conditions. The 49 year old male, a nonsmoker truck driver, reported his general health as sick and healthy and reported being sick one day per week and three days per month. He also reported experiencing odor events once per day, one day per week and 12 days per month. The 55 year old female reported her health as healthy, did not report the number of times sick

and listed odor events as two days per month. She is a smoker and has smoked for 30 plus years.

Correlation of Chemicals Detected in the Ambient Air of DISH with the Health Impacts Experienced by Community Members in DISH/Clark

Wolf Eagle Environmental sampled the ambient air in DISH at seven locations from August 17 to 18, 2009. The air samples were analyzed for Volatile Organic Chemicals, Hazardous Air Pollutants, Tentatively Identified Compounds and NOX. Sixteen chemicals were detected in the ambient air of DISH in excess of Texas Commission on Environmental Quality (TCEQ) Short-term and Long-term Effects Screening Levels. These chemicals consisted of Benzene, Carbon Disulfide, 1,2,4-Trimethylbenzene, Xylene, Naphthalene, Carbonyl Sulfide, Trimethyl Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Methyl Pyridine, Dimethyl Disulfide, Methyl Ethyl Disulphide, Ethyl-Methylethyl Disulfide, Diemethyl Pyridine, and Diethyl Benzene. The health impacts associated with the chemicals detected in the air of DISH in excess of TCEQ Short-term and Long-term Effects Screening Levels correspond to the health impacts being experienced by DISH community members.

Human Health Effects Associated with Chemicals Detected in the air in Excess of TCEQ Short and Long-Term Effects Screening Levels

Acute Health Effects	Chronic Health Effects
Irritates skin, eyes, nose, throat and lungs	Damage to Liver and Kidneys
Headaches	Damage to lungs
Dizziness, Light Headed	Damage to Developing Fetus
Nausea, Vomiting	Causes Reproductive Damage
Skin Rashes	Damages Nerves Causing Weakness and Poor Coordination
Fatigue	
Tense and Nervous	Affects Nervous System
Personality Changes	Affects the Brain
Depression, Anxiety, Irritability	Leukemia
Confusion	Aplastic Anemia
Drowsiness	Changes in Blood Cells
Weakness	Affects Blood Clotting Ability
Muscle Cramps	Carcinogen
Irregular Heartbeat (arrhythmia)	Mutagen
	Teratogen — Developmental Malformations

The most prevalent health impacts reported by individuals surveyed during the Health Survey and the health impacts associated with odor events correspond to the health effects of chemicals detected in the air in DISH in excess of the TCEQ Short-term and Long-term Effects Screening Levels.

Most Prevalent Health Impacts and Health Impacts Associated with Odor Events With the associated chemicals known to cause those health impact. These chemicals exceeded TCEQ short-term and long-term effects screening levels in the air of DISH.

Allergies
Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Diethyl Benzene, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Ethyl Disulphide, Ethyl-Methylethyl Disulfide

Breathing Difficulties
Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Diethyl Benzene, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Ethyl Disulphide, Ethyl-Methylethyl Disulfide

Bronchitis
Trimethyl Benzene

Difficulty in Concentrating
Naphthalene

Easy Bruising
Benzene

Eye Irritation
Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Diethyl Benzene, Carbon Disulfide, Carbonyl Sulfide, Methyl Ethyl Disulphide, Ethyl-Methylethyl Disulfide

Frequent Irritation
Carbon Disulfide

Frequent Nausea
Benzene, Xylenes, Naphthalene, Diethyl Benzene, Carbon Disulfide, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Pyridine, Dimethyl Pyridine

Muscle Aches and Pains
Carbonyl Sulfide

Nasal Irritation
Benzene, Xylenes, Naphthalene, Diethyl Benzene, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Ethyl Disulphide, Ethyl-Methylethyl Disulfide

Severe Headaches
Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Diethyl Benzene, Carbon Disulfide, Methyl Pyridine, Dimethyl Pyridine

Sinus Problems
Benzene, Xylenes, Naphthalene, Diethyl Benzene, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Ethyl, Disulphide, Ethyl-Methylethyl Disulfide

61%

Health effects reported by the DISH community were associated with toxics measured in excess of TCEQ screening levels

Abnormal EEG
Brain disorders
Bronchitis
Chronic Eye Irritation
Decreased Motor Skills
Depression
Dizziness
Eyes Burning
Falling, Staggering
Frequent Irritation
Frequent Nausea
Increased Fatigue
Irregular/Rapid Heart Beat
Muscle Aches & Pains
Nasal Irritation
Pre-Cancerous Lesions
Severe Anxiety
Severe Headaches
Sinus Problems
Throat Irritation
Tired
Weakness
Allergies
Difficulty in Concentrating
Easy Bruising
Nervous System Impacts
Difficulty in Breathing

Skin Irritation
Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Diethyl Benzene, Carbon Disulfide, Carbonyl Sulfide, Methyl Ethyl Disulphide, Ethyl-Methylethyl Disulfide

Throat Irritation
Benzene, Xylenes, Naphthalene, Trimethyl, Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Diethyl Benzene, Carbonyl, Sulfide, Dimethyl Disulfide, Methyl Ethyl Disulphide, Ethyl-Methylethyl Disulfide

Vision Impairment
Carbonyl Sulfide, Naphthalene

Weakness and Fatigue
Carbonyl Sulfide, Carbon Disulfide, Dimethyl Disulfide, Naphthalene

These chemicals exceeded TCEQ short-term and long-term levels in the air of DISH, TX

The medical conditions reported by DISH community members in the Health Survey correspond to the health conditions associated with the toxic air pollutants present in the air of DISH during August 2009 in excess of the TCEQ Short-term and Long-term Effects Screening Levels.

Summary

Thirty-one individuals (15 females and 16 males) completed the DISH/Clark Health Survey. Thirty individuals were current residents of DISH/Clark and one was a previous resident. Fourteen households were surveyed.

Eighty-one percent of the individuals surveyed considered themselves healthy, 15%, sick and 4% both healthy and sick. Thirty-nine percent of the population surveyed reported frequency of illnesses an average of three days per week and five days per month, with a maximum of seven days per week and all days per month.

Twenty-eight of the 31 individuals surveyed experienced odor events. The frequency of odor events occurred up to 7 days per week and 24 days per month. Odors were more predominant when the wind was out of the south, transporting emissions from the area of the compressor stations and gas plants towards the residential areas of DISH.

The individuals surveyed identified the sources of odors as compressor stations, gas processing plants/gas metering stations, natural gas lines, gas wells, sewer system and pastures.
The community members identified substantial health impacts due to odor events associated with the compressor stations, gas processing plants and gas metering stations. These sources were identified as being located 50,100, 600, and 1,000 feet from most of the homes surveyed and 0.5 to 2 miles from other surveyed homes.

A total of 165 medical symptoms and diseases were reported by the 31 individuals who completed the DISH/Clark Health Survey forms. Twenty-three medical conditions were the most prevalent conditions reported by the 31 individuals surveyed. These most prevalent health conditions included sinus problems, throat irritation, allergies, weakness and fatigue, eye irritation, nasal irritation, joint pain, muscle aches and pains, breathing difficulties, vision impairment, severe headaches, sleep disturbances, swollen and painful joints, frequent irritation, skin irritation, wheezing, frequent nausea, ringing in ears, decreased motor skills, loss

of sexual drive, bronchitis, easy bruising and difficulty in concentrating. In addition to these 23 most prevalent medical conditions, the survey identified more than 130 medical conditions and medical symptoms each occurring in a small number of individuals. Two females have neurological conditions - neuromuscular disorder, dystonia and muscular/skeletal disorder. Additional medical conditions occurring in a small number of individuals each, range from lung, liver and kidney disorders, brain disorders, strokes, thyroid problems internal bleeding, frequent nose bleeds, and bone conditions, to high blood pressure, depression, anxiety, tremors, and behavioral changes. Twenty-two of the 31 individuals surveyed (71%) reported having respiratory ailments.

The human health impacts reported during the survey were compared to the health impacts associated with the toxic air emission chemicals detected in the ambient air of DISH in August 2009, in excess of TCEQ Short-term and Long-term Effects Screening Levels. The medical conditions reported by DISH community members in the Health Survey correspond to the health conditions associated with the toxic air pollutants present in the ambient air of DISH during August 2009 in excess of the TCEQ Short-term and Long-term Effects Screening Levels.

Recommendations

In order to further evaluate the health impacts being experienced by DISH community members, The Texas Department of State Health Services should, at a minimum, test the blood of community members for a Comprehensive Metabolic Panel, Hepatic Profile and CBC. In addition, the Health Agency should be requested to evaluate the exposure of residents through the use of biomonitoring parameters for the chemicals of concern in the blood and urine of current and past DISH residents. The overall health impacts being experienced by DISH residents (past and present) should be tracked over time through surveys and follow up consultations.

The Texas Commission on Environmental Quality should establish a process of documenting Odors and Symptoms should be established by which community members can document odor events and associated health impacts. The Odor and Symptom Logs should contain reporting of date, time, location, description of odors, wind speed and direction, health impacts, associated with the odor events, possible sources of the odors, duration of the odor event and duration of health impacts

Increased tracking of operational upsets, spills, releases and permit violations of the compressor stations, gas processing stations, gas metering stations, wells and pipelines in the DISH area should also be put in place by the Texas Commission on Environmental Quality and the Texas Railroad Commission.

A continuous monitoring network should be established by the Texas Commission on Environmental Quality to monitor speciated Volatile Organic Chemicals, Hazardous Air Pollutants, Sulphur compounds and meteorological conditions in the DISH area.

The recommended measures are needed to further define the negative human health impacts being experienced by DISH community members, address appropriate medical intervention and treatment, identify the specific sources of the chemical emissions and pathways of human health exposure, and implement measures needed to reduce chemicals being emitted into the air of the DISH area.

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Scientific Solutions

INVESTIGATING LINKS BETWEEN SHALE GAS DEVELOPMENT AND HEALTH IMPACTS THROUGH A COMMUNITY SURVEY PROJECT IN PENNSYLVANIA

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LISA SUMI

ABSTRACT

Across the United States, the race for new energy sources is picking up speed and reaching more places, with natural gas in the lead. While the toxic and polluting qualities of substances used and produced in shale gas development and the general health effects of exposure are well established, scientific evidence of causal links has been limited, creating an urgent need to understand health impacts. Self-reported survey research documenting the symptoms experienced by people living in proximity to gas facilities, coupled with environmental testing, can elucidate plausible links that warrant both response and further investigation. This method, recently applied to the gas development areas of Pennsylvania, indicates the need for a range of policy and research efforts to safeguard public health.

Keywords: health surveys, shale gas, toxic exposure, hydraulic fracturing, fracking

> Public health was not brought into discussions about shale gas extraction at earlier stages; in consequence, the health system finds itself lacking critical information about environmental and public health impacts of the technologies and unable to address concerns by regulators at the federal and state levels, communities, and workers. . . .
>
> —Institute of Medicine at the National Academies of Science [1]

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For many years, extracting natural gas from deep shale formations across the United States (such as the Marcellus Shale in the East or the Barnett Shale in Texas) was considered economically and technologically infeasible. More recently, changes in hydraulic fracturing technology and its combination with horizontal drilling have made it possible to drill much deeper and farther. Bolstered by declining global oil resources and a strong political push to expand domestic energy production, this has resulted in a boom in shale gas production nationwide and projections of tens or even hundreds of thousands of wells being drilled in the coming decades.

By mid-2012, there were nearly 490,000 producing natural gas wells in the United States, 60,000 more than in 2005 [2]. In Pennsylvania alone, more than 5,900 unconventional oil and gas wells had been drilled, and more than 11,700 had been permitted, between 2005 and September 2012; the pace of expansion has been rapid, with 75 percent of all unconventional wells drilled just in the last two years [3]. The rapid pace of industry expansion is increasingly divergent from the slower pace of scientific understanding of its impacts, as well as policy and regulatory measures to prevent them—in turn raising many questions that have yet to be answered [4]. Further, the limited availability of information has both contributed to the public perception and supported industry assertions that health impacts related to oil and gas development are isolated and rare.

Modern-day industrial gas and oil development has many stages, uses a complex of chemicals, and produces large volumes of both wastewater and solid waste, which create the potential for numerous pathways of exposure to substances harmful to health, in particular to air and water pollution [5]. Many reports of negative health impacts by people living in proximity to wells and oil and gas facilities have been documented in the media and through research by organizations [6-8]. In addition, several self-reporting health survey and environmental testing projects have been conducted in response to complaints following pollution events or the establishment of facilities [9-12].

Such short-term projects have been initiated in a research context in which longer-term investigations—particularly ones that seek to establish causal links between health problems and oil and gas development—have historically been narrow and inconsistent [13]. Reflecting growing concern over the need to deepen knowledge among scientists, public agency representatives, and environmental and health professionals, four conferences on the links between shale gas development and human health were convened in just a one-year period (November 2011–November 2012), including by the Graduate School of Public Health at the University of Pittsburgh; by Physicians, Scientists, and Engineers for Healthy Energy; and by the Institute of Medicine of the National Academy of Sciences.

In-depth research on the health impacts of oil and gas development has also begun to appear in the literature. In 2011, a review of more than 600 known chemicals used in natural gas operations concluded that many could cause cancer

and mutations and have long-term health impacts (including on the skin, eyes, and kidneys and on the respiratory, gastrointestinal, brain/nervous, immune, endocrine, and cardiovascular systems) [14]. In early 2012, a study by researchers at the University of Colorado concluded that the toxicity of air emissions near natural gas sites puts residents living close by at greater risk of health-related impacts than those living farther away [15]. Also in 2012, a paper (published in this journal) documented numerous cases in which livestock and pets exposed to toxic substances from natural gas operations suffered negative health impacts and even death [16].

Public health has not been a priority for decision-makers confronting the expansion of natural gas development and consumption. Commissions to study the impacts of shale gas development have been established by Maryland and Pennsylvania and by the U.S. Secretary of Energy, but of the more than 50 members on these official bodies, none had health expertise [17]. In addition, state and federal agencies in charge of reviewing energy proposals and issuing permits do not require companies to provide information on potential health impacts, while only a few comprehensive health impact assessments (HIAs) on oil and gas development have ever been conducted in the United States [18]. Data on air and water quality near oil and gas facilities are also lacking because federal environmental testing and monitoring has long focused on a limited number of air contaminants and areas of high population density [19], while testing at oil and gas facilities in states like Pennsylvania began only recently [20]. Finally, only a few states (including Pennsylvania, Ohio, and Colorado) have any requirements for baseline air and water quality testing before drilling begins, making it difficult for researchers and regulators—as well as individuals who are directly impacted—to establish a clear connection afterwards.

SUMMARY OF THE RELEVANCE OF SELF-REPORTING HEALTH SURVEYS

For many individuals and communities living amidst oil and gas development and experiencing rapid change in their environments, too much can be at stake to rely solely on the results of long-term studies, especially those that are just now being developed. Recent examples include a new study by Guthrie Health and the Geisinger Health System in Pennsylvania, set to take from 5 to 15 years [21], and research proposals solicited in April 2012 by the National Institute of Environmental Health Sciences [22].

In contrast, self-reporting health survey research facilitates the collection and analysis of data on current exposures and medical symptoms—thereby helping to bridge the prevailing knowledge gap and pointing the way toward possible policy changes needed to protect public health. Another premise throughout the various phases of this project (location selection, survey distribution and completion, environmental testing, report development and distribution, and

outreach to decision-makers) was the value of public participation in science and the engagement of a variety of actors and networks to both conduct the research and ensure its beneficial application [23].

With this in mind, this health and testing project reflects some of the core principles of community-based participatory research (CBPR), including an emphasis on community engagement, use of strengths and resources within communities, application of findings to help bring about change, and belief in the research relevance and validity of community knowledge [24]. For example, the current project selected areas for investigation based in part on the observations of change in environmental conditions by long-time residents, and upon completion, participants received resources on air and water testing and reporting of drilling problems for use in their communities.

In addition, CBPR is often used by public agencies and academic researchers to gather information on health conditions that may be related to social or environmental factors manifested on the community as well as individual level [25]. Relevant examples include identification of linkages between environmental health and socioeconomic status [26], adverse health impacts associated with coal mining [27], and the perception of health problems from industrial wind turbines [28].

Community survey and environmental testing projects such as the current one are also valuable in identifying linkages and considerations that can be used to develop protocols for additional research and policy measures. For example, community survey projects similar to the current one have revealed the presence of toxic chemicals in water and air that were known to be associated with health symptoms reported by residents, resulting in the strengthening of state standards for the control of drilling-related odors in Texas [9], expansion of a groundwater contamination investigation by the U.S. Environmental Protection Agency in Wyoming [10], and relocation of residential communities away from nearby oil refineries and contaminated waste storage areas in Louisiana [29].

METHODS

Between August 2011 and July 2012, a self-reporting health survey and environmental testing project was undertaken in order to:

- investigate the extent and types of health symptoms experienced by people living in the “gas patches” (that is, gas development areas) of Pennsylvania;
- provide air and water quality testing to some of the participating households in need of such information;
- identify possible connections between health symptoms and proximity to gas extraction and production facilities;
- provide information to researchers, officials, regulators, and residents concerned about the impact of gas development on health and air and water quality; and

- make recommendations for both further research and the development of policy measures to prevent negative health and environmental impacts.

This project did not involve certain research elements, such as structured control groups in non-impacted areas and in-depth comparative health history research, that aim to show a direct cause-and-effect relationship or to rule out additional exposures and risks. Such work, while important, was beyond the scope of the project.

The primary routes of exposure to chemicals and other harmful substances used and generated by oil and gas facilities are inhalation, ingestion, and dermal absorption—of substances in air, drinking water, or surface water—which can lead to a range of symptoms. The health survey instrument explored such variations in exposure through checklists of health symptoms grouped into categories (skin, sinus/respiratory, digestive/stomach, vision/eyes, ear/nose/mouth, neurological, urinary/urological, muscles/joints, cardiac/circulatory, reproductive, behavioral/mood/energy, lymphatic/thyroid, and immunological). A similar structure was followed for different categories of problems in participants' disease history (kidney/urological, liver, bones/joints, ulcers, thyroid/lymphatic, heart/lungs, blood disorders, brain/neurological, skin/eyes/mouth, diabetes, and cancer). Questions were also asked about occupational background and related toxic exposure history. In addition, the survey included questions on proximity to three types of facilities (compressor and pipeline stations, gas-producing wells, and impoundment or waste pits) to explore possible sources of exposure. It also asked participants to describe the type and frequency of odors they observe, since odors can both indicate the presence of a pollutant and serve as warning signs of associated health risks [30].

As indicated in Table 1, the survey was completed by 108 individuals (in 55 households) in 14 counties across Pennsylvania, with the majority (85 percent) collected in Washington, Fayette, Bedford, Bradford, and Butler counties. Taken together, the counties represent a geographical range across the state and have active wells and other facilities that have increased in number in the past few years, allowing reports of health impacts and air and water quality concerns by residents to surface [31, 32]. The survey and testing locations were all in rural and suburban residential communities.

All survey participants were assured that their names, addresses, and other identifying information on both the surveys and environmental testing results would be kept confidential and used only for purposes related to this project, such as following up with clarifying questions, responding to requests for assistance, or providing resources. Due to expressed concerns about confidentiality, participants had the option of completing the surveys anonymously, which some chose to do. Most participants answered questions on their own. In some cases, spouses, parents, or neighbors completed surveys for participants, and a few provided answers to the project coordinator in person or over the phone.

Table 1. Survey Locations

County surveyed	Number of surveys collected and percent of all surveys
Washington	24 (22%)
Fayette	20 (18%)
Bedford	20 (18%)
Bradford	17 (16%)
Butler	12 (11%)
Jefferson	3 (3%)
Sullivan	2 (2%)
Greene	2 (2%)
Warren	2 (2%)
Elk	2 (2%)
Clearfield	1 (1%)
Erie	1 (1%)
Susquehanna	1 (1%)
Westmoreland	1 (1%)
Total	108

While less formal and structured, the approach taken to identifying project participants has similarities to established non-random research methods that are respondent-driven and rely on word-of-mouth and a chain of referrals to reach more participants, such as "snowball" and "network" sampling [33]. As in studies in which these methods are used, the current project had a specific purpose in mind, focused on a group of people that can be hard to identify or reach, and had limited resources available for recruitment [34].

The survey was distributed in print form either by hand or through the mail and was initiated through existing contacts in the target counties. These individuals then chose to participate in the project themselves and/or recommended prospective participants, who in turn provided additional contacts. The survey was also distributed to individuals who expressed interest in participating directly to the project coordinator at public events or through neighbors, family members, and friends who had already completed surveys.

A second phase of the project involved environmental testing conducted at the homes (i.e., in the yards, on porches, or at other locations close to houses) of a

subset of the survey participants (70 in total) in order to identify the presence of pollutants that may be coming from gas development facilities. In all, 34 air tests and nine water tests were conducted at 35 households. Test locations were selected based on household interest, the severity of symptoms reported, and proximity to gas facilities; results were made available to the households where the testing took place. The air tests were conducted with Summa Canisters put out for 24 hours by trained individuals and the results analyzed with TO-14 and TO-15 methods, which are used and approved by the U.S. Environmental Protection Agency to test for volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (known as BTEX chemicals). The water tests were based on samples drawn directly from household sinks or water wells by technicians employed by certified laboratories and covered the standard Tier 1, Tier 2, and Tier 3 (including VOCs/BTEX) and in one case, gross alpha/beta radiation, radon, and radium.

FINDINGS

Health Surveys

Among participants, 45 percent were male, ranging from 18 months to 79 years of age, and 55 percent were female, ranging from 7 to 77 years of age. The closest a participant lived to gas facilities was 350 feet and the farthest away was 5 miles.

Participants had a wide range of occupational backgrounds, including animal breeding and training, beautician, child care, construction, domestic work, farming, management, mechanic, medical professional, office work, painter, retail, teaching, and welding. About 20 percent of participants reported an occupation-related chemical exposure (for example, to cleaning products, fertilizers, pesticides, or solvents). At the time of survey completion, 80 percent of participants did not smoke and 20 percent did. More than 60 percent of the current nonsmokers had never smoked, although 20 percent of nonsmokers lived with smokers.

Almost half of the survey participants answered the question on whether they had any health problems prior to shale gas development. A little less than half of those responses indicated no health conditions before the development began and a little more than half reported having had one or just a few—in particular allergies, asthma, arthritis, cancer, high blood pressure, and heart, kidney, pulmonary, and thyroid conditions were named by respondents.

While not asked specifically in the survey, some participants volunteered (verbally or in writing) additional information that points to health-related concerns warranting further investigation. For example, five reported that their existing health symptoms became worse after shale gas development started and 15 that their symptoms lessened or disappeared when they were away from home. Participants in 22 households reported that pets and/or livestock had unexplained symptoms (such as seizures or losing hair) or suddenly fell ill and died after gas development began nearby.

Some variation was noted with regard to the specific symptoms reported for each category surveyed, and some symptoms were reported to a notable degree in only one or a few locations. However, as seen in Table 2, the same overall categories of problems reported by survey participants garnered high response rates among survey participants regardless of region or county. For example, sinus/respiratory problems garnered the highest percentage of responses by participants overall, as well as in four of the five focus counties; the second top complaint category, behavioral/mood/energy, was the first in one county, second in three, and fourth in one. The total number of symptoms reported by individual participants ranged from 2 to 111; more than half reported having more than 20 symptoms and nearly one-quarter reported more than 50 symptoms. The highest numbers were reported by a 26-year-old female in Fayette County (90), a 51-year-old female in Bradford County (94), and a 59-year-old female in Warren County (111).

The 25 most prevalent individual symptoms among all participants were increased fatigue (62%), nasal irritation (61%), throat irritation (60%), sinus problems (58%), eyes burning (53%), shortness of breath (52%), joint pain (52%), feeling weak and tired (52%), severe headaches (51%), sleep disturbance (51%), lumbar pain (49%), forgetfulness (48%), muscle aches and pains (44%), difficulty breathing (41%), sleep disorders (41%), frequent irritation (39%), weakness (39%), frequent nausea (39%), skin irritation (38%), skin rashes (37%), depression (37%), memory problems (36%), severe anxiety (35%), tension (35%), and dizziness (34%).

Many symptoms were commonly reported regardless of the distance from the facility (in particular sinus problems, nasal irritation, increased fatigue, feeling weak and tired, joint pain, and shortness of breath). In addition, there was some variability in the percentage of respondents experiencing certain symptoms in relation to distance from facility, including higher rates at longer distances in a few instances. Possible influencing factors could include topography, weather conditions, participant reporting, the use of emission control technologies at facilities, or type of production (e.g., wet gas contains higher levels of liquid hydrocarbons than dry gas).

However, many symptoms showed a clearly identifiable pattern: as the distance from facilities increases, the percentage of respondents reporting the symptoms generally decreases [35]. For example, when a gas well, compressor station, and/or impoundment pit were 1500-4000 feet away, 27 percent of participants reported throat irritation; this increased to 63 percent at 501-1500 feet and to 74 percent at less than 500 feet. At the farther distance, 37 percent reported sinus problems; this increased to 53 percent at the middle distance and 70 percent at the shortest distance. Severe headaches were reported by 30 percent of respondents at the farther distance, but by about 60 percent at the middle and short distances.

Table 2. Percent of Participants Reporting Symptoms in the Most Prevalent Categories of Symptoms, by County

		Percent of individuals reporting symptoms in category					
Symptom category	All counties	Bedford	Bradford	Butler	Fayette	Washington	Others[a]
Sinus/respiratory	88	80	82	75	85	95	87
Behavioral/mood/energy	80	60	88	67	85	74	67
Neurological	74	45	71	50	70	79	60
Muscles/joints	70	55	82	67	70	74	47
Digestive/stomach	64	55	65	58	75	63	33
Ear/nose/mouth	66	40	59	50	75	68	47
Skin reactions	64	45	70	67	75	63	27
Vision/eyes	63	40	65	50	70	79	53

[a]Includes Clearfield, Elk, Erie, Jefferson, Greene, Sullivan, Susquehanna, Warren, and Westmoreland counties. The surveys from these counties (15) were analyzed together to create a group comparable in number to each of the counties where more surveys were collected.

Figure 1 shows, for the top 20 symptoms, the percentage of residents living within 1500 feet of a natural gas facility (well, compressor, or impoundment) who reported the symptom, compared to the percentage among residents living more than 1500 feet from the facility. For 18 of the 20 symptoms, a higher percentage of those living within 1500 feet of a facility experienced the symptom than of those living further away.

The difference in percentages reporting the symptom in the two groups (i.e., 1500 feet or closer vs. more than 1500 feet from a facility) was statistically significant for 10 of the 20 symptoms. Notably, this finding reinforces the value of data attained through self-reporting health surveys. It shows that, regardless of how symptom data were acquired, they suggest that increased proximity to gas facilities has a strong association with higher rates of symptoms reported.

When the most prevalent symptoms are broken out by age and distance from facility, some patterns stand out [35]. Within each age group, the subset living within 1500 feet of any oil and gas facility had a higher percentage of most symptoms than the age group as a whole.

Among the youngest respondents (1.5-16 years of age), for example, those within 1500 feet experienced higher rates of throat irritation (57% vs. 69%) and severe headaches (52% vs. 69%). It is also notable that the youngest group had the highest occurrence of frequent nosebleeds (perhaps reflective of the more sensitive mucosal membranes in the young), as well as experiencing conditions not typically associated with children, such as severe headaches, joint and lumbar pain, and forgetfulness.

Among 20- to 40-year-olds, those living within 1500 feet of a facility reported higher rates of nearly all symptoms; for example, 44 percent complained of frequent nosebleeds, compared to 29 percent of the entire age group. The same pattern existed among 41- to 55-year-olds with regard to several symptoms (e.g., throat and nasal irritation and increased fatigue), although with smaller differences and greater variability than in the other age groups.

The subset of participants in the oldest group (56- to 79-year-olds) living within 1500 feet of facilities had much higher rates of several symptoms, including throat irritation (67% vs. 47 %), sinus problems (72% vs. 56%), eye burning (83% vs. 56%), shortness of breath (78% vs. 64%), and skin rashes (50% vs. 33%).

In sum, while these data do not prove that living closer to oil and gas facilities causes health problems, they do suggest a strong association since symptoms are more prevalent in those living closer to facilities than those living further away. Symptoms such as headaches, nausea, and pounding of the heart are known to be the first indications of excessive exposure to air pollutants such as VOCs [36], while the higher level of nosebleeds in the youngest age group is also consistent with patterns identified in health survey projects in other states [9, 10].

The survey also asked respondents to indicate whether they were smokers. While the average number of symptoms for smokers was higher for smokers than nonsmokers (30 vs. 22), the most frequently reported symptoms were very

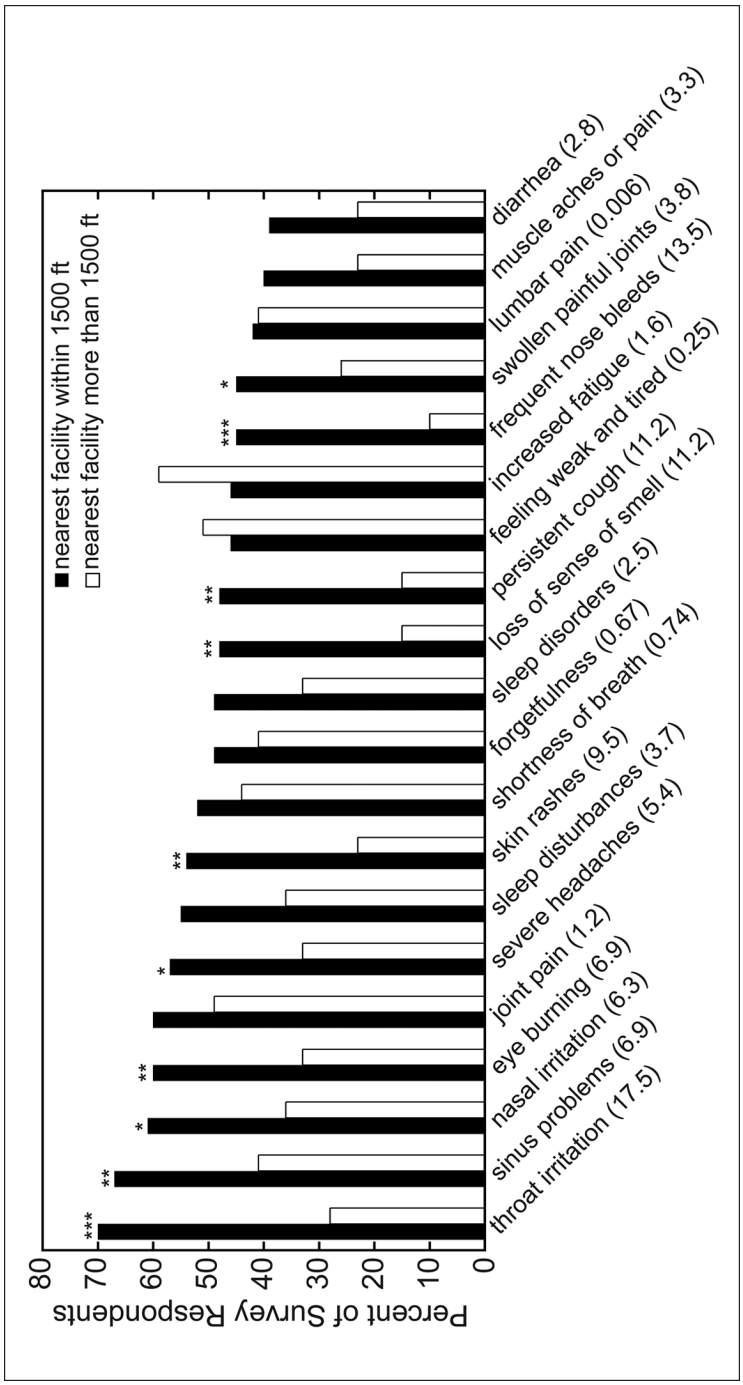

Figure 1. Association of symptoms and distance from facilities.

Note: The significance of the effect was tested using a two-way contingency table analysis, and the chi-square value is given in parenthesis after each symptom. Effects significant at $p < 0.001$ are indicated by ***, those significant at $p < 0.01$ by **, and those significant at $p < 0.05$ by *.

similar (including forgetfulness, increased fatigue, lumbar pain, joint pain, eye burning, nasal irritation, sinus problems, sleep disturbances, severe headaches, throat irritation, shortness of breath, frequent nausea, muscle aches or pains, and weakness). The fact that the nonsmokers experienced symptoms that are commonly considered to be side effects of smoking (e.g., persistent hoarseness, throat irritation, sinus problems, nasal irritation, shortness of breath, and sleep disturbances) suggests that factors other than smoking were at play.

In addition, while the smoking subpopulation generally reported a larger number of symptoms, the symptoms most frequently reported by smokers and nonsmokers were remarkably similar within each age group [35]. For example, for 20- to 40-year-olds, increased fatigue, sinus problems, throat irritation, frequent nausea, and sleep problems were among the top symptoms for both smokers and nonsmokers. In the 41- to 55-year-old group, increased fatigue, throat irritation, eye burning, severe headaches, and nasal irritation were among the top symptoms for both smokers and nonsmokers, and in the over-55 age group, eye burning, sinus problems, increased fatigue, joint pain, and forgetfulness were among the top symptoms of both smokers and nonsmokers.

Participants were asked if they had noticed any odors and were asked whether they knew the source of the odors. In all but a few cases, survey participants mentioned only gas-related sources. Responses focused on locations, facilities, and processes, including drilling, gas wells, well pads, fracturing, compressor stations, condensate tanks, flaring, impoundments and pits, retention ponds, diesel engines, truck traffic, pipelines and pipeline stations, spills and leaks, subsurface ground events or migrations from underground, seismic testing, blue-colored particles in the air (possibly catalytic compounds or particulate matter), and water and stock wells. Odors were among the most common of complaints, with 81 percent of participants experiencing them sometimes or constantly. The frequency ranged from one to seven days per week and from several times per day to all day long; 18 percent said they could smell odors every day.

Participants were also asked to describe odors and whether they noticed any health symptoms when odor events occurred. The most prevalent links between odors and symptoms reported were:

- *nausea:* ammonia, chlorine, gas, propane, ozone, rotten gas;
- *dizziness:* chemical burning, chlorine, diesel, ozone, petrochemical smell, rotten/sour gas, sulfur;
- *headache:* chemical smell, chlorine, diesel, gasoline, ozone, petrochemical smell, propane, rotten/sour gas, sweet smell;
- *eye/vision problems:* chemical burning, chlorine, exhaust;
- *respiratory problems*: ammonia, chemical burning, chlorine, diesel, perfume smell, rotten gas, sulfur;
- *nose/throat problems:* chemical smell, chlorine, exhaust, gas, ozone, petrochemical smell, rotten gas, sulfur, sweet smell;

- *nosebleeds:* kerosene, petrochemical smell, propane, sour gas;
- *skin irritation:* chemical smell, chlorine, ozone, sulfur;
- *decreased energy/alertness:* chemical gas, ozone, rotten/sour gas, sweet smell; and
- *metallic/bad taste in mouth:* chemical burning, chlorine, turpentine.

Environmental Testing

As detailed in Table 3, the air tests detected a total of 19 VOCs in ambient air sampled outside of homes.

The number of compounds detected in a single sample ranged from one to 25; there was some consistency with regard to the chemicals present in most of the samples, although the concentrations of VOCs detected varied across counties [35]. The highest numbers of VOCs were detected in air samples from Washington County (15), Butler County (15), Bradford County (12), and Fayette County (9). Washington County also had the highest measured concentration of five VOCs and the second highest concentration of 12 chemicals. Samples from Butler and Bradford Counties had the highest concentrations of five and three VOCs, respectively. Five chemicals were detected in all nine of the samples from Washington County and in the six samples from Butler County: 1,1,2-trichloro-1,2,2-trifluoroethane, carbon tetrachloride, chloromethane, toluene, and trichlorofluoromethane.

It is also possible that in some places, sampling did not occur at the precise times when facilities were emitting high concentrations of chemicals or when the wind was blowing contaminants toward canisters. Some of the additional variation in number of chemicals and concentrations could be due to differences in topography, the total number of active oil and gas wells, the types of wells (conventional versus unconventional), the use of emission control technologies, and the number of active drilling sites, compressor stations, and oil and gas waste impoundments located within a certain radius of the sampling locations.

In 2010, the Pennsylvania Department of Environmental Protection (DEP) conducted air testing around natural gas wells and facilities in three regions across the state, in part using the same canister sampling methods as in this project [37]. When compared to DEP's results, our results showed some striking similarities in both the chemicals detected and concentrations. In particular, BTEX chemicals that we measured in Butler and Washington counties were consistently higher than concentrations found at DEP control sites (ethylbenzene and — and *p*-xylenes were not detected at any of the control sites). When compared to the sampling done by DEP around oil and gas facilities, the concentrations in Butler and Washington counties were in the same range for benzene, but were considerably higher for toluene, ethylbenzene and *m*- and *p*-xylenes. It is also striking that some of the concentrations of ethylbenzene and

Table 3. Volatile Organic Compounds (VOCs) in Ambient Air, Sorted by Percent Detection[a]

Compound	Total number of samples	Number of samples detecting VOCs	Percent of samples detecting VOCs	Minimum concentration	Maximum concentration	Chemical reporting limits for the three labs		
						Columbia	Con-Test	Pace[b]
2-Butanone	17	16	94	0.95	2.9	0.85-1.3	NA	NA
Acetone	17	15	88	8.0	19	6.5-10	NA	NA
Chloromethane	34	27	79	1.0	1.66	0.59-0.90	0.1	1.39-1.53
1,1,2-Trichloro-1,2,2-trifluoroethane	34	26	76	0.54	0.73	0.22-0.34	0.38	5.13-5.67
Carbon tetrachloride	34	26	76	0.4	0.76	0.091-0.14	0.31	4.21-4.65
Trichlorofluoromethane	34	26	76	0.6	1.8	0.81-1.2	0.28	3.32-3.66
Toluene	34	22	65	0.68	7.9	0.53-0.82	0.19	2.52-2.79
Dichlorodifluoromethane	17	9	63	1.9	2.8	NA	0.25	3.32-3.66
n-Hexane	8	3	38	3.03	7.04	NA	NA	2.37-2.61
Benzene	34	11	32	0.31	1.5	0.46-0.67	0.16	2.14-2.36

Methylene chloride	34	10	29	1.9	32.62	0.49-0.76	1.7	2.33-2.57
Total hydrocarbons (gas)[c]	8	2	25	49.8	146	NA	NA	46.9-52.2
Tetrachloroethylene	34	8	24	0.12	10.85	0.10-0.16	0.34	4.54-5.02
1,2,4-Trimethylbenzene	17	4	24	0.38	0.61	NA	0.25	3.30-3.64
Ethylbenzene	34	6	1	0.27	1.5	1.4-1.9	0.22	2.91-3.21
Trichloroethylene	34	6	18	0.17	5.37	0.08-0.12	0.27	3.60-3.98
Xylene (— and *p*-)	34	5	15	0.92	5.2	2.5-3.8	0.43	2.82-3.12
Xylene (*o*)	34	5	15	0.39	1.9	1.2-1.9	0.22	2.91-3.21
1,2-Dichloroethane	34	1	3	0.64	0.64	0.59-0.90	0.2	2.71-2.99

[a]Concentrations are in micrograms per cubic meter, $\mu g/m^3$ (n = total number of canister samples that were analyzed for a particular chemical).

[b]Pace Lab's reporting limits were in parts per billion volume (ppbv). We converted to micrograms per cubic meters ($\mu g/m^3$) using equations in the Air Unit Conversion Table (Torrent Labs, www.torrentlab.com/torrent/Home/ResourceCenter.html).

[c]Total hydrocarbons reported as parts per billion volume (ppbv).

xylene measured at rural and suburban residential homes in Butler and Washington counties were higher than any concentration detected by the DEP at the Marcus Hook industrial site in 2010.

As stated above, several factors can influence air results. However, it is also highly possible that the poorer air quality in the areas where we tested—which were rural and residential, with little or no other industry nearby—can be attributed to gas facilities. While the DEP reports on the agency's air testing indicated that some of the VOCs we found in our study may not be due to oil and gas development since they persist in the atmosphere and have been widely used (for example, as refrigerants), the agency also indicates that acetone and the BTEX chemicals can be attributed to gas development [37].

With regard to the water tests conducted, Table 4 shows the 26 parameters that were detected in at least one sample. More than half of the project water samples contained methane; although some groundwater contains low concentrations of methane under normal conditions, this finding could also indicate natural gas migration from casing failure or other structural integrity problems [38]. Four of the substances detected in water well samples in Bradford and Butler Counties—manganese, iron, arsenic, and lead—were found at levels that exceed the Maximum Contaminant Levels (MCLs) set by Pennsylvania DEP's Division of Drinking Water Management [39]. Two of the water samples, both from Butler County, were more acidic than the recommended pH for drinking water.

Some metals, such as manganese and iron, are elevated in Pennsylvania surface waters and soils, either naturally or due to past industrial activities, and levels can vary regionally [40]. In 2012, Pennsylvania State University (PSU) researchers found that some drinking water wells in the state contained somewhat elevated concentrations of certain contaminants prior to any drilling in the area [41]. However, seven out of the nine water supplies sampled in our study (78%) had manganese levels above the state MCL—a much higher percentage than what was found in the pre-drilling samples in the PSU study (27%). Even where metals are naturally occurring or predate gas development, drilling and hydraulic fracturing can contribute to elevated concentrations of these contaminants [42] and have the potential to mobilize substances in formations such as Marcellus Shale, which is enriched with barium, uranium, chromium, zinc, and other metals [43].

LINKAGES BETWEEN SURVEYS AND ENVIRONMENTAL TESTING

More research would be required to identify cause-and-effect connections between the chemicals present in air and water in Pennsylvania's gas patches and symptoms reported by residents in specific locations. Nonetheless, such links are plausible since many of the chemicals detected in the testing are

known to be related both to oil and gas operations and to the health symptoms reported by individuals living at the sites where air and water testing was conducted [13-15].

The air tests together detected 19 chemicals that are known to cause sinus, skin, ear/nose/mouth, and neurological symptoms, 17 that may affect vision/eyes, and 16 that may induce behavioral effects; as well as 11 that have been associated with liver damage, nine with kidney damage, and eight with digestive/stomach problems. In addition, the brain and nervous system may be affected by five of the VOCs detected, the cardiac system by five, muscle by two, and blood cells by two [44, 45].

Using these sources [44, 45], we compared lists of the established health effects of the chemicals detected at households where testing occurred with lists of the symptoms reported in surveys by participants at those testing locations in order to identify associations. We then calculated the rate of association, in which the denominator is the total number of health impacts reported by an individual and the numerator is the total number of health impacts reported by that individual that are consistent with the known health impacts of the chemicals detected through air or water testing where they live.

Benzene, toluene, ethylbenzene, xylene, chloromethane, carbon disulfide, trichloroethylene (TCE), and acetone were detected through testing at the same households where survey participants reported symptoms established in the literature [13-15, 44, 45] as associated with these chemicals, including symptoms in the categories of sinus/respiratory, skin, vision/eyes, ear/nose/mouth, and neurological. Some of these chemicals, as well as others (such as carbon tetrachloride and tetrachloroethylene) were found at sites where survey participants reported known associated symptoms in the categories of digestion, kidney and liver damage, and muscle problems. Specific examples of chemicals and symptoms that are linked in the research literature, and were found together at households where testing and surveys were conducted, are: benzene and dizziness and nasal, eye, and throat irritation; carbon tetrachloride and nausea, headaches, and liver and kidney disease; and tetrachloroethylene and skin rashes, persistent cough, and nerve damage.

As shown in Table 5, health symptoms reported by the individuals living in a home where testing occurred matched the known health effects of chemicals detected in that home at an overall rate of 68 percent. Fayette and Washington counties had the highest match, followed by Greene, Bedford, and Butler counties.

In addition, the percent of individuals reporting symptoms that have been associated with chemicals detected in air testing at households participating in this study showed some consistency across counties with regard to the most significant categories of problems reported, as shown in Table 6—indicating that patterns in both chemicals detected and symptoms exist despite different geographic locations.

Table 4. Water Quality Results from Nine Private Water Wells in Bradford and Butler Counties, Pennsylvania

Parameter[a]	Units	Number of samples	Number above detection limit	Minimum[b]	Maximum	Mean[c]	PA DEP MCL[d]	Number of samples above MCL[e]
Barium	mg/L	9	9	0.029	0.5	0.25	2	0
Calcium	mg/L	9	9	33	66.2	43.7	None	
Magnesium	mg/L	9	9	4.5	16.8	9.1	None	
Sodium	mg/L	9	9	9.2	64.1	20.9	None	
Strontium	mg/L	9	9	0.126	1.7	0.5	None	
Hardness (total as $CaCO_3$)	mg/L	9	9	120	234	147	None	
pH	Std Units	9	9	6	7.9	6.5	6.5-8.5	[f]
Alkalinity (total as $CaCO_3$)	mg/L	9	9	38	285	130	None	
Total dissolved solids	mg/L	9	9	138	392	218	500	0
Sulfate	mg/L	9	9	6.7	231	33	250	0
Manganese	mg/L	9	7	< 0.005	6.44	1.04	0.05	7
Chloride	mg/L	9	7	< 5.0	84.3	24.1	250	0
Iron	mg/L	9	6	< 0.04	153	19.5	0.3	5
Potassium	mg/L	6	6	1.14	1.57	1.1	None	

Specific conductance	μmhos/cm	6	6	287	552	326	None	
Methane	μg/L	9	5	1.06	57.4	10	0.3	
Arsenic	mg/L	9	4	< 0.001	0.0282	0.005	0.010	1
Lead	mg/L	9	4	< 0.001	0.113	0.113	0.01	3
Total coliform	per 100 mL	9	4	Absent	Present		None	
Total suspended solids	mg/L	6	4	< 5	448	118	None	
Temperature, water	Degree/Celsis	3	3	25	29	28	None	
Turbidity	NTU	3	3	0.22	5.7	2.3	None	
Nitrate	mg/L	3	3	0.076	0.71	0.46	10	0
E. coli	per 100 mL	9	2	Absent	Present		None	
Sulfur	μg/L	1	1	< 1,000	7,550	2,850	None	
Bromide	mg/L	1	1	0.26	0.26	0.26	None	

[a]Note: not all parameters were analyzed in every sample.

[b]Minimum values: If reports included non-detects of a particular chemical, the minimum value in the table was shown as being less than (<) the lowest laboratory detection limit.

[c]Mean values: Non-detected chemicals were assigned a concentration equal to half of the detection limit *only if* there were other samples that detected the chemical.

[d]MCL: Maximum Contaminant Levels published by the Pennsylvania Department of Environmental Protection Division of Drinking Water Management.

[e]No values are provided if MCLs for substances do not exist.

[f]Two samples had higher acidity (lower pH) than the value recommended by the PA DEP.

Table 5. Match between Health Symptoms Reported by Individuals at Air Testing Sites and Known Effects of Chemicals Detected

County	Number of individuals surveyed at homes where testing was conducted	Match between known health effects of chemicals detected and symptoms reported (percent)[a]	
		Average	Range
Overall	59	68	33-100
Fayette	16	73	33-100
Washington	15	73	33-100
Bradford	8	58	16-100
Butler	8	63	56-68
Bedford	6	69	63-100
Elk	2	64	53-74
Clearfield	1	none	none
Greene	1	70	70
Susquehanna	1	50	50

[a]When a health symptom was associated in the literature with more than one of the chemicals detected, only one match was counted for that symptom.

As mentioned above, levels of iron, manganese, arsenic, and lead were detected in our water well samples in Bradford and Butler Counties at levels that exceeded drinking water standards set by the Pennsylvania DEP. These substances are known to be associated with numerous symptoms reported by individuals living in the homes where these particular exceedances occurred, including symptoms in the categories of sinus/respiratory, skin reactions, digestive/stomach, vision/eyes, ear/nose/mouth, neurological, muscle/joint, behavioral/mood/energy, and liver and kidney damage. Survey participants in the homes where water samples contained methane reported health symptoms known to be associated with methane, including in the categories of sinus/respiratory, digestive/stomach, neurological, and behavioral/mood/energy. While the water samples taken for this project did not show detectable exceedances of safety standards for other substances, it is notable that no drinking water standards have been set for methane, bromide, sodium, strontium, or Total Suspended Solids (TSS)—and thus no exceedances would be indicated in laboratory reports.

Table 6. Percent of Individuals at Air Testing Sites Reporting Symptoms Associated in the Literature with Chemicals Detected at Those Sites, by Symptom Category and Primary Air

		Testing counties					
Symptom category	All	Bedford	Bradford	Butler	Fayette	Washington	Others[a]
Sinus/respiratory	83	100	88	100	81	73	80
Vision/eyes	73	—	100	63	69	67	60
Digestive/stomach	69	50	63	88	75	80	—
Skin reactions	63	50	63	88	69	53	40
Neurological	60	50	88	75	44	53	60
Behavioral/mood/energy	54	67	50	63	63	47	40
Ear/nose/mouth	33	50	—	38	44	33	20
Muscle problems	—	—	—	—	—	40	—

[a]This includes air samples from Clearfield, Elk, Greene, and Susquehanna counties.

DISCUSSION

> Complete evidence regarding health impacts of gas drilling cannot be obtained due to incomplete testing and disclosure of chemicals, and non-disclosure agreements. Without rigorous scientific studies, the gas drilling boom sweeping the world will remain an uncontrolled health experiment on an enormous scale.
>
> —Michelle Bamberger and Robert Oswald [16]

While the survey and testing results, and their related findings, do not constitute definitive proof of cause and effect, we believe they do indicate the strong likelihood that the health of people living in proximity to gas facilities is being affected by exposure to pollutants from those facilities. Most participants report a high number of health symptoms; similar patterns of symptoms were identified across project locations and distances from facilities; and consistency in symptoms reported exists regardless of age group or smoking history. In addition, contaminants that result from oil and gas development were detected in air and water samples in areas where residents are experiencing health symptoms that are established in the literature as consistent with such exposures.

Because of the short-term nature of the air-canister testing (24 hours) and the single water tests conducted at households, our results were contingent on conditions at particular "moments in time." Thus additional chemicals, or the same chemicals at different concentrations, might be captured through expanded testing; and residents could be experiencing exposures that were not detected but would be detectable through such testing. In addition, some of the variation in the air test results may have been due to the different reporting protocols of the laboratories used in this project. Although all the labs test for the same core suite of chemicals, both their reporting limits and the additional chemicals for which they test vary. These will be key considerations for future testing work.

Another consideration that warrants further exploration involves the established standards on both the state and federal levels for "safe" concentrations, which are set only for exposure to single contaminants. This prevailing regulatory approach can not adequately address the potential risks posed by chronic, long-term exposure to lower levels of multiple contaminants simultaneously—in other words, the experience of people living in oil and gas areas day in and day out, and of workers at job sites where toxic substances are continuously used. In addition, for many substances in the environment (including those that come from gas operations and were detected in our air and water sampling), data on health risks or safe exposure levels simply do not exist.

More research is also needed that focuses on the sources of odors and odor events experienced by residents living near gas facilities. In some cases, participants reported different health impacts associated with specific sources and odor events than those they reported in the overall health survey. Since odors are

a clear sign of the presence of airborne substances (such as fuel and chemicals), this aspect warrants tracking and analysis.

Although we did not investigate additional factors that can influence health conditions (e.g., through ordered control groups, in-depth health history research, or identification of other potential sources of contaminants), such factors may affect an individual's health independent of gas operations. The relationship between symptoms and distance from gas facilities also warrants more research.

At the same time, we strongly suggest that for individuals with a history of other health concerns (e.g., asthma or heart conditions) and who are already living with other exposures (e.g., traffic fumes or workplace chemicals), the presence of gas facilities and related pollution could have a strong "trigger effect" that can make existing problems worse and put individuals at higher risk of developing new ones.

RECOMMENDATIONS

As discussed earlier, scientific knowledge about the health and environmental impacts of shale gas development—and also the adoption of policy and regulatory measures to prevent them—are proceeding at a far slower pace than the development itself. This timing mismatch creates situations (already being experienced by residents of Pennsylvania and other states) in which problems are widely reported but left unaddressed. Several measures can be taken to ensure that public health impacts are fully understood and given greater priority in decision-making about shale gas development.

1) *Elevate the role of public health considerations in gas development decisions.* A key measure would be to conduct health impact assessments before permitting begins. HIAs aim to minimize negative impacts and to improve health outcomes associated with land use decisions by analyzing problems that could arise over time, as well as existing health and environmental risks that could be exacerbated by new activities [46]. HIAs can also have a strong preventive effect by identifying mitigation measures related to aspects such as toxic exposures, air and water pollution, and emergency response [47]. In addition, regulatory agencies could comprehensively plan the scope and pace of permits for wells and other facilities in order to reduce impacts on air and water quality, rather than continuing the permit-by-permit process currently being followed in Pennsylvania and other states. Information on where wells and facilities would be built in relation to places where health could be at risk (e.g., homes, schools, and hospitals) could also be required in permit applications.

2) *Increase the involvement of state departments of health in assessing the impacts of gas development.* Efforts should be increased to track and respond to health concerns, and a database should be established to document these problems and the agency response. Health departments could provide training for health and medical professionals on exposure pathways and health symptoms

related to gas operations, so that residents receive more informed advice and appropriate testing and care referrals. Financial aid mechanisms should be established to enable low-income residents to have blood and urine tests for chemical exposure.

3) *Conduct baseline water testing and continuous long-term monitoring of air quality.* Such testing would apply to private wells and public drinking water supplies prior to drilling and to the air at or near facilities during all phases of operations. Testing and monitoring should cover a full suite of chemicals, and contaminants and results should be reported regularly and made available to the public. Air quality testing in particular should be conducted at a range of facilities (e.g., compressor stations, impoundment pits, dehydrators) that cause emissions. These efforts could be carried out by the state regulatory agencies that issue permits or through an agreement between those agencies and health departments. Inter-agency agreements could also be developed to track potential health impacts that could result following spills of chemicals and waste, the underground migration of fracturing fluids, leaks, and other problems.

4) *Strengthen regulations for facilities to minimize air and water pollution risks.* These could include significantly increased setback distances; the installation of advanced technologies on all equipment to reduce emissions, odors, and noise; the use of closed-loop storage systems for waste and drilling fluids (rather than open pits); and the practice of "green completions" to reduce or eliminate flaring and venting of methane gas and other pollutants.

5) *Advance changes in testing parameters that determine "safe" exposure in order to account for low-level, chronic exposure and multiple chemical exposure in testing and monitoring.* Such changes are necessary to reflect impacts on people living in oil and gas development areas day in and day out, as well as workers at facilities. Under current testing parameters (which are based largely on acute episodes involving single contaminants), results may show below-threshold levels even though residents are negatively affected. For example, a recent paper showed that endocrine-disrupting chemicals can have different but still harmful effects at lower doses than at higher ones and concluded that fundamental changes in chemical testing and safety protocols are needed to protect human health [48]. Additionally, current health guidelines should be updated to capture more of the chemicals currently in use and to assess complex or indirect sources of contamination, such as oil and gas operations that rely on a variety of substances, equipment, and facilities at numerous stages of development.

CONCLUSION

> While we realize that human activities may involve hazards, people must proceed more carefully than has been the case in recent history. Corporations, government entities, organizations, communities, scientists, and other individuals must adopt a precautionary approach to all human endeavors. . . . When an activity raises threats of harm to human health or the environment,

> precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.
>
> —Wingspread Consensus Statement on the Precautionary Principle [49]

Across the gas patches of the United States, people experiencing health problems voice the simple wish to be believed. Many say that their health has worsened since gas development began in their communities and that they feel better when they are away from home. Often these conversations turn to what it will take for regulators and policymakers to view their stories not just as "anecdotes," but as valid concerns worthy of an effective response.

There is no doubt that more research on the environmental and health impacts of shale gas development is needed and can play a critical role in making sound decisions about a complex and controversial issue. Yet an equally important consideration is how to respond to the presence of unanswered questions. For many proponents of unfettered gas development, the absence of definitive causal links between gas facilities and specific health impacts indicates the absence of a problem. But for impacted communities and others who believe health and the environment deserve protection and that water and air quality should be maintained, what we don't yet know makes the need for caution even greater.

We believe that the findings of this survey and testing project in Pennsylvania, coupled with similar projects elsewhere and an emerging body of research, provide sufficient evidence for decision-makers to take action to slow the rush to drill, at least until the wide gaps in scientific knowledge, policies, and regulations are bridged. Much is already known about the chemicals used and pollution caused by oil and gas activities, which alone create the real potential for negative health effects in any area where development occurs [50]. The precautionary principle should be applied to decisions about shale gas development (both in existing gas patches and in areas slated for new development), and this should include shifting the burden of proof that harm does or does not occur to those proposing the action.

The status quo—in which science and policy changes proceed slowly while gas development accelerates rapidly—is likely to worsen air and water quality, resulting in negative health impacts and possibly a public health crisis. Greater understanding of the experiences reported by individuals living near gas facilities can play an important role in pointing the way forward to preventing these problems, both in Pennsylvania and nationwide.

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[DRAFT] MEMORANDUM

SUBJECT: Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program

FROM: Stephen D. Page, Director
Office of Air Quality Planning and Standards

TO: Regional Air Division Directors, 1-10

The purpose of this memorandum is to provide guidance on compliance demonstration tools for use with ozone and fine particles ($PM_{2.5}$) in the Prevention of Significant Deterioration (PSD) permitting program. The Environmental Protection Agency has developed a new analytical approach and has used it to identify a significant impact level (SIL) for each ozone and $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) and the $PM_{2.5}$ PSD increments. We recommend that permitting authorities[1] consider using these values to help determine whether a proposed PSD source[2] causes or contributes to a violation of the corresponding NAAQS or PSD increments. The supporting technical document[3] provides a detailed discussion of the technical analysis used to develop these values. The supporting legal memorandum provides further detail on a legal basis that permitting authorities may choose to adopt to support using SILs to show that requirements for obtaining a PSD permit are satisfied.[4] This memorandum provides the results of the technical analysis and information on the particular points in the PSD air quality analysis at which permitting authorities may decide to use these values on a case-by-case basis in the review of PSD permit applications.[5] This memorandum and the supporting documents

[1] Permitting authorities include the EPA, state, local and tribal permitting authorities.
[2] As used in this memorandum, "PSD source" means a construction or modification of a major stationary source triggering PSD permitting requirements.
[3] "Technical Basis for the EPA's Development of Significant Impact Thresholds for $PM_{2.5}$ and Ozone"; EPA/XXX-X-XX-XXX, [DATE]
[4] Legal Support Memorandum: Application of Significant Impact Levels in the Air Quality Demonstration for Prevention of Significant Deterioration Permitting under the Clean Air Act," [DATE]
[5] The term "case-by-case basis" is used in this memorandum to refer to a permitting authority's use of a SIL value in a particular air quality analysis in an individual PSD permitting action when the SIL value has not been adopted in the state's EPA-approved PSD SIP rules (or the federal PSD rules, as applicable) pursuant to section 165(a)(3) of the Clean Air Act (CAA). When the SIL value has not been adopted into the applicable PSD rules, the permitting authority's record of each PSD permitting action in which a SIL is used must contain a justification demonstrating that the particular level and use of the SIL value is consistent with the CAA and applicable PSD rules. The permitting authority's justification may make use of the policy, legal and technical analysis documents developed by the EPA. We note that in a broader sense, all PSD permit reviews are "case-by-case" under section 165(a) of the CAA; in this memorandum, for clarity we refer to the case-specific nature of PSD permit reviews as "permit-specific" when not discussing the use of a SIL value by a permitting authority on a case-by-case basis.

are not final agency actions and do not create any binding requirements on permitting authorities, permit applicants or the public.

I. INTRODUCTION

When a PSD permit applicant has shown through air quality modeling that the projected impact from a proposed source is less than a SIL value for a particular pollutant, the EPA believes there is a valid analytical and legal basis for the permitting authority to conclude that this showing is sufficient to demonstrate that the proposed source will not cause or contribute to a violation of a NAAQS or PSD increment for that pollutant. Permitting authorities may elect to use the SILs discussed below, and the EPA has provided policy, technical and legal analyses that permitting authorities may choose to adopt or adapt in supporting their use of the SILs in particular PSD permitting actions. The use of SILs can help satisfy PSD requirements while conserving resources for applicants and permitting authorities.

The EPA has previously issued guidance describing particular uses of SILs.[6,7,8,9] Permitting authorities have long had the discretion to apply SILs on a case-by-case basis in the review of individual permit applications, provided such use was justified in the permitting record.[10] In an effort to reduce the need for case-by-case justification by permitting authorities, in 2010, the EPA finalized a rule to codify particular $PM_{2.5}$ SIL values and specific applications of those values,[11] but in subsequent litigation the EPA found an inconsistency between the preamble and regulatory text, and the court granted the EPA's request to vacate and remand the inconsistent regulatory text.[12]

Following the litigation, the EPA initially began developing a new rule to address the inconsistencies identified in the 2010 rulemaking.[13] However, after further evaluation and the identification of a revised set of SIL values based on the technical and legal analyses described below, the EPA believes it should first obtain experience with the application of these values in the permitting program before establishing a generally applicable rule.[14] In addition, permit applicants and permitting authorities have

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[6] Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program," August 23, 2010.
[7] Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program," June 29, 2010.
[8] Memorandum from Stephen D. Page, EPA OAQPS, to OAQPS Personnel and EPA Regional Modelers, "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS," March 23, 2010.
[9] Memorandum from Gerald A. Emison, EPA OAQPS, to Thomas J. Maslany, EPA Air Management Division EPA Region 3, "Air Quality Analysis for Prevention of Significant Deterioration (PSD)," July 5, 1988.
[10] Order Responding to Petitioner's Request that the Administrator Object to Issuance of a State Operating Permit, In the Matter of CF&I Steel, L.P. dba EVRAZ Rocky Mountain Steel, Petition Number VIII-2011-01, at 15-17 (May 31, 2012) ("Rocky Mountain Steel Order"); In re: Mississippi Lime Company, 15 E.A.D. 349, 375-379 (EAB 2011).
[11] 75 FR 84864 (October 20, 2010).
[12] *Sierra Club v. EPA*, 705 F.3d 458 (D.C. Cir. 2013). In its litigation brief at n. 10, the EPA stated an intent to issue guidance in the near future concerning $PM_{2.5}$ SIL values remaining in 40 CFR 51.165(b). The EPA issued such guidance in May 2014. Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance for $PM_{2.5}$ Permit Modeling," May 20, 2014.
[13] Fall 2015 Regulatory Agenda, USEPA, 80 FR 78024, December 15, 2015. Ozone and Fine Particulate Matter ($PM_{2.5}$) Significant Impact Levels (SILs) for Prevention of Significant Deterioration (PSD), RIN: 2060-AR28. *http://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201510&RIN=2060-AR28*.
[14] *See SEC v. Chenery Corp.*, 332 U.S. 194, 199-203 (1947) (recognizing that some principles may warrant further development before they are ready to be codified in a rule of general applicability).

communicated a need for the EPA to develop SIL values for ozone on an expedited basis. As a result, the EPA intends at this point to take a two-step approach.

First, the EPA is providing non-binding guidance so that we may gain valuable experience and information as permitting authorities use their discretion to apply and justify the application of the SIL values identified below on a case-by-case basis in the context of individual permitting decisions. We will be seeking to learn generally about permitting agencies' experiences in applying SILs in particular PSD permitting decisions. We will also be seeking more specific information, including how often and in what types of settings the application of a SIL at the single-source assessment and cumulative assessment stages of the PSD air quality analysis has made a critical difference in whether a conclusion was reached that the proposed source will not cause or contribute to a NAAQS or PSD increment violation. The EPA intends to obtain this information through its own PSD permitting activities in states that do not have SIP-approved PSD programs, regular discussions between our regional offices and air agencies, regular conference calls with the permitting committees of national organizations of air agencies, and technical conferences of air quality modelers and others interested in permitting activities.

Second, the EPA will use this experience and information to assess, refine and, as appropriate, codify SIL values and specific applications of those values in a future, potentially binding rulemaking. [15] During this second step, to assess whether it is appropriate to codify the particular SIL values derived using EPA's technical methodology or to codify revised values, the EPA will consider what SIL values are suitable in all locations and circumstances to show that an increase in air quality concentration below the corresponding SIL value does not cause or contribute to a violation of the NAAQS or PSD increments. Until the EPA conducts a rulemaking, permitting authorities retain discretion to use or not to use the EPA-derived SILs in particular PSD permitting actions. If a permitting authority chooses to use these or other SIL values on a case-by-case basis, it must justify the values and their use in the administrative record for the permitting action.

Since the 2010 rulemaking, the EPA has examined the legal basis for using SIL values in PSD air quality impact analyses. In addition, the EPA has sought to develop an improved technical methodology for deriving SIL values. This memorandum and supporting documents are the products of this effort. They identify specific SIL values for ozone and $PM_{2.5}$ and provide a supporting justification that permitting authorities may choose to apply on a case-by-case basis. The values and supporting justification are designed so that permitting authorities can choose to apply the SIL values at any location to demonstrate that a proposed source does not cause or contribute to a violation of air quality standards. In contrast to the 2010 rulemaking, we have developed separate SIL values for the $PM_{2.5}$ NAAQS and PSD increments, and we have developed SILs for the ozone NAAQS. Since there are no PSD increments for ozone, the EPA has not developed SILs for ozone.

The EPA believes that the application of these SILs in the manner described below would be sufficient in most situations for a permitting authority to conclude that a proposed source will not cause or contribute to a violation of an ozone or $PM_{2.5}$ NAAQS or $PM_{2.5}$ PSD increment. However, this guidance is not a final agency action and does not reflect a final determination by the EPA that any particular proposed source, or class of proposed sources, does not cause or contribute to a violation or may obtain

[15] The EPA does not at present have a schedule for a future rulemaking on ozone and $PM_{2.5}$ SILs, but we will review the status from time to time. This rulemaking will continue to appear in the EPA's regulatory agendas under longer-term actions until we develop a specific schedule.

a PSD permit. A determination that a proposed source does not cause or contribute to a violation can only be made by a permitting authority on a permit-specific basis after consideration of the permit record. This guidance is not legally binding and does not affect the rights or obligations of permit applicants, permitting authorities, or others. The SIL values identified by the EPA have no practical effect unless and until permitting authorities decide to use those values in particular permitting actions. The experience of permitting authorities in using these SILs on a case-by-case basis, or in choosing to limit or forego their use in specific situations, will be valuable information for the EPA to consider in a future rulemaking. Permitting authorities retain the discretion to apply and justify different approaches and to require additional information from the permit applicant to make the required air quality impact demonstration, consistent with the relevant PSD permitting requirements.

II. BACKGROUND

A PSD permit applicant must demonstrate that "emissions from construction or operation of such facility will not cause, or contribute to, air pollution in excess of any" NAAQS or PSD increment.[16] The EPA has reflected this requirement in its PSD regulations.[17] The CAA does not specify how a permit applicant or permitting authority is to make this demonstration, but section 165(e) authorizes the EPA to determine how the analysis is to be conducted, including the use of air quality models. In accordance with this authority, the EPA has promulgated regulations that identify such models and the conditions under which they may be used in the PSD program to make the demonstration required under the Act.[18]

Using the models identified in EPA regulations, there are two basic ways that a PSD permit applicant can demonstrate that the proposed source's emissions will not cause or contribute to a violation of any NAAQS or PSD increment. One way is to demonstrate that no such violation is occurring or projected to occur in the area affected by the emissions from the proposed source.[19] A second way is to demonstrate that the emissions from the proposed source do not cause or contribute to any identified violation of the NAAQS or PSD increments.[20]

The Act does not define "cause" or "contribute." Reading these terms in context, the EPA has historically interpreted this provision in section 165(a)(3) of the CAA and associated regulations to mean that a source must have a "significant impact" on ambient air quality in order to cause or contribute to a violation.[21] Thus, the EPA and other permitting authorities have concluded that a proposed source may meet the requirements in CAA section 165(a)(3) and the EPA's PSD regulations by showing that its projected impact on air quality at the site of a modeled violation is below a level of air quality impact considered to be significant.[22]

[16] Section 165(a)(3) of the CAA. The EPA interprets the phrase "in excess of" to mean a violation, not the exceedance described in 40 CFR 50.1(l).
[17] 40 CFR 51.166(k); 40 CFR 52.21(k).
[18] 40 CFR 51.166(l); 40 CFR 52.21(l); 40 CFR part 51, Appendix W (Guideline on Air Quality Models).
[19] 1990 Draft NSR Workshop Manual at C.51.
[20] 40 CFR part 51, App. W, § 10.2.3.2(a); 1990 Draft NSR Workshop Manual at C.52.
[21] In re Prairie State Generating Co., 13 E.A.D. 1, 105 (EAB 2006). This EAB opinion includes a long discussion of EPA's prior guidance with other examples.
[22] 1990 Draft NSR Workshop Manual at C.52.

Historic Use of SILs

In the context of section 165(a)(3) of the CAA, the EPA has historically used pollutant-specific concentration levels known as "significant impact levels" to identify the degree of air quality impact that "causes, or contributes to" a violation of a NAAQS or PSD increment.[23] Consistent with EPA guidance, proposed sources have met the requirement to demonstrate that they do not cause or contribute to a violation by showing that the ambient air quality impacts resulting from the proposed source's emissions would be below these concentration levels.[24] The SIL values have served as a compliance demonstration tool to make the required demonstration in the PSD program. They have helped to reduce the burden on permitting authorities and permit applicants to conduct often time-consuming and resource-intensive air dispersion modeling where such modeling was unnecessary to demonstrate that a permit applicant meets the requirements of section 165(a)(3), consistent with the procedures set forth originally in 1977 in the "Guidelines for Air Quality Maintenance Planning and Analysis, Vol 10 (Revised) and Procedures for Evaluating Air Quality Impact of New Stationary Sources."[25]

Recent Status of SILs for Ozone and $PM_{2.5}$

Stakeholders have long sought compliance demonstration tools for ozone and secondarily-formed $PM_{2.5}$. In July 2010, Sierra Club petitioned the EPA to designate computer models to use in determining if major proposed sources of air pollution cause or contribute to violations of the ozone or $PM_{2.5}$ NAAQS. In January 2012, the EPA granted the petition and committed to engage in rulemaking to evaluate whether updates to Appendix W are warranted and, as appropriate, incorporate new analytical techniques or models for ozone and secondarily-formed $PM_{2.5}$. In granting the petition, the EPA explained that the "complex chemistry of ozone and secondary formation of $PM_{2.5}$ are well-documented and have historically presented significant challenges to the designation of particular models for assessing the impacts of individual stationary sources on the formation of these air pollutants."[26] Because of these considerations, the EPA's past judgment had been that it was not technically sound to designate with particularity specific models that must be used to assess the impacts of a single source on ozone and secondarily-formed $PM_{2.5}$ concentrations. Instead, the EPA established a consultation process with permitting authorities for determining (on a permit-specific basis) the analytical techniques that should be used for single-source analyses for both ozone and secondarily-formed $PM_{2.5}$.

The EPA has responded to the Sierra Club petition by proposing revisions to Appendix W.[27] As discussed in the Appendix W proposed language, recent technical advances have made it reasonable for the EPA to provide more specific guidelines that identify appropriate analytical techniques or models that may be used in compliance demonstrations for the ozone and $PM_{2.5}$ NAAQS. The EPA expects that the final Appendix W revisions will include criteria and process steps for choosing single-source analytical techniques or models to estimate ozone impacts from precursor nitrogen oxide and volatile organic compound emissions. The ozone SIL value recommended in this guidance is intended to complement the Appendix W updates by providing a threshold that may be used to determine whether

[23] 61 FR 38250, 38293 (July 23, 1996); 72 Fed. Reg. 54112, at 54139 (September 21, 2007).
[24] 1990 Draft NSR Workshop Manual at C.51-C.52.
[25] October 1977, U.S. EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711. Specific applications of how SILs have been used in the PSD program are discussed later in this memorandum.
[26] Letter from Gina McCarthy, Assistant Administrator, EPA Office of Air and Radiation, to Robert Ukeiley, Sierra Club, January 4, 2012.
[27] 80 FR 45340 (July 29, 2015).

an impact predicted by the chosen technique or model causes or contributes to a violation. With respect to $PM_{2.5}$, the EPA expects the final Appendix W revisions will include criteria and process steps for choosing single-source analytical techniques or models to assess concentrations of direct and secondarily-formed $PM_{2.5}$.

In the 2010 $PM_{2.5}$ SILs rule, the EPA established SIL values for $PM_{2.5}$ in paragraph (k)(2) of 40 CFR 51.166 and 52.21 of the PSD regulations. In January 2013, the U.S. Court of Appeals for the District of Columbia Circuit granted the EPA's request to vacate and remand the paragraph (k)(2) provision in both PSD regulations so the EPA could correct them.[28] Paragraph (k)(2) as promulgated in 2010 included numerical values of $PM_{2.5}$ SILs and statements about their role in completing an air quality impact analysis with regard to the $PM_{2.5}$ NAAQS and PSD increments. Specifically, the 52.21(k)(2) rule text stated that if the impact of a proposed source seeking a federal PSD permit were below the relevant SIL value(s), then the proposed source would be deemed to not cause or contribute to a violation. The 51.166(k)(2) rule text stated that a state's PSD rules could contain a similar provision. The EPA asked the court to vacate and remand the (k)(2) paragraphs of both PSD regulations so that the EPA could correct an inconsistency between (1) that rule text, which left no discretion for the permitting authority, and (2) our statements in the preamble to the 2010 $PM_{2.5}$ SILs rule, which identified circumstances where it may not be appropriate for a permitting authority to rely solely on the $PM_{2.5}$ SILs as a basis for concluding that a proposed source does not cause or contribute to a violation.[29]

The court left intact the $PM_{2.5}$ NAAQS SIL values contained in 40 CFR 51.165(b)(2), because the regulatory text therein did not say that a showing that a proposed source has an impact equal to or less than the SIL value is always deemed to not cause or contribute. The regulatory text contained at 51.165(b)(2) says that, at a minimum, an impact greater than the listed SIL must be considered significant, but does not compel the opposite conclusion for impacts equal to or below that value.[30]

III. RECOMMENDED SIL VALUES FOR USE IN AIR QUALITY IMPACT DEMONSTRATION REQUIRED TO OBTAIN A PSD PERMIT

As discussed above, the EPA has interpreted the phrase "cause, or contribute to" in section 165(a)(3) of the Act to mean that a proposed source is prevented from obtaining a permit if the proposed source will have a "significant impact" on air pollutant concentrations that violate the standards. In this context, the EPA believes permitting authorities may read the phrase "cause, or contribute to" to be inapplicable to an air quality impact that is insignificant. This interpretation is more fully explained in the legal support memorandum. In this context, the EPA believes an insignificant impact is an impact on air quality

[28] *Sierra Club v. EPA*, 294 F.3d 155, 160 (D.C. Cir. 2002).

[29] These preamble statements were the following: "[N]otwithstanding the existence of a SIL, permitting authorities should determine when it may be appropriate to conclude that even a *de minimis* impact will 'cause or contribute' to an air quality problem and to seek remedial action from the proposed new source or modification." *See* 75 FR 64864 at 64892. "[T]he use of a SIL may not be appropriate when a substantial portion of any NAAQS or increment is known to be consumed." *See* 75 FR 64864 at 64894. "[W]e earlier provided an example of when it might be appropriate to require a modified source to mitigate its contribution to a violation of a NAAQS or increment even when the predicted ambient impact of the proposed emissions increase would result in what is normally considered to be *de minimis*." *See* 75 FR 64864 at 64894.

[30] Section 165(b)(2) is phrased such that an impact equal to the listed value is treated the same as impacts below the listed value. This contrasts to the approach in (k)(2), and in this guidance, that an impact equal to the SIL is treated the same as impacts above the SIL.

concentrations that is small and not meaningful. (The EPA has often described such an impact as "trivial" or "*de minimis*".)

The term "contribute," as used in the context of section 165(a)(3), is ambiguous. In the absence of specific language in section 165(a)(3) regarding the degree of contribution that is required (such as the term "significantly"), the EPA has the discretion under this provision to exercise its judgment to determine the degree of impact that "contributes" to adverse air quality conditions based on the particular context in which the term "contribute" is used. The EPA may also identify criteria or factors that may be used to determine whether something "contributes," including qualitative or quantitative criteria that are appropriate to the particular context.[31] For purposes of implementing section 165(a)(3) of the Act, the EPA has found it more expedient and practical to use a quantitative threshold (expressed as a level of change in air quality concentration) to determine whether increased emissions from proposed construction or modification of a source will contribute to air quality concentrations in violation of applicable standards. The EPA believes that the permitting process can be streamlined without compromising air quality, if the EPA and permitting authorities are able to identify a quantitative threshold or dividing line between an insignificant and significant impact on air pollutant concentration. Using a quantified threshold for this purpose is permissible as long as the EPA or the appropriate permitting authority provides a reasoned explanation for why impacts below that value do not constitute a contribution to a violation in this context.

To determine what is (and is not) a significant impact in the context of section 165(a)(3) of the Act, the EPA has generally supported using the values in 40 CFR 51.165(b).[32] The EPA has described these levels as "significance levels."[33] Section 51.165(b)(2) was originally promulgated by the EPA in 1987 as part of an offset program that permitting authorities could apply after it was determined that construction at a stationary source was predicted to cause or contribute to a violation of the NAAQS.[34] This regulation provides that a proposed source planning to locate in an attainment area will be considered to "cause or contribute to" a violation of the NAAQS if its impact would exceed specific values identified in the regulations. For example, section 51.165(b) states that a proposed source impact any larger than 5 micrograms per cubic meter ($\mu g/m^3$) for the 24-hour SO_2 NAAQS causes or contributes to a violation of that NAAQS. The section refers to these values as "significance levels." Values are not provided for every NAAQS, and in particular not for ozone (and until 2010 not for $PM_{2.5}$), but for those NAAQS covered in this regulation, the application is the same. Over time, these air quality concentration

[31] See *Catawba County, N.C. v. EPA*, 571 F.3d 20, 39 (D.C. Cir. 2009). In this case interpreting the term "contributes" in section 107(d) of the CAA, the court held that the EPA is not required to establish a quantitative or objective, bright-line test to define a contribution by sources to adverse air quality conditions in a nearby area in the context of designations with respect to attainment of a NAAQS. The court recognized that the EPA has the discretion to use a totality-of-the-circumstances test if the agency defines and explains the criteria that it is applying. While this opinion said that a quantified threshold is not required to define contribution in the context of section 107(d), the court's reasoning does not preclude PSD permitting authorities from choosing to use a quantitative level of impact to represent a contribution to a violation of the NAAQS or PSD increment when implementing section 165(a)(3) of the CAA.

[32] Emison Memo at footnote 5 references 40 CFR 51.165(b), which defines "significant," and the NSR Workshop Manual at C.26-C.28 lists values from 40 CFR 51.165(b)(2) for the purpose of defining the area of "significant ambient impact."

[33] The EPA initially promulgated these same concentration values in 1979 as the "significance levels" under which a source locating in the "clean" portion of a nonattainment area may be exempt from the preconstruction review requirements in Appendix S to Part 51, 44 FR 3274, 3283 (January 16, 1979).

[34] 52 FR 24672, 24713 (July 1, 1987).

significance levels in section 51.165(b) have become known as "significant *impact levels*"[35] [emphasis added] in order to distinguish them from the significant *emissions rates* reflected in the definition of the term "significant," which serve a different function in the PSD program.[36] The EPA has also issued guidance memoranda that have provided recommended SIL values for the 1-hour NO_2 and SO_2 NAAQS, to be used for the purpose of determining what are (and are not) significant impacts for these pollutants.[37] The EPA has also observed that permitting authorities have discretion to develop their own SIL values, provided that such values are properly supported in permitting authority actions or decisions in which the values are used to make the required showing.[38]

The EPA's basis for the values in section 51.165(b)(2) of its regulations has generally been a percentage of the applicable PSD increments for each pollutant. The EPA used a similar approach in 2010 to add $PM_{2.5}$ values to section 51.165(b)(2) and establish $PM_{2.5}$ values in sections 51.166(k)(2) and 52.21(k)(2). However, given limitations in the rationale supporting them, the EPA recognized in the preamble to the 2010 $PM_{2.5}$ SILs rule that a permitting authority may not be able to apply the SIL values derived through this approach in every situation to show that proposed construction does not cause or contribute to a violation of standards. The EPA acknowledged that "the use of a SIL may not be appropriate when a substantial portion of any NAAQS or increment is known to be consumed." The EPA also said that "notwithstanding the existence of a SIL, permitting authorities should determine when it may be appropriate to conclude that even a *de minimis* impact will 'cause or contribute' to an air quality problem and to seek remedial action from the proposed new source or modification."[39] To guard against the improper use of the 2010 SILs for $PM_{2.5}$ in such circumstances, the EPA later recommended that permitting authorities use those SILs only where they could establish that the difference between background concentrations in a particular area and the NAAQS was greater than those SIL values.[40] This approach was intended to guard against misuse of the SILs that were based on a percentage of the $PM_{2.5}$ PSD increments.

Since that $PM_{2.5}$ modeling guidance was issued, the EPA has developed a new technical method for determining a concentration level that can be considered an insignificant impact on air pollutant concentrations for ozone and $PM_{2.5}$ in the context of PSD permitting. This technical method, referred to as the air quality variability approach, is described in the supporting technical docuement. Given the improvements reflected in this method, the EPA does not see a need for permitting authorities to show that the difference between background concentrations and the relevant NAAQS is greater than the SIL value before applying one of the recommended $PM_{2.5}$ SIL values, as previously stated. The EPA's intention with this new method is to derive SIL values that are more universally applicable to a range of

[35] The first reference to "significant impact levels" is in the 1980 NSR Workshop Manual, which the EPA subsequently updated in the 1990 draft. It is worth noting that the 1977 comments to the proposed Appendix W rule (45 FR 58543) addressed whether a single-source screening technique should be used to determine if a cumulative modeling analysis would be required in a preconstruction review; industry and state agency comments indicated both groups favored some use of a tool to alleviate resource burden.

[36] Section 52.21(b)(23) also uses the term "significance" and applies discrete values for determining if a proposed source is significant. This regulation states that significance is any net emissions increase equal to or exceeding 40 tons per year (TPY) for ozone, and, for direct emissions of $PM_{2.5}$, 10 TPY (40 TPY for SO_2 and 40 TPY NO_2 unless demonstrated not to be a $PM_{2.5}$ precursor).

[37] Page memoranda at footnotes 5 and 6.

[38] 77 FR 37038 (June 20, 2010); 14 E.A.D. 723 (EAB 2010).

[39] 75 FR 64864, 64892.

[40] Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance for $PM_{2.5}$ Permit Modeling," May 20, 2014.

conditions, including those where a substantial portion of the NAAQS or PSD increment is known to be consumed. The EPA does not consider its qualifying statements from the preamble of the 2010 rule (quoted in the prior paragraph) to be applicable to the $PM_{2.5}$ SIL values derived with this new method; however, permitting authorities retain discretion to decide to apply or not to apply SILs as a general matter, or in particular permitting actions based on information in the administrative record.

In order for a concentration level to be used to show that the air quality impact of a proposed source does not cause or contribute to a violation of the NAAQS or PSD increment, the concentration value must represent a level of impact on ambient air quality that is insignificant or not meaningful. An insignificant impact on air pollutant concentrations can be identified and quantified based on an assessment of the variability of air quality, using data from the U.S. ambient $PM_{2.5}$ and ozone monitoring network. Due to fluctuating meteorological conditions and changes in day-to-day source operations, there is an inherent variability in the air quality in the area of a monitoring site. This variability can be characterized through the application of a well-established statistical framework for quantifying uncertainty in population statistics. The analysis described in the supporting technical document quantifies the fluctuations in pollutant concentrations (as measured by design values) and, for each NAAQS, determines a value for a concentration difference that is meaningful in the context of inherent variability. Changes of less than this magnitude may be considered to be in the "noise" of observed design values. This technical analysis provides a basis for a permitting authority to conclude that concentration increases below this SIL do not cause or contribute to violations of the relevant NAAQS or PSD increments.

SILs for NAAQS

Using this air quality variability approach, the EPA derived SIL values for the 8-hour ozone NAAQS and each $PM_{2.5}$ NAAQS averaging period, which are applicable to attainment and unclassifiable areas. The SIL values for the NAAQS are listed in Table 1. Each SIL value is based on the level, averaging period and statistical form of its corresponding NAAQS. For example, for ozone the recommended SIL value is based on the 4th highest daily maximum 8-hour concentration, averaged over 3 years. The derived value from the air quality variability analysis is 1.0 parts per billion (ppb), and we recommend the case-by-case application of this value as the SIL for the 8-hour ozone NAAQS.

For the 24-hour $PM_{2.5}$ NAAQS, the SIL value we recommend is 1.2 $\mu g/m^3$. The derived value from the air quality variability analysis is 1.3 $\mu g/m^3$ and is based on an analysis of the 98th percentile 24-hour concentrations averaged over 3 years; however, 40 CFR 51.165(b)(2) still lists 1.2 $\mu g/m^3$ as the SIL value for the 24-hour $PM_{2.5}$ NAAQS, and, pending further evaluation by the EPA, we recommend it for maintaining consistency with the rule. In the 2010 $PM_{2.5}$ SILs rulemaking, the EPA determined that an impact above this value will be considered to cause or contribute to a violation of the 24-hour $PM_{2.5}$ NAAQS at any location that does not meet this standard. In the same rule, the EPA also sought to establish that an impact below this value would not cause or contribute to a violation of this NAAQS but acknowledged that there could be circumstances where this conclusion was not always valid. Even though the ambient air quality variability approach indicates that an impact below 1.3 $\mu g/m^3$ is not significant, 51.165(b)(2) remains in the EPA's regulations and the agency is presently bound by its prior conclusion (that an impact above 1.2 $\mu g/m^3$ is significant and will cause or contribute to a violation of the 24-hour $PM_{2.5}$ NAAQS). Thus, the EPA cannot conclude at this time that an impact between 1.2 $\mu g/m^3$ and 1.3 $\mu g/m^3$ is an insignificant impact or an impact that will not cause or contribute to a violation of the NAAQS. However, based on the ambient air quality variability approach, the EPA is

able to conclude that impacts below 1.2 µg/m^3 are insignificant at any location and will not cause or contribute to a violation of the NAAQS.[41] The case-by-case use of this recommended SIL value should be justified in the record for each permit.

For the annual $PM_{2.5}$ NAAQS, we recommend 0.2 µg/m^3 as the SIL value, which is the value derived from the air quality variability analysis and is based on a 3-year average of annual average concentrations. The case-by-case use of this recommended SIL value should be justified in the record for each permit. This value is lower than the value of 0.3 µg/m^3 listed in 51.165(b)(2). Since section 51.165(b)(2) does not address whether an impact below 0.3 µg/m^3 causes or contributes to a violation of the NAAQS, permitting authorities retain the discretion under this provision to determine on a case-by-case basis whether an impact between 0.2 µg/m^3 and 0.3 µg/m^3 will cause or contribute to a violation of the annual $PM_{2.5}$ NAAQS. Based on the ambient air quality variability approach, the EPA's judgment is that an impact below 0.2 µg/m^3 is insignificant and should be considered to not cause or contribute to any violation of the annual $PM_{2.5}$ NAAQS that is identified.

Table 1. Recommended SIL Values for Ozone and $PM_{2.5}$ NAAQS

Criteria Pollutant (NAAQS level)	NAAQS SIL concentration
Ozone 8-hour (70 ppb)	1.0 ppb
$PM_{2.5}$ 24-hour (35 µg/m^3)	1.2 µg/m^3*
$PM_{2.5}$ annual (12 µg/m^3 or 15 µg/m^3)	0.2 µg/m^3

* The table takes into account the SIL value for the 24-hour $PM_{2.5}$ NAAQS that is in section 51.165(b)(2). Refer to the guidance discussion for details.

We recommend that these SIL values apply everywhere, regardless of the class of the airshed.[42] For $PM_{2.5}$, this recommendation is different than what was provided in the vacated (k)(2) paragraphs, where the SIL value that would be used for NAAQS purposes was different for Class I areas than for Class II and III areas. The EPA recognizes that, historically, Congress has provided special protections to Class I areas, via PSD increments. The EPA believes that because each ozone and $PM_{2.5}$ NAAQS is uniform throughout the class areas, no class-specific protection via SILs is necessary when assessing whether a source causes or contributes to a violation of the NAAQS.

[41] 40 CFR 165(b)(2) provides that a source impact higher than one of the listed significance levels is to be considered significant. A source impact exactly equal to a significance level need not be considered significant. In contrast, in this memorandum, consistent with past guidance, we are recommending that a value exactly equal to a recommended SIL be considered significant. Thus, these two approaches treat a value equal to the stated level differently. In practice, we do not expect this to be a practical difference because it will be very unusual for a source's impact to exactly equal one of the recommended SIL values.

[42] When Congress established the PSD program requirements under the 1977 CAA Amendments, it included specific numerical increment levels for SO_2 and particulate matter (expressed at that time as "total suspended particulate") for Class I, II and III areas. Congress designated Class I areas (including certain national parks and wilderness areas) as areas of special national concern, where the need to prevent deterioration of air quality is the greatest. Consequently, the PSD increments are the smallest in Class I areas. The increments of Class II areas are larger than those of Class I areas and allow for a moderate degree of emissions growth. Class III areas have the largest increments, but to date no Class III areas have been designated. The EPA subsequently defined Class I, II and III increments for NO_2 and PM_{10}, and $PM_{2.5}$ in multiple rulemakings.

SILs for PSD Increment

There are no PSD increments established for ozone, and, thus, no ozone SIL values are needed for PSD increment compliance purposes. We used the air quality variability approach to develop increment SILs for the $PM_{2.5}$ PSD increments (Table 2), but in an indirect way. The SIL values for the $PM_{2.5}$ PSD increments are derived from the NAAQS SIL values and reflect that, under the PSD regulations, the allowable PSD increment values are different for Class I, II and III areas. For Class II areas (which comprise most of the U.S.) and Class III areas (of which there are currently none), we recommend that the values of the NAAQS SILs also be used for PSD increment SILs. For Class I areas, we are recommending annual and 24-hour PSD increment SIL values that are lower than the NAAQS SIL values. The EPA recognizes that Class I areas have historically been provided special protection.[43] To achieve this additional protection, we applied the ratios of the Class I and Class II allowable PSD increments to the NAAQS SIL values derived in our technical analysis.[44] The EPA believes these values for Class I areas will continue to reflect this higher level of protection through the PSD increment SILs.

Table 2. Recommended SIL Values for $PM_{2.5}$ Increment

Criteria Pollutant (averaging period)	PSD increment SIL concentration		
	Class I	Class II	Class III
$PM_{2.5}$ (24-hour)	0.07 µg/m^3	1.2 µg/m^3	1.2 µg/m^3
$PM_{2.5}$ (annual)	0.04 µg/m^3	0.2 µg/m^3	0.2 µg/m^3

IV. APPLICATION OF SILS

The EPA recommends that permitting authorities consider using these SIL values for $PM_{2.5}$ and ozone on a case-by-case basis at the same points in the PSD air quality analysis as SIL values historically have been used in the PSD program, as described below, with one exception regarding defining the spatial extent for modeling.

First, permitting authorities may elect to use the SIL values reflected in this memorandum in a preliminary (single-source) analysis that considers only the impact of the proposed source in the permit application on air quality to determine whether a full (or cumulative) impact analysis is necessary before reaching a conclusion as to whether the proposed source would (or would not) cause or contribute to a violation.[45] A model result predicting that a proposed source's maximum impact will be below the corresponding SIL value recommended above generally may be considered to be a sufficient demonstration that the proposed source will not cause or contribute to a violation of the applicable NAAQS or PSD increment. If the single-source analysis shows that a proposed source will not have a significant impact on air quality, permitting authorities may generally conclude there is no need to conduct a cumulative impact analysis to assess whether there will be any violations of the NAAQS or PSD increment. However, upon considering the permit record in an individual case, if a permitting

[43] The CAA section 169A declares a national goal of preventing future and remedying any existing impairment of visibility in Class I areas.

[44] The Class I PSD increment SIL value starts with the NAAQS SIL value as the base number and is further constrained by the ratio of the associated Class I and II NAAQS. For the annual $PM_{2.5}$ NAAQS, the NAAQS SIL value is reduced by the ratio of 1:4, because the Class I PSD increment is 1 µg/m^3 and the Class II PSD increment is 4 µg/m^3. The ratio of 2:9 is used for the 24-hour $PM_{2.5}$ NAAQS. For the 24-hour NAAQS, we are using the 51.165(b)(2) value of 1.2 µg/m^3 as our base number.

[45] 1990 Draft NSR Workshop Manual at C.24-C.25, C.51.

authority has a basis for concern that a demonstration that a proposed source's impact is below the relevant SIL value at all locations is not sufficient to demonstrate that the proposed source will not cause or contribute to a violation, then the permitting authority should require additional information from the permit applicant to make the required air quality impact demonstration.

Second, where the preliminary analysis described in the prior paragraph is not sufficient, permitting authorities may choose to use the recommended SIL values in a cumulative impact analysis for a NAAQS, which, in addition to the proposed source, includes the impact of existing sources (on and offsite), and the appropriate background concentration. The EPA has described this application of a SIL as a "culpability analysis."[46] Where a cumulative impact analysis predicts a NAAQS violation, the permitting authority may further evaluate whether the proposed source will cause or contribute to the violation by comparing the proposed source's modeled contribution to that violation to the corresponding SIL value. If the modeled impact is below the SIL value at the violating receptor during the violation, the EPA believes this will be sufficient in most cases for a permitting authority to conclude that the source does not cause or contribute to (is not culpable for) the predicted violation; thus, allowing the permit to be issued. If the proposed source's modeled impact is higher than or equal to the SIL value at the violating receptor during a violation, then a permit should not be issued unless (1) further modifications are made to the proposed source to reduce the proposed source's impact to an insignificant level at the affected receptor during the violation, or (2) the proposed source obtains sufficient emissions reductions from other sources to compensate for its contribution to the violation.[47]

Third, permitting authorities may decide to use the SIL values recommended above in a cumulative impact analysis for a PSD increment. According to 40 CFR 51.166(c)(1) and 52.21(c), an allowable PSD increment based on an annual average may not be exceeded and the allowable PSD increment for any other time period may be exceeded during one such period per year at any one location. In either case, the PSD increment SILs recommended above may be used to determine if the proposed source will cause or contribute to that exceedance. If the cumulative impact analysis shows an annual average $PM_{2.5}$ PSD increment exceedance or a 24-hour PSD increment exceedance at a location, then the comparison of the proposed source's impact at that location during the exceedance to the corresponding SIL value may be used to determine whether the proposed source will cause or contribute to the exceedance(s) at that receptor. If the modeled impact is below the SIL and all other PSD requirements are met, then the permitting authority may conclude that the source does not cause or contribute to a violation of the PSD increment.

Finally, SILs have been used in defining the spatial extent of the modeling domain for a cumulative impact analysis. Because an impact from a proposed source below a SIL value is considered not to cause or contribute to a violation, the EPA has previously recognized that there was no informational value in placing modeling receptors farther from the proposed source than the most distant point at which the proposed source's impact is equal to or greater than the applicable SIL value. Streamlining the modeling demonstration to reduce the number of receptors to those of value in determining if the proposed source will cause or contribute to a violation of the applicable NAAQS or PSD increment has enabled permit applicants and reviewers to complete the required modeling with a reasonable effort. As discussed earlier, the EPA recently proposed updates to its Guideline on Air Quality Models. The revisions include providing an appropriate, revised basis for determining the modeling domain for NAAQS and PSD

[46] Prairie State, 13 E.A.D. at 100; Mississippi Lime, 15 E.A.D. at 374.
[47] 1990 Draft NSR Workshop Manual at C.52-C.53; this latter alternative is referred to as a PSD offset, and state implementation plans may include on offset program based on federal regulations at 40 CFR 51.165(b).

increment assessments. Once finalized, the revised Appendix W will be the appropriate resource to use when considering the extent of the modeling domain.

The SILs identified in this memorandum should not influence Air Quality Related Values analyses, which are independent reviews by the Federal Land Managers during the application review process.

Before a rulemaking is conducted and subject to limitations described in this memorandum, we recommend that permitting authorities consider using the values in the above tables on a case-by-case basis to support air quality analyses and demonstrations required for issuance of PSD permits. Permitting authorities that implement the PSD program under an EPA-approved implementation plan may also choose to use these recommended SILs. Since this memorandum is neither a final determination nor a binding regulation, permitting authorities retain the discretion not to use SILs as described here, either in specific cases or programmatically.

To ensure an adequate record, any PSD permitting decision that is based on the guidance in this memorandum should incorporate the information contained in this memorandum and the supporting technical and legal supporting documents. The permitting authority should also consider any additional information in the record that is relevant to making the required demonstration.

The permitting authorities also retain the discretion to use other values that may be justified separately from this memorandum as levels of insignificant impact, subject to one limitation for the $PM_{2.5}$ NAAQS. Since the EPA has established by regulation that a $PM_{2.5}$ impact greater than certain values will cause or contribute to a violation of the relevant NAAQS, permitting authorities may not use a value higher than 1.2 $\mu g/m^3$ for the 24-hour $PM_{2.5}$ NAAQS or a value higher than 0.3 $\mu g/m^3$ for the annual $PM_{2.5}$ NAAQS. Because ozone is not addressed in section 51.165(b)(2), permitting authorities are not precluded from developing a higher ozone NAAQS SIL value than recommended in this guidance. Likewise, section 51.165(b)(2) does not address PSD increments and, thus, does not constrain the discretion of a permitting authority to use a higher SIL value that a permitting authority may develop for increment purposes. Permitting authorities are also not precluded from developing and using lower SIL values than recommended in this guidance. The case-by-case use of a SIL value should be supported by a comparable record in each instance that shows that the value represents a level below which a proposed source does not cause or contribute to a violation of the NAAQS or PSD increment.

Please inform your permitting authorities of the guidance provided by this memorandum. If you have questions regarding policy or general implementation, please contact Raj Rao at *rao.raj@epa.gov* or (919) 541-5344. For questions regarding the supporting technical document, please contact Tyler Fox at *fox.tyler@epa.gov* or (919) 541-5562. For questions regarding the supporting legal document, please contact Brian Doster at *doster.brian@epa.gov* or (202) 564-1932.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MAY 20 2014

MEMORANDUM

SUBJECT: Guidance for $PM_{2.5}$ Permit Modeling

FROM: Stephen D. Page Michael Koerber for
Director

TO: Regional Air Division Directors, Regions 1-10

This memorandum and attachment, titled "Guidance for $PM_{2.5}$ Permit Modeling," provides guidance on demonstrating compliance with the fine particulate matter ($PM_{2.5}$) National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments, especially with regard to considerations of the secondarily formed component of $PM_{2.5}$. This document reflects the EPA's recommendations for how a major stationary source seeking a PSD permit may demonstrate that it will not cause or contribute to a violation of the NAAQS and PSD increments for $PM_{2.5}$, as required under section 165(a)(3) of the Clean Air Act (CAA) and 40 CFR Sections 51.166(k) and 52.21(k).

A draft version of this guidance document was provided to the public on March 4, 2013, for a 90-day comment period. The document was revised in response to public comments and additional information provided through on-going interactions with various stakeholders.

Noteworthy changes made to the draft version include:

- Clarifications throughout with respect to procedures for adequately addressing primary and secondarily formed $PM_{2.5}$.
- Inclusion of an example hybrid (qualitative/quantitative) secondary $PM_{2.5}$ impact assessment.
- Revision of a second tier cumulative $PM_{2.5}$ NAAQS compliance approach.
- Revision of Section V and other sections relative to PSD increment for $PM_{2.5}$.

Please distribute the attached guidance document to state, local, and tribal governments, as appropriate. If you have any questions regarding this document, please contact Tyler Fox, Air Quality Modeling Group Leader, Air Quality Assessment Division/OAQPS, at (919) 541-5562, fox.tyler@epa.gov.

Attachment

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Guidance for $PM_{2.5}$ Permit Modeling

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EPA-454/B-14-001
May 2014

Guidance for $PM_{2.5}$ Permit Modeling

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Air Quality Assessment Division
Research Triangle Park, North Carolina

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Disclaimer

This document recommends procedures for permit applicants and permitting authorities to use to show that they have satisfied the criteria for obtaining or issuing a permit under applicable regulations. This document is not a rule or regulation, and the guidance it contains may not apply to a particular situation based upon the individual facts and circumstances. This guidance does not change or substitute for any law, regulation, or any other legally binding requirement and is not legally enforceable. The use of non-mandatory language such as "guidance," "recommend," "may," "should," and "can," is intended to describe EPA policies and recommendations. Mandatory terminology such as "must" and "required" are intended to describe controlling requirements under the terms of the Clean Air Act and EPA regulations, but this document does not establish legally binding requirements in and of itself. This document does not create any rights or obligations enforceable by any party or impose binding, enforceable requirements on any permit applicant for a PSD permit or PSD permitting authority.

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Executive Summary

The U.S. Environmental Protection Agency (EPA) is providing this "Guidance for $PM_{2.5}$ Permit Modeling" to fulfill a need for additional guidance on demonstrating compliance with the fine particulate matter ($PM_{2.5}$) National Ambient Air Quality Standards (NAAQS) and the Prevention of Significant Deterioration (PSD) increments, especially with regard to considerations of the secondarily formed components of $PM_{2.5}$. This guidance incorporates the modeling procedures and recommendations from the EPA's March 23, 2010, guidance memorandum, "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS," and further clarifies procedures for adequately addressing primary and secondarily formed $PM_{2.5}$ in a NAAQS and PSD increments compliance demonstration. This guidance is consistent with the EPA's *Guideline on Air Quality Models*, also published as Appendix W of Title 40 of the Code of Federal Regulations (CFR) Part 51. The release of this "Guidance for $PM_{2.5}$ Permit Modeling" is also consistent with the commitments contained in the EPA's January 4, 2012, grant of a July 28, 2010, petition filed by the Sierra Club.

Because of the complex chemistry of secondary formation of $PM_{2.5}$, the EPA's judgment in the past has been that it was not technically sound to assign with particularity specific models that must be used to assess the impacts of a single source on $PM_{2.5}$ concentrations. Instead, the EPA has determined it was appropriate to satisfy the requirements of Section 165(e)(3)(D) of the Clean Air Act (CAA) by recommending that the "[c]hoice of methods used to assess the [$PM_{2.5}$] impact of an individual source depends on the nature of the source and its emissions," as stated in Section 5.2.2.1.c. of Appendix W. As such, the appropriate methods for assessing $PM_{2.5}$ impacts are determined as part of the normal consultation process with the appropriate permitting authority. A modeling protocol should be developed by the permit applicant and approved by the

appropriate permitting authority to ensure that the analysis conducted will conform to the recommendations, requirements, and principles of Section 10.2.1 of Appendix W. This guidance is intended to inform that process through recommendations regarding appropriate methods to assess secondary $PM_{2.5}$ impacts from the precursor emissions from the new or modifying source by providing the permit applicant and the appropriate permitting authority with both focus and flexibility. As experience is gained with these NAAQS and increments compliance demonstrations (and as the EPA moves forward to consider single source modeling techniques pursuant to its grant of the petition from the Sierra Club), this guidance will likely evolve such that the EPA will be able to provide further specificity on assessing the impacts of a single source on $PM_{2.5}$ concentrations.

This guidance document is broken down into five primary sections:

- I. Background – The first section provides the relevant regulatory actions and historical context to this guidance starting with the promulgation of the initial $PM_{2.5}$ NAAQS in 1997; chronicling the PM_{10} Surrogate Policy that for a period of time was relied upon for demonstrating compliance with the $PM_{2.5}$ NAAQS; and arriving at the present where there is a need for an assessment of both the primary and secondary $PM_{2.5}$ impacts, as appropriate, of a new or modifying source for demonstrating compliance with $PM_{2.5}$ NAAQS and increments.
- II. Guidance Overview – The second section provides a general overview of the steps that a permit applicant would routinely take under the PSD program for demonstrating compliance with the $PM_{2.5}$ NAAQS and increments. The concepts of significant emissions rates (SERs) and significant impact levels (SILs) are introduced and then presented in the context of a source impact analysis and a cumulative impact

analysis. The ramifications of the January 22, 2013, decision from U.S. Court of Appeals for the District of Columbia Circuit on the use of SILs in a source impact analysis or otherwise are included for reference and consideration throughout the remaining sections. Four assessment cases (Table ES-1) are then introduced with respect to assessing the primary and secondary $PM_{2.5}$ impacts through either the source impact analysis or the cumulative impact analysis.

- III. Source Impact Analysis for the $PM_{2.5}$ NAAQS – The third section provides a detailed discussion of a screening assessment of primary and secondary $PM_{2.5}$ impacts from a new or modifying source using a SIL. The specifics of the four assessment cases (Table ES-1) are presented along with appropriate approaches for assessing the primary and secondary impacts of $PM_{2.5}$. For assessing the primary $PM_{2.5}$ impacts from the direct $PM_{2.5}$ emissions from the new or modifying source, the typical use of an appropriate preferred dispersion model for near-field $PM_{2.5}$ modeling listed in Appendix W, currently AERMOD for most applications, or an approved alternative model is recommended. For assessing the secondary $PM_{2.5}$ impacts from the precursor emissions from the new or modifying source, three different approaches are described. These approaches are 1) a qualitative assessment, 2) a hybrid qualitative/quantitative assessment utilizing existing technical work, and 3) a full quantitative photochemical grid modeling exercise.
- IV. Cumulative Impact Analysis for the $PM_{2.5}$ NAAQS – The fourth section provides a detailed discussion of the assessment of primary and secondary $PM_{2.5}$ impacts from a new or modifying source with the inclusion of the primary and secondary $PM_{2.5}$ impacts of nearby sources and of monitored background. There are specific

discussions of the modeling inventory and the monitored background. Section IV concludes with information on determining significant contributions to modeled violations.

- V. PSD Increments for $PM_{2.5}$ – The fifth section provides a detailed discussion of the assessment of primary and secondary $PM_{2.5}$ impacts of a new or modifying source with respect to the increments.

Table ES-1. EPA Recommended Approaches for Assessing Primary and Secondary $PM_{2.5}$ Impacts by Assessment Case

Assessment Case	Description of Assessment Case	Primary Impacts Approach	Secondary Impacts Approach
Case 1: No Air Quality Analysis	Direct PM2.5 emissions < 10 tpy SER NOx and SO2 emissions < 40 tpy SER	N/A	N/A
Case 2: Primary Air Quality Impacts Only	Direct PM2.5 emissions ≥ 10 tpy SER NOx and SO2 emissions < 40 tpy SER	**Appendix W preferred or approved alternative dispersion model**	N/A
Case 3: Primary and Secondary Air Quality Impacts	Direct PM2.5 emissions ≥ 10 tpy SER NOx and/or SO2 emissions ≥ 40 tpy SER	**Appendix W preferred or approved alternative dispersion model**	• **Qualitative** • **Hybrid qualitative / quantitative** • **Full quantitative photochemical grid modeling**
Case 4: Secondary Air Quality Impacts Only	Direct PM2.5 emissions < 10 tpy SER NOx and/or SO2 emissions ≥ 40 tpy SER	N/A	• **Qualitative** • **Hybrid qualitative / quantitative** • **Full quantitative photochemical grid modeling**

In summary, this "Guidance for $PM_{2.5}$ Permit Modeling" recommends technical approaches for conducting $PM_{2.5}$ NAAQS and PSD increments compliance demonstrations which include adequate accounting for contributions from primary $PM_{2.5}$ concentrations from a proposed new or modifying source's direct $PM_{2.5}$ emissions and from secondarily formed $PM_{2.5}$ concentrations resulting from the source's $PM_{2.5}$ precursor emissions. This guidance does not create any rights or obligations enforceable by any party or impose binding, enforceable requirements on any permit applicant for a PSD permit or PSD permitting authority. Since each

permitting action will be considered on a case-by-case basis, this document does not limit or restrict any particular justifiable approach permit applicants and permitting authorities may take to conduct the required compliance demonstrations. Each individual decision to issue a PSD permit must be supported by a record sufficient to demonstrate that the proposed construction and operation of a stationary source will not cause or contribute to a violation of the applicable $PM_{2.5}$ NAAQS and PSD increments. While this document illustrates a particular approach that the EPA considers appropriate and acceptable as a general matter, permit applicants and permitting authorities should examine all relevant information regarding air quality in the area that may be affected by a proposed new or modified source and evaluate whether alternative or additional analysis may be necessary in a given case to demonstrate that the criteria for obtaining a permit are satisfied. This document does not represent a conclusion or judgment by EPA that the technical approaches recommended in this document will be sufficient to make a successful compliance demonstration in every permit application or circumstance.

Permitting authorities retain the discretion to address particular issues discussed in this document in a different manner than the EPA recommends so long as the approach is adequately justified, supported by the permitting record and technical literature, and consistent with the applicable requirements in the CAA and implementing regulations, including the terms of an approved State Implementation Plan (SIP).

Furthermore, this guidance does not represent final agency action with respect to applicable legal requirements or the approvability of any particular permit application. To improve the quality of this guidance, the EPA has solicited public comment and considered the comments submitted. The EPA has revised the draft guidance in response to many points raised in public comment, but this document does not reflect a final determination by the EPA as to any

issue raised in public comments. Concerns expressed in public comments about the permissibility or sufficiency of the approach recommended in this guidance for making the required demonstration in particular circumstances may be raised in the context of each individual permit application and should be considered by the permitting authority in light of the record in each instance before making a final determination to issue or deny a PSD permit.

Acknowledgements

We would like to acknowledge contributions from members of the National Association of Clean Air Agencies (NACAA) $PM_{2.5}$ Modeling Implementation Workgroup (NACAA Workgroup) in providing a detailed set of recommendations (NACAA, 2011) to the EPA with regards to $PM_{2.5}$ permit compliance demonstration modeling. This NACAA Workgroup was comprised of state and local air permitting agency dispersion modelers, permit engineers, and technical staff from throughout the country. In particular, we recognize Jim Hodina (Linn County Public Health), Bob Hodanbosi (Ohio EPA, Division of Air Quality), and Clint Bowman (Washington Department of Ecology) for their roles as Chairpersons for the Emissions Inventories, Secondary Formation from Project Source, and Representative Background Concentrations Sub-workgroups, respectively.

We would also like to acknowledge the contributions of the staff of the EPA Office of Transportation and Air Quality (OTAQ) for their input and assistance in the development of this document. The EPA's "Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas" (U.S. EPA, 2013a) guidance document served as a foundation for many aspects of the modeling guidance contained within this document.

Finally, there were numerous comments received with respect to issues and concerns of demonstrating compliance with the NAAQS and increments for $PM_{2.5}$ during the formal public comment period for the 10th Conference on Air Quality Modeling and comprehensive comments received specific to the overall guidance and recommendations presented here through the comment period for the "Draft Guidance on $PM_{2.5}$ Permit Modeling" (U.S. EPA 2013b). This invaluable feedback along with additional information gleaned through ongoing interactions with

various stakeholders have been particularly useful in the consideration of a range of acceptable options for $PM_{2.5}$ NAAQS and PSD increments compliance demonstrations and aided the EPA in the completion of this guidance document

I. Background

Under Section 165(a)(3) of the CAA, a PSD permit applicant must demonstrate that emissions from the proposed construction and operation of a facility "will not cause, or contribute to, air pollution in excess of any (A) maximum allowable increase or maximum allowable concentration for any pollutant… , [or] (B) national ambient air quality standard…" This requirement is implemented in the PSD regulations at 40 CFR 52.21(k)(1) (and at 40 CFR 51.166(k)(1) with slightly different wording) as follows:

> (k) *Source impact analysis*—(1) *Required demonstration*. The owner or operator of the proposed source or modification shall demonstrate that allowable emission increases from the proposed source or modification, in conjunction with all other applicable emissions increases or reductions (including secondary emissions), would not cause or contribute to air pollution in violation of:
>
> (i) Any national ambient air quality standard in any air quality control region; or
>
> (ii) Any applicable maximum allowable increase over the baseline concentration in any area.

On July 18, 1997, the EPA revised the NAAQS for particulate matter (PM) to add new annual and 24-hour standards for fine particles using particulate matter less than 2.5 micrometers or $PM_{2.5}$ as the indicator.[1] The EPA revised the 24-hour NAAQS for $PM_{2.5}$ on September 21, 2006, by lowering the level of the standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$.[2] In the September 21, 2006, action, the EPA also retained the previous 1997 annual standard for $PM_{2.5}$ and the 24-hour standard for PM_{10}, and revoked the previous annual standard for PM_{10}. Subsequently, the

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[1] See 62 Fed. Reg. 58652.

[2] See 71 Fed. Reg. 61144.

Agency revised the $PM_{2.5}$ standard again on December 14, 2012, by lowering the level of the annual $PM_{2.5}$ NAAQS from 15 μg/m^3 to 12 μg/m^3 and retaining the 24-hour standards for $PM_{2.5}$ and PM_{10}.[3] The annual $PM_{2.5}$ standard is met when the 3-year average of annual arithmetic mean concentrations is less than or equal to 12.0 μg/m^3. The 24-hour $PM_{2.5}$ standard is met when the 3-year average of the annual 98th percentile 24-hour concentrations is less than or equal to 35 μg/m^3.

On October 20, 2010, EPA established maximum allowable increases for $PM_{2.5}$.[4] These values are also frequently described as the PSD increments. For Class I areas, the increments for $PM_{2.5}$ are 1 μg/m^3 for the annual averaging time and 2 μg/m^3 for the 24-hour averaging time. In Class II areas, the increments are 4 μg/m^3 for the annual period and 9 μg/m^3 for the 24-hour period.

To address the compliance demonstration for the $PM_{2.5}$ NAAQS, on October 23, 1997, citing significant technical difficulties with respect to $PM_{2.5}$ monitoring, emissions estimation, and modeling, the EPA established a policy known as the PM_{10} Surrogate Policy (U.S. EPA, 1997). This policy allowed permit applicants to use compliance with the applicable PM_{10} requirements as a surrogate approach for meeting $PM_{2.5}$ New Source Review (NSR) requirements until certain technical difficulties were resolved. On May 16, 2008, the EPA promulgated final rules governing the implementation of the NSR program for $PM_{2.5}$, which facilitated phasing out the application of the PM_{10} Surrogate Policy to permits involving $PM_{2.5}$.[5] With regard to nonattainment NSR permits, the rule provided that as of July 15, 2008 (the rule's effective date), permit applicants and permitting authorities would no longer be able to use the

[3] See 78 Fed. Reg. 3086.

[4] See 75 Fed. Reg. 64864.

[5] See 73 Fed. Reg. 28321.

PM_{10} Surrogate Policy to satisfy the NSR requirements for $PM_{2.5}$. With regard to PSD permits, the rule provided that PSD permits issued under the federal PSD program at 40 CFR 52.21 would no longer be allowed to rely on the PM_{10} Surrogate Policy as of the effective date of the rule. The exception to this outcome was that the rule also provided a "grandfathering provision" allowing permit applicants for federal PSD permits covered by 40 CFR 52.21, with complete permit applications submitted as of July 15, 2008, to continue relying on the PM_{10} Surrogate Policy. The 2008 rule also provided that states with approved PSD programs for $PM_{2.5}$ could continue to use the PM_{10} Surrogate Policy until May 2011 (when SIP revisions containing provisions to meet the new requirements in the 2008 rule were due), or until the EPA approved the revised SIP for $PM_{2.5}$, whichever occurred first.

On June 1, 2009, in response to a petition challenging the continued use of the PM_{10} Surrogate Policy for issuing PSD permits, the EPA issued a 3-month administrative stay of the grandfathering provision for $PM_{2.5}$ affecting federal PSD permits to give the EPA time to propose repealing the challenged grandfathering provision.[6] On September 16, 2009, the original 3-month stay was extended to June 22, 2010, to allow additional time for the EPA to propose repealing the grandfathering provision from the $PM_{2.5}$ NSR implementation rule for federal PSD permits issued under 40 CFR 52.21.[7] On February 11, 2010, the EPA published its proposal to repeal the grandfathering provision.[8] These actions cite the fact that the technical difficulties that necessitated the PM_{10} Surrogate Policy had been largely, although not entirely, resolved. As part of the proposed rulemaking to repeal the grandfathering provision contained in the federal PSD program, the EPA also proposed to require an early end to the use of the PM_{10} Surrogate Policy

[6] See 74 Fed. Reg. 26098.

[7] See 74 Fed. Reg. 48153.

[8] See 75 Fed. Reg. 6827.

for state PSD programs that the EPA had already approved as part of the SIP required by 40 CFR 51.166.

On May 18, 2011, the EPA published a final rule, titled "Implementation of the New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$); Final Rule to Repeal Grandfather Provision" (76 Fed. Reg. 28646), that repealed the grandfathering provision. In that final action, the EPA ended the use of the PM_{10} Surrogate Policy for PSD permits under the federal PSD program for sources that were covered by the grandfathering provision (that is, those sources for which a complete permit application was submitted before July 15, 2008) and that were not yet issued a permit by the effective date of the final rule. [9] The final rule also reaffirmed that as of May 2011, states with SIP-approved PSD programs for $PM_{2.5}$ could no longer use the PM_{10} Surrogate Policy. After the final rule became effective, in order for any PSD permits to be issued through the federal PSD program or a state SIP, such permit applications were to be reviewed directly against the $PM_{2.5}$ requirements. The demonstration must show, at a minimum, that the source's emissions are controlled to a level that satisfies Best Available Control Technology (BACT) requirements for $PM_{2.5}$ and that the emissions (filterable and condensable[10]) would not cause or contribute to a violation of any NAAQS for $PM_{2.5}$.

On March 23, 2010, the EPA issued a guidance memorandum titled "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS" (U.S. EPA, 2010b) to assist sources and permitting authorities in carrying out the required air quality analysis. The guidance memorandum recommended certain interim procedures to address the fact that compliance with the $PM_{2.5}$ NAAQS is based on a statistical form, and that there are technical complications

[9] Sources that applied for a PSD permit under the federal PSD program on or after July 15, 2008, were already excluded from using the 1997 PM10 Surrogate Policy as a means of satisfying the PSD requirements for PM2.5. See 73 Fed. Reg. 28321.

[10] See 40 CFR 51.165(a)(l)(xxxvii)(D), 51.166 (b)(49)(i)(a), and 52.21(b)(50) (i)(a).

associated with the ability of existing models to estimate the impacts of secondarily formed $PM_{2.5}$ in the atmosphere resulting from emissions of $PM_{2.5}$ precursors. For the latter issue, the EPA recommended that special attention be given to the assessment of monitored background air quality data since such data account for the contribution of both primary and secondarily formed $PM_{2.5}$ in the atmosphere associated with both nearby and regional sources.

On January 7, 2011, the NACAA Workgroup delivered a final report (NACAA, 2011), including a set of specific recommendations, to the EPA. The NACAA Workgroup was formed in early 2010 with the objective of providing technical recommendations to the Agency to aid in further development of $PM_{2.5}$ permit modeling guidance. The NACAA Workgroup's final report addressed three specific issues regarding $PM_{2.5}$ modeling implementation: 1) Emissions Inventories; 2) Secondary Formation from Project Source; and 3) Representative Background Concentrations.

The need for additional clarification on addressing both the primary and secondarily formed $PM_{2.5}$ in NAAQS compliance demonstrations was heightened following an administrative action on January 4, 2012, in which the EPA granted a petition submitted on behalf of the Sierra Club on July 28, 2010 (U.S. EPA, 2012a). The Sierra Club petition requested that the EPA initiate rulemaking to establish air quality models for ozone and $PM_{2.5}$ for use by all major sources applying for a PSD permit. In the petition grant, the EPA committed to engage in rulemaking to evaluate updates to the *Guideline on Air Quality Models* as published as Appendix W of 40 CFR Part 51 and, as appropriate, incorporate new analytical techniques or models for ozone and secondarily formed $PM_{2.5}$. As a part of this commitment and in compliance with Section 320 of the CAA, the EPA conducted the 10th Conference on Air Quality Modeling

(10th Modeling Conference) in March 2012. [11] At the 10th Modeling Conference, there were invited presentations of ongoing research of single source plume chemistry and photochemical grid modeling techniques, an overview presentation on the development of the "Draft Guidance for $PM_{2.5}$ Permit Modeling", and several public forums and subsequently written comments given pertaining to $PM_{2.5}$ NAAQS modeling.

Based on the EPA's March 23, 2010, guidance memorandum, the NACAA Workgroup final report recommendations, input from a mixture of stakeholders through numerous forums, and permit applicant-submitted $PM_{2.5}$ compliance demonstrations up to that point, the EPA prepared the "Draft Guidance on $PM_{2.5}$ Permit Modeling" and released it for public comment on March 4, 2013. During the course of the public comment period following the release of the draft guidance, the EPA received numerous comprehensive comments that provided invaluable feedback on the document and on the newly recommended approaches for $PM_{2.5}$ NAAQS and PSD increments compliance demonstrations. This feedback along with additional information gleaned through ongoing interactions with various stakeholders was particularly useful in the consideration of a range of acceptable options for $PM_{2.5}$ NAAQS and PSD increments compliance demonstrations and aided the EPA in the completion of this guidance document.

This "Guidance for $PM_{2.5}$ Permit Modeling" recommends appropriate technical approaches for conducting a $PM_{2.5}$ NAAQS and PSD increments compliance demonstration which includes adequate accounting for contributions from primary $PM_{2.5}$ concentration from a proposed new or modifying source's direct $PM_{2.5}$ emissions and from secondarily formed $PM_{2.5}$ concentrations resulting from the source's $PM_{2.5}$ precursor emissions. This guidance is consistent with the EPA's *Guideline on Air Quality Models*. The release of this "Guidance for $PM_{2.5}$ Permit

[11] Additional information regarding and presentations from the 10th Modeling Conference can be found on the SCRAM website at: http://www.epa.gov/ttn/scram/10thmodconf.htm.

Modeling" is also consistent with the commitments contained in the EPA's January 4, 2012, grant of the July 28, 2010, petition filed by the Sierra Club.

Since each permitting action will be considered on a case-by-case basis, this guidance does not limit or restrict any particular justifiable approach permit applicants and permitting authorities may take to conduct the required compliance demonstrations. Prospective permit applicants should recognize the importance of the consultation process with the appropriate permitting authority. This process will help identify the most appropriate analytical techniques to be used for conducting a $PM_{2.5}$ NAAQS and PSD increments compliance demonstration, including addressing the impacts of individual sources on secondary $PM_{2.5}$ formation, pursuant to Section 5.2.2.1.c of Appendix W.

In addition to this guidance, other recently issued EPA guidance of relevance for consideration in permit modeling for $PM_{2.5}$ includes:

- "Model Clearinghouse Review of Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS," February 26, 2010 (U.S. EPA, 2010a);
- "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS," March 23, 2010 (U.S. EPA, 2010b);
- "Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas," November 2013 (U.S.EPA, 2013); and
- "Interim Guidance on the Treatment of Condensable Particulate Matter Test Results in the PSD and NSR Permitting Programs," April 8, 2014 (U.S. EPA, 2014a).

The guidance listed above, in addition to other relevant support documents, can be found on the SCRAM website at http://www.epa.gov/ttn/scram/.

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II. Guidance Overview

This modeling guidance provides recommendations on how to conduct a $PM_{2.5}$ NAAQS and PSD increments compliance demonstration under the PSD program. It is based on and is consistent with Appendix W. Appendix W is the primary source of information on the regulatory application of air quality models for SIP revisions for existing sources and for NSR and PSD programs for permitting new and modifying sources.

The complexity of secondary $PM_{2.5}$ formation has historically presented significant challenges for the identification and establishment of particular models for assessing the $PM_{2.5}$ impacts of individual stationary sources (NARSTO, 2004; Seinfeld and Pandis, 1998; Cohan and Napelenok, 2011). Because of these considerations, the EPA's judgment in the past has been that it was not technically sound to assign with particularity specific models that must be used to assess the impacts of a single source on $PM_{2.5}$ concentrations.[12] Instead, the EPA has chosen to satisfy the requirements of the CAA, Section 165(e)(3)(D) through a process of determining particular models or other analytical techniques that should be used on a case-by-case basis because the "[c]hoice of methods used to assess the [$PM_{2.5}$] impact of an individual source depends on the nature of the source and its emissions," as stated in Section 5.2.2.1c. of Appendix W. As such, the appropriate methods for assessing $PM_{2.5}$ impacts are determined as part of the normal consultation process with the appropriate permitting authority. A modeling protocol should be developed by the permit applicant and approved by the appropriate permitting authority to ensure that the analysis conducted will conform to the recommendations, requirements, and principles of Section 10.2.1 of Appendix W.

[12] We note that this technical judgment has no effect on the obligation of sources subject to PSD to conduct a source impact analysis and demonstrate that a proposed source or modification will not cause or contribute to a violation of any NAAQS or applicable increment. See 40 CFR 51.166(k); 52.21(k). That is, the inclusion of a process rather than a specific preferred model in Appendix W does not relieve the source of the requirement to make this demonstration, which necessarily involves an analysis.

Due to the potentially important contribution from secondary formation of $PM_{2.5}$ and the more prominent role of ambient monitoring data in the cumulative analysis to represent background $PM_{2.5}$ concentrations including secondary formation from precursors from nearby sources, certain aspects of standard modeling practices used for PM_{10} and other criteria pollutants may not be appropriate for $PM_{2.5}$. For example, the contribution from secondary formation of $PM_{2.5}$ is not explicitly accounted for by the current preferred dispersion model (i.e., AERMOD), which is used to simulate dispersion of direct $PM_{2.5}$ emissions. Given these issues, PSD modeling of secondarily formed $PM_{2.5}$ should currently be viewed as screening-level analyses under Appendix W, analogous to Section 5.2.4 of Appendix W regarding dispersion modeling for nitrogen dioxide (NO_2) impacts due to the importance of chemistry in the conversion of nitric oxide (NO) emissions to ambient NO_2 and lack of a specified "refined" model.[13] The recommendations presented in this guidance for demonstrating compliance with the $PM_{2.5}$ NAAQS through dispersion modeling and other techniques have been developed with the factors listed above in mind.

As with any modeling analysis conducted using approved models identified in Appendix W, alternative models and methods may be considered on a case-by-case basis, subject to approval by the EPA Regional Office in accordance with the recommendations in Section 3.2. Additionally, Section 10.2.2 of Appendix W could potentially be given consideration in select situations. The provisions of Section 10.2.2 acknowledge that there are circumstances where there is no applicable model for a particular NAAQS compliance demonstration and that data

[13] Section 5.2.4 of Appendix W puts forth a 3-tiered screening approach for NO_2 NAAQS compliance demonstrations to obtain estimates of NO_2 for PSD and SIP planning purposes. The level of conservativeness in the tiered approaches decreases as fewer assumptions are made and a more detailed analysis is applied with the 3rd tier approach being the use of detailed screening techniques based on dispersion modeling.

from an array of ambient monitors surrounding the facility to be permitted could be used in lieu of modeling if appropriately justified.

Given the complexity of the technical issues that arise in the context of demonstrating compliance with the $PM_{2.5}$ NAAQS, we strongly encourage following the recommendations in Section 10.2.1 of Appendix W that "[e]very effort should be made by the Regional Office to meet with all parties involved in either a SIP revision or a PSD permit application prior to the start of any work on such a project. During this meeting, a protocol should be established between the preparing and reviewing parties to define the procedures to be followed, the data to be collected, the model to be used, and the analysis of the source and concentration data." Furthermore, we recommend that the consultative process involve regular communication between the appropriate permitting authority and the permit applicant at key milestones to ensure timely resolution of issues that may arise.

As necessary, the EPA Regional Office may seek clarification from the EPA's Office of Air Quality Planning and Standards (OAQPS) on technical issues and areas of concern in a modeling protocol or NAAQS compliance demonstration. Through these interactions and subsequent resolutions of the specific issues, clarifications of preferred modeling procedures can ultimately become official EPA guidance. This can happen in several ways: 1) the preferred procedures are published as regulations or guidelines; 2) the preferred procedures are formally transmitted as guidance to the Air Division Directors in the EPA Regional Offices; 3) the preferred procedures are formally transmitted as guidance to the EPA Regional Office modeling contacts as a result of a regional consensus on technical issues; or 4) the preferred procedures are relied upon in decisions by the EPA's Model Clearinghouse that effectively establish national precedent that the approach is technically sound. The Model Clearinghouse is the EPA focal

point for the review of the technical adequacy of pollutant modeling to satisfy regulatory criteria and other NAAQS compliance demonstration techniques. Model Clearinghouse memoranda involving interpretation of modeling guidance for specific applications, as well as clarification memoranda addressing needs to clarify guidance more generally, are available at the Support Center for Regulatory Atmospheric Modeling (SCRAM) website at: http://www.epa.gov/ttn/scram.

The guidance that follows is appropriate for those new or modifying sources locating or located in an area classified as attainment or unclassifiable for $PM_{2.5}$. This document is intended to provide recommendations on how to conduct $PM_{2.5}$ NAAQS and PSD increments compliance demonstrations under the PSD program following the progressive steps shown in Figure II-1 (NAAQS) and Figure II-2 (Increments). The EPA has historically allowed the use of screening tools to help facilitate the implementation of the PSD program and streamline the permitting process in circumstances where proposed construction is projected to have an insignificant (or *de minimis*) impact on air quality. These screening tools have included SERs, SILs, and significant monitoring concentrations (SMCs). The use of these screening tools at each progressive step on the left side (attainment or unclassifiable areas) of Figure II-1 and Figure II-2 are described in more detail in Sections II.1, II.2, and II.3.

Figure II-1. Overview of $PM_{2.5}$ NAAQS Compliance Demonstration for New or Modifying Sources under NSR/PSD Programs

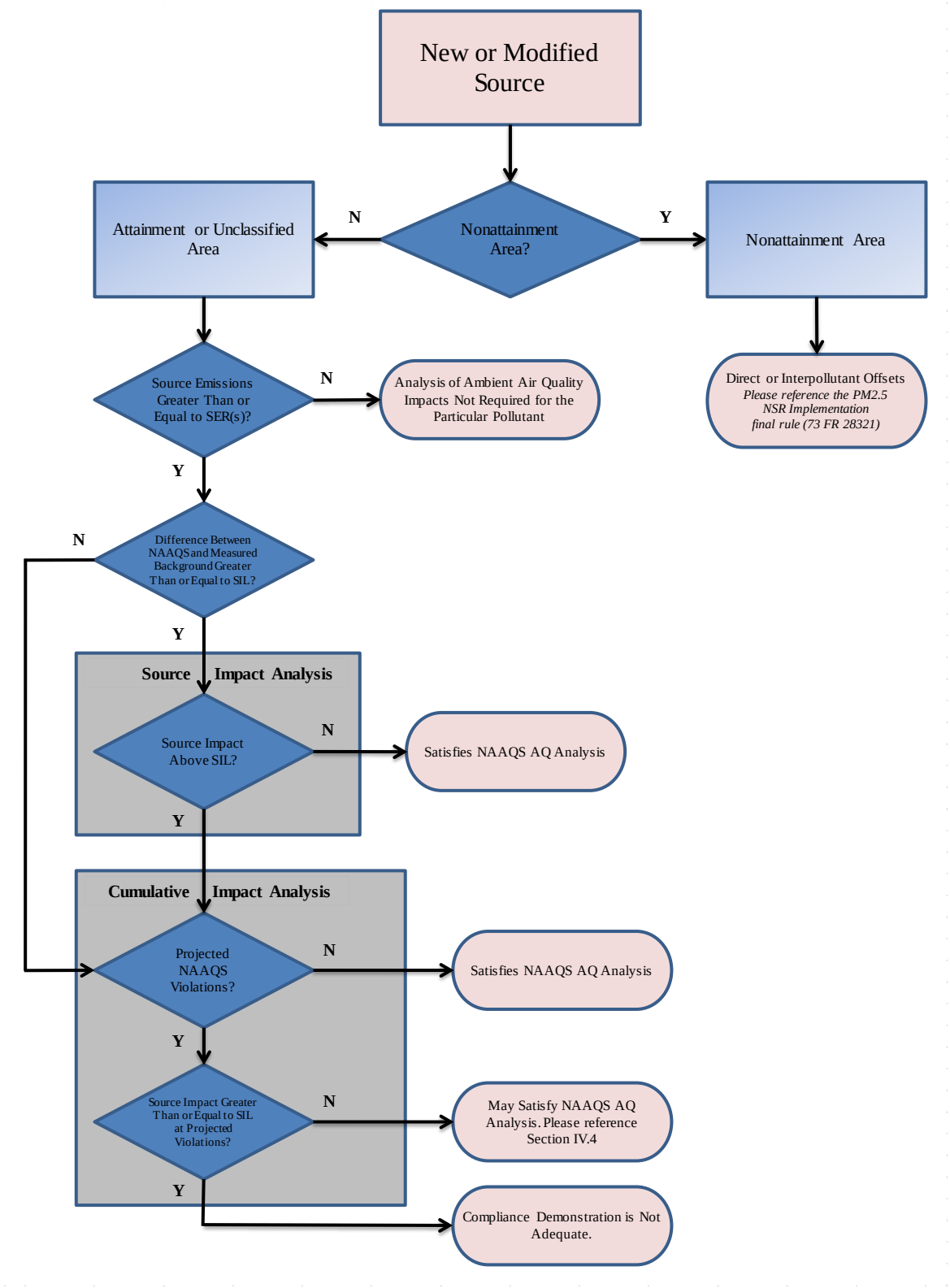
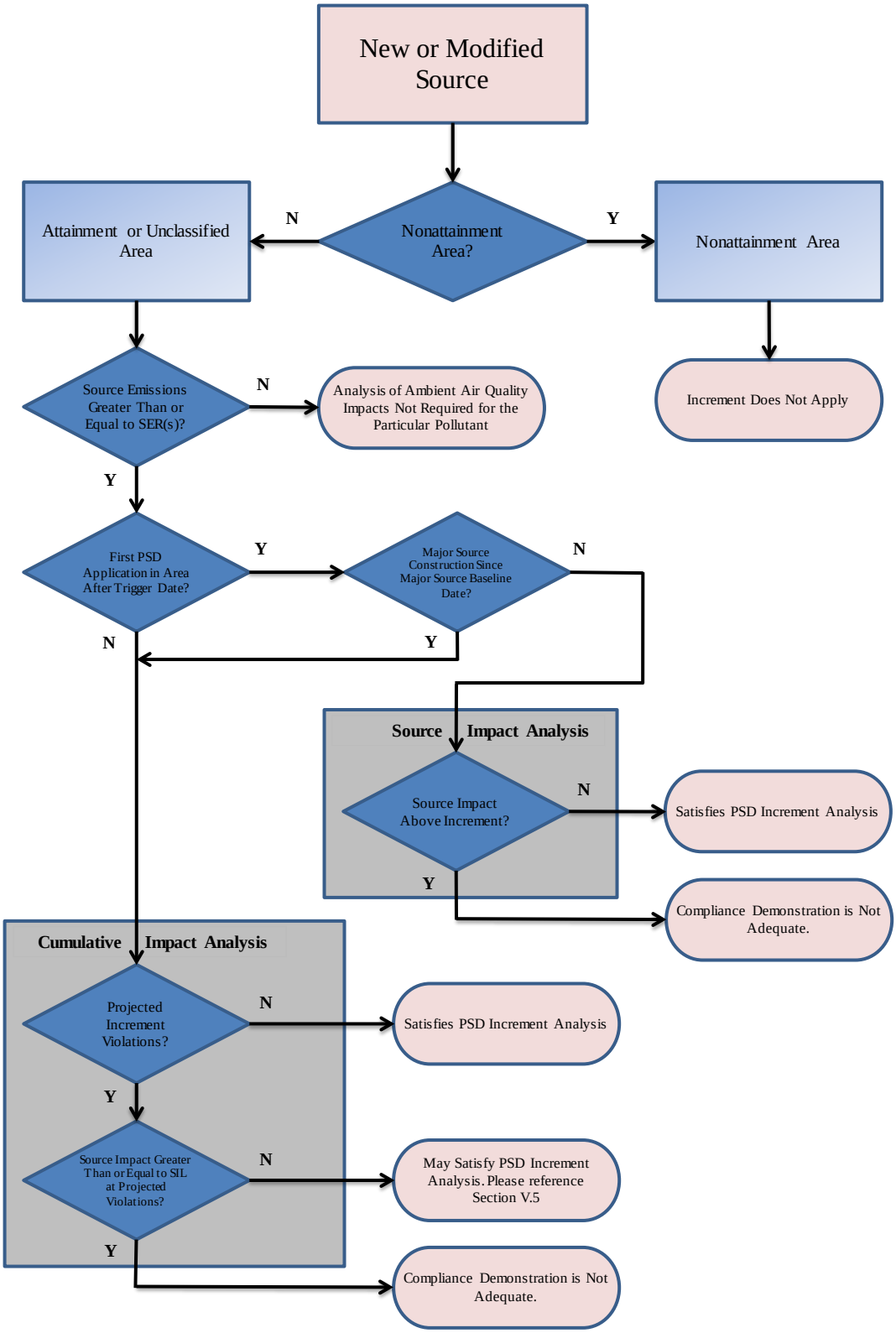


Figure II-2. Overview of PSD Increments Compliance Demonstration for New or Modifying Sources under NSR/PSD Programs



II.1 Significant Emissions Rates

EPA regulations only require an analysis of ambient air quality impacts for pollutants that a source emits (or that a modification of a source increases) in an amount equal to or greater than the significant emission rate for that pollutant defined in EPA regulations.[14] The EPA promulgated SERs for $PM_{2.5}$ and for the $PM_{2.5}$ precursors, nitrogen oxides (NO_x) and sulfur dioxide (SO_2), in 2008 as part of the first phase of PSD amendments to address $PM_{2.5}$.[15] (74 Fed. Reg. 28321 at 28333). The $PM_{2.5}$ SER for direct emissions of primary $PM_{2.5}$, defined as 10 tons per year (tpy) of direct $PM_{2.5}$ emissions, and the $PM_{2.5}$ precursor SERs, defined as either 40 tpy of NO_x or 40 tpy of SO_2, are used to determine whether any proposed new major stationary source or major modification will emit sufficient amounts of direct $PM_{2.5}$ and/or $PM_{2.5}$ precursors, i.e., equal to or above the respective SERs, to require review for $PM_{2.5}$ under the PSD program.

II.2 Screening and Source Impact Analysis

The EPA has historically supported the use of screening techniques in the PSD program to determine the extent of the air quality analysis that must be carried out to demonstrate that the source's emissions will not cause or contribute to a violation of any NAAQS or increment. [16]

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[14] See 40 CFR 51.166(m)(1)(i); 40 CFR 52.21(m)(1)(i).

[15] The EPA's final NSR rules for $PM_{2.5}$ do not require regulation of volatile organic compounds (VOC) or ammonia (NH_3) as precursors to $PM_{2.5}$ for the PSD program. However, a state may demonstrate to the Administrator's satisfaction or the EPA may demonstrate that VOC emissions in a specific area are a significant contributor to that area's ambient $PM_{2.5}$ concentrations. See 74 Fed. Reg. 28321. If so, then permit applicants with project sources having emissions of these pollutants should consult with the appropriate permitting authority and EPA Regional Office about how to deal with these emissions for the purposes of a NAAQS or PSD increments analysis.

[16] This has been consistent with overall support for screening techniques in the modeling guidelines. See, 40 CFR Part 51, Appendix W, Sections 2.2 and 4.2.1. The Guideline observes that "use of screening techniques followed, as appropriate, by a more refined analysis is always desirable." 40 CFR Part 51, Appendix W, Section 2.2.c. With respect to PSD permit review specifically, the Guideline says the following: "The purpose of [screening] techniques

Using this screening approach, when a proposed source's modeled impacts are found to be greater than the level of a SIL identified by the EPA, the EPA has called for a cumulative impact analysis (considering the combined impact of the proposed source and other sources in the affected area) to demonstrate that the proposed source will not cause or contribute to a violation of the NAAQS. On the other hand, the EPA has generally said that if the proposed source's modeled impacts are found to be below the level of a SIL identified by EPA for the relevant pollutant, this showing may be sufficient to demonstrate that the source will not cause or contribute to a modeled violation of the NAAQS.[17] However, the EPA has also acknowledged that there can be circumstances where a showing that the air quality impact of a proposed source is less than a SIL value identified by the EPA is not sufficient by itself to demonstrate that a source will not cause or contribute to a violation of the NAAQS or increment.

Prior to 2010, EPA had expressed support in guidance for applying the values in Section 51.165(b)(2) of its regulations as SILs that could be used as part of a demonstration that a source does not cause or contribute to a violation of the NAAQS. However, when the EPA added SILs for $PM_{2.5}$ in 2010 to paragraph (k)(2) of its Section 51.166 and 52.21 regulations, the Agency observed that "the use of a SIL may not be appropriate when a substantial portion of any NAAQS or increment is known to be consumed." (75 Fed. Reg. 64894). The EPA also said that "notwithstanding the existence of a SIL, permitting authorities should determine when it may be appropriate to conclude that even a *de minimis* impact will "cause or contribute" to an air quality problem and to seek remedial action from the proposed new source or modification." (75 Fed. Reg. 64892).

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is to eliminate the need of more detailed modeling for those sources that clearly will not cause or contribute to ambient concentrations in excess of either the National Ambient Air Quality Standards (NAAQS) or the allowable prevention of significant deterioration (PSD) concentration increments." *Id.* Section 2.2.a.

[17] See 72 Fed. Reg. 54112 at 54139 and 75 Fed. Reg. 64864 at 64890.

In the course of litigation challenging the SILs for $PM_{2.5}$, the EPA acknowledged that the regulatory language the EPA adopted in Sections 51.166(k)(2) and 52.21(k)(2) did not provide sufficient flexibility for permitting authorities to exercise discretion to conduct or require additional analysis in some circumstances where the EPA had advised doing so. As a result, the EPA requested that the U.S. Court of Appeals for the District of Columbia Circuit remand and vacate these provisions so the EPA could take corrective action. On January 22, 2013, the court granted this request and observed that, under the language in Sections 51.166(k)(2) and 52.21(k)(2), sources in some scenarios would not be required to demonstrate that they would not cause or contribute to a violation of the NAAQS or increments, even though, based on Petitioner's arguments, the sources likely would cause or contribute to a violation in such scenarios. The court concluded this would contravene the statutory command in Section 165(a)(3) of the Act. 705 F.3d at 464-65. The court also said that on remand the EPA may choose to promulgate regulations that "include SILs that do not allow the construction or modification of a source to evade the requirements of the Act as do the SILs in the current rule" and that such regulations would be subject to further review by the court. (Id. at 464).

EPA does not interpret the court's decision to preclude the use of SILs for $PM_{2.5}$ as part of a demonstration that a source will not cause or contribute to a violation of the $PM_{2.5}$ NAAQS. However, to ensure that PSD permitting decisions meet the requirements of the CAA, permitting authorities that continue using SILs for $PM_{2.5}$ must ensure that they select and apply such SILs in a manner that is consistent with the court's decision and the EPA's statements from the preamble of the 2010 regulation adopting SILs for $PM_{2.5}$. The EPA is developing a proposed rule to address the issues identified by the EPA and the court's decision. If necessary and as appropriate, this guidance will be amended after this rulemaking is proposed and subsequently finalized. In

the interim, permitting authorities may not apply the SIL provisions in the vacated and repealed Sections 51.166(k)(2) and 52.21(k)(2). Furthermore, permitting authorities should not apply any state regulations that have not yet been amended to conform to the repeal of these provisions and still contain regulatory text that is the same as or has a similar effect as the paragraph (k)(2) language, particularly in the types of scenarios described in the court decision and the EPA's 2010 preamble to the $PM_{2.5}$ Increments, SILs, and SMC Rule. [18] However, with appropriate safeguards, the EPA believes permitting authorities may continue to select and apply SILs values for $PM_{2.5}$ to support PSD permitting decisions and to determine the level of analysis needed to demonstrate that a source will not cause or contribute to violation of the NAAQS.[19] These safeguards involve two related considerations – the particular values of the SILs to be used and how those values are used.

The court decision does not preclude the use of SILs for $PM_{2.5}$, but requires that the EPA correct the error in the SIL regulations for $PM_{2.5}$ at 51.166(k)(2) and 52.21(k)(2). As a first step, on December 9, 2013, the EPA issued a final rule removing these sections of its regulations from the CFR (78 Fed. Reg. 73698). Until the EPA completes a rulemaking to replace these provisions, the EPA believes permitting authorities may continue to apply SILs for $PM_{2.5}$ to support a PSD permitting decision, but permitting authorities should take care to ensure that SILs are not used in a manner that is inconsistent with the requirements of Section 165(a)(3) of the CAA.

Permitting authorities have the discretion to select the particular $PM_{2.5}$ SIL values that are

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[18] Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$) – Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC). See 75 Fed. Reg. 64864 (October 20, 2010).

[19] The topic of the level of analysis needed for PSD increments compliance analysis is discussed in more detail in Section V.

used to support a permitting decision, but the values used should be supported by either a permitting record or regulation that supports the use of those values in the particular manner they are used.[20] Permitting authorities may not rely on the values contained in the vacated Sections 51.166(k)(2) and 52.21(k)(2) of the EPA's regulations as a screening tool without providing additional justification in the permitting record. However, with additional justification, it may be permissible in some cases for a permitting authority to use the same $PM_{2.5}$ SIL values as listed in the vacated Sections 51.166(k)(2) and 52.21(k)(2) to demonstrate that a full cumulative impacts analysis is not needed to make the NAAQS compliance demonstration

To the extent a permitting authority wishes to use any of the SILs values in the vacated Sections 51.166(k)(2) or 52.21(k)(2) as a screening tool to determine whether it is necessary to conduct a cumulative analysis of NAAQS compliance, the permitting authority must first examine background air quality concentrations to determine whether a substantial portion of the NAAQS has been consumed.[21] For this purpose, the EPA recommends using the preconstruction monitoring data compiled to meet the requirements of Section 51.166(m) or 52.21(m) of the EPA's regulations. If the preconstruction monitoring data are sufficiently representative of the air quality in existence before the increase in emissions from the proposed source and the difference between the $PM_{2.5}$ NAAQS and the measured $PM_{2.5}$ background concentrations in the

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[20] The EPA has previously observed that the absence of an EPA-promulgated SIL does not preclude PSD permitting authorities from developing and applying SILs to support permitting decisions. *See,* Response to Comments, Implementation of New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers in Diameter ($PM_{2.5}$) at 82 (March 2008) [EPA-HQ-OAR-2003-0062-0278]. However, the EPA has also observed that, "[t]he application of any SIL that is not reflected in a promulgated regulation should be supported by a record in each instance that shows the value represents a *de minimis* impact." *See,* NO_2 NAAQS Guidance at 13; and *Mississippi Lime* at 41 (granting the petition for review where the permitting authority failed to substantiate in the record which SIL it applied and its reasons for doing so).

[21] The recent court decision vacating the $PM_{2.5}$ SMC from the PSD regulations will mean that each PSD application must include ambient monitoring data representative of the area of concern. These data need not be collected by the PSD permit applicant if existing data are determined by the permitting authority to represent the air quality in the area of concern over the 12-month period prior to the submittal of a complete PSD application.

area is greater than or equal to the SIL value selected from the vacated Sections 51.166(k)(2) and 52.21(k)(2), then the EPA believes it would be sufficient in most cases for permitting authorities to conclude that a source with an impact equal to or below that SIL value will not cause or contribute to a violation of the NAAQS and to forego a cumulative modeling analysis for $PM_{2.5}$ with respect to the NAAQS.

The above comparison of background air quality concentrations and the NAAQS would not by itself provide adequate justification for foregoing a cumulative modeling analysis for the $PM_{2.5}$ increments. Such an approach would be inappropriate because it would not ensure that there is sufficient "headroom" within the allowable increment to absorb a source contribution equal to the SIL. However, a permitting authority may still be able to justify reaching a determination that a new or modified source will not cause or contribute to a violation of the increments without performing cumulative modeling for increments.

Since the trigger date has only recently been established (i.e., October 20, 2011), for the next several years, a new or modified source being evaluated for increments compliance will often be the first source with increment-consuming emissions in the area. As indicated in Figure II-2, under this situation, a permitting authority may have sufficient reason to conclude that the impacts of the new or modified source (based on the approach for conducting source impact analysis described below) may be compared directly to the allowable increments, without the need for a cumulative modeling analysis. Such a situation would involve the new or modified source representing the first PSD application in the area after the trigger date, which establishes the minor source baseline date and baseline area, and confirmation that no relevant major source construction has already occurred since the major source baseline date.

II.3 Cumulative Impact Analysis

As part of a NAAQS compliance demonstration, a cumulative impact analysis for $PM_{2.5}$ accounts for the combined impacts of direct and precursor emissions from the new or modifying source, of direct emissions from nearby sources (as appropriate), and of monitored background levels of $PM_{2.5}$ that account for secondary $PM_{2.5}$ impacts from regional transport, secondary $PM_{2.5}$ impacts from precursor emissions from nearby sources, and primary $PM_{2.5}$ impacts from background sources not included in the modeled inventory. The cumulative impacts are then compared to the NAAQS to determine whether the source will cause or contribute to a violation of the NAAQS. Several aspects of the cumulative impact analysis for $PM_{2.5}$ will be comparable to analyses conducted for other criteria pollutants, while other aspects will differ due to the issues identified earlier.

The measured background levels incorporated into a cumulative analysis should be based on the preconstruction monitoring data gathered in accordance with the requirements of the EPA regulations. 40 CFR 51.166(m)(1)(iii)-(iv); 40 CFR 52.21(m)(1)(iii)-(iv) (2). The EPA regulations contain an exemption from the preconstruction monitoring requirements in cases where ambient concentrations or the predicted impact of the source are less than the SMC. 40 CFR 51.166(i)(5)(i) ; 40 CFR 52.21(i)(5)(i). In the decision mentioned above, a U.S. Court of Appeals vacated the SMC for $PM_{2.5}$. *Sierra Club v. EPA*, 705 F.3d 458. The court concluded that the $PM_{2.5}$ SMC provisions (51.166(i)(5)(i)(c) and 52.21(i)(5)(i)(c)) were inconsistent with the requirements of Section 165(e)(2) of the CAA. The EPA has subsequently removed the $PM_{2.5}$ SMC provisions from the regulation.[22] Thus, permitting authorities may no longer rely on the SMCs for $PM_{2.5}$ to exempt permit applicants from compiling preconstruction monitoring data for

[22] See 78 Fed. Reg. 73698.

$PM_{2.5}$ in accordance with Sections 51.166(m) and 52.21(m) of the EPA's regulation. However, the EPA believes PSD permit applicants may continue to meet the preconstruction monitoring requirements in these regulations by gathering for purposes of the permitting analysis data already available from existing monitors that are determined by the applicable permitting authority to be representative of background conditions in the affected area.[23]

Where the screening analysis described in Section II.2 above is insufficient to show that a source will not cause or contribute to a violation of the PSD increments, a cumulative impact assessment would be necessary to make the demonstration. A cumulative assessment accounts for the combined impact of the new or modifying source's emissions and those emissions changes from sources that affect the increment. The cumulative impacts are then compared to the PSD increments to determine whether the new or modifying source emissions will cause or contribute to a violation of the PSD increments.

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[23] "EPA has long implemented the PSD program pursuant to the understanding that representative data may be substituted where circumstances warrant." (*In re: Northern Michigan University Ripley Heating Plant*, PSD Appeal No. 08-02, slip op. at 58 (Feb. 18, 2009));

"…the prospective PSD source must use existing … representative air quality data or collect … monitoring data." (52 Fed. Reg. 24672 (July 1, 1987) at 24686); and

With regard to the PSD requirement for monitoring data, "use of 'monitoring data' refers to either the use of existing representative air quality data or monitoring the existing air quality." (Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), EPA-450/4-80-012, November 1980, at page 3).

II.4 Assessment Cases for Source Impacts

To support the processes shown in Figure II-1 and Figure II-2, the EPA is recommending four different assessment cases shown in Table II-1 that define which air quality analyses, *if any*, a permit applicant should conduct to demonstrate compliance with the $PM_{2.5}$ NAAQS and PSD increments.

Table II-1. EPA Recommended Assessment Cases that Define Needed Air Quality Analyses of Source Impacts

Assessment Case	Description of Assessment Case	Assess Primary Impacts of Direct $PM_{2.5}$ Emissions?	Assess Secondary Impacts of Precursor Emissions of NO_x and/or SO_2?
Case 1: No Air Quality Analysis	Direct PM2.5 emissions < 10 tpy SER NOx and SO2 emissions < 40 tpy SER	NO	NO
Case 2: Primary Air Quality Impacts Only	Direct PM2.5 emissions ≥ 10 tpy SER NOx and SO2 emissions < 40 tpy SER	**YES**	NO
Case 3: Primary and Secondary Air Quality Impacts	Direct PM2.5 emissions ≥ 10 tpy SER NOx and/or SO2 emissions ≥ 40 tpy SER	**YES**	**YES**
Case 4: Secondary Air Quality Impacts Only	Direct PM2.5 emissions < 10 tpy SER NOx and/or SO2 emissions ≥ 40 tpy SER	NO	**YES**

The four assessment cases presented in Table II-1 include:

- For "Case 1—No Air Quality Analysis," if direct $PM_{2.5}$ emissions are less than the SER of 10 tpy and both NO_x and SO_2 emissions are individually less than the respective SERs of 40 tpy, then no modeled compliance demonstration is required.[24]
- For "Case 2—Primary Air Quality Impacts Only," if the direct $PM_{2.5}$ emissions are greater than or equal to the SER of 10 tpy and both NO_x and SO_2 emissions are individually less than the respective SERs of 40 tpy, then a modeled $PM_{2.5}$

[24] See 40 CFR 51.166(m)(1)(i); 40 CFR 52.21(m)(1)(i)

compliance demonstration is required for only the direct $PM_{2.5}$ emissions based on dispersion modeling and no modeling to account for impacts of precursor emissions from the project source is necessary.

- For "Case 3—Primary and Secondary Air Quality Impacts," if the direct $PM_{2.5}$ emissions are greater than or equal to the SER of 10 tpy and NO_x and/or SO_2 precursor emissions are greater than or equal to the respective SERs of 40 tpy, then a modeled $PM_{2.5}$ compliance demonstration is required for the direct $PM_{2.5}$ emissions based on dispersion modeling and the permit applicant should also assess the potential impact of the significant precursor emissions from the project source. The accounting of the precursor emissions impact on secondary $PM_{2.5}$ formation may be: a) qualitative in nature; b) based on a hybrid of qualitative and quantitative assessments utilizing existing technical work; or c) a full quantitative photochemical grid modeling exercise. The EPA anticipates only a few situations would require explicit photochemical grid modeling.
- For "Case 4—Secondary Air Quality Impacts Only," if the direct $PM_{2.5}$ emissions are less than the SER of 10 tpy, but the NO_x and/or SO_2 precursor emissions are greater than or equal to the respective SERs of 40 tpy, then a modeled $PM_{2.5}$ compliance demonstration for the direct $PM_{2.5}$ emissions is not required, but the permit applicant should assess the potential impact of the significant precursor emissions from the project source. Similar to "Case 3," the accounting of the precursor emissions impact on secondary $PM_{2.5}$ formation may be: a) qualitative in nature; b) based on a hybrid of qualitative and quantitative assessments utilizing existing technical work; or c) a full quantitative photochemical grid

modeling exercise. Again, the EPA anticipates that only a limited number of situations would require explicit photochemical grid modeling.

Details regarding the source impact analysis and cumulative impact analysis associated with Cases 2, 3, and 4, where project emissions are equal to or greater than the respective SERs for direct $PM_{2.5}$ emissions only (Case 2), for both direct $PM_{2.5}$ and precursor emissions of NO_x and/or SO_2 (Case 3), or for precursor emissions of NO_x and/or SO_2 only (Case 4), are provided in Sections III and IV (NAAQS) and Section V (Increments).

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III. Source Impact Analysis for the $PM_{2.5}$ NAAQS

This section provides details regarding the recommended approaches for conducting the source impact analysis associated with each of the four assessment cases presented in Table III-1 so long as the SIL has been appropriately justified for use in each NAAQS compliance demonstration as described in Section II.2. In each of the assessment cases, the analysis should begin by evaluating the impacts of direct $PM_{2.5}$ emissions and/or $PM_{2.5}$ precursor emissions based upon the total amount of these emissions as compared to the respective SERs.

Table III-1. EPA Recommended Approaches for Assessing Primary and Secondary $PM_{2.5}$ Impacts by Assessment Case

Assessment Case	Description of Assessment Case	Primary Impacts Approach	Secondary Impacts Approach
Case 1: No Air Quality Analysis	Direct PM2.5 emissions < 10 tpy SER NOx and SO2 emissions < 40 tpy SER	N/A	N/A
Case 2: Primary Air Quality Impacts Only	Direct PM2.5 emissions ≥ 10 tpy SER NOx and SO2 emissions < 40 tpy SER	**Appendix W preferred or approved alternative dispersion model**	N/A
Case 3: Primary and Secondary Air Quality Impacts	Direct PM2.5 emissions ≥ 10 tpy SER NOx and/or SO2 emissions ≥ 40 tpy SER	**Appendix W preferred or approved alternative dispersion model**	• **Qualitative** • **Hybrid qualitative / quantitative** • **Full quantitative photochemical grid modeling**
Case 4: Secondary Air Quality Impacts Only	Direct PM2.5 emissions < 10 tpy SER NOx and/or SO2 emissions ≥ 40 tpy SER	N/A	• **Qualitative** • **Hybrid qualitative / quantitative** • **Full quantitative photochemical grid modeling**

A modeled NAAQS compliance demonstration is not required for Case 1 since neither direct $PM_{2.5}$ emissions nor $PM_{2.5}$ precursor (NO_x and/or SO_2) emissions are equal to or greater than the respective SERs. Case 1 is the only assessment case that does not require a modeled NAAQS compliance demonstration. Each of the remaining three assessment cases would necessitate a source impact analysis.

The simplest or most traditional assessment case is Case 2 where only direct $PM_{2.5}$

emissions are greater than or equal to the SER. For Case 2, the permit applicant would only need to demonstrate that ambient $PM_{2.5}$ impacts associated with its increase in direct $PM_{2.5}$ emissions are below a SIL based on dispersion modeling using AERMOD or other appropriate preferred model listed in Appendix A of Appendix W, or an alternative model subject to the provisions of Section 3.2 of Appendix W.

Since both direct $PM_{2.5}$ emissions and NO_x and/or SO_2 precursor emissions are equal to or greater than the respective SERs for Case 3, this will likely be the most challenging of the four assessment cases. As with Case 2, the ambient $PM_{2.5}$ impacts associated with direct $PM_{2.5}$ emissions can be estimated based on application of an appropriate preferred dispersion model for near-field $PM_{2.5}$ modeling listed in Appendix W, currently AERMOD for most applications, or an approved alternative model. However, AERMOD does not account for secondary formation of $PM_{2.5}$ associated with the source's precursor emissions. Since the source also emits quantities of $PM_{2.5}$ precursors above the respective SERs for Case 3, some assessment of their potential contribution to secondary $PM_{2.5}$ is necessary. The assessment of NO_x and/or SO_2 precursor emission impacts on secondary $PM_{2.5}$ formation may be: a) qualitative in nature; b) based on a hybrid of qualitative and quantitative assessments utilizing existing technical work; or c) a full quantitative photochemical grid modeling exercise. The EPA anticipates that only a limited number of situations would require explicit photochemical grid modeling.

Since direct $PM_{2.5}$ emissions are below the applicable SER for Case 4, the source impact analysis in this case would only address the potential contribution to secondary $PM_{2.5}$ from NO_x and/or SO_2 precursor emissions, and would not require any modeling of direct $PM_{2.5}$ emissions. As discussed above for Case 3, the assessment of the precursor emission impacts on secondary $PM_{2.5}$ formation for Case 4 may be: a) qualitative in nature; b) based on a hybrid of qualitative

and quantitative assessments utilizing existing technical work; or c) a full quantitative photochemical grid modeling exercise. As with Case 3, the EPA anticipates that only a few situations would require explicit photochemical grid modeling.

III.1 Assessing Primary $PM_{2.5}$ Impacts

The assessment of primary $PM_{2.5}$ impacts from the proposed new or modifying source is generally the same for the NAAQS and increments and should be consistent with Appendix W. As noted above, Appendix W recommends specific models as "preferred" for specific types of applications, based on model performance evaluations and other criteria. The purpose of recommending the use of a particular preferred model is to ensure that the best-performing model is used in assessing PM impacts from a particular project and is employed in a consistent fashion.[25] In 2005, the EPA promulgated AERMOD as the Agency's preferred near-field dispersion model for a wide range of regulatory applications in all types of terrain based on extensive developmental and performance evaluation.[26] For NSR/PSD modeling for the $PM_{2.5}$ NAAQS, the AERMOD modeling system should be used to model direct $PM_{2.5}$ emissions unless another preferred model is more appropriate, such as the Buoyant Line and Point source dispersion model (BLP), or the use of an alternative model can be justified consistent with Section 3.2 of Appendix W.

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[25] The best performing model is one that best predicts regulatory design values for a particular pollutant. The EPA's *Protocol for Determining the Best Performing Model* (U.S. EPA, 1992) defines appropriate methodologies and statistical criteria for this evaluation. According to the document, "For a pollutant… for which short-term ambient standards exist, the statistic of interest involves the network-wide highest concentration…the precise time, location, and meteorological condition is of minor concern compared to the magnitude of the highest concentration actually occurring."

[26] The final rule can be found at: http://www.epa.gov/scram001/guidance/guide/appw_05.pdf. Extensive documentation is available describing the various components of AERMOD, including user guides, model formulation, and evaluation papers. See EPA's SCRAM website for AERMOD documentation: www.epa.gov/scram001/dispersion_prefrec.htm#aermod

As noted in the EPA's March 23, 2010, $PM_{2.5}$ guidance memorandum, although dry and/or wet deposition may be important processes when estimating ambient concentrations of PM in general, these factors are expected to be minor for $PM_{2.5}$ due to the small particle size. In addition, there may be additional uncertainty associated with deposition modeling for $PM_{2.5}$ due to the fact that deposition properties may vary depending on the constituent elements of $PM_{2.5}$. Therefore, use of deposition algorithms to account for depletion in estimating ambient $PM_{2.5}$ concentrations should be done with caution and only when clear documentation and justification of the deposition parameters is provided.

The AERMOD modeling system includes the following components:

- AERMOD: the dispersion model (U.S. EPA, 2004a; U.S. EPA, 2014b);
- AERMAP: the terrain processor for AERMOD (U.S. EPA, 2004b, U.S. EPA, 2011a); and
- AERMET: the meteorological data processor for AERMOD (U.S. EPA, 2004c; U.S. EPA, 2014c).

Other components that may be used, depending on the application, are:

- BPIPPRIME: the building input processor (U.S. EPA, 2004d);
- AERSURFACE: the surface characteristics processor for AERMET (U.S. EPA, 2008);
- AERSCREEN: a screening version of AERMOD (U.S. EPA, 2011b; U.S. EPA, 2011c); and
- AERMINUTE: a pre-processor to calculate hourly average winds from ASOS 2-minute observations (U.S. EPA, 2011d).

Before running AERMOD, the user should become familiar with the user's guides

associated with the modeling components listed above and the most recent version of the AERMOD Implementation Guide (U.S. EPA, 2009). In addition to these documents, detailed guidance on the use of the AERMOD modeling system for estimating primary $PM_{2.5}$ impacts is provided in Appendix B. Because AERMOD is limited to modeling only direct $PM_{2.5}$ emissions, additional or alternative approaches must be used to provide an assessment of the secondary $PM_{2.5}$ impact from the proposed new or modifying source, as discussed in more detail in the following sections.

III.2 Assessing Secondary $PM_{2.5}$ Impacts

This section provides more detail on the recommended approaches for assessing the impacts of precursor emissions on secondary $PM_{2.5}$ formation for Cases 3 and 4 presented in Table III-1 including:

- a qualitative assessment;
- a hybrid of qualitative and quantitative assessments utilizing existing technical work; and
- a full quantitative photochemical grid modeling exercise.

III.2.1 Qualitative Assessments

In a number of NAAQS compliance demonstrations requiring an assessment of the impact from secondary $PM_{2.5}$ formation, it is anticipated that a holistic qualitative analysis of the new or modifying emissions source and the atmospheric environment in which the emissions source is to be located will suffice for determining that secondary $PM_{2.5}$ impacts associated with the source's precursor emissions will not cause or contribute to a violation of the 24-hour or annual $PM_{2.5}$ NAAQS. Each NAAQS compliance demonstration will be unique and may require

multiple factors to be considered and assumptions to be thoroughly justified as a part of the qualitative assessment. A well-developed modeling protocol that includes a detailed conceptual description of the current air pollution concentrations in the area (see Appendix A for examples of elements of a conceptual description) and of the nature of the emissions sources surrounding the new or modifying emissions source is paramount for determining the necessary components of an acceptable qualitative assessment of the impact from secondary $PM_{2.5}$ formation.[27] With appropriate consultation, submittal, and subsequent approval of the modeling protocol by the appropriate permitting authority, many potential problems and unintended oversights in the qualitative assessment can be resolved early in the process or avoided all together.

In the development of an appropriate conceptual description of $PM_{2.5}$ to support a qualitative assessment of the impact from secondary $PM_{2.5}$ formation, it is important to fully characterize the current $PM_{2.5}$ concentrations in the region where the new or modifying emissions source is to be located. This characterization should take into consideration not only the most current 24-hour and annual $PM_{2.5}$ design values, which would typically be used as background concentrations in a cumulative modeling demonstration, but should also include an understanding of the seasonality and speciated composition of the current $PM_{2.5}$ concentrations and any long term trends that may be occurring. Understanding whether or not $PM_{2.5}$

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[27] For more detailed information on the development of such conceptual descriptions for an area, please refer to the following:

Chapter 10 of "Particulate Matter Assessment for Policy Makers: A NARSTO Assessment." P. McMurry, M. Shepherd, and J. Vickery, eds. Cambridge University Press, Cambridge, England (NARSTO, 2004).

Section 11, "How Do I Get Started? 'A Conceptual Description'" of "Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze." U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (U.S. EPA, 2007a).

In addition, relevant regional examples include: "Conceptual Model of $PM_{2.5}$ Episodes in the Midwest", January 2009, Lake Michigan Air Directors Consortium; and "Conceptual Model of Particulate Matter Pollution in the California San Joaquin Valley," Document Number CP045-1-98, September 8, 1998.

concentrations are higher or lower in certain seasons or fairly uniform throughout a year and determining whether there are particular component species (e.g., sulfates, nitrates, and elemental or organic carbon) that dominate the makeup of high, low, and average $PM_{2.5}$ concentrations will help guide the degree of analysis and ultimately the justification that will be required in the qualitative assessment based on the magnitude and characteristics of any significant precursor emissions from the source. It may also be important to describe the typical background concentrations of certain chemical species that participate in the photochemical reactions that form secondary $PM_{2.5}$, such as NH_3, VOC, and ozone. It is possible that there are mitigating factors for secondary $PM_{2.5}$ formation given limitations of other chemical species important in the photochemical reactions, e.g., minimal NH_3 in the ambient environment that could limit any precursor pollutant from readily reacting to form secondary $PM_{2.5}$. The qualitative assessment should include a narrative explaining how any identified significant precursor emissions and subsequent secondary $PM_{2.5}$ formation could contribute to the existing $PM_{2.5}$ concentration environment in the region.

A good conceptual description will also characterize the meteorological conditions that are representative of the region and are associated with periods and/or seasons of higher and lower ambient 24-hour $PM_{2.5}$ concentrations. Identification of meteorological phenomena that typically occur during periods of high 24-hour $PM_{2.5}$ concentrations, such as low-level temperature inversions, stagnant high pressure systems, etc., can be extremely important in understanding the importance, or lack thereof, of photochemistry and secondary $PM_{2.5}$ formation for the higher ambient $PM_{2.5}$ concentrations. The analysis and understanding of meteorological conditions will also inform the assessment of the seasonality of the 24-hour $PM_{2.5}$ concentrations in the region. The qualitative assessment should expand upon the characterization of

meteorology described in the conceptual description to explain any meteorological factors that could limit or enhance the formation of secondary $PM_{2.5}$ from any significant precursor emissions.

Analysis of existing photochemical grid modeling developed for regional haze, ozone, and $PM_{2.5}$ SIPs or other photochemical grid modeling used in related sensitivity projects or analysis to support prior air quality rules may also be considered to help understand the general response of secondary $PM_{2.5}$ formation to certain magnitudes of a precursor pollutant in that region. While the new or modifying emissions source may emit a significant level of a precursor pollutant under PSD regulations, that level of emission may be extremely small when compared against the total emissions of that precursor pollutant throughout the region. The qualitative assessment of the impact from secondary $PM_{2.5}$ formation can be strengthened if substantial regional decreases or increases of that precursor pollutant have been demonstrated through photochemical grid modeling exercises do not cause significant decreases or increases of secondary $PM_{2.5}$.

An example of a thoroughly developed qualitative assessment of the potential for secondary $PM_{2.5}$ formation to cause or contribute to a violations of the NAAQS was provided by the EPA Region 10 Office through a response to public comments document regarding a CAA permit issued for Shell's *Discoverer* drill ship and support fleet to explore for oil and gas in the Chukchi Sea off Alaska. While the environment in and around the Chukchi Sea and North Slope of Alaska is unique when compared to the rest of the United States, the various components contained within this qualitative assessment provide a template that could be followed, with appropriate modifications, in the development of other case-specific qualitative assessments. An excerpt from this response to public comments document is provided in Appendix C.

As shown in the EPA Region 10 example, the qualitative assessment of the potential for secondary $PM_{2.5}$ formation by Shell's *Discoverer* drill ship and support fleet was developed in a narrative manner integrating numerous factors specific to the North Slope region of Alaska that provided sufficient evidence that the $PM_{2.5}$ NAAQS would not be violated in this particular case. The qualitative assessment examined the regional background $PM_{2.5}$ monitoring data and aspects of secondary $PM_{2.5}$ formation from existing sources; the relative ratio of the combined modeled primary $PM_{2.5}$ impacts and background $PM_{2.5}$ concentrations to the level of the NAAQS; the spatial and temporal correlation of the primary and secondary $PM_{2.5}$ impacts; meteorological characteristics of the region during periods of precursor pollutant emissions; the level of conservatism associated with the modeling of the primary $PM_{2.5}$ component and other elements of conservatism built into the overall NAAQS compliance demonstration; aspects of the precursor pollutant emissions in the context of limitations of other chemical species necessary for the photochemical reactions to form secondary $PM_{2.5}$; and an additional level of NAAQS protection through a post-construction monitoring requirement. While each of the components of the EPA Region 10 example may or may not be necessary, this example should provide a useful template for other qualitative assessments under this guidance, recognizing that additional components may be essential in other qualitative assessments of the potential for secondary $PM_{2.5}$ formation.

III.2.2 Hybrid Qualitative/Quantitative Assessment

The qualitative assessment discussed above is largely focused on a determination that the proposed new or modifying source precursor emissions, in combination with the estimated primary $PM_{2.5}$ impacts (if applicable for Case 3), will not cause or contribute to a violation of the

24-hour and/or annual $PM_{2.5}$ NAAQS. However, it may not always be possible to provide such a justification without some quantification of the potential secondary $PM_{2.5}$ impacts from the proposed new or modifying source's precursor emissions. In such cases, the EPA expects that existing air quality model-based information regarding the potential for SO_2 and NO_x precursor emissions to form secondary $PM_{2.5}$ concentrations may be used to establish an appropriate estimate of secondary $PM_{2.5}$ impacts from the proposed new or modifying source. As described above, there may be situations where the proposed new or modifying source's total ambient impact (i.e., primary and secondary impacts) is less than a SIL, and the record demonstrates that no further air quality assessment would be needed to demonstrate that the source would not cause or contribute to a violation of any NAAQS. Otherwise, a cumulative impact assessment would be necessary, which is discussed in Section IV.

To inform a hybrid qualitative/quantitative assessment, the existing air quality model-based information would need to be appropriate in terms of representing the type of source, its precursor emissions, and its geographic location, in addition to those elements of the conceptual description discussed above for the qualitative assessment. The quantitative modeling information may be available from past or current SIP attainment demonstration modeling, published modeling studies, or peer-review literature with estimates of model responsiveness to precursor emissions in contexts that are relevant to the new or modifying source. The estimates of model responsiveness, such as impact on $PM_{2.5}$ concentrations per ton of SO_2 emissions, could then be used in conjunction with the precursor emissions estimates for the proposed new or modifying source to provide a quantitative estimate of the impact of such precursor emissions on the formation of secondary $PM_{2.5}$ concentrations. The estimates should be technically credible in representing such impacts and it may be advisable for the estimate to reflect an upper bound of

potential impacts.

The NACAA Workgroup final report (NACAA, 2011) provides details on potential approaches to quantify the secondary $PM_{2.5}$ impacts from a proposed new or modifying source that may be appropriate to inform a hybrid qualitative/quantitative assessments of $PM_{2.5}$ impacts (See Appendix C and D of NACAA, 2011). One suggested method in the final report is to convert emissions of precursors into equivalent amounts of direct $PM_{2.5}$ emissions using "pollutant offset ratios" and then use a dispersion model to assess the impacts of the combination of direct $PM_{2.5}$ emissions and the equivalent direct $PM_{2.5}$ emissions. The "pollutant offset ratios" referenced in the final report were those put forth by the EPA in the 2008 "Implementation of the New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$)" final rule (73 Fed. Reg. 28321) concerning the development and adoption of interpollutant trading (offset) provisions for $PM_{2.5}$ under state nonattainment area NSR programs for $PM_{2.5}$.[28] The EPA's July 23, 2007, technical analysis titled "Details on Technical Assessment to Develop Interpollutant Trading Ratios for $PM_{2.5}$ Offsets," describes the method used to establish the original "preferred" precursor offset ratios (U.S. EPA, 2007b).

We do not support using the specific results from the EPA's 2007 technical assessment in this context without additional technical demonstration specific to the source(s) and area(s) for which the ratios would be applied. However, we expect that the EPA Regional Offices, with assistance from the OAQPS, may assist state/local air permitting agencies, as necessary, to

[28] In the preamble to the 2008 final rule (73 Fed. Reg. 28321), the EPA included preferred or presumptive offset ratios, applicable to specific $PM_{2.5}$ precursors that state/local air agencies may adopt in conjunction with the new interpollutant offset provisions for $PM_{2.5}$, and for which the state could rely on the EPA's technical work to demonstrate the adequacy of the ratios for use in any $PM_{2.5}$ nonattainment area. In a July 21, 2011 memorandum, EPA changed its policy and stated that it no longer supported the ratios provided in the preamble to the 2008 final rule as presumptively approvable ratios for adoption in SIPs containing nonattainment NSR programs for $PM_{2.5}$. Memorandum from Gina McCarthy, Assistant Administrator to Regional Air Division Directors, "Revised Policy to Address Reconsideration of Interpollutant Trading Provisions for Fine Particles ($PM_{2.5}$)" (U.S. EPA, 2011e).

structure appropriate technical demonstrations leading to the development of appropriate source and area-specific offset ratios for $PM_{2.5}$ that may be appropriate for the purposes of estimating potential secondary $PM_{2.5}$ impacts. As described in the EPA's July 21, 2011, memorandum addressing reconsideration of the interpollutant trading provisions for the 2008 final rule, the EPA acknowledged that existing models and techniques are adequate to "conduct local demonstrations leading to the development of area-specific ratios for $PM_{2.5}$ nonattainment areas" and provided a general framework for efforts that may be relevant in developing appropriate "pollutant offset ratios" for use in hybrid qualitative/quantitative assessment of secondary $PM_{2.5}$ impacts (U.S. EPA, 2011e).

An example of a hybrid qualitative/quantitative assessment of secondary $PM_{2.5}$ impacts was developed by a permit applicant, Sasol, for a major facility expansion in Southern Louisiana through close coordination with the EPA Region 6 Office and the Louisiana Department of Environmental Quality (LDEQ). Sasol and LDEQ worked closely with Region 6 to ensure that the ambient impacts analysis was robust and defendable. In this particular hybrid assessment, Sasol took an approach of using the formerly presumptive interpollutant trading ratios for NO_x and SO_2 to $PM_{2.5}$ offsets and conservatively applied them in an illustrative example to demonstrate how relatively inconsequential the impacts of secondary $PM_{2.5}$ formation would be in the area of significant impact surrounding their facility. Sasol did not seek to directly apply the formerly presumptive interpollutant trading ratios in an absolute sense. Rather, the intention was to present the analysis in a manner to determine if further technical justification would be required or if the application of the formerly presumptive interpollutant trading ratios was adequate in a hybrid qualitative/quantitative sense. A more detailed discussion of Sasol's hybrid assessment is provided in Appendix D.

The EPA also notes that the NACAA Workgroup "considered, but rejected, other methods for assessing secondary $PM_{2.5}$ impacts, including use of a simple emissions divided by distance (Q/D) metric and use of AERMOD with 100 percent conversion of SO_2 and NO_x concentrations to $(NH_4)_2SO_4$ and $(NH_4)NO_3$." The EPA has reviewed the detailed discussion provided in Appendix E of the NACAA Workgroup final report and agrees with these conclusions.

III.2.3 Full Quantitative Photochemical Grid Modeling

In those rare cases where it is deemed necessary to estimate secondary $PM_{2.5}$ impacts with full quantitative photochemical grid modeling, the candidate model for use in estimating single source impacts on secondarily formed $PM_{2.5}$ should meet the general criteria for an "alternative model" outlined in Section 3.2.2 of 40 CFR 51.112 and 40 CFR Part 51, Appendix W, for condition (3) where "the preferred model is less appropriate for the specific application, or there is no preferred model," i.e.,

i. The model has received a scientific peer review;

ii. The model can be demonstrated to be applicable to the problem on a theoretical basis;

iii. The databases that are necessary to perform the analysis are available and adequate;

iv. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates; and

iv. A protocol on methods and procedures to be followed has been established.

Section 3.2.1 of Appendix W also discusses appropriate methodologies for evaluating performance of models for regulatory applications, including the EPA's "Protocol for Determining the Best Performing Model" (U.S. EPA, 1992). The determination of acceptability of a particular model and approach for such an alternative model application is an EPA Regional Office responsibility that may also include consultation with the EPA Headquarters, if appropriate.

As noted in the NACAA Workgroup final report, photochemical grid models provide a complete characterization of emissions, chemical transformation, transport, and deposition using time and space variant meteorology. The EPA's modeling guidance for $PM_{2.5}$ attainment demonstrations (U.S. EPA, 2007a) identifies both the Comprehensive Air Quality Model with Extensions (CAMx) (ENVIRON, 2011; Nobel et al., 2001; Russell, 2008) and the Community Multiscale Air Quality (CMAQ) model (Byun and Schere, 2006; Foley et al., 2010). These state-of-the-science photochemical grid models have been used by the EPA for air quality modeling to support federal rulemaking and by state/local air permitting agencies for their air quality planning efforts. Some photochemical grid models have been instrumented with extensions that allow for the identification of impacts from specific sources to important receptor locations. These extensions generally fall in the categories of source apportionment and source sensitivity, and of sub-grid plume treatment and sampling, as described below.

Based on the current capabilities of photochemical grid models and consistent with the NACAA Workgroup report, the EPA recommends the following approaches be considered to estimate secondary $PM_{2.5}$ impacts from a proposed new or modifying source using this type of model:

- "Brute force zero-out" or difference method where two model simulations are conducted,

one with all existing sources and a second, counterfactual simulation with all existing sources and the new source emissions, with the difference being taken as the contribution from the new or modifying source.

- Instrumented techniques such as
    - Source apportionment tools where the precursor emissions from the new or modifying source are tracked to provide a contribution estimate for that individual source, or
    - Higher-order decoupled direct method (HDDM) which tracks the sensitivity of results to the emissions from a new or modifying source to provide coefficients relating source emissions to air quality response.

The NACAA Workgroup final report notes that these approaches represent fundamentally different methods and may result in different estimates for secondary $PM_{2.5}$ impacts depending on the non-linear chemical processes. The EPA, state/local permitting agencies, and others within the atmospheric modeling community continue to apply these techniques to test and evaluate their suitability for estimating single source impacts on secondarily formed $PM_{2.5}$. These efforts are critically important to inform current application of these models and techniques for purposes of assessing the secondary $PM_{2.5}$ impacts from a proposed new or modifying source, as well as to inform efforts to evaluate updates to Appendix W with new analytical techniques or models for ozone and secondary $PM_{2.5}$ per the commitments contained in the EPA's January 4, 2012, grant of the July 28, 2010, petition filed by the Sierra Club.[29]

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[29] Several photochemical grid modeling approaches that allow for estimation of the secondary $PM_{2.5}$ impacts from a proposed new or modifying source were presented during the Emerging Models / Techniques Session of the 10th

Photochemical grid models that have been instrumented with source apportionment techniques track emissions from specific sources through the chemical transformation, transport, and deposition processes to estimate the source's contribution to predicted air quality at downwind receptors (Baker and Foley, 2011). Source sensitivity approaches provide information about how model predicted concentrations change based on an increase or decrease in emissions from a specific source. The difference in air quality between the original baseline simulation and the simulation where emissions are perturbed provides a quantitative estimate of that source's contribution to the cumulative impact estimate.

Another approach to differentiate the contribution of single sources on changes in model predicted air quality is the higher-order decoupled direct method (HDDM), which tracks the sensitivity of model results to emissions for a specific source through all chemical and physical processes in the modeling system (Bergin et al., 2008). Sensitivity coefficients relating source emissions to air quality are estimated during the model simulation and output at the resolution of the photochemical grid model. An important difference between source apportionment and source sensitivity is that source apportionment answers the "contribution" question, "How much did a source contribute overall to modeled air quality?" and source sensitivity answers the "responsiveness" question, "How will modeled air quality change if the source's emissions change?"

In some instances where the source and critical receptors are in very close proximity, the source and receptors may be located in the same photochemical grid model cell. Since physical and chemical processes simulated in the model represent a volume average, this may not adequately (or appropriately) represent the gradients of pollution that may exist between the

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Modeling Conference. Additional information regarding and presentations from the 10th Modeling Conference can be found on the SCRAM website at: http://www.epa.gov/ttn/scram/10thmodconf.htm.

source and receptors. One approach to more explicitly represent the spatial gradient in source-receptor relationships when they are in close proximity would be to use smaller sized grid cells. Grid resolution would be defined such that the source and receptors are no longer in the same grid cell. Ideally, there would also be several grid cells between the source and receptors to best resolve near-source pollution gradients.

In these situations of close proximity between the source and receptors, a photochemical grid model instrumented with sub-grid plume treatment and sampling may be an alternative approach for characterizing these relationships. Sub-grid plume treatment extensions in photochemical grid models typically solve for in-plume chemistry and use a set of physical and chemical criteria for determination of when puff mass is merged back into the host model grid. However, accounting for source specific impacts both at the sub-grid and grid levels is challenging and enhancements to traditional implementations of this approach may be necessary to fully capture source impacts for permit applications.

For this guidance, the EPA is not prescribing in detail how photochemical grid models (or their instrumented extensions) should be applied for the purposes of conducting a NAAQS compliance demonstration since these details may involve case-specific factors that would need to be part of the consultative process with the appropriate permitting authority and reflected in the agreed-upon modeling protocol. With this in mind, we recommend that the modeling protocols for this purpose should include the follow elements:

1. Overview of Modeling/Analysis Project
    - Participating organizations
    - Schedule for completion of the project
    - Description of the conceptual model for the project source/receptor area

- Identify how modeling and other analyses will be archived and documented
- Identify specific deliverables to the appropriate permitting authority

2. Model and Modeling Inputs

- Rationale for the selection of air quality, meteorological, and emissions models
- Modeling domain
- Horizontal and vertical resolution
- Specification of initial and boundary conditions
- Episode selection and rationale for episode selection
- Rationale for and description of meteorological model setup
- Basis for and development of emissions inputs
- Methods used to quality assure emissions, meteorological, and other model inputs

3. Details on the approach for comparison to the SIL and/or NAAQS

4. Model Performance Evaluation

- Describe ambient database(s)
- Describe evaluation procedures and performance metrics

As stated previously, we expect that the EPA Regional Offices, with assistance from the OAQPS, may assist states, as necessary, to structure appropriate technical demonstrations leading to the development of appropriate photochemical grid modeling applications for the purposes of estimating potential secondary $PM_{2.5}$ impacts.

III.3 Comparison to the SIL

Where a permit applicant wishes to compare the proposed source's total ambient $PM_{2.5}$ impacts to a SIL in order to make the required demonstration that a source does not cause or contribute to a violation of the NAAQS, the compliance demonstration will vary depending on whether Case 2, 3, or 4, where direct $PM_{2.5}$ and/or precursor emissions are equal to or greater than the respective SERs, is applicable.

For Case 2, where only direct $PM_{2.5}$ emissions are equal to or greater than the applicable (10 tpy) SER, the SIL may be compared to the modeled estimates of ambient primary $PM_{2.5}$ concentrations due to direct emissions using the preferred AERMOD dispersion model (or acceptable preferred or alternative model). The modeling methods used in this initial source impact assessment phase of the $PM_{2.5}$ analysis for Case 2 are similar to the methods used for other pollutants, including the use of maximum allowable emissions, following Table 8-2 of Appendix W. However, due to the form of the $PM_{2.5}$ NAAQS, we recommend that a SIL be compared to either of the following, depending on the meteorological data used in the analysis:

- The highest of the 5-year averages of the maximum modeled 24-hour or annual $PM_{2.5}$ concentrations predicted each year at each receptor, based on 5 years of representative National Weather Service (NWS) data; or
- The highest modeled 24-hour or annual $PM_{2.5}$ concentrations predicted across all receptors based on 1 year of site-specific meteorological data, or the highest of the multi-year averages of the maximum modeled 24-hour or annual $PM_{2.5}$ concentrations predicted each year at each receptor, based on 2 or more years, up to 5 complete years of available site-specific meteorological data.

These metrics represent the maximum contribution that project emissions could make to the air

quality impact at any receptor, given the form of the NAAQS, and therefore provide an appropriate part of the basis for determining whether a cumulative modeling analysis would be needed.

For Case 3, where the source's direct $PM_{2.5}$ emissions and emissions of at least one precursor are equal to or greater than the respective SERs, the comparison of the SIL would need to address both primary and secondary $PM_{2.5}$ ambient impacts associated with the proposed source. As with Case 2, the ambient impacts due to direct $PM_{2.5}$ emissions would be estimated using the preferred AERMOD dispersion model (or acceptable alternative model). However, the comparison to the SIL will depend on the type of assessment conducted for the secondary $PM_{2.5}$ impacts from the source. As noted above, the assessment of the precursor emission impacts on secondary $PM_{2.5}$ formation may be: a) qualitative in nature; b) based on a hybrid of qualitative and quantitative assessments utilizing existing technical work; or c) a full quantitative photochemical grid modeling exercise.

Since any SIL that is used should represent a specific insignificant (or *de minimis*) ambient concentration of $PM_{2.5}$ that may be used to demonstrate that a source will not cause or contribute to a NAAQS violation without conducting a cumulative impact assessment, basing the initial source impact analysis for Case 3 on a qualitative assessment (or a hybrid of qualitative and quantitative assessments) of secondary $PM_{2.5}$ ambient impacts may be difficult to justify. This is because there would be no specific quantitative estimate of total $PM_{2.5}$ impacts for comparison to the SIL, unless a valid argument can be made that secondary $PM_{2.5}$ impacts associated with the source's precursor emissions will be very small (e.g., precursor emissions barely exceed the respective SERs and/or the chemical environment is not conducive to secondary formation). As such, when using either of these approaches, it may be appropriate to

forego the SIL assessment and focus on the NAAQS compliance demonstration using a cumulative impact analysis.

For cases where a full quantitative photochemical grid modeling assessment of secondary $PM_{2.5}$ is conducted, the SIL comparison for Case 3 should be based on the combined ambient impacts of primary and secondary $PM_{2.5}$. However, the primary and secondary $PM_{2.5}$ impacts may be combined in various ways which may entail greater or lesser degrees of conservatism. For example, combining the peak estimated primary $PM_{2.5}$ impact with the peak estimated secondary $PM_{2.5}$ impact, unpaired in time and space would likely result in a conservative estimate of combined impacts since, as noted above, peak impacts associated with a source's direct $PM_{2.5}$ and precursor emissions are not likely well-correlated in time or space. On the other hand, the conservatism associated with combining peak estimated primary and secondary impacts for comparison to a SIL would likely make such an approach easier to justify than other approaches for combining estimated primary and secondary $PM_{2.5}$ impacts.

The other extreme for combining primary and secondary $PM_{2.5}$ impacts for comparison to a SIL for Case 3, relative to combining peak primary and peak secondary impacts unpaired in time and space, would be full temporal and spatial pairing of estimated primary and secondary $PM_{2.5}$ impacts. Such an approach may not be feasible in many cases, given that the dispersion modeling and photochemical grid modeling may be based on different data periods. Furthermore, full temporal and spatial pairing of primary and secondary $PM_{2.5}$ impacts may not be appropriate in many cases due to the fact that photochemical grid modeling represents gridded concentration estimates whereas dispersion modeling produces estimates at discrete receptor locations and given the limitations in the skill of both the dispersion model and the photochemical grid model to accurately predict impacts on a paired in time and space basis. On the other hand, some degree

of temporal pairing of primary and secondary $PM_{2.5}$ impacts on a seasonal or monthly basis should be appropriate in most cases, recognizing the general lack of correlation between primary and secondary impacts.

The permitting authority and the permit applicant should thoroughly discuss the details regarding combining modeled primary and secondary $PM_{2.5}$ impacts for Case 3 and should reach agreement on a protocol during the initial review of the modeling protocol. It may be appropriate for the protocol to specifically identify multiple tiers for combining the modeled primary and secondary $PM_{2.5}$ impacts with the more conservative approaches being easier to justify. The permitting authority should ensure that any approach for combining estimated primary and secondary $PM_{2.5}$ impacts for comparison to a SIL for Case 3 conforms to the recommendations described above for Case 2 regarding the form of the modeled estimate. Accordingly, the approach should be based on the highest of the multi-year averages of the maximum modeled 24-hour or annual $PM_{2.5}$ concentrations predicted each year at each receptor, which represents the maximum contribution that the source's emissions could make in a cumulative impact assessment.

For Case 4, where the source's precursor emissions are equal to or greater than the respective SERs but direct $PM_{2.5}$ emissions are not, the SIL comparison would only address secondary $PM_{2.5}$ ambient impacts associated with the proposed source. The assessment of the precursor emission impacts on secondary $PM_{2.5}$ formation may be: a) qualitative in nature; b) based on a hybrid of qualitative and quantitative assessments utilizing existing technical work; or c) a full quantitative photochemical grid modeling exercise. As discussed above for Case 3, since a SIL should represent a specific insignificant (or *de minimis*) ambient concentration of $PM_{2.5}$ that may be used to demonstrate that a source will not cause or contribute to a violation without a

cumulative impact assessment, basing the source impact analysis on a purely qualitative assessment of secondary $PM_{2.5}$ ambient impacts or a hybrid of qualitative and quantitative assessments, utilizing existing technical work for Case 4, may be difficult to justify unless a demonstrably conservative estimate of the secondary $PM_{2.5}$ contribution can be made that is below a SIL. As such, when using either of these approaches, it may be appropriate for the permitting authority to recommend the permit applicant to forego the SIL assessment and focus on the NAAQS compliance demonstration using a cumulative impact analysis. However, it may be more feasible for the permitting authority to allow the permit applicant to apply a SIL to full photochemical grid model estimates of secondary $PM_{2.5}$ for Case 4 than for Case 3 since the issues associated with combining modeled estimates of primary and secondary $PM_{2.5}$ would not apply for Case 4. In these cases, the highest of the multi-year averages of the maximum modeled 24-hour or annual $PM_{2.5}$ concentrations predicted each year at each receptor should be compared to a SIL, since these metrics represent the maximum contribution that the source could make.

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IV. Cumulative Impact Analysis for the $PM_{2.5}$ NAAQS

Where the screening analysis described in Section II is insufficient to show that a source will not cause or contribute to a violation of the NAAQS, a cumulative impact assessment would be necessary to make the NAAQS compliance demonstration. A cumulative assessment accounts for the combined impact of the new or modifying source's emissions, emissions from other nearby sources, and representative background levels of $PM_{2.5}$ within the modeling domain. The cumulative impacts are then compared to the NAAQS to determine whether the new or modifying source emissions will cause or contribute to a violation of the NAAQS. This section provides details on conducting an appropriate cumulative impact assessment for the $PM_{2.5}$ NAAQS.

The cumulative impact assessment should include the following components of $PM_{2.5}$ impacts, as appropriate, for comparison to the NAAQS:

- Proposed new or modifying source
    - Primary impacts on $PM_{2.5}$, i.e., from direct $PM_{2.5}$ emissions
    - Secondary impacts on $PM_{2.5}$, i.e., from precursor (NO_x and/or SO_2) emissions
- Nearby sources
    - Primary impacts on $PM_{2.5}$, as appropriate
- Monitored background of $PM_{2.5}$ that accounts for secondary $PM_{2.5}$ impacts from regional transport, secondary $PM_{2.5}$ impacts from nearby sources, and primary $PM_{2.5}$ impacts from background sources not included in the modeled inventory.

As with the source impact analysis discussed previously, the primary impacts related to direct $PM_{2.5}$ emissions from the proposed new or modifying source and nearby sources should be

estimated based on the AERMOD dispersion model (or other acceptable preferred model or an approved alternative model) while the estimate of secondary $PM_{2.5}$ impacts from the proposed new or modifying source will vary depending on whether the assessment of the proposed source's precursor emission impacts on secondary $PM_{2.5}$ formation are: a) qualitative in nature; b) based on a hybrid of qualitative and quantitative assessments utilizing existing technical work; or c) based on a full quantitative photochemical grid modeling exercise. As noted above, secondary impacts on $PM_{2.5}$ from regional transport and precursor emissions from nearby sources should be accounted for through representative monitored background concentrations.

IV.1 Modeling Inventory

The current guidelines on emission inventories for purposes of NAAQS compliance modeling contained in Section 8.1 of Appendix W will generally be applicable for the $PM_{2.5}$ modeling inventory. The guidelines in Appendix W address the appropriate emission level to be modeled, which in most cases is the maximum allowable emission rate under the proposed permit. The remainder of this section will focus on the modeling inventory of direct $PM_{2.5}$ emissions that should be used in dispersion modeling of primary $PM_{2.5}$ impacts. Although the EPA's "Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze" (U.S. EPA, 2007a) provides some guidance relevant to applications involving full quantitative photochemical grid modeling, additional considerations and guidance regarding modeling inventories for such analyses in support of $PM_{2.5}$ NAAQS compliance demonstrations in PSD permitting under this guidance will be provided by EPA on a case-by-case basis.

As discussed in more detail in the EPA's March 1, 2011, clarification memorandum

regarding Appendix W modeling guidelines for the 1-hour NO_2 NAAQS (U.S. EPA, 2011f), Section 8.2.3 of Appendix W emphasizes the importance of professional judgment in the identification of nearby and other sources to be included in the modeled emission inventory and establishes "a significant concentration gradient in the vicinity of the [proposed] source" as the main criterion for this selection. Appendix W also suggests that "the number of such [nearby] sources is expected to be small except in unusual situations." (Section 8.2.3.b). The EPA's March 1, 2011, guidance also includes a detailed discussion of the significant concentration gradient criterion included in Section 8.2.3.b of Appendix W, indicating that the significant concentration gradient criterion suggests that the emphasis on determining which nearby sources to include in the cumulative modeling analysis should focus on the area within about 10 kilometers of the project location in most cases. However, several application-specific factors should be considered when determining the appropriate inventory of nearby sources to include in the cumulative modeling analysis, including the potential influence of terrain characteristics on concentration gradients and the availability and adequacy of ambient monitoring data to account for background sources.

Consistent with the March 1, 2011, guidance, the EPA cautions against the application of very prescriptive procedures for identifying which nearby sources should be included in the modeled emission inventory for NAAQS compliance demonstrations, such as the procedures described in Chapter C, Section IV.C.1 of the draft "New Source Review Workshop Manual" (U.S. EPA, 1990). This caution should not be taken to imply that the procedures outlined in the draft "New Source Review Workshop Manual" are flawed or inappropriate. Cumulative impact assessments based on following such procedures will generally be acceptable as the basis for permitting decisions, contingent on an appropriate accounting for the monitored contribution.

Our main concern is that following such procedures in a literal and uncritical manner may increase the likelihood of double-counting modeled and monitored concentrations in many cases, resulting in cumulative impact assessments that are overly conservative and would unnecessarily complicate the permitting process in some cases. The identification of which sources to include in the modeled emissions inventory should be addressed in the modeling protocol and, as necessary, discussed in advance with the permitting authority.

Since modeling of direct $PM_{2.5}$ emissions has not been frequently conducted to date, the availability of an adequate direct $PM_{2.5}$ emission inventory for nearby sources may not exist in all cases. Recommendations for developing $PM_{2.5}$ emission inventories for use in PSD applications will be addressed separately, but existing SIP inventories for $PM_{2.5}$ or statewide PSD inventories of sources for refined modeling may provide a useful starting point for this effort.

IV.2 Monitored Background

Sections 8.2.2 and 8.2.3 of Appendix W provide recommendations for determination of background concentrations for inclusion in cumulative impact assessments for NAAQS compliance, which should account for impacts from existing sources that are not explicitly included in the modeled inventory and natural sources. From newly-acquired pre-construction monitoring data and/or existing representative air quality data gathered for purposes of a permitting analysis, permit applicants should assess and document what the background monitoring data represent to the extent possible, including any information that may be available

from the state or other agency responsible for siting and maintaining the monitor.[30] It is also worth noting that the relative makeup of $PM_{2.5}$ components and temporal patterns associated with the highest 24-hour $PM_{2.5}$ levels may differ considerably from the relative amounts of $PM_{2.5}$ components associated with annual average $PM_{2.5}$ levels, especially in western states.

The determination of monitored background concentrations of $PM_{2.5}$ to include in the $PM_{2.5}$ cumulative impact assessment may entail different considerations from those for other criteria pollutants and may also depend on whether the application involves full quantitative photochemical grid modeling. An important aspect of the monitored background concentration for $PM_{2.5}$ is that the ambient monitoring data should, in most cases account for the contribution of secondary $PM_{2.5}$ formation associated with existing sources impacting the modeling domain in addition to the background levels of primary $PM_{2.5}$ associated with background sources that are not included in the modeled inventory. As with other criteria pollutants, consideration should also be given to the potential for some double-counting of the impacts from modeled emissions that may be contributing to the background monitored concentrations, but this should generally be of less importance for $PM_{2.5}$ than the representativeness of the monitor for secondary contributions, unless the monitor is located relatively close to nearby sources of primary $PM_{2.5}$ that could be impacting the monitor. Also, the nature of secondary $PM_{2.5}$, monitored background concentrations of $PM_{2.5}$ are likely to be more homogeneous across the modeling domain in most cases compared to most other pollutants, although this will also depend on the potential for local sources of primary $PM_{2.5}$ to be contributing to the monitored concentrations.

Depending on the nature of local $PM_{2.5}$ levels within the modeling domain, it may be

[30] Please note in the case of an existing source seeking a permit for a modification, there is potential overlap across secondary contributions from monitored background and from precursor emission from the existing source. In such cases, recommendations for excluding monitored values when the source in question is impacting the monitor in Section 8.2.2.b of Appendix W may need to be modified to avoid overcompensating in cases where the monitored concentrations are also intended to account for the existing project source's contributions to secondary $PM_{2.5}$.

appropriate to account for seasonal variations in monitored background $PM_{2.5}$ levels which may not be correlated with seasonal patterns of the modeled primary $PM_{2.5}$ levels. For example, maximum modeled primary $PM_{2.5}$ impacts associated with fugitive or other low-level emission sources are likely to occur during winter months due to longer periods of stable atmospheric conditions, whereas maximum ambient levels of secondary $PM_{2.5}$ in the eastern United States typically occur during spring and summer months due to high levels of sulfates. The use of temporally-varying monitored background concentrations in a cumulative impact analysis is discussed in more detail in Section IV.3.

IV.3 Comparison to the NAAQS

Combining the modeled and monitored concentrations of $PM_{2.5}$ for comparison to the $PM_{2.5}$ NAAQS entails considerations that differ from those for other criteria pollutants due to the issues identified above. The discussion below addresses comparisons to the NAAQS in the context of dispersion modeling of direct $PM_{2.5}$ emissions only (for Case 2), and also provides guidance regarding NAAQS comparisons for applications involving qualitative, hybrid qualitative/quantitative, or full quantitative photochemical grid modeling assessments of secondary $PM_{2.5}$ impacts (for Cases 3 and 4).

Given the importance of secondary contributions for $PM_{2.5}$ and the potentially high background levels relative to the $PM_{2.5}$ NAAQS, greater emphasis is generally placed on the monitored background contribution relative to the modeled inventory for $PM_{2.5}$ than for other pollutants. This is true for both NAAQS and increments assessments. Also, given the probabilistic form of the $PM_{2.5}$ NAAQS, careful consideration should be given to how the monitored and modeled concentrations are combined to estimate the cumulative impact levels.

The representative monitored $PM_{2.5}$ design value, rather than the overall maximum monitored background concentration, should generally be used as the monitored component of the cumulative analysis. The $PM_{2.5}$ design value for the annual averaging period is based on the 3-year average of the annual average $PM_{2.5}$ concentrations. The $PM_{2.5}$ design value for the 24-hour averaging period is based on the 3-year average of the annual 98th percentile 24-hour average $PM_{2.5}$ concentrations. Details regarding the determination of the annual 98th percentile monitored 24-hour value based on the number of days sampled during the year are provided in the data interpretation procedures for the $PM_{2.5}$ NAAQS, Appendix N to 40 CFR Part 50.

It should be noted here that although the monitored design values for the $PM_{2.5}$ standards are defined in terms of 3-year averages, this definition does not preempt or alter the Appendix W requirement for use of 5 years of representative NWS meteorological data or at least 1 year of site-specific data for air quality modeling purposes. [31] The 5-year average based on use of representative NWS meteorological data, or an average across one or more (up to 5) complete years of available site-specific data, serves as an unbiased estimate of the 3-year average for purposes of modeling demonstrations of compliance with the NAAQS. Modeling of "rolling 3-year averages," using years 1 through 3, years 2 through 4, and years 3 through 5 as recommended in the EPA's "Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze", is not required.[32]

The EPA's March 23, 2010, clarification memo recommended as a First Tier that the modeled annual (or 24-hour) concentrations of primary $PM_{2.5}$ to be added to the monitored

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[31] See 40 CFR Part 51, Appendix W, Section 8.3.1.2.b.

[32] The "Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze" can be found on the SCRAM website at: http://www.epa.gov/ttn/scram/guidance/guide/final-03-pm-rh-guidance.pdf

annual (or 24-hour) design value for comparison to the NAAQS should be based on the highest average of the modeled annual (or 24-hour) averages across 5 years for representative NWS meteorological data or the highest modeled annual (or 24-hour) average for one year (or multi-year average of 2 up to 5 complete years) of site-specific meteorological data using the same procedures recommended for the initial source impact analysis. The memo cited several issues, especially the importance of the contribution from secondary formation of $PM_{2.5}$ from precursor emissions and the fact that such contributions are not explicitly accounted for by the dispersion model, as the basis for viewing modeling of $PM_{2.5}$ as screening-level analyses, analogous to the screening nature of the guidance in Section 5.2.4 of Appendix W regarding dispersion modeling for NO_2 impacts, given the importance of chemistry in the conversion of NO emissions to ambient NO_2.

Recognizing that the primary focus and motivation for this guidance is to provide recommendations on appropriate tools and methodologies to account for the potential contribution from a new or modifying source's precursor emissions on ambient $PM_{2.5}$ levels, it is appropriate to reassess the EPA's March 23, 2010, guidance under this broadened paradigm. Since each of the four cases outlined above, based on comparisons of the project's direct $PM_{2.5}$ and precursor emissions with the respective SERs, involves some assessment of the source's potential secondary $PM_{2.5}$ impacts, we recommend as a new First Tier that the modeled design value be added to the monitored design value from a representative monitor. This represents no fundamental change with respect to the modeled annual concentration. However, the modeled 24-hour concentration to be added to the monitored design value would now be based on the multi-year average of the 98th percentile of modeled annual 24-hour concentrations rather than the multi-year average of the highest (100th percentile) of modeled annual 24-hour

concentrations.

For Case 2, where only the project's direct $PM_{2.5}$ emissions are equal to or greater than the SER, the modeled design value should be based on AERMOD (or other acceptable preferred or alternative model) estimates of primary $PM_{2.5}$ impacts combined with the monitored design value. The monitor should be representative in that it accounts for the contribution of secondary $PM_{2.5}$ formation associated with existing sources within the modeling domain, in addition to the background levels of primary $PM_{2.5}$ associated with background sources that are not included in the modeled inventory. For Case 3, where both the project's direct $PM_{2.5}$ emissions and precursor emissions are equal to or greater than the respective SERs, the cumulative impact for comparison to the NAAQS should be based on the sum of the modeled design value for primary $PM_{2.5}$ impacts (from dispersion model estimates based on the project's and other nearby source's direct $PM_{2.5}$ emissions), the modeled design value for secondary $PM_{2.5}$ impacts (from a qualitative, hybrid, or quantitative assessment accounting for the project's precursor $PM_{2.5}$ emissions), and the monitored design value (same representativeness caveats as with Case 2). For Case 4, where only the project's precursor emissions are equal to or greater than the respective SERs, the cumulative impact for comparison to the NAAQS should be based on the sum of the modeled design value for secondary $PM_{2.5}$ impacts (from a qualitative, hybrid, or quantitative assessment as with Case 3) and the monitored design value (same representativeness caveats as with Cases 2 and 3). The resulting cumulative $PM_{2.5}$ concentrations would then be compared to the annual $PM_{2.5}$ NAAQS of 12 $\mu g/m^3$ and 24-hour $PM_{2.5}$ NAAQS of 35 $\mu g/m^3$.

The recommendations provided above constitute a First Tier modeling analysis for $PM_{2.5}$ NAAQS compliance demonstrations that should be acceptable without further justification. For applications where impacts from primary $PM_{2.5}$ emissions are not temporally correlated with

background $PM_{2.5}$ levels, combining the modeled and monitored contributions as described above may be overly conservative in some situations. For example, there are areas of the country where background $PM_{2.5}$ levels are substantially higher on average during the summer months as compared to the winter months; however, the projected modeled impacts from the new or modified source may be substantially greater in the winter rather than in the summer. In such cases, a Second Tier modeling analysis that would involve combining the monitored and modeled $PM_{2.5}$ concentrations on a seasonal (or quarterly) basis may be considered. The use of a seasonally-varying monitored background component is likely to be a more important factor for the 24-hour NAAQS analysis than for the annual NAAQS. Careful evaluation of when model projections of $PM_{2.5}$ impacts and background $PM_{2.5}$ levels peak throughout the year is strongly advised before embarking on a Second Tier modeling analysis. This is because the First Tier approach may adequately capture the temporal correlation and would otherwise make a Second Tier modeling analysis unnecessary. As a part of this evaluation process, consultation with the appropriate permitting authority is advised.

The AERMOD model provides several options for specifying the monitored background concentration for inclusion in the cumulative impact assessment. The options that are most relevant to $PM_{2.5}$ analyses include an option to specify a single annual background concentration that is applied to each hour of the year (appropriate for the First Tier annual and 24-hour analyses described above), and an option to specify four seasonal background values that are combined with modeled concentrations on a seasonal basis (appropriate for a Second Tier 24-hour analysis). The AERMOD model also allows the user to track the contribution from background concentrations to the cumulative modeled design value.

For the Second Tier 24-hour modeling analyses, it is recommended that the distribution

of monitored data equal to and less than the annual 98th percentile be appropriately divided into seasons (or quarters) for each of the three years that are used to develop the monitored design value. This results in data for each year (for three years) which contains one season (quarter) with the 98th percentile value and three seasons (quarters) with the maximum values which are less than or equal to the 98th percentile value. The maximum concentration from each of the seasonal (or quarterly) subsets should then be averaged across these three years of monitoring data. The resulting average of seasonal (or quarterly) maximums should then be included as the four seasonal background values within the AERMOD model. Therefore, the monitored concentrations greater than the 98th percentile in each of the three years would not be included in the seasonal (or quarterly) subsets. These excluded monitored concentrations are the same values that are excluded when determining the monitored design value. An example of the calculations for a Second Tier 24-hour modeling analysis is provided in Appendix E.

For a monitor with a daily (1-in-1 day monitor) sampling frequency and 100% data completeness, this would mean that the top seen monitored concentrations for each year would be excluded from the seasonal (or quarterly) subdivided datasets. Similarly, for a monitor with every third day (1-in-3 day monitor) sampling frequency and 100% data completeness, the top two monitored concentrations for each year would be excluded from the seasonal (or quarterly) subdivided datasets. The monitored concentrations excluded from the subdivided datasets could primarily come from one or two seasons (or quarters) each year or could be evenly distributed across all four seasons (or quarters) each year. Additionally, the monitored concentrations not included in the subdivided datasets could shift seasonally (or quarterly) from one year to the next. Given the reasoning for considering a Second Tier 24-hour analysis (lack of temporal correlation between modeled and monitored concentrations), it is likely that the monitored data

greater than the 98th percentile would be concentrated in one or two season as opposed to evenly distributed throughout the year. As mentioned earlier, one should reference Appendix N of 40 CFR Part 50 to determine the appropriate 98th percentile rank of the monitored data based on the monitor sampling frequency and valid number of days sampled during each year.

Since several recent permit applications have come to our attention proposing to combine monitored background and modeled concentrations on an hour-by-hour basis, using hourly monitored background data collected concurrently with the meteorological data period being processed by the model, we feel compelled to include a discussion of the potential merits and concerns regarding such an approach in the context of $PM_{2.5}$ NAAQS compliance demonstrations. On the surface, the hourly pairing or "paired sums" approach could be perceived as being a more “refined” method than what is recommended in the First or Second Tier methods and, therefore, more appropriate for assessing the impacts from primary $PM_{2.5}$ emissions. However, the implicit assumption underlying this approach is that the background monitored levels for each hour are spatially uniform and that the monitored values are fully representative of background levels at each receptor for each hour. Such an assumption clearly ignores the many factors that contribute to the temporal and spatial variability of ambient $PM_{2.5}$ concentrations across a typical modeling domain on an hourly basis.

The complexities of the $PM_{2.5}$ ambient monitoring network also present special challenges with a "paired sum" approach that are not present with the other NAAQS pollutants. The Federal Reference Method (FRM) $PM_{2.5}$ monitoring network is based on 24-hour samples that are taken on average every third day at the 1-in-3 day monitors. The frequency of daily or 1-in-1 day $PM_{2.5}$ monitors is steadily increasing but is relatively limited to the largest cities and metropolitan regions of the U.S. Various methods to "data fill" the 1-in-3 day monitoring

database to create a pseudo-daily dataset have been explored in a few situations , but none of these data filling methods have been demonstrated to create a representative daily $PM_{2.5}$ dataset that the EPA would consider acceptable for inclusion in a $PM_{2.5}$ NAAQS compliance demonstration. The use of continuous $PM_{2.5}$ monitors, which are more limited in number compared to the FRM monitors and may require careful quality assurance of individual hourly measurements, may be an option but should be discussed in advance with the appropriate permitting authority.

Considering the spatial and temporal variability throughout a typical modeling domain on an hourly basis and the complexities and limitations of hourly observations from the current $PM_{2.5}$ ambient monitoring network, we do not recommend a "paired sums" approach on an hour-by-hour basis. Furthermore, the pairing of daily monitored background and 24-hour average modeled concentrations is not recommended except in rare cases of relatively isolated sources where the available 1-in-1 day FRM/FEM monitor can be shown to be representative of the ambient concentration levels in the areas of maximum impact from the proposed new source. In most cases, the seasonal (or quarterly) pairing of monitored and modeled concentrations previously described in the Second Tier method should sufficiently address situations to which the impacts from primary $PM_{2.5}$ emissions are not temporally correlated with background $PM_{2.5}$ levels. Any monitor-model pairing approach aside from the First or Second Tier methods should be justified on a case-by-case basis in consultation with the appropriate permitting authority and the appropriate EPA Regional Office.

IV.4 Determining Whether Proposed Source Causes or Contributes to Modeled Violations

If the cumulative impact assessment following these recommendations results in modeled violations of the $PM_{2.5}$ NAAQS, then the permit applicant will need to determine whether the project's emissions cause or contribute to the modeled violations. The EPA has previously supported showing the proposed source does not cause or contribute by showing that the source does not make a "significant contribution" to the modeled violation based on a comparison of the modeled impacts from the project emissions associated with the modeled violation, paired in time and space, to the SIL for the relevant pollutant and averaging period contained in 40 CFR 51.165(b) of the EPA's regulations. The EPA has interpreted this regulation to support the conclusion that a source with an impact below the relevant value in section 51.165(b)(2) does not significantly contribute to either an existing violation of the NAAQS in a nonattainment area or violations predicted in an attainment area based on a cumulative analysis.[33]

The January 22, 2013, court decision did not vacate the $PM_{2.5}$ SIL value in section 51.165(b) of the EPA's regulations. However, the court recognized that the language in section 51.165(b)(2) operates in a manner different from sections 51.166(k)(2) and 52.21(k)(2), which were vacated by the court. The court observed that section 51.165(b)(2) "simply states that a source may be deemed to violate the NAAQS if its exceeds the SILs in certain situations." (705 F.3d at 465-66). For this reason, the court did not see the need to resolve the Petitioner's challenge to the EPA's methodology for determining the $PM_{2.5}$ values in section 51.165(b)(2) of the regulations, which are the same as the Class II area values in the vacated sections 51.166(k)(2) and 52.21(k)(2). The court decision did not directly address the use of the values in

[33] See 75 Fed. Reg. at 64,890; 61 Fed. Reg. 38,250, 38,293 (July 23, 1996); *In re Prairie State Generating Co.*, 13 E.A.D. 1, 103-09 (EAB 2006). EPA has sometimes described this step as a "culpability analysis."

section 51.165(b)(2) to determine whether a source causes or significantly contributes to a modeled violation. However, in light of other elements of the court decision, the EPA advises permitting authorities to consult with the EPA before using the SIL value for $PM_{2.5}$ in section 51.165(b)(2) as the basis for concluding that a source with an impact below this value does not cause or contribute to a modeled violation.

A demonstration that a proposed source does not make a significant contribution should be based on a comparison of the modeled concentrations at the receptor location showing the violation to a SIL, across 5 years for representative NWS meteorological data and the modeled concentration for 1 year, or multiyear average of 2 up to 5 complete years, of site-specific meteorological data. For a violation of the annual $PM_{2.5}$ NAAQS, the average of the predicted annual concentrations at the affected receptor(s) should be compared to a SIL, while the average of the predicted annual 98th percentile 24-hour average concentrations at the affected receptor(s) should be used for the 24-hour $PM_{2.5}$ NAAQS.

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V. PSD Increments for $PM_{2.5}$

As cited in Section II of this guidance, section 165(a)(3) of the CAA requires that proposed new and modified major stationary sources seeking a PSD permit must demonstrate that their proposed emissions increases will not cause or contribute to a violation of any NAAQS or PSD increment. Based on the flow diagram presented in Figure II-2 in Section II, this section describes the EPA's recommendations for completing the required analysis of the PSD increments for $PM_{2.5}$.

V.1 Overview of PSD Increments

The term "increment" generally refers to what the CAA calls the "maximum allowable increase" of an air pollutant that is allowed to occur above the applicable baseline air quality concentration for that pollutant. Thus, by establishing the maximum allowable increase for a particular pollutant and averaging period, any cumulative increase in the ambient concentration of that pollutant that is greater than the amount allowed is considered "significant deterioration."

In order to apply the increment concept as part of a PSD permit review, it is necessary to identify the affected geographic area in which the increment will be tracked and the emissions changes that affect increment. The relevant geographic area for determining the amount of increment consumed is known as the "baseline area." [34] The baseline area may be comprised of one or more attainment or unclassifiable areas for a particular pollutant that are in a particular state. In accordance with the definition of "baseline area," the area is an "intrastate area" and does not include any area in another state. At a minimum, the baseline area is the attainment or unclassifiable area in which a PSD source will locate. Within any baseline area, three key dates

[34] "Baseline area" is defined in the PSD regulations at 40 CFR 51.166(b)(15) and 52.21(b)(15).

will apply in order to track increment: (1) trigger date; (2) minor source baseline date; and (3) major source baseline date. The trigger date is a fixed date, which is the earliest date after which proposed sources must track increment in the baseline area. In turn, the minor source baseline date is the date on which the first PSD application in a baseline area is submitted to the PSD permitting authority after the trigger date. Depending upon the number of separate attainment areas that exist for a particular pollutant in the state, there may be a number of minor source baseline dates that apply to different baseline areas established in that state. Beginning with the PSD source whose complete application has established the minor source baseline date in a particular area, any increase or decrease in actual emissions from any major or minor source henceforth will consume or expand the available PSD increments for that baseline area. Finally, the major source baseline date is a fixed date, which precedes the trigger date, after which construction related emissions solely from major stationary sources affect increment, as further explained below.

$PM_{2.5}$ emissions changes occurring before the minor source baseline date generally do not impact increment in an area, but are considered to contribute to the baseline air quality level also known as the baseline concentration, as described in more detail below. However, it is important to note that the CAA provides an exception for certain emissions changes that occur specifically at major stationary sources regardless of when those emissions changes actually occur. This date, as explained above, is the "major source baseline date." Specifically, for projects at major stationary sources on which construction commenced at a date prior to the major source baseline date, the emissions increases from such projects should be considered to contribute to the baseline air quality level even though the emissions change may not actually occur until after the minor source baseline date. Alternately, for projects at major stationary sources on which

construction commenced after the major source baseline date, the project emissions will be considered to affect increment, even if the project actually begins operation before the minor source baseline date.

V.2 $PM_{2.5}$ Increments Considerations

In its 2010 $PM_{2.5}$ Increments, SILs, and SMC Rule, the EPA established $PM_{2.5}$ increments at the levels shown in Table V-1, as follows:

Table V-1. $PM_{2.5}$ Increments

	Class I	Class II	Class III
Increments, $\mu g/m^3$			
Annual arithmetic mean	1	4	8
24-hour maximum	2	9	18

Source: Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers (PM2.5) - Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC) final rule (75 FR 64864)

The $PM_{2.5}$ increments analysis includes many of the same technical considerations in assessing source impacts as discussed earlier in this guidance for $PM_{2.5}$ NAAQS compliance demonstrations, specifically the assessment cases described in Section II-4 and detailed in Table III-1. However, there are some important differences. The main difference is that the increments compliance demonstration is based on calculating the change in ambient $PM_{2.5}$ concentrations over the applicable baseline concentration, which includes proposed emissions increases from the new or modified source, increment-consuming emissions from other sources that affect increment consumption in the baseline area, and increment-expanding decreases in emissions from the same sources. Another key difference is that the cumulative impact analysis for increments is based on the actual emission changes occurring after a prescribed minor source baseline date (with the stated exception related to major sources commencing construction after

the major source baseline date), whereas NAAQS analyses are generally based on the cumulative impact associated with the maximum allowable emissions from the new or modifying source and other nearby sources. Finally, it is important to note that the $PM_{2.5}$ NAAQS and increments for the 24-hour averaging period are defined in different forms and therefore must be analyzed differently.[35] The 24-hour $PM_{2.5}$ NAAQS is defined based on the 3-year average of the annual 98th percentile of the 24-hour average concentrations, while the 24-hour $PM_{2.5}$ increments are based on the second highest maximum 24-hour concentration.

The 2010 "$PM_{2.5}$ Increments, SILs, and SMC Rule" established October 20, 2011, as the "trigger date" and October 20, 2010, as the "major source baseline date" for $PM_{2.5}$ increments. The EPA developed the increment system for $PM_{2.5}$ generally following the same concepts that were previously applied for the increments for PM_{10}, SO_2, and NO_2. In each case, the framework reflects the statutory concepts set forth in the definition of "baseline concentration" contained in the CAA at section 169(4), which reads as follows:

> The term "baseline concentration" means, with respect to a pollutant, the ambient concentration levels which exist at the time of the first application for a permit in an area subject to this part, based on air quality data available in the Environmental Protection Agency or a State air pollution control agency and on such monitoring data as the permit applicant is required to submit. Such ambient concentration levels shall take into account all projected emissions in, or which may affect, such area from any major emitting facility on which construction commenced prior to January 6, 1975, but which has not begun operation by the date of the baseline air quality concentration determination (i.e., the minor source baseline date). Emissions of sulfur oxides and particulate matter from

[35] The annual NAAQS and increments for $PM_{2.5}$ are both measured as annual arithmetic mean values.

> any major emitting facility on which construction commenced after January 6, 1975, shall not be included in the baseline and shall be counted against the maximum allowable increases in pollutant concentrations established under this part.

Thus, from this definition, it can be seen that it is conceptually possible to measure "significant deterioration" in at least two separate ways. That is, either as (1) a direct modeled projection of the change in air quality after the applicable baseline date caused by all increment-consuming or expanding emissions compared to the maximum allowable increase of the air pollutant concentration (increment) in the baseline area, or (2) a determination of whether the ambient air quality concentration in a baseline area will exceed an allowable ambient air quality ceiling, determined by adding the maximum allowable pollutant concentration increase (increment) to the baseline air quality concentration (baseline concentration) for the baseline area.

Historically, because of various limitations associated with the use of ambient air quality monitoring data for measuring increment consumption,[36] the EPA elected to determine significant deterioration exclusively on the basis of the first approach, which models only the increment-related emissions increases or decreases to determine the resulting ambient air quality change and compares this value with maximum allowable pollutant concentration increases (increments) for a particular pollutant. However, the present technical challenges associated with the ability to estimate the impacts of secondarily formed $PM_{2.5}$ in the atmosphere resulting from emissions of $PM_{2.5}$ precursors make it necessary to consider alternative methods of assessing increments where the increments are affected by both direct $PM_{2.5}$ emissions and $PM_{2.5}$ precursor

[36] The EPA described certain limitations associated with the use of ambient air quality monitoring data for measuring increment consumption in the preamble to its proposed PSD regulations in 1979. For example, the CAA provided that certain emissions changes should not be considered to be increment consuming. These limitations generally continue to apply to the extent that certain emissions changes detected by an ambient monitor are not considered to consume increment. See 44 Fed. Reg. 51924 at 51944 (September 5, 1979).

emissions that form secondary $PM_{2.5}$. Accordingly, the remainder of this section provides recommendations for accomplishing the $PM_{2.5}$ increments analysis.

V.3 Screening Analysis for Increments

The comparison of background air quality concentrations and the NAAQS, as recommended in Section II of this document as an initial step for the NAAQS compliance demonstration, would not by itself provide adequate justification for foregoing a cumulative modeling analysis for the $PM_{2.5}$ increments. Such an approach would be inappropriate because it would not ensure that there is sufficient "headroom" within the allowable increment to absorb a source contribution equal to the SIL. However, a permitting authority may still be able to justify reaching a determination that a new or modified source will not cause or contribute to a violation of the increments without performing cumulative modeling for increments.

The EPA recommends that a justification for not performing cumulative modeling for $PM_{2.5}$ increments compliance should be based on (1) a comparison of the predicted impacts of the new or modified source and the allowable increment values, (2) information on the extent to which, if any, increment has already been consumed since either the major source baseline date (for major source construction prior to the minor source baseline date) or minor source baseline date by nearby sources that have been permitted prior to the source under analysis, and (3) information on increment consumption or expansion by more distant sources.

Since the trigger date has only recently been established (i.e., October 20, 2011), for the next several years a new or modified source being evaluated for increments compliance will often be the first source with increment-consuming emissions in the area. As indicated in Figure II-2, under this situation, a permitting authority may have sufficient reason to conclude that the

impacts of the new or modified source (based on the approach for conducting source impact analysis described below) may be compared directly to the allowable increments, without the need for a cumulative modeling analysis. Such an approach would be appropriate when the new or modified source represents the first PSD application in the area after the trigger date, which establishes the minor source baseline date and baseline area, and no relevant major source construction has already occurred since the major source baseline date.

V.4 $PM_{2.5}$ Increments Analysis

The guidance provided under Sections III and IV regarding NAAQS compliance demonstrations should generally be applicable for $PM_{2.5}$ increments analyses, with the primary distinction that actual emission increases (or decreases) from only increment-affecting sources may be used instead of maximum allowable emissions in the cumulative impact analysis.

V.4.1 Source Impact Analysis

The EPA's recommendations on conducting the source impact analysis for $PM_{2.5}$ increments rely upon the same four assessment cases for NAAQS, as described in Section II.4. As shown in Table V-2, a modeled compliance demonstration is not required for Case 1 since neither direct $PM_{2.5}$ emissions nor $PM_{2.5}$ precursor (NO_x and/or SO_2) emissions are equal to or greater than the respective SERs. Case 1 is the only assessment case that does not require a modeled compliance demonstration for $PM_{2.5}$, whereas each of the remaining three assessment cases would necessitate a source impact analysis that should be conducted following the detailed recommendations provided in Section III for NAAQS analysis.

Table V-2. EPA Recommended Approaches for Assessing Primary and Secondary $PM_{2.5}$ Impacts by Assessment Case

Assessment Case	Description of Assessment Case	Primary Impacts Approach	Secondary Impacts Approach
Case 1: No Air Quality Analysis	Direct PM2.5 emissions < 10 tpy SER NOx and SO2 emissions < 40 tpy SER	N/A	N/A
Case 2: Primary Air Quality Impacts Only	Direct PM2.5 emissions ≥ 10 tpy SER NOx and SO2 emissions < 40 tpy SER	**Appendix W preferred or approved alternative dispersion model**	N/A
Case 3: Primary and Secondary Air Quality Impacts	Direct PM2.5 emissions ≥ 10 tpy SER NOx and/or SO2 emissions ≥ 40 tpy SER	**Appendix W preferred or approved alternative dispersion model**	• **Qualitative** • **Hybrid qualitative / quantitative** • **Full quantitative photochemical grid modeling**
Case 4: Secondary Air Quality Impacts Only	Direct PM2.5 emissions < 10 tpy SER NOx and/or SO2 emissions ≥ 40 tpy SER	N/A	• **Qualitative** • **Hybrid qualitative / quantitative** • **Full quantitative photochemical grid modeling**

V.4.2 Cumulative Impact Analysis

Where the screening analysis described above is insufficient to show that a source will not cause or contribute to a violation of the PSD increments, a cumulative impact assessment would be necessary to make the demonstration. A cumulative assessment accounts for the combined impact of the new or modifying source's emissions and those emissions changes from sources that affect the increments. The cumulative impacts are then compared to the PSD increments to determine whether the new or modifying source emissions will cause or contribute to a violation of the PSD increments. This section provides details on conducting an appropriate cumulative impact assessment for $PM_{2.5}$.

V.4.2.1 Assessing Primary $PM_{2.5}$ Impacts from Other Sources

To assess direct $PM_{2.5}$ emissions from increment-consuming or increment-expanding sources, the $PM_{2.5}$ increments analysis would follow the traditional approach involving modeling of only $PM_{2.5}$ emissions changes that affect the increment, and should be based on application of

AERMOD (or other appropriate preferred or approved alternative model), using actual emission changes associated with any increment-consuming or increment-expanding sources. The AERMOD model allows for inclusion of these emissions (represented as negative emissions for the sources expanding increment) in the same model run that includes the allowable increase in emissions from the project source, and will therefore output the net cumulative concentrations (although the "maximum" cumulative impacts will be output as zero if the cumulative impacts computed in the model are less than zero).

V.4.2.2 Assessing Secondary $PM_{2.5}$ Impacts from Other Sources

To assess changes in $PM_{2.5}$ precursor emissions from increment-consuming or increment-expanding sources, the assessment of potential impacts of secondary $PM_{2.5}$ due to those emissions changes may be: a) qualitative in nature; b) based on a hybrid of qualitative and quantitative assessments utilizing existing technical work; or c) a full source-specific quantitative photochemical modeling exercise.

Several promulgated rules have resulted in reductions in precursor emissions affecting ambient $PM_{2.5}$ concentrations across most areas in recent years.[37] This is particularly true in the Eastern U.S. As a result, in many cases, the potential for increment consumption due to secondary $PM_{2.5}$ impacts from existing sources may easily be addressed through a qualitative assessment, supported by data that generally confirms a downward trend in precursor emissions occurring after the applicable $PM_{2.5}$ minor source baseline date (or the major source baseline date). In such cases, the $PM_{2.5}$ increments modeling analysis may be simplified to focus solely on potential increment consumption associated with direct $PM_{2.5}$ emissions. For areas where $PM_{2.5}$

[37] Such rules would include the Clean Air Interstate Rule (CAIR), Mercury and Air Toxics Standards Rule (MATS), NOx SIP Call and multiple federal mobile source rules.

precursor emissions increases from other sources are known to contribute to $PM_{2.5}$ concentration increases within the baseline area and thus consume $PM_{2.5}$ increment, the photochemical grid modeling methods discussed in Section III may be appropriate for estimating the portion of $PM_{2.5}$ increment consumed due to secondary $PM_{2.5}$ impacts associated with those increases in precursor emissions.

V.4.2.3 Consideration of $PM_{2.5}$ Ambient Air Quality Monitoring Data

In light of the current technical complications associated with the ability to model precursor emissions to estimate secondarily formed $PM_{2.5}$ in the atmosphere, the EPA believes it may be possible under certain circumstances to use ambient air quality monitoring data for $PM_{2.5}$ as part of the cumulative impact analysis. This involves using ambient monitoring data as the primary means of assessing increment consumption or expansion for $PM_{2.5}$ by measuring ambient air quality on the minor source baseline date (baseline concentration) and thereafter to determine changes in air quality resulting from direct $PM_{2.5}$ emissions and $PM_{2.5}$ precursors. This document does not provide detailed recommendations for conducting the $PM_{2.5}$ increments analysis in this manner, but simply acknowledges that it may be possible in certain circumstances to use this approach for PSD permitting. There would continue to be a need to model projected impacts as part of the $PM_{2.5}$ increments analysis to include consideration of increment consumed by emissions that have not yet occurred. One should also consider the extent to which the available monitoring data adequately reflect the air quality changes caused by direct $PM_{2.5}$ and precursor emissions from sources impacting the baseline area.

Where the PSD permit applicant believes that this approach is potentially useful for conducting the $PM_{2.5}$ increments analysis for a particular PSD permit review, early coordination

with the permitting authority is strongly encouraged to establish the appropriate baseline concentration(s) within the applicable baseline area and how subsequent ambient monitoring data in the area, when compared to the baseline air quality data, can be used to assess cumulative increment consumption. The EPA will work with air agencies to support this approach on a case specific basis. Based on these experiences, it is our intention to provide additional guidance setting forth more specific recommendations on this particular approach at a future date.

V.5 Determining Significant Contribution to an Increment Violation

As previously explained, the EPA does not anticipate the need to complete a cumulative increments analysis in most situations due to the recent setting of the trigger date for $PM_{2.5}$. Therefore, most $PM_{2.5}$ increments analyses will need to consider the emissions increases resulting only from the proposed new source or modification that establishes the minor source baseline date for an area. Consequently, we believe that permitting authorities will encounter few, if any, situations over the next several years in which there is a predicted increment violation.

Nevertheless, there may be situations where a cumulative increments analysis is necessary and that analysis projects a modeled increment violation. This guidance recommends that such violations be addressed in a manner similar to the NAAQS analysis described in Section IV of this document; that is, when a PSD applicant elects to use a SIL to show to the permitting authority that the source's emissions do not make a significant contribution to a modeled violation, the EPA advises permitting authorities to consult with the EPA before allowing the use of a SIL value, including those $PM_{2.5}$ values contained in section 51.165(b)(2), as the basis for concluding that a source with an impact below this value does not cause or

contribute to a modeled violation of the $PM_{2.5}$ increment.

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Appendix A: Draft Conceptual Description of $PM_{2.5}$ Concentrations in the U.S.

This appendix provides a brief summary of the current $PM_{2.5}$ monitoring networks and characterizes PM air quality in terms of its chemical composition, concentration levels, and spatial and temporal patterns across the nation based largely on ambient data and analyses contained in the EPA's The Particle Pollution Report,[38] Particulate Matter Staff Paper,[39] and new ambient data summaries based on 2008-2010 $PM_{2.5}$ mass and speciation data. It also discusses regional and local source contributions to urban $PM_{2.5}$ concentrations. Such information may be useful for permit applicants in preparing conceptual descriptions, as discussed in Section III.2.1 of this guidance.

1. $PM_{2.5}$ Monitoring Networks

1.1. $PM_{2.5}$, PM_{10} and $PM_{10-2.5}$ Mass Networks

The 1997 promulgation of a fine particulate NAAQS (EPA, 1997) led to deployment of over 1500 $PM_{2.5}$ sites (about 1000 currently) used to determine whether an area complies with the standard. These sites use a Federal Reference Method (FRM) or Federal Equivalent Method (FEM), daily sampling over 24-hours, or every third or sixth day. Nearly 300 additional measurements not meeting FRM or FEM specifications are provided by the chemical speciation sites (Figure A-1). Approximately 600 stations provide indirect measurements of continuous (hourly resolution) $PM_{2.5}$ mass using a variety of techniques.

1.2. Interagency Monitoring of Protected Visual Environments (IMPROVE) Program

The IMPROVE network, with over 100 sites, has provided nearly a two-decade record of major components of $PM_{2.5}$ (sulfate, nitrate, organic and elemental carbon fractions, and trace metals) in pristine areas of the United States (Figure A-1). IMPROVE is led by the National Park Service; various federal and state agencies support its operations. The primary focus of the network is to track visibility and trends in visibility.

1.3. $PM_{2.5}$ Chemical Speciation Monitoring

In addition to the IMPROVE network, over 300 EPA speciation sites were added from 2000 - 2002 in urban areas of the United States to assist $PM_{2.5}$ assessment efforts. No FRM exists for particulate speciation, which is not directly required to determine attainment, and there are slight differences between monitors and methods used in the Speciation Trends Network (STN). However, the network's coverage (Figure A-1) across urban and rural areas has proved essential for a wide range of research and analysis. The speciation networks typically collect a 24-hour sample every three, and sometimes six, days.

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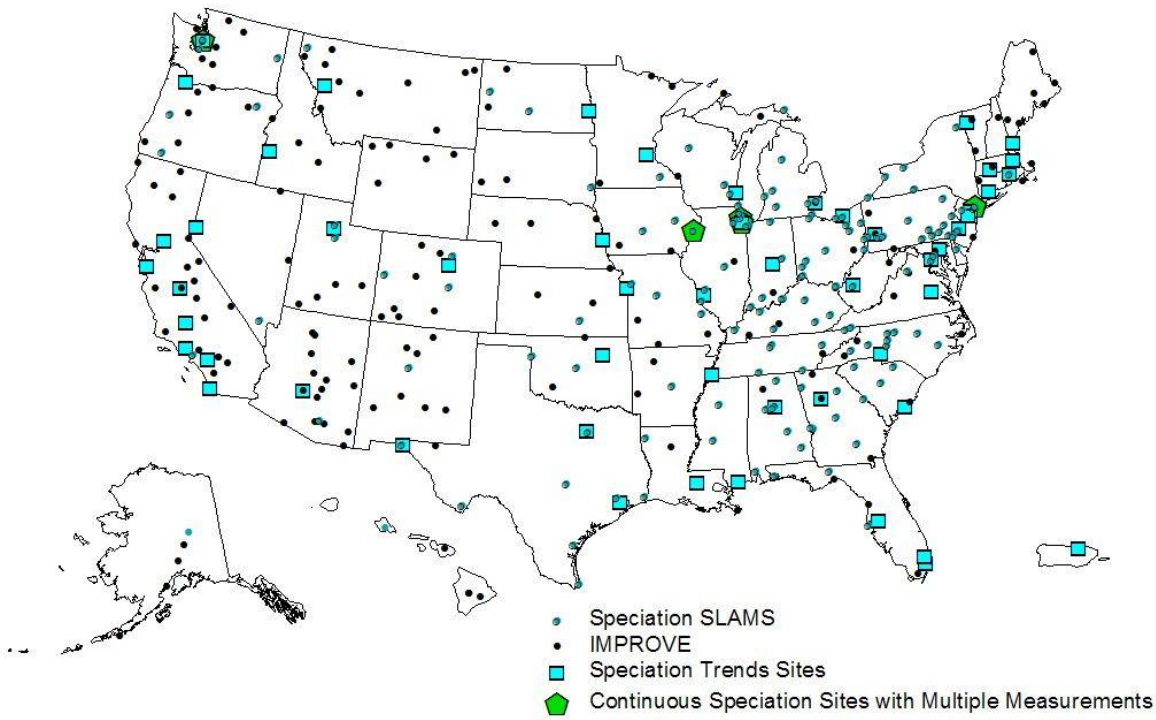
[38] The Particle Pollution Report: Current Understanding of Air Quality and Emissions through 2003. http://www.epa.gov/airtrends/aqtrnd04/pmreport03/pmcover_2405.pdf#page=1.

[39] Particulate Matter Staff Paper: Review completed in 2012. http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_cr_sp.html.

Daily 24-hour speciation collection is limited to occasional efforts in the SEARCH (see below) network. Similarly, only a handful of sites provide near continuous speciation data, usually limited to some combination of sulfate, carbon (organic and elemental splits) and nitrate. This enables insight to diurnal patterns for diagnosing various cause-effect phenomena related to emissions characterization, source attribution analysis and model evaluation.

Figure A-1. Locations of chemical speciation sites delineated by program type



1.4. South Eastern Aerosol Research and Characterization (SEARCH) Study

This study experiment is an industry-funded network of 8 sites that originally emerged from the Southern Oxidants Study (SOS) in the 1990s and has operated for over a decade in response to the 1997 revisions to the national ambient air quality standards for ground-level ozone and particulate matter. SEARCH is part of a public-private collaboration that provides an array of standard criteria pollutant measurements but also includes daily 24-hour PM speciation at selected times and locations, gaseous ammonia, reactive nitrogen (NO_y), and true nitrogen dioxide (i.e., a measurement of NO_2 concentration unaffected by other nitrogen oxides, which contaminate FRM NO_2 measurements). These measurements had not been available in major government-funded routine networks and in order to identify sources of ozone precursors and fine particulate matter and to attribute health effects to specific components, the SEARCH project sponsors believe that it is necessary to measure pollutant composition as well as mass.

1.5. PM Supersites Program

This program provided highly resolved aerosol measurements at eight U.S. cities for several time periods from 1999 through 2004, with some sites collecting data after 2004.[40] A number of instrument configurations were deployed, ranging from additional locations for standard speciation monitors, to systems capturing near-continuous size-dependent speciation profiles.

2. Composition of $PM_{2.5}$

Particulate matter (PM) is a highly complex mixture of solid particles and liquid droplets distributed among numerous atmospheric gases which interact with solid and liquid phases. Particles range in size from those smaller than 1 nanometer (10^{-9} meter) to over 100 microns (1 micron is 10^{-6} meter) in diameter (for reference, a typical strand of human hair is 70 microns and particles less than about 20 microns generally are not detectable by the human eye). Particles are classified as $PM_{2.5}$ and $PM_{10-2.5}$, corresponding to their size (diameter) range in microns and referring to total particle mass under 2.5 and between 2.5 and 10 microns, respectively.

Particles span many sizes and shapes and consist of hundreds of different chemicals. Particles are emitted directly from sources and also are formed through atmospheric chemical reactions and often are referred to as primary and secondary particles, respectively. Particle pollution also varies by time of year and location and is affected by several aspects of weather such as temperature, clouds, humidity, and wind. Further complicating particles is the shifting between solid/liquid and gaseous phases influenced by concentration and meteorology, especially temperature.

Particles are made up of different chemical components. The major components, or species, are carbon, sulfate and nitrate compounds, and crustal materials such as soil and ash (Figure A-2). The different components that make up particle pollution come from specific sources and are often formed in the atmosphere. Particulate matter includes both “primary” PM, which is directly emitted into the air, and “secondary” PM, which forms indirectly from fuel combustion and other sources. Primary PM consists of carbon (soot)—emitted from cars, trucks, heavy equipment, forest fires, and burning waste—and crustal material from unpaved roads, stone crushing, construction sites, and metallurgical operations. Secondary PM forms in the atmosphere from gases. Some of these reactions require sunlight and/or water vapor. Secondary PM includes:

- Sulfates formed from sulfur dioxide emissions from power plants and industrial facilities;
- Nitrates formed from nitrogen oxide emissions from cars, trucks, industrial facilities, and power plants; and

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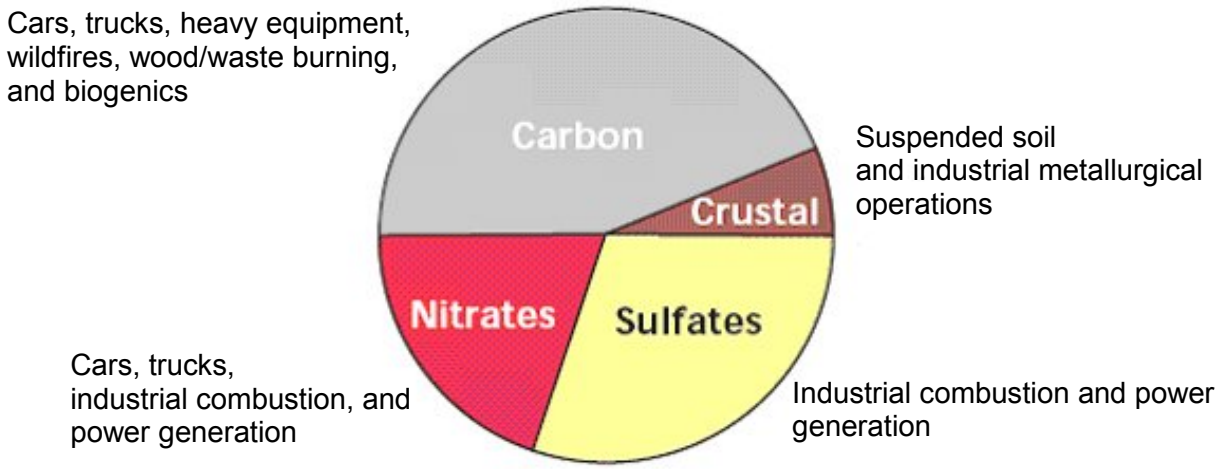
[40] Solomon, P.A., P.K. Hopke, J. Froines, and R. Scheffe, 2008: Key Scientific and Policy and Health-Relevant Findings from the U.S. EPA’s Particulate Matter Supersites Program and Related Studies: An Integration and Synthesis of Results, J. Air & Waste Manage. Assoc., 58, S-1 – S-92.

- Carbon formed from reactive organic gas emissions from cars, trucks, industrial facilities, forest fires, and biogenic sources such as trees.

Figure A-2. National Average of Source Contribution to Fine Particle Levels



Source: The Particulate Matter Report, EPA-454-R-04-002, Fall 2004. Carbon reflects both organic carbon and elemental carbon. Organic carbon accounts for automobiles, biogenics, gas-powered off-road, and wildfires. Elemental carbon is mainly from diesel powered sources.

In addition, ammonia from sources such as fertilizer and animal feed operations contributes to the formation of sulfates and nitrates that exist in the atmosphere as ammonium sulfate and ammonium nitrate. Note that fine particles can be transported long distances by wind and weather and can be found in the air thousands of miles from where they were formed.

The chemical makeup of particles varies across the United States (as shown in Figure A-3).[41] For example, fine particles in the eastern half of the United States contain more sulfates than those in the West, while fine particles in southern California contain more nitrates than other areas of the country. Organic carbon is a substantial component of fine particle mass everywhere. This figure represents the composition of $PM_{2.5}$ as measured by the $PM_{2.5}$ FRM.[42]

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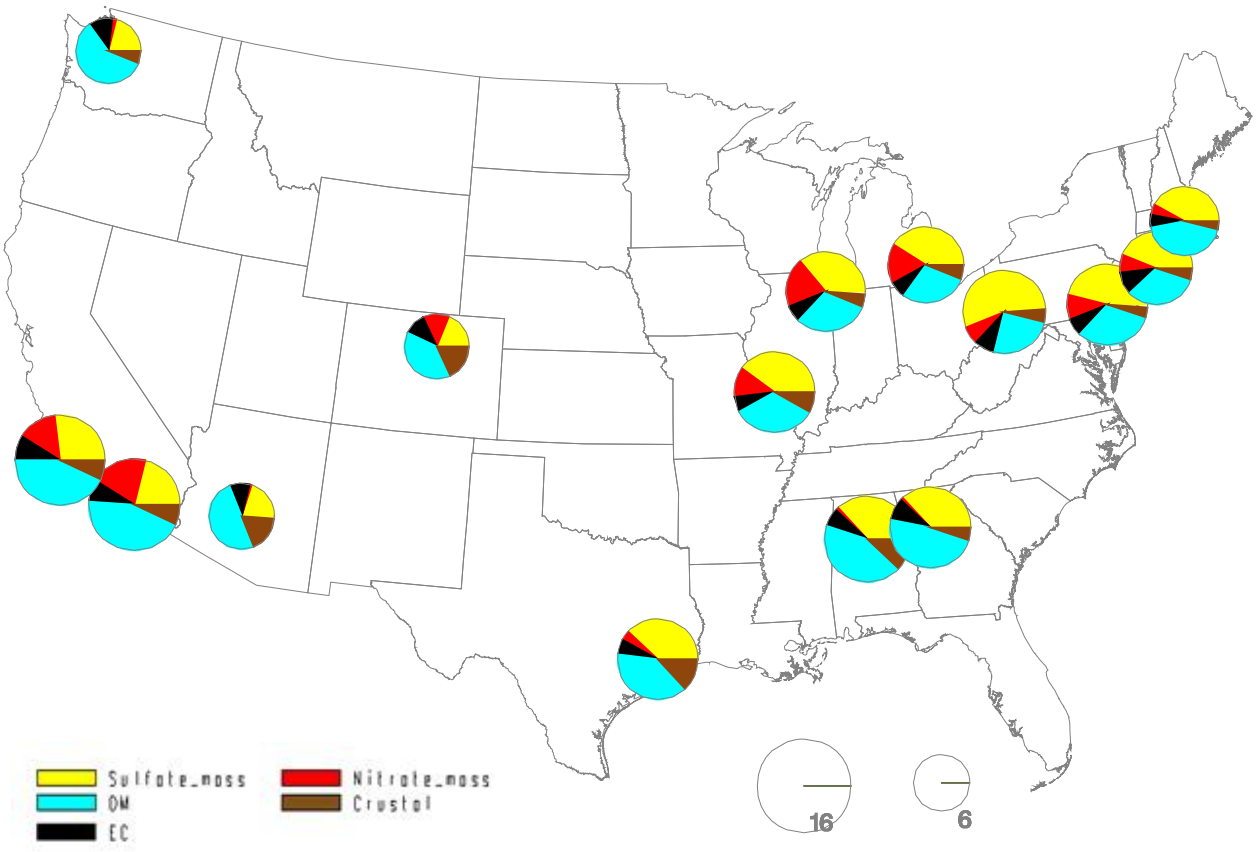
[41] The 15 cities are the same ones included in the Integrated Science Assessment for Particulate Matter (2009) which includes a similar map based on 2005-2007 $PM_{2.5}$ data.

[42] Frank, N. H., Retained Nitrate, Hydrated Sulfates, and Carbonaceous Mass in Federal Reference Method Fine Particulate Matter for Six Eastern U.S. Cities, 'J. Air & Waste Manage. Assoc.' 2006, '56', 500-511.

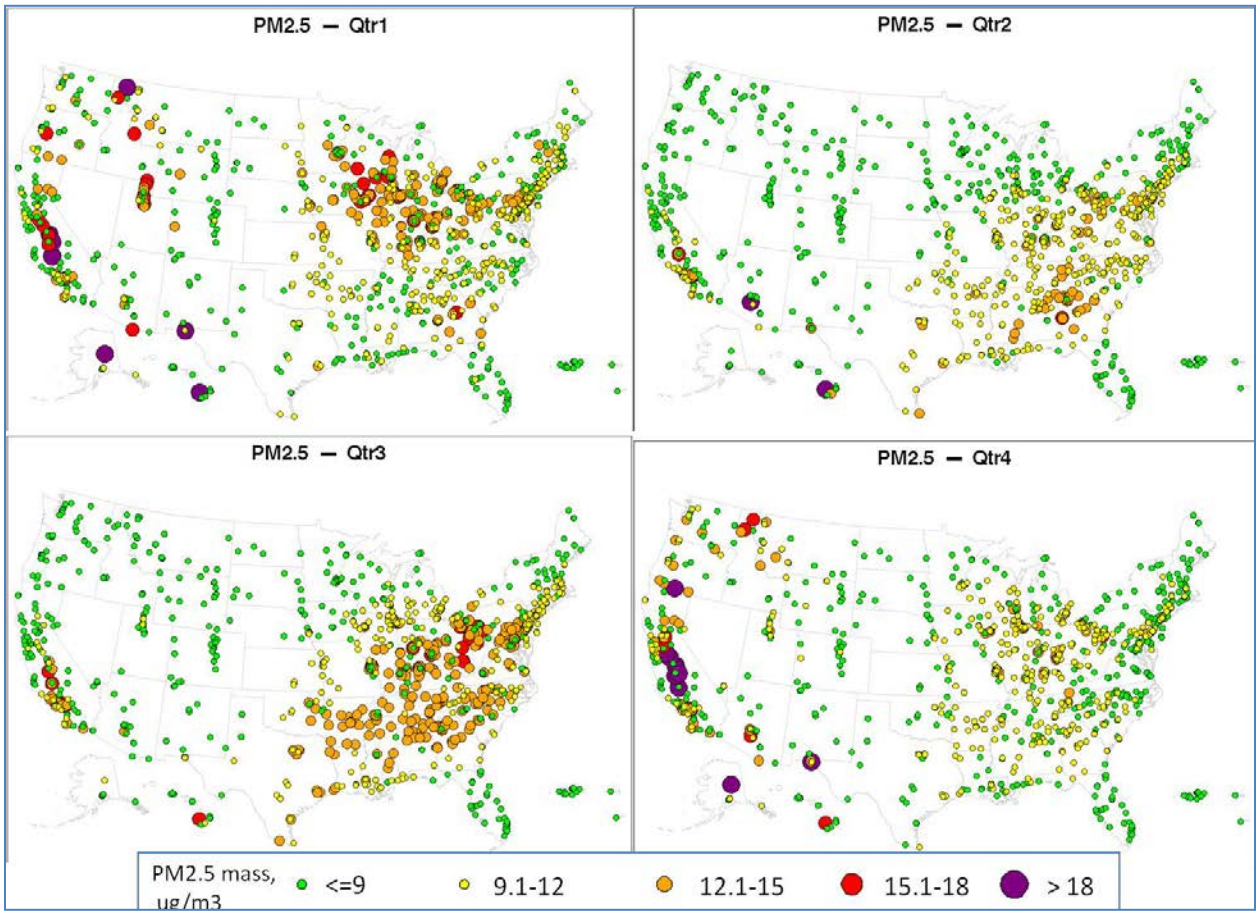
Figure A-3. Annual Average $PM_{2.5}$ Composition in 15 Urban Areas: 2008-2010



3. Seasonal and Daily Patterns of $PM_{2.5}$

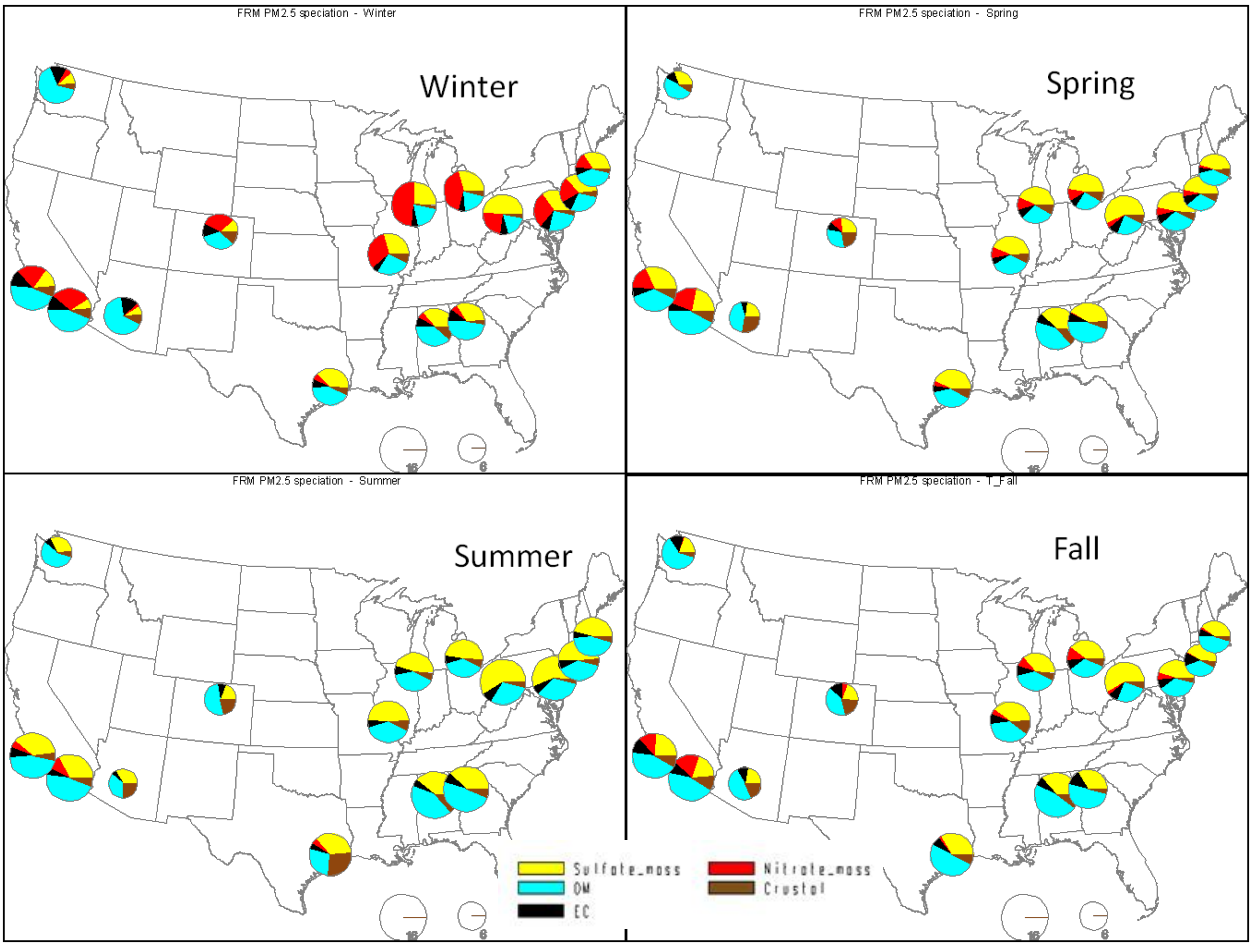
Fine particles often have a seasonal pattern. Both daily values and quarterly average of $PM_{2.5}$ also reveal patterns based on the time of year. Unlike daily ozone levels, which are usually elevated in the summer, daily $PM_{2.5}$ values at some locations can be high at any time of the year. As shown in Figure A-4, $PM_{2.5}$ values in the eastern half of the United States are typically higher in the third calendar quarter (July-September) when sulfates are more readily formed from sulfur dioxide (SO_2) emissions from power plants in that region and when secondary organic aerosol is more readily formed in the atmosphere. Fine particle concentrations tend to be higher in the first calendar quarter (January through March) in the Midwest in part because fine particle nitrates are more readily formed in cooler weather. $PM_{2.5}$ values are high during the first (January through March) and fourth calendar quarter (October through December) in many areas of the West, in part because of fine particle nitrates and also due to carbonaceous particles which are directly emitted from wood stove and fireplace use. Average concentration from all locations reporting $PM_{2.5}$ with valid design values is shown.

Figure A-4. Quarterly Averages of $PM_{2.5}$ Concentration: 2008-2010



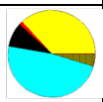
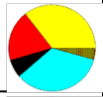
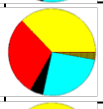
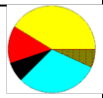
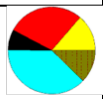
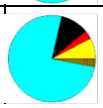
The composition of $PM_{2.5}$ also varies by season and helps explain why mass varies by season. Figure A-5 shows the average composition by season (spring, summer, fall and winter) for $PM_{2.5}$ data collected during 2008-10. In the eastern United States, sulfate are high in the spring (March-May) and summer (July-September). Nitrates are most evident in the midwest and western cities where its percentage is moderately high in the spring and fall (October-and highest during the winter.) Organic mass (OM) is high throughout the year.

Figure A-5. Seasonal Speciation Profiles of $PM_{2.5}$ for Select Urban Areas: 2008-2010



The composition of the highest daily $PM_{2.5}$ values may be different than that for the annual average. Table A-1 provides 2008-10 data on daily $PM_{2.5}$ values and their composition on high mass days for various sites within large metropolitan areas (in the east: Birmingham, AL; Atlanta, GA; New York City, NY; Cleveland, OH; Chicago, IL; and St. Louis, MO; in the west: Salt Lake City, UT; and Fresno, CA). Mass is proportioned into five components: sulfates, nitrates, OM, elemental carbon (EC) and crustal material. For each site, the table shows the 2008-2010 annual average speciation profile, the breakdown for the top 10 percent of days per year and corresponding FRM mass. The table shows some notable differences in the percentage contribution of each of the species to total mass when looking at the high end of the distribution versus the annual average. Except for the southeast (where there is little nitrate in $PM_{2.5}$), nitrates are slightly higher in the top 10 percent of the $PM_{2.5}$ days. For the 2008-2010 measurements, the percent of sulfates is currently similar or slightly less on the top 10 percent of the days as compared to the annual averages. The portion of OM appears to be similar on the high days compared to the annual averages.

Table A-1. $PM_{2.5}$ Composition on High $PM_{2.5}$ Mass Days in Select Urban Areas: 2008-2010

Urban Area	Metric	Composition Percents (%)					PM2.5 Mass (ug/m3)	Ann. Avg	Top 10 %
		Sulfate	Nitrate	OM	EC	Crustal			
Atlanta	Ann Mean	35	1	46	9	5	12.2		
	Top 10%	35	1	49	8	5	22.3		
Birmingham	Ann Mean	37	1	42	7	9	14.1		
	Top 10%	34	1	47	8	9	27.4		
New York City	Ann Mean	44	9	26	12	5	11.3		
	Top 10%	41	13	30	10	4	24.2		
Cleveland	Ann Mean	40	13	27	7	9	13.4		
	Top 10%	42	15	26	7	7	28.5		
Chicago	Ann Mean	34	18	33	6	4	11.7		
	Top 10%	36	29	25	5	3	25.2		
St Louis	Ann Mean	40	13	29	7	7	12.3		
	Top 10%	37	20	30	6	4	24.2		
Salt Lake City	Ann Mean	13	27	36	7	12	10.2		
	Top 10%	8	55	25	5	6	35.3		
Fresno	Ann Mean	14	21	50	5	6	15.4		
	Top 10%	8	43	43	4	1	45.6		
San Diego	Ann Mean	26	4	54	7	5	12.4		
	Top 10%	16	14	58	7	2	23.2		
Tacoma	Ann Mean	17	2	62	9	4	9.4		
	Top 10%	8	3	74	10	3	25.1		

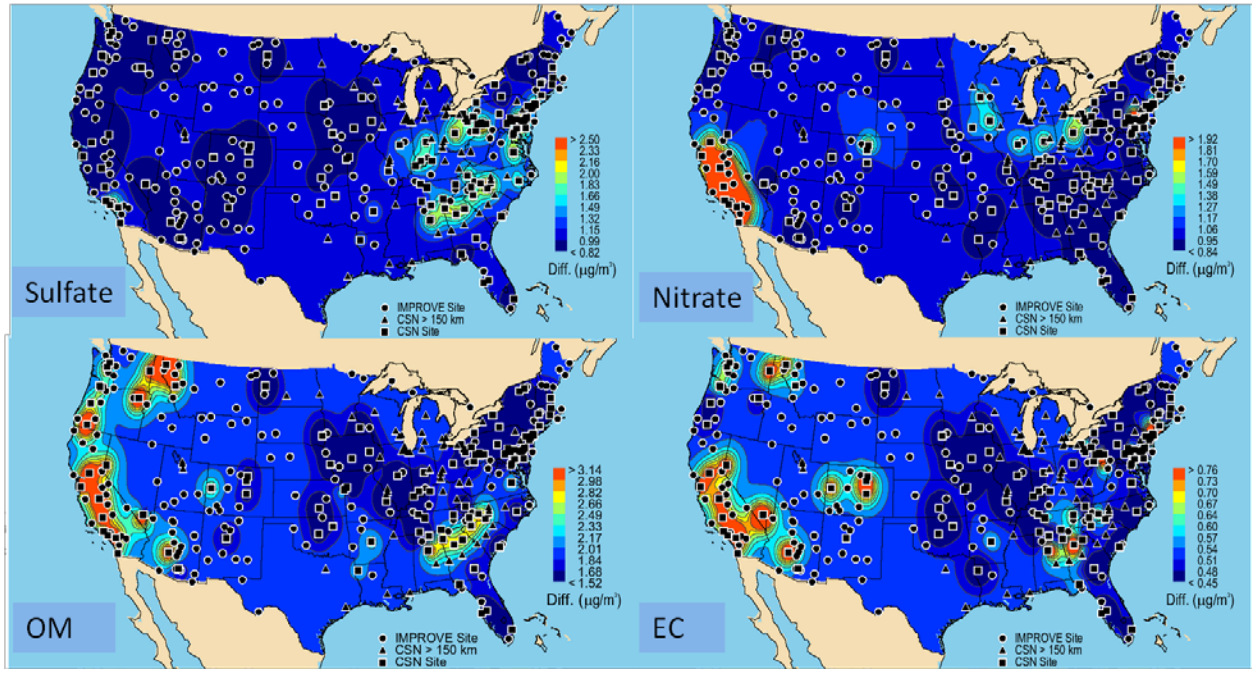
Note: The percentages do not add to 100% due to a small amount of passively collected fine particle mass included in the measurement of $PM_{2.5}$ by the FRM

4. Regional and Local Sources of $PM_{2.5}$

Both local and regional sources contribute to particle pollution. Figure A-6 shows how much of the $PM_{2.5}$ mass can be attributed to local versus regional sources for 13 selected urban areas. In each of these urban areas, monitoring sites were paired with nearby rural sites. When the average rural concentration is subtracted from the measured urban concentration, the estimated local and regional contributions become apparent. Urban and nearby rural $PM_{2.5}$ concentrations suggest substantial regional contributions to fine particles in the East. The measured $PM_{2.5}$ concentration is not necessarily the maximum for each urban area. Regional

concentrations are derived from the rural IMPROVE monitoring network.[43]

Figure A-6. "Urban excess" of locally generated $PM_{2.5}$ mass for four chemical components: sulfate, nitrate, organic mass (OM) and elemental carbon (EC)



Note: derived as the interpolated difference between urban CSN concentrations (squares) compared with nearby IMPROVE site concentrations within 150 km (circles). Annual mean concentrations from 2005-2008 are used. CSN sites not used in the analyses are shown as triangles.[44]

As shown in Figure A-6, we observe a large urban excess across the United State for most $PM_{2.5}$ species but especially for elemental carbon (EC) and organic mass (OM). Large excess for OM is observed in California, throughout the Northwest, and in the Southeast. The prevalence of urban excess in EC is seen more widely. Large urban excess of nitrates is seen in California. These results indicate that local sources of these pollutants are indeed contributing to the $PM_{2.5}$ air quality problem in these areas. As expected for a predominately regional pollutant, only a modest urban excess is observed for sulfates.

In the East, regional pollution contributes more than half of total $PM_{2.5}$ concentrations. Rural background $PM_{2.5}$ concentrations are high in the East and are somewhat uniform over large geographic areas. These regional concentrations come from emission sources such as power plants, natural sources, and urban pollution and can be transported hundreds of miles. The local and regional contributions for the major chemical components that make up urban $PM_{2.5}$: sulfates, carbon, and nitrates.

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[43] Information regarding the IMPROVE monitoring network can be found at the following website: http://vista.cira.colostate.edu/improve

[44] Hand et. al., Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States: Report V, 2011 (http://vista.cira.colostate.edu/improve/Publications/Reports/2011/2011.htm)

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Appendix B: General Guidance on Use of Dispersion Models for Estimating Primary $PM_{2.5}$ Concentrations

This appendix provides general guidance on the application of dispersion models for estimating ambient concentrations of $PM_{2.5}$ associated with direct emissions of primary $PM_{2.5}$. This guidance is based on and is consistent with the EPA's *Guideline on Air Quality Models*, published as Appendix W of 40 CFR Part 51, and focuses primarily on the application of AERMOD, the EPA's preferred dispersion model for most situations. Appendix W is the primary source of information on the regulatory application of air quality models for State Implementation Plan (SIP) revisions for existing sources and for New Source Review (NSR) and Prevention of Significant Deterioration (PSD) programs. There will be applications of dispersion models unique to specific areas, (*i.e.*, there may be areas of the country where it is necessary to model unique specific sources or types of sources). In such cases, there should be consultation with the state or appropriate permitting authority with the appropriate EPA Regional Office modeling contact to discuss how best to model a particular source.

Recently issued EPA guidance of relevance for consideration in modeling for $PM_{2.5}$ includes:

- "Model Clearinghouse Review of Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS" February 26, 2010 (U.S. EPA, 2010a);
- "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS" March 23, 2010 (U.S. EPA, 2010b); and
- "Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas" November 2013 (U.S.EPA, 2013a).

The guidance listed above, in addition to other relevant support documents can be found on the SCRAM website at: http://www.epa.gov/ttn/scram/.

The following sections will refer to the relevant sections of Appendix W and other existing guidance with summaries as necessary. Please refer to those original guidance documents for full discussion and consult with the appropriate EPA Regional Office modeling contact if questions arise about interpretation on modeling techniques and procedures.[45]

1. Model selection

Preferred air quality models for use in regulatory applications are addressed in Appendix A of the EPA's *Guideline on Air Quality Models*. If a model is to be used for a particular application, the user should follow the guidance on the preferred model for that application. These models may be used without an area specific formal demonstration of applicability as long as they are used as indicated in each model summary of Appendix A. Further recommendations for the application of these models to specific source problems are found in Appendix W. In

[45] A list of EPA Regional Office modeling contacts is available on the SCRAM website at: http://www.epa.gov/ttn/scram/guidance_cont_regions.htm.

2005, the EPA promulgated the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) as the Agency's preferred near-field dispersion model for a wide range of regulatory applications in all types of terrain based on extensive developmental and performance evaluation. For PSD/NSR modeling under the $PM_{2.5}$ NAAQS, AERMOD should be used to model primary $PM_{2.5}$ emissions unless use of an alternative model can be justified (Section 3.2, Appendix W), such as the Buoyant Line and Point Source Dispersion Model (BLP).

The AERMOD modeling system includes the following components:

- AERMOD: the dispersion model (U.S. EPA, 2004a; U.S. EPA, 2014a);
- AERMAP: the terrain processor for AERMOD (U.S. EPA, 2004b, U.S. EPA, 2011a); and
- AERMET: the meteorological data processor for AERMOD (U.S. EPA, 2004c; U.S. EPA, 2014b).

Other components that may be used, depending on the application, are:

- BPIPPRIME: the building input processor (U.S. EPA, 2004d);
- AERSURFACE: the surface characteristics processor for AERMET (U.S. EPA, 2008);
- AERSCREEN: a screening version of AERMOD (U.S. EPA, 2011b; U.S. EPA, 2011c); and
- AERMINUTE: a pre-processor to calculate hourly average winds from ASOS 2-minute observations (U.S. EPA, 2011d).

Before running AERMOD, the user should become familiar with the user's guides associated with the modeling components listed above and the AERMOD Implementation Guide (AIG) (U.S. EPA, 2009). The AIG lists several recommendations for applications of AERMOD that would be applicable for SIP and PSD permit modeling.

1.2. Receptor grid

The model receptor grid is unique to the particular situation and depends on the size of the modeling domain, the number of modeled sources, and complexity of the terrain. Receptors should be placed in areas that are considered ambient air (i.e., where the public generally has access) and placed out to a distance such that areas of violation can be detected from the model output to help determine the size of nonattainment areas. Receptor placement should be of sufficient density to provide resolution needed to detect significant gradients in the concentrations with receptors placed closer together near the source to detect local gradients and placed farther apart away from the source. In addition, the user may want to place receptors at key locations such as around facility fence lines (which define the ambient air boundary for a particular source) or monitor locations (for comparison to monitored concentrations for model evaluation purposes). The receptor network should cover the modeling domain. States may already have existing receptor placement strategies in place for regulatory dispersion modeling under NSR/PSD permit programs.

If modeling indicates elevated levels of $PM_{2.5}$ (near the standard) near the edge of the receptor grid, consideration should be given to expanding the grid or conducting an additional modeling run centered on the area of concern. As noted above, terrain complexity should also be considered when setting up the receptor grid. If complex terrain is included in the model calculations, AERMOD requires that receptor elevations be included in the model inputs. In those cases, the AERMAP terrain processor (U.S. EPA, 2004b; U.S EPA, 2011a) should be used to generate the receptor elevations and hill heights. The latest version of AERMAP (version 09040 or later) can process either Digitized Elevation Model (DEM) or National Elevation Data (NED) data files. The AIG recommends the use of NED data since it is more up to date than DEM data, which is no longer updated (Section 4.3 of the AIG).

2. Source inputs

This section provides guidance on source characterization to develop appropriate inputs for dispersion modeling with the AERMOD modeling system. Section 2.1 provides guidance on use of emission, Section 2.2 covers guidance on Good Engineering Practice (GEP) stack heights, Section 2.3 provides details on source configuration and source types, Section 2.4 provides details on urban/rural determination of the sources, and Section 2.5 provides general guidance on source grouping, which may be important for design value calculations.

2.1. Emissions

Consistent with Appendix W, dispersion modeling for the purposes of PSD permitting should be based on the use of continuous operation at maximum allowable emissions or federally enforceable permit limits (see Table 8-2 of Appendix W) for the project source for all applicable averaging periods. Also consistent with past and current guidance, in the absence of maximum allowable emissions or federally enforceable permit limits, potential to emit emissions (i.e., design capacity) should be used. Maximum allowable emissions and continuous operation should also be assumed for nearby sources included in the modeled inventory for the 24-hr $PM_{2.5}$ NAAQS, while maximum allowable emissions and the actual operating factor averaged over the most recent 2 years should be used for modeled nearby sources for the annual $PM_{2.5}$ NAAQS.

2.2. Good Engineering Practice (GEP) stack height

Consistent with previous modeling guidance and Section 6.2.2 of Appendix W, for stacks with heights that are within the limits of Good Engineering Practice (GEP), actual heights should be used in modeling. Under the EPA's regulations at 40 CFR 51.100, GEP height, H_g, is determined to be the greater of:

- 65 m, measured from the ground-level elevation at the base of the stack;
- for stacks in existence on January 12, 1979, and for which the owner or operator had obtained all applicable permits or approvals required under 40 CFR Parts 51 and 52

$$H_g=2.5H$$

provided the owner or operator produces evidence that this equation was actually relied

on in designing the stack or establishing an emission limitation to ensure protection against downwash;

- for all other stacks,

  $$H_g = H + 1.5L,$$

  where H is the height of the nearby structure(s) measured from the ground-level elevation at the base of the stack and L is the lesser dimension of height or projected width of nearby structure(s); or

- the height demonstrated by a fluid model or a field study approved by the EPA or the state/local permitting agency which ensures that the emissions from a stack do not result in excessive concentrations of any air pollutant as a result of atmospheric downwash, wakes, eddy effects created by the source itself, nearby structures or nearby terrain features.

For more details about GEP, see the Guideline for Determination of Good Engineering Practice Stack Height Technical Support Document (U.S. EPA, 1985).

If stack heights exceed GEP, then GEP heights should be used with the individual stack's other parameters (temperature, diameter, exit velocity). For stacks modeled with actual heights below GEP that may be subject to building downwash influences, building downwash should be considered as this can impact concentrations near the source (Section 6.2.2b, Appendix W). If building downwash is being considered, the BPIPPRIME program (U.S. EPA, 2004d) should be used to input building parameters for AERMOD. More information about buildings and stacks is provided in Section 6.5.

2.3. Source configurations and source types

An accurate characterization of the modeled facilities is critical for refined dispersion modeling, including accurate stack parameters and physical plant layout. Accurate stack parameters should be determined for the emissions being modeled. Since modeling would be done with maximum allowable or potential emissions levels at each stack, the stack's parameters such as exit temperature, diameter, and exit velocity should reflect those emissions levels. Accurate locations (i.e.. latitude and longitude or Universal Transverse Mercator (UTM) coordinates and datum)[46] of the modeled emission sources are also important, as this can affect the impact of an emission source on receptors, determination of stack base elevation, and relative location to any nearby building structures. Not only are accurate stack locations needed, but accurate information for any nearby buildings is important. This information would include location and orientation relative to stacks and building size parameters (height, and corner coordinates of tiers) as these parameters are input into BPIPPRIME to calculate building parameters for AERMOD. If stack locations and or building information are not accurate,

[46] Latitudes and longitudes to four decimal places position a stack within 30 feet of its actual location and five decimal places position a stack within three feet of its actual location. Users should use the greatest precision available.

downwash will not be accurately accounted for in AERMOD.

Emission source type characterization within the modeling environment is also important. As stated in the AERMOD User's Guide (U.S. EPA, 2004a; U.S. EPA, 2012a), emissions sources can be characterized as several different source types: POINT sources, capped stacks (POINTCAP), horizontal stacks (POINTHOR), VOLUME sources, OPENPIT sources, LINE sources, rectangular AREA sources, circular area sources (AREACIRC), and irregularly shaped area sources (AREAPOLY). Note that POINTCAP and POINTHOR are not part of the regulatory default option in AERMOD because the user must invoke the BETA option in the model options keyword MODELOPT while not including the "DFAULT" modeling option for these options to work properly. While most sources can be characterized as POINT sources, some sources, such as fugitive releases or nonpoint sources (emissions from ports/ships, airports, or smaller point sources with no accurate locations), may be best characterized as VOLUME or AREA type sources. Sources such as flares can be modeled in AERMOD using the parameter input methodology described in Section 2.1.2 of the AERSCREEN User's Guide (U. S. EPA, 2011b). If questions arise about proper source characterization or typing, users should consult the appropriate EPA Regional Office modeling contact.

2.4. Urban/rural determination

For any dispersion modeling exercise, the urban or rural determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. Figure B-1 gives example maximum 24-hour concentration profiles for a 10 meter stack (Figure B-1a) and a 100 m stack (Figure B-1b) based on urban vs. rural designation. The urban population used for the examples is 100,000. In Figure B-1a, the urban concentration is much higher than the rural concentration for distances less than 750 m from the stack but then drops below the rural concentration beyond 750 m. For the taller stack in Figure B-1b, the urban concentration is much higher than the rural concentration even as distances increase from the source. These profiles show that the urban or rural designation of a source can be quite important.

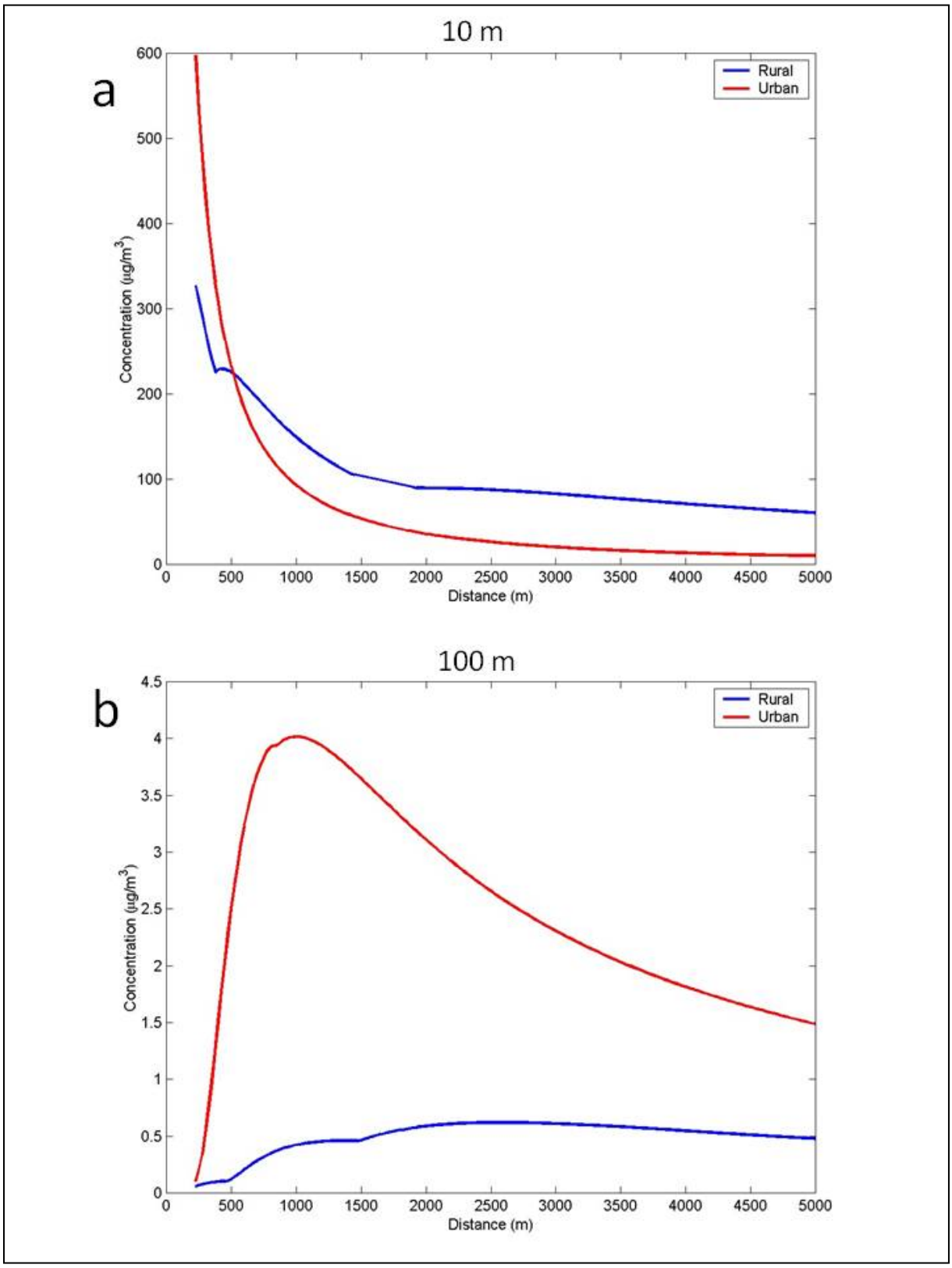
Determining whether a source is urban or rural can be done using the methodology outlined in Section 7.2.3 of Appendix W and recommendations outlined in Sections 5.1 through 5.3 in the AIG (U.S. EPA, 2009). In summary, there are two methods of urban/rural classification described in Section 7.2.3 of Appendix W.

The first method of urban determination is a land use method (Appendix W, Section 7.2.3c). In the land use method, the user analyzes the land use within a 3 km radius of the source using the meteorological land use scheme described by Auer (1978). Using this methodology, a source is considered urban if the land use types I1 (heavy industrial), I2 (light-moderate industrial), C1 (commercial), R2 (common residential), and R3 (compact residential) are 50 percent or more of the area within the 3 km radius circle. Otherwise, the source is considered a rural source. The second method uses population density and is described in Section 7.2.3d of Appendix W. As with the land use method, a circle of 3 km radius is used. If the population density within the circle is greater than 750 people/km^2, then the source is considered urban. Otherwise, the source is modeled as a rural source. Of the two methods, the land use method is

considered more definitive (Section 7.2.3e, Appendix W).

Caution should be exercised with either classification method. As stated in Section 5.1 of the AIG (U.S. EPA, 2009), when using the land use method, a source may be in an urban area but located close enough to a body of water or other non-urban land use category to result in an erroneous rural classification for the source. The AIG in Section 5.1 cautions users against using the land use scheme on a source by source basis, but advises considering the potential for urban heat island influences across the full modeling domain. When using the population density method, Section 7.2.3e of Appendix W states, “Population density should be used with caution and should not be applied to highly industrialized areas where the population density may be low and thus a rural classification would be indicated, but the area is sufficiently built-up so that the urban land use criteria would be satisfied...” With either method, Section 7.2.3(f) of Appendix W recommends modeling all sources within an urban complex as urban, even if some sources within the complex would be considered rural using either the land use or population density method.

Figure B-1. Urban (red) and rural (blue) concentration profiles for (a) 10 m buoyant stack release, and (b) 100 m buoyant stack release



Another consideration that may need attention by the user, and is discussed in Section 5.1 of the AIG, relates to tall stacks located within or adjacent to small to moderate size urban areas. In such cases, the stack height or effective plume height for very buoyant sources may extend above the urban boundary layer height. The application of the urban option in AERMOD for these types of sources may artificially limit the plume height. The use of the urban option may not be appropriate for these sources, since the actual plume is likely to be transported over the urban boundary layer. Section 5.1 of the AIG gives details on determining if a tall stack should be modeled as urban or rural based on comparing the stack or effective plume height to the urban boundary layer height. The 100 m stack illustrated in Figure B-1b, may be such an example as the urban boundary layer height for this stack would be 189 m (based on a population of 100,000) and equation 104 of the AERMOD formulation document (Cimorelli, et al., 2004). This equation is:

$$z_{iuc} = z_{iuo}\left(\frac{P}{P_o}\right)^{1/4} \tag{B-1}$$

where z_{iuo} is a reference height of 400 m corresponding to a reference population P_o of 2,000,000 people.

Given that the stack is a buoyant release, the plume may extend above the urban boundary layer and may be best characterized as a rural source, even if it were near an urban complex. Exclusion of these elevated sources from application of the urban option would need to be justified on a case-by-case basis in consultation with the appropriate permitting authority.

AERMOD requires the input of urban population when utilizing the urban option. Population can be entered to one or two significant digits (i.e., an urban population of 1,674,365 can be entered as 1,700,000). Users can enter multiple urban areas and populations using the URBANOPT keyword in the runstream file (U.S. EPA, 2004a; U.S. EPA, 2012a). If multiple urban areas are entered, AERMOD requires that each urban source be associated with a particular urban area or AERMOD model calculations will abort. Urban populations can be determined by using a method described in Section 5.2 of the AIG (U.S. EPA, 2009).

2.5. Source groups

In AERMOD, individual emission sources' concentration results can be combined into groups using the SRCGROUP keyword (Section 3.3.11 of the AERMOD User's Guide (U.S, EPA, 2004a). The user can automatically calculate a total concentration (from all sources) using the SRCGROUP ALL keyword. For the purposes of design value calculations, source group ALL should be used, especially if all sources in the modeling domain are modeled in one AERMOD run. Design values should be calculated from the total concentrations (all sources and background). Individual source contributions outputs to the total concentration may be necessary to determine the culpability to any NAAQS violations.

3. Meteorological data

This section gives guidance on the selection of meteorological data for input into AERMOD. Much of the guidance from Section 8.3 of Appendix W is applicable to SIP and PSD permit modeling and is summarized here. In Section 7.2.1, the use of a new tool, AERMINUTE (U.S. EPA, 2011d), is introduced. AERMINUTE is an AERMET pre-processor that calculates hourly averaged winds from ASOS (Automated Surface Observing System) 1-minute winds.

3.1. Surface characteristics and representativeness

The selection of meteorological data that are input into a dispersion model should be considered carefully. The selection of data should be based on spatial and climatological (temporal) representativeness (Appendix W, Section 8.3). The representativeness of the data is based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data are: National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), military stations, and others. Appendix W addresses spatial representativeness issues in Sections 8.3.a and 8.3.c.

Spatial representativeness of the meteorological data can be adversely affected by large distances between the source and receptors of interest and the complex topographic characteristics of the area (Appendix W, Section 8.3.a and 8.3.c). If the modeling domain is large enough such that conditions vary drastically across the domain, then the selection of a single station to represent the domain should be carefully considered. Also, care should be taken when selecting a station if the area has complex terrain. While a source and meteorological station may be in close proximity, there may be complex terrain between them such that conditions at the meteorological station may not be representative of the source. An example would be a source located on the windward side of a mountain chain with a meteorological station a few kilometers away on the leeward side of the mountain. Spatial representativeness for off-site data should also be assessed by comparing the surface characteristics (albedo, Bowen ratio, and surface roughness) of the meteorological monitoring site and the analysis area. When processing meteorological data in AERMET (U.S. EPA, 2004c; U.S. EPA, 2014b), the surface characteristics of the meteorological site should be used (Section 8.3.c of Appendix W and the AERSURFACE User's Guide (U.S. EPA 2008)). Spatial representativeness should also be addressed for each meteorological variable separately. For example, temperature data from a meteorological station several kilometers from the analysis area may be considered adequately representative, while it may be necessary to collect wind data near the plume height (Section 8.3.c of Appendix W).

Surface characteristics can be calculated in several ways. For details see Section 3.1.2 of the AIG (U.S. EPA, 2009). The EPA has developed a tool, AERSURFACE (U.S. EPA, 2008) to aid in the determination of surface characteristics. The current version of AERSURFACE uses the 1992 National Land Cover Data. Note that the use of AERSURFACE is not a regulatory requirement but the methodology outlined in Section 3.1.2 of the AIG should be followed unless an alternative method can be justified.

3.2. Meteorological inputs

Appendix W states in Section 8.3.1.1 that the user should acquire enough meteorological data to ensure that worst-case conditions are adequately represented in the model results. Appendix W states that 5 years of NWS meteorological data or at least 1 year of site-specific data should be used(Section 8.3.1.2, Appendix W) and should be adequately representative of the study area. If 1 or more years of site-specific data are available, those data are preferred. While the form of the $PM_{2.5}$ NAAQS contemplates obtaining 3 years of monitoring data, this does not preempt the use of 5 years of NWS data or at least 1 year of site-specific data in the modeling. The 5-year average based on the use of NWS data, or an average across 1 or more years of available site specific data, serves as an unbiased estimate of the 3-year average for purposes of modeling demonstrations of compliance with the NAAQS.

3.2.1. NWS data

NWS data are available from the National Climatic Data Center (NCDC) in many formats, with the most common one in recent years being the Integrated Surface Hourly data (ISH). Most available formats can be processed by AERMET. As stated in Section 3.1, when using data from an NWS station alone or in conjunction with site-specific data, the data should be spatially and temporally representative of conditions at the modeled sources. Key points regarding the use of NWS data can be found in the EPA's March 8, 2013 clarification memo "Use of ASOS meteorological data in AERMOD dispersion modeling" (U.S. EPA, 2013b). The key points are:

- The EPA has previously analyzed the effects of ASOS implementation on dispersion modeling and found that generally AERMOD was less sensitive than ISCST3 to the implementation of ASOS.
- The implementation of the ASOS system over the conventional observation system should not preclude the consideration of NWS stations in dispersion modeling.
- The EPA has implemented an adjustment factor (0.5 knots) in AERMET to adjust for wind speed truncation in ASOS winds
  The EPA has developed the AERMINUTE processor (U.S. EPA, 2011d) to process 2-minute ASOS winds and calculate an hourly average for input into AERMET. The use of hourly averaged winds better reflect actual conditions over the hour as opposed to a single 2-minute observation.

While the EPA's March 8, 2013, memo states that ASOS should not preclude the use of NWS data in dispersion modeling, and Section 8.3.1.2 of Appendix W recommends the most recent five years of NWS data, Section 8.3.1.2 also recognizes cases where professional judgment indicates that ASOS data are inadequate and pre-ASOS, or observer based data may be considered for use. The appropriate permitting authority and EPA Regional Office modeling contact should be consulted when questions arise about the representativeness or applicability of NWS data.

3.2.2. Site-specific data

The use of site-specific meteorological data is the best way to achieve spatial representativeness. AERMET can process a variety of formats and variables for site-specific data. The use of site-specific data for regulatory applications is discussed in detail in Section 8.3.3 of Appendix W. Due to the range of data that can be collected onsite and the range of formats of data input to AERMET, the user should consult Appendix W, the AERMET User's Guide (U.S. EPA, 2004c; U. S. EPA, 2014b), and Meteorological Monitoring Guidance for Regulatory Modeling Applications (U.S. EPA, 2000). Also, when processing site-specific data for an urban application, Section 3.3 of the AERMOD Implementation Guide offers recommendations for data processing. In summary, the guide recommends that site-specific turbulence measurements should not be used when applying AERMOD's urban option in order to avoid double counting the effects of enhanced turbulence due to the urban heat island.

3.2.3. Upper air data

AERMET requires full upper air soundings to calculate the convective mixing height. For AERMOD applications in the U.S., the early morning sounding, usually the 1200 UTC (Universal Time Coordinate) sounding, is typically used for this purpose. Upper air soundings can be obtained from the Radiosonde Data of North America CD for the period 1946-1997. Upper air soundings for 1994 through the present are also available for free download from the Radiosonde Database Access website. Users should choose all levels or mandatory and significant pressure levels[47] when selecting upper air data. Selecting mandatory levels only would not be adequate for input into AERMET as the use of just mandatory levels would not provide an adequate characterization of the potential temperature profile.

4. Running AERMOD and implications for design value calculations

Recent enhancements to AERMOD include options to aid in the calculation of design values for comparison with the $PM_{2.5}$ NAAQS and to aid in determining whether emissions from the project source contributed significantly to any modeled violations. These enhancements include:

- The MAXDCONT option, which shows the contribution of each user-specified source group to the high ranked values for a specified target source group paired in time and space. The user can specify a range of ranks to analyze or specify an upper bound rank, i.e. 8th highest, corresponding to the 98th percentile for the 24-hour $PM_{2.5}$ NAAQS, and a lower threshold concentration value, such as the NAAQS for the target source group. The model will process each rank within the range specified, but will stop after the first rank (in descending order of concentration) that is below the threshold value if specified by the user. A warning message will be generated if the threshold is not reached within the range of ranks analyzed (based on the range of ranks specified on the RECTABLE keyword). This option may be needed to aid in determining which sources should be considered for controls.

[47] By international convention, mandatory levels are in millibars: 1,000, 850, 700, 500, 400, 300, 200, 150, 100, 50, 30, 20, 10, 7 5, 3, 2, and 1. Significant levels may vary depending on the meteorological conditions at the upper-air station.

For more details about the enhancements, see the AERMOD User's guide Addendum (U. S. EPA, 2014a).

Ideally, all explicitly modeled sources, receptors, and background should be modeled in one AERMOD run for all modeled years. In this case, one of the above output options can be used in AERMOD to calculate design values for comparison to the NAAQS and determine the area's attainment status and/or inform attainment/nonattainment boundaries. The use of these options in AERMOD allows AERMOD to internally calculate concentration metrics that can be used to calculate design values and, therefore, lessen the need for large output files, i.e. hourly POSTFILES.

However, there may be situations where a single AERMOD run with all explicitly modeled sources is not possible. These situations often arise due to runtime or storage space considerations during the AERMOD modeling. Sometimes separate AERMOD runs are done for each facility or group of facilities, or by year, or the receptor network is divided into separate sub-networks. In some types of these situations, the MAXDCONT output option may not be an option for design value calculations, especially if all sources are not included in a single run. If the user wishes to utilize one of the three output options, then care should be taken in developing the model inputs to ensure accurate design value calculations.

Situations that would effectively preclude the use of the MAXDCONT option to calculate meaningful AERMOD design value calculations include the following examples:

- Separate AERMOD runs for each source or groups of sources.
    - SIP modeling includes 10 facilities for 5 years of NWS data and each facility is modeled for 5 years in a separate AERMOD run, resulting in ten separate AERMOD runs.
- Separate AERMOD runs for each source and each modeled year.
    - 10 facilities are modeled for 5 years of NWS data. Each facility is modeled separately for each year, resulting in fifty individual AERMOD runs.

In the two situations listed above, the MAXDCONT option would not be useful as the different AERMOD runs do not include a total concentration with contributions from all facilities. In these situations, the use of 24-hour POSTFILES, which can be quite large, and external post-processing would be needed to calculate design values.

Situations in which the MAXDCONT options may be used but may necessitate some external post-processing afterwards to calculate a design value include:

- The receptor network is divided into sections and an AERMOD run, with all sources and years, is made for each sub-network.
    - A receptor network of 1,000 receptors is divided into four 250 receptor sub-networks. 10 facilities are modeled with 5 years of NWS data in one AERMOD run for each receptor network, resulting in four AERMOD runs. After the

AERMOD runs are complete, the MAXDCONT results for each network can be re-combined into the larger network.

- All sources and receptors are modeled in an AERMOD run for each year.
- Ten facilities are modeled with 5 years of NWS data. All facilities are modeled with all receptors for each year individually, resulting in five AERMOD runs. MAXDCONT output can be used and post-processed to generate the necessary design value concentrations. The receptor network is divided and each year is modeled separately for each sub-network with all sources.
- Ten facilities are modeled with 5 years of NWS data for 1,000 receptors. The receptor network is divided into four 250 receptor networks. For each sub-network, all ten facilities are modeled for each year separately, resulting in twenty AERMOD runs. MAXDCONT output can be used and post-processed to generate the necessary design value concentrations.

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Appendix C: Example of a Qualitative Assessment of the Potential for Secondary $PM_{2.5}$ Formation

In late 2011, the EPA Region 10 Office developed a qualitative assessment of the potential for secondary fine particulate matter ($PM_{2.5}$) formation to cause or contribute to a violation of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) through a response to public comments document regarding a Clean Air Act permit issued for Shell's *Discoverer* drill ship and support fleet to explore for oil and gas in the Chukchi Sea off Alaska. While the environment in and around the Chukchi Sea and North Slope of Alaska is unique when compared to the rest of the United States, the various components contained within this qualitative assessment provide a template that could be followed, with appropriate modifications, in the development of other case-specific qualitative assessments. An excerpt from this response to public comments document is provided below for reference.

As shown in the EPA Region 10 example, the qualitative assessment of the potential for secondary $PM_{2.5}$ formation by the Shell's *Discoverer* drill ship and support fleet was developed in a narrative manner integrating numerous factors specific to the North Slope region of Alaska that provided sufficient evidence that the $PM_{2.5}$ NAAQS would not be violated in this particular case. The qualitative assessment examined the regional background $PM_{2.5}$ monitoring data and aspects of secondary $PM_{2.5}$ formation from existing sources; the relative ratio of the combined modeled primary $PM_{2.5}$ impacts and background $PM_{2.5}$ concentrations to the level of the NAAQS; the spatial and temporal correlation of the primary and secondary $PM_{2.5}$ impacts; meteorological characteristics of the region during periods of precursor pollutant emissions; the level of conservatism associated with the modeling of the primary $PM_{2.5}$ component and other elements of conservatism built into the overall NAAQS compliance demonstration; aspects of the precursor pollutant emissions in the context of limitations of other chemical species necessary for the photochemical reactions to form secondary $PM_{2.5}$; and an additional level of NAAQS protection through a post-construction monitoring requirement. While each of the components of the EPA Region 10 example may or may not be necessary, this example should provide a useful template for other qualitative assessments under this guidance, recognizing that additional components may be essential in other qualitative assessments of the potential for secondary $PM_{2.5}$ formation.

Additional information regarding this EPA Region 10 Office permit action can be found through the following web link: http://yosemite.epa.gov/R10/airpage.nsf/Permits/chukchiap/.

Region 10 example:

> In support of the 2011 Revised Draft Permits, Region 10 provided a detailed explanation for why it believes that modeling secondary $PM_{2.5}$ emissions is not needed in order to determine that emissions of $PM_{2.5}$ precursors from the *Discoverer* and Associated Fleet would not, together with emissions of primary $PM_{2.5}$, cause or contribute to a violation of the 24-hour $PM_{2.5}$ NAAQS. The factors Region 10 relied on to reach this conclusion include:

1) The background $PM_{2.5}$ monitoring data considered in the air quality analysis is quality assured, quality controlled data from monitors operating for more than one year that Region 10 believes will have accounted for much of the secondary formation from existing regional emission sources that will occur in the Chukchi Sea and Beaufort Sea regions. Monitoring data show low levels of daily $PM_{2.5}$, generally in the range of 2 $\mu g/m^3$, with the higher $PM_{2.5}$ values generally occurring on days where windblown dust or fires are believed to be contributing factors. Thus, there is no indication that secondary formation of $PM_{2.5}$ from existing sources in the North Slope is currently causing or contributing to exceedances or a violation of the $PM_{2.5}$ NAAQS in the onshore communities.

2) Modeled primary $PM_{2.5}$ impacts from the *Discoverer* and Associated Fleet that, when using a conservative "First Tier" approach to combining modeled primary $PM_{2.5}$ impacts with monitored background $PM_{2.5}$ concentrations, are less than 67 percent of the $PM_{2.5}$ NAAQS. Thus, although not expected, considerable formation of secondary $PM_{2.5}$ emissions could occur before the NAAQS would be threatened.

3) Secondary $PM_{2.5}$ impacts associated with *Discoverer* and Associated Fleet precursor emissions are expected to be low near the emission release points where modeled concentrations associated with primary $PM_{2.5}$ emissions are highest, because there has not been enough time for the secondary chemical reactions to occur. Conversely, secondary $PM_{2.5}$ impacts are more likely to be higher farther from the *Discoverer* and the Associated Fleet where impacts from primary $PM_{2.5}$ emissions from the *Discoverer* and the Associated Fleet are expected to be lower. This makes it unlikely that maximum primary $PM_{2.5}$ impacts and maximum secondary $PM_{2.5}$ impacts from the *Discoverer* and the Associated Fleet will occur at the same time (paired in time) or location (paired in space). See March 23, 2010 $PM_{2.5}$ Guidance Memo at 9.

4) The relatively small amount of NO_X emissions (a $PM_{2.5}$ precursor) that will be authorized under these permits in comparison to existing NO_X emissions in the North Slope area in general, together with the generally low levels of $PM_{2.5}$ recorded at monitoring stations in the area, make it unlikely that NO_X emissions from the *Discoverer* and the Associated Fleet would cause or contribute to a violation of the $PM_{2.5}$ NAAQS.

5) The background concentrations of certain chemical species that participate in photochemical reactions to form secondary $PM_{2.5}$, including ammonia and volatile organic compounds, are expected to be negligible in the offshore air masses where the *Discoverer* will be permitted to operate. The emissions authorized under the permits of approximately 43 tons per year of VOC and 0.52 tons per year of ammonia [citation omitted] would also not be expected to result in the conversion of significant quantities of NO_X emissions to secondary particles in the areas impacted by primary $PM_{2.5}$ emissions.

6) There are several other conservative assumptions incorporated in the modeling of primary $PM_{2.5}$ emissions. These include the conservatism inherent in using a "First Tier" approach to combining modeled primary $PM_{2.5}$ impacts with monitored background $PM_{2.5}$ concentrations; assuming that the *Discoverer* will be operating in a single drilling location for 3 years, when it is more likely that the *Discoverer* will operate in a different location each year (if not more frequently); orienting the Associated Fleet with hourly modeled wind direction and using emission release characteristics based on actual meteorological conditions; and the fact that the background monitored data used to represent offshore conditions was collected onshore, where it is influenced by local sources, and is, therefore likely to be a conservative estimate of background $PM_{2.5}$ levels in the area of maximum impact near the *Discoverer*.

7) With respect to the Chukchi Sea impacts, the predominant easterly wind directions in the Chukchi Sea along with the distance between the project location and the existing sources in the North Slope oil and gas fields are such that emissions from the *Discoverer* and Associated Fleet are not likely to significantly contribute to the maximum ambient concentrations resulting from the existing source emissions.

8) Region 10 required post-construction monitoring in the previous permits because the conservative screening modeling resulted in predicted levels that were just below the 24-hour $PM_{2.5}$ NAAQS. With the additional emission reductions in direct $PM_{2.5}$ emissions and the use of a refined model, predicted $PM_{2.5}$ concentrations are now well below the NAAQS. However, Region 10 has decided to retain the post-construction monitoring requirement in order to obtain better information on the quantity of secondary particles in the North Slope communities.

Based on these factors, and consistent with current guidance, Region 10 believes that an adequate assessment has been made to demonstrate that the $PM_{2.5}$ NAAQS will be protected, accounting for primary $PM_{2.5}$ impacts and potential contributions due to $PM_{2.5}$ precursors from the *Discoverer* and the Associated Fleet, and that it is not necessary to use a photochemical model to further evaluate secondary $PM_{2.5}$ formation in these permitting actions.

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Appendix D: Example of a Hybrid Qualitative/Quantitative Assessment of the Potential for Secondary $PM_{2.5}$ Formation

In late 2013/early 2014, a permit applicant, Sasol, engaged and closely coordinated with the EPA Region 6 Office and the Louisiana Department of Environmental Quality (LDEQ) in the development of a hybrid qualitative/quantitative assessment of the potential for secondary fine particulate matter ($PM_{2.5}$) formation to cause or contribute to a violation of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) for their proposed major facility expansions in Southern Louisiana. Sasol's expansion and new plant are a very large investment (up to $18 Billion), and Sasol and LDEQ worked closely with Region 6 to ensure that the ambient impacts analysis was robust and defendable. In this particular hybrid assessment, Sasol took an approach of using the formerly presumptive interpollutant trading ratios for NO_x and SO_2 to $PM_{2.5}$ offsets and conservatively applied them in an illustrative example to demonstrate how relatively inconsequential the impacts of secondary $PM_{2.5}$ formation would be in the area of significant impact surrounding their facility. In Sasol's case, the projected emissions increases of the direct $PM_{2.5}$ emissions and both $PM_{2.5}$ precursors of NO_x and SO_2 were above their respective Significant Emissions Rates (SERs). Sasol also performed an analysis of $PM_{2.5}$ speciated monitoring data to further support the amount of impacts of nitrates on high $PM_{2.5}$ values in the area is relatively small and corroborate the ratio based analysis. Thus, this situation is an example of a Case 3 assessment as presented in Table III-1 of this guidance.

It is important to note that the EPA revised the provisions of the interpollutant trading policy for $PM_{2.5}$ on July 21, 2011, as described in Section III.2.2 of this guidance, to remove the general presumptiveness of the interpollutant trading ratios without further technical justification. Sasol is located in Southwestern Louisiana near the coast but chose to use the western state value of 100 for NOx as a more conservative assessment. Sasol did not seek to directly apply the formerly presumptive interpollutant trading ratios in an absolute sense. Rather, the intention was to present the analysis in a manner to determine if further technical justification would be required or if the application of the formerly presumptive interpollutant trading ratios where adequate in a hybrid qualitative/quantitative sense.

Using the formerly presumptive interpollutant trading ratios resulted in total projected secondary $PM_{2.5}$ formation of 0.18 $\mu g/m^3$ for the 24-hour $PM_{2.5}$NAAQS and of 0.04 $\mu g/m^3$ for the annual $PM_{2.5}$ NAAQS. When considered along with the primary $PM_{2.5}$ impacts and representative background data, the secondary $PM_{2.5}$ impacts with respect to the 24-hour NAAQS would have to be on the order of 32 times higher and to the annual NAAQS would have to be at least 15 times greater before a potential projected violation might occur. This also assumes that the maximum secondary $PM_{2.5}$ impacts from the NO_x and SO_2 precursor emissions would occur at the same place and time as the maximum primary $PM_{2.5}$ impacts. Based upon Sasol's $PM_{2.5}$ primary modeling projecting maximum concentrations very close to the facility and decreasing 60% within three kilometers of the facility, it is very unlikely that the primary and secondary maximums would ever occur at the same receptors. So, it would take a considerable and unreasonably conservative change to the interpollutant trading ratios used in this example before the NAAQS could be threatened based on the total proposed emissions increases from this facility.

At the same time Sasol also conducted an analysis of speciated data at a nearby monitor to further corroborate the ratio analysis. There is a $PM_{2.5}$ monitor within ½ mile of the Sasol's property line, but it does not have speciated data collection. Sasol utilized a representative $PM_{2.5}$ monitor approximately 25 miles away that did have long-term speciated data. Sasol evaluated the $PM_{2.5}$ speciated data from the nearby monitor to support that nitrate is not a large contributer to high $PM_{2.5}$ values on an annual basis or even on the higher daily values in the colder months when nitrates would be expected to yield more secondary $PM_{2.5}$.

Given the close coordination with the respective permitting authorities, it was determined that a more thorough technical demonstration with respect to interpollutant ratios specific to this source and area was not warranted and that the illustrative use of the formerly presumptive interpollutant trading ratios was sufficient to demonstrate that secondary $PM_{2.5}$ formation would not cause or contribute to a violation of the NAAQS. The permit applicant's corroborative analysis of the $PM_{2.5}$ speciated data further supported that the main increase of emissions (NO_x) would not be expected to yield significant levels of secondary $PM_{2.5}$ and the applicable ambient standards will not be exceeded by this project.

Region 6 example:

Justification on Secondary $PM_{2.5}$ Approach

At a December 13, 2013, meeting and on a January 17, 2014, conference call EPA Region 6 requested an analysis to examine the fraction of sulfate and nitrate in the $PM_{2.5}$ measurements in the study area and additional justification on the modeling approach for secondary $PM_{2.5}$. This document presents the results of the requested analysis.

Secondary $PM_{2.5}$ is formed primarily from reaction of sulfur dioxide (SO_2) emissions to form particulate sulfate and from nitrogen oxides (NO_x) reacting to form particulate nitrate. The approach used to estimate the secondary particulate is described in Section [Secondary Particulate Estimate *(listed below)*].

With regard to NO_x. and SO_2, the Sasol project emissions are dominated by NO_x with annual emissions of 1,595 tons per year compared to SO_2 emissions of only 121 tons per year. EPA requested additional information on the secondary $PM_{2.5}$ formation from nitrate in the colder months.

The $PM_{2.5}$ background monitor is the Westlake monitor located very near the project site. However, this monitor did not record speciated $PM_{2.5}$ data, so it is not possible to compute the sulfate and nitrate fractions at this location. Monitors with speciated $PM_{2.5}$ data include the Port Arthur Memorial School (AIRS: 48-245-0021) in Port Arthur, Texas, the Capitol Baton Rouge (AIRS: 22-033-0009), and the Shreveport (AIRS: 22-015-0008) monitors. The Port Arthur monitor was chosen as being the most representative because it is the closest monitor to the Sasol site and is in a less urban area than the Capitol Baton Rouge monitor and is not as far inland as the Shreveport monitor. The Port Arthur area is also located along the gulf coast and most closely represents the combination of a metropolitan size and industrial presence when compared to the Calcasieu Parish area where Sasol is located.

The Port Arthur monitor, located in Port Arthur, Texas, is approximately 25 miles west of the project. Given the regional nature of $PM_{2.5}$ concentrations, this monitor should be representative of the study area. The most recently available five years of data for this site was for 2006-2010 and was obtained from the USEPA. The data shows that nitrate makes up 2.6 percent of the average of the 24-hour concentrations of $PM_{2.5}$ and 2.3 percent of the 5-year average concentration. On the day with the highest 24-hour average $PM_{2.5}$ measurement, nitrate was 2.2 percent of the $PM_{2.5}$ concentration.

In general, the generation of $PM_{2.5}$ occurs more from nitrate during colder winter months than during the summer. Examination of the worst 10% of $PM_{2.5}$ days during the colder months (November through February) at the Port Arthur monitor for 2006-2010 reveals that the average nitrate contribution is 2.9 percent, only slightly higher than the 5-year average concentration. Thus, even on days with high $PM_{2.5}$ concentrations in the colder months, particulate nitrate is still a relatively small portion of the total $PM_{2.5}$ concentrations.

Based on this relatively low fraction of particulate nitrate in the observed $PM_{2.5}$, and the magnitude of existing NO_x emissions in the area, it is clear that secondary formation of particulate nitrate is not significant in the project area.

Particulate sulfate makes up 29.6 percent of the 5-year average of the 24-hour concentrations and 29.0 percent of the 5-year average concentrations. On the day with the highest 24-hour average $PM_{2.5}$ observation, sulfate was 10.6 percent of the $PM_{2.5}$ concentration.

Table 1 presents the total $PM_{2.5}$ ambient air impact estimated using the formerly approved interpollutant trading ratios. The nitrate equivalent ratio (1.026) is [6.5] times greater than the sulfate equivalent ratio ([1.004]). While sulfate does make up a significant portion of the total $PM_{2.5}$ mass, the projected increase in SO_2 emissions (121 tpy) from the Sasol GTL and LCCP projects are a very small fraction of the total SO_2 emissions in the large industrial area impacting Port Arthur (i.e. Beaumont/Port Arthur, Lake Charles, Houston/Galveston).

An implicit conservatism to the ratio approach that was used by Sasol is that the primary and secondary impacts occur at the same location at the same time. The 24-hour average modeled $PM_{2.5}$ concentration is presented in Figure 1. Examination of this figure reveals that the highest impact occurs very near the Sasol project border. Within a few kilometers of the project site, the concentrations fall significantly from the peak of modeled concentration of 9 $\mu g/m^3$ to less than 3 $\mu g/m^3$. Formation of secondary sulfate and nitrate particulate is a fairly slow process with conversion rates taking many hours to days. Thus, the peak secondary impacts are expected to occur well downwind of the peak primary impacts.

Given this information, the study team is comfortable that the ambient ratio analysis

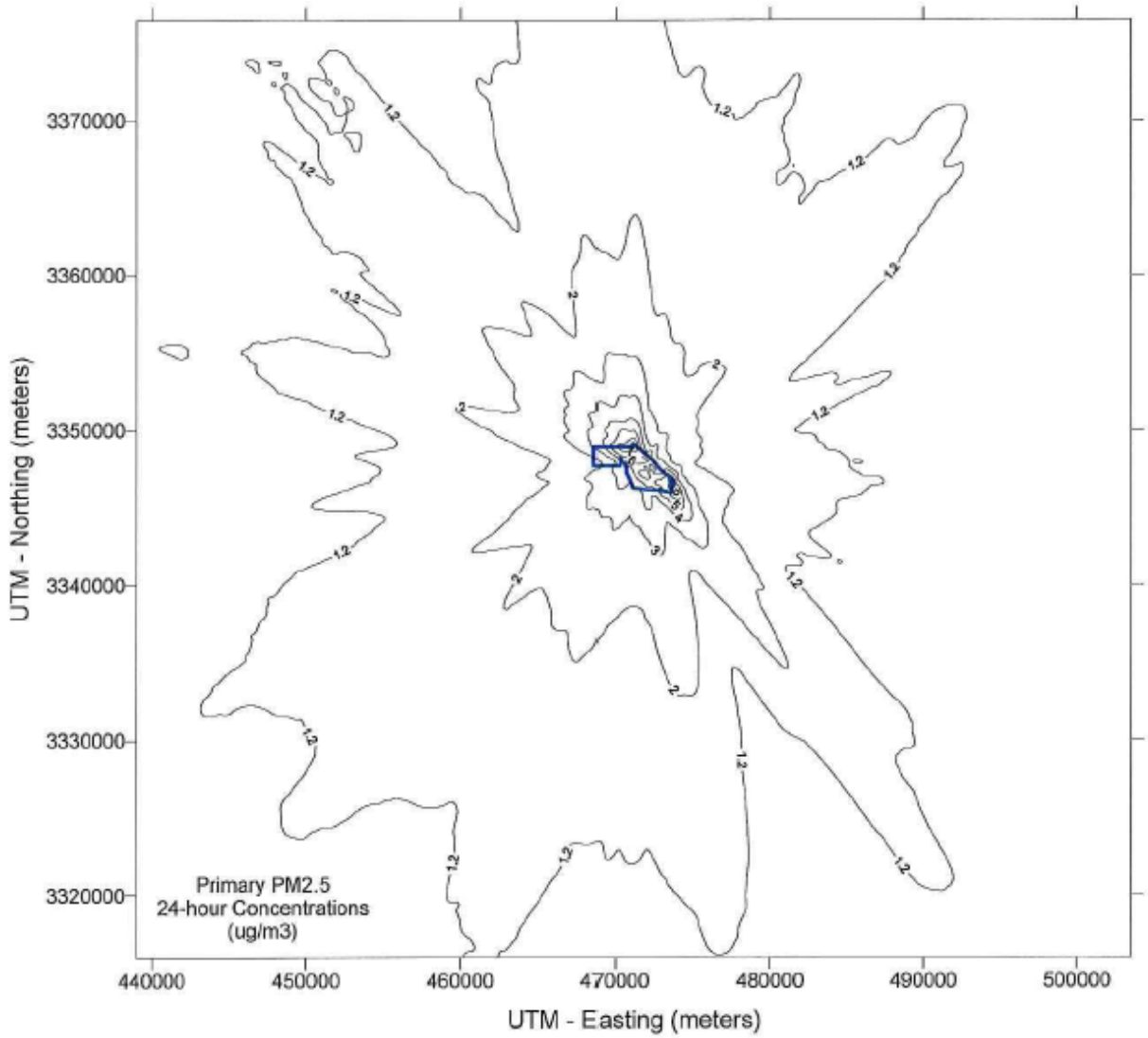
presented in the ozone and secondary $PM_{2.5}$ modeling report is an appropriate approach to estimating the secondary $PM_{2.5}$ impacts for the project.

Table 1: Total $PM_{2.5}$ (Primary + Secondary) Ambient Air Impacts with Comparison with NAAQS and PSD Increment Limits

	Modeled Primary $PM_{2.5}$ ($\mu g/m^3$)	Sulfate Equivalent Ratio	Nitrate Equivalent Ratio	Primary and Secondary $PM_{2.5}$ ($\mu g/m^3$)	PM2.5 Standard ($\mu g/m^3$)
NAAQS 24-hour	6	1.004	1.026	6.2 + 23 = 29.2	35
NAAQS Annual	1.6	1.004	1.026	1.6 + 9.8 = 11.4	12
PSD Increment 24-hour	7.6	1.004	1.026	7.8	9
PSD Increment Annual	1.5	1.004	1.026	1.5	4

Monitored background concentrations for $PM_{2.5}$ 24-hour is 23 $\mu g/m^3$ and for PM2.5 annual is 9.8 $\mu g/m^3$.

Figure 1: Sasol Primary 24-hour Maximum PM2.5 Concentration Isopleth ($\mu g/m^3$). Peak value is 8.6 $\mu g/m^3$.



[Secondary Particulate Estimate]

Recent EPA guidance (EPA March 2013) has suggested the need to examine secondary particulate formation. Directly emitted sulfur or nitrogen compounds are likely to react with available water and other pollutants in secondary reactions to form particulate ammonium sulfate –$(NH_4)_2SO_4$ or ammonium nitrate –NH_4NO_3. These latter compounds are formed primarily downwind of the specific sources of concern, given reaction times, ambient temperature and other environmental factors. The sulfur compounds emitted by the two projects are in the form of SO_2. The nitrogen compounds emitted by the two projects are in the form of NO_x. The Sasol projects (GTL and LCCP combined) would have 1,595 tpy of NO_x, 121 tpy SO_2, and 612 tpy of direct $PM_{2.5}$ emissions.

The NACAA/EPA recommendation to account for secondary $PM_{2.5}$ formation is to divide the projected emissions by a region average offset ratio. The national ratio for SO_2 is 40 and for NO_x is 100 for western states and 200 for eastern states. To be conservative, the western value was used in the analysis since it estimates a higher secondary ratio. The total $PM_{2.5}$ emissions are calculated by multiplying the primary $PM_{2.5}$ modeled concentration by the ratio obtained from the secondary equivalent $PM_{2.5}$ calculation.

For the Sasol combined project emissions the formulas are:

Total Equivalent $PM_{2.5}$ = Primary $PM_{2.5}$ + (SO_2/40) + (NO_x/100) = 612 + (121/400) + (1,595/100) = 631.0 ton/year

Total $PM_{2.5}$ Impact ($\mu g/m^3$) = Primary $PM_{2.5}$ Impact ($\mu g/m^3$) * (Total Equivalent Primary $PM_{2.5}$ (tpy) / Primary $PM_{2.5}$ (tpy))

Total Equivalent $PM_{2.5}$ / Primary $PM_{2.5}$ = 631.0 tpy / 612 tpy = 1.03

Hence the modeled impacts for $PM_{2.5}$ could be increased by a factor of 1.03 [(1.004 for SO_2 and 1.026 for NO_x)] to account for the secondary formation for those sources emitting significant amounts of secondary $PM_{2.5}$ precursor emissions.

Appendix E: Example of the background monitoring data calculations for a Second Tier 24-hour modeling analysis

This appendix provides an illustrative example of the calculations and data sorting recommendations for the background monitoring data to be used in a Second Tier 24-hour $PM_{2.5}$ modeling analysis. In this example, it was determined through discussion and coordination with the appropriate permitting authority that the impacts from the project source's primary $PM_{2.5}$ emissions were most prominent during the cool season and were not temporally correlated with background $PM_{2.5}$ levels that were typical highest during the warm season. So, combining the modeled and monitored contributions through a First Tier 24-hour $PM_{2.5}$ modeling analysis was determined to be potentially overly conservative. Extending the compliance demonstration to a Second Tier analysis allows for a more refined and appropriate assessment of the cumulative impacts on the primary $PM_{2.5}$ emissions in this particular situation.

The example provided is from an idealized Federal Reference Method (FRM) $PM_{2.5}$ monitoring site that operates on a daily (1-in-1 day) frequency with 100% data completeness. In this case, the annual 98th percentile concentration is the 8th highest concentration of the year. In most cases, the FRM monitoring site will likely operate on a 1-and-3 day frequency and will also likely have missing data due to monitor maintenance or collected data not meeting all of the quality assurance criteria. Please reference Appendix N to 40 CFR Part 50 to determine the appropriate 98th percentile rank of the monitored data based on the monitor sampling frequency and valid number of days sampled during each year.

The appropriate seasonal (or quarterly) background concentrations to be included as inputs to the AERMOD model per a Second Tier 24-hour $PM_{2.5}$ modeling analysis are as follows:

- Step 1 – Start with the most recent 3-years of representative background $PM_{2.5}$ ambient monitoring data that are being used to develop the monitored background $PM_{2.5}$ design value. In this example, the 3-years of 2008 to 2010 are being used to determine the monitored design value.

- Step 2 – For each year, determine the appropriate rank for the daily 98th percentile $PM_{2.5}$ concentration. Again, this idealized example is from a 1-in-1 day monitor with 100% data completeness. So, the 8th highest concentration of each year is the 98th percentile $PM_{2.5}$ concentration. The 98th percentile $PM_{2.5}$ concentration for 2008 is highlighted in Table E-1. The full concentration data from 2009 and 2010 are not shown across the steps in this Appendix for simplicity but would be similar to that of 2008.

- Step 3 – Remove from further consideration in this analysis the $PM_{2.5}$ concentrations from each year that are greater than the 98th percentile $PM_{2.5}$ concentration. In the case presented for a 1-in-1 day monitor, the top 7 concentrations are removed. If the monitor were a 1-in-3 day monitor, only the top 2 concentrations would be removed. The resultant dataset after the top 7 concentrations have been removed from further consideration in this analysis for 2008 is presented in Table E-2.

- Step 4 – For each year, divide the resultant annual dataset of the monitored data equal to or less than the 98th percentile $PM_{2.5}$ concentration into each season (or quarter). For 2008, the seasonal subsets are presented in Table E-3.

- Step 5 – Determine the maximum $PM_{2.5}$ concentration from each of the seasonal (or quarterly) subsets created in Step 4 for each year. The maximum $PM_{2.5}$ concentration from each season for 2008 is highlighted in Table E-3.

- Step 6 – Average the seasonal (or quarterly) maximums from Step 5 across the three years of monitoring data to create the four seasonal background PM2.5 concentrations to be included as inputs to the AERMOD model. These averages for the 2008 to 2010 dataset used in this example are presented in Table E-4. As noted above, the full concentration data from 2009 and 2010 are not shown across the steps in this Appendix for simplicity, but the seasonal maximums from 2009 and 2010 presented in Table E-4 were determined by following the previous five steps similar to that of 2008.

Table E-1. 2008 Daily $PM_{2.5}$ Concentrations

Date	Conc.	Date	Conc.	Date	Conc.	Date	Conc.	Date	Conc.	Date	Conc.	Date	Conc.	Date	Conc.
1-Jan	10.4	16-Feb	15.1	2-Apr	10.5	18-May	11.1	3-Jul	17.1	18-Aug	18.7	3-Oct	12.3	18-Nov	4.4
2-Jan	5.4	17-Feb	11.8	3-Apr	8.2	19-May	7.7	4-Jul	19.8	19-Aug	21.5	4-Oct	19.5	19-Nov	8.2
3-Jan	10.0	18-Feb	3.4	4-Apr	9.7	20-May	13.6	5-Jul	14.3	20-Aug	20.1	5-Oct	23.7	20-Nov	11.1
4-Jan	16.4	19-Feb	4.5	5-Apr	6.9	21-May	12.1	6-Jul	11.5	21-Aug	18.4	6-Oct	19.8	21-Nov	5.3
5-Jan	11.2	20-Feb	4.8	6-Apr	6.3	22-May	10.0	7-Jul	14.3	22-Aug	16.7	7-Oct	21.7	22-Nov	8.9
6-Jan	11.1	21-Feb	11.9	7-Apr	7.9	23-May	13.3	8-Jul	12.2	23-Aug	13.8	8-Oct	12.2	23-Nov	14.0
7-Jan	10.2	22-Feb	20.1	8-Apr	9.8	24-May	11.2	9-Jul	11.1	24-Aug	19.0	9-Oct	5.1	24-Nov	12.7
8-Jan	11.4	23-Feb	11.4	9-Apr	16.5	25-May	17.7	10-Jul	9.7	25-Aug	17.6	10-Oct	10.2	25-Nov	9.7
9-Jan	8.1	24-Feb	19.3	10-Apr	13.3	26-May	14.2	11-Jul	16.4	26-Aug	15.4	11-Oct	10.7	26-Nov	12.8
10-Jan	9.4	25-Feb	18.2	11-Apr	11.0	27-May	15.4	12-Jul	21.5	27-Aug	12.6	12-Oct	5.6	27-Nov	16.6
11-Jan	5.7	26-Feb	12.8	12-Apr	8.8	28-May	13.9	13-Jul	25.1	28-Aug	12.1	13-Oct	5.9	28-Nov	17.2
12-Jan	8.9	27-Feb	5.5	13-Apr	6.3	29-May	9.3	14-Jul	11.7	29-Aug	10.1	14-Oct	9.7	29-Nov	16.6
13-Jan	18.1	28-Feb	9.7	14-Apr	5.1	30-May	14.5	15-Jul	18.9	30-Aug	17.2	15-Oct	12.8	30-Nov	4.5
14-Jan	11.0	29-Feb	12.1	15-Apr	7.9	31-May	20.5	16-Jul	28.9	31-Aug	19.9	16-Oct	16.4	1-Dec	7.5
15-Jan	11.8	1-Mar	9.6	16-Apr	8.2	1-Jun	15.3	17-Jul	27.6	1-Sep	19.4	17-Oct	12.0	2-Dec	10.6
16-Jan	10.7	2-Mar	5.6	17-Apr	14.7	2-Jun	11.5	18-Jul	12.8	2-Sep	18.2	18-Oct	7.9	3-Dec	16.7
17-Jan	10.0	3-Mar	12.5	18-Apr	22.5	3-Jun	17.9	19-Jul	6.2	3-Sep	24.0	19-Oct	6.6	4-Dec	12.5
18-Jan	15.6	4-Mar	7.1	19-Apr	12.8	4-Jun	21.1	20-Jul	20.1	4-Sep	15.4	20-Oct	8.1	5-Dec	7.3
19-Jan	18.0	5-Mar	4.9	20-Apr	6.9	5-Jun	17.9	21-Jul	26.5	5-Sep	12.4	21-Oct	12.2	6-Dec	10.4
20-Jan	6.6	6-Mar	9.9	21-Apr	7.5	6-Jun	17.6	22-Jul	16.9	6-Sep	12.5	22-Oct	4.6	7-Dec	13.4
21-Jan	7.4	7-Mar	11.2	22-Apr	6.0	7-Jun	15.0	23-Jul	12.8	7-Sep	15.8	23-Oct	6.1	8-Dec	10.5
22-Jan	13.5	8-Mar	5.5	23-Apr	9.1	8-Jun	22.3	24-Jul	7.9	8-Sep	23.4	24-Oct	4.6	9-Dec	9.3
23-Jan	16.0	9-Mar	8.8	24-Apr	10.3	9-Jun	27.9	25-Jul	15.7	9-Sep	11.5	25-Oct	4.5	10-Dec	6.5
24-Jan	9.4	10-Mar	11.0	25-Apr	12.0	10-Jun	21.6	26-Jul	24.9	10-Sep	6.0	26-Oct	10.5	11-Dec	3.0
25-Jan	12.6	11-Mar	12.1	26-Apr	12.5	11-Jun	19.4	27-Jul	22.2	11-Sep	11.8	27-Oct	6.4	12-Dec	3.5
26-Jan	13.6	12-Mar	9.7	27-Apr	11.3	12-Jun	21.2	28-Jul	17.5	12-Sep	10.7	28-Oct	4.6	13-Dec	10.2
27-Jan	16.1	13-Mar	15.1	28-Apr	7.6	13-Jun	29.1	29-Jul	19.1	13-Sep	7.6	29-Oct	5.6	14-Dec	17.6
28-Jan	10.0	14-Mar	21.6	29-Apr	7.4	14-Jun	15.6	30-Jul	21.1	14-Sep	7.5	30-Oct	7.6	15-Dec	12.4
29-Jan	10.4	15-Mar	16.6	30-Apr	11.4	15-Jun	14.8	31-Jul	18.0	15-Sep	7.1	31-Oct	11.2	16-Dec	9.7
30-Jan	6.9	16-Mar	7.9	1-May	12.6	16-Jun	17.8	1-Aug	16.3	16-Sep	7.7	1-Nov	16.2	17-Dec	7.0
31-Jan	4.9	17-Mar	9.6	2-May	10.0	17-Jun	12.6	2-Aug	19.3	17-Sep	11.3	2-Nov	17.3	18-Dec	7.9
1-Feb	5.4	18-Mar	10.3	3-May	11.2	18-Jun	10.5	3-Aug	17.9	18-Sep	16.8	3-Nov	18.3	19-Dec	6.9
2-Feb	7.1	19-Mar	8.4	4-May	10.4	19-Jun	15.0	4-Aug	25.1	19-Sep	14.8	4-Nov	8.9	20-Dec	8.1
3-Feb	10.9	20-Mar	4.9	5-May	15.7	20-Jun	22.7	5-Aug	29.3	20-Sep	8.0	5-Nov	5.8	21-Dec	4.9
4-Feb	12.1	21-Mar	8.7	6-May	16.1	21-Jun	18.7	6-Aug	19.1	21-Sep	10.8	6-Nov	8.6	22-Dec	7.7
5-Feb	17.1	22-Mar	13.3	7-May	16.8	22-Jun	15.2	7-Aug	14.0	22-Sep	14.5	7-Nov	15.0	23-Dec	7.7
6-Feb	10.3	23-Mar	12.2	8-May	14.5	23-Jun	16.8	8-Aug	10.8	23-Sep	21.2	8-Nov	8.3	24-Dec	10.5
7-Feb	4.0	24-Mar	10.3	9-May	11.7	24-Jun	15.1	9-Aug	15.0	24-Sep	8.6	9-Nov	10.0	25-Dec	6.5
8-Feb	9.7	25-Mar	11.9	10-May	9.0	25-Jun	20.7	10-Aug	21.7	25-Sep	1.2	10-Nov	12.8	26-Dec	7.6
9-Feb	11.5	26-Mar	20.1	11-May	6.7	26-Jun	23.0	11-Aug	14.3	26-Sep	16.0	11-Nov	11.8	27-Dec	13.3
10-Feb	3.0	27-Mar	22.5	12-May	7.9	27-Jun	17.8	12-Aug	14.7	27-Sep	12.1	12-Nov	14.8	28-Dec	6.4
11-Feb	5.5	28-Mar	18.2	13-May	8.3	28-Jun	12.4	13-Aug	13.0	28-Sep	18.0	13-Nov	14.5	29-Dec	3.7
12-Feb	18.9	29-Mar	10.8	14-May	12.2	29-Jun	12.7	14-Aug	13.5	29-Sep	17.8	14-Nov	7.7	30-Dec	4.7
13-Feb	17.6	30-Mar	6.4	15-May	13.1	30-Jun	8.9	15-Aug	17.5	30-Sep	16.4	15-Nov	3.6	31-Dec	4.4
14-Feb	11.2	31-Mar	3.3	16-May	8.8	1-Jul	7.1	16-Aug	23.9	1-Oct	12.3	16-Nov	4.6		
15-Feb	14.4	1-Apr	7.8	17-May	8.2	2-Jul	13.8	17-Aug	18.4	2-Oct	8.2	17-Nov	7.8		

Annual 98th Percentile Concentration = 21.5 µg/m^3

Table E-2. 2008 Daily $PM_{2.5}$ Concentrations Less Than or Equal to the 98th Percentile

Date	Conc.	Date	Conc.	Date	Conc.	Date	Conc.	Date	Conc.	Date	Conc.	Date	Conc.	Date	Conc.
1-Jan	10.4	16-Feb	15.1	2-Apr	10.5	18-May	11.1	3-Jul	17.1	18-Aug	18.7	3-Oct	12.3	18-Nov	4.4
2-Jan	5.4	17-Feb	11.8	3-Apr	8.2	19-May	7.7	4-Jul	19.8	19-Aug	21.5	4-Oct	19.5	19-Nov	8.2
3-Jan	10.0	18-Feb	3.4	4-Apr	9.7	20-May	13.6	5-Jul	14.3	20-Aug	20.1	5-Oct	23.7	20-Nov	11.1
4-Jan	16.4	19-Feb	4.5	5-Apr	6.9	21-May	12.1	6-Jul	11.5	21-Aug	18.4	6-Oct	19.8	21-Nov	5.3
5-Jan	11.2	20-Feb	4.8	6-Apr	6.3	22-May	10.0	7-Jul	14.3	22-Aug	16.7	7-Oct	21.7	22-Nov	8.9
6-Jan	11.1	21-Feb	11.9	7-Apr	7.9	23-May	13.3	8-Jul	12.2	23-Aug	13.8	8-Oct	12.2	23-Nov	14.0
7-Jan	10.2	22-Feb	20.1	8-Apr	9.8	24-May	11.2	9-Jul	11.1	24-Aug	19.0	9-Oct	5.1	24-Nov	12.7
8-Jan	11.4	23-Feb	11.4	9-Apr	16.5	25-May	17.7	10-Jul	9.7	25-Aug	17.6	10-Oct	10.2	25-Nov	9.7
9-Jan	8.1	24-Feb	19.3	10-Apr	13.3	26-May	14.2	11-Jul	16.4	26-Aug	15.4	11-Oct	10.7	26-Nov	12.8
10-Jan	9.4	25-Feb	18.2	11-Apr	11.0	27-May	15.4	12-Jul	21.5	27-Aug	12.6	12-Oct	5.6	27-Nov	16.6
11-Jan	5.7	26-Feb	12.8	12-Apr	8.8	28-May	13.9	13-Jul	RC	28-Aug	12.1	13-Oct	5.9	28-Nov	17.2
12-Jan	8.9	27-Feb	5.5	13-Apr	6.3	29-May	9.3	14-Jul	11.7	29-Aug	10.1	14-Oct	9.7	29-Nov	16.6
13-Jan	18.1	28-Feb	9.7	14-Apr	5.1	30-May	14.5	15-Jul	18.9	30-Aug	17.2	15-Oct	12.8	30-Nov	4.5
14-Jan	11.0	29-Feb	12.1	15-Apr	7.9	31-May	20.5	16-Jul	RC	31-Aug	19.9	16-Oct	16.4	1-Dec	7.5
15-Jan	11.8	1-Mar	9.6	16-Apr	8.2	1-Jun	15.3	17-Jul	RC	1-Sep	19.4	17-Oct	12.0	2-Dec	10.6
16-Jan	10.7	2-Mar	5.6	17-Apr	14.7	2-Jun	11.5	18-Jul	12.8	2-Sep	18.2	18-Oct	7.9	3-Dec	16.7
17-Jan	10.0	3-Mar	12.5	18-Apr	22.5	3-Jun	17.9	19-Jul	6.2	3-Sep	24.0	19-Oct	6.6	4-Dec	12.5
18-Jan	15.6	4-Mar	7.1	19-Apr	12.8	4-Jun	21.1	20-Jul	20.1	4-Sep	15.4	20-Oct	8.1	5-Dec	7.3
19-Jan	18.0	5-Mar	4.9	20-Apr	6.9	5-Jun	17.9	21-Jul	RC	5-Sep	12.4	21-Oct	12.2	6-Dec	10.4
20-Jan	6.6	6-Mar	9.9	21-Apr	7.5	6-Jun	17.6	22-Jul	16.9	6-Sep	12.5	22-Oct	4.6	7-Dec	13.4
21-Jan	7.4	7-Mar	11.2	22-Apr	6.0	7-Jun	15.0	23-Jul	12.8	7-Sep	15.8	23-Oct	6.1	8-Dec	10.5
22-Jan	13.5	8-Mar	5.5	23-Apr	9.1	8-Jun	22.3	24-Jul	7.9	8-Sep	23.4	24-Oct	4.6	9-Dec	9.3
23-Jan	16.0	9-Mar	8.8	24-Apr	10.3	9-Jun	RC	25-Jul	15.7	9-Sep	11.5	25-Oct	4.5	10-Dec	6.5
24-Jan	9.4	10-Mar	11.0	25-Apr	12.0	10-Jun	21.6	26-Jul	24.9	10-Sep	6.0	26-Oct	10.5	11-Dec	3.0
25-Jan	12.6	11-Mar	12.1	26-Apr	12.5	11-Jun	19.4	27-Jul	22.2	11-Sep	11.8	27-Oct	6.4	12-Dec	3.5
26-Jan	13.6	12-Mar	9.7	27-Apr	11.3	12-Jun	21.2	28-Jul	17.5	12-Sep	10.7	28-Oct	4.6	13-Dec	10.2
27-Jan	16.1	13-Mar	15.1	28-Apr	7.6	13-Jun	RC	29-Jul	19.1	13-Sep	7.6	29-Oct	5.6	14-Dec	17.6
28-Jan	10.0	14-Mar	21.6	29-Apr	7.4	14-Jun	15.6	30-Jul	21.1	14-Sep	7.5	30-Oct	7.6	15-Dec	12.4
29-Jan	10.4	15-Mar	16.6	30-Apr	11.4	15-Jun	14.8	31-Jul	18.0	15-Sep	7.1	31-Oct	11.2	16-Dec	9.7
30-Jan	6.9	16-Mar	7.9	1-May	12.6	16-Jun	17.8	1-Aug	16.3	16-Sep	7.7	1-Nov	16.2	17-Dec	7.0
31-Jan	4.9	17-Mar	9.6	2-May	10.0	17-Jun	12.6	2-Aug	19.3	17-Sep	11.3	2-Nov	17.3	18-Dec	7.9
1-Feb	5.4	18-Mar	10.3	3-May	11.2	18-Jun	10.5	3-Aug	17.9	18-Sep	16.8	3-Nov	18.3	19-Dec	6.9
2-Feb	7.1	19-Mar	8.4	4-May	10.4	19-Jun	15.0	4-Aug	25.1	19-Sep	14.8	4-Nov	8.9	20-Dec	8.1
3-Feb	10.9	20-Mar	4.9	5-May	15.7	20-Jun	22.7	5-Aug	RC	20-Sep	8.0	5-Nov	5.8	21-Dec	4.9
4-Feb	12.1	21-Mar	8.7	6-May	16.1	21-Jun	18.7	6-Aug	19.1	21-Sep	10.8	6-Nov	8.6	22-Dec	7.7
5-Feb	17.1	22-Mar	13.3	7-May	16.8	22-Jun	15.2	7-Aug	14.0	22-Sep	14.5	7-Nov	15.0	23-Dec	7.7
6-Feb	10.3	23-Mar	12.2	8-May	14.5	23-Jun	16.8	8-Aug	10.8	23-Sep	21.2	8-Nov	8.3	24-Dec	10.5
7-Feb	4.0	24-Mar	10.3	9-May	11.7	24-Jun	15.1	9-Aug	15.0	24-Sep	8.6	9-Nov	10.0	25-Dec	6.5
8-Feb	9.7	25-Mar	11.9	10-May	9.0	25-Jun	20.7	10-Aug	21.7	25-Sep	1.2	10-Nov	12.8	26-Dec	7.6
9-Feb	11.5	26-Mar	20.1	11-May	6.7	26-Jun	23.0	11-Aug	14.3	26-Sep	16.0	11-Nov	11.8	27-Dec	13.3
10-Feb	3.0	27-Mar	22.5	12-May	7.9	27-Jun	17.8	12-Aug	14.7	27-Sep	12.1	12-Nov	14.8	28-Dec	6.4
11-Feb	5.5	28-Mar	18.2	13-May	8.3	28-Jun	12.4	13-Aug	13.0	28-Sep	18.0	13-Nov	14.5	29-Dec	3.7
12-Feb	18.9	29-Mar	10.8	14-May	12.2	29-Jun	12.7	14-Aug	13.5	29-Sep	17.8	14-Nov	7.7	30-Dec	4.7
13-Feb	17.6	30-Mar	6.4	15-May	13.1	30-Jun	8.9	15-Aug	17.5	30-Sep	16.4	15-Nov	3.6	31-Dec	4.4
14-Feb	11.2	31-Mar	3.3	16-May	8.8	1-Jul	7.1	16-Aug	23.9	1-Oct	12.3	16-Nov	4.6		
15-Feb	14.4	1-Apr	7.8	17-May	8.2	2-Jul	13.8	17-Aug	18.4	2-Oct	8.2	17-Nov	7.8		

Annual 98th Percentile Concentration = 21.5 µg/m^3
RC = Above 98th Percentile and Removed from Consideration

Table E-3. 2008 Daily $PM_{2.5}$ Concentrations Less Than or Equal to the 98th Percentile by Quarter

Season / Quarter 1			
Date	Conc.	Date	Conc.
1-Jan	10.4	16-Feb	15.1
2-Jan	5.4	17-Feb	11.8
3-Jan	10.0	18-Feb	3.4
4-Jan	16.4	19-Feb	4.5
5-Jan	11.2	20-Feb	4.8
6-Jan	11.1	21-Feb	11.9
7-Jan	10.2	22-Feb	20.1
8-Jan	11.4	23-Feb	11.4
9-Jan	8.1	24-Feb	19.3
10-Jan	9.4	25-Feb	18.2
11-Jan	5.7	26-Feb	12.8
12-Jan	8.9	27-Feb	5.5
13-Jan	18.1	28-Feb	9.7
14-Jan	11.0	29-Feb	12.1
15-Jan	11.8	1-Mar	9.6
16-Jan	10.7	2-Mar	5.6
17-Jan	10.0	3-Mar	12.5
18-Jan	15.6	4-Mar	7.1
19-Jan	18.0	5-Mar	4.9
20-Jan	6.6	6-Mar	9.9
21-Jan	7.4	7-Mar	11.2
22-Jan	13.5	8-Mar	5.5
23-Jan	16.0	9-Mar	8.8
24-Jan	9.4	10-Mar	11.0
25-Jan	12.6	11-Mar	12.1
26-Jan	13.6	12-Mar	9.7
27-Jan	16.1	13-Mar	15.1
28-Jan	10.0	14-Mar	21.6
29-Jan	10.4	15-Mar	16.6
30-Jan	6.9	16-Mar	7.9
31-Jan	4.9	17-Mar	9.6
1-Feb	5.4	18-Mar	10.3
2-Feb	7.1	19-Mar	8.4
3-Feb	10.9	20-Mar	4.9
4-Feb	12.1	21-Mar	8.7
5-Feb	17.1	22-Mar	13.3
6-Feb	10.3	23-Mar	12.2
7-Feb	4.0	24-Mar	10.3
8-Feb	9.7	25-Mar	11.9
9-Feb	11.5	26-Mar	20.1
10-Feb	3.0	27-Mar	22.5
11-Feb	5.5	28-Mar	18.2
12-Feb	18.9	29-Mar	10.8
13-Feb	17.6	30-Mar	6.4
14-Feb	11.2	31-Mar	3.3
15-Feb	14.4		
Seasonal / Quarterly Maximum			22.5

Season / Quarter 2			
Date	Conc.	Date	Conc.
1-Apr	7.8	17-May	8.2
2-Apr	10.5	18-May	11.1
3-Apr	8.2	19-May	7.7
4-Apr	9.7	20-May	13.6
5-Apr	6.9	21-May	12.1
6-Apr	6.3	22-May	10.0
7-Apr	7.9	23-May	13.3
8-Apr	9.8	24-May	11.2
9-Apr	16.5	25-May	17.7
10-Apr	13.3	26-May	14.2
11-Apr	11.0	27-May	15.4
12-Apr	8.8	28-May	13.9
13-Apr	6.3	29-May	9.3
14-Apr	5.1	30-May	14.5
15-Apr	7.9	31-May	20.5
16-Apr	8.2	1-Jun	15.3
17-Apr	14.7	2-Jun	11.5
18-Apr	22.5	3-Jun	17.9
19-Apr	12.8	4-Jun	21.1
20-Apr	6.9	5-Jun	17.9
21-Apr	7.5	6-Jun	17.6
22-Apr	6.0	7-Jun	15.0
23-Apr	9.1	8-Jun	22.3
24-Apr	10.3	9-Jun	RC
25-Apr	12.0	10-Jun	21.6
26-Apr	12.5	11-Jun	19.4
27-Apr	11.3	12-Jun	21.2
28-Apr	7.6	13-Jun	RC
29-Apr	7.4	14-Jun	15.6
30-Apr	11.4	15-Jun	14.8
1-May	12.6	16-Jun	17.8
2-May	10.0	17-Jun	12.6
3-May	11.2	18-Jun	10.5
4-May	10.4	19-Jun	15.0
5-May	15.7	20-Jun	22.7
6-May	16.1	21-Jun	18.7
7-May	16.8	22-Jun	15.2
8-May	14.5	23-Jun	16.8
9-May	11.7	24-Jun	15.1
10-May	9.0	25-Jun	20.7
11-May	6.7	26-Jun	23.0
12-May	7.9	27-Jun	17.8
13-May	8.3	28-Jun	12.4
14-May	12.2	29-Jun	12.7
15-May	13.1	30-Jun	8.9
16-May	8.8		
Seasonal / Quarterly Maximum			23.0

Season / Quarter 3			
Date	Conc.	Date	Conc.
1-Jul	7.1	16-Aug	23.9
2-Jul	13.8	17-Aug	18.4
3-Jul	17.1	18-Aug	18.7
4-Jul	19.8	19-Aug	21.5
5-Jul	14.3	20-Aug	20.1
6-Jul	11.5	21-Aug	18.4
7-Jul	14.3	22-Aug	16.7
8-Jul	12.2	23-Aug	13.8
9-Jul	11.1	24-Aug	19.0
10-Jul	9.7	25-Aug	17.6
11-Jul	16.4	26-Aug	15.4
12-Jul	21.5	27-Aug	12.6
13-Jul	RC	28-Aug	12.1
14-Jul	11.7	29-Aug	10.1
15-Jul	18.9	30-Aug	17.2
16-Jul	RC	31-Aug	19.9
17-Jul	RC	1-Sep	19.4
18-Jul	12.8	2-Sep	18.2
19-Jul	6.2	3-Sep	24.0
20-Jul	20.1	4-Sep	15.4
21-Jul	RC	5-Sep	12.4
22-Jul	16.9	6-Sep	12.5
23-Jul	12.8	7-Sep	15.8
24-Jul	7.9	8-Sep	23.4
25-Jul	15.7	9-Sep	11.5
26-Jul	24.9	10-Sep	6.0
27-Jul	22.2	11-Sep	11.8
28-Jul	17.5	12-Sep	10.7
29-Jul	19.1	13-Sep	7.6
30-Jul	21.1	14-Sep	7.5
31-Jul	18.0	15-Sep	7.1
1-Aug	16.3	16-Sep	7.7
2-Aug	19.3	17-Sep	11.3
3-Aug	17.9	18-Sep	16.8
4-Aug	25.1	19-Sep	14.8
5-Aug	RC	20-Sep	8.0
6-Aug	19.1	21-Sep	10.8
7-Aug	14.0	22-Sep	14.5
8-Aug	10.8	23-Sep	21.2
9-Aug	15.0	24-Sep	8.6
10-Aug	21.7	25-Sep	1.2
11-Aug	14.3	26-Sep	16.0
12-Aug	14.7	27-Sep	12.1
13-Aug	13.0	28-Sep	18.0
14-Aug	13.5	29-Sep	17.8
15-Aug	17.5	30-Sep	16.4
Seasonal / Quarterly Maximum			25.1

Season / Quarter 4			
Date	Conc.	Date	Conc.
1-Oct	12.3	16-Nov	4.6
2-Oct	8.2	17-Nov	7.8
3-Oct	12.3	18-Nov	4.4
4-Oct	19.5	19-Nov	8.2
5-Oct	23.7	20-Nov	11.1
6-Oct	19.8	21-Nov	5.3
7-Oct	21.7	22-Nov	8.9
8-Oct	12.2	23-Nov	14.0
9-Oct	5.1	24-Nov	12.7
10-Oct	10.2	25-Nov	9.7
11-Oct	10.7	26-Nov	12.8
12-Oct	5.6	27-Nov	16.6
13-Oct	5.9	28-Nov	17.2
14-Oct	9.7	29-Nov	16.6
15-Oct	12.8	30-Nov	4.5
16-Oct	16.4	1-Dec	7.5
17-Oct	12.0	2-Dec	10.6
18-Oct	7.9	3-Dec	16.7
19-Oct	6.6	4-Dec	12.5
20-Oct	8.1	5-Dec	7.3
21-Oct	12.2	6-Dec	10.4
22-Oct	4.6	7-Dec	13.4
23-Oct	6.1	8-Dec	10.5
24-Oct	4.6	9-Dec	9.3
25-Oct	4.5	10-Dec	6.5
26-Oct	10.5	11-Dec	3.0
27-Oct	6.4	12-Dec	3.5
28-Oct	4.6	13-Dec	10.2
29-Oct	5.6	14-Dec	17.6
30-Oct	7.6	15-Dec	12.4
31-Oct	11.2	16-Dec	9.7
1-Nov	16.2	17-Dec	7.0
2-Nov	17.3	18-Dec	7.9
3-Nov	18.3	19-Dec	6.9
4-Nov	8.9	20-Dec	8.1
5-Nov	5.8	21-Dec	4.9
6-Nov	8.6	22-Dec	7.7
7-Nov	15.0	23-Dec	7.7
8-Nov	8.3	24-Dec	10.5
9-Nov	10.0	25-Dec	6.5
10-Nov	12.8	26-Dec	7.6
11-Nov	11.8	27-Dec	13.3
12-Nov	14.8	28-Dec	6.4
13-Nov	14.5	29-Dec	3.7
14-Nov	7.7	30-Dec	4.7
15-Nov	3.6	31-Dec	4.4
Seasonal / Quarterly Maximum			23.7

Seasonal / Quarterly Maximum Concentration
RC = Above 98th Percentile and Removed from Consideration

Table E-4. Resulting Average of Seasonal (or Quarterly) Maximums for Inclusion into AERMOD

Seasonal / Quarterly Average Highest Monitored Concentration

(From Annual Datasets Equal To and Less Than the 98th Percentile)

	Q1	Q2	Q3	Q4
2008	22.5	23.0	25.1	23.7
2009	21.1	20.7	21.2	19.8
2010	20.7	22.6	23.5	20.7
Average	**21.433**	**22.100**	**23.267**	**21.400**

(Note, the complete datasets for 2009 and 2010 are not shown in Appendix E but would follow the same steps as for 2008)

United States
Environmental Protection
Agency

Office of Air Quality Planning and Standards
Air Quality Assessment Division
Research Triangle Park, NC

Publication No. EPA-454/B-14-001
[May 2014]

From:	Gary
To:	Finke, John (Health)
Subject:	TGP - public comment
Date:	Wednesday, August 03, 2016 4:24:47 PM
Attachments:	JOHN FINKE - LETTER # 4.docx JOHN FINKE - Letter # 5.docx JOHN FINKE - LETTER # 6.docx John Finke - Letter 1.docx John Finke – Letter 2.docx John Finke - Letter 3.docx

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Mr. John Finke
Metro Public Health department
2500 Charlotte Avenue
Nashville, TN 37209

Mr.

Finke,

Please find my comments attached.

Gary Moore4
Sent from Mail for Windows 10

John Finke – Letter 1

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TGP/KM # 563. Specifically, how can the Metro Health Department issue an air/construction permit in direct violation of not one, but two sections of the Metro Code of Law?

As you will recall, substitute ordinance no. BL2015-1210 by Councilman Lonnell Matthews passed the Metro Council and is now in the Metro Code of Laws. You will further recall, the second substitute ordinance no. BL2016-234 by Councilman Fabian Bedne also passed the Metro Council and is now law.

1) SUBSITUTE ORDINANCE NO. BL2015-1210
An ordinance to amend various sections of Title 17 of the Metropolitan Zoning Code related to natural gas compressor stations. (Proposal No. 2015Z-014TX-001).
WHEREAS, Natural gas compressor stations are operationally and physically similar to an industrial use;
WHEREAS, Industrial uses are incompatible with many other land uses and are not sensitive to the environment; and
WHEREAS, Because of the similarity to industrial uses, natural gas compressor stations are only appropriate in industrial zoning districts.
NOW, THEREFORE, BE IT ENACTED BY THE COUNTY OF THE METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY:
Section 1. Section 17.04.060 (Definitions of general terms) of the Metropolitan Code is hereby amended by inserting the follow definition of "Natural Gas Compressor Station":
Natural Gas Compressor Station means a facility designed and constructed to compress natural gas that originates from an Oil and Gas well or collection of such wells operating as a midstream facility for delivery of Oil and Gas to a transmission pipeline, distribution pipeline, Natural Gas Processing Plant or underground storage field, including one or more natural gas compressors, associated buildings, pipes, valves, tanks and other equipment.
Section 2. Section 17.08.030.F (District land use tables) of the Metropolitan Code is hereby amended by adding "Compressor Station" as a permitted use (P) in IWD, IR and IG zoning districts.
Section 3. Table 17.20.030 (Parking requirements) of the Metropolitan Code is hereby amended by inserting the following row for "Compressor Station" under Industrial uses:
Natural Gas Compressor Station 1 space per employee
Section 4. This Ordinance shall take effect five (5) days from and after its passage and such change be published in a newspaper of general circulation, the welfare of The Metropolitan Government of Nashville and Davidson County requiring it.
Introduced by:

2) SECOND SUBSTITUTE ORDINANCE NO. BL2016-234

An ordinance amending various sections of Chapter 10.56 of the Metropolitan Code of Laws to allow additional information requirements under section 10.56.020.A.1, and to add Metropolitan Zoning Code compliance to the provisions of section 10.56.020H.

BE IT ENACTED BY THE COUNCIL OF THE METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY:

Section 1. That Chapter 10.56 of the Metropolitan Code of Laws shall be and the same is hereby amended by deleting Section 10.56.020.A in its entirety and substituting in lieu thereof the following new Section 10.56.020.A:

10.56.020 - Construction permits.

A. 1. It is unlawful for any person to install, erect, construct, reconstruct, alter, or add to, or cause to be installed, erected, constructed, reconstructed, altered or added to, any fuel-burning equipment, incinerator, process equipment, control device, or any equipment pertaining thereto, or any stack or chimney connected therewith, or to make or cause to be made any alteration or repairs which increases the amount of any air contaminant emitted by such source or which results in the emission of any air contaminant not previously emitted until application for a construction permit has been filed with the metropolitan health department and plans and specifications applicable to the work have been submitted to the director and a construction permit issued by him for such construction, installations, alterations or repairs. Applications for a construction permit shall be filed in duplicate in the offices of the director on forms adopted by the director and supplied by the metropolitan health department along with a copy of plans and specifications. The director shall not grant a construction permit to any source which does not comply with the provisions of the New Source Review Regulations as adopted by the board. If the director determines, on the basis of information available to him, that such source does, or in all likelihood will, operate in violation of this chapter, or that the source will operate so as to prevent attainment or maintenance of any national ambient air quality standard, he shall either impose conditions on the face of the construction permit that in his opinion will promote compliance with this chapter, and/or attainment and maintenance of any national ambient air quality standard, or he shall deny the application for the construction permit. At the request of the director, the applicant shall provide information necessary for the director to make the determination of whether the source does, or in all likelihood will, operate in violation of this chapter, or whether the source will operate so as to prevent attainment or maintenance of any national ambient air quality standard. For a major source, such information required may include a source impact analysis and air quality analysis as set out in regulations adopted by the Board. This section shall not apply to fuel-burning equipment used exclusively for heating less than three dwelling units, or to gas, or fuel oil equipment of five hundred thousand BTU input or less or to internal combustion engines.

2. In addition to any other remedies available on account of the issuance of an order prohibiting construction, installation, or establishment of any fuel-burning equipment, incinerator, process equipment, or control devices, and prior to invoking any such remedies, the person aggrieved

thereby shall, upon request in accordance with the provisions of this chapter and the rules and regulations adopted by the board be entitled to a hearing. Such hearing shall be conducted pursuant to the contested cases provisions of the Uniform Administrative Procedures Act, Tennessee Code Annotated, Title 4, Chapter 5, Part 3 (T.C.A. § 4-5-301 et seq.).
3. The absence or failure to issue a rule, regulation or order pursuant to this section shall not relieve any person from compliance with any emission control requirements or with any other provision of law.
Section 2. That Chapter 10.56 of the Metropolitan Code of Laws shall be and the same is hereby amended by deleting Section 10.56.020.H in its entirety and substituting in lieu thereof the following new Section 10.56.020.H:
H. No new source shall be granted a construction permit unless the new source complies with the Metropolitan Zoning Code for the use of the property on which the new source is to be constructed. For purposes of legal nonconforming uses, in accordance with Tenn. Code Ann. §13-7-208, this requirement shall not apply. The receipt of a construction permit from the Metropolitan Health Department shall not be construed to indicate approval of the strength or safety of any equipment or to indicate compliance with the requirements of the Building Code of Metropolitan Nashville and Davidson County or any other ordinance thereof. Neither shall it relieve anyone from the responsibility to comply fully with the applicable provisions of this Code, nor any other requirement(s) imposed by statute, rule or regulation of the Metropolitan Government of Nashville and Davidson County, Tennessee, the State of Tennessee or the United States Government.
Section 3. This Ordinance shall take effect from and after its enactment, the welfare of The Metropolitan Government of Nashville and Davidson County requiring it.
Sponsored by: Fabian Bedne, Jacobia Dowell, Karen Johnson, Tanaka Vercher
LEGISLATIVE HISTORY Introduced: May 3, 2016 Passed First Reading: May 3, 2016
Referred to: Codes, Fair, and Farmers' Market Committee Health, Hospitals, and Social Services Committee Substitute Introduced: May 17, 2016
Passed Second Reading: May 17, 2016
Deferred to July 5, 2016: June 7, 2016
Second Substitute Introduced: July 5, 2016
Passed Third Reading: July 5, 2016 - Roll Call Vote
Approved: July 6, 2016
By:
Requests for ADA accommodation should be directed to the Metropolitan Clerk at 615/862-6770.

Based on the two aforementioned Metro laws, I respectfully request that the Metro Health Department enforce the laws that were duly passed by two separate Metro Council bodies and deny the application for TGP/KM compressor station # 563.

Thank you,

Gary Moore

Mr. John Finke
Metro Public Health Department
2500 Charlotte Avenue
Nashville, TN 37209

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/comment regarding the air/construction permit for the Joelton compressor station TGP/KM # 563.

The following mission statement was taken directly from the Metro Nashville Health Department website:

> "The mission of the Metro Public Health Department is to protect, improve, and sustain the health and well-being of all people in Metropolitan Nashville."

In addition, the Metro Code of Law is very clear as it states in 10.56.170;

> **"10.56.170 - Emission of gases, vapors or objectionable odors.**
>
> No person shall cause, suffer, allow or permit any emission of gases, vapors or objectionable odors beyond the property line from any source whatsoever which causes injury, detriment, nuisance or annoyance to any considerable number of persons or to the public, or which causes or has a natural tendency to cause injury or damage to business or property."
>
> (Prior code § 4-1-10)

Given the forty documented ill effects sited below regarding compressor stations that give a clear indication of what to expect with compressor station 563 and 10.56.170 of the code; how can the Metro Health Department be expected **to protect, improve, and sustain the health and well-being of all people in Metropolitan Nashville** and see that **no person shall cause, suffer, allow or permit any emission of gases, vapors or objectionable odors beyond the property line from any source whatsoever which causes injury, detriment, nuisance or annoyance to any considerable number of persons or to the public, or which causes or has a natural tendency to cause injury or damage to business or property**?

It is my hope, that given the potential of serious ill effects of the proposed TGP/KM compressor station # 563, you will take time to open each link below and read firsthand the illnesses caused by compressor stations that are much smaller in size than the proposed Joelton station.

Not only do I think the right thing to do would be to deny the permit application, I also think it is incumbent on the Metro Health Department to adhere to their on mission statement and comply with the Metropolitan Code of Law.

Based on the afore mentioned, I respectfully request the Metro Health Department deny TGP/KM application for compressor station # 563 in Joelton.

Thanks,

Gary Moore

Appendix A

Restricted to only natural gas compressor station incidents, the compiled list of harmed taken from https://pennsylvaniaallianceforcleanwaterandair.wordpress.com/the-list/ is as follows:

1. #1) **Pam Judy and family**; Carmichael, PA; compressor station 780 feet from home; air exposure; blood tests revealed benzene and compound chemicals; symptoms include neurological (headaches, vertigo, fatigue), nausea, nosebleeds
2. #5) **Phyllis Carr and family**; Fayette County, PA; 3 compressor stations and dehydrator; air exposure; blood tests revealed phenol and benzene; symptoms include neurologic (headache, vertigo), blisters, sore throats, respiratory distress; http://www.frackcheckwv.net/2011/01/17/a-good-whiff-will-put-blisters-up-your-nose/
3. #11) **Wayne and Angel Smith**; Bedford County, PA; compressor station, pipeline and storage; air and water exposures; dead animals (5 cows, 12 chickens, 3 dogs and 4 cats); http://www.altoonamirror.com/page/content.detail/id/543123/clearville-residents-blame-reduced-property-values-on-natural-gas-project.html ; http://www.accountability-central.com/nc/single-view-default/article/voices-from-the-shale-citizen-regulators-trade-incidents/
4. #25) **Lorrie Squibb**; Flower Mound, TX; heavy gas production facilities; air exposure; diagnosis of multiple myeloma; http://www.dentonrc.com/local-news/special-projects/gas-well-drilling-headlines/20110831-breast-cancer-rate-climbs-up
5. #28) **Megan Collins**, Dish, TX; 32YO pediatric nurse; compressor station; air exposure; multiple tests but no confirmed diagnosis; symptoms include respiratory, neurological, sore throat, nausea; http://www.npr.org/templates/story/story.php?storyId=120043996
6. #51) **Susan Haire**; Morrisania Mesa, CO; compressor station and wells; air exposure; symptoms include sinus/sore throat, itch/rash, respiratory distress, extreme leg (nerve) pain; http://www.hcn.org/water/16376 ; also, *High Country News*, "Health is a casualty on the fast track to gas drilling"; Rebecca Clarren, January 12, 2006
7. #67) **Lloyd Burgess**, horse rancher; Dish, TX; compressor stations, pipelines, gas facilities; air exposure; dead horse, mare blinded; http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav_n_827478.html
8. #68) **Charles Morgan**, retired engineer/rancher; Freestone County, TX; compressor station 12KHP; air and noise exposure; increased, intense noise twice ruptured his eardrums as well as his daughter's eardrums; http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav_n_827478.html
9. #70) **Sharon Ward** (deceased 2011); Freestone County, TX; 130 compressors in county; air exposure; documented headaches, tinnitus and sleep disturbances due to high noise levels
10. #82) **Warren and Rebekah Sheffield (and 17 and 19YO sons**); Dish, TX; multiple compressor stations and pipelines; air exposure; symptoms include headaches, seizures, multiple chemical sensitivities; vertigo, nausea, hives, sore throats; http://dentonrc.com/local-news/special-projects/gas-well-drilling-headlines/20110328-atmosphere-of-concern (see for #s 82-84)

11. #83) **Chuck and Geri Pegg**; Dish, TX; compressor station within 300 feet from home; air and noise exposures; air samples indicate high levels of benzene and carbon disulfide per TX Department of Air Quality, which also revealed 4.8ppb (high) levels of formaldehyde; symptoms similar to other Dish, TX residents
12. #84) **Jim and Judy Caplinger**; Dish, TX; compressor stations; air and noise exposures; settled out of court with gas company for unnamed monetary amount in 2007
13. #209) **Mary Mack**; Bedford County, PA; compressor station; air and water exposures; arsenic and VOC's found; suffered dermatological and neurological symptoms; http://www.youtube.com/MaryMack#1.m4v
14. #308) **Ron Moss and wife**; gas production; air and water exposures; documented asthma; http://earthworksaction.org/files/publications/LOguideCh4.pdf?pubs/LOguideCh4.pdf
15. #573) **Louis, Bessie and daughter Lisa Vecchio**; Dunkard and Greene Townships, PA; five compressor stations; noise exposure; entered a 2011 lawsuit for excessive noise exposure; http://triblive.com/x/pittsburghtrib/news/regional/s_764486.html#axzz2CEGWAial
16. #574) **William Justiss**; Lamar County, TX; compressor station; air and noise exposures; nausea; one of 5 families in Supreme Court lawsuit ebrief #10/10045106.pdf
17. #575) **Tom and Judy Alspaugh**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms; see above ebrief
18. #576) **J.D. Mashburn and wife, Judy**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms; see above ebrief
19. #577) **J.D. Mashburn and Christine**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms; see above ebrief
20. #578) **J. Justiss**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms and cattle not feeding
21. #751) **Graham Feil**; compressor station; neurological symptoms; air exposure noted
22. #758/#759) **Doug Jenkins and Larry L. Joseph**; Carbon County, UT; compressor station; explosion; critical burns on bodies; crater formed 30 feet wide by 15 feet deep; http://www.bizjournals.com/denver/news/2012/11/21/2-injured-in-fire-at-bill-barrett-gas.html; *Denver Business Journal*; Mark Hardin
23. #766/#767) **Harriet Irby and Betty Clark**; Pentango, TX; compressor station; air exposure; ENT problems, respiratory distress; dead chickens; open valve venting NG and VOC's http://www.star-telegram.com/living/family/moms/article3828826.html; 9/2/2011; S. Schrock
24. #792) **Richard Usack**; Crawford County, PA; compressor station; noise and light exposure; http://www.tiogagaslease.org/images/BVW_11_03_09.pdf
25. #795) **Margaret Heinkel-Wolfe**; Denton County, TX; compressor station; air exposure; neurological and respiratory symptoms; #2010-40355362, November 3, 2010 lawsuit, *Heinkel v Wms Prod. Co., LLC*; suing for devalued property, formaldehyde, sulfur dioxide, benzene, toluene and xylene exposures emitted from compressor station caused documented illnesses
26. #888/#889) **Earl Wenger and Cindy Tout**; Dolores County, TX; air and noise exposures; neurological and ENT symptoms; http://fourcornersfreepress.com/?p=550 "Is Kinder Morgan a Good Neighbor?"; Gail Binkly, May 5, 2012
27. #890/#891**) Albert Nutgrass and Michael Brock**; Glenville, WVA; compressor station; fire on 10/6/2006; severely burned while replacing valves; lawsuit in Kanawha County #06-C-1749; http://wvrecord.com/stories/510590899-fireball-injured-workers-suit-says

28. #899) **Calvin Tillman and family**; Dish, TX; compressor stations and pipelines; air exposures; children suffered repeat nosebleeds; family moved away; http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav_n_827478.html
29. #1106) **Mandy Mobley and two sons**; Ft. Worth, TX; compressor station within 1000 feet of home; air exposure; allergies and related ENT symptoms, migraines, vertigo, fatigue; house has structural damage from constant vibrations; http://www.fwweekly.com/2013/01/16
30. #1204) **John Kurucz**, retired farmer; Wash County, PA; 27 drilling wells and countless compressor stations and pipelines; infrastructure placed on known 'slip' area and now hillside is sliding away; Kurucz says the pipeline company is blaming his cattle for walking on the area!; http://www.youtube.com/watch?v=qoohCRCZvuY "From the Frontlines"
31. #1220) **Lisa Beck and Sonny Beck**; Blair County, PA; fracking well and compressor station; air and water exposures; headaches, fatigue, vertigo, rash; http://womensnews.org/2013/04/fracking-natural-gas-fuels-health-worries/
32. #1355 thru #1369 (**15 people**); Somerset, NJ; compressor station; **flash fire**; 2 hospitalized with 13 minor injuries; fire began in an inactive part of pipeline; "Multiple Injuries Reported at Branchburg Gas Pipeline Facility Flash Fire", Walter O'Brien, 05-30-2013, http://www.nj.com/somerset/index.ssf/
33. #1376 to #1378 (**3 people**); Logan County, OK; compressor station; **explosion** in building 4/5/2013; no injuries; 3 homes **evacuated** at night; http://www.news9.com/.../homes-evacuated-after-gas-explosion-in-eastern-logan-county ; story #21886634
34. #1379/#1380) **Benjamin Groover, Sr., wife and 2 sons; Robert Nicklow**; Franklin County, PA; compressor station; air and noise exposure; *Bloomberg News*, "Chevron Among Drillers Facing Gas Wells Nuisance Lawsuit", Sophia Pearson and Jim Esttathiou, Jr., 06-10-2013; people seek damages for effects of chemical exposure, noise – exposed to methane leaks and noise that forced Groover and family to abandon home June 2009; Nicklow subjected to 'screeching' noise continuously and exposed to benzene, methane, ethane and is forced to stay inside; *Headley v Chevron Appalachia LLC*, Court of Common Pleas of Allegheny County, PA
35. #2492) **Jessica and Andy Keyon and two children**; Hancock, DE; compressor station and pipeline; evacuation due to compressor station main line venting millions of gallons of natural gas from 10 mile stretch of 30" pipelines; had to vent station for safety for hours on 12-5-2013; incident not reported by Millenium Pipeline to proper state/federal agencies!; http://www.watershedpost.com/2013/hancock-family-evacuated-after-pipeline-accident
36. #2515) **David Crichton**; compressor station; flash fire; burns suffered on hands and face 12-26-2013; http://www.dailyranger.com/story.php?story_id_10585 by Katie Roenigk
37. #5070) **Pramilla Malick and family**; Orange County, NY; compressor station; air exposure; asthma; http://www.truth-out.org/news/item/18636-rural-new-jersey-township-fights-ferc-approved-gas-compressor
38. #6153) **Dan Bykens**; Washington County, PA; compressor station; air exposure; asthma; http://www.observer-reporter.com/article/20140719/NEWS080101/140719418#.VAKMkFfiG2X
39. #7474) **Rebecca Williams**, registered nurse; Tarrant County, TX; compressor station; air exposure; dermatologic, neurologic, ENT, and respiratory symptoms and nausea; http://www.publicintegrity.org/2014/12/11/16396/health-worries
40. Not on the list of harmed are the following: 19YO **Taylor Ishee** – diagnosed with Burkitt's Leukemia at 19, but exposed to 37 gas wells and compressor stations within 1½ mile of his home; Taylor's best friend, **Justin Eaklor**, 21YO, diagnosed with lymphatic leukemia – lived 2/3 mile from 4 wells and compressor station. Texas Air Quality's Terry Clawson said, "TCEQ can't

determine the cause of residents' health problems…but it is highly unlikely that chemicals are being emitted at levels high enough to cause adverse health effects such as cancer, kidney damage or liver damage…TCEQ has found no cause for alarm". However, there are only 26 air monitoring stations are in place to monitor more than 6,000 compressor stations! At 11 stations, samples are taken only every six days. And of the 1,370 air quality complaints, TCEQ issued violation notices for 2% from 2009 to 2014 (five years). Yet, TCEQ states the consequences of this are negligible. According to the World Health Organization, "there is no safe level of exposure" with regard to benzene. However, TCEQ in 2007 raised the amount considered "safe" to 54ppb for short durations and 1.4ppb for long durations. Up to the late 1940's, research produced for the American Petroleum Industry and Shell "concluded that no amount of benzene was safe". And in a confidential report, Shell in 1943 stated, "prolonged exposures to low concentrations [to benzene] may be the most dangerous". https://www.publicintegrity.org/2014/12/11/16396/health-worries-pervade-north-texas-fracking-zone

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/comment regarding the air/construction permit for the Joelton compressor station TGP/KM # 563.

You have heard a brief, two minute, report from Bill Powers regarding the proposed TGP/KM gas compressor station for Joelton. I am sure by now you have taken the opportunity to read the full report. There are two points I would like to make regarding the TGP/KM application dated September 15, 2015. That is, in my opinion, TGP/GM were one, incompetent or two, were intentionally trying to deceive members of the Metro Health Department. I say this because in the Powers report he states: "The Tennessee Gas Pipeline Company, L.L.C.1 (TGP) has submitted a Reasonably Available Control Technology (RACT) analysis that uses outdated and incomplete information to incorrectly conclude that an oxides of nitrogen (NOx) limit of 25 ppm is RACT for the two Titan 250 turbines at the proposed Joelton Compressor Station. The Metro Nashville/Davidson County Air Pollution Control Division erroneously accepted the TGP RACT analysis with essentially no critical or independent review."

Regardless of whether their actions were a mistake or intentional, I think, it would be incumbent upon the Metro Health Department to assume that the individual submitting the application for a company that submits applications on a routine basis would have, or should have known, the information was outdated.

I am of the opinion they knew better, but knew this was a first for the Metro Health Department and thought they would get away with it. Who knows, maybe they would have had it not been for the Powers report.

Is this the only fallacy in their application?

As I have requested in previous emails, I respectfully ask that the application for the proposed compressor station # 563 in Joelton be denied.

Gary Moore

Mr. John Finke
Metro Public Health Department
2500 Charlotte Avenue
Nashville, TN 37209

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TGP/KM # 563. Specifically, if a citizen has pre-testing done, such as an annual physical, before the compressor is constructed and receives a clean bill of health, and sometime later undergoes post-testing that confirms they have developed an illness related to exposure to toxic substances – such as BTEX (benzene, toluene, ethylbenzene and xylene). Who will bear the burden of responsibility such as medical expenses and or disability or even worse death? Will it be the Metro Health Department if the department allows the facility to be built?

Thank You,

Gary Moore

Mr. John Finke
Metro Public Health Department
2500 Charlotte Avenue
Nashville, TN 37209

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TGP/KM # 563. Specifically, how often are emissions checked at the proposed compressor station? Given the recent exposer of TGP/KM inadequate maintenance and self-regulation of their pipes, will they also self-regulate their emissions? If not, who validates the figures for accuracy at the site? What happens if the numbers are exceeded? If numbers are exceeded, are these violations communicated to residents? Do violations result in fines levied against the company?

Based on TGP/KM unwillingness to properly maintain and inspect their existing equipment, I respectfully request that the Metro Health Department deny the TGP/KM application for compressor station # 563 in Joelton.

Thank you,

Gary Moore

Mr. John Finke
Metro Public Health Department
2500 Charlotte Avenue
Nashville, TN 37209

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TGP/KM # 563. Specifically: The Federal level specified for Prevention of Significant Deterioration is, I believe, 100,000 tons per year for greenhouse gas emissions. Yet the compressor station proposed for Joelton will emit over twice that amount: almost 219,000 tons per year. Why has this facility been exempted from having to meet PSD standards?

Based on TGP/KM exceeding the 100,000 TPY, I respectfully request that the Metro Health Department deny the application for TGP/KM compressor station # 563.

Thank you,

Gary Moore

From: James Wright
To: Finke, John (Health)
Subject: Joelton Gas Compressor
Date: Wednesday, August 03, 2016 4:24:02 PM

Dear Mr. Finke,
I want to thank you for devoting so much time to this issue. As a resident of Joelton living less than 1 mile from proposed site noise and air pollution is a real concern to me. My 90 year old mother moved in with us 2 years ago. She has been having trouble with noise bleeds. I'm concerned that the pollution from this Gas compressor will only add to the frequency. Please do all that is in your power to protect the citizens of Nashville.
Thanks and God bless,
Rev. Jim Wright
3041 Morgan Road
Joelton, Tn 37080

From: Gary Davis
To: Finke, John (Health)
Subject: TGP Public Comment
Date: Wednesday, August 03, 2016 4:18:05 PM

Mr. Finke,

Can you confirm you received the email from me with attachments?

Thanks,

Gary

Gary A. Davis
Davis & Whitlock, PC
21 Battery Park Avenue
Suite 206
Asheville, NC 28801
Phone: 828-622-0044
Fax: 828-398-0435
enviroattorney.com

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From:	Anne Davis
To:	Finke, John (Health)
Cc:	Barry, Megan (Mayor); "rich.riebling@nashville.gov"; Cooper, Jon (Legal); Lee, Josh (Legal); McClain, Blake (Health); "Gary Davis"; Gary Moore (tpffapres@comcast.net); lori@byfaithfarm.com; Bill Robertson (rjcoones@gmail.com); "Bill Powers"
Subject:	Permit to Construct or Modify Air Pollutant Source, Tennessee Gas Pipeline Company, LLC, Compressor Station 563; Permit No. C28XX Draft/Proposed Part 70 Operation Permit, Tennessee Gas Pipeline Company, LLC, Compressor Station 563, Permit No.
Date:	Wednesday, August 03, 2016 4:15:36 PM
Attachments:	Joelton Comment letter with attachment.pdf

Dear Mr. Finke,

Attached please find comments we are submitting on behalf of Concerned Citizens for a Safe Environment in connection with the proposed Joelton Compressor Station.

Please let me know if we can provide any further information.

Best,

Anne

Delta Anne Davis
Managing Attorney, Nashville Office
Southern Environmental Law Center
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Nashville, TN 37213
(615) 921-9470 (o)
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SOUTHERN ENVIRONMENTAL LAW CENTER

Telephone 615-921-9470 | 2 VICTORY AVENUE SOUTH, SUITE 500 NASHVILLE, TN 37213 | Facsimile 615-921-8011

August 3, 2016

John Finke, P.E., Director
Metro Public Health Department
Air Pollution Control Division
2500 Charlotte Avenue
Nashville, TN 37209
John.Finke@Nashville.gov

RE: Permit to Construct or Modify Air Pollutant Source, Tennessee Gas Pipeline Company, LLC, Compressor Station 563, Permit No. C28XX
Draft/Proposed Part 70 Operation Permit, Tennessee Gas Pipeline Company, LLC, Compressor Station 563, Permit No. 70-0XX

Dear Mr. Finke,

Thank you for the opportunity to comment on the two permits the Metropolitan Government of Nashville and Davidson County is proposing to issue to Tennessee Gas Pipeline Co., LLC for the construction and operation of Compressor Station 563 in Joelton, Tennessee. Southern Environmental Law Center submits these comments, together with the attached technical comments of Bill Powers, P.E. ("the Powers Report"), on behalf of Concerned Citizens for a Safe Environment.

The Joelton Compressor Station, as proposed by Tennessee Gas Pipeline (TGP), will be one of the very largest compressor stations in the Unites States, with two turbine engines of 29,766 horsepower each that will operate 24 hours a day, 7 days a week. It will be located in in a rural area of the county, on a parcel that is zoned for agricultural use, and adjacent to a park that provides afterschool activities for children. The two turbines will emit 167.4 tons per year of NO_x and 11.52 tons per year of VOC. As discussed in the Powers Report, as proposed the Joelton Compressor Station has the highest permitted NO_x emissions by far of **any** similar compressor stations that have applied for air permits over the last two years.[1] It will add a significant quantity of additional NO_x and VOC emissions from point sources of fuel combustion in

[1] Of the sites reviewed in the Powers Report, the Joelton Compressor Station is the only single compressor station that is classified as a major source, due to its potential to emit more than 100 tons per year of NO_x. The other contemporaneous compressor stations examined in the Powers Report have 15, 9, or 5 ppm NO_x controls, despite being located in areas that are in attainment for ozone. The sole exception is one much smaller compressor station in West Virginia, also proposed by Tennessee Gas Pipeline. Although this station's potential air emissions are well below the cutoff for Title V inclusion, its emissions were aggregated with those of an existing source, yielding a combined potential emissions figure above the cutoff.

Davidson County—an increase of 22% for both NO_x and VOC[2]--and in a region that is on the cusp of non-compliance with ambient air standards.[3] The additional emissions from the Joelton Compressor Station may influence health outcomes in the area, as NO_x and VOC emissions are associated with a range of negative health impacts alone and when they combine to form ozone.[4]

Applicable law requires that both permits be denied. First, issuance of the construction permit would violate the laws of Metropolitan Nashville and Davidson County because the Joelton Compressor Station, as proposed, violates local zoning ordinances. Second, issuance of the construction permit, as well as of the Part 70 Operation Permit, as drafted, would violate the standards in the applicable regulations because they fail to apply adequate Reasonably Available Control Technology to reduce toxic NO_x emissions.

1. The Construction Permit Must be Denied because its Issuance Would Violate the Law

First, issuance of the construction permit for the Joelton Compressor Station must be denied because it violates the recently passed Second Substitute Ordinance No. BL2016-234.[5] That ordinance, in pertinent part, provides:

> No new source shall be granted a construction permit unless the new source complies with the Metropolitan Zoning Code for the use of the property on which the new source is to be constructed.[6]

---

[2] The permits authorize the Joelton Compressor Station to emit 167.4 tons per year of NO_x and 11.5 tons per year of VOC; the additions of these emissions will increase Davidson County point source fuel combustion NO_x emissions from 760 to 927 tons per year and VOC emissions from 52.6 to 64.1 tons per year. Davidson County emissions data was accessed at: Metro Nashville/Davidson County Health Department Pollution Control Division, *Air Pollution Control – 2013 Annual Report* (publication pending).

[3] Although Davidson County is currently in compliance with the 2008 National Air Ambient Air Quality Standards for ozone, historical ozone data indicate that maintaining compliance with the new lower 8-hour ozone standard (which will replace the 2008 standards after 2018) may pose a challenge. Indeed, 8-hour ozone levels in Davidson County have exceeded the new standard (0.07 ppm) five times in the past two years. Source: EPA. "AirData." Accessed at: https://www3.epa.gov/airdata/.

[4] Short-term exposure to nitrogen dioxide, a compound within the larger category of NOx, is associated with adverse respiratory effects in people with and without asthma, and research has identified a connection between nitrogen dioxide inhalation and emergency room visits and hospital admissions for respiratory issues. NOx can react with other compounds to form tiny particles that can trigger or exacerbate respiratory disease and aggravate heart disease. Exposure to toxic VOCs may result in a range of health effects, including: eye, nose and throat irritation, headaches, loss of coordination and nausea; and damage to the liver, kidney, and central nervous system. EPA reports that some VOCs are suspected or known to cause cancer in humans. EPA. "Nitrogen Dioxide." Air & Radiation. Accessed at: https://www3.epa.gov/airquality/nitrogenoxides/index.html. EPA. "Volatile Organic Compounds Health Effects." Indoor Air Quality. Accessed at: https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality#Health_Effects.

[5] Nashville & Davidson County, Tenn., Second Substitute Ordinance No. BL2016-234 (to be codified at Municipal Code § 10.56).This ordinance was passed by the Metropolitan Council on July 5, 2016 by a vote of 25-3-6. It was approved by Mayor Megan Barry on July 6, 2016.

[6] Ibid.

The property at 7650 Whites Creek Pike on which Compressor Station 563 is proposed to be located is zoned for agricultural use.[7] Metropolitan zoning requires that compressor stations be located only in areas zoned for industrial use.[8] Thus, on its face, the construction application violates Metropolitan Nashville and Davidson County law.

Governmental authorities, such as Metropolitan Nashville and Davidson County, have a duty to enforce properly enacted laws such as the Second Substitute Ordinance.[9,10] Therefore, the application for the construction permit for the Joelton Compressor Station must be denied.

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[7] This parcel of land is classified under the zoning code AR2A, described on the metro planning website as "agricultural, requiring a minimum lot size of 2 acres and intended for uses that generally occur in rural areas, including single-family, two-family, and mobile homes." Metro Government of Nashville & Davidson County Planning Department, *Parcel ID 00900002600*, Mapping and GIS (Aug. 2, 2016 at 12:20 PM), http://maps.nashville.gov/ParcelViewer/

[8] Nashville & Davidson County, Tenn., Second Substitute Ordinance No. BL2015-1210 (Aug. 10, 2015) (amending Municipal Code § 17). This ordinance was passed by the Metropolitan Council on August 4, 2014 by a vote of 30-3-1. It was approved by Mayor Megan Barry on August 10, 2015.

[9] The Charter of the Metropolitan Government of Nashville and Davidson County specifically provides for the power to enact laws to regulate zoning and to protect public health (see Metropolitan Nashville and Davidson County, Tenn., Charter art. 2 sec. 2.01, and art. 10 ch. 1 .) The Metropolitan Code (see Metropolitan Nashville and Davidson County, Tenn., Code §10.56.090): also provides specific authority to the Health Board: "There is imposed upon the board in addition to those functions and duties set forth in Article 10, Chapter 1, of the Charter of the metropolitan government, the authority, power and duty to adopt, promulgate and enforce such rules and regulations to carry out the provisions of this chapter which the board deems necessary in order to achieve and maintain such levels of air quality as will protect human health and safety and to the greatest degree practical, prevent injury to plant life and property, foster the comfort and convenience of the inhabitants of the metropolitan government area and promote the economic and social development of the metropolitan government area; provided, that such rules and regulations shall not conflict with any laws of the state, the Charter of the metropolitan government or any ordinance of the metropolitan government, nor shall such rules and regulations exceed the limits of authority granted to the board in this chapter."

[10] Neither the United States Supreme Court nor the Sixth Circuit have ruled on the scope of preemption of local air, health or zoning ordinances under the Natural Gas Act. Recently, however, the Supreme Court in Oneok, Inc. v. Learjet, Inc. 135 S. Ct. 1591 (2015) limited federal preemption of the Natural Gas Act to allow state antitrust regulation of wholesale natural gas rates, even though that area was traditionally recognized as squarely within the exclusive jurisdictional scope of that Act. See Schneidewind v. ANR Pipeline Co., 485 U.S. 293, 308, 108 S. Ct. 1145 (1988).

The D.C. Circuit appears to be the only Court of Appeals that has examined preemption in the context of the Clean Air Act, and it has twice refused to determine the exact scope of preemption. Myersville Citizens for a Rural Cmty., Inc. v. Fed. Energy Regulatory Comm'n, 783 F 3d 1301,1321 (D.C. Cir. 2015) (declining to address question as not properly before court; Dominion Transmission v. Summers, 723 F. 3d 238, 245 (D.C. Cir. 2013) (deferring to Maryland Department of the Environment). The Fourth Circuit has examined the preemption issue, but only in the context of the Coastal Zone Management Act. AES Sparrows Point LNG, LLC v. Smith, 527 F.3rd 120 (4th Cir. 2008). With no guidance from the Supreme Court or the Sixth Circuit on this issue of first impression, the Metropolitan Nashville/Davidson County Health Department must follow local law and deny the permit. Moreover, in a case such as this, where the natural gas is being transported to a private company for export from the United States, the purposes for comprehensive regulation of the market by the Natural Gas Act do not exist.

2. **<u>Both the Construction Permit and the Draft/Proposed Part 70 Operation Permit Violate Applicable Law Because They do not Require that Toxic Emissions be Minimized by Reasonably Available Control Technology.</u>**

Because of the toxic nature of the NO_x emissions form the Joelton Compressor Station, applicable regulations require that Reasonably Available Control Technology (RACT) be applied to reduce NO_x emissions.[11] The owner or operator—here TGP—must submit the RACT analysis, which is then evaluated by the Metropolitan Nashville/Davidson County Health Department.[12] The 25 ppm of NO_x proposed by the RACT analysis for these permits would be the highest in the nation for similarly situated compressor stations.

As discussed in the Powers Report, TGP totally failed to provide a complete and accurate RACT analysis, and the Metropolitan Nashville/Davidson County Health Department erred in accepting that analysis and failing to conduct a robust independent analysis.

The attached Powers Report describes in detail how TGP's—and Metropolitan Nashville/Davidson County Health Department's -- RACT analysis is insufficient:

1. There is an almost exclusive reliance on the EPA's limited RACT/BACT/LAER Clearinghouse to evaluate NO_x limits and controls for gas turbines.
2. There is no identification or discussion of the three different dry low NO_x (DLN) control levels offered by the manufacturer for the Titan turbine: 25 ppm, 15 ppm, and 9 ppm, or of NO_x limits in contemporaneous Titan (or smaller) gas turbine compressor station air permit applications.
3. It relies on generic and obsolete selective catalytic reduction and DLN cost data from 1990.
4. There is no identification of an appropriate $/ton cost-effectiveness ceiling by which to compare the cost feasibility of available RACT options.

Most disturbingly, among other issues, the Powers Report demonstrates that TPG failed to disclose in its RACT analysis technology that TPG proposed almost contemporaneously in another state to lower the NO_x emissions to 9ppm—a 70% reduction from the 25 ppm it is proposing for the Joelton Compressor Station.[13]

Where, as here, the RACT analysis fails to comply with the applicable law, the permits must be denied.

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[11] Metro Nashville/Davidson County Health Department Division of Air Pollution Control, Regulation No. 14 – Regulation for Control of Nitrogen Oxides, Section 14-2: Emissions Standards, (p)(a), August 10, 1993, p. 1.
[12] Ibid, Section 14-3(a), p. 3.
[13] TGP filed an air permit application for its Supply Path Head Compressor Station in Pennsylvania about seven weeks after the Joelton Compressor Station application was filed. In this permit application, TGP opted for the 9 ppm NO_x DLN package.

3. Conclusion

Based on the Powers Report, and for the foregoing reasons, CCSE respectfully asks that the Metropolitan Nashville/Davidson County Health Department deny the Permit to Construct or Modify Air Pollutant Source, Tennessee Gas Pipeline Company, LLC, Compressor Station 563, Permit No. C28XX and the Draft/Proposed Part 70 Operation Permit, Tennessee Gas Pipeline Company, LLC, Compressor Station 563, Permit No. 70-0XX.

Thank you for the opportunity to provide comments.

Sincerely,

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Review of Reasonableness of NO_x Emission Limits for Two Titan Turbines at Proposed Joelton, Tennessee Compressor Station

Bill Powers, P.E.,[1] Powers Engineering, San Diego, California

August 1, 2016

I. Summary

The Tennessee Gas Pipeline Company, L.L.C.[2] (TGP) has submitted a Reasonably Available Control Technology (RACT) analysis that uses outdated and incomplete information to incorrectly conclude that a nitrogen oxides (NO_x) limit of 25 ppm is RACT for the two Titan 250 turbines at the proposed Joelton Compressor Station. The Metro Nashville/Davidson County Air Pollution Control Division erroneously accepted the TGP RACT analysis with essentially no critical or independent review.

Properly determined NO_x RACT for the two Titan 250 turbines is either 9 ppm NO_x using advanced dry low NO_x technology or 2.5 ppm NO_x using selective catalytic reduction. Both of these alternatives are technically and economically feasible using a NO_x RACT cost-effectiveness ceiling of $2,500/ton to $5,500/ton.

As proposed, the Joelton Compressor Station has the highest permitted NO_x emission rate by far among similar compressor stations that have applied for air permits within the last two years.[3] This is the case despite Joelton Compressor Station being the only compressor station among the six compressor stations evaluated that will be a major source of NO_x emissions under the federal Title V air permit program based on the potential for the compressor station to emit, by itself, more than 100 tons per year of NO_x.

II. Project Description

A Part 70 air operating permit application prepared by TGP for a new natural gas compressor station in Joelton, Tennessee was received on September 15, 2015 by the Air Pollution Control Division of the Metro Nashville/Davidson County Health Department. The proposed natural gas compressor station will consist of two Solar Titan 250-30000S natural gas-fired turbines and ancillary equipment, including one small heater and a back-up internal combustion engine.[4] Table 1 lists the annual air emissions potential of the two Titan 250 turbines at the Joelton Compressor Station.

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[1] Resume for Bill Powers, P.E. is provided as **Attachment A**.
[2] Tennessee Gas Pipeline Company, L.L.C. is a wholly-owned subsidiary of Kinder Morgan.
[3] The one exception is a substantially smaller TGP compressor station in Kanawha County, West Virginia - Compressor Station 119A. This station, like the proposed Joelton Compressor Station, is part of TGP's Broad Run Expansion Project and has the same 25 ppm NO_x limit proposed for the turbines at the Joelton Compressor Station.
[4] B. McClain – Air Pollution Control Division, Joelton Compressor Station Construction Permit Review, June 2016, pdf p. 11.

Table 1. Draft Permit Annual Air Emissions Limits – Two Titan 250 Turbines, TGP Joelton Compressor Station[5]

Pollutant	Annual emission limit (tpy), 12-month rolling average
NO_x	167.4
VOC	11.5
CO	107.6
PM_{10}	12.0
SO_2	6.2

NO_x = nitrogen oxides; VOC = volatile organic compounds; CO = carbon monoxide; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; SO_2 = sulfur dioxide.

The Joelton Compressor Station is classified as a major source under Metro Nashville/Davidson County air quality regulations, due to its potential to emit more than 100 tons per year (tpy) of NO_x.[6] Major sources are subject to the federal Title V operating permit program and are required to apply RACT to reduce NO_x emissions.[7] RACT is the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.[8]

The proposed compressor station is not a major NO_x source under the federal Prevention of Significant Deterioration (PSD) program, which has a trigger level of 250 tpy for compressor stations as an industrial category.

III. The Joelton Compressor Station, as Proposed, Will Add Significantly to NO_x and VOC Emissions in Metro Nashville

The Joelton Compressor Station will add a significant quantity of additional NO_x and VOC emissions from point sources of fuel combustion in Davidson County when the compressor station becomes operational. NO_x emissions from point sources of fuel combustion will increase 22 percent, from 760 tpy to 927 tpy.[9] VOC emissions from point sources of fuel combustion will also increase 22 percent, from 52.6 tpy to 64.1 tpy.[10,11]

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[5] Metro Nashville/Davidson County Health Department Air Pollution Control Division, *Draft/Proposed Part 70 (Title V) Operating Permit, Permit Number 70-0XXX, Tennessee Gas Pipeline Company, L.L.C. – Compressor Station 563, Joelton, TN*, June 2016, p. 13.

[6] Metro Nashville/Davidson County Health Department Division of Air Pollution Control, Regulation No. 13 - Part 70 Operating Permit Program, Section 13-1: Definitions, (p)(2), as amended December 2, 2010, p. 3.

[7] Ibid, Regulation 13-2: Applicability, (a)(1).

[8] Metropolitan Health Department Air Pollution Control Division, Regulation No. 14-1(f): Definitions.

[9] Metro Nashville/Davidson County Health Department Pollution Control Division, *Air Pollution Control – 2013 Annual Report* (publication pending), Table 1 – 2013 Davidson County Annual Emission Inventory, p. 5. 167.4 tpy/759.6 tpy = 0.22 (22 percent).

[10] Ibid. 11.5 tpy/52.6 tpy = 0.22 (22 percent).

[11] A second pipeline compressor station, Cane Ridge, has also been proposed for location in Davidson County. Cane Ridge will consist of two Titan 130 gas turbines with combined potential NO_x emissions of 78.2 tpy and VOC emissions of 10.2 tpy. The proposed NO_x limit for the Cane Ridge Titan 130 turbines is 25 ppm. See: Columbia Pipeline Group, *Columbia Gulf Transmission LLC, Cane Ridge Compressor Station, Air Quality Construction Permit and Initial Part 70 Operating Permit Application*, May 26, 2016, pdf pp. 16-17 and pdf pp. 26-27.

NO_x and VOC are ozone precursors, meaning these are necessary ingredients, in the presence of sunlight, to the formation of ozone in ambient air. Ozone is a lung irritant, and inhalation of ground-level ozone can trigger a range of health effects. EPA revised the primary and secondary ozone standards to 0.070 ppm in 2015, a decrease from the 2008 ozone standard of 0.075 ppm. The 2008 standards will be revoked in 2018-2019, and the 0.070 ppm standard will be incorporated into State Implementation Plans shortly thereafter.[12] Although Davidson County remains in attainment based on the 2008 ozone standard, 8-hour ozone levels have been exceeded 0.070 ppm five times in the past two years. This indicates that Davidson County may face challenges achieving continuous compliance with the 0.070 ppm ozone standard, even at the current emissions rate.[13]

IV. TGP's RACT Evaluation for the Joelton Compressor Station Was Incomplete and Inadequate

A. Scope of RACT Evaluation as Defined in Metro Regulation 14-3

Metro Nashville/Davidson County Air Pollution Control Division Regulation 14-3 defines in detail the RACT analysis procedure.[14] The owner or operator of each source of NO_x subject to the Regulation (except large utility boilers) must:

- Fully describe the applicable emission points and basis for estimating current and potential emissions.
- List the emission points and possible source emission points available for emission reductions.
- List each alternative nitrogen oxides control technique for each emission point such as burner modifications, process modifications, add-on control devices, etc., along with the emission reduction achievable by use of each alternative.
- List the cost of each alternative control technique, including initial costs as well as cost effectiveness (cost of control per ton of emission reduction).
- Where applicable, list regulatory requirements in other states in which identical or similar sources are subject to nitrogen oxide RACT requirement.
- Recommend the level of control considered to be RACT.

The Metro Nashville/Davidson County Health Department Air Pollution Control Division is responsible for determining whether or not the RACT demonstration is adequate to justify the RACT recommendation. This is to be accomplished by reviewing the list of alternative control techniques evaluated to ensure that all reasonably available and demonstrated control techniques were considered, by reviewing the cost analysis for reasonableness, and by independently

[12] EPA. "2015 Ozone NAAQS Timelines." *Ozone Pollution.* Accessed at: https://www.epa.gov/ozone-pollution/2015-ozone-naaqs-timelines
[13] Metro Nashville/Davidson County Health Department Air Pollution Control Division, *Air Pollution Control – 2013 Annual Report* (publication pending).
[14] Regulation 14-3(a) – Procedure for Determining RACT.

contacting other air pollution control agencies and the U.S. EPA to determine what level of control is required or suggested at identical or similar sources in other areas of jurisdiction.[15]

B. The RACT Evaluation Conducted by TGP and Accepted by Metro Nashville/Davidson County Health Department Was Inadequate and as a Result Reached the Wrong Conclusion

The TGP RACT evaluation included in the September 15, 2015 application concludes that a NO_x limit of 25 ppm using dry low NO_x (DLN) combustion is RACT for the two Titan 250 turbines at the Joelton Compressor Station.[16] The RACT evaluation identifies the following technically feasible NO_x control technologies for the two Titan 250 turbines proposed for the Joelton Compressor Station:[17]

- Selective catalytic reduction (SCR)
- DLN (also known as SoLoNO_x™)
- Steam/water injection
- Good operating practices

However, following the identification of these technically feasible NO_x control technologies, the TGP RACT analysis is completely inadequate in its assessment of the range and cost-effectiveness of the technologically feasible controls. As a result the analysis reaches the wrong conclusion regarding RACT for the Titan turbines. The principal inadequacies of the TGP RACT evaluation are:

1. An almost exclusive reliance on the EPA's RACT/BACT/LAER Clearinghouse to evaluate NO_x limits and controls for gas turbines.
2. No identification or discussion of the three different DLN NO_x control levels offered by the manufacturer for the Titan turbine: 25 ppm, 15 ppm, and 9 ppm, or of NO_x limits in contemporaneous Titan (or smaller) gas turbine compressor station air permit applications.
3. Reliance on generic and obsolete SCR and DLN cost data from 1990.[18]
4. No identification of an appropriate $/ton cost-effectiveness ceiling by which to compare the cost feasibility of available RACT options.

Each of these inadequacies in the TGP RACT evaluation is discussed in more detail in the following sections.

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[15] Ibid, Regulation 14-3(b).
[16] Tennessee Gas Pipeline Company, L.L.C., *Compressor Station 563, Davidson County, Joelton, TN – MHDDPC Title V Permit Application Updates and Supplemental Information*, September 11, 2015, p. 29.
[17] Ibid, p. 26.
[18] Ibid, p. 26.

1. **Reliance Solely on the EPA's Voluntary RACT/BACT/LAER Clearinghouse to Evaluate the Universe of NO_x Limits Is Inappropriate**

The RACT/BACT/LAER Clearinghouse (RBLC) is EPA's voluntary compilation of emission limits for a wide variety of air emission sources, including gas turbines. However, this database is known to be substantially incomplete for gas turbine applications.[19] While review of the RBLC is a necessary part of a review of current NO_x control levels, it is a starting point, not the entirety of the review to be undertaken. Regulation 14-3, which applies to the Metro Nashville/Davidson County Health Department reviewer, also necessarily applies to the scope of the RACT analysis conducted by the applicant: ". . . *independently contacting other air pollution control agencies and the U.S. EPA to determine what level of control is required or suggested at identical or similar sources in other areas of jurisdiction*."[20]

Contacting the manufacturer of the Titan turbine, Solar Turbines, Inc., should have been part of the RACT assessment process. This should have been done to: 1) collect current information on the range of NO_x emission guarantees provided by Solar Turbines for its turbines in compressor drive or simple cycle power generation applications, and 2) obtain accurate, current information on the incremental cost of progressively more stringent NO_x control measures on the Titan turbine.

A basic google search using the terms "*Titan compressor turbine air permit application*" would have produced multiple contemporaneous Titan compressor station (or smaller Solar Turbines models) air permit applications. A partial list of compressor station applications contemporaneous with the Joelton Compressor Station application is provided in Table 2. This basic search conducted by Powers Engineering produced numerous pipeline compressor station applications in the same region, several also using the Titan turbine.

The Joelton Compressor Station has the highest NO_x emissions by far among these compressor station applications. This is the case despite Joelton Compressor Station being the only compressor station among the six compressor stations evaluated that will be a major source of NO_x emissions under the federal Title V air permit program based on the potential for the compressor station to emit, by itself, more than 100 tpy of NO_x.[21]

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[19] N.H. Hydari et al - EnvironPlan Consulting, *Comparison of the Most Recent BACT/LAER Determinations for Combustion Turbines by State Air Pollution Control Agencies*, presented at 2002 A&WMA Annual Conference, 2002, p.2. "Only 13% of the most recent BACT/LAER determinations in this survey were included in the [RACT/BACT/LAER Clearinghouse] database."

[20] Regulation 14-3(b).

[21] Two other proposed compressor stations are classified as Title V sources. However, as noted in Table 2, p. 6, the Sabal Trail Compressor Station in Georgia was classified as major source under the Title V operating permit program even though potential NO_x emissions were only 46.8 tpy. A Supreme Court ruling in June 2014 vacated the rationale, based on the annual CO_2 emission rate, used to classify Sabal Trail as major source under the Title V air operating permit program. See Reference 2 to Table 2 for further explanation. Also, the emissions from the proposed Mockingbird Compressor Station expansion in West Virginia are aggregated to those of an existing Title V source. The Mockingbird Compressor Station expansion would not be a Title V source if only its potential air emissions, 55.5 tpy of NO_x, were considered.

Table 2. Contemporaneous Compressor Station Air Permit Applications – Comparison of Projected NO_x Annual Emission Rates and Permit Requirements Applicable to Each Compressor Station

Permittee/project	Date of application	State	County	Attainment area status for the 8-hour ozone (2008) NAAQS	Turbine type and number	Facilitywide NO_x emissions (tpy)	Title V Major Source? (>100 tpy)	PSD Major Source? (>250 tpy)
TGP (Kinder-Morgan)/ Joelton Compressor Station	9/15/15	TN	Davidson	In attainment	Titan 250 (2)	170.2	Y	N
Spectra Energy, NextEra, Duke Energy/ Sabal Trail Compressor Station	5/30/14	GA	Dougherty	In attainment	Titan 130 (2)	46.8	Y (Ref. 2)	Y (Ref. 2)
Dominion/ Mockingbird Hill Compressor Station	9/16/15	WV	Wetzel	In attainment	Titan 130 (2)	55.5	Y	N
Mountain Valley Pipeline/ Harris Compressor Station	10/23/15	WV	Braxton	In attainment	Titan 130 (2)	86.7	N	N
TGP (Kinder-Morgan)/ NE Energy Direct/ Supply Path Head Compressor Station	11/1/15	PA	Susquehanna	In attainment	Titan 130 (1) Mars 100 (2)	66.6	N	N
Dominion/ Buckingham Compressor Station	9/16/15	VA	Buckingham	In attainment	Mars 100 (1) Taurus 70 (2) Centaur 50L (1)	41.5	N	N

References:

1. 2008 National Ambient Air Quality Standards (NAAQS): EPA. "8-Hour Ozone (2008) Area Information." Green Book Nonattainment Areas. Accessed at: https://www3.epa.gov/airquality/greenbook/hindex.html.
2. Joelton Compressor Station: Tennessee Gas Pipeline Company , L.L.C., *Compressor Station 563, Davidson County, Joelton, TN – MHDDPC Title V Permit Application Updates and Supplemental Information*, September 11, 2015, p. 1, p.8, and Table 3, p. 4.
3. Sabal Trail Compressor Station: Trinity Consultants, *Sabal Trail Transmission – Construction and Operating Permit Application, Volume I*, May 30, 2014, p. 1-2 and p. 1-3. Note – at the time the application was filed, the projected CO2 emissions from the projected exceeded the CO2 PSD major source threshold. This triggered classification of NO_x and VOC as PSD pollutants subject to BACT for exceeding the PSD Significant Emission Rate (SER) for these pollutants of 40 tpy. Subsequent to the filing of the application, on June 23, 2014, the

Supreme Court issued a decision that vacated the PSD applicability interpretation that resulted in Sabal Trail being classified as a PSD source for NOx based on CO_2 PSD major source status only: https://www.epa.gov/nsr/clean-air-act-permitting-greenhouse-gases.

4. Mockingbird Hill Compressor Station: Dominion Resources Services, Inc., *Construction/Major Modification (45CSR13), Mockingbird Hill Compressor Station (Facility ID#017-00003)*, September 16, 2015, p. 3, p. 16, Table 4-2, p. 17. The two proposed Titan 130 turbines will be elements of an expansion project at the existing Mockingbird Hill Compressor Station. The existing Mockingbird Hill Compressor Station operates under Title V operating permit number R30-10300006-2011. The operating permit covers emission sources at the Mockingbird Hill Compressor Station, Lewis Wetzel Compressor Station, and Hastings Compressor Station.
5. Harris Compressor Station: Trinity Consultants, *R13 Permit Application – Mountain Valley Pipeline, L.L.C. – Harris Compressor Station*, October 2015, Attachment D – Regulatory Applicability; Attachment N – Supporting Emission Calculations, Table 11.
6. Supply Path Head Compressor Station: TetraTech, Inc., *Tennessee Gas Pipeline Company, L.L.C. Northeast Energy Direct Project - Plan Approval Permit Application Supply Path Head Compressor Station*, November 2015, p. 4, Table 1, p. 9.
7. Buckingham Compressor Station: Dominion Resources Services, Inc., *Buckingham Compressor Station – Article 6 New Source Permit Application*, September 16, 2015, p. 21. The Buckingham Compressor Station is subject to state-level BACT only as it triggers state rule 9 VAC 5-50-260 B. "Virginia's regulations establish that a BACT review must be completed for certain sources that are not otherwise exempt and whose total emissions exceed Uncontrolled Emission Rate (UER) thresholds." Table 6.1, p. 24: NOx UER exemption level = 40 tpy; VOC UER exemption level = 25 tpy.

NO_x limits in RBLC search conducted by TGP: Despite the limitations of the RBLC, several relevant permits with limits lower than the 25 ppm NO_x limit proposed for the Titan 250 turbines at the Joelton Compressor Station are shown for turbines in compressor drive or simple cycle power generation applications, when the RBLC search terms used by TGP are utilized (process type 16.110, small combustion turbines < 25 MW, simple cycle, natural gas fired). These permit limits, and associated NO_x controls, are shown in Table 3.

Table 3. RBLC Simple Cycle < 25 MW Turbine Permits with NO_x Limits Lower than Limit Proposed for Joelton Compressor Station Titan Turbines

Year of issue	State	RBLC number	Turbine application	Turbine size (MW)	Number of turbines	NO_x control technology	NO_x limit (@ 15% oxygen)
2009	WY	WY-0067	compressor	~10	2	DLN	15
2009	LA	LA-0232	compressor	~8	2	DLN	15
2007	MD	MD-0035	simple cycle power for electric drive compressors	21.7	2	DLN + SCR	2.5
2003	WA	WA-0304	simple cycle power	22	7	SCR	9

Simple cycle: No heat recovery in use downstream of gas turbine to utilize heat and reduce exhaust gas temperature.
DLN - Dry Low NO_x; SCR – selective catalytic reduction.

There are two entries in Table 3, addressing a total of nine individual units, for turbines that are the same size as the 21.7 MW Titan 250s proposed at the Joelton Compressor Station and that utilize SCR to control NO_x emissions to either 2.5 ppm or 9 ppm. These permits were issued nine years ago (2.5 ppm) and thirteen years ago (9 ppm). There are also two entries, both seven years old, for turbines in compressor drive applications with permit limits of 15 ppm NO_x. Yet there is no discussion of any of these potential NO_x limits for the Joelton Titan 250 turbines in the RACT analysis included in the Joelton Compressor Station application.

The RBLC is an incomplete database. Two compressor drive gas turbines permitted in Tennessee in the last decade, but not reported in the RBLC, are examples of the incomplete nature of RBLC listings. The permit conditions for these two turbines are shown in Table 4. This is an example of why other sources of information must supplement the RBLC search to develop a complete picture of the current state of air emission control levels for gas turbines in compressor service.

Table 4. Compressor Turbine Permits Issued in Tennessee and Not Reported to the RBLC

Initial application date	State	Turbine type	Turbine application	Turbine size (MW)	Number of turbines	NO_x control technology	NO_x limit (@ 15% oxygen)
2015[22]	TN	Mars 100	compressor	11.4	1	DLN	15
2008[23]	TN	Titan 250	compressor	21.7	1	DLN	25

[22] ANR Pipeline Company, NSR Application for Construction of Brownsville Compressor Station, Haywood County, TN, May 2015. The air permit for this turbine was issued by the Tennessee Air Pollution Control Board, Department of Environment and Conservation, on August 12, 2015.

NO_x and VOC limits in contemporaneous compressor station permit applications: The turbine types, turbine NO_x and VOC limits, and the turbine NO_x and VOC control technologies proposed in the contemporaneous compressor station permit applications evaluated by Powers Engineering are provided in Table 5. One of the listed contemporaneous applications is another TGP application, for a Titan 130 in Pennsylvania with a 9 ppm NO_x limit.[24] TGP had to have been aware, when it submitted the Joelton Compressor Station air permit application in September 2015, that it would also be submitting an air application in Pennsylvania several weeks later for a Titan turbine at the proposed Supply Path Head Compressor Station with a NO_x limit of 9 ppm.

Table 5. NO_x and VOC Emission Limits in Compressor Station Air Permit Applications Contemporaneous to the TGP Joelton Compressor Station Application

Permittee/project/state	Date of application	Turbine type and number	NO_x/VOC limits (ppm)	NO_x/VOC control systems
TGP (Kinder-Morgan)/ Joelton - TN	9/15/15	Titan 250 (2)	NO_x = 25 VOC = 2.5	DLN1
Spectra, NextEra, Duke / Sabal Trail - GA	5/30/14	Titan 130 (2)	NO_x = 9 VOC = 2-3	DLN3 + OxCat
Dominion/ Mockingbird Hill - WV	9/16/15	Titan 130 (2)	NO_x = 9 VOC = 1.3	DLN3 + OxCat
Mountain Valley Pipeline, L.L.C./ Harris - WV	10/23/15	Titan 130 (2)	NO_x = 15 VOC = 2.5	DLN2
TGP (Kinder-Morgan)/ NE Energy Direct/ Supply Path Head - PA	11/1/15	Titan 130 (1) Mars 100 (2)	NO_x = 9 VOC = 1.5	DLN3 + OxCat
Dominion/ Buckingham - VA	9/16/15	Mars 100 (1) Taurus 70 (1) Taurus 60 (1) Centaur 50L (1)	NO_x = 5 VOC = 1.3	SCR + OxCat

MW equivalent capacity of turbines listed: Titan 250 = 21.7 MW; Titan 130 = 15.0 MW; Mars 100 = 11.4 MW; Taurus 70 =8.0 MW; Centaur 50 = 4.6 MW.

The Sabal Trail, L.L.C. May 30, 3014 air permit application (Albany, GA) proposed a NO_x limit of 9 ppm on two Titan 130 turbines using advanced DLN technology offered by the turbine manufacturer, Solar Turbines. This was the first instance of the 9 ppm NO_x limit being proposed by a compressor station applicant using the Titan turbine.[25] The Sabal Trail application notes that, "*Sabal Trail will the first customer of Solar to receive the 9 ppm NO_x vendor guarantee for a Solar Titan 130 turbine, all previous units have been guaranteed at 15 ppm NO_x.*"[26] The Sabal Trail application, with a 9 ppm NO_x limit on two Titan turbines, was filed sixteen months before

[23] Columbia Gulf Transmission Company, Columbia Gulf Transmission Hartsville Compressor Station (Reference No. 56-0004) - Revised Air Permit Application, February 24, 2009, pdf p. 1. Note: This Titan 250 was among the first Titan 250 turbines built, as installation of the Titan 250 did not begin until 2009. See (p. 2): https://www.vgb.org/vgbmultimedia/V04_NEU090608-p-3199.pdf.

[24] The 15.0 MW Titan 130 turbine is first Titan model manufactured by Solar Turbines. The Titan 250 is a newer, higher capacity, 21.7 MW version of the same model. The Titan 250 is a variation of the Titan 130 model. The relationship of the Titan 250 to the Titan 130 is similar to the relationship of an extended cab F150 truck with a V-8 engine to the regular cab F150 truck with a V-6 engine.

[25] Sabal Trail application, p.5-34.

[26] Ibid, 5-34.

TGP filed the Joelton Compressor Station application with a proposed Titan turbine NO_x limit of 25 ppm.

2. TGP Analysis of NO_x RACT Alternatives Was Incomplete and Flawed

TGP only identified one DLN control level for the Titan 250 turbines proposed for the Joelton Compressor Station – 25 ppm.[27] Significantly, the manufacturer of the Titan 250 turbine, Solar Turbines, has offered a 15 ppm NO_x guarantee on the Titan 250 since at least 2012.[28] The 9 ppm NO_x DLN level was guaranteed on the Titan turbine for the first time in 2014, as stated in the May 30, 2014 Sabal Trail air permit application.

For the purposes of this comment letter, the three levels of Titan 250 DLN control, 25 ppm, 15 ppm, and 9 ppm, are respectively identified in Table 2 as "DLN1", "DLN2", and "DLN3" to avoid confusion regarding the different levels of DLN NO_x control.

TGP states in the RACT analysis it prepared for the two Joelton Compressor Station Titan 250 turbines that "*Based on vendor information, the Titan 250-30000S model turbine is available with SoLoNO$_x$ (DLN) control, which is designed to achieve 25 ppmv NO$_x$*." As noted, TGP must have been aware that all three DLN NO_x control levels were available for the Titan turbine at the time it was preparing the Joelton Compressor Station RACT analysis. TGP opted for the 9 ppm NO_x DLN package for the Titan 130 turbine in the air application it filed on November 1, 2015 for its Supply Path Head Compressor Station in Pennsylvania. This application was filed approximately seven weeks after the Joelton Compressor Station application was filed.

There is no discussion in the TGP RACT evaluation of the Titan turbines that have been equipped with SCR and oxidation catalyst in combined heat and power (CHP) applications to limit NO_x emissions to 2.5 ppm. Titan 130 turbines in CHP applications at Cornell University (NY) and Kimberly-Clark (CT) each have NO_x limits of 2.5 ppm are equipped with SCR and oxidation catalyst.[29,30] The exhaust gas temperature of gas turbines in compressor drive applications can be significantly higher than in CHP applications, as compressor drive applications do not have heat recovery systems upstream of the SCR catalyst. The higher exhaust gas temperature can shorten the useful life of the SCR catalyst. To overcome the potential for high exhaust gas temperature to damage a standard temperature SCR catalyst in a compressor drive application, a dilution air blower is added to reduce peak exhaust gas temperature and protect the SCR catalyst.[31]

Dominion voluntarily selected SCR and oxidation catalyst as its air emission control package on each turbine of a four-turbine compressor station, the Buckingham Compressor Station, in

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[27] Corrected to 15 percent exhaust gas oxygen concentration.
[28] Solar Turbines, *PIL 167: SoLoNO$_x$ Products: Emissions in Non-SoLoNO$_x$ Modes*, June 6, 2012, Table 1. This document is provided as **Attachment B**.
[29] Combined Cycle Journal, *Pacesetter Plants: Class of 2009/2010 Cornell Combined Heat and Power Plant*, 2nd Quarter 2010. "Emissions limits for the CHP facility are 10 ppm CO, 2.5 ppm NO_x, and 5 ppm ammonia slip. Annual limit on NO_x is 40 tons."
[30] Connecticut Department of Energy & Environmental Protection - Bureau of Air Management, New Source Review Permit Numbers 130-0070 and 130-0071, Kimberly-Clark Corporation, New Milford, CT, August 15, 2012.
[31] Sabal Trail Application, Table C-12.

Virginia. The Buckingham application was filed on September 16, 2015, almost the same day TGP filed the Joelton Compressor Station application. The NO_x limit in the Buckingham Compressor Station application is 5 ppm NO_x. The Buckingham Compressor Station turbines will be equipped with dilution air systems to protect the SCR catalyst.[32]

The annual NO_x and VOC emissions reduction impacts of DLN2, DLN3, or SCR with oxidation catalyst, relative to the basic DLN1 package identified by TGP and the Metro Nashville/Davidson County Health Department Air Pollution Control Division as RACT, are shown in Table 6. Major reductions in NO_x, and to a lesser extent VOC, would be achieved by selecting any of these alternatives as RACT other than DLN1 for the Titan turbines at the Joelton Compressor Station.

Table 6. NO_x/VOC Emissions Reductions That Would Be Achieved at Joelton Compressor Station by Technically Feasible NO_x/VOC Control Measures on the Titan Gas Turbine

NO_x limit (ppm @ 15% O_2)	NO_x/VOC Technology	NO_x & VOC PTE (tpy)		NO_x & VOC reductions (tpy)		Total NO_x & VOC reductions (tpy)
		NO_x	VOC	NO_x	VOC	
25	DLN1	167.4	11.5	--	--	base case
15	DLN2	100.4	11.5	67.0	--	67.0
9 (from Mockingbird Hill application, Table N-2)	DLN3 + oxidation catalyst + noise control	53.2	4.8	114.2	6.7	120.9
2.5	SCR[33] + oxidation catalyst	16.7	5.8	150.7	5.8	156.5

PTE: Potential To Emit

3. Overreliance on Generic and Obsolete SCR and DLN Cost Data from 1990

TGP concluded that SCR is technically feasible for the turbines at the Joelton Compressor Station.[34] TGP indicates a control cost-effectiveness range for SCR of $350/ton to $4,500/ton, with the cost effectiveness declining as the size of the turbine increases.[35] After concluding that SCR is technically feasible, TGP dismisses SCR as "*not for compressor stations*."[36] In effect, TGP finds SCR to be technically feasible and then, a few pages later, implies it is not technically feasible – without substantiating that claim. TGP does not address the issue of concern – high exhaust gas temperature – and ignores that the use of a dilution blower eliminates the high gas

[32] Dominion, *Buckingham Compressor Station Article 6 New Source Permit Application*, September 26, 2015, p. 26.
[33] 90 percent NO_x reduction across the SCR is assumed per: EPA, *Catalog of CHP Technologies: Section 3. Technology Characterization – Combustion Turbines*, March 2015, Table 3-8, p. 3-17 (System 4, 20,336 kW). A 2.5 ppm NO_x SCR outlet concentration is assumed per 90 percent NO_x reduction and 25 ppm NO_x at SCR inlet. May 30, 2014 Sabal Trails application, Table C-12, footnote 2 ("This is consistent with the vendor estimate for SCR outlet NO_x concentration of 2.5 ppm.")
[34] Joelton Application, p. 26.
[35] Ibid, p. 27. "Capital costs (for SCR) on a $/MW basis are highest for the smallest turbine . . . and decrease exponentially with increasing turbine size."
[36] Ibid, p. 29.

temperature concern associated with use of SCRs in turbine compressor drive and other simple cycle applications.[37]

Dominion's choice of SCR for four turbines at its proposed Buckingham Compressor Station further undercuts TGP's assertion that SCR is not for use in compressor applications. Dominion found multiple instances of SCR installed on simple cycle turbines. "Simple cycle" means the turbine exhaust gas does not pass through any heat recovery system downstream of the turbine. Two examples of simple cycle turbine operation would be a peaking turbine power generation application and a compressor drive application. In either case, the higher exhaust gas temperatures must be addressed to protect the SCR catalyst. Following its review of the RBLC, Dominion determined that SCR was in use on simple cycle gas turbines and therefore SCR is a technically viable NO_x control alternative for compressor applications:[38,39]

> Based on a review of EPA's RBLC database, SCR systems have been installed on some simple cycle combustion turbines and are therefore considered technically feasible, and SCR is considered further in the BACT analysis.

Dominion identified DLN NO_x control at 9 ppm as BACT for the turbines at the Buckingham Compressor Station. However, Dominion opted to add SCR to each turbine to further reduce NO_x emissions to 5 ppm.[40] The decision by Dominion to add SCR to each turbine at the Buckingham Compressor Station indicates that SCR in this application is both cost feasible and cost reasonable.

The cost of DLN identified by TGP is essentially *de minimis* at $55/ton to $138/ton.[41] However, because TGP addresses only the least effective type of DLN available for the Titan turbine (25 ppm NO_x), it is not clear whether this DLN cost-effectiveness range identified in the RACT analysis applies generally to any form of DLN, only the 25 ppm NO_x DLN level identified by TGP as NO_x RACT for Joelton, or some other unrelated turbine installation.

Current, accurate installed capital costs for DLN2, DLN3, and SCR + oxidation catalyst for the Titan 250 turbine are provided in Table 7.

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[37] Dominion Buckingham Application, pp. 26-27.
[38] Dominion Buckingham Application, p. 29.
[39] The primary distinction between BACT and RACT in the context of economic feasibility is BACT would generally have a higher control cost-effectiveness ceiling than RACT.
[40] Dominion Resources Services, Inc., *Buckingham Compressor Station – Article 6 New Source Permit Application*, September 16, 2015, p. 33.
[41] Ibid, p. 28. TGP identified the NO_x control cost effectiveness of DLN as declining as the size of the turbine increases: "On a unit basis, corresponding capital cost figures for DLN combustion range from $85/hp for a 3.3 MW unit to $19/hp for an 85 MW machine."

Table 7. Capital Cost of Technically Feasible NO_x/VOC Control Measures for Titan 250 Gas Turbine

NO_x limit (ppm @ 15% O_2)	Technology	Installed capital cost ($)	Source of cost estimate	Month/year of cost estimate
25	DLN1	base case	not applicable	not applicable
15	DLN2	500,000	Solar Turbines, Pittsburgh office[42]	July 2016
9	DLN3 + oxidation catalyst + noise control	1,300,000	Solar Turbines, Pittsburgh office[43]	July 2016
2.5	SCR + oxidation catalyst	2,400,000	EPA, CHP turbine report[44]	March 2015

4. No Identification of An Appropriate $/ton Cost-Effectiveness Ceiling

TGP makes no effort to define the term "cost feasible" in its RACT analysis. As a result it is not known what cost-effectiveness TGP would consider cost feasible from a RACT standpoint. In contrast, numerous state air quality agencies have defined cost-effectiveness ceilings for NO_x RACT determinations. A partial list of these agency RACT cost-effectiveness ceiling determinations is provided in Table 8.

Table 8. Partial List of Air Agencies with Defined NO_x RACT Cost-Effectiveness Ceilings

Air Agency[45]	NO_x RACT cost-effectiveness ceiling ($/ton)
New York	5,000 – 5,500
Ohio	5,000
Maryland	3,500 – 5,000
Pennsylvania	3,500
Illinois	2,500 – 3,000
Wisconsin[46]	2,500

[42] Telephone communication between B. Powers, Powers Engineering, and Solar Turbines Pittsburgh, PA office, July 12, 2016.
[43] Ibid.
[44] EPA, Catalog of CHP Technologies: Section 3. Technology Characterization – Combustion Turbines, March 2015, Table 3-5, p. 3-14. Equipment cost for SCR + oxidation catalyst + continuous emissions monitoring system (CEMS) for 21.7 MW (Titan) turbine = $1.516 million. Installed capital cost multiplier = $30,879,300 /$19,397,900 = 1.59. Therefore, installed capital cost of SCR + oxidation catalyst + CEMS = $1.516 million × 1.59 = $2.41 million. It is assumed by Powers Engineering that a tempering air fan (dilution blower) is included in the SCR system design in a Titan compressor application to allow use of standard SCR catalyst (instead of high temperature catalyst). A 100 hp dilution blower is assumed consistent with the May 30, 2014 Sabal Trails application, Table C-12.
[45] Pennsylvania Department of Environmental Protection, *Responses to Frequently Asked Questions - Final Rulemaking, Additional RACT Requirements for Major Sources of NO_x and VOCs, 25 Pa. Code Chapters 121 and 129, 46 Pa. B. 2036 (April 23, 2016)*, June 21, 2016, p. 9.
[46] Ibid, p. 1.

The NO_x cost-effectiveness of the DLN2, DLN3, and SCR control alternatives are shown in Table 9. Assuming a RACT cost feasibility ceiling of $2,500/ton to $5,500/ton, the DLN3 control level on the Titan turbine, at just over $1,000/ton, is clearly economically feasible as a NO_x RACT control measure on the Joelton Compressor Station turbines. SCR is also economically feasible as RACT, at a cost-effectiveness of $2,842/ton, if TGP prefers to utilize an end-of-pipe NO_x emissions control system as an alternative to the DLN3 control level.

Table 9. Cost-Effectiveness of Technically Feasible NO_x/VOC Control Measures for Titan Gas Turbine

NO_x limit (ppm @ 15% O_2)	Installed capital cost ($)	Annualized capital cost[47] ($/yr)	NO_x and VOC reduced (tpy)	Cost effectiveness ($/ton)
25	base case	base case	0	not applicable
15	500,000	47,200	67.0	704
9	1,300,000	122,720	120.9	1,015
2.5	2,400,000	428,325[48,49,50]	150.7	2,842

TGP states in its RACT analysis for the Joelton Compressor Station, after listing a dozen states with RACT requirements, including New York, Ohio, Maryland, and Pennsylvania, among others, that:[51]

> A number of other states have RACT requirements . . . (and) Because the proposed (25 ppm NO_x) limit is equivalent to BACT values listed in the RBLC, TGP assumes that the proposed NO_x RACT (for Joelton) is comparable to RACT in other states.

This is an incorrect assumption by TGP. The control cost-effectiveness of the RACT control levels shown in Table 8, including a 2.5 ppm NO_x limit using SCR, is well below the NO_x RACT cost-effectiveness ceilings of $3,500/ton to $5,500/ton in New York, Ohio, Maryland, and Pennsylvania, as shown in Table 7.

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[47] Assume 20-year financial term at 7% interest per May 30, 2014 Sabal Trail application, SCR assumptions, Table C-12.

[48] The annualized installed capital cost of the SCR + oxidation catalyst + CEMS = $2,400,000 × 0.0944 = $226,560/yr. SCR catalyst may require replacement at 3-year intervals. Assuming Titan SCE catalyst replacement costs in the May 30, 2014 Sabal Trail application, Table C-12, this periodic cost would add approximately $17,000 per year to the annualized SCR cost (282.52 ft^3 × 159/ft^3 × 0.3811 = $17,119/yr). This would increase the SCR annualized cost from $188,800/yr to: $226,560/yr + $17,119/yr = $243,679/yr.

[49] Approximately 3.2 tons of 29% aqueous ammonia must be injected into the SCR per ton of NO_x removed per the Sabal Trails application, Table C-12. (49.93 tons aqueous NH_3/15.57 tons NO_x removed) × 150.7 tons NO_x removed × $292.83/ton aqueous ammonia = $141,515/yr. Therefore total annual SCR cost, to achieve a 2.5 ppm NO_x at the SCR outlet assuming a 25 ppm NO_x inlet concentration (90% reduction) = $243,679/yr + $141,515/yr = $385,194/yr.

[50] Annual operating cost of 100 hp dilution blower = 100 hp × (0.746 kW/hp) × $0.066/kW (Sabal Trails application, Table C-12) × 8,760 hr/yr = $43,131/yr. Therefore, total annual costs for SCR + oxidation catalyst + CEMS, including installed capital cost, periodic catalyst replacement, aqueous ammonia supply, and dilution blower operating cost = $385,194/yr + $43,131/yr = $428,325/yr.

[51] Joelton Application, p. 28.

V. Review of TGP RACT Determination by Metro Nashville/Davidson County Health Department Was Inadequate

The Metro Nashville/Davidson County Air Pollution Control Division did no independent corroboration of the information provided in the TGP RACT analysis. The engineering review repeats the SCR and DLN NO_x control cost-effectiveness ranges provided in the TGP RACT analysis, makes no assessment of the applicability of SCR to the Joelton Compressor Station turbines, and concludes that DLN with a 25 ppm NO_x limit satisfies RACT for the source. Although required by Regulation 14-3(b), no "*. . . independently contacting other air pollution control agencies and the U.S. EPA to determine what level of control is required or suggested at identical or similar sources in other areas of jurisdiction*" took place. If it had, the Air Pollution Control Division would have identified current NO_x limits on compressor turbines that are substantially more rigorous than 25 ppm, would have identified RACT cost-effectiveness ranges considered reasonable in other jurisdictions, and would not have concluded that 25 ppm is NO_x RACT for the two Titan 250 turbines at the Joelton Compressor Station.

VI. Conclusion

The TGP RACT analysis uses outdated and incomplete information to incorrectly conclude that a NO_x limit of 25 ppm is RACT for the two Titan 250 turbines at the proposed Joelton Compressor Station. The Metro Nashville/Davidson County Air Pollution Control Division erroneously accepted the TGP RACT analysis with no critical or independent review. Properly determined NO_x RACT for the two Titan 250 turbines is either 9 ppm NO_x using DLN3 technology or 2.5 ppm using SCR. Both of these alternatives are technically and economically feasible assuming a RACT cost-effectiveness ceiling of $2,500/ton to $5,500/ton.

Attachment A

BILL POWERS, P.E.

PROFESSIONAL HISTORY

Powers Engineering, San Diego, CA 1994-
ENSR Consulting and Engineering, Camarillo, CA 1989-93
Naval Energy and Environmental Support Activity, Port Hueneme, CA 1982-87
U.S. Environmental Protection Agency, Research Triangle Park, NC 1980-81

EDUCATION

Master of Public Health – Environmental Sciences, University of North Carolina
Bachelor of Science – Mechanical Engineering, Duke University

PROFESSIONAL AFFILIATIONS

Registered Professional Mechanical Engineer, California (Certificate M24518)
American Society of Mechanical Engineers
Air & Waste Management Association

TECHNICAL SPECIALTIES

Thirty years of experience in:

- Power plant air emission control system and cooling system assessments
- Petroleum refinery air engineering and testing
- Combustion equipment permitting, testing and monitoring
- Air pollution control equipment retrofit design/performance testing
- Distributed solar photovoltaics (PV) siting and regional renewable energy planning
- Latin America environmental project experience

POWER PLANT EMISSION CONTROL AND COOLING SYSTEM CONVERSION ASSESSMENTS

LMS100 Gas Turbine Power Plant Air Emissions Control Assessment. Lead engineer to assess Best Available Control Technology (BACT) for four proposed LMS100 gas turbines to be owned and operated by El Paso Electric Company. El Paso Electric proposed NOx and CO emission rates of 2.5 ppm and 6.0 ppm respectively, use of wet cooling tower(s) for intercooler heat rejection, and up to 5,000 hours per year of operation. I identified BACT as equivalent to combined cycle plant levels, 2.0 ppm NO_x and 2.0 ppm CO, due to high operating hour limit., and air cooling with mist augmentation at high ambient temperatures as BACT for PM. The TCEQ Office of Public Interest Council agreed that BACT for the LMS100s should be 2.0 ppm NO_x and 2.0 ppm CO, and that air cooling with mist augmentation should be BACT for PM**.**

Biomass Plant NO_x and CO Air Emissions Control Evaluation. Lead engineer for evaluation of available nitrogen oxide (NO_x) and carbon monoxide (CO) controls for a 45 MW Aspen Power biomass plant in Texas where proponent had identified selective non-catalytic reduction (SNCR) for NO_x and good combustion practices for CO as BACT. Identified the use of tail-end SCR for NO_x control at several operational U.S. biomass plants, and oxidation catalyst in use at two of these plants for CO and VOC control, as BACT for the proposed biomass plant. Administrative law judge concurred in decision that SCR and oxidation catalyst is BACT. Developer added SCR and oxidation catalyst to project in subsequent settlement agreement.

Biomass Plant Air Emissions Control Consulting. Lead expert on biomass air emissions control systems for landowners that will be impacted by a proposed 50 MW biomass to be built by the local East Texas power cooperative. Public utility agreed to meet current BACT for biomass plants in Texas, SCR for NOx and oxidation catalyst for CO, in settlement agreement with local landowners.

Combined-Cycle Power Plant Startup and Shutdown Emissions. Lead engineer for analysis of air permit startup and shutdown emissions minimization for combined-cycle power plant proposed for the San Francisco Bay Area. Original equipment was specified for baseload operation prior to suspension of project in early 2000s. Operational profile described in revised air permit was load following with potential for daily start/stop. Recommended that either fast start turbine technology be employed to minimize start/stop emissions or that "demonstrated in practice" operational and control software modifications be employed to minimize startup/shutdown emissions.

IGCC as BACT for Air Emissions from Proposed 960 MW Coal Plant. Presented testimony on IGCC as BACT for air emissions reduction from 960 MW coal plant. Applicant received air permit for a pulverized coal plant to be equipped with a baghouse, wet scrubber, and wet ESP for air emissions control. Use of IGCC technology at the emission rates permitted for two recently proposed U.S. IGCC projects, and demonstrated in practice at a Japanese IGCC plant firing Chinese bituminous coal, would substantially reduce potential emissions of NO_x, SO_2, and PM. The estimated control cost-effectiveness of substituting IGCC for pulverized coal technology in this case was approximately $3,000/ton.

Analysis of Proposed Air Emission Limits for 600 MW Pulverized Coal Plant. Project engineer tasked with evaluating sufficiency of air emissions limits and control technologies for proposed 600 MW coal plant Arkansas. Determined that the applicant had: 1) not properly identified SO_2, sulfuric acid mist, and PM BACT control levels for the plant, and 2) improperly utilized an incremental cost effectiveness analysis to justify air emission control levels that did not represent BACT.

Eight Pulverized Coal Fired 900 MW Boilers – IGCC Alternative with Air Cooling. Provided testimony on integrated gasification combined cycle (IGCC) as a fully commercial coal-burning alternative to the pulverized coal (PC) technology proposed by TXU for eight 900 MW boilers in East Texas, and East Texas as an ideal location for CO2 sequestration due to presence of mature oilfield CO2 enhanced oil recovery opportunities and a deep saline aquifer underlying the entire region. Also presented testimony on the major increase in regional consumptive water use that would be caused by the evaporative cooling towers proposed for use in the PC plants, and that consumptive water use could be lowered by using IGCC with evaporative cooling towers or by using air-cooled condensers with PC or IGCC technology. TXU ultimately dropped plans to build the eight PC plants as a condition of a corporate buy-out.

Utility Boilers – Conversion of Existing Once-Through Cooled Boilers to Wet Towers, Parallel Wet-Dry Cooling, or Dry Cooling. Provided expert testimony and preliminary design for the conversion of four natural gas and/or coal-fired utility boilers (Unit 4, 235 MW; Unit 3, 135 MW; Unit 2, 65 MW; and Unit 1,65 MW) from once-through river water cooling to wet cooling towers, parallel wet-dry cooling, and dry cooling. Major design constraints were available land for location of retrofit cooling systems and need to maintain maximum steam turbine backpressure at or below 5.5 inches mercury to match performance capabilities of existing equipment. Approach temperatures of 12 ^{o}F and 13 ^{o}F were used for the wet towers. SPX Cooling Technologies F-488 plume-abated wet cells with six feet of packing were used to achieve approach temperatures of 12 ^{o}F and 13 ^{o}F. Annual energy penalty of wet tower retrofit designs is approximately 1 percent. Parallel wet-dry or dry cooling was determined to be technically feasible for Unit 3 based on straightforward access to the Unit 3 surface condenser and available land adjacent to the boiler.

Utility Boiler – Assessment of Air Cooling and Integrated Gasification/Combined Cycle for Proposed 500 MW Coal-Fired Plant. Provided expert testimony on the performance of air-cooling and IGCC relative to the conventional closed-cycle wet cooled, supercritical pulverized coal boiler proposed by the applicant. Steam Pro™ coal-fired power plant design software was used to model the proposed plant and evaluate the impacts on performance of air cooling and plume-abated wet cooling. Results indicated that a conservatively designed air-cooled condenser could maintain rated power output at the design ambient temperature of 90 ^{o}F. The IGCC comparative analysis indicated that unit reliability comparable to a conventional pulverized coal unit could be

achieved by including a spare gasifier in the IGCC design, and that the slightly higher capital cost of IGCC was offset by greater thermal efficiency and reduced water demand and air emissions.

Utility Boiler – Assessment of Closed-Cycle Cooling Retrofit Cost for 1,200 MW Oil-Fired Plant. Prepared an assessment of the cost and feasibility of a closed-cycle wet tower retrofit for the 1,200 MW Roseton Generating Station. Determined that the cost to retrofit the Roseton plant with plume-abated closed-cycle wet cooling was well established based on cooling tower retrofit studies performed by the original owner (Central Hudson Gas & Electric Corp.) and subsequent regulatory agency critique of the cost estimate. Also determined that elimination of redundant and/or excessive budgetary line items in owners cost estimate brings the closed-cycle retrofit in line with expected costs for comparable new or retrofit plume-abated cooling tower applications.

Nuclear Power Plant – Assessment of Closed-Cycle Cooling Retrofit Cost for 2,000 MW Plant. Prepared an assessment of the cost and feasibility of a closed-cycle wet tower retrofit for the 2,000 MW Indian Point Generating Station. Determined that the most appropriate arrangement for the hilly site would be an inline plume-abated wet tower instead of the round tower configuration analyzed by the owner. Use of the inline configuration would allow placement of the towers at numerous sites on the property with little or need for blasting of bedrock, greatly reducing the cost of the retrofit. Also proposed an alternative circulating cooling water piping configuration to avoid the extensive downtime projected by the owner for modifications to the existing discharge channel.

Kentucky Coal-Fired Power Plant – Pulverized Coal vs IGCC. Expert witness in Sierra Club lawsuit against Peabody Coal Company's plan to construct a 1,500 MW pulverized-coal fired power plant in Kentucky. Presented case that Integrated Gasification Combined Cycle (IGCC) is a superior method for producing power from coal, from environmental and energy efficiency perspective, than the proposed pulverized-coal plant. Presented evidence that IGCC is technically feasible and cost competitive with pulverized coal.

Power Plant Dry Cooling Symposium – Chair and Organizer. Chair and organizer of the first symposium held in the U.S. (May 2002) that focused exclusively on dry cooling technology for power plants. Sessions included basic principles of wet and dry cooling systems, performance capabilities of dry cooling systems, case studies of specific installations, and reasons why dry cooling is the predominant form of cooling specified in certain regions of North America (Massachusetts, Nevada, northern Mexico).

Utility Boiler – Best Available NO_x Control System for 525 MW Coal-Fired Circulating Fluidized Bed Boiler Plant. Expert witness in dispute over whether 50 percent NO_x control using selective non-catalytic reduction (SNCR) constituted BACT for a proposed 525 MW circulating fluidized bed (CFB) boiler plant. Presented testimony that SNCR was capable of continuous NO_x reduction of greater than 70 percent on a CFB unit and that tail-end selective catalytic reduction (SCR) was technically feasible and could achieve greater than 90 percent NO_x reduction.

Utility Boilers – Evaluation of Correlation Between Opacity and PM_{10} Emissions at Coal-Fired Plant. Provided expert testimony on whether correlation existed between mass PM_{10} emissions and opacity during opacity excursions at large coal-fired boiler in Georgia. EPA and EPRI technical studies were reviewed to assess the correlation of opacity and mass emissions during opacity levels below and above 20 percent. A strong correlation between opacity and mass emissions was apparent at a sister plant at opacities less than 20 percent. The correlation suggests that the opacity monitor correlation underestimates mass emissions at opacities greater than 20 percent, but may continue to exhibit a good correlation for the component of mass emissions in the PM_{10} size range.

Utility Boilers – Retrofit of SCR and FGD to Existing Coal-Fired Units.
Expert witness in successful effort to compel an existing coal-fired power plant located in Massachusetts to meet an accelerated NO_x and SO_2 emission control system retrofit schedule. Plant owner argued the installation of advanced NO_x and SO_2 control systems would generate > 1 ton/year of ancillary emissions, such as sulfuric acid mist, and that under Massachusetts Dept. of Environmental Protection regulation ancillary emissions > 1 ton/year would require a BACT evaluation and a two-year extension to retrofit schedule. Successfully demonstrated that no ancillary emissions would be generated if the retrofit NO_x and SO_2 control systems were properly sized and optimized. Plant owner committed to accelerated compliance schedule in settlement agreement.

Utility Boilers – Retrofit of SCR to Existing Natural Gas-Fired Units.
Lead engineer in successful representation of interests of California coastal city to prevent weakening of an existing countywide utility boiler NO_x rule. Weakening of NO_x rule would have allowed a merchant utility boiler plant located in the city to operate without installing selective catalytic reduction (SCR) NO_x control systems. This project required numerous appearances before the county air pollution control hearing board to successfully defend the existing utility boiler NO_x rule.

LNG LIQUEFACTION PLANT EXPERIENCE

Corpus Christie LNG Air Permit Review. Conducted review of BACT determinations for the proposed Corpus Christie LNG liquefaction facility in Corpus Christie, TX. Issues addressed included: electric compressor drive systems as alternative to gas turbine compressor drive, technical feasibility and cost-effectiveness of SCR to reduce compressor drive gas turbine NOx emissions, and comparative benefits of ground flares over elevated flares to assure consistent flare performance.

PETROLEUM REFINERY AIR ENGINEERING/TESTING EXPERIENCE

BP Whiting Refinery Expansion Air Permit. Served as lead engineer on review of netting analysis that resulted in the BP Whiting Refinery Expansion receiving a minor source air permit from the Indiana Department of Environmental Management. Determined that BP Whiting omitted several major sources of emissions, underestimated others, and incorrectly calculated contemporaneous increases and decreases in air emissions. These sources included refinery heaters, flares, coking units, sulfur recovery, and fugitive emissions. These errors and omissions were sufficient in number and magnitude to exceed NSR significance thresholds.

Hyperion Refinery Air Permit. Served as lead engineer on review of BACT determinations in the PSD air permit for the proposed Hyperion Refinery in South Dakota.. BACT review included controls for refinery heaters, cooling systems, fugitive emissions, and greenhouse gases. BACT was identified as SCR for all refinery heaters, use of enclosed ground flare for periodic flare gas emissions from gasification process, and use of leakless fugitive emission components.

Big West Refinery Expansion EIS. Lead engineer on comparative cost analysis of proposed wet cooling tower and fin-fan air cooler for process cooling water for the proposed clean fuels expansion project at the Big West Refinery in Bakersfield, California. Selection of the fin-fin air-cooler would eliminate all consumptive water use and wastewater disposal associated with the cooling tower. Air emissions of VOC and PM_{10} would be reduced with the fin-fan air-cooler even though power demand of the air-cooler is incrementally higher than that of the cooling tower. Fin-fan air-coolers with approach temperatures of 10 ^oF and 20 ^oF were evaluated. The annualized cost of the fin-fin air-cooler with a 20 ^oF approach temperature is essentially the same as that of the cooling tower when the cost of all ancillary cooling tower systems are considered.

Criteria and Air Toxic Pollutant Emissions Inventory for Proposed Refinery Modifications. Project manager and technical lead for development of baseline and future refinery air emissions inventories for process modifications required to produce oxygenated gasoline and desulfurized diesel fuel at a California

refinery. State of the art criteria and air toxic pollutant emissions inventories for refinery point, fugitive and mobile sources were developed. Point source emissions estimates were generated using onsite criteria pollutant test data, onsite air toxics test data, and the latest air toxics emission factors from the statewide refinery air toxics inventory database. The fugitive volatile organic compound (VOC) emissions inventories were developed using the refinery's most recent inspection and maintenance (I&M) monitoring program test data to develop site-specific component VOC emission rates. These VOC emission rates were combined with speciated air toxics test results for the principal refinery process streams to produce fugitive VOC air toxics emission rates. The environmental impact report (EIR) that utilized this emission inventory data was the first refinery "Clean Fuels" EIR approved in California.

Development of Air Emission Standards for Petroleum Refinery Equipment - Peru. Served as principal technical consultant to the Peruvian Ministry of Energy in Mines (MEM) for the development of air emission standards for Peruvian petroleum refineries. The sources included in the scope of this project included: 1) SO_2 and NO_x refinery heaters and boilers, 2) desulfurization of crude oil, particulate and SO_2 controls for fluid catalytic cracking units (FCCU), 3) VOC and CO emissions from flares, 4) vapor recovery systems for marine unloading, truck loading, and crude oil/refined products storage tanks, and 5) VOC emissions from process fugitive sources such as pressure relief valves, pumps, compressors and flanges. Proposed emission limits were developed for new and existing refineries based on a thorough evaluation of the available air emission control technologies for the affected refinery sources. Leading vendors of refinery control technology, such as John Zink and Exxon Research, provided estimates of retrofit costs for the largest Peruvian refinery, La Pampilla, located in Lima. Meetings were held with refinery operators and MEM staff to discuss the proposed emission limits and incorporate mutually agreed upon revisions to the proposed limits for existing Peruvian refineries.

Air Toxic Pollutant Emissions Inventory for Existing Refinery. Project manager and technical lead for air toxic pollutant emissions inventory at major California refinery. Emission factors were developed for refinery heaters, boilers, flares, sulfur recovery units, coker deheading, IC engines, storage tanks, process fugitives, and catalyst regeneration units. Onsite source test results were utilized to characterize emissions from refinery combustion devices. Where representative source test results were not available, AP-42 VOC emission factors were combined with available VOC air toxics speciation profiles to estimate VOC air toxic emission rates. A risk assessment based on this emissions inventory indicated a relatively low health risk associated with refinery operations. Benzene, 1,3-butadiene and PAHs were the principal health risk related pollutants emitted.

Air Toxics Testing of Refinery Combustion Sources. Project manager for comprehensive air toxics testing program at a major California refinery. Metals, Cr^{+6}, PAHs, H_2S and speciated VOC emissions were measured from refinery combustion sources. High temperature Cr^{+6} stack testing using the EPA Cr^{+6} test method was performed for the first time in California during this test program. Representatives from the California Air Resources Board source test team performed simultaneous testing using ARB Method 425 (Cr^{+6}) to compare the results of EPA and ARB Cr^{+6} test methodologies. The ARB approved the test results generated using the high temperature EPA Cr^{+6} test method.

Air Toxics Testing of Refinery Fugitive Sources. Project manager for test program to characterize air toxic fugitive VOC emissions from fifteen distinct process units at major California refinery. Gas, light liquid, and heavy liquid process streams were sampled. BTXE, 1,3-butadiene and propylene concentrations were quantified in gas samples, while BTXE, cresol and phenol concentrations were measured in liquid samples. Test results were combined with AP-42 fugitive VOC emission factors for valves, fittings, compressors, pumps and PRVs to calculate fugitive air toxics VOC emission rates.

COMBUSTION EQUIPMENT PERMITTING, TESTING AND MONITORING

EPRI Gas Turbine Power Plant Permitting Documents – Co-Author.

Co-authored two Electric Power Research Institute (EPRI) gas turbine power plant siting documents. Responsibilities included chapter on state-of-the-art air emission control systems for simple-cycle and combined-cycle gas turbines, and authorship of sections on dry cooling and zero liquid discharge systems.

Air Permits for 50 MW Peaker Gas Turbines – Six Sites Throughout California.
Responsible for preparing all aspects of air permit applications for five 50 MW FT-8 simple-cycle turbine installations at sites around California in response to emergency request by California state government for additional peaking power. Units were designed to meet 2.0 ppm NO_x using standard temperature SCR and innovative dilution air system to maintain exhaust gas temperature within acceptable SCR range. Oxidation catalyst is also used to maintain CO below 6.0 ppm.
Kauai 27 MW Cogeneration Plant – Air Emission Control System Analysis. Project manager to evaluate technical feasibility of SCR for 27 MW naphtha-fired turbine with once-through heat recovery steam generator. Permit action was stalled due to questions of SCR feasibility. Extensive analysis of the performance of existing oil-fired turbines equipped with SCR, and bench-scale tests of SCR applied to naphtha-fired turbines, indicated that SCR would perform adequately. Urea was selected as the SCR reagent given the wide availability of urea on the island. Unit is first known application of urea-injected SCR on a naphtha-fired turbine.
Microturbines – Ronald Reagan Library, Ventura County, California.

Project manager and lead engineer or preparation of air permit applications for microturbines and standby boilers. The microturbines drive the heating and cooling system for the library. The microturbines are certified by the manufacturer to meet the 9 ppm NO_x emission limit for this equipment. Low-NO_x burners are BACT for the standby boilers.

Hospital Cogeneration Microturbines – South Coast Air Quality Management District.
Project manager and lead engineer for preparation of air permit application for three microturbines at hospital cogeneration plant installation. The draft Authority To Construct (ATC) for this project was obtained two weeks after submittal of the ATC application. 30-day public notification was required due to the proximity of the facility to nearby schools. The final ATC was issued two months after the application was submitted, including the 30-day public notification period.

Gas Turbine Cogeneration – South Coast Air Quality Management District. Project manager and lead engineer for preparation of air permit application for two 5.5 MW gas turbines in cogeneration configuration for county government center. The turbines will be equipped with selective catalytic reduction (SCR) and oxidation catalyst to comply with SCAQMD BACT requirements. Aqueous urea will be used as the SCR reagent to avoid trigger hazardous material storage requirements. A separate permit will be obtained for the NO_x and CO continuous emissions monitoring systems. The ATCs is pending.

Industrial Boilers – NO_x BACT Evaluation for San Diego County Boilers.
Project manager and lead engineer for preparation of Best Available Control Technology (BACT) evaluation for three industrial boilers to be located in San Diego County. The BACT included the review of low NO_x burners, FGR, SCR, and low temperature oxidation (LTO). State-of-the-art ultra low NO_x burners with a 9 ppm emissions guarantee were selected as NO_x BACT for these units.

Peaker Gas Turbines – Evaluation of NO_x Control Options for Installations in San Diego County.
Lead engineer for evaluation of NO_x control options available for 1970s vintage simple-cycle gas turbines proposed for peaker sites in San Diego County. Dry low-NO_x (DLN) combustors, catalytic combustors, high-temperature SCR, and NO_x absorption/conversion ($SCONO_x$) were evaluated for each candidate turbine make/model. High-temperature SCR was selected as the NOx control option to meet a 5 ppm NO_x emission requirement.

Hospital Cogeneration Plant Gas Turbines – San Joaquin Valley Unified Air Pollution Control District.
Project manager and lead engineer for preparation of air permit application and Best Available Control Technology (BACT) evaluation for hospital cogeneration plant installation. The BACT included the review of DLN combustors, catalytic combustors, high-temperature SCR and $SCONO_x$. DLN combustion followed by high temperature SCR was selected as the NO_x control system for this installation. The high temperature SCR

is located upstream of the heat recovery steam generator (HRSG) to allow the diversion of exhaust gas around the HRSG without compromising the effectiveness of the NO_x control system.

1,000 MW Coastal Combined-Cycle Power Plant – Feasibility of Dry Cooling.
Expert witness in on-going effort to require use of dry cooling on proposed 1,000 MW combined-cycle "repower" project at site of an existing 1,000 MW utility boiler plant. Project proponent argued that site was two small for properly sized air-cooled condenser (ACC) and that use of ACC would cause 12-month construction delay. Demonstrated that ACC could easily be located on the site by splitting total of up to 80 cells between two available locations at the site. Also demonstrated that an ACC optimized for low height and low noise would minimize or eliminate proponent claims of negative visual and noise impacts.

Industrial Cogeneration Plant Gas Turbines – Upgrade of Turbine Power Output.
Project manager and lead engineer for preparation of Best Available Control Technology (BACT) evaluation for proposed gas turbine upgrade. The BACT included the review of DLN combustors, catalytic combustors, high-, standard-, and low-temperature SCR, and $SCONO_x$. Successfully negotiated air permit that allowed facility to initially install DLN combustors and operate under a NO_x plantwide "cap." Within two major turbine overhauls, or approximately eight years, the NO_x emissions per turbine must be at or below the equivalent of 5 ppm. The 5 ppm NO_x target will be achieved through technological in-combustor NO_x control such as catalytic combustion, or SCR or SCR equivalent end-of-pipe NO_x control technologies if catalytic combustion is not available.

Gas Turbines – Modification of RATA Procedures for Time-Share CEM.
Project manager and lead engineer for the development of alternate CO continuous emission monitor (CEM) Relative Accuracy Test Audit (RATA) procedures for time-share CEM system serving three 7.9 MW turbines located in San Diego. Close interaction with San Diego APCD and EPA Region 9 engineers was required to receive approval for the alternate CO RATA standard. The time-share CEM passed the subsequent annual RATA without problems as a result of changes to some of the CEM hardware and the more flexible CO RATA standard.

Gas Turbines – Evaluation of NO_x Control Technology Performance. Lead engineer for performance review of dry low-NO_x combustors, catalytic combustors, high-, standard-, and low-temperature selective catalytic reduction (SCR), and NO_x absorption/conversion ($SCONO_x$). Major turbine manufacturers and major manufacturers of end-of-pipe NO_x control systems for gas turbines were contacted to determine current cost and performance of NO_x control systems. A comparison of 1993 to 1999 "$/kwh" and "$/ton" cost of these control systems was developed in the evaluation.

Gas Turbines – Evaluation of Proposed NO_x Control System to Achieve 3 ppm Limit.
Lead engineer for evaluation for proposed combined cycle gas turbine NO_x and CO control systems. Project was in litigation over contract terms, and there was concern that the GE Frame 7FA turbine could not meet the 3 ppm NO_x permit limit using a conventional combustor with water injection followed by SCR. Operations personnel at GE Frame 7FA installatins around the country were interviewed, along with principal SCR vendors, to corroborate that the installation could continuously meet the 3 ppm NO_x limit.

Gas Turbines – Title V "Presumptively Approvable" Compliance Assurance Monitoring Protocol.
Project manager and lead engineer for the development of a "presumptively approval" NO_x parametric emissions monitoring system (PEMS) protocol for industrial gas turbines. "Presumptively approvable" means that any gas turbine operator selecting this monitoring protocol can presume it is acceptable to the U.S. EPA. Close interaction with the gas turbine manufacturer's design engineering staff and the U.S. EPA Emissions Measurement Branch (Research Triangle Park, NC) was required to determine modifications necessary to the current PEMS to upgrade it to "presumptively approvable" status.

Environmental Due Diligence Review of Gas Turbine Sites – Mexico. Task leader to prepare regulatory compliance due diligence review of Mexican requirements for gas turbine power plants. Project involves eleven potential sites across Mexico, three of which are under construction. Scope involves identification of all environmental, energy sales, land use, and transportation corridor requirements for power projects in Mexico. Coordinator of Mexican environmental subcontractors gathering on-site information for each site, and translator of Spanish supporting documentation to English.

Development of Air Emission Standards for Gas Turbines - Peru. Served as principal technical consultant to the Peruvian Ministry of Energy in Mines (MEM) for the development of air emission standards for Peruvian gas turbine power plants. All major gas turbine power plants in Peru are currently using water injection to increase turbine power output. Recommended that 42 ppm on natural gas and 65 ppm on diesel (corrected to 15% O_2) be established as the NO_x limit for existing gas turbine power plants. These limits reflect NO_x levels readily achievable using water injection at high load. Also recommended that new gas turbine sources be subject to a BACT review requirement.

Gas Turbines – Title V Permit Templates. Lead engineer for the development of standardized permit templates for approximately 100 gas turbines operated by the oil and gas industry in the San Joaquin Valley. Emissions limits and monitoring requirements were defined for units ranging from GE Frame 7 to Solar Saturn turbines. Stand-alone templates were developed based on turbine size and NO_x control equipment. NO_x utilized in the target turbine population ranged from water injection alone to water injection combined with SCR.

Gas Turbines – Evaluation of NO_x, SO_2 and PM Emission Profiles. Performed a comparative evaluation of the NO_x, SO_2 and particulate (PM) emission profiles of principal utility-scale gas turbines for an independent power producer evaluating project opportunities in Latin America. All gas turbine models in the 40 MW to 240 MW range manufactured by General Electric, Westinghouse, Siemens and ABB were included in the evaluation.

Stationary Internal Combustion Engine (ICE) RACT/BARCT Evaluation. Lead engineer for evaluation of retrofit NO_x control options available for the oil and gas production industry gas-fired ICE population in the San Joaquin Valley affected by proposed RACT and BARCT emission limits. Evaluation centered on lean-burn compressor engines under 500 bhp, and rich-burn constant and cyclically loaded (rod pump) engines under 200 bhp. The results of the evaluation indicated that rich burn cyclically-loaded rod pump engines comprised 50 percent of the affected ICE population, though these ICEs accounted for only 5 percent of the uncontrolled gas-fired stationary ICE NO_x emissions. Recommended retrofit NO_x control strategies included: air/fuel ratio adjustment for rod pump ICEs, Non-selective catalytic reduction (NSCR) for rich-burn, constant load ICEs, and "low emission" combustion modifications for lean burn ICEs.

Development of Air Emission Standards for Stationary ICEs - Peru. Served as principal technical consultant to the Peruvian Ministry of Energy in Mines (MEM) for the development of air emission standards for Peruvian stationary ICE power plants. Draft 1997 World Bank NO_x and particulate emission limits for stationary ICE power plants served as the basis for proposed MEM emission limits. A detailed review of ICE emissions data provided in PAMAs submitted to the MEM was performed to determine the level of effort that would be required by Peruvian industry to meet the proposed NO_x and particulate emission limits. The draft 1997 WB emission limits were revised to reflect reasonably achievable NO_x and particulate emission limits for ICEs currently in operation in Peru.

Air Toxics Testing of Natural Gas-Fired ICEs. Project manager for test plan/test program to measure volatile and semi-volatile organic air toxics compounds from fourteen gas-fired ICEs used in a variety of oil and gas production applications. Test data was utilized by oil and gas production facility owners throughout California to develop accurate ICE air toxics emission inventories.

AIR ENGINEERING/AIR TESTING PROJECT EXPERIENCE – GENERAL

Reverse Air Fabric Filter Retrofit Evaluation – Coal-Fired Boiler. Lead engineer for upgrade of reverse air fabric filters serving coal-fired industrial boilers. Fluorescent dye injected to pinpoint broken bags and damper leaks. Corrosion of pneumatic actuators serving reverse air valves and inadequate insulation identified as principal causes of degraded performance.

Pulse-Jet Fabric Filter Performance Evaluation – Gold Mine. Lead engineer on upgrade of pulse-jet fabric filter and associated exhaust ventilation system serving an ore-crushing facility at a gold mine. Fluorescent dye used to identify bag collar leaks, and modifications were made to pulse air cycle time and duration. This marginal source was in compliance at 20 percent of emission limit following completion of repair work.

Pulse-Jet Fabric Filter Retrofit - Gypsum Calciner. Lead engineer on upgrade of pulse-jet fabric filter controlling particulate emissions from a gypsum calciner. Recommendations included a modified bag clamping mechanism, modified hopper evacuation valve assembly, and changes to pulse air cycle time and pulse duration.

Wet Scrubber Retrofit – Plating Shop. Project engineer on retrofit evaluation of plating shop packed-bed wet scrubbers failing to meet performance guarantees during acceptance trials, due to excessive mist carryover. Recommendations included relocation of the mist eliminator (ME), substitution of the original chevron blade ME with a mesh pad ME, and use of higher density packing material to improve exhaust gas distribution. Wet scrubbers passed acceptance trials following completion of recommended modifications.

Electrostatic Precipitator (ESP) Retrofit Evaluation – MSW Boiler. Lead engineer for retrofit evaluation of single field ESP on a municipal solid waste (MSW) boiler. Recommendations included addition of automated power controller, inlet duct turning vanes, and improved collecting plate rapping system.

ESP Electric Coil Rapper Vibration Analysis Testing - Coal-Fired Boiler. Lead engineer for evaluation of ESP rapper effectiveness test program on three field ESP equipped with "magnetically induced gravity return" (MIGR) rappers. Accelerometers were placed in a grid pattern on ESP collecting plates to determine maximum instantaneous plate acceleration at a variety of rapper power setpoints. Testing showed that the rappers met performance specification requirements.

Aluminum Remelt Furnace Particulate Emissions Testing. Project manager and lead engineer for high temperature (1,600 ^{o}F) particulate sampling of a natural gas-fired remelt furnace at a major aluminum rolling mill. Objectives of test program were to: 1) determine if condensable particulate was present in stack gases, and 2) to validate the accuracy of the in-stack continuous opacity monitor (COM). Designed and constructed a customized high temperature (inconel) PM_{10}/Mtd 17 sampling assembly for test program. An onsite natural gas-fired boiler was also tested to provide comparative data for the condensable particulate portion of the test program. Test results showed that no significant levels of condensable particulate in the remelt furnace exhaust gas, and indicated that the remelt furnace and boiler had similar particulate emission rates. Test results also showed that the COM was accurate.

Aluminum Remelt Furnace CO and NO_x Testing. Project manager and lead engineer for continuous week-long testing of CO and NO_x emissions from aluminum remelt furnace. Objective of test program was to characterize CO and NO_x emissions from representative remelt furnace for use in the facility's criteria pollution emissions inventory. A TECO Model 48 CO analyzer and a TECO Model 10 NO_x analyzer were utilized during the test program to provide $\pm$1 ppm measurement accuracy, and all test data was recorded by an automated data acquisition system.

DISTRIBUTED SOLAR PV SITING AND REGIONAL RENEWABLE ENERGY PLANNING

Bay Area Smart Energy 2020 Plan . Author of the March 2012 *Bay Area Smart Energy 2020* strategic energy plan for the nine-county region surrounding San Francisco Bay. This plan uses the zero net energy building targets in the *California Energy Efficiency Strategic Plan* as a framework to achieve a 60 percent reduction in GHG emissions from Bay Area electricity usage, and a 50 percent reduction in peak demand for grid electricity,

by 2020. The 2020 targets in the plan include: 25 percent of detached homes and 20 percent of commercial buildings achieving zero net energy, adding 200 MW of community-scale microgrid battery storage and 400 MW of utility-scale battery storage, reduction in air conditioner loads by 50 percent through air conditioner cycling and targeted incentive funds to assure highest efficiency replacement units, and cooling system modifications to increase power output from The Geysers geothermal production zone in Sonoma County. Report is available online at: http://pacificenvironment.org/-1-87.

Solar PV technology selection and siting for SDG&E Solar San Diego project. Served as PV technology expert in California Public Utilities Commission proceeding to define PV technology and sites to be used in San Diego Gas & Electric (SDG&E) $250 million "Solar San Diego" project. Recommendations included: 1) prioritize use of roof-mounted thin-film PV arrays similar to the SCE urban PV program to maximize the installed PV capacity, 2) avoid tracking ground-mounted PV arrays due to high cost and relative lack of available land in the urban/suburban core, 3) and incorporate limited storage in fixed rooftop PV arrays to maximizing output during peak demand periods. Suitable land next to SDG&E substations capable of supporting 5 to 40 MW of PV (each) was also identified by Powers Engineering as a component of this project.

Rooftop PV alternative to natural gas-fired peaking gas turbines, Chula Vista. Served as PV technology expert in California Energy Commission (CEC) proceeding regarding the application of MMC Energy to build a 100 MW peaking gas turbine power plant in Chula Vista. Presented testimony that 100 MW of PV arrays in the Chula Vista area could provide the same level of electrical reliability on hot summer days as an equivalent amount of peaking gas turbine capacity at approximately the same cost of energy. The preliminary decision issued by the presiding CEC commissioner in the case recommended denial of the application in part due to failure of the applicant or CEC staff to thoroughly evaluate the PV alternative to the proposed turbines. No final decision has yet been issued in the proceeding (as of May 2009).

San Diego Smart Energy 2020 Plan. Author of October 2007 "San Diego Smart Energy 2020," an energy plan that focuses on meeting the San Diego region's electric energy needs through accelerated integration of renewable and non-renewable distributed generation, in the form of combined heat and power (CHP) systems and solar photovoltaic (PV) systems. PV would meet approximately 28 percent of the San Diego region's electric energy demand in 2020. Annual energy demand would drop 20 percent in 2020 relative to 2003 through use all cost-effective energy efficiency measures. Existing utility-scale gas-fired generation would continue to be utilized to provide power at night, during cloudy whether, and for grid reliability support. Report at: http://www.etechinternational.org/new_pdfs/smartenergy/52008_SmE2020_2nd.pdf

Development of San Diego Regional Energy Strategy 2030. Participant in the 18-month process in the 2002-2003 timeframe that led to the development of the San Diego Regional Energy Strategy 2030. This document was adopted by the SANDAG Board of Directors in July 2003 and defines strategic energy objectives for the San Diego region, including: 1) in-region power generation increase from 65% of peak demand in 2010 to 75% of peak demand in 2020, 2) 40% renewable power by 2030 with at least half of this power generated in-county, 3) reinforcement of transmission capacity as needed to achieve these objectives. The SANDAG Board of Directors voted unanimously on Nov. 17, 2006 to take no position on the Sunrise Powerlink proposal primarily because it conflicts the Regional Energy Strategy 2030 objective of increased in-region power generation. The Regional Energy Strategy 2030 is online at: http://www.energycenter.org/uploads/Regional_Energy_Strategy_Final_07_16_03.pdf

OIL AND GAS PRODUCTION AIR ENGINEERING/TESTING EXPERIENCE

Air Toxics Testing of Oil and Gas Production Sources. Project manager and lead engineer for test plan/test program to determine VOC removal efficiency of packed tower scrubber controlling sulfur dioxide emissions from a crude oil-fired steam generator. Ratfisch 55 VOC analyzers were used to measure the packed tower scrubber VOC removal efficiency. Tedlar bag samples were collected simultaneously to correlate BTX removal efficiency to VOC removal efficiency. This test was one of hundreds of air toxics tests performed during this test program for oil and gas production facilities from 1990 to 1992. The majority of the volatile air toxics analyses were performed at in-house laboratory. Project staff developed thorough familiarity with the applications and limitations of GC/MS, GC/PID, GC/FID, GC/ECD and GC/FPD. Tedlar bags, canisters,

sorbent tubes and impingers were used during sampling, along with isokinetic tests methods for multiple metals and PAHs.

Air Toxics Testing of Glycol Reboiler – Gas Processing Plant. Project manager for test program to determine emissions of BTXE from glycol reboiler vent at gas processing facility handling 12 MM/cfd of produced gas. Developed innovative test methods to accurately quantify BTXE emissions in reboiler vent gas.

Air Toxics Emissions Inventory Plan. Lead engineer for the development of generic air toxics emission estimating techniques (EETs) for oil and gas production equipment. This project was performed for the Western States Petroleum Association in response to the requirements of the California Air Toxics "Hot Spots" Act. EETs were developed for all point and fugitive oil and gas production sources of air toxics, and the specific air toxics associated with each source were identified. A pooled source emission test methodology was also developed to moderate the cost of source testing required by the Act.

Fugitive NMHC Emissions from TEOR Production Field. Project manager for the quantification of fugitive Nonmethane hydrocarbon (NMHC) emissions from a thermally enhanced oil recovery (TEOR) oil production field in Kern County, CA. This program included direct measurement of NMHC concentrations in storage tank vapor headspace and the modification of available NMHC emission factors for NMHC-emitting devices in TEOR produced gas service, such as wellheads, vapor trunklines, heat exchangers, and compressors. Modification of the existing NMHC emission factors was necessary due to the high concentration of CO_2 and water vapor in TEOR produced gases.

Fugitive Air Emissions Testing of Oil and Gas Production Fields. Project manager for test plan/test program to determine VOC and air toxics emissions from oil storage tanks, wastewater storage tanks and produced gas lines. Test results were utilized to develop comprehensive air toxics emissions inventories for oil and gas production companies participating in the test program.

Oil and Gas Production Field – Air Emissions Inventory and Air Modeling. Project manager for oil and gas production field risk assessment. Project included review and revision of the existing air toxics emission inventory, air dispersion modeling, and calculation of the acute health risk, chronic non-carcinogenic risk and carcinogenic risk of facility operations. Results indicated that fugitive H_2S emissions from facility operations posed a potential health risk at the facility fenceline.

TITLE V PERMIT APPLICATION/MONITORING PLAN EXPERIENCE

Title V Permit Application – San Diego County Industrial Facility. Project engineer tasked with preparing streamlined Title V operating permit for U.S. Navy facilities in San Diego. Principal emission units included chrome plating, lead furnaces, IC engines, solvent usage, aerospace coating and marine coating operations. For each device category in use at the facility, federal MACT requirements were integrated with District requirements in user friendly tables that summarized permit conditions and compliance status.

Title V Permit Application Device Templates - Oil and Gas Production Industry. Project manager and lead engineer to prepare Title V permit application “templates” for the Western States Petroleum Association (WSPA). The template approach was chosen by WSPA to minimize the administrative burden associated with listing permit conditions for a large number of similar devices located at the same oil and gas production facility. Templates are being developed for device types common to oil and gas production operations. Device types include: boilers, steam generators, process heaters, gas turbines, IC engines, fixed-roof storage tanks, fugitive components, flares, and cooling towers. These templates will serve as the core of Title V permit applications prepared for oil and gas production operations in California.

Title V Permit Application - Aluminum Rolling Mill. Project manager and lead engineer for Title V permit application prepared for largest aluminum rolling mill in the western U.S. Responsible for the overall direction of the permit application project, development of a monitoring plan for significant emission units, and

development of a hazardous air pollutant (HAP) emissions inventory. The project involved extensive onsite data gathering, frequent interaction with the plant's technical and operating staff, and coordination with legal counsel and subcontractors. The permit application was completed on time and in budget.

Title V Model Permit - Oil and Gas Production Industry. Project manager and lead engineer for the comparative analysis of regional and federal requirements affecting oil and gas production industry sources located in the San Joaquin Valley. Sources included gas turbines, IC engines, steam generators, storage tanks, and process fugitives. From this analysis, a model applicable requirements table was developed for a sample device type (storage tanks) that covered the entire population of storage tanks operated by the industry. The U.S. EPA has tentatively approved this model permit approach, and work is ongoing to develop comprehensive applicable requirements tables for each major category of sources operated by the oil and gas industry in the San Joaquin Valley.

Title V Enhanced Monitoring Evaluation of Oil and Gas Production Sources. Lead engineer to identify differences in proposed EPA Title V enhanced monitoring protocols and the current monitoring requirements for oil and gas production sources in the San Joaquin Valley. The device types evaluated included: steam generators, stationary ICEs, gas turbines, fugitives, fixed roof storage tanks, and thermally enhanced oil recovery (TEOR) well vents. Principal areas of difference included: more stringent Title V O&M requirements for parameter monitors (such as temperature, fuel flow, and O_2), and more extensive Title V recordkeeping requirements.

RACT/BARCT/BACT EVALUATIONS

BACT Evaluation of Wool Fiberglass Insulation Production Line. Project manager and lead engineer for BACT evaluation of a wool fiberglass insulation production facility. The BACT evaluation was performed as a component of a PSD permit application. The BACT evaluation included a detailed analysis of the available control options for forming, curing and cooling sections of the production line. Binder formulations, wet electrostatic precipitators, wet scrubbers, and thermal oxidizers were evaluated as potential PM_{10} and VOC control options. Low NO_x burner options and combustion control modifications were examined as potential NO_x control techniques for the curing oven burners. Recommendations included use of a proprietary binder formulation to achieve PM_{10} and VOC BACT, and use of low-NO_x burners in the curing ovens to achieve NO_x BACT. The PSD application is currently undergoing review by EPA Region 9.

RACT/BARCT Reverse Jet Scrubber/Fiberbed Mist Eliminator Retrofit Evaluation. Project manager and lead engineer on project to address the inability of existing wet electrostatic precipitators (ESPs) and atomized mist scrubbers to adequately remove low concentration submicron particulate from high volume recovery boiler exhaust gas at the Alaska Pulp Corporation mill in Sitka, AK. The project involved thorough on-site inspections of existing control equipment, detailed review of maintenance and performance records, and a detailed evaluation of potential replacement technologies. These technologies included a wide variety of scrubbing technologies where manufacturers claimed high removal efficiencies on submicron particulate in high humidity exhaust gas. Packed tower scrubbers, venturi scrubbers, reverse jet scrubbers, fiberbed mist eliminators and wet ESPs were evaluated. Final recommendations included replacement of atomized mist scrubber with reverse jet scrubber and upgrading of the existing wet ESPs. The paper describing this project was published in the May 1992 TAPPI Journal.

Aluminum Smelter RACT Evaluation - Prebake. Project manager and technical lead for CO and PM_{10} RACT evaluation for prebake facility. Retrofit control options for CO emissions from the anode bake furnace, potline dry scrubbers and the potroom roof vents were evaluated. PM_{10} emissions from the coke kiln, potline dry scrubbers, potroom roof vents, and miscellaneous potroom fugitive sources were addressed. Four CO control technologies were identified as technologically feasible for potline CO emissions: potline current efficiency improvement through the addition of underhung busswork and automated puncher/feeders, catalytic incineration, recuperative incineration and regenerative incineration. Current efficiency improvement was identified as probable CO RACT if onsite test program demonstrated the effectiveness of this approach. Five PM_{10} control technologies were identified as technologically feasible: increased potline hooding efficiency

through redesign of shields, the addition of a dense-phase conveying system, increased potline air evacuation rate, wet scrubbing of roof vent emissions, and fabric filter control of roof vent emissions. The cost of these potential PM_{10} RACT controls exceeded regulatory guidelines for cost effectiveness, though testing of modified shield configurations and dense-phase conveying is being conducted under a separate regulatory compliance order.

RACT/BACT Testing/Evaluation of PM_{10} Mist Eliminators on Five-Stand Cold Mill. Project manager and lead engineer for fiberbed mist eliminator and mesh pad mist eliminator comparative pilot test program on mixed phase aerosol (PM_{10})/gaseous hydrocarbon emissions from aluminum high speed cold rolling mill. Utilized modified EPA Method 5 sampling train with portion of sample gas diverted (after particulate filter) to Ratfisch 55 VOC analyzer. This was done to permit simultaneous quantification of aerosol and gaseous hydrocarbon emissions in the exhaust gas. The mesh pad mist eliminator demonstrated good control of PM_{10} emissions, though test results indicated that the majority of captured PM_{10} evaporated in the mesh pad and was emitted as VOC.

Aluminum Remelt Furnace/Rolling Mill RACT Evaluations. Lead engineer for comprehensive CO and PM_{10} RACT evaluation for the largest aluminum sheet and plate rolling mill in western U.S. Significant sources of CO emissions from the facility included the remelt furnaces and the coater line. The potential CO RACT options for the remelt furnaces included: enhanced maintenance practices, preheating combustion air, installation of fully automated combustion controls, and energy efficiency modifications. The coater line was equipped with an afterburner for VOC and CO destruction prior to the initiation of the RACT study. It was determined that the afterburner meets or exceeds RACT requirements for the coater line. Significant sources of PM_{10} emissions included the remelt furnaces and the 80-inch hot rolling mill. Chlorine fluxing in the melting and holding furnaces was identified as the principal source of PM_{10} emissions from the remelt furnaces. The facility is in the process of minimizing/eliminating fluxing in the melting furnaces, and exhaust gases generated in holding furnaces during fluxing will be ducted to a baghouse for PM_{10} control. These modifications are being performed under a separate compliance order, and were determined to exceed RACT requirements. A water-based emulsion coolant and inertial separators are currently in use on the 80-inch hot mill for PM_{10} control. Current practices were determined to meet/exceed PM_{10} RACT for the hot mill. Tray tower absorption/recovery systems were also evaluated to control PM_{10} emissions from the hot mill, though it was determined that the technical/cost feasibility of using this approach on an emulsion-based coolant had not yet been adequately demonstrated.

BARCT Low NO_x Burner Conversion – Industrial Boilers. Lead engineer for evaluation of low NO_x burner options for natural gas-fired industrial boilers. Also evaluated methanol and propane as stand-by fuels to replace existing diesel stand-by fuel system. Evaluated replacement of steam boilers with gas turbine co-generation system.

BACT Packed Tower Scrubber/Mist Eliminator Performance Evaluations. Project manager and lead engineer for Navy-wide plating shop air pollution control technology evaluation and emissions testing program. Mist eliminators and packed tower scrubbers controlling metal plating processes, which included hard chrome, nickel, copper, cadmium and precious metals plating, were extensively tested at three Navy plating shops. Chemical cleaning and stripping tanks, including hydrochloric acid, sulfuric acid, chromic acid and caustic, were also tested. The final product of this program was a military design specification for plating and chemical cleaning shop air pollution control systems. The hydrochloric acid mist sampling procedure developed during this program received a protected patent.

BACT Packed Tower Scrubber/UV Oxidation System Pilot Test Program. Technical advisor for pilot test program of packed tower scrubber/ultraviolet (UV) light VOC oxidation system controlling VOC emissions from microchip manufacturing facility in Los Angeles. The testing was sponsored in part by the SCAQMD's Innovative Technology Demonstration Program, to demonstrate this innovative control technology as BACT for microchip manufacturing operations. The target compounds were acetone, methylethylketone (MEK) and

1,1,1-trichloroethane, and compound concentrations ranged from 10-100 ppmv. The single stage packed tower scrubber consistently achieved greater than 90% removal efficiency on the target compounds. The residence time required in the UV oxidation system for effective oxidation of the target compounds proved significantly longer than the residence time predicted by the manufacturer.

BACT Pilot Testing of Venturi Scrubber on Gas/Aerosol VOC Emission Source. Technical advisor for project to evaluate venturi scrubber as BACT for mixed phase aerosol/gaseous hydrocarbon emissions from deep fat fryer. Venturi scrubber demonstrated high removal efficiency on aerosol, low efficiency on VOC emissions. A number of VOC tests indicated negative removal efficiency. This anomaly was traced to a high hydrocarbon concentration in the scrubber water. The pilot unit had been shipped directly to the jobsite from another test location by the manufacturer without any cleaning or inspection of the pilot unit.

Pulp Mill Recovery Boiler BACT Evaluation. Lead engineer for BACT analysis for control of SO_2, NO_x, CO, TNMHC, TRS and particulate emissions from the proposed addition of a new recovery furnace at a kraft pulp mill in Washington. A "top down" approach was used to evaluate potential control technologies for each of the pollutants considered in the evaluation.

Air Pollution Control Equipment Design Specification Development. Lead engineer for the development of detailed Navy design specifications for wet scrubbers and mist eliminators. Design specifications were based on field performance evaluations conducted at the Long Beach Naval Shipyard, Norfolk Naval Shipyard, and Jacksonville Naval Air Station. This work was performed for the U.S. Navy to provide generic design specifications to assist naval facility engineering divisions with air pollution control equipment selection. Also served as project engineer for the development of Navy design specifications for ESPs and fabric filters.

CONTINUOUS EMISSION MONITOR (CEM) PROJECT EXPERIENCE

Process Heater CO and NO_x CEM Relative Accuracy Testing. Project manager and lead engineer for process heater CO and NO_x analyzer relative accuracy test program at petrochemical manufacturing facility. Objective of test program was to demonstrate that performance of onsite CO and NO_x CEMs was in compliance with U.S. EPA "Boiler and Industrial Furnace" hazardous waste co-firing regulations. A TECO Model 48 CO analyzer and a TECO Model 10 NO_x analyzer were utilized during the test program to provide $\pm$1 ppm measurement accuracy, and all test data was recorded by an automated data acquisition system. One of the two process heater CEM systems tested failed the initial test due to leaks in the gas conditioning system. Troubleshooting was performed using O_2 analyzers, and the leaking component was identified and replaced. This CEM system met all CEM relative accuracy requirements during the subsequent retest.

Performance Audit of NO_x and SO_2 CEMs at Coal-Fired Power Plant. Lead engineer on system audit and challenge gas performance audit of NO_x and SO_2 CEMs at a coal-fired power plant in southern Nevada. Dynamic and instrument calibration checks were performed on the CEMs. A detailed visual inspection of the CEM system, from the gas sampling probes at the stack to the CEM sample gas outlet tubing in the CEM trailer, was also conducted. The CEMs passed the dynamic and instrument calibration requirements specified in EPA's Performance Specification Test - 2 (NO_x and SO_2) alternative relative accuracy requirements.

LATIN AMERICA ENVIRONMENTAL PROJECT EXPERIENCE

Preliminary Design of Ambient Air Quality Monitoring Network – Lima, Peru. Project leader for project to prepare specifications for a fourteen station ambient air quality monitoring network for the municipality of Lima, Peru. Network includes four complete gaseous pollutant, particulate, and meteorological parameter monitoring stations, as well as eight PM_{10} and TSP monitoring stations.

Evaluation of Proposed Ambient Air Quality Network Modernization Project – Venezuela. Analyzed a plan to modernize and expand the ambient air monitoring network in Venezuela. Project was performed for the U.S. Trade and Development Agency. Direct interaction with policy makers at the Ministerio del Ambiente y de los Recursos Naturales Renovables (MARNR) in Caracas was a major component of this project.

Evaluation of U.S.-Mexico Border Region Copper Smelter Compliance with Treaty Obligations – Mexico. Project manager and lead engineer to evaluate compliance of U.S. and Mexican border region copper smelters with the SO_2 monitoring, recordkeeping and reporting requirements in Annex IV [Copper Smelters] of the La Paz Environmental Treaty. Identified potential problems with current ambient and stack monitoring practices that could result in underestimating the impact of SO_2 emissions from some of these copper smelters. Identified additional source types, including hazardous waste incinerators and power plants, that should be considered for inclusion in the La Paz Treaty process.

Development of Air Emission Limits for ICE Cogeneration Plant - Panamá. Lead engineer assisting U.S. cogeneration plant developer to permit an ICE cogeneration plant at a hotel/casino complex in Panama. Recommended the use of modified draft World Bank NO_x and PM limits for ICE power plants. The modification consisted of adding a thermal efficiency factor adjustment to the draft World Bank NO_x and PM limits. These proposed ICE emission limits are currently being reviewed by Panamanian environmental authorities.

Mercury Emissions Inventory for Stationary Sources in Northern Mexico. Project manager and lead engineer to estimate mercury emissions from stationary sources in Northern Mexico. Major potential sources of mercury emissions include solid- and liquid-fueled power plants, cement kilns co-firing hazardous waste, and non-ferrous metal smelters. Emission estimates were provided for approximately eighty of these sources located in Northern Mexico. Coordinated efforts of two Mexican subcontractors, located in Mexico City and Hermosillo, to obtain process throughput data for each source included in the inventory.

Translation of U.S. EPA Scrap Tire Combustion Emissions Estimation Document – Mexico. Evaluated the Translated a U.S. EPA scrap tire combustion emissions estimation document from English to Spanish for use by Latin American environmental professionals.

Environmental Audit of Aluminum Production Facilities – Venezuela. Evaluated the capabilities of existing air, wastewater and solid/hazardous waste control systems used by the aluminum industry in eastern Venezuela. This industry will be privatized in the near future. Estimated the cost to bring these control systems into compliance with air, wastewater and solid/hazardous waste standards recently promulgated in Venezuela. Also served as technical translator for team of U.S. environmental engineers involved in the due diligence assessment.

Assessment of Environmental Improvement Projects – Chile and Peru. Evaluated potential air, water, soil remediation and waste recycling projects in Lima, Peru and Santiago, Chile for feasibility study funding by the U.S. Trade and Development Agency. Project required onsite interaction with in-country decisionmakers (in Spanish). Projects recommended for feasibility study funding included: 1) an air quality technical support project for the Santiago, Chile region, and 2) soil remediation/metals recovery projects at two copper mine/smelter sites in Peru.

Air Pollution Control Training Course – Mexico. Conducted two-day Spanish language air quality training course for environmental managers of assembly plants in Mexicali, Mexico. Spanish-language course manual prepared by Powers Engineering. Practical laboratory included training in use of combustion gas analyzer, flame ionization detector (FID), photoionization detector (PID), and occupational sampling.

Stationary Source Emissions Inventory – Mexico. Developed a comprehensive air emissions inventory for stationary sources in Nogales, Sonora. This project requires frequent interaction with Mexican state and federal environmental authorities. The principal Powers Engineering subcontractor on this project is a Mexican firm located in Hermosillo, Sonora.

VOC Measurement Program – Mexico. Performed a comprehensive volatile organic compound (VOC) measurements program at a health products fabrication plant in Mexicali, Mexico. An FID and PID were used to quantify VOCs from five processes at the facility. Occupational exposures were also measured. Worker exposure levels were above allowable levels at several points in the main assembly area.

Renewable Energy Resource Assessment Proposal – Panama. Translated and managed winning bid to evaluate wind energy potential in Panama. Direct interaction with the director of development at the national utility monopoly (IRHE) was a key component of this project.

Comprehensive Air Emissions Testing at Assembly Plant – Mexico. Project manager and field supervisor of emissions testing for particulates, NO_x, SO_2 and CO at turbocharger/air cooler assembly plant in Mexicali, Mexico. Source specific emission rates were developed for each point source at the facility during the test program. Translated test report into Spanish for review by the Mexican federal environmental agency (SEMARNAP).

Air Pollution Control Equipment Retrofit Evaluation – Mexico. Project manager and lead engineer for comprehensive evaluation of air pollution control equipment and industrial ventilation systems in use at assembly plant consisting of four major facilities. Equipment evaluated included fabric filters controlling blast booth emissions, electrostatic precipitator controlling welding fumes, and industrial ventilation systems controlling welding fumes, chemical cleaning tank emissions, and hot combustion gas emissions. Recommendations included modifications to fabric filter cleaning cycle, preventative maintenance program for the electrostatic precipitator, and redesign of the industrial ventilation system exhaust hoods to improve capture efficiency.

Comprehensive Air Emissions Testing at Assembly Plant – Mexico. Project manager and field supervisor of emissions testing for particulates, NO_x, SO_2 and CO at automotive components assembly plant in Acuña, Mexico. Source-specific emission rates were developed for each point source at the facility during the test program. Translated test report into Spanish.

Fluent in Spanish. Studied at the Universidad de Michoacán in Morelia, Mexico, 1993, and at the Colegio de España in Salamanca, Spain, 1987-88. Have lectured (in Spanish) on air monitoring and control equipment at the Instituto Tecnológico de Tijuana. Maintain contact with Comisión Federal de Electricidad engineers responsible for operation of wind and geothermal power plants in Mexico, and am comfortable operating in the Mexican business environment.

PUBLICATIONS

Bill Powers, "*More Distributed Solar Means Fewer New Combustion Turbines*," Natural Gas & Electricity Journal, Vol. 29, Number 2, September 2012, pp. 17-20.

Bill Powers, "*Bay Area Smart Energy 2020,*" March 2012. See: http://pacificenvironment.org/-1-87

Bill Powers, "*Federal Government Betting on Wrong Solar Horse*," Natural Gas & Electricity Journal, Vol. 27, Number 5, December 2010,

Bill Powers, "*Today's California Renewable Energy Strategy—Maximize Complexity and Expense*," Natural Gas & Electricity Journal, Vol. 27, Number 2, September 2010, pp. 19-26.

Bill Powers, "*Environmental Problem Solving Itself Rapidly Through Lower Gas Costs*," Natural Gas & Electricity Journal, Vol. 26, Number 4, November 2009, pp. 9-14.

Bill Powers, "*PV Pulling Ahead, but Why Pay Transmission Costs?*" Natural Gas & Electricity Journal, Vol. 26, Number 3, October 2009, pp. 19-22.

Bill Powers, "*Unused Turbines, Ample Gas Supply, and PV to Solve RPS Issues*," Natural Gas & Electricity Journal, Vol. 26, Number 2, September 2009, pp. 1-7.

Bill Powers, "*CEC Cancels Gas-Fed Peaker, Suggesting Rooftop Photovoltaic Equally Cost-Effective*," Natural Gas & Electricity Journal, Vol. 26, Number 1, August 2009, pp. 8-13.

Bill Powers, "*San Diego Smart Energy 2020 – The 21st Century Alternative*," San Diego, October 2007.

Bill Powers, "*Energy, the Environment, and the California – Baja California Border Region*," Electricity Journal, Vol. 18, Issue 6, July 2005, pp. 77-84.

W.E. Powers, *"Peak and Annual Average Energy Efficiency Penalty of Optimized Air-Cooled Condenser on 515 MW Fossil Fuel-Fired Utility Boiler,"* presented at California Energy Commission/Electric Power Research Institute Advanced Cooling Technologies Symposium, Sacramento, California, June 2005.

W.E. Powers, R. Wydrum, P. Morris, *"Design and Performance of Optimized Air-Cooled Condenser at Crockett Cogeneration Plant,"* presented at EPA Symposium on Technologies for Protecting Aquatic Organisms from Cooling Water Intake Structures, Washington, DC, May 2003.

P.J. Blau and W.E. Powers, *"Control of Hazardous Air Emissions from Secondary Aluminum Casting Furnace Operations Through a Combination of: Upstream Pollution Prevention Measures, Process Modifications and End-of-Pipe Controls,"* presented at 1997 AWMA/EPA Emerging Solutions to VOC & Air Toxics Control Conference, San Diego, CA, February 1997.

W.E. Powers, et. al., *"Hazardous Air Pollutant Emission Inventory for Stationary Sources in Nogales, Sonora, Mexico ,"* presented at 1995 AWMA/EPA Emissions Inventory Specialty Conference, RTP, NC, October 1995.

W.E. Powers, *"Develop of a Parametric Emissions Monitoring System to Predict NO_x Emissions from Industrial Gas Turbines,"* presented at 1995 AWMA Golden West Chapter Air Pollution Control Specialty Conference, Ventura, California, March 1995.

W. E. Powers, et. al., *"Retrofit Control Options for Particulate Emissions from Magnesium Sulfite Recovery Boilers,"* presented at 1992 TAPPI Envr. Conference, April 1992. Published in *TAPPI Journal*, July 1992.

S. S. Parmar, M. Short, W. E. Powers, *"Determination of Total Gaseous Hydrocarbon Emissions from an Aluminum Rolling Mill Using Methods 25, 25A, and an Oxidation Technique,"* presented at U.S. EPA Measurement of Toxic and Related Air Pollutants Conference, May 1992.

N. Meeks, W. E. Powers, *"Air Toxics Emissions from Gas-Fired Internal Combustion Engines,"* presented at AIChE Summer Meeting, August 1990.

W. E. Powers, *"Air Pollution Control of Plating Shop Processes,"* presented at 7th AES/EPA Conference on Pollution Control in the Electroplating Industry, January 1986. Published in *Plating and Surface Finishing* magazine, July 1986.

H. M. Davenport, W. E. Powers, *"Affect of Low Cost Modifications on the Performance of an Undersized Electrostatic Precipitator,"* presented at 79th Air Pollution Control Association Conference, June 1986.

AWARDS

Engineer of the Year, 1991 – ENSR Consulting and Engineering, Camarillo
Engineer of the Year, 1986 – Naval Energy and Environmental Support Activity, Port Hueneme
Productivity Excellence Award, 1985 – U. S. Department of Defense

PATENTS

Sedimentation Chamber for Sizing Acid Mist, Navy Case Number 70094

Attachment B

SoLoNOx Products: Emissions in Non-SoLoNOx Modes

Leslie Witherspoon
Solar Turbines Incorporated

PURPOSE

Solar's gas turbine dry low NOx emissions combustion systems, known as *SoLoNOx*™, have been developed to provide the lowest emissions possible during normal operating conditions. In order to optimize the performance of the turbine, the combustion and fuel systems are designed to reduce NOx, CO and unburned hydrocarbons (UHC) without penalizing stability or transient capabilities. At very low load and cold temperature extremes, the *SoLoNOx* system must be controlled differently in order to assure stable operation. The required adjustments to the turbine controls at these conditions cause emissions to increase.

The purpose of this Product Information Letter is to provide emissions estimates, and in some cases warrantable emissions for NOx, CO and UHC, at off-design conditions.

Historically, regulatory agencies have not required a specific emissions level to be met at low load or cold ambient operating conditions, but have asked what emissions levels are expected. The expected values are necessary to appropriately estimate emissions for annual emissions inventory purposes and for New Source Review applicability determinations and permitting.

COLD AMBIENT EMISSIONS ESTIMATES

Solar's standard temperature range warranty for gas turbines with *SoLoNOx* combustion is ≥ 0°F (–20°C). The *Titan*™ 250 is an exception, with a lower standard warranty at ≥ –20°F (–29°C). At ambient temperatures below 0°F, many of Solar's turbine engine models are controlled to increase pilot fuel to improve flame stability and emissions are higher. Without the increase in pilot fuel at temperatures below 0°F the engines may exhibit combustor rumble, as operation may be near the lean stability limit.

If a cold ambient emissions warranty is requested, a new production turbine configured with the latest combustion hardware is required. For most models this refers to the inclusion of Cold Ambient Fuel Control Logic.

Emissions warranties are not offered for ambient temperatures below –20°F (–29°C). In addition, cold ambient emissions warranties cannot be offered for the *Centaur*® 40 turbine.

Table 1 provides expected and warrantable (upon Solar's documented approval) emissions levels for Solar's *SoLoNOx* combustion turbines. All emissions levels are in ppm at 15% O_2. Refer to Product Information Letter 205 for *Mercury*™ 50 turbine emissions estimates.

For information on the availability and approvals for cold ambient temperature emissions warranties, please contact Solar's sales representatives.

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Table 2 summarizes "expected" emissions levels for ambient temperatures below 0°F (–20°C) for Solar's *SoLoNOx* turbines that do not have current production hardware or for new production hardware that is not equipped with the cold ambient fuel control logic. The emissions levels are extrapolated from San Diego factory tests and may vary at extreme temperatures and as a result of variations in other parameters, such as fuel composition, fuel quality, etc.

For more conservative NOx emissions estimate for new equipment, customers can refer to the New Source Performance Standard (NSPS) 40CFR60, subpart KKKK, where the allowable NOx emissions level for ambient temperatures < 0°F (–20°F) is 150 ppm NOx at 15% O_2. For pre-February 18, 2005, *SoLoNOx* combustion turbines subject to 40CFR60 subpart GG, a conservative estimate is the appropriate subpart GG emissions level. Subpart GG levels range from 150 to 214 ppm NOx at 15% O_2 depending on the turbine model.

Table 3 summarizes emissions levels for ambient temperatures below –20°F (–29°C) for the *Titan* 250.

Table 1. Warrantable Emissions Between 0°F and –20°F (–20° to –29°C) for New Production

Turbine Model	Fuel System	Fuel	Applicable Load	NOx, ppm	CO, ppm	UHC, ppm
Centaur 50	Gas Only	Gas	50 to 100% load	42	100	50
	Dual Fuel	Gas	50 to 100% load	72	100	50
Taurus™ 60	Gas Only or Dual Fuel	Gas	50 to 100% load	42	100	50
Taurus 65	Gas Only	Gas	50 to 100% load	42	100	50
Taurus 70	Gas Only or Dual Fuel	Gas	50 to 100% load	42	100	50
Mars® 90	Gas Only	Gas	50 to 100% load	42	100	50
Mars 100	Gas Only or Dual Fuel	Gas	50 to 100% load	42	100	50
Titan 130	Gas Only or Dual Fuel	Gas	50 to 100% load	42	100	50
Titan 250	Gas Only	Gas	40 to 100% load	25	50	25
	Gas Only	Gas	40 to 100% load	15	25	25
Centaur 50	Dual Fuel	Liquid	65 to 100% load	120	150	75
Taurus 60	Dual Fuel	Liquid	65 to 100% load	120	150	75
Taurus 70	Dual Fuel	Liquid	65 to 100% load	120	150	75
Mars 100	Dual Fuel	Liquid	65 to 100% load	120	150	75
Titan 130	Dual Fuel	Liquid	65 to 100% load	120	150	75

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Table 2. Expected Emissions below 0°F (–20°C) for SoLoNOx Combustion Turbines

Turbine Model	Fuel System	Fuel	Applicable Load	NOx, ppm	CO, ppm	UHC, ppm
Centaur 40	Gas Only or Dual Fuel	Gas	80 to 100% load	120	150	50
Centaur 50	Gas Only	Gas	50 to 100% load	120	150	50
	Dual Fuel	Gas	50 to 100% load	120	150	50
Taurus 60	Gas Only or Dual Fuel	Gas	50 to 100% load	120	150	50
Taurus 65	Gas Only	Gas	50 to 100% load	120	150	50
Taurus 70	Gas Only or Dual Fuel	Gas	50 to 100% load	120	150	50
Mars 90	Gas Only	Gas	80 to 100% load	120	150	50
Mars 100	Gas Only or Dual Fuel	Gas	50 to 100% load	120	150	50
Titan 130	Gas Only or Dual Fuel	Gas	50 to 100% load	120	150	50
Centaur 40	Dual Fuel	Liquid	80 to 100% load	120	150	75
Centaur 50	Dual Fuel	Liquid	65 to 100% load	120	150	75
Taurus 60	Dual Fuel	Liquid	65 to 100% load	120	150	75
Taurus 70	Dual Fuel	Liquid	65 to 100% load	120	150	75
Mars 100	Dual Fuel	Liquid	65 to 100% load	120	150	75
Titan 130	Dual Fuel	Liquid	65 to 100% load	120	150	75

Table 3. Expected Emissions below –20°F (–29°C) for the Titan 250 SoLoNOx Combustion Turbine

Turbine Model	Fuel System	Fuel	Applicable Load	NOx, ppm	CO, ppm	UHC, ppm
Titan 250	Gas Only	Gas	40 to 100% load	70	150	50

COLD AMBIENT PERMITTING STRATEGY

There are several permitting options to consider when permitting in cold ambient climates. Customers can use a tiered permitting approach or choose to permit a single emission rate over all temperatures. Historically, most construction and operating permits were silent on the ambient temperature boundaries for *SoLoNOx* operation.

Some customers have used a tiered permitting strategy. For purposes of compliance and annual emissions inventories, a digital thermometer is installed to record ambient temperature. The amount of time is recorded that the ambient temperature falls below 0°F. The amount of time below 0°F is then used with the emissions estimates shown in Tables 1 and 2 to estimate "actual" emissions during sub-zero operation.

A conservative alternative to using the NOx values in Tables 1, 2 and 3 is to reference 40CFR60 subpart KKKK, which allows 150 ppm NOx at 15% O_2 for sub-zero operation.

For customers who wish to permit at a single emission rate over all ambient temperatures, inlet air heating can be used to raise the engine inlet air temperature (T_1) above 0°F. With inlet air heating to keep T_1 above 0°F, standard emission warranty levels may be offered.

Inlet air heating technology options include an electric resistance heater, an inlet air to exhaust heat exchanger and a glycol heat exchanger.

If an emissions warranty is desired and ambient temperatures are commonly below –20°F (–29°C), inlet air heating can be used to raise the turbine inlet temperature (T_1) to at least –20°F. In such cases, the values shown in Table 1 can be warranted for new production.

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EMISSIONS ESTIMATES IN NON-SOLONOX MODE (LOW LOAD)

At operating loads < 50% (<40% load for the *Titan* 250) on natural gas fuel and < 65% (< 80% load for *Centaur* 40) on liquid fuels, *SoLoNOx* engines are controlled to increase stability and transient response capability. The control steps that are required affect emissions in two ways: 1) pilot fuel flow is increased, increasing NOx emissions, and 2) airflow through the combustor is increased, increasing CO emissions. Note that the load levels are approximate. Engine controls are triggered either by power output for single-shaft engines or gas producer speed for two-shaft engines.

A conservative method for estimating emissions of NOx at low loads is to use the applicable NSPS: 40CFR60 subpart GG or KKKK. For projects that commence construction after February 18, 2005, subpart KKKK is the applicable NSPS and contains a NOx level of 150 ppm @ 15% O_2 for operating loads less than 75%.

Table 4 provides estimates of NOx, CO, and UHC emissions when operating in non-SoLoNOx mode for natural gas or liquid fuel. The estimated emissions can be assumed to vary linearly as load is decreased from just below 50% load for natural gas (or 65% load for liquid fuel) to idle.

The estimates in Table 4 apply for any product for gas only or dual fuel systems using pipeline quality natural gas. Refer to Product Information Letter 205 for *Mercury* 50 emissions estimates.

Table 4. Estimated Emissions in non-SoLoNOx Mode

Ambient	Fuel System	Engine Load	NOx, ppm	CO, ppm	UHC, ppm
***Centaur* 40/50, *Taurus* 60/65/70, *Mars* 90/100, *Titan* 130**					
≥ –20°F (–29°C)	Natural Gas	Less than 50%	70	8,000	800
		Idle	50	10,000	1,000
< –20°F (–29°C)	Natural Gas	Less than 50%	120	8,000	800
		Idle	120	10,000	1,000
***Titan* 250**					
≥ –20°F (–29°C)	Natural Gas	Less than 40%	50	25	20
		Idle	50	2,000	200
< –20°F (–29°C)	Natural Gas	Less than 40%	70	150	50
		Idle	70	2,000	200
***Centaur* 50, *Taurus* 60/70, *Mars* 100, *Titan* 130**					
≥ –20°F (–29°C)	Liquid	Less than 65%	120	1,000	100
		Idle	120	10,000	3,000
< –20°F (–29°C)	Liquid	Less than 65%	120	1,000	150
		Idle	120	10,000	3,000
***Centaur* 40**					
≥ –20°F (–29°C)	Liquid	Less than 80%	120	1,000	100
		Idle	120	10,000	3,000
< –20°F (–29°C)	Liquid	Less than 80%	120	1,000	150
		Idle	120	10,000	3,000

Solar Turbines Incorporated
9330 Sky Park Court
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From: Lynn Stenglein
To: Finke, John (Health)
Subject: Questions about proposed Joelton Compressor Station
Date: Wednesday, August 03, 2016 4:11:11 PM

Dear Mr. Finke:

As residents of (1202 Walker Road, Goodlettsville, our home is within 2 miles of the proposed compressor station at Joelton and less than ½ mile from the existing pipeline. Succulently, we are at the intersection of the circle-area that will be adversely impacted by the proposed Joelton compressor and the Cane Ridge compressor. We have the following questions and concerns:

1. What will be the impact of ground water on the area? My neighbors and I have wells and are very concerned about the water quality of these wells that supply our drinking water.
2. What will be the impact on the air quality for the people and animals in the area, especially when the compressor gases are released into the air during shutdown, start up, blow out? There are many schools, churches, parks in the area, not to mention residences.
3. How does this station benefit anyone other than the Kinder Morgan, TN Pipeline, and their stockholders? Kinder Morgan has plenty of resources to put the compressor in an industrial area instead of the convenient White's Creek location.
4. What will happen, given the atrocious condition of a decades-old pipeline, with the increased pressure? The pipeline is on the property adjacent to ours. And many residences, churches, schools and businesses are much closer to it.
5. What is the impact on the wildlife and trees in the area? This area includes Bells Bend, Beaman Park, Paradise Ridge Park. It is one of the last areas of Davidson County that such natural areas. Why should this area be sacrificed?
6. What benefit will this compressor bring to the people of Tennessee or to the USA for that matter? We heat with propane; in the winter when we have needed deliveries of gas, the price of the gas has dramatically increased because the gas was being shipped overseas. Our local gas provider confirmed this. Kinder Morgan's and the other companies' scheme will decrease internal supply.

Thank you for your attention to this matter.

Sincerely,

Lynn and George Stenglein
1202 Walker Road
Goodlettsville, TN 37072

From: richelledeharde@comcast.net
To: Finke, John (Health)
Subject: Tgp -public comments
Date: Wednesday, August 03, 2016 3:55:39 PM

Please protect my air -
Donald 14years old

Sent from my LG Mobile

From: kbentley3@comcast.net
To: Finke, John (Health)
Subject: TGP - public comment
Date: Wednesday, August 03, 2016 3:52:20 PM

My name is Kaye Bentley. I'm a resident of Joelton and live within 1,100 feet of the proposed gas compressor station. My family has lived here since 1889, six generations have lived on this land passing it down from one generation to the next. Two years ago we spent over $30,000 dividing the land between my sons and my nieces and nephews. Now with the possibility of a gas compressor station going in they are reluctant to build on the property. If families with this history and free land are reluctant to invest in this community why would anyone else want to move here? This would kill any growth in the Joelton community.

My second question is about the bat population. I know Kinder Morgan had to pay off the Tennessee Wildlife Resources because of the known bat population on this property. I have seen the number of bats in our area dwindle over the past years, however, the mosquito population is still fairly low compared to other areas in Davidson County. We don't have any testing or spraying from Metro that I know of for mosquito's. With the rising concern over the Ziki virus you would think reducing the number of bats would be a real concern for the Health Dept. Kinder Morgan keeps saying the facility only covers 26 acres, but did they tell you they are clear cutting over 40 acres of mature trees that are documented bat nesting trees? With the noise from the compressor station the bats will likely not come back to this area. How does the Health Dept./Metro plan on compensating for this loss?

My third concern is the noise. It's my understanding the frequency not governed by the Federal Government is the very low frequency. I have a documented hearing loss in the higher register, but the low frequency is way above normal. How will this effect my hearing? Will my hearing be consumed by the steady noise from the station?

I guess my biggest concern is the air quality. I've heard Kinder Morgan say the gas is clean, but I have also read in their reports that the gas will be sent to the gulf to refineries before being sent overseas. That just doesn't make sense to me, if the gas is clean when it's going through the pipeline here, why would it need to be refined there? Also, there have been so many documented reports of the public who live near compressor stations getting sick from the known chemicals in the gas, how could you expose us to this health hazard?

Thank you,

Kaye Bentley

From: Gary
To: Finke, John (Health)
Subject: TGP - public commente
Date: Wednesday, August 03, 2016 3:52:13 PM

Mr. John Finke
Metro Public Health Department
2500 Charlotte Avenue
Nashville, TN 37209

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TGP/KM # 563. Specifically, how often are emissions checked at the proposed compressor station? Given the recent exposer of TGP/KM inadequate maintenance and self-regulation of their pipes, will they also self-regulate their emissions? If not, who validates the figures for accuracy at the site? What happens if the numbers are exceeded? If numbers are exceeded, are these violations communicated to residents? Do violations result in fines levied against the company?

Based on TGP/KM unwillingness to properly maintain and inspect their existing equipment, I respectfully request that the Metro Health Department deny the TGP/KM application for compressor station # 563 in Joelton.

Thank you,

Gary Moore

Sent from Mail for Windows 10

From: rebarmstrong06@yahoo.com
To: Finke, John (Health)
Subject: CCSE against the permit for natural gas Compressor Station
Date: Wednesday, August 03, 2016 3:46:45 PM

Questions for John Finke:

1. Why is the financial responsibility of the citizens of Joelton and Antioch as well as other concerned citizens to prove why the compressor stations would not be a safe option for Davidson County? The pipelines are old and clearly showing signs of stress and damage from the lack of maintenance from Kinder-Morgan/TGP.
2. How can the Health Department issue a permit knowing very real possibility of the pipelines and/or the compressor station releasing toxins into the environment resulting in health issues?
3. Once the permit allows compressor stations to be built in our county, how an you 'shut the doors' or limit the size or limit the number of additional stations being built?
4. History shows Kinder-Morgan/TGP aren't able to prevent or maintain their pipelines and they are a multi-billion dollar company. So how will the Metro Health Department be equipped and manned to monitor and ensure the standards are being maintained?

My husband and Mike Younger were two of the Joelton residents that went out to personally see if the pipelines were maintained. They were disappointed to see them in such bad condition. My husband would still be fighting against the compressor station, but he was killed in a car wreck on Whites Creek Pike on September 29, 2015. The Armstrong's have owned land in Joelton for many generations; we were hoping to continue that tradition with our children and grandchildren. Unfortunately, with the compressor station being proposed, the decline in the property value and possibility of the environment and air being polluted with toxins, they may never build their homes on their land. As a long time resident of Joelton, I'm worried about so many of the health issues associated with the pipelines and compressor stations.

Thank you for listening to my/our concerns,

Rebecca Armstrong (CCSE member)
7760 Whites Creek Pike
Joelton, TN 37080
615 418-0353 (cell)

Sent from Windows Mail

From:	Sharon Felton
To:	Finke, John (Health)
Subject:	TGP -- Public Comment
Date:	Wednesday, August 03, 2016 3:28:54 PM

I am certain that Bill Powers, the air expert from California, has submitted his comments to you. However, on the tiny OFF chance that he hasn't, I learned one important bit of advice from him:

***Make sure that you demand that a catalytic control system be included if the permit goes forward*.**

Ideally, of course, the permit should be denied, and I feel confident you have enough evidence by this point to deny this permit. It takes a village, and this village clearly rejects this compressor.

--Sharon Felton
sharonfelton@yahoo.com

From: Gary
To: Finke, John (Health)
Subject: TGP - public comment
Date: Wednesday, August 03, 2016 3:28:52 PM

Mr. John Finke
Metro Public Health Department
2500 Charlotte Avenue
Nashville, TN 37209

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TPG/KM # 563. Specifically, if a citizen has pre-testing done, such as an annual physical, before the compressor is constructed and receives a clean bill of health, and sometime later undergoes post-testing that confirms they have developed an illness related to exposure to toxic substances – such as BTEX (benzene, toluene, ethylbenzene and xylene). Who will bear the burden of responsibility such as medical expenses and or disability or even worse death? Will it be the Metro Health Department if the department allows the facility to be built?

Thank You,

Gary Moore

Sent from Mail for Windows 10

From:	Scott Banbury
To:	Finke, John (Health)
Cc:	Axel C Ringe; Cliff Cockerham; Brian Paddock; Lori Birckhead
Subject:	Sierra Club Comments on Tennessee Gas Pipeline Air Permit
Date:	Wednesday, August 03, 2016 2:33:33 PM
Attachments:	SierraClubCommentsonTennesseeGasPipelineAirPermit.pdf

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Please accept the attached comments on behalf of the 1082 members of the Sierra Club that reside in Davidson County.

Thank you,

Scott Banbury, Conservation Program Coordinator
Tennessee Chapter of the Sierra Club
smbanbury@gmail.com or 901-619-8567

"When we try to pick out anything by itself,
we find it hitched to everything else in the Universe"
- John Muir

John Finke
Metro Health Department
Air Pollution Control

July 3, 2016

Re: Tennessee Gas Pipeline Air Permit

Mr. Finke,

On behalf of the 1082 members of the Tennessee Chapter of the Sierra Club that live in Davidson County, I respectfully ask that you deny the pending air permit for the Tennessee Gas Pipeline Compressor Station in Joelton, TN.

Compressor stations are known to emit and or release Volatile Organic Compounds and EPA listed Hazardous Air Pollutants. Sierra Club believes that emissions from the proposed facility will have chronic impacts on human health and the surrounding natural environment. We know that emissions will contribute to ground level ozone formation, as well as greenhouse gases. For these reasons, we believe the permit for this facility, which serves no local need, and offers little economic benefit to the community, should be denied.

Continuous fugitive emissions are poorly documented but under increasing scrutiny. They occur as a result of intentional engineering, including pneumatic controllers and, in some cases, the type of seals used on the compression turbines. Other fugitive emissions originate from poorly sealed joints on pipes and other equipment, as well as the venting of condensate tanks. While we are happy to see that the Health Department is incorporating EPA's new fugitive emissions rules issued May 12, 2016, we believe that quarterly monitoring is insufficient to protect the public health. Should this permit be issued, we believe that Metro Health should invest in Optical Gas Imaging (OGI) equipment and monitor fugitive emissions on a much more frequent and randomly scheduled basis, or preferably by permanently installed, continuously recording OGI equipment and air sampling stations.

We note that emissions from pipeline liquids storage tanks have been specifically exempted from monitoring. These tanks pose a serious threat as a source of fugitive emissions, several components of which may pose both acute and chronic health risks, including cancer. We believe that fugitive emissions from these tanks must be included in fugitive emission monitoring.

Blowdowns, whether planned as part of routine maintenance or a result of accidents or emergency situations, are a source of enormous releases of methane and the Volatile Organic Compounds and Hazardous Air Pollutants present in Natural Gas. Since the enormous emissions released during blowdown events are released in a very short time period they often exceed concentrations that would be safe for human health, particularly for sensitive populations. Should this permit be issued, we believe it should require monitoring of all

scheduled blowdowns using OGI equipment as well as air sampling at various distances around the facility. Permanently installed OGI and air sampling equipment should be installed and designed to automatically sample and record when unscheduled blowdowns occur.

Particulates: the permit lists only PM10 in the list of pollutants to be monitored. Sierra Club believes that the facility should also be subject to monitoring for PM2.5.

Lastly, the Sierra Club believes that the combination of Metro Ordinance No. BL2015-1210, enacted in August, 2015, which established “natural gas compressor station” as a use permitted only in industrial zoning districts, and Metro Ordinance NO. BL2016-234, enacted on July 5, 2016, which established that conformity to Metro Zoning be a condition of Metro Health Department New Source permits, prohibits the Health Department from issuing this permit. For this reason alone, the permit should be denied.

Sincerely.

Scott Banbury, Conservation Programs Coordinator
Tennessee Chapter of the Sierra Club
901-619-8567 or smbanbury@gmail.com

From:	WENDY.BULLINGTON
To:	Finke, John (Health)
Subject:	Compressor
Date:	Wednesday, August 03, 2016 2:29:01 PM

I do not want the compressor in joelton. It's dangerous and will ruin our quality of life. It's a terrible idea and I don't know why it'd being considered. I live at 2830 union hill rd

Sent from XFINITY Connect Mobile App

From: ï»¿Dan and Glenda Kirby
To: Finke, John (Health)
Subject: TGP--Public Comment
Date: Wednesday, August 03, 2016 2:25:25 PM

I have the following concerns about the proposed gas compressor proposed for Joelton.

My mother used to live in Springfield which is well within the 30 miles affected area for the proposed Joelton compressor. She has many friends who still live in that area and we are concerned for their health. In addition, my cousin, his wife, and their children and grandchildren live in Roberson County within the affected zone. The air quality in Davidson County where my family now lives may also be affected.

I have to take two medications that can potentially compromise my lungs. It is my understanding that the compressor will affect air quality with a 30-mile radius of the unit. I do not want to be exposed to methane and other toxins, including benzene, toluene, sulfuric oxide, and formaldehyde that may further put my lungs at risk.

Will this compressor emit nitrous oxide? I am not a chemist, but I have read that nitrous oxide would put local crops at risk because it interacts with other organic compounds to create ozone. Will that ozone also affect the quality of the air we breathe?

A compressor is also being proposed in Antioch, TN. How will Davidson county's air quality be affected since most of the county will be within 30 miles of both compressors?

The owner of the proposed compressor says that air quality will be safe because it is monitored and will not exceed certain levels. Who monitors the emissions once it is up and running? How often is it checked? What happens if the dangerous emissions level is exceeded? Will they be shut down or will they just be fined? I don't believe a fine is sufficient deterrent because they can just pay the fine and continue to pollute the air--causing damage that cannot be undone.

Thank you for your careful consideration of this matter. We ask that their permit be denied unless they can prove beyond a doubt that there will be no harm to Davidson county residents.

From:	ï»¿Dan and Glenda Kirby
To:	Finke, John (Health)
Subject:	TGP--Public Comment
Date:	Wednesday, August 03, 2016 2:28:59 PM

I apologize for submitting my comments twice. I thought it didn't go through the first time so I resubmitted--then realized it did go through the first time. I am not very computer literate, but I am very concerned about the proposed gas compressor! Thank you for your concern.

From:	Joan Sullivan
To:	Finke, John (Health)
Subject:	TGP--public comment
Date:	Wednesday, August 03, 2016 2:25:22 PM

I am writing to urge you to reject Tennessee Gas Pipeline's request for a permit to build and operate a high-pressure gas compressor station in Joelton. 1) The pollution expected to emanate from this facility during normal operation is projected to spread out for a 50 km radius, thus making this a health hazard throughout Davidson County, much of TN, up beyond Clarksville into KY. So this is clearly not a "NIMBY" issue; it covers a large chunk of TN and beyond. And that is under "normal operating conditions." 2) They are planning to use existing pipelines, many of which are 60+ years old. We have seen evidence of exposed pipes which are corroded and unsafe under normal pressure. How long will it take for these areas to explode under high pressure??? PHMSA records indicate that TGP experienced 92 "significant incidents" (i.e. fires and explosions) between 2006-2014. This resulted in $88,144,152. in property damage and 19 federal enforcement actions. 3) Another potential problem increasing the likelihood of leaks and explosions is their plan to reverse the flow of gas through these old pipes. The flow currently is south to north, but when the compressor station is built it will be used for north to south flow. Therefore, the pipe connections with one pipe sliding into the next pipe will also be reversed---and now will unfortunately result in a narrowing of the pipe's capacity within the overlap area. This resulted in a temporary reduction in pressure when the flow was from south to north, but will increase the pressure once the flow is reversed to north to south. Combine this with the 60-year old corroded pipes and we have a major explosion waiting to happen. 4) PLEASE deny this risky permit as part of your role in "Protecting, Improving, and Sustaining Health" for residents of Metro and far beyond. Thank you, Joan M. Sullivan 7601 Harper Rd. Joelton TN 37080.

From:	Kaila Sewell
To:	Finke, John (Health)
Subject:	Gas Compressor Station- Joelton
Date:	Wednesday, August 03, 2016 2:24:57 PM

Mr. Finke,

My name is Kaila Sewell and I am a life-long resident of Joelton. (at 3429 Binkley Road). I am writing this email to let you know that I absolutely do not support the addition of the Gas Compressor station to my community for a variety of reasons. First, much like the growing city of Nashville, with the Compressor, Joelton will see rapid growth, and will likely lose its small town charm--- the charm that the residents of this town have fought valiantly to save. Second, the noise pollution produced by this compressor is enough to ruin the residents' quality of life. I am sure that you, much like me, and the rest of the occupants of Joelton who are fighting against this monstrosity, have no desire to live with what will sound essentially like a giant bumble bee buzzing in your yard, home, and head at all hours of the day and night. Third, there is a safety issue with this compressor. Apparently compressor stations such as this one have the potential to spontaneously combust, leaving the people of Joelton homeless, jobless, and perhaps without their lives. Finally, there is a wildlife rehabilitation center called Walden's Puddle that is very close to the proposed compressor site. If the compressor is placed in our rural, residential area, then Walden's Puddle will be forced to close, leaving an unknown number of animals without the help that they need.

As a life-long member of the Joelton community, I am asking you to please fight against this compressor to make the future for my little town safer, quieter, and more charming for generations to come.

Thank you,
Kaila Sewell

From: marisab2001@yahoo.com
To: Finke, John (Health)
Subject: Compressor
Date: Wednesday, August 03, 2016 2:05:38 PM

I live at 2830 union hill in Joelton and I am fully against the compressor being put in. I don't know a single person that thinks it's a good idea to have it here

From: Sharon Litts
To: Finke, John (Health)
Subject: TGP Public Comment
Date: Wednesday, August 03, 2016 2:02:37 PM

Mr. Finke,

As a resident of Southeastern Davidson County , our family is very concerned about the proposed gas compression station in Joelton. It will change the air quality in this growing urban area, and with the possibility of another station being built nearby, the threat to the environment will be much greater. We appreciate anything you can do to stop the Joelton plant from happening.

Bob & Sharon Litts
Cane Ridge, TN 37013

From: Jonathan Ramirez
To: Finke, John (Health)
Subject: Compressor station concerns
Date: Wednesday, August 03, 2016 1:59:41 PM

As a farmer in Joetlon TN, I care about the quality of the earth around me. If I care for it, it returns its gifts to me with the abundance of life and health. Our beautiful land is under threat. Kinder Morgan and other colluding parties wish to exploit the people of Nashville and the people of this country for a massive profit. They do this with no true regard for the peoples health and safety nor for the health and well being of the land that gives us life. The community is fully aware of the criminal collusion occurring between big business and the Federal Energy Regulatory Commission (FERC) all around the county, and the community has pledged that it will not be another victim of this so-called "progress". We ask you to stand with the residents of Joelton in your position of sacred responsibility and hold true to your intention to protect the health of our beautiful neighborhood. The community did not want it many years ago when the pipes first came in and we do not want it now. We know that it is unsafe and polluting and our community refuses its presence.

Thank you for your service,

Jonathan Ramirez

From: Gary
To: Finke, John (Health)
Subject: TGP - public comment
Date: Wednesday, August 03, 2016 1:57:24 PM

Mr. John Finke
Metro Public Health Department
Pollution Control Division
2500 Charlotte Avenue
Nashville, TN 37209

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/comment regarding the air/construction permit for the Joelton compressor station TPG/KM # 563.

You have heard a brief, two minute, report from Bill Powers regarding the proposed TGP/KM gas compressor station for Joelton. I am sure by now you have taken the opportunity to read the full report. There are two points I would like to make regarding the TGP/KM application dated September 15, 2015. That is, in my opinion, TGP/GM were one, incompetent or two, were intentionally trying to deceive members of the Metro Health Department. I say this because in the Powers report he states: "The Tennessee Gas Pipeline Company, L.L.C.1 (TGP) has submitted a Reasonably Available Control Technology (RACT) analysis that uses outdated and incomplete information to incorrectly conclude that an oxides of nitrogen (NOx) limit of 25 ppm is RACT for the two Titan 250 turbines at the proposed Joelton Compressor Station. The Metro Nashville/Davidson County Air Pollution Control Division erroneously accepted the TGP RACT analysis with essentially no critical or independent review."

Regardless of whether their actions were a mistake or intentional, I think, it would be incumbent upon the Metro Health Department to assume that the individual submitting the application for a company that submits applications on a routine basis would have, or should have, known the information was outdated.

I am of the opinion they knew better, but knew this was a first for the Metro Health Department and thought they would get away with it. Who knows, maybe they would have had it not been for the Powers report.

Is this the only fallacy in their application?

As I have requested in previous emails, I respectfully ask that the application for the

proposed compressor station # 563 in Joelton be denied.

Thank you,

Gary Moore

Sent from Mail for Windows 10

From:	Sharon Litts
To:	Finke, John (Health)
Subject:	Joelton gas compression station
Date:	Wednesday, August 03, 2016 1:50:15 PM

As residents of Southeast Davidson County, my family is very concerned about the planned gas compression plant in Joelton. It will affect our air quality in this growing urban area, and with the possibility of a second station being built close by, there is even more of a threat to the environment. We appreciate any effort you can give to stopping this.

Bob & Sharon Litts
3497 Chandler Cove Way
Cane Ridge, TN 37013

From:	Gary
To:	Finke, John (Health)
Subject:	TGP - public comment
Date:	Wednesday, August 03, 2016 1:46:21 PM
Attachments:	John Finke – Letter 2.docx

Mr. John Finke
Metro Public Health Department
Pollution Control Division
2500 Charlotte Avenue
Nashville, TN 37209

Mr. Finke,

Please find attached my comments regarding the proposed compressor station for Joelton by TGP/KM.

Sent from Mail for Windows 10

Mr. John Finke
Metro Public Health Department
2500 Charlotte Avenue
Nashville, TN 37209

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/comment regarding the air/construction permit for the Joelton compressor station TGP/KM # 563.

The following mission statement was taken directly from the Metro Nashville Health Department website:

> "The mission of the Metro Public Health Department is to protect, improve, and sustain the health and well-being of all people in Metropolitan Nashville."

In addition, the Metro Code of Law is very clear as it states in 10.56.170;

> **"10.56.170 - Emission of gases, vapors or objectionable odors.**
>
> No person shall cause, suffer, allow or permit any emission of gases, vapors or objectionable odors beyond the property line from any source whatsoever which causes injury, detriment, nuisance or annoyance to any considerable number of persons or to the public, or which causes or has a natural tendency to cause injury or damage to business or property."
>
> (Prior code § 4-1-10)

Given the forty documented ill effects sited below regarding compressor stations that give a clear indication of what to expect with compressor station 563 and 10.56.170 of the code; how can the Metro Health Department be expected **to protect, improve, and sustain the health and well-being of all people in Metropolitan Nashville** and see that **no person shall cause, suffer, allow or permit any emission of gases, vapors or objectionable odors beyond the property line from any source whatsoever which causes injury, detriment, nuisance or annoyance to any considerable number of persons or to the public, or which causes or has a natural tendency to cause injury or damage to business or property**?

It is my hope, that given the potential of serious ill effects of the proposed TGP/KM compressor station # 563, you will take time to open each link below and read firsthand the illnesses caused by compressor stations that are much smaller in size than the proposed Joelton station.

Not only do I think the right thing to do would be to deny the permit application, I also think it is incumbent on the Metro Health Department to adhere to their on mission statement and comply with the Metropolitan Code of Law.

Based on the afore mentioned, I respectfully request the Metro Health Department deny TGP/KM application for compressor station # 563 in Joelton.

Thanks,

Gary Moore

Appendix A

Restricted to only natural gas compressor station incidents, the compiled list of harmed taken from https://pennsylvaniaallianceforcleanwaterandair.wordpress.com/the-list/ is as follows:

1. #1) **Pam Judy and family**; Carmichael, PA; compressor station 780 feet from home; air exposure; blood tests revealed benzene and compound chemicals; symptoms include neurological (headaches, vertigo, fatigue), nausea, nosebleeds
2. #5) **Phyllis Carr and family**; Fayette County, PA; 3 compressor stations and dehydrator; air exposure; blood tests revealed phenol and benzene; symptoms include neurologic (headache, vertigo), blisters, sore throats, respiratory distress; http://www.frackcheckwv.net/2011/01/17/a-good-whiff-will-put-blisters-up-your-nose/
3. #11) **Wayne and Angel Smith**; Bedford County, PA; compressor station, pipeline and storage; air and water exposures; dead animals (5 cows, 12 chickens, 3 dogs and 4 cats); http://www.altoonamirror.com/page/content.detail/id/543123/clearville-residents-blame-reduced-property-values-on-natural-gas-project.html ; http://www.accountability-central.com/nc/single-view-default/article/voices-from-the-shale-citizen-regulators-trade-incidents/
4. #25) **Lorrie Squibb**; Flower Mound, TX; heavy gas production facilities; air exposure; diagnosis of multiple myeloma; http://www.dentonrc.com/local-news/special-projects/gas-well-drilling-headlines/20110831-breast-cancer-rate-climbs-up
5. #28) **Megan Collins**, Dish, TX; 32YO pediatric nurse; compressor station; air exposure; multiple tests but no confirmed diagnosis; symptoms include respiratory, neurological, sore throat, nausea; http://www.npr.org/templates/story/story.php?storyId=120043996
6. #51) **Susan Haire**; Morrisania Mesa, CO; compressor station and wells; air exposure; symptoms include sinus/sore throat, itch/rash, respiratory distress, extreme leg (nerve) pain; http://www.hcn.org/water/16376 ; also, *High Country News*, "Health is a casualty on the fast track to gas drilling"; Rebecca Clarren, January 12, 2006
7. #67) **Lloyd Burgess**, horse rancher; Dish, TX; compressor stations, pipelines, gas facilities; air exposure; dead horse, mare blinded; http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav_n_827478.html
8. #68) **Charles Morgan**, retired engineer/rancher; Freestone County, TX; compressor station 12KHP; air and noise exposure; increased, intense noise twice ruptured his eardrums as well as his daughter's eardrums; http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav_n_827478.html
9. #70) **Sharon Ward** (deceased 2011); Freestone County, TX; 130 compressors in county; air exposure; documented headaches, tinnitus and sleep disturbances due to high noise levels
10. #82) **Warren and Rebekah Sheffield (and 17 and 19YO sons**); Dish, TX; multiple compressor stations and pipelines; air exposure; symptoms include headaches, seizures, multiple chemical sensitivities; vertigo, nausea, hives, sore throats; http://dentonrc.com/local-news/special-projects/gas-well-drilling-headlines/20110328-atmosphere-of-concern (see for #s 82-84)

11. #83) **Chuck and Geri Pegg**; Dish, TX; compressor station within 300 feet from home; air and noise exposures; air samples indicate high levels of benzene and carbon disulfide per TX Department of Air Quality, which also revealed 4.8ppb (high) levels of formaldehyde; symptoms similar to other Dish, TX residents
12. #84) **Jim and Judy Caplinger**; Dish, TX; compressor stations; air and noise exposures; settled out of court with gas company for unnamed monetary amount in 2007
13. #209) **Mary Mack**; Bedford County, PA; compressor station; air and water exposures; arsenic and VOC's found; suffered dermatological and neurological symptoms; http://www.youtube.com/MaryMack#1.m4v
14. #308) **Ron Moss and wife**; gas production; air and water exposures; documented asthma; http://earthworksaction.org/files/publications/LOguideCh4.pdf?pubs/LOguideCh4.pdf
15. #573) **Louis, Bessie and daughter Lisa Vecchio**; Dunkard and Greene Townships, PA; five compressor stations; noise exposure; entered a 2011 lawsuit for excessive noise exposure; http://triblive.com/x/pittsburghtrib/news/regional/s_764486.html#axzz2CEGWAial
16. #574) **William Justiss**; Lamar County, TX; compressor station; air and noise exposures; nausea; one of 5 families in Supreme Court lawsuit ebrief #10/10045106.pdf
17. #575) **Tom and Judy Alspaugh**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms; see above ebrief
18. #576) **J.D. Mashburn and wife, Judy**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms; see above ebrief
19. #577) **J.D. Mashburn and Christine**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms; see above ebrief
20. #578) **J. Justiss**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms and cattle not feeding
21. #751) **Graham Feil**; compressor station; neurological symptoms; air exposure noted
22. #758/#759) **Doug Jenkins and Larry L. Joseph**; Carbon County, UT; compressor station; explosion; critical burns on bodies; crater formed 30 feet wide by 15 feet deep; http://www.bizjournals.com/denver/news/2012/11/21/2-injured-in-fire-at-bill-barrett-gas.html; *Denver Business Journal*; Mark Hardin
23. #766/#767) **Harriet Irby and Betty Clark**; Pentango, TX; compressor station; air exposure; ENT problems, respiratory distress; dead chickens; open valve venting NG and VOC's http://www.star-telegram.com/living/family/moms/article3828826.html; 9/2/2011; S. Schrock
24. #792) **Richard Usack**; Crawford County, PA; compressor station; noise and light exposure; http://www.tiogagaslease.org/images/BVW_11_03_09.pdf
25. #795) **Margaret Heinkel-Wolfe**; Denton County, TX; compressor station; air exposure; neurological and respiratory symptoms; #2010-40355362, November 3, 2010 lawsuit, *Heinkel v Wms Prod. Co., LLC*; suing for devalued property, formaldehyde, sulfur dioxide, benzene, toluene and xylene exposures emitted from compressor station caused documented illnesses
26. #888/#889) **Earl Wenger and Cindy Tout**; Dolores County, TX; air and noise exposures; neurological and ENT symptoms; http://fourcornersfreepress.com/?p=550 "Is Kinder Morgan a Good Neighbor?"; Gail Binkly, May 5, 2012
27. #890/#891**) Albert Nutgrass and Michael Brock**; Glenville, WVA; compressor station; fire on 10/6/2006; severely burned while replacing valves; lawsuit in Kanawha County #06-C-1749; http://wvrecord.com/stories/510590899-fireball-injured-workers-suit-says

28. #899) **Calvin Tillman and family**; Dish, TX; compressor stations and pipelines; air exposures; children suffered repeat nosebleeds; family moved away; http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav_n_827478.html
29. #1106) **Mandy Mobley and two sons**; Ft. Worth, TX; compressor station within 1000 feet of home; air exposure; allergies and related ENT symptoms, migraines, vertigo, fatigue; house has structural damage from constant vibrations; http://www.fwweekly.com/2013/01/16
30. #1204) **John Kurucz**, retired farmer; Wash County, PA; 27 drilling wells and countless compressor stations and pipelines; infrastructure placed on known 'slip' area and now hillside is sliding away; Kurucz says the pipeline company is blaming his cattle for walking on the area!; http://www.youtube.com/watch?v=qoohCRCZvuY "From the Frontlines"
31. #1220) **Lisa Beck and Sonny Beck**; Blair County, PA; fracking well and compressor station; air and water exposures; headaches, fatigue, vertigo, rash; http://womensnews.org/2013/04/fracking-natural-gas-fuels-health-worries/
32. #1355 thru #1369 (**15 people**); Somerset, NJ; compressor station; **flash fire**; 2 hospitalized with 13 minor injuries; fire began in an inactive part of pipeline; "Multiple Injuries Reported at Branchburg Gas Pipeline Facility Flash Fire", Walter O'Brien, 05-30-2013, http://www.nj.com/somerset/index.ssf/
33. #1376 to #1378 (**3 people**); Logan County, OK; compressor station; **explosion** in building 4/5/2013; no injuries; 3 homes **evacuated** at night; http://www.news9.com/.../homes-evacuated-after-gas-explosion-in-eastern-logan-county ; story #21886634
34. #1379/#1380) **Benjamin Groover, Sr., wife and 2 sons; Robert Nicklow**; Franklin County, PA; compressor station; air and noise exposure; *Bloomberg News*, "Chevron Among Drillers Facing Gas Wells Nuisance Lawsuit", Sophia Pearson and Jim Esttathiou, Jr., 06-10-2013; people seek damages for effects of chemical exposure, noise – exposed to methane leaks and noise that forced Groover and family to abandon home June 2009; Nicklow subjected to 'screeching' noise continuously and exposed to benzene, methane, ethane and is forced to stay inside; *Headley v Chevron Appalachia LLC*, Court of Common Pleas of Allegheny County, PA
35. #2492) **Jessica and Andy Keyon and two children**; Hancock, DE; compressor station and pipeline; evacuation due to compressor station main line venting millions of gallons of natural gas from 10 mile stretch of 30" pipelines; had to vent station for safety for hours on 12-5-2013; incident not reported by Millenium Pipeline to proper state/federal agencies!; http://www.watershedpost.com/2013/hancock-family-evacuated-after-pipeline-accident
36. #2515) **David Crichton**; compressor station; flash fire; burns suffered on hands and face 12-26-2013; http://www.dailyranger.com/story.php?story_id_10585 by Katie Roenigk
37. #5070) **Pramilla Malick and family**; Orange County, NY; compressor station; air exposure; asthma; http://www.truth-out.org/news/item/18636-rural-new-jersey-township-fights-ferc-approved-gas-compressor
38. #6153) **Dan Bykens**; Washington County, PA; compressor station; air exposure; asthma; http://www.observer-reporter.com/article/20140719/NEWS080101/140719418#.VAKMkFfiG2X
39. #7474) **Rebecca Williams**, registered nurse; Tarrant County, TX; compressor station; air exposure; dermatologic, neurologic, ENT, and respiratory symptoms and nausea; http://www.publicintegrity.org/2014/12/11/16396/health-worries
40. Not on the list of harmed are the following: 19YO **Taylor Ishee** – diagnosed with Burkitt's Leukemia at 19, but exposed to 37 gas wells and compressor stations within 1½ mile of his home; Taylor's best friend, **Justin Eaklor**, 21YO, diagnosed with lymphatic leukemia – lived 2/3 mile from 4 wells and compressor station. Texas Air Quality's Terry Clawson said, "TCEQ can't

determine the cause of residents' health problems…but it is highly unlikely that chemicals are being emitted at levels high enough to cause adverse health effects such as cancer, kidney damage or liver damage…TCEQ has found no cause for alarm". However, there are only 26 air monitoring stations are in place to monitor more than 6,000 compressor stations! At 11 stations, samples are taken only every six days. And of the 1,370 air quality complaints, TCEQ issued violation notices for 2% from 2009 to 2014 (five years). Yet, TCEQ states the consequences of this are negligible. According to the World Health Organization, "there is no safe level of exposure" with regard to benzene. However, TCEQ in 2007 raised the amount considered "safe" to 54ppb for short durations and 1.4ppb for long durations. Up to the late 1940's, research produced for the American Petroleum Industry and Shell "concluded that no amount of benzene was safe". And in a confidential report, Shell in 1943 stated, "prolonged exposures to low concentrations [to benzene] may be the most dangerous". https://www.publicintegrity.org/2014/12/11/16396/health-worries-pervade-north-texas-fracking-zone

From:	Geoff Collins
To:	Finke, John (Health)
Subject:	TGP--Public Comment
Date:	Wednesday, August 03, 2016 1:42:00 PM

Mr. Finke,

I urge you to consider the health effects of the gas compressor stations and deny the permit for Joelton station.
The two natural gas pipeline compressor stations proposed in Davidson County will affect much more than just the people who live in Joelton and Southeast Nashville. According to the Federal Energy Regulatory Commission (FERC), the cumulative effect of these large compressor stations will impact residents up to a 30-mile radius from each location. Emissions from these two facilities would also contribute to ground level ozone formation and may threaten Davidson County's attainment for National Ambient Air Quality Standards on ozone, jeopardizing economic growth in sectors that promise much greater employment opportunities.

Thank you,
Geoff Collins
2626 Bowwater Lane
Antioch, TN 37013

From: Gary
To: Finke, John (Health)
Subject: TGP - public comment
Date: Wednesday, August 03, 2016 1:37:01 PM

Mr. John Finke
Metro Public Health Department
2500 Charlotte Avenue
Nashville, TN 37209

Mr. Finke,

Thank you for hosting the public hearing on the proposed compressor station in Joelton. This is a follow up question/statement regarding the air/construction permit for the Joelton compressor station TPG/KM # 563. Specifically, how can the Metro Health Department issue an air/construction permit in direct violation of not one, but two sections of the Metro Code of Law?

As you will recall, substitute ordinance no. BL2015-1210 by Councilman Lonnell Matthews passed the Metro Council and is now in the Metro Code of Laws. You will further recall, the second substitute ordinance no. BL2016-234 by Councilman Fabian Bedne also passed the Metro Council and is now law.

1) SUBSITUTE ORDINANCE NO. BL2015-1210

An ordinance to amend various sections of Title 17 of the Metropolitan Zoning Code related to natural gas compressor stations. (Proposal No. 2015Z-014TX-001).

WHEREAS, Natural gas compressor stations are operationally and physically similar to an industrial use;

WHEREAS, Industrial uses are incompatible with many other land uses and are not sensitive to the environment; and

WHEREAS, Because of the similarity to industrial uses, natural gas compressor stations are only appropriate in industrial zoning districts.

NOW, THEREFORE, BE IT ENACTED BY THE COUNTY OF THE METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY:

Section 1. Section 17.04.060 (Definitions of general terms) of the Metropolitan Code is hereby amended by inserting the follow definition of "Natural Gas Compressor Station":

Natural Gas Compressor Station means a facility designed and constructed to compress natural gas that originates from an Oil and Gas well or collection of such wells operating as a midstream facility for delivery of Oil and Gas to a transmission pipeline, distribution pipeline, Natural Gas Processing Plant or underground storage field, including one or more natural gas compressors, associated buildings, pipes, valves, tanks and other

equipment.
Section 2. Section 17.08.030.F (District land use tables) of the Metropolitan Code is hereby amended by adding "Compressor Station" as a permitted use (P) in IWD, IR and IG zoning districts.
Section 3. Table 17.20.030 (Parking requirements) of the Metropolitan Code is hereby amended by inserting the following row for "Compressor Station" under Industrial uses:
Natural Gas Compressor Station 1 space per employee
Section 4. This Ordinance shall take effect five (5) days from and after its passage and such change be published in a newspaper of general circulation, the welfare of The Metropolitan Government of Nashville and Davidson County requiring it.
Introduced by:

2) SECOND SUBSTITUTE ORDINANCE NO. BL2016-234
An ordinance amending various sections of Chapter 10.56 of the Metropolitan Code of Laws to allow additional information requirements under section 10.56.020.A.1, and to add Metropolitan Zoning Code compliance to the provisions of section 10.56.020H.
BE IT ENACTED BY THE COUNCIL OF THE METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY:
Section 1. That Chapter 10.56 of the Metropolitan Code of Laws shall be and the same is hereby amended by deleting Section 10.56.020.A in its entirety and substituting in lieu thereof the following new Section 10.56.020.A:
10.56.020 - Construction permits.
A. 1. It is unlawful for any person to install, erect, construct, reconstruct, alter, or add to, or cause to be installed, erected, constructed, reconstructed, altered or added to, any fuel-burning equipment, incinerator, process equipment, control device, or any equipment pertaining thereto, or any stack or chimney connected therewith, or to make or cause to be made any alteration or repairs which increases the amount of any air contaminant emitted by such source or which results in the emission of any air contaminant not previously emitted until application for a construction permit has been filed with the metropolitan health department and plans and specifications applicable to the work have been submitted to the director and a construction permit issued by him for such construction, installations, alterations or repairs. Applications for a construction permit shall be filed in duplicate in the offices of the director on forms adopted by the director and supplied by the metropolitan health department along with a copy of plans and specifications. The director shall not grant a construction permit to any source which does not comply with the provisions of the New Source Review Regulations as adopted by the board. If the director determines, on the basis of information available to him, that such source does, or in all likelihood will, operate in violation of this chapter, or that the source will operate so as to prevent attainment or maintenance of any national ambient air quality standard, he shall either impose conditions on the face of the construction permit that in his opinion will promote compliance with this chapter, and/or

attainment and maintenance of any national ambient air quality standard, or he shall deny the application for the construction permit. At the request of the director, the applicant shall provide information necessary for the director to make the determination of whether the source does, or in all likelihood will, operate in violation of this chapter, or whether the source will operate so as to prevent attainment or maintenance of any national ambient air quality standard. For a major source, such information required may include a source impact analysis and air quality analysis as set out in regulations adopted by the Board. This section shall not apply to fuel-burning equipment used exclusively for heating less than three dwelling units, or to gas, or fuel oil equipment of five hundred thousand BTU input or less or to internal combustion engines.

2. In addition to any other remedies available on account of the issuance of an order prohibiting construction, installation, or establishment of any fuel-burning equipment, incinerator, process equipment, or control devices, and prior to invoking any such remedies, the person aggrieved

thereby shall, upon request in accordance with the provisions of this chapter and the rules and regulations adopted by the board be entitled to a hearing. Such hearing shall be conducted pursuant to the contested cases provisions of the Uniform Administrative Procedures Act, Tennessee Code Annotated, Title 4, Chapter 5, Part 3 (T.C.A. § 4-5-301 et seq.).

3. The absence or failure to issue a rule, regulation or order pursuant to this section shall not relieve any person from compliance with any emission control requirements or with any other provision of law.

Section 2. That Chapter 10.56 of the Metropolitan Code of Laws shall be and the same is hereby amended by deleting Section 10.56.020.H in its entirety and substituting in lieu thereof the following new Section 10.56.020.H:

H. No new source shall be granted a construction permit unless the new source complies with the Metropolitan Zoning Code for the use of the property on which the new source is to be constructed. For purposes of legal nonconforming uses, in accordance with Tenn. Code Ann. §13-7-208, this requirement shall not apply. The receipt of a construction permit from the Metropolitan Health Department shall not be construed to indicate approval of the strength or safety of any equipment or to indicate compliance with the requirements of the Building Code of Metropolitan Nashville and Davidson County or any other ordinance thereof. Neither shall it relieve anyone from the responsibility to comply fully with the applicable provisions of this Code, nor any other requirement(s) imposed by statute, rule or regulation of the Metropolitan Government of Nashville and Davidson County, Tennessee, the State of Tennessee or the United States Government.

Section 3. This Ordinance shall take effect from and after its enactment, the welfare of The Metropolitan Government of Nashville and Davidson County requiring it.

Sponsored by: Fabian Bedne, Jacobia Dowell, Karen Johnson, Tanaka Vercher

LEGISLATIVE HISTORY Introduced: May 3, 2016 Passed First Reading: May 3, 2016

Referred to: Codes, Fair, and Farmers' Market Committee Health, Hospitals, and Social Services Committee Substitute Introduced: May 17, 2016
Passed Second Reading: May 17, 2016
Deferred to July 5, 2016: June 7, 2016
Second Substitute Introduced: July 5, 2016
Passed Third Reading: July 5, 2016 - Roll Call Vote
Approved: July 6, 2016
By:
Requests for ADA accommodation should be directed to the Metropolitan Clerk at 615/862-6770.

Based on the two aforementioned Metro laws, I respectfully request that the Metro Health Department enforce the laws that were duly passed by two separate Metro Council bodies and deny the application for TGP/KM compressor station # 563.

Thank you,

Gary Moore

Sent from Mail for Windows 10

From:	Rita Jane Coones
To:	Finke, John (Health)
Subject:	Comment on TGP Draft Air Permit
Date:	Wednesday, August 03, 2016 1:14:21 PM
Attachments:	RobertsonTGPAirPermitComments.pdf

Mr. Finke:

I have attached my comments in pdf format. Because my free gmail does not support return receipts, could you please reply with a "got it" so that I know my material was successfully received.

Thanks

Bill Robertson
615 838 7301

Comment 1. The Proposed Joelton Compressor Station is overbuilt

The 563 compressor station proposed for construction in Joelton, Tennessee by Tennessee Gas Pipeline/ Kinder Morgan (TGP/KM) is overly large at 60,000 horsepower (HP) to achieve the requested increase in gas transmission capacity. The excessive size of the facility results, in part, because the proposed location in Joelton does not evenly split the distance between the neighboring compressor stations on the suction and discharge side. Because the same gas carrying capacity could be achieved with approximately 40% lower emissions (see detailed analysis below), EPA should require the 563 compressor station to relocate to a site that would require lower total horsepower and concomitantly lower emission. The air permit at the proposed location in Joelton should be denied.

Detailed Analysis:

At a FERC scoping meeting on Tuesday, June 21 2016 concerning the proposed Cane Ridge compressor station, a part of Columbia Pipeline Group's Gulf Xpress project (docket CP16-361-000), I had the opportunity to learn more details from Columbia's engineers about the hydraulic factors of compressor station size and placement. Based on this information I believe that the compressor station 563 proposed for Joelton, Tennessee is much larger than necessary to transport the proposed increased gas capacity target of 200,000 Dekatherms/day under the Broad Run Project (Docket CP15-77-000). The same gas capacity increase would likely be realized using two Titan 130 turbines operating at just over 40,000 HP, particularly if the station were relocated to a point that more evenly splits the distance between the adjacent two compressor stations on the pipeline.

Let me give the specific information comparing the two projects that leads to this conclusion. Both projects connect to equivalent systems of 3 pipelines, two of which have diameters of 30" and one of 36", with comparable maximum allowable operating pressures. For the Gulf Xpress project the targeted increase in capacity is 860,000 Dekatherms/day, much larger than the Broad Run project at 200,000 Dekatherms/day. The Cane Ridge compressor is based on two Titan 130 compressors rated at 41,000 HP combined. The proposed site of the Cane Ridge compressor lies almost exactly mid-way between the two adjacent compressor stations along the pipeline at Hartsville, TN and at Hampshire, TN. The distance to each compressor station is about 42 miles. Columbia Gas engineers explained that to move the compressor site by more than a mile in either direction would require an increase in turbine horsepower to realize the targeted increase in gas capacity. The central location is crucial in keeping the size of the compressor station at 41,000 HP.

Now consider the Joelton compressor station (563)—it is not centrally located between the adjacent compressor stations of Portland, TN and Centerville, TN. The proposed site lies 27 miles from Portland, TN and 47 miles from Centerville. By analogy with the Columbia Gas project if the 563 compressor station were located closer to the midpoint between Portland and Centerville, it would be possible to scale down the compressor station to two Titan 130 compressors instead of the proposed twin Titan 250's. The reduction in horsepower from 60,000 HP to 41,000 HP would dramatically reduce air emission: based on the air permits for the two projects NOx emission would drop by 40% (over 70 tons per year) with similar drops in the other regulated and hazardous air pollutants.

Simple Engineering Analysis

As more quantitative evidence of the excessive size of the proposed Joelton compressor station, consider the following simplified engineering analysis. The power of a compressor stage, assuming perfect efficiency, is given by:

$$P = \frac{dm}{dt}\Delta H$$

…where dm/dt is the mass flow rate in kg/s and ΔH is the change in enthalpy in J/kg. Taking the simple assumptions of natural gas being 100% methane and acting as an ideal gas, we can write:

$$\Delta H = C_p \Delta T$$

…where $C_p = 2.226 \frac{kJ}{kg\ K}$ is the heat capacity of methane at constant pressure, and ΔT is the change in temperature of the gas as it is compressed. To determine the temperature change requires some parameters. In the TGP/KM filing with FERC they specify that the suction pressure is P_1 = 650 lbs/in^2. If we assume that the discharge pressure P_2 = 1100 lbs/in^2, then using the assumption of adiabatic compression we can use:

$$P_1 V_1^{\gamma} = P_2 V_2^{\gamma}$$

..where $\gamma = 1.299$ is $\frac{C_p}{C_V}$ ratio for methane. If $V_1 = 1\ m^3$then $V_2 = 0.667\ m^3$. Finally, using the ideal gas equation we can solve for the discharge temperature T_2assuming an input temperature $T_1 = 300\ K$.

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$T_2 = \frac{P_2 V_2}{P_1 V_1} T_1 = 339\ K$$

With these values for the temperature increase we can thus find ΔH per kg of gas:

$$\Delta H = C_p (T_2 - T_1) = 2226\ \frac{J}{kg\ K} \text{x}\ 39\ K = 85{,}967\ \frac{J}{kg}$$

Finally, using the quoted gas transport capacity of 200,000 dekatherms per day, taking 1 dekatherm as equal to 1000 cubic feet of natural gas, and the density of natural gas as 0.044 lbs per cubic foot gives:

$$\frac{dm}{dt} = 101\ \frac{lbs}{s} = 46.2\ \frac{kg}{s}$$

Now we have the necessary parts to estimate the compressor power:

$$P = \frac{dm}{dt}\Delta H = 46.2 \frac{kg}{s} \text{x}\ 85{,}967\ \frac{J}{kg} = 3.975 \text{ x } 10^6\ \frac{J}{s} = 5400\ hp$$

This value assumes perfect efficiency. If we assume a 60% efficiency, the power of the compressor would be $\frac{5400}{0.6} = 9000$ hp. This value is far below the specified power of 60,000 hp for the Joelton

station. Yet if the same analysis were done for the proposed Cane Ridge station, assuming similar values for the pressures but with the much larger gas transport capacity of 860,000 dekatherms per day, the final value of power for that project would be P = 38,700 hp, very close to the 41,000 hp specified in the design of the Cane Ridge compressor station. **The conclusion is unassailable: the size of the proposed Joelton compressor station is much too large by over a factor of <u>five</u> for the targeted gas transport capacity.**

Are suitable alternate sites available?

As described more fully in the following section, Kinder Morgan's analysis on alternate sites contains at least two alternate sites that split the distance between Portland and Centerville more evenly and would permit the scale of the compressor station to be reduced as indicated. At least one of these alternate sites is superior to the Joelton site on essentially every engineering and environmental metric (see separate analysis below in Comment 2). Reducing the turbine size by moving to an alternate site that more evenly splits the distance between adjacent compressor stations would significantly diminish the environmental impact of the Broad Run project.

For both engineering and environmental reasons TGP/KM should be required to relocate the 563 compressor station to a site that would require lower total horsepower thereby significantly reducing the environmental impact without sacrificing capacity.

<u>Comment 2.</u> EPA should require a more thorough review of Alternate sites.

As detailed in Comment 1 above, the gas transmission capacity proposed by TGP/KM can be realized with much lower emissions (40% or more) by moving to an alternate site and reducing the horsepower of the turbines. In addition, the alternate sites are in isolated rural areas far from residences, these sites are not adjacent to a city park, and the alternates do not require federal action to preempt local zoning ordinances.

In the Environmental Assessment [EA] (FERC Accession number 20160311-4000) process conducted by FERC, KM/TGP identified a number of different alternative sites. Using the data supplied in the EA for these sites, it is clear that there are a number of alternate locations that are superior on essentially every engineering and environmental metric.

Detailed Analysis:

In section D of TGP's ANSWER TO COMMENTS ON ENVIRONMENTAL ASSESSMENT document (FERC Accession number 20160603-5264), it is claimed that the alternative site analysis concluded that "none of the alternatives offer significant environmental advantages over the proposed site for Compressor Station 563." As evidence they quote a selected set of facts from the analysis (Environmental Assessment FERC Accession number 20160311-4000, Table 3.4). Their analysis is flawed because they weighted property ownership so heavily that their final conclusion was foregone. The analysis should be conducted using *only engineering and environmental factors*.

Here I present an objective point-by-point analysis between the Proposed Site and the Site C1 using data taken from their own information (Environmental Assessment FERC Accession number 20160311-4000, Table 3.4). It is worth noting that C1 was not considered by TGP to be in the top 5 alternate sites

analyzed—there are actually even better alternatives according to TGP. However, as the following analysis shows, alternate site C1 is demonstrably superior on almost every metric. In the table below, the red highlights indicate that the site is inferior on that metric.

Metric	Proposed Site	Site C1
Number of Acres	43.2	43.2
Wetlands Crossed	0	0
Perennial Waterbodies crossed	0	0
Intermittent Waterbodies	1*	1
Ponds and Lakes	0	0
Wells within 150 ft	1	0
Floodplains	0	0
Prime Farmland	23.6	0.7
Steep Slopes	29.3	41.4
Sinkholes potential (acres)	42.9	42
High Seismicity areas	2	0
NRHP Eligible sites within ½ mile	2	0
Critical Wildlife habitat	0	0
Forest land impact (acres)	42.8	33.8
Residences within 0.5 mi	25	13**
Parks within 1 mile	1	0

* The ARAP for the proposed site detailed one intermittent stream that would be crossed.

** In my analysis of C1 there are 0 residences within 0.5 mile. I do not know how TGP arrived at the value of 13 in EA Table 3.4. They have the answer of 1 in the original Resource Report 10 Alternatives Analysis.

On the objective analysis alone it is clear that the proposed site for 563 is inferior to C1 on every metric save for the issue of steep terrain. Even this objection is readily traversed. In the full analysis of alternate sites (Report 10 Alternatives Analysis) for the Broad Run, TGP chose a site for CS 118A that has topography listed as steep slopes/extreme topography for 43.5 acres out of the total site acreage of 46.1 acres. Similarly, compressor site 119A has topography listed as steep slopes/extreme topography for 46.9 acres out of the total site acreage of 47.5 acres. TGP/KM has extensive experience with construction of compressor stations in problematic terrain; this factor is not a legitimate impediment.

Site C1 offers other advantages not considered by the applicant in the filing:

(a) Building at the proposed site would conflict with a City Zoning Ordinance requiring the invocation of federal preemption, an unnecessary and unwarranted imposition on the many surrounding landowners and on the residents of Davidson County. An alternate site outside of Davidson County would obviate this requirement.

(b) Site C1 better splits the distance between the two adjacent compressor stations on either side (Portland to the northeast and Centerville to the southwest) making it a better engineering choice from an efficiency standpoint in terms of power required to move the same fixed volume of gas. Reducing the overall size of the compressor station would clearly have a significant environmental impact. The difference in distances is quite dramatic indicating that a reduced size facility is a strong possibility. For

the proposed site, the distances are unusually skewed 27 miles to Portland and 47 miles to Centerville. For the C1 site the distances are 38 miles and 35 miles respectively.

In conclusion, this analysis shows that at least one superior site exists. In the full analysis (Resources Report 10 Alternatives Analysis) site C1 actually ranked 6th according to TGP. This finding implies that many better sites exist. **With this conclusion established, it is incumbent on EPA to deny the current permit because the same gas transport capacity could be realized with much lower environmental impact if the 563 compressor station were moved to an alternate site.**

Comment 3. The Permit Application appears to underestimate formaldehyde emissions.

The values listed in the Hazardous Air Pollutant list in the permit application are inconsistent with other compressor stations on the same pipeline system, in particular for the level of formaldehyde emitted. The next compressor station on the discharge side of the proposed Joelton compressor station is in Centerville (TGP Station 860). Using the EPA ECHO Enforcement and Compliance History web page, the air pollutant report for the Centerville Station lists formaldehyde emission of 47,100 pounds per year in 2007 and 33,986 pounds per year in 2010, the last year for which data are reported. Similarly the Portland station, on the suction side of the proposed Joelton compressor station, lists formaldehyde emission of 53,388 pounds per year in 2007 and 15,670 pounds per year in 2010, the last year for which data are reported.

The values for both adjacent compressor stations are much higher than the estimates quoted in TGP/KM Permit application for the proposed Joelton compressor station which are listed, facility-wide, as being 1.51 tons per year = 3,020 pounds per year. This value appears to underestimate the project formaldehyde emission of the proposed facility by a factor of between 5 and 10. The applicant should be required to provide a justification for the dramatically different estimate of formaldehyde emission for the proposed station compared to the actual measurements at existing compressor stations.

Comment 4. The opening paragraph of Section 1.2 of the draft Air Permit is copied below.

1.2 General Provisions - [MCL 10.56.070 and 13-4(a)5]

(a) The permittee must comply with all conditions of this permit. Any permit noncompliance, excluding locally enforceable-only requirements, constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation, and reissuance, or modification; or for denial of a permit renewal application.

Why are “locally enforceable-only requirements” excluded as being in violation of the Metro Code of Laws and thus not subject to enforcement action? This statement is not included in all Air Permits and the condition appears designed to selectively and purposefully undermine enforcement of 10.56.170 and the local zoning ordinance passed last year. This unilateral decision as to which Metro ordinances can or cannot be enforced is a legal determination that is not within the purview of the Health Department to make. This phrase should be removed from the draft permit before it goes forward.

Comment 5. Environmental Justice.

Pursuant to Executive Order 12898 - *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, the proposed Joelton compressor station should be evaluated for its impact. In Kinder Morgan/Tennessee Gas Pipeline's filings with FERC the Joelton area was erroneously connected to Pleasant View as being the nearest community by which to evaluate the population and demographics. Pleasant View is not in the same county and it is not the nearest community to Joelton. Joelton is better categorized by its existence within Davidson County council district 1 which has one of the highest minority populations in Davidson County. The EPA ECHO system was used to make a rough estimate of more accurate demographic data. The EPA ECHO system was employed to generate 5 mile radius demographic data using the closest emission source to the proposed site in Joelton (CRT Custom Products in neighboring White's Creek). The population density returned is 742/square mile with 62% minority and with 24,284 out of total population of 58,399 being below the poverty line (41.6%). The permit should not be issued. EPA should require an accurate evaluation of the true demographics of the impacted population near the Joelton site.

Comment 6. Children's Health review by EPA because of proximity to Paradise Ridge Park.

Under EPA Executive Order 13045 - *Protection of Children from Environmental Health Risks and Safety Risks*, the proposed Gas Compressor facility should receive special EPA scrutiny because the property is immediately adjacent to a Metropolitan Nashville public park (Paradise Ridge Park). The park hosts a variety of programs for children, including structured after-school activities. Of 13 alternative sites considered by TGP/KM, this site is the only one located next to a park. As detailed in Comment 2 above, many of the other sites are superior on essentially every environmental and engineering metric.

Given the lack of substantive data on Hazardous Air Pollutants from the facility and the apparent underestimation of formaldehyde emissions, the air permit should be withheld until the long term cumulative effect of HAPs on the adjacent park population can be evaluated.

Comment 7

The state of Kentucky is an affected state by EPA guidelines as it is within 50 miles of the new source. Was notice given to the state of Kentucky as specified in 40 CFR 70.8 (b) [quoted below]?

40 CFR 70.8(b) Review by affected States.

(1) The permit program shall provide that the permitting authority give notice of each draft permit to any affected State on or before the time that the permitting authority provides this notice to the public under § 70.7(h) of this part, except to the extent § 70.7(e) (2) or (3) of this part requires the timing of the notice to be different.

(2) The permit program shall provide that the permitting authority, as part of the submittal of the proposed permit to the Administrator [or as soon as possible after the submittal for minor permit modification procedures allowed under § 70.7(e) (2) or (3) of this part], shall notify the Administrator and any affected State in writing of any refusal by the permitting authority to accept all recommendations for the proposed permit that the affected State submitted during the

public or affected State review period. The notice shall include the permitting authority's reasons for not accepting any such recommendation. The permitting authority is not required to accept recommendations that are not based on applicable requirements or the requirements of this part.

From:	Brassel , Alandis
To:	Finke, John (Health)
Subject:	TGP - Public Comment
Date:	Wednesday, August 03, 2016 1:07:55 PM
Attachments:	TGP Public Comment - Rep. Jim Cooper.pdf

John:

Please find Rep. Jim Cooper's comments regarding the proposed TGP compressor station attached. Please let me know if you need additional information.

Thank you,

Alandis Brassel
Counsel
Rep. Jim Cooper (TN-05)
Phone: (615) 736-5295
Email: Alandis.Brassel@mail.house.gov

JIM COOPER
5TH DISTRICT, TENNESSEE

COMMITTEES:
ARMED SERVICES
OVERSIGHT AND
GOVERNMENT REFORM

WEB SITE: www.cooper.house.gov

Congress of the United States
House of Representatives
Washington, DC 20515

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(615) 736–5295
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(202) 225–4311
FAX: (202) 226–1035

August 3, 2016

Mr. John Finke
Director
Metro Public Health Department – Pollution Control Division
2500 Charlotte Avenue
Nashville, TN 37209-4129

Dear Mr. Finke:

I am writing in opposition to the proposed Tennessee Gas Pipeline compressor station.

I am deeply concerned about the proposed compressor station's emissions, and that the pipeline operator is knowingly taking advantage of weaker emission standards and using weaker emission controls just to save money. If allowed to continue as proposed, the construction and operation could harm the Joelton community. Homes, farms, property values and neighbors' livelihoods are at risk. I trust that you will thoroughly review the permit application, but worry that long-term health risks are unnecessary and avoidable.

- Under what circumstances, if any, could the proposed compressor station emissions make Davidson County noncompliant under the National Ambient Air Quality Standards? What safeguards, if any, will the Pollution Control Division put in place to make sure that the compressor station adheres to these standards?

- Please include in your response any alternative cost-benefit analyses conducted by the Pollution Control Division with stronger, currently available emission controls for the proposed turbines. If no alternative controls have been reviewed, please give a detailed explanation as to why they were excluded.

- Please explain how your review accounted for emissions' potential effects on surrounding vegetation and the health of citizens in the area. What assurances do you have that the proposed compressor station's emissions will not harm the surrounding community?

Thank you for reviewing my questions. I look forward to your prompt response.

Sincerely,

Rep. Jim Cooper

THIS STATIONERY PRINTED ON PAPER MADE OF RECYCLED FIBERS

From:	Rebekah
To:	Finke, John (Health)
Subject:	Opposed to the pipeline.
Date:	Wednesday, August 03, 2016 12:54:20 PM

I would like to a moment of your time to express my feelings about the compressor pipeline that may be installed in the Joelton/ Whites Creek area. This community is a quiet and peaceful area where many choose to raise families and farm animals. This addition is not welcome. The level of noise and the potential hazards are too risky. Please consider how much the negatives outweigh the positives.

The Andersons @
3005 Union Hill Rd.
Nashville, TN 37207

From:	Benita Bullion
To:	Finke, John (Health)
Subject:	TN Gas Pipeline Air Permit
Date:	Wednesday, August 03, 2016 11:25:44 AM

Joelton and Metro Nashville are in danger of being environmentally poisoned by toxic emissions from a proposed compressor station. Your help is essential to stop this construction.

Many toxic gases will be released into our air via blow-downs, fugitive releases, poor maintenance (well documented), and accidents. These emissions are known to cause major adverse health effects in humans and animals.

Blow-downs are just one of the many major concerns I have to the threats our community would face. A blow-down, according to research reports, is a complete venting of the gas within a compressor/pipeline into the atmosphere. **Planned blown-downs typically occur 8 to 10 times a year with multiple blow-downs occurring per month.**

A single blow-down from a much smaller station than this one is proposed to be releases a gas plume 30 to 60 meters upward of 15,000 cubic feet plus of methane and other VOCs into the atmosphere. The first 30 to 60 minutes of the blow-down is the most intense, but the entire blow-down may last up to three hours or more. This can sound like a jet taking off.

Consider the health risks to Joelton---its citizens, parks, schools, churches, businesses---and that of our larger Metro Nashville community...just a breeze away. Please deny this permit.

Respectfully submitted,
Benita Bullion
615-948-6736
7474 Whites Creek Pike
Joelton, TN 37080

(0.9 mile from the proposed site)

From:	Diane Butler
To:	Finke, John (Health)
Subject:	Public Comment: Joelton Compressor Station
Date:	Wednesday, August 03, 2016 11:15:19 AM

Dear Mr. Finke:

The proposed compressor station in Joelton is inappropriate, damaging, and probably illegal. The area in question is a residential one and the quality life for those living there will be adversely impacted in ways most harmful to them - health, property values, etc. - and without their consent. This station will benefit no actual people who live there.

Tennessee is a beautiful state blessed with abundant natural resources. Water is our most precious resource and should be protected for it's life-essential benefits; it may well be the most valuable asset that our future depends on.

Please consider the future well being of our state and its citizens and understanding for the people of Joelton.

Thank you for your consideration.

Sincerely,
Diane Butler
Nashville, TN 37220

From: ms8383@comcast.net
To: Finke, John (Health)
Subject: Air pollution permit -Tennessee Gas Pipeline
Date: Wednesday, August 03, 2016 11:04:34 AM

I am gravely concerned for the environmental welfare of not just Joelton but the entire Metro Nashville area. The health impact of potentially living near one of the largest gas compressor stations in the United States is terrifying.

Chemical emissions from blow-downs, fugitive releases, and accidents of nitrogen oxides, carbon monoxide, particulate matter, and other volatile organic compounds are all major components of smog. These emissions are known to cause significant health effects in exposed populations. These dangerous emissions along with others you are familiar with are toxic, carcinogenic or neurotoxic - highly associated with health impacts on respiratory, neurological and cardiovascular body systems.

Know that these emissions will not only affect the park and citizens living within one mile as I do of the proposed site, but also the children attending the elementary and middle schools approximately two miles away, the three church congregations, community ball park, businesses
and citizens living here. Consider, also, the collection of these emissions in the Cumberland bowl area of nearby Nashville---Joelton being above Nashville.

Please do the right thing for Joelton and Nashville. Put our health/air quality and safety first above the export profits of an industry giant.

Sincerely,
Martha S.Sanford
615-876-8383

From:	Vanessa Paz
To:	Finke, John (Health)
Subject:	TGP-public comments (Kinder Morgan and their plans for our community)
Date:	Wednesday, August 03, 2016 10:13:15 AM

Mr. John Finke;

I moved to Nashville almost 2 decades ago and now it has become my home. I have seen growth and I have been part of the growth with work and the way I use my capital. I made a decision to move to the rural area investing on land and creating with others a community that cares about the food, water, air and quality of life that is closer to nature. We are a strong and vibrant community and many more are joining and investing on rural Davidson and Cheatham County.
When you have a company like Kinder Morgan that have only financial interest planning on moving into our community, We are going to speak out !! What are they bringing for us and for you ? I have read and listened about what this gas compressors do, noise, air and water pollution, no jobs, no end product for our community. This is the kind of investment that will bring a vibrant and strong community to decay and fail, people will start selling their land moving away and leaving desolated rural areas, a weak economy and a sick and impoverish population; please see what has happened in other parts of the county when you start granting permits to big polluters!!
Please see the 2 possibilities and remember that public service is to serve the people. Stop TGP.

Thank you
Vanessa Paz

From:	Roger Kanies
To:	Finke, John (Health)
Subject:	Compressor stations
Date:	Wednesday, August 03, 2016 9:56:44 AM

Dear Mr. Finke,
I am against the proposed compressor stations. They are a loud, industrial intrusion into rural areas and neighborhoods where the locals don't want them. There are questions about the safety about existing pipelines some of which are old. Why should we endanger our citizens for the gas companies when one of the main purposes of these stations is to enable the companies to export to other countries.

Roger Kanies, Hermitage, TN

From: Renee
To: Finke, John (Health)
Subject: Joelton Compressor Station
Date: Wednesday, August 03, 2016 9:23:41 AM

Our farm is only 1.25 miles from the site where Tennessee Pipeline, LLC/Kinder Morgan plans to put a gas compressor station the size of two football fields combined. My husband and I have only lived in the Joelton area for 15 years but we both are life long Davidson County residents. Both born in this county, I am in my late 40's and my husband late 50's. We have two daughters; the youngest 10 years of age, was born with two major heart defects. She is our biggest concern with this compressor station. Studies have shown that the gasses that are emitted into the air (by-products of the natural gas that are not needed to ship to the gulf for export) cause heart problems for otherwise healthy people. So what does this mean for our daughter who has the right side of her heart missing? She has only been hospitalized twice in her 10 years for illness. She participates in any studies that help with medical advances. Part of her staying healthy is exercise and fresh air that she gets running around our farm and riding her pony. We do not own an X-Box. As my girls point out to friends or relatives who say they should get one, we have the farm to play on and farm animals to care for, we don't need an X-Box. Now my 10 year old miracle is anxious that when they put this compressor station so close to our farm that she will no longer be able to play outside or ever ride her pony again. I heard the representative for Tennessee Pipeline, LLC/Kinder Morgan say at the Health Department Public Hearing that this station will not adversely effect the residents, yet the FERC report shows that they admit it will permanently effect our air quality. I filled out a card about our daughter and farm animals that was sent to the FERC and they returned a generic letter with a "book" regarding the proposed station. No specifics on how this will directly impact her or our animals.

Our animals are another concern regarding the air and noise pollution. We have chickens and we raise a calf for our own organic food to keep our family as healthy as possible, especially, our 10 year old. We also have dogs, cats, fish, horses, ponies, and mini donkeys including a mini donkey that is 18 months old and one that is only 3 months old. We have a quarter horse that may be expecting also. The noise and air pollution will affect her pregnancy and her foal in a very negative way. The 2 mini donkeys will be effected in a very negative way. Horses and donkeys are growing and maturing for 5 years. Any noise and air pollution of the quantities that will be produced by this compressor station will cause their growth to be effected in a very negative way.

Joelton has the largest concentration of organic farms that supply food to a large portion of Nashville. I want to know what the USDA says regarding these farms keeping their organic status once this station is operational. One farm is directly across the street. If their organic status is lost, how does that not translate into this station being a detriment to our community pollution wise?

This proposed station has already negatively impacted our property values so that those of us with mortgages are stuck here. We have no choice but to stay even with this giant station polluting our farms and families. This lifelong Davidson County family doesn't want to give up our farm, but we have to make sure our children and animals are kept healthy. We are asking the persons who have the ability to keep our citizens and animals safe to please do so.

Sincerely,

Randy and Renee Alexander
7631 Bidwell Road
Joelton, TN 37080

Sent from Mail for Windows 10

From:	Matthew Beadlecomb
To:	Finke, John (Health)
Subject:	TGP Pipeline
Date:	Wednesday, August 03, 2016 9:10:49 AM

This pipeline project is really not wanted in this area. Please help us in anyway possible to keep it from coming to fruition.

Thank you,
Matthew Beadlecomb

From: jlek24@gmail.com on behalf of Nashville Foodscapes
To: Finke, John (Health)
Subject: TGP pipeline
Date: Wednesday, August 03, 2016 9:05:18 AM

To Whom It May Concern,

I am writing to express my concerns over the gas compressor stations that are trying to be built in Joelton and Cane Ridge (and potentially Ashland City I have heard). The evidence confirming the ill health effects from these gas compressor stations is overwhelming. That alone should prevent these compressors from being built.

The people of Nashville have spoken up loudly and it is very clear that the people of this city do not want these stations here. I have full confidence too that if the rest of Nashville was polled about these stations, you would find almost no one who would support it. So, with this as such, why are the people of Nashville continuing to have to fight to keep this from happening? Why is Kinder Morgan even trying to continue this? Also, do any Kinder Morgan executives live in Joelton and Cane Ridge?

Thank you,
Jeremy

From:	Lori Birckhead
To:	Finke, John (Health)
Subject:	TGP-Public Comment
Date:	Wednesday, August 03, 2016 8:32:10 AM
Attachments:	Madison-Co-NY-Health-Response-to-FERC.pdf Madison Co. letter gascompressor.pdf

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Dear Mr. Finke,

When first learning that Kinder Morgan planned to construct a gas compressor station on land 1000 feet from my farm, I searched online to understand what this was and what type of an impact it would have. I had to read through countless articles and research papers that consisted of personal experiences and scientific data. Then I researched Kinder Morgan. This company and its subsidiary Tennessee Gas Pipeline, as I found out are not the "good neighbors" they profess to be. I quickly came to realize that there was no way TGP would or could ensure the safety of its neighbors here in our area.

On March 5, 2015, I was told by the Kinder Morgan's land access agent that this was a done deal and there was nothing I could do about it. I asked why wasn't there a public meeting and was told it was not *necessary* as they had put an announcement in the newspaper. At that time, I made it my personal mission to encourage my neighbors to do the same as I did and do their own research. I reached out to local political representatives. Then one day while researching, I came across a document online that was from the Madison County Health Department in a response filing to the FERC. This report was my first bit of *hope*. In response to a *10,880 HP* gas compressor station being proposed for their county, Madison County Health Department wrote a very comprehensive report to the FERC detailing their concerns and the detailed medical research they had compiled on the adverse health effect of the compressor station's emissions to the public. I have attached this document with my comment. MCHD also hired a consultant to help individuals file their comments with the FERC and they recommended setting up a regional health registry so that long-term health effects from natural gas infrastructure, including the Sheds compressor station, could be adequately assessed and addressed. Ideally, this registry would be part of a larger state and/or national level registry, since the infrastructure for natural gas energy is increasing across the USA. I felt sure that our own health department would be just as proactive in it's concern for its citizens, particularly with the threats we now face.

My question to you is have you read the attached documents? If not, would you please? After reading the Madison County Health Department reaction to a proposed compressor station in their county, as well as all the other scientifically based and researched comments from people like Dr. Bill Robertson, and others in our

community, what are your concerns for the public health should this compressor station be built despite all the evidence at hand to the contrary? If there is absolutely no way for the Metro Nashville Health Department to deny the air permit and stop this atrocity, would you at least, based on all the evidence you have received recommend to the EPA a baseline health analysis or health screening for the people of Joelton who live in close proximity to this station? If there is any legal possibility to deny the Title V permit would you do this?

Thank you for your time and I look forward to your answering my questions,

Sincerely,

Lori Birckhead

MADISON COUNTY
DEPARTMENT *of* HEALTH

Eric Faisst, Director of Public Health *Dr. John B. Endres, President of Board of Health*

NEWS Release

FOR IMMEDIATE Release: July 17, 2014
Submitted: July 17, 2014
No. 27-14

Contact: Jennifer McGohan
Public Health Educator II
Madison County Health Department
315-366-2361

****

Public Comment Sought on Health Concerns of Proposed Gas Compressor Station

Georgetown. In June, a workgroup was established to identify resident's health concerns if a proposed gas compressor station is built in Sheds in the Town of Georgetown.

The proposed gas compressor station would be added along an already existing gas pipeline. A compressor station would help transport natural gas from one location to another by compressing the gas, thereby increasing its pressure and providing the energy to move the gas through the pipeline.

The workgroup was started by a concerned group of community members and elected officials from the Town of Georgetown, Town of DeRuyter, and also includes the County Health Department in Madison County. The workgroup seeks to collect information and feedback from the community to ensure that any local concerns are considered during the evaluation of the proposed project by the Federal Energy Regulatory Commission (FERC).

Madison County Health Department has hired a consultant to ensure community feedback, comments, and health concerns are formally presented to FERC during their evaluation process of the proposed compressor station project. The FERC review process is expected to take several months to complete with a response expected by the spring of 2015. The consultant will also design a baseline health study that may be implemented should the proposed project be approved.

Residents from the Towns of Georgetown and DeRuyter are encouraged to provide their health concerns and feedback to the workgroup. Comments may be submitted in writing to: 995 State Route 26, PO Box 103, Georgetown, NY, 13072; by email to: Georgetowncompressorproject@gmail.com; or by phone: (315) 837-4299. **Please submit public comments by August 15th.**

###

Madison County, New York Department of Health

Comments to the Federal Energy Regulatory Committee

Concerning Docket No. CP14-497-000, Dominion Transmission, Inc.

Prepared for Madison County Department of Health
by
Thimble Creek Research

September 30, 2014

Executive Summary

The following comments are addressed to the Federal Energy Regulatory Commission in response to the permit application (Docket No. CP14-497-000) filed June 2, 2014, by Dominion Transmission, Inc. of Richmond, Virginia. The Madison County Department of Health has concerns that impacts to public health have not been adequately addressed in this permit, specifically in regard to the Sheds compressor station in Madison County. The National Environmental Policy Act requires that FERC take into account potential environmental impacts and that FERC address public concerns in its permit review. The Madison County Department of Health's concerns are based in part on the report from the United States Environmental Protection Agency (USEPA) Inspector General that documents a lack of emissions data from oil and gas facilities which, in turn, casts doubt on the accuracy of projected air quality impacts. This brings into question the appropriateness of using the National Ambient Air Quality Standards to establish health safety risk near the Sheds compressor station. There are also documented correlations between health impacts and residential proximity to unconventional natural gas development facilities, including compressor stations.

Section II of these comments reviews what is known from the literature about compressor station emissions. Information specific to compressors is very limited. The types of chemicals that have been identified include VOCs, carbonyls and aldehydes, HAPs, aromatics and particulate matter. In particular, there is a lack of information on the intensity, frequency and duration of emission peaks that occur during blowdowns and large venting episodes that are a normal part of compressor operations. Blowdowns, on average, release 15 Mcf of gas into the atmosphere. Fugitive emissions and accidents are also of concern. One study from Fort Worth, Texas reported 2,126 fugitive emission points from a set of compressor stations. Radioactive chemicals are present in natural gas pipelines and can be released into the atmosphere, though little is yet known about exposure profiles for communities near compressor stations.

Section III reviews known health risks from known chemicals emitted, while acknowledging that there are data gaps in both chemicals emitted and potential health effects. Health risks from VOCs in the short term include eye and respiratory tract irritation, headaches, dizziness, visual disorders, fatigue, loss of coordination, allergic skin reaction, nausea, and memory impairment. Effects from long-term exposure include loss of coordination and damage to the liver, kidney, and central nervous system as well as elevated risk of cancer. Health effects from particulate matter affect both the respiratory and cardiovascular systems. Inhalation of PM2.5 can cause decreased lung function, aggravate asthma symptoms, cause nonfatal heart attacks and high blood pressure. Diesel emissions from truck traffic (primarily during construction of the compressor) can irritate the eyes, nose, throat and lungs, and can cause coughs, headaches, lightheadedness and nausea. Short-term exposure to diesel exhaust also causes inflammation in the lungs, which may aggravate chronic respiratory symptoms and increase the frequency or intensity of asthma attacks. Long-term exposure can

cause increased risk of lung cancer. Chemical exposure to vulnerable populations is a particular concern. The problem of chemical mixtures and how these might affect health needs further research.

Health effects associated with compressor stations are summarized in section IV. This set of research relies primarily on self-reported data from public health surveys. The symptoms identified are associated with health impacts on respiratory, neurological and cardiovascular body systems. These health effects correlate with the impacts associated with many of the chemicals emitted from compressor stations.

Madison County residents have reported numerous concerns to FERC and to the MCDOH (Section V). Primary concerns are for health safety and food/crop safety. Concerns about the safety record of compressors and pipelines, impact on community character and home values, emergency response preparedness, air quality and other environmental impacts were also raised.

Recommendations for framing and scoping public health issues (Section VI) includes information on relevant health data sources. Methods for assessing environmental health determinants include baseline data collection on air emissions, soil, and water quality.

Data gaps and other challenges to the implementation of a public health analysis are identified in section VII. These are: a lack of previous health studies that address compressor stations; limited data on chemical constituents of compressor air emissions including intensity, frequency and duration; the problem of poorly identified chemical mixtures and potential health effects; unidentified related emissions from metering stations and pipelines; the lack of data on potential radioactive chemical emissions; inadequate assessment of the effect of local weather patterns on dispersal of air pollutants (air dispersion modeling); and very limited information on the exposure pathway of air pollutants entering soil and food crops, and the potential for human health impacts.

Recommendations are also provided in the event that the permit is granted, as follows:

- Perform a baseline health study to establish population health status before the compressor station is built.
- Require best practices to ensure that effective emissions control measures are kept up to date.
- Establish an alert system for blowdowns or other large emissions and/or noise events.
- Put Emergency Plans in place.
- Institute a monitoring strategy at the Sheds compressor station and surrounding locations.
- Institute a health registry.

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I. Introduction

On June 2, 2014, Dominion Transmission, Inc. (DTI), of Richmond, Virginia filed an application with the Federal Energy Regulatory Commission (FERC), pursuant to Section 7(c) of the Natural Gas Act, to "construct, install, own, operate and maintain certain compression facilities that comprise the New Market Project located in Chemung, Herkimer, Madison, Montgomery, Schenectady, and Tompkins Counties, New York." One new compressor station, known as the Sheds compressor station, would be located in Madison County. The Madison County Department of Health (MCDOH) submits the following comments to FERC in regard to public health concerns relating to the Sheds compressor station and associated infrastructure. These comments are submitted for the FERC Scoping Process which opened for comments on September 18, 2014. The National Environmental Policy Act (NEPA) requires that FERC take into account potential environmental impacts in its permit review. NEPA also requires FERC to discover and address public concerns, which in this case focus on risks to public health.[1]

While the Madison County Department of Health understands that FERC has determined that the New Market Project (of which the Sheds compressor station is included) would follow an Environmental Assessment (EA) review process, instead of FERC's more comprehensive Environmental Impact Statement process, there remain many unanswered questions pertaining to the impacts on public health from the installation and operation of the Sheds compressor station along with concerns that the application of the EA process may fail to consider such health impacts in its review of the Sheds compressor station.

A recent report from the United States Environmental Protection Agency (USEPA) Inspector General states that there is inadequate information available on direct measurement emissions from oil and gas production activities.[2] The report finds that incomplete datasets lead to underestimates of air quality impacts from these sources. The report further notes that "Limited data could affect decision-making impacting human health and the environment." Health effects such as cancer risk, birth outcomes, skin rashes and respiratory problems have been correlated to production activities in peer-reviewed literature.[3] These findings, in addition to our review of the current literature on compressor emissions and potential health impacts frames the MCDOH concern that there is an underestimation of risk by DTI.

Currently available literature suggests that emissions produced during the construction and operation of the proposed Sheds Compressor station will have

the potential to put nearby residents at risk for health effects (see sections II, III, IV below). The MCDOH believes that a more comprehensive public health analysis is needed because:

1. There is incomplete information on the content of compressor emissions
2. Important aspects of the air emissions are not explicitly addressed in the DTI application (DTI permit application Section 9) such as episodic periods of very high emissions, including but not limited to blowdowns, which can adversely affect human health
3. Standards by which estimated emissions are evaluated (DTI permit application p.9-11) for health risk were not intended to be health protective at an individual or neighborhood level
4. Madison County residents have documented concerns about health risks

Table 1 shows the types and distribution of land parcels surrounding the proposed compressor station within a three mile radius. Local residents and the MCDOH are concerned that health impacts may be experienced by individuals in the vicinity of the station (sections IV and V).

Table 1. Land parcel distribution within three miles of proposed Sheds compressor station*

Parcel Category	1/2 Mile Radius	1 Mile Radius	3 Mile Radius
Agricultural Land	**5**	**9**	**60**
Residential Year Round	17*	30	207
Seasonal	2	3	21
Vacant Rural Residential Land	4	22	161
State/County Owned Forest	0	1	53
Private Forest	**0**	**0**	**1**
Utility Land	**1**	**1**	**1**
Cemeteries	**0**	**0**	**3**
Miscellaneous	**0**	**0**	**4****
Notes:			
* Closest Residential Structure Approx. 1,150 feet			
** Reputed Amish School Approx. 6,700 feet			

*Accessed from the Georgetown, NY Assessor's Office 9.17.2014

The MCDOH recommends that if the more comprehensive EIS process is considered for this project it should take into account the following public health analysis component:

1. Data collection of baseline prevalence of relevant diseases including asthma, cancer, COPD, birth outcomes, as well as data on vulnerable populations in Madison County
2. Identification of impact pathways, susceptibility analysis, and cumulative impact factors
3. Consideration of local concerns in the assessment of health and environmental impacts

The remaining sections of these comments provide background information on four areas of public health concern for MCDOH (sections II – V), information on current data gaps (section VI), recommendations (section VII), and a summary of critical questions (section VIII):

Section II – Compressor station emissions - There are known emissions from compressor stations, as well as unidentified emissions. Frequency, intensity and duration of emissions at the proposed compressor station are not documented, yet these factors will determine the impact on nearby residents' health.
Section III – Health risks from relevant air contaminants - The full array of possible health effects is not known, but there are known health effects from some of the chemicals emitted. A review of some known chemical effects on health is provided.
Section IV – Reported health effects specific to compressors - Some health effects have been documented in the vicinity of other compressor stations and associated pipelines and metering stations. A review of available research is provided.
Section V - Concerns of Madison County residents – A review of comments submitted to FERC ad MCDOH is provided.
Section VI - Recommendations for framing and scoping the public health issues for the Sheds compressor station.
Section VII – Data gaps and other challenges to the implementation of a public health analysis are identified.
Section VIII – Recommendations and mitigation (if permit granted) - MCDOH suggests several recommendations for mitigation specific to the Sheds compressor station.
Section IX - A summary of questions for FERC to address in assessing risks to public health.

II. **Compressor station emissions**

Compressor station emissions fall into two categories: construction emissions and operational emissions. Within operational emissions there are three types that warrant individual attention – blowdowns, fugitives and accidents. DTI provides a set of emissions projections for both the construction and overall operational phases of the Sheds compressor station (Resource Report 9 of DTI's Application). This section of our comments reviews those projections and provides perspective on the aptness of the method of estimation (in tons per year) and need for further detail about the VOC and PM estimated emissions to better consider health risk. Discussion of the health risks produced by compressor station emissions will be presented in Sections III and IV.

Construction emissions

DTI reports the dust and other air contaminant emissions projections in its Abbreviated Application for a Certificate of Public Convenience and Necessity[4]. The Application states that of the six sites in the New Market Project, only three – the new compressor stations at Horseheads and Sheds, and adding combustion equipment to the existing Brookman Corners site – are large enough to require pre-construction permits. The other three are small and exempt from the Air State Facility Permit that the larger projects require.[5]

Fugitive Dust Emissions from Construction Activities[6]

Construction-related fugitive dust emission projections are required for the three larger facilities mentioned above. It is not clear whether the totals provided in the Application are for all six sites or just the three that require pre-permitting. The estimates are based on the extent and duration of active surface disturbance and are provided in tons per year (tpy).[7]

Table 2. Fugitive Dust Emissions (tpy) for multiple New Market locations

	2015	2016
PM	2.90	21.44
PM 10	2.90	21.44
PM 2.5	0.29	2.14

These aggregated estimates tell us nothing specific about the construction phase of the Sheds compressor site. Because construction dust exposures at homes nearby would increase residents' risks for respiratory and cardiac illness, we believe a set of estimates specific to Sheds is needed to adequately evaluate health risk.

Total construction emissions for Sheds project

Total emissions estimates for construction-related engines are provided specifically for the Sheds project. These construction emissions are, in part, the result of diesel powered vehicles and equipment.

Table 3. Sheds non-road and on-road construction engine emissions (tpy)[8]

	2015	2016
CO	2.12	3.45
NOx	3.76	4.70
SO2	0.01	0.02
VOC	0.37	0.60
PM10	0.27	0.39
PM2.5	0.27	0.38
CO2	959.44	1288.86
CH4	0.05	0.06
N2O	0.02	0.02
CO2e	966.80	1297.69

When thinking about exposures in the vicinity of the Sheds construction site, it is important to note the particulate matter (PM) numbers. Table 3 includes only the PM10 and PM2.5 emissions from construction engines. For a total estimate, those numbers would need to be added to the PM10 and PM2.5 dust emissions (Table 2). Additionally, the estimates in tons per year raise concerns that will be addressed in conjunction with the operational emissions below.

<u>Operational emissions</u>

DTI presents a summary of its estimated operational emissions for the Sheds Compressor Station.[9] The Sheds combustion turbine will be fired exclusively with natural gas.[10] The operational emissions estimates are:

NOx	24.4 tpy	SO2	0.7 tpy
CO	6.6 tpy	Formaldehyde	0.1 tpy
PM10/PM2.5	6.4 tpy	Other HAPs	0.1 tpy
VOCs	2.9 tpy	Total HAPs	0.3 tpy

Perspective on emissions projected by DTI

The Sheds construction and operational phases are projected to produce emissions below the NAAQS standards. They are presented in *tons per year*. This measure of emissions is used for NAAQS purposes which determines the air quality designation over a region and over long periods of time. The problem posed by estimating tons of contaminants emitted per year is that over the course of a year emissions will vary, often greatly. As phases of construction and operation change so will emissions content and concentrations. For a resident living near a compressor station, the concern is not simply PM2.5 emissions over the course of a year, but is PM2.5 emissions during the peak construction time when it's at its most intense.

Even during normal operations compressor stations have been shown not to emit uniformly ("blowdown" and accident events will be discussed separately).[11] The measurement *tons per year*, while common in the industry and common in the environmental field where regional air quality is at issue, is not an appropriate measure to determine individuals' health risks which increase during episodes of high exposures.

Table 4 shows the day to day and morning to evening variability in emissions at one compressor station near Hickory, Pennsylvania. It comes from a Pennsylvania Department of Environmental Protection. We present this case to show documentation of fluctuations not captured by averages.[12] Note how much relevant emissions information is lost when relying on averages, even of just three days. When extending this logic across a year, there is little doubt that there will be times of high levels of contaminants released and these high levels can increase health risks to residents. It is also notable that the EPA inhalation reference concentration (RfC) for ethylbenzene is 1 mg/m3 (equivalent to 1,000 ug/m3).[13] Some of the reported emissions exceed this standard of health safety.

Table 4. Variation in ambient air measurements of five VOCs near a compressor station reported in ug/m^3 *[14]

Chemical	May 18		May 19		May 20		3 day average
	morning	evening	morning	evening	morning	evening	
Ethyl-benzene	No detect	No detect	964	2,015	10,553	27,088	6,770
n-Butane	385	490	326	696	12,925	915	2,623
n-Hexane	No detect	536	832	11,502	33,607	No detect	7,746

*The PA DEP collected data on many more chemicals than those listed above; the authors of this paper have chosen these chemicals specifically to highlight variation in emissions.

Without knowing the characteristics of peak exposures expected from the Sheds project, an accurate estimate of health risk cannot be made. Discussion of those health risks is found in Sections IV and V of this report.

Documented compressor emissions

It is important to know, with more specificity, what chemicals will be emitted by the proposed Sheds facility so that a targeted assessment can be made about its potential health impacts.

There is a small but growing body of literature on emissions from shale gas extraction, processing and transport activities. In its early stages of inquiry, the focus was predominantly on drill pad activity, but there are now some reports on natural gas compressor station emissions. Below are examples of chemicals that have been found at or near compressor stations during operations. These emissions reports – whether from public databases or from a private sector firm or organization – do not provide relevant background levels of the chemicals detected. Without a "control" location it is not possible to say with certainty that the chemicals found are the result of the compressor station, although these facilities are often the only industrial activity in the areas where they are found.

Emissions from two compressor stations (Stewart and Energy Corps), published by the Pennsylvania Department of Environmental Protection (DEP)[15] are:

MTBE	2-methyl butane
CO	2 methyl pentane
iso-Butane	3 methyl pentane
methyl mercaptan	ethyl benzene
n-Butane	benzene
n-hexane	ethane
n-octane	propane
nitrogen dioxide	methanol
nitrous-acidstyrene	napthlelene

The Texas Commission on Environmental Quality (TCEQ), as part of its Barnett Shale Formation Area Monitoring Projects found the following chemicals downwind from two monitored compressor stations[16]:

- Downwind of Devon Energy Company LP's Justin compressor station the TCEQ reports propane, isobutene, n-butane, ethane, cyclohexane, benzene, n-octane, toluene, m+p-xylene, n-hexane.
- Downwind of Targa North Texas LP's Bryan Compressor Station the TCEQ reports: ethane, propane, isobutene, n-butane, cyclohexane, n-octane, toluene, isopentane, n-pentane + isoprene, benzene.[17]

Officials in DISH, TX commissioned a study of compressor station emissions in its vicinity. Wolf Eagle Consultants performed whole air emissions sampling for VOCs, HAPs as well as Tentatively Identified Compounds (TICs). Chemicals identified as *exceeding* Texas's ESLs include: [18]

benzene
dimethyl disulfide
methyl ethyl disulphide
ethyl-methylethyl disulfide
trimethyl benzene
diethyl benzene
methyl-methylethyl benzene
tettramethyl benzene
naphthalene 1,2,4-trimethyl benzene
m&p xylenes
carbonyl sulfide
carbon disulfide
methyl pyridine
dimethyl pyridine

In 2011 and 2013, Earthworks, a non-profit organization, collected air samples within 0.33 miles of two compressor stations: Springhill compressor in Fayette County and the Cumberland/Henderson compressor station in Greene County, Pennsylvania.[19] Results from samples collected include:

1,1,2-Trichloro-1,2,2-trifluoroethane,
1,2-dichlorobenzene
2-butanone
benzene
carbon tetrachloride
chloromethane
dichlorodifluoromethane
ethylbenzene
methane
methylene chloride
tetrachloroethylene
toluene
trichloroethylene
trichlorofluoromethane

Anecdotally, we know that people living near compressor stations report episodic strong odors as well as visible plumes during venting or blowdowns. Residents often report symptoms that they associate with odors such as burning eyes and throat, skin irritation, and headaches. These are simply anecdotes but they are fairly consistently reported. It should be noted that residents in southwest Pennsylvania where these anecdotes were collected, often live near drill pads and in some instances processing plants along with compressor stations.[20]

Emissions pathways

In addition to the emissions produced during the normal operations of a compressor station there are several other ways that emissions might be dispersed from the site. These include fugitive releases, blowdowns, and accidents. Trucks play a significant

role in the emissions profile during construction but are not common once the facility is complete and on line.

Fugitive emissions

Fugitive emissions are uncontrolled or under-controlled releases. They occur from equipment leaks and evaporative sources. DTI includes fugitive emissions in its estimate of VOC emissions. Other categories of fugitive pollutants such as PM likely would increase if they were included in emissions projections. It has been suggested that fugitive emissions will increase over time as machinery begins to wear.[21]

There does not appear to be a central publically available source of information of these emissions. There are, however, many opportunities for fugitive emissions to be released from a compressor station. We were able to locate only one study on natural gas compressor station fugitive emissions. In that study, conducted in the Fort Worth, TX area, researchers evaluated compressor station emissions from eight sites, focusing in part on fugitive emissions. A total of 2,126 fugitive emission points were identified in the four month field study of 8 compressor stations: 192 of the emission points were valves; 644 were connectors (including flanges, threaded unions, tees, plugs, caps and open-ended lines where the plug or cap was missing); and 1,290 were classified as Other Equipment. The Other category consists of all remaining components such as tank thief hatches, pneumatic valve controllers, instrumentation, regulators, gauges, and vents. 1,330 emission points were detected with an IR camera (i.e. high level emissions) and 796 emission points were detected by Method 21 screening (i.e. low level emissions). Pneumatic Valve Controllers were the most frequent emission sources encountered at well pads and compressor stations.[22]

Blowdowns

The largest single emission at a compressor station is the compressor blowdown.[23] They can be scheduled or accidental. As the natural gas rushes through the blowdown valve, a gas plume extends upward of 30 to 60 meters. The most forceful rush of air occurs at the very beginning, then the flow gradually slows down. The first 30 to 60 minutes of the blowdown are the most intense, but the entire blowdown may last up to three hours.[24] One blowdown vents 15 MCf gas to atmosphere on average. Isolation valves leak about 1.4 Mcf/hr on average through open blowdown vents.[25]

It is not possible to know what exactly would be emitted in a given natural gas compressor station blowdown as there is no data available. We know that it will include whatever is in the pipeline when the blowdown occurs. This would undoubtedly include the constituents of natural gas: methane, ethane, etc., and various additional constituents would be present during different episodes. We are especially concerned about the presence of radioactive material during a blowdown

[see Radioactivity section]. Anecdotally, there are reports of odors and burning eyes, headaches and coughing associated with the events.[26]

In addition to uncertainty about *what* would be emitted and therefore what nearby residents would be exposed to, there is no special mention of *how much* is emitted under different circumstances in the DTI Application. There is attention paid to these episodic events in terms of noise disturbance, but not in terms of air contamination and subsequent exposure to individuals nearby. Because DTI does not address blowdown emissions separately, we cannot know at this point if blowdown emissions are included in the annual TPY emissions projections. This should be clarified. Whether they are or are not, their potency, when they are underway, is not known although the emission is extreme.

In Section III we show why averaging over a year such extreme emission events will underestimate the risks posed by them. An exposure to blowdown concentrations of contaminants would have different health implications than a long-term lower level exposure (i.e. yearly average) to the same contaminants when the compressor is on line.

Accidents

In addition to planned emissions, fugitive emissions and blowdowns there is also the possibility of accidents at the compressor station. There are no central national or state inventories of compressor station accidents that we were able to locate. In their absence we turned to local news accounts of individual accidents (which are generally in the form of fires). Without knowing what precisely is in the pipeline nor what else (if anything) may be housed on the site, it is not possible to estimate emissions from a fire at the compressor station. The possibility, however, is very real. A gas compressor station exploded near Godley, TX. That fire destroyed the compressor station where it started and also the one next to it. The fire burned for several hours.[27] In a compressor station fire in Madison County, TX volunteer firefighters from four towns were dispatched to the site. First responders blocked roads near the site and evacuated three homes.[28] In Corpus Christi, TX a fire broke out at a compressor station which then spread to nearby brush before being extinguished.[29]

The possibility of fire or other accidents raises the concern over whether the localities surrounding the proposed Sheds compressor station have the resources available to contain a fire or explosion adequately and whether first responders and hospitals are able to care for injured workers or others nearby or whether an evacuation plan could be implemented. In Wheeler County, TX four contractors were performing maintenance activities near a compressor station when a flash fire occurred. The workers were brought to a nearby hospital. Two were treated and released; the other two were transferred to a burn unit in Lubbock.[30] In Carbon County, UT an explosion and fire damaged a natural gas compressor station and other buildings on the site

injuring two workers and engulfing the facility in flame. Firefighters from every city in the county responded to the emergency. Injured workers had to be evacuated by medical helicopters.[31]

Overall, there is little information on the division of responsibility between the company operating the facility and the locality. This should be clarified if the Sheds compressor station moves forward.

The question of radioactivity

A 2008 publication of the International Association of Oil & Gas Producers has laid out the discussion on radioactive material in the natural gas extraction and production process.

> During the production process, naturally occurring radioactive material (NORM) flows with the oil, gas and water mixture and accumulates in scale, sludge and scrapings. It can also form a thin film on the interior surfaces of gas processing equipment and vessels. The level of NORM accumulation can vary substantially from one facility to another depending on geological formation, operational and other factors.
>
> [R]adionuclides such as Lead-210 and Polonium-210 can … be found in pipelines scrapings as well as sludge accumulating in tank bottoms, gas/oil separators, dehydration vessels, liquid natural gas (LNG) storage tanks and in waste pits as well as in crude oil pipeline scrapings.[32]

The gas which flows through the pipeline likely carries gaseous radon with it, and as radon decays within the pipeline, the solid daughter elements, polonium and lead, accumulate along the interior of the pipes. There is a concern that the gas transiting, and being compressed and regulated, will have radioactivity levels which will put at risk not only the workers at these stations and along the pipeline, but potentially also to the residents.[33] Radon, a gas, has a short half-life (3.8 days) but its progeny are lead and polonium, and these are toxic and have relatively long half-lives of 22.6 years and 138 days respectively.[34] There is no data that we can turn to in order to assess the risk of radioactive exposures in our community.

III. Health risks from relevant air contaminants

Averages, peaks and health events

As stated in the Operational Emissions section, one of our primary concerns is the poor fit of a *tons per year* measurement to the assessment of risk to the public's health near the proposed Sheds compressor station. Furthermore, the National Ambient Air

Quality Standards (NAAQS) used by DTI as a benchmark for air quality were not created to assess the air quality and safety in a small geographic area with fluctuating emissions. NAAQS effectively address regional air quality concerns. But these standards do not adequately assess risk to human health for residents living in close proximity to polluting sources such as unconventional natural gas development (UNGD) sites, where emissions can be highly variable. Generally, it has been shown that:

1. Current protocols used for assessing compliance with ambient air standards do not adequately determine the intensity, frequency or durations of the actual human exposures to the mixtures of toxic materials released regularly at UNGD sites, including compressor stations.
2. The typically used periodic 24-hour average measures can underestimate actual exposures by an order of magnitude.
3. Reference standards are set in a form that inaccurately determines health risk because they do not fully consider the potential synergistic combinations of toxic air emissions.[35]

Thus estimates of yearly totals of contaminants released by the Sheds compressor station do not allow for an assessment of the physiological impact of those emissions on individuals.

About the construction emissions, DTI says:

> Operations associated with Project facilities will not exceed any NAAQS. At the Sheds Compressor Station, modeling results indicate that all resultant pollutant concentrations (baseline concentration plus impact of the new compressor station) would be less than approximately 55 percent of any NAAQS. However, because of the relatively large margin between modeled concentrations and NAAQS limits, it is unlikely that any NAAQS would be exceeded from the cumulative impacts in the Project area.

NAAQS reflects what, over a region, over time, is deemed safe population-wide. This is very different than what is safe within for instance 1200 feet of this compressor station (which is how close the nearest residence is). As already stated, averaging over a year can wash out important higher spikes in emissions (thus exposures) that may occur at various points throughout the year. These high spikes can put residents at risk for illnesses caused by air toxics.

<u>Toxicity and characterization of exposures</u>

Toxicity of a chemical to the human body is determined by the concentration of the agent at the receptor where it acts. This concentration is determined by the intensity and duration of the exposure. All other physiological sequelae follow from the

interaction between agent and receptor. Once a receptor is activated, a health event might be produced immediately or in as little as one to two hours.[36 37] In some instances, where there is a high concentration of an agent, a single significant exposure can cause injury or illness. This is the case in the instance of an air contaminant induced asthma event. On the other hand, after an initial exposure, future exposures might compound the impact of the first one, in time, producing a health effect. Repeated exposures will increase, for instance, the risk for ischemic heart disease.[38]

Peak exposures

Researchers have demonstrated the wisdom of looking at peak exposures as compared to averages over longer periods of time. Darrow et al (2011) write that sometimes peak exposures better capture relevant biological processes. This is the case for health effects that are triggered by, short-term, high doses. They write, "Temporal metrics that reflect peak pollution levels (e.g., 1-hour maximum) may be the most biologically relevant if the health effect is triggered by a high, short-term dose rather than a steady dose throughout the day. Peak concentrations … are frequently associated with episodic, local emission events, resulting in spatially heterogeneous concentrations…."[39]

Delfino et al (2002) posited that maxima of hourly data, not 24-hour averages, better captured the risks to asthmatic children, stating, "it is expected that biologic responses may intensify with high peak excursions that overwhelm lung defense mechanisms." Additionally, they suggest that "[o]ne-hour peaks may be more influenced by local point sources near the monitoring station that are not representative of regional exposures…."[40]

Because episodic high exposures are not typically documented and analyzed by researchers and public agencies, natural gas compressor stations emissions are rarely correlated with health effects in nearby residents. However, examination of published air emission measurements shows the very real potential for harm from industry emissions.[41] Reports of acute onset of respiratory, neurologic, dermal, vascular, abdominal, and gastrointestinal sequelae near natural gas facilities contrast with research that suggests there is limited risk posed by unconventional natural gas development.

Health Effects from exposures to VOCs

VOCs, present at compressor station construction and operation, are a varied group of compounds which can range from having no known health effects to being highly toxic. Short-term exposure can cause eye and respiratory tract irritation, headaches, dizziness, visual disorders, fatigue, loss of coordination, allergic skin reaction, nausea, and memory impairment. Long-term effects include loss of coordination and damage to the liver, kidney, and central nervous system. Some VOCs, such as benzene,

formaldehyde, and styrene, are known or suspected carcinogens.[42] The case for elevated risk of cancer from UNGD VOC exposure has been made by McKenzie et al (2012) and others.[43]

The inhalation of the VOC, benzene, produces a number of risks including

> [acute (short-term)] drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation, and, at high levels, unconsciousness. Chronic (long-term) inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings. Reproductive effects have been reported for women exposed by inhalation to high levels, and adverse effects on the developing fetus have been observed in animal tests. Increased incidence of leukemia (cancer of the tissues that form white blood cells) have been observed in humans occupationally exposed to benzene. EPA has classified benzene as known human carcinogen for all routes of exposure.[44]

Benzene, which is documented at compressor stations by the States of Pennsylvania and Texas, carries its own risk, including risk for cancer.[45] [46] There is growing evidence that benzene is associated with childhood leukemia. Benzene affects the blood-forming system at low levels of occupational exposures, and there is no evidence of a threshold. It has been argued in the literature that "[t]here is probably no safe level of exposure to benzene, and all exposures constitute some risk in a linear, if not supralinear, and additive fashion.[47]

Another substance that is detected near compressor stations is methylene chloride. According to the EPA

> The acute (short-term) effects of methylene chloride inhalation in humans consist mainly of nervous system effects including decreased visual, auditory, and motor functions, but these effects are reversible once exposure ceases. The effects of chronic (long-term) exposure to methylene chloride suggest that the central nervous system (CNS) is a potential target in humans and animals. Human data are inconclusive regarding methylene chloride and cancer. Animal studies have shown increases in liver and lung cancer and benign mammary gland tumors following the inhalation of methylene chloride.[48]

The VOC formaldehyde is also considered a Hazardous Air Pollutant (HAP) by the US EPA (EPA).[49] It is one of the emissions chemicals that the natural gas development industry is required to report, for instance to the PA DEP. According to these reports, compressor stations are the highest UNGD source for formaldehyde.[50] For the year 2012, emissions of formaldehyde from compressor stations in Pennsylvania ranged from 0.0 TPY to 22.5 TPY. [51]

A recent study of air emissions in the Barnett shale region of Texas found concentrations of formaldehyde at sites with large compressor stations.[52] Some of these concentrations were greater than the Texas Commission on Environmental Quality's health protective levels (page 62). Formaldehyde was one of 101 chemicals found in association with methane in this study. The research showed that aromatics in particular were associated with compressor stations.

Air exposures to formaldehyde target the lungs and mucous membranes and in the short-term can cause asthma-like symptoms, coughing, wheezing, and shortness of breath. The EPA classifies it as a probable human carcinogen.[53] The World Health Organization classifies it as carcinogenic to humans.[54] It has also been associated with childhood asthma.[55] The California Office of Environmental Health Hazard assessment (OEHHA) has "identified formaldehyde as a Toxic Air Contaminant and gives it an inhalation Reference Exposure Level (REL) of 55 ug/m^3 for acute exposures and 9 ug/m^3 for both 8-hour and chronic exposures.[56] The acute REL is 74 ppb based on irritation of asthmatics.[57] It has also been linked with adverse pregnancy outcomes and reproductive and developmental toxicity.[58]

More recent investigations on formaldehyde near compressor stations are focused on the chemical reaction between methane and sunlight.[59] While it is well known that stationary compressor station engines emit formaldehyde, it is less well known that formaldehyde may also be formed at these sites through this chemical reaction. While the research is ongoing, it suggests that health hazards associated with formaldehyde may be greater than previously thought. Because reported health symptoms near compressor stations, such as respiratory impacts and shortness of breath, can be caused by exposure to formaldehyde, targeted monitoring of this chemical at these sites would be recommended.

Effects from exposure to particulate matter

In addition to the VOC exposure presented above, PM2.5 also poses a significant health concern and interacts with the airborne VOCs increasing their impact. In fact, at a compressor station PM2.5 may pose the greatest threat to the health of nearby residents. Fine particles are expected to reach a total of 1.136 tons for 2015 and 2016.

The size of particles determines the depth of inhalation into the lung; the smaller the particles are, the more readily they reach the deep lung. Particulate matter (PM10, PM2.5 and ultrafine PM), in conjunction with other emissions, are at the core of concern over potential effects of UNGD.

High particulate concentrations are of grave concern because they absorb airborne chemicals in their midst. The more water soluble the chemical, the more likely it is to be absorbed onto a particle. Larger sized particles are trapped in the nose and moist

upper respiratory tract thereby blocking or minimizing their absorption into the blood stream. The smaller PM2.5 however, is more readily brought into the deep lung with airborne chemicals and from there into the blood stream. As the particulates reach the deep lung alveoli the chemicals on their surface are released at higher concentrations than they would in the absence of particles. The combination of particles and chemicals serves, in effect, to increase in the dose of the chemical. The consequences are much greater than additivity would indicate; and the physiological response is intensified. Once in the body, the actions between particles and chemicals are synergistic, enhancing or altering the effects of chemicals in sometimes known and often unknown ways.[60]

Reported clinical actions resulting from PM2.5 inhalation affect both the respiratory and cardiovascular systems. Inhalation of PM2.5 can cause decreased lung function, aggravate asthma symptoms, cause nonfatal heart attacks and high blood pressure.[61] Research reviewing health effects from highway traffic, which, like UNGD, has especially high particulates, concludes, "[s]hort-term exposure to fine particulate pollution exacerbates existing pulmonary and cardiovascular disease and long-term repeated exposures increases the risk of cardiovascular disease and death."[62] PM2.5, it has been suggested, "appears to be a risk factor for cardiovascular disease via mechanisms that likely include pulmonary and systemic inflammation, accelerated atherosclerosis and altered cardiac autonomic function. Uptake of particles or particle constituents in the blood can affect the autonomic control of the heart and circulatory system."[63]

Ultrafine particles (<0.1) get less attention in the literature than PM2.5 but is found to have high toxic potency.[64] These particles readily deposit in the airways and centriacinar region of the lung.[65] Research suggests increases in ultrafine particles pose additional risk to asthmatic patients.[66] Ultrafine particles are generally produced by combustion processes. They, along with the larger PM2.5, are found in diesel exhaust.

Diesel is prevalent during the construction phase of compressor station site. High levels of diesel exhaust from construction machinery as well as trucks increase the level of respirable particles. Health consequences of diesel exposure have been widely studied and include immediate and long term health effects. Diesel emissions can irritate the eyes, nose, throat and lungs, and can cause coughs, headaches, lightheadedness and nausea. Short-term exposure to diesel exhaust also causes inflammation in the lungs, which may aggravate chronic respiratory symptoms and increase the frequency or intensity of asthma attacks. Long-term exposure can cause increased risk of lung cancer.[67]

<u>PM2.5 acute effects</u>

There is an abundance of research on the health effects of short term PM2.5 exposure. Mills et al demonstrate that one to two hours of a diesel exhaust exposure, which occurs during the construction phase of development, includes reduced brachial artery diameter and exacerbation of exercise-induced ST-segment depression in people with pre-existing coronary artery disease; ischemic and thrombotic effects in men with coronary heart disease;[68] and is associated with acute endothelial response and vasoconstriction of a conductance artery.[69] Fan He et al. suggest that health effects can occur within 6 hours of elevated PM2.5 exposures, the strongest effects occurring between 3 and 6 hours. Such an acute effect of PM2.5 may contribute to acute increase in the risk of cardiac disease, or trigger the onset of acute cardiac events, such as arrhythmia and sudden cardiac death.[70]

Numerous epidemiological studies have demonstrated a consistent link between particulate matter and increased cardiopulmonary morbidity and mortality (Brook et al. 2004; Mann et al. 2002; Pope et al. 2002; Samet et al. 2009; Schwartz 1999).[71] Previous studies have suggested that PM2.5 exposure is significantly associated with increased heart rate and decreased heart rate variability (HRV; Gold et al., 2000; He et al. 2010; Liao et al. 1999; Luttmann-Gibson et al. 2006; Magari et al. 2001; Park et al. 2005).

In addition to short term exposures and associated effects, there is evidence of health impacts from long-term exposures.[72] An HIA reviewing data from a number of European cities found that nearly 17,000 premature deaths from all causes, including cardiopulmonary deaths and lung-cancer deaths, could be prevented annually if long-term exposure to PM2.5 levels were reduced. Equivalently, this reduction would increase life expectancy at age 30 by a range between one month and more than two years in the study cities. A Canadian national cohort study found positive and statistically significant associations between non-accidental mortality and estimates of PM2.5, the strongest association being with ischemic heart disease. Associations in this study were with concentrations of PM2.5 as low as only a few micrograms per cubic meter.[73] Research has also shown that there is an association between PM2.5 and hospitalization for COPD in elderly people.[74]

There is also a considerable literature on the health effects specifically from diesel emission that include PM2.5 along with chemical components. Mills et al conclude that even dilute diesel emissions can induce risk and point to ischemic and thrombotic mechanisms for the adverse cardiovascular events associated with diesel exposure.[75] After an extensive review The EPA concluded that

> long-term inhalation exposure is likely to pose a lung cancer risk to humans. Estimation of cancer potency from available epidemiology studies was not attempted…. A noncancer chronic human health hazard is inferred from rodent studies showing dose-dependent inflammation and histopathology in rats. Short-term exposures were noted to cause irritation and inflammatory symptoms of a transient nature these being

highly variable across an exposed population. The assessment also indicates that there is emerging evidence fro the exacerbation of existing allergies and asthma symptoms.[76]

Children, pregnant women and air contaminants

Children and pregnant women are especially sensitive to pollution. Many studies confirm a range of adverse effects of air pollution on children's lung function and respiratory symptoms, especially for asthmatics. Recent studies have found statistically significant associations between the prevalence of childhood asthma or wheezing and living very close to high volume vehicle roadways.[77] Other research aimed specifically at children's PM2.5 exposure has found that PM2.5 and several of its components have important effects on hospital admissions for respiratory disease, especially pneumonia. The authors count among the sources for this exposure diesel exhaust, motor vehicle emissions, and fuel combustion processes.[78] While those living near the proposed Sheds compressor station are not on what would be consider typical high volume vehicle roadways, during the construction phase of the project residents along the access roads will be exposed to heavy emissions. And even once the construction phase is completed and compressor station is up and running there are similarities in what Dominion projects it will emit and those emissions from high volume vehicle traffic.

Health effects have been found in pregnant women from high particulate highway pollution. Such particle pollution "may provoke oxidative stress and inflammation, cause endocrine disruption, and impair oxygen transport across the placenta, all of which can potentially lead to or may be implicated in some low birth weight … and preterm births." The consequences do not stop with low birth weight and preterm births because these conditions can negatively affect health throughout childhood and into adulthood.[79]

Mixtures and sequential exposures

Mixtures of pollutants are a critically important topic in addressing the public health implications of UNGD broadly and compressor stations in this case. While this report has focused primarily on three pollutants (VOCs, formaldehyde as one example, and PM2.5), in fact, a very large number of chemicals are released together. Medical reference values are not able to take the complex nature of the shale environment, its multiple emissions and interactions into full consideration.[80] Although the shale gas industry is not unique in emitting multiple pollutants simultaneously, this industry is unique in doing so as close as 500 feet from residences.

Chemicals that reach the body interfere with metabolism and the uptake and release of other chemicals, be they vitally important biochemical produced and needed by the

body or other environmental chemicals with potentially toxic effects. Some chemicals attack the same or similar target sites creating an additive effect. This is the case with chemicals of similar structure such as many in the class of VOCs. Some mixtures like PM and VOC act synergistically to increase the toxicity of the chemicals. Other chemicals released environmentally are rapidly absorbed and slowly excreted. These slowly excreted chemicals will interfere with subsequent actions of chemicals because the body has not yet cleared the effects from the earlier exposure.

Noise

Excessive noise has been associated with an array of psychological and physical effects. A review article on noise exposure and health risk published in *Noise and Health* claims that the evidence for a causal relationship between community or transportation noise and cardiovascular risk has risen in recent years. In sum, the author finds limited evidence for a causal relationship between noise and biochemical effects; limited or sufficient evidence for hypertension; and sufficient evidence for ischemic heart disease.[81]

According to a World Health Organization assessment of research, excessive noise can also increase risk of cognitive impairment in children, sleep disturbance, tinnitus, and high levels of annoyance.[82] Researchers have found associations between elevated sound levels – including community sounds levels – and hearing loss, reduced performance and aggressive behavior.[83] Additionally some attention is being paid to the health effects of vibration exposure which is connected with but distinct from noise itself.[84]

Noise exposures are associated with construction activities and during blowdown episodes. Although noise estimates were provided by DTI, we believe the effects of these exposures as well as vibration exposures should be evaluated by outside experts in the field. As with air exposures, the periods of extreme exposures (in this case noise exposures) can cause different and sometimes more serious effects than low-level exposures.

Summary

In sum, we know that a number of different chemicals as well as PM2.5 are present during the construction phase of compressor stations and they are present in close proximity to compressor stations that are on line. Some, although not all, have documented health effects on vulnerable populations and on the population at large. What we do not know, in the case of the proposed Sheds compressor station, is the precise mix and concentration of chemicals that will be released into the air. Without that information it is not possible to assess the compressor station's full impact on area residents. A thorough community health study could, however, reveal important risks specific to residents in Madison County, NY.

IV. Reported health effects specific to compressor stations

There is a growing body of research on emissions and health impacts from UNGD generally, though few studies specifically address health impacts from compressor stations. This is partly due to the fact that many compressors are sited in proximity to other UNGD sites such as well pads, impoundments, condensate tanks and processing stations. As the infrastructure for transporting natural gas continues to expand, more pipelines, metering stations and compressor stations will be sited away from other UNGD facilities.

Recent research that has been conducted near compressor stations in different parts of the country shows consistencies in the types of symptoms experienced by those living near these sites. These symptoms are associated with health impacts on respiratory, neurological and cardiovascular body systems. It should be noted that in each of the studies cited here health survey forms were filled out by residents and, as such, the findings are self-reported. To date there have been no epidemiological studies performed to identify health impacts from compressor stations.

A peer-reviewed article, *Investigating Links Between Shale Gas Development And Health Impacts Through A Community Survey Project In Pennsylvania* (2014) is one of the few publications that explicitly addresses health impacts from compressors.[85] The report states:

> In the Pennsylvania study, distance to industrial sites correlated with the prevalence of health symptoms. For example, when a gas well, compressor station, and/or impoundment pit were 1500-4000 feet away, 27 percent of participants reported throat irritation; this increased to 63 percent at 501-1500 feet and to 74 percent at less than 500 feet. At the farther distance, 37 percent reported sinus problems; this increased to 53 percent at the middle distance and 70 percent at the shortest distance. Severe headaches were reported by 30 percent of respondents at the farther distance, but by about 60 percent at the middle and short distances. [86] P.62

Age groups also responded differently in terms of health symptoms:

> Among the youngest respondents (1.5-16 years of age), for example, those within 1500 feet experienced higher rates of throat irritation (57% vs. 69%) and severe headaches (52% vs. 69%). It is also notable that the youngest group had the highest occurrence of frequent nosebleeds (perhaps reflective of the more sensitive mucosal membranes in the young), as well as experiencing conditions not typically associated with children, such as severe headaches, joint and lumbar pain, and forgetfulness.

> Among 20- to 40-year-olds, those living within 1500 feet of a facility reported higher rates of nearly all symptoms; for example, 44 percent complained of frequent nosebleeds, compared to 29 percent of the entire age group. The same pattern existed among 41- to 55-year-olds with regard to several symptoms (e.g., throat and nasal irritation and increased fatigue), although with smaller differences and greater variability than in the other age groups.
>
> The subset of participants in the oldest group (56- to 79-year-olds) living within 1500 feet of facilities had much higher rates of several symptoms, including throat irritation (67% vs. 47 %), sinus problems (72% vs. 56%), eye burning (83% vs. 56%), shortness of breath (78% vs. 64%), and skin rashes (50% vs. 33%).
>
> In sum, while these data do not prove that living closer to oil and gas facilities causes health problems, they do suggest a strong association since symptoms are more prevalent in those living closer to facilities than those living further away. Symptoms such as headaches, nausea, and pounding of the heart are known to be the first indications of excessive exposure to air pollutants such as VOCs [36], while the higher level of nosebleeds in the youngest age group is also consistent with patterns identified in health survey projects in other states [9, 10]." P.64

Earthworks, a non-profit organization, conducted the Pennsylvania study referred to above, (Gas Patch Roulette 2012) in which they surveyed residents about health symptoms and conducted air and water tests near residences in Pennsylvania and New York[87]. In their report, specific mention is given of a residence 800 feet from a compressor station. Health symptoms experienced by the residents (parents and children) were extreme tiredness, severe headaches, runny noses, sore throats and muscle aches, as well as dizziness and vomiting by one individual.

Based on data from the Town Assessor's office (Table 1), 17 year-round residences are located within ½ mile (2,640 feet) of the proposed compressor station and 30 residences are within 1 mile (5,280 feet). The nearest residence is 1,150 feet for the site. Symptoms reported in the Pennsylvania study, primarily throat irritation, sinus problems and headaches could potentially be experienced by town residents within these distances. Numerous additional symptoms are possible and would vary depending upon the age and overall health of individuals.

Earthworks also conducted a health survey in Dish, Texas in 2009.[88] The health symptoms reported to be associated with compressors were: burning eyes, nausea, headaches, running nose, sore throat, asthma, sinus problems and bronchitis. Odors experienced by residents near compressor stations were described as: sulfur smell, odorized natural gas, burnt wire, strong chemical-like smell and ether.

Wilma Subra[89], an environmental chemist and consultant who is on the Earthworks Board of Directors, has compiled information on health symptoms experienced near compressor stations based on her research with communities concerned about health impacts from UNGD[90]. Subra has served as Vice-Chair of the Environmental Protection Agency National Advisory Council for Environmental Policy and Technology (NACEPT), and recently completed a five year term on the National Advisory Committee of the U.S. Representative to the Commission for Environmental Cooperation and a six year term on the EPA National Environmental Justice Advisory Council (NEJAC) where she served as a member of the Cumulative Risk and Impacts Working Group of the NEJAC Council. While her research on health impacts associated with compressor stations is reported back to communities, most of the data shown here have not been published in peer-reviewed journals (she is an author on the above-mentioned peer-reviewed article on Pennsylvania data).

Subra has reported the following health impacts in association with compressor stations:

Table 2. Most Prevalent Medical Conditions In Individuals Living in Close Proximity to Compressor Stations and Metering Stations

Medical Conditions:	% of Individuals (71)
Respiratory Impacts	58
Throat Irritation	55
Weakness and Fatigue	55
Nasal Irritation	55
Muscle Aches & Pains	52
Vision Impairment	48
Sleep Disturbances	45
Sinus Problems	42
Allergies	42
Eye Irritation	42
Joint Pain	39
Breathing Difficulties	39
Severe Headaches	39
Swollen & Painful Joints	32
Frequent irritation	32

The full list of health impacts "Reported by Community Members Living 50 feet to 2 miles from Compressor Stations and Gas Metering Stations Along Gas Transmission Pipelines" is available at the Luzerne County Citizens for Clean Air website[91]. It is notable that Subra reports that 61% of health impacts are associated with the chemicals present in the air that were in excess of short and long term effects screening levels.

Subra further reports that the following units at compressor stations and gas metering stations release emissions into the air:

- Compressor Engines
- Compressor Blowdowns
- Condensate Tanks
- Storage Tanks
- Truck Loading Racks
- Glycol Dehydration Units
- Amine Units
- Separators
- Fugitive Emission Sources

She reports that 90% of individuals surveyed reported experiencing odor events from these facilities. Based on her analysis, the following health symptoms are associated with the chemicals detected in the air at compressor stations:

- Allergies
- Persistent Cough
- Shortness of Breath
- Frequent Nose Bleeds
- Sleep Disturbances
- Joint Pain
- Difficulty in Concentrating
- Nervous System Impacts
- Forgetfulness
- Sores and Ulcers in Mouth
- Thyroid Problems

Subra reports that both the construction and production phases of compressor stations can cause acute and chronic impacts. In the construction phase impacts come from diesel truck emissions and from dust particles. In the production phase impacts are derived from constant emissions, venting, blowdowns, accidents/malfunctions and from the effects of noise, light and stress. She considers respiratory health impacts of particular concern, and vulnerable groups such as pregnant women, children, the elderly and sensitive individuals to be at greatest risk. Acute and chronic health impacts that Subra has documented are listed below.

Acute Health Impacts Experienced by Individuals Living and Working near Compressor Stations

- Tense and nervous
- Joint and muscle aches and pains
- Vision Impairment
- Personality changes
- Depression, Anxiety
- Irritability
- Confusion
- Drowsiness
- Weakness
- Irregular Heartbeat
- Irritates skin, eyes, nose, throat and lungs
- Respiratory impacts
- Sinus problems
- Allergic reactions
- Headaches
- Dizziness, Light headedness
- Nausea, Vomiting

Skin rashes
Fatigue
Weakness

Chronic Health Impacts Experienced by Individuals Living and Working near Compressor Stations

Damage to Liver and Kidneys
Damage to Lungs
Damage to Cardiovascular System
Damage to Developing Fetus
Reproductive Damage
Mutagenic Impacts
Developmental Malformations
Damage to Nervous System
Brain Impacts
Leukemia
Aplastic Anemia
Changes in Blood Cells
Impacts to Blood Clotting Ability

Radioactive elements: a long-term health threat

The possibility of exposure to radiation from natural gas pipelines and compressor stations is also a concern, especially for long-term health effects. The New York public health group, Concerned Health Professionals of New York, describes the problem in their report, Compendium Of Scientific, Medical, And Media Findings Demonstrating Risks And Harms Of Fracking (Unconventional Gas And Oil Extraction) (July 10, 2014): "Unsafe levels of radon and its decay products in natural gas produced from the Marcellus Shale, known to have particularly high radon content, may also contaminate pipelines and compressor stations, as well as pose risks to end-users when allowed to travel into homes."(P.5). Health impacts from exposure to radioactive materials in compressor station emissions have not been documented, but the risk of exposure to these carcinogens are a serious public health concern.

V. Concerns from residents

FERC is required by NEPA to address concerns reported by local residents in the permitting process. Engaging community members in this process can effectively inform decision-making that ultimately improves public safety.[92,93]

In the public comments submitted to FERC by residents and in comments submitted to the MCDOPH, concerns about health risk are a priority. In reviewing these comments we found that of the 15 individuals who submitted comments to FERC the top 10 concerns mentioned were:

Food safety (risks to crops/farms/gardens and consumers)	10
Health risks (including risks to children)	9
Home values (resale, insurance, mortgage)	9

Air pollution	8
Environment	8
Water pollution	7
Noise pollution	7
Safety record of compressors	7
Rural character of community disruption	7
Wildlife	7

Of the 21 comments written to the MCDOPH during and following two public information meetings the top ten concerns were[94]:

Health Risks (including risks to children)	19
Food safety (Risks to crops/farms/gardens and consumers)	16
Air pollution	15
Noise pollution	14
Safety record of compressors	11
Water pollution	11
Emergency response	9
Rural character of community disruption	7
Home values (resale, insurance, mortgage)	7
Pipeline safety	5

Health safety and food safety are the top concerns for these residents. While the risks to health from potential chemical exposure is documented (and summarized above in relation to compressors), less is known about the route of exposure from air emissions through soil and food pathways. There are reports of soil contamination from UNGD caused by spills, leaks and underground contamination[95,96]. For this industry, we found no documentation of soil and plant contamination from air pollutants, but the pathway for contamination through air is well documented.[97 ,98 ,99] Thus concerns about food safety related to air emissions should not be discounted.

There is evidence of loss of property values near UNGD sites, though not specifically addressing to compressor stations.[100,101] Risks to wildlife and local habitats from UNGD has been addressed in the literature by Kiviat (2013).[102] Concern about accidents, emergency response, compressor safety records and pipeline safety are related issues that bear on public health. In fact, each of the concerns listed above is related, directly or indirectly to public health. From the broad scope of “environment” and “rural community character” to the specifics of safety records and emergency response, these issues impact the health and wellbeing of the local community. These concerns can best be addressed through a thorough assessment of health risks.

VI. Recommendations for framing and scoping the public health issues for the Sheds compressor station:

FERC should consider expanding the scope of its public health analysis on the Sheds compressor station to address the concerns raised in this report to ensure that public health is not endangered in Madison County. To protect public health it is necessary to know whether dangerous spikes in pollutants will ever occur at this compressor station, how often, and what the health effects would be for nearby residents in the short and the long term. The important impact of local weather conditions on exposure profiles also needs to be considered.

To adequately assess human health impacts public health professionals and analysts would need to know:

- The pathways of exposure (air, water, soil)
- The intensity of the exposure
- The frequency of the exposure
- The duration of the exposure
- Interaction of components of the chemical mixture
- Length of time living near the compressor station

Public health professionals understand that:

- Chemical toxicity in the human body can occur within minutes or hours of exposure.
- Repeated episodic exposures increase the damage.
- High exposures to chemicals increase the seriousness of the damage.
- Understanding the variability of exposure is essential.

The need for a public health perspective in the process of regulating UNGD including transportation infrastructure has been presented in peer-reviewed journals, at scientific conferences and in public comments to State officials. See the following references:

A. Wernham, "Health Impact Assessment for Shale Gas Extraction," www.healthimpactproject.org/resources/health-impactassessment-for-shale-gas-extraction (accessed July 30, 2014).

Adgate, JA, Goldstein, BA and Mckenzie, LM. Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development Environmental Science and Technology. 2014. [103]

Adgate et al (2014) report that :
"… pollution from UNG development originates from (1) direct and fugitive emissions of methane and nonmethane hydrocarbons from the well and associated infrastructure (e.g., production tanks, valves, pipelines, and collection and processing facilities); (2) diesel engines that power equipment, trucks, and generators; (3) drilling muds,

fracturing fluids, and flowback water; and (4) deliberate venting and flaring of gas and related petroleum products." (page D)[104]

They further state that:
"Pilot studies in Colorado's Piceance Basin, Pennsylvania's Marcellus, and Texas's Barnett Shale indicate that VOCs, including C2− C8 alkanes, aromatic hydrocarbons, methyl mercaptan, and carbon disulfide, are emitted during well completions as well as from compressors, condensate storage tanks and related infrastructure." (page E)[105]

The lack of environmental public health expertise on advisory panels at the state and federal levels has also been addressed by:

Goldstein, B., Kriesky, J., Pavliakova, B. "Missing from the Table: Role of the Environmental Public Health Community in Governmental Advisory Commissions Related to Marcellus Shale Drilling." Environmental Health Perspectives. Vol 120(4)483-486, 2012. [106]

<u>Baseline health data and environmental data: where to find it</u>

Baseline health data provides the foundation for effective public health assessments. Numerous sources are available to develop a baseline dataset for specific locations and to identify susceptible populations. Primary resources are listed below.

The gathering of environmental data for assessment of health impacts would, in the case of compressor station air emissions, require accessing data on a subset of known chemicals emitted at similar sites (e.g. a similar size compressor station during normal operation including blowdowns and venting). The monitoring protocols at existing sites would need to address the realtime variations at compressor stations, capturing peak emissions as well as duration of peaks. Public health officials could then more accurately estimate health impacts for both acute and cumulative exposures to the local population.

Local baseline health statistics are necessary so that risk can be assessed in relation to a specific population. Baseline data sources include County, State and Federal health statistics databases. Nongovernmental resources include the American Lung Association, American Cancer Society and the National Cancer Institute. Recommended baseline health topics and sources of data are listed below.

Physical health determinants:

- Major causes of morbidity and mortality: CDC Wonder; National Cancer Institute
- Life expectancy: CDC's Community Health Status Indicators
- Poor physical health days: Behavioral Risk Factor Surveillance System (BRFSS)
- Chronic disease: BRFSS

- Identification of vulnerable populations: County level health data and sociodemographic data
- Birth outcomes: Health Indicators Warehouse and National Vital Statistics System
- School data: New York State Department of Health, Health Data NY, Schools, Statistics and Chronic Diseases
- Hospital data: New York State Department of Health, Health Data NY, Hospital reports

Environmental health determinants:

- Baseline local air quality: requires targeted monitoring in addition to current NAAQS data
    - To estimate the impact of compressor station air emissions MCDOH suggests site specific air monitoring from comparable compressor stations to capture the intensity, duration and frequency of peak emissions that could impact public health (including blowdowns). A subset of known chemicals could be tested for including but not limited to BTEX, methylene chloride, formaldehyde, $PM_{2.5}$ and ultrafine particles.
    - This can be followed by the modeling of emissions dispersion that takes local topographic and meteorological data into consideration. In this way the potential for spikes in exposures can be estimated for different locations.
- Soil health: perform baseline soil tests for relevant chemicals to establish baseline levels in case of future potential contamination of local yards, play areas and gardens as well as local agricultural fields and farm products.
    - To be followed by periodic soil tests if permit is granted.
- Baseline local water quality: requires targeted testing of local wells and surface waters [of concern to residents]
    - To be followed by periodic monitoring of local water resources if permit is granted.
- Noise levels: compare current and projected levels.
- Traffic: compare current and projected levels.
- Construction: assess projected impacts from dust and diesel emissions.

Suggested references of reports that assess health impacts, including cumulative risks, related to UNGD

University of Maryland: Potential Public Health Impacts of Natural Gas Development and Production in the Marcellus Shale in Western Maryland. Maryland Institute for Applied Environmental Health School of Public Health University of Maryland, College Park. July 2014.[107]

New Brunswick, Canada: Chief Medical Officer of Health's Recommendations Concerning Shale Gas Development in New Brunswick. Office of the Chief Medical Officer of Health, New Brunswick Department of Health. 2012.[108]

Colorado School of Public Health: Battlement Mesa Health Impact Assessment, Colorado School of Public Health, February, 2011 [109]

State of Alaska: Health and Social Services Alaska Health Impact Assessment Program[110]

VII. Data gaps and other challenges for implementing a health assessment:

There are a number of knowledge gaps that make it difficult to perform a thorough public health analysis, yet each such effort contributes to the broader challenge of understanding the health consequences of living near UNGD installations, including compressor stations.

1. Baseline health studies: Studies on health status before infrastructure development are lacking, yet are critical for measuring health impacts.[111] Currently little is known about the direct consequences of living near these sites. Baseline studies in relation to UNGD are needed and should be followed by health status monitoring during development and production phases.

2. Chemical constituents: More site specific monitoring is needed to quantify and qualify the chemical constituents of compressor station emissions. Emissions can vary between sites as well as over time at each site. Normal operations will produce different emissions from venting, blowdowns or accidental releases. Targeted monitoring can help address this gap by providing information on the chemical identities and quantities along with timeline and duration of emissions that may lead to exposures.

3. Chemical toxicity and chemical mixtures: information on toxicity is lacking for some chemical constituents that have yet to be thoroughly studied. With no health standards, risks are difficult to assess. Even when health standards for each chemical are known, understanding risks to chemical mixtures in air emissions poses a greater challenge. Research on how chemicals react with each other, as well as how mixtures then affect the human body are sorely lacking. These data gaps can be mitigated to some extent by conducting health impact assessments.

4.: Pipeline and metering station emissions: In addition to compressor stations, pipelines and metering stations also emit chemicals into the air. These emissions contribute to both environmental and public health impacts. Targeted monitoring

would help in assessing regional air quality impacts, as well as local impacts for residential areas.

5., Radioactive emissions: Natural gas sourced from shale plays is known to contain radioactive elements. These elements build up in pipeline scale. The extent to which radioactive materials are emitted during venting, blowdowns or other events is not well known. Monitoring specifically for harmful radioactive substances is needed.

6. Air dispersion modeling: Determining how emissions travel from a source to nearby residents is an important part of understanding human exposure. The topography and the weather patterns of each local environment affect dispersal patterns. Consequently some residents may be impacted more than others. Targeted air dispersion modeling for specific industrial sites can contribute to anticipating local health impacts.

7. Soil and farm products: With the increased placement of natural gas transmission infrastructure through rural farming communities, the need for monitoring soils and farm products for chemical contamination also increases. As chemical constituents are identified, targeted soils and food testing can help bridge this knowledge gap.

VIII. Recommendations and mitigation (if permit granted)

In the event that the DTI New Market project is permitted by FERC, MCDOH would make the following recommendations so that public health can be adequately addressed :

1. Perform a baseline health study to establish population health status before the compressor station is built.

- A baseline health study would allow MCDOH to monitor and measure health impacts over time and support the development and initiation of mitigation for health consequences if any are found.
- A baseline study that includes air pollution monitoring would provide data to distinguish between background and additional impacts from compressor station emissions. With indoor air monitoring in residences, distinctions could be made between the use of natural gas in the home on a regular basis and the potential impact of emissions dispersing into residences. For example, a measure of spikes that might occur from cooking (short-term) would look different from longer-term spikes that result from outdoor air pollution, or nighttime spikes that might occur due to weather conditions.

2. Require best practices to ensure that effective emissions control measures are kept up to date.

Technology is rapidly changing in this industry and while some improvements have been made in emissions controls and environmental impacts, there is room for more

improvement. To protect public health, MCDOH recommends that upgrades to equipment be required for continued operation of the compressor station. [112]

The health effects of living near compressor stations include impacts from this constant source of noise. To reduce these health effects MCDOH requests the implementation of special noise abatement measures such as those in use at the Minisink Compressor Station. These include the addition of an "internal mass septum layer for the compressor building walls and roof; additional baffle length for the first and second stage exhaust silencers; high performance turbine exhaust and air inlet systems; low noise turbine lube oil coolers; and unit blowdown silencers." [113] It should be noted, however, that some residents near the Minisink Compressor station continue to report that noise and vibrations interfere with their quality of life. Continued upgrades would help to mitigate ongoing effects.

3. Establish an alert system for blowdowns or other large emissions and/or noise events. These types of events, while considered a normal part of compressor station operations, can potentially cause health effects for nearby residents. A system that alerts residents to the intensity and duration of these events is recommended.

4. Put Emergency Plans in place. The application filed by DTI states that the company is not required by the USEPA to prepare a risk management plan for the New Market Project. Because of the risk of chemical accidental (or intentional) release at levels that could harm human health, MCDOH recommends that emergency plans be put in place for both pipeline release events, metering station events and compressor station accidents. In association with emergency plans, MCDOH further recommends that :

- First responders be properly trained for these specific scenarios
- Local health providers receive training for specific environmental exposures
- An evacuation plan is put in place

5. Institute a monitoring strategy at the Sheds compressor station and surrounding locations. To adequately protect public health it is necessary to measure air emissions at the source and to determine air pollution impacts locally. MCDOH recommends monitoring air emissions such as formaldehyde, VOCs and particulate matter at residences within one mile of the compressor station. MCDOH also recommends monitoring impacts to soil and crops within one mile of the compressor station to assess impacts on farm products. With realtime monitoring in place, DTI would have the capability to respond to events that jeopardize human health and adjust venting events accordingly.

6. Institute a health registry. MCDOH recommends that a regional health registry be established so that long-term health effects from natural gas infrastructure, including the Sheds compressor station, can be adequately assessed. Ideally this registry would

be part of a larger state and/or national level registry, since the infrastructure for natural gas energy is increasing across the USA.

IX. Summary of Questions for FERC to address in assessing risks to public health

1. What is the health status of the local population?
2. What chemicals will be emitted, at what concentrations and in what mixtures?
3. How often do releases occur (frequency), how long do they last (duration) and at what intensities? What times of day do they occur?
4. What is the health effect downwind, especially at night for residences within 1 mile of the compressor?
5. Will radioactive material be emitted (intentionally, as fugitives or accidentally) and if so, at what levels?
6. Are adequate emergency/notification plans in place?
7. Are adequate mitigation strategies in place?

X. Glossary of Abbreviations

CDC	Centers for Disease Control
DTI	Dominion Transmission, Incorporated
EPA	Environmental Protection Agency
HAP	Hazardous Air Pollutants
MCDOH	Madison County Department of Health
NAAQS	National Ambient Air Quality Standards
PM	Particulate Matter
REL	Reference Exposure Level
UNGD	Unconventional Natural Gas Development
VOC	Volatile Organic Compound
USA	United States of America
USEPA	United States Environmental Protection Agency

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[4] Dominion Transmission, Inc., Abbreviated Application for a Certificate of Public Convenience and Necessity ,New Market Project, filed June 2, 2014. Hereafter referenced as "DTI Application".
[5] DTI Application, p. 9-17.
[6] DTI Application, Table 9.1-4, p. 9-18
[7] DTI Application, p.9-18.
[8] DTI Application, Appendix 9-A,
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From: mtkota@aol.com
To: Finke, John (Health)
Subject: Please don"t buckle under to Kinder Morgan
Date: Wednesday, August 03, 2016 7:52:13 AM

Mr Finke, I am writing concerning the proposed gas compressor station in Joelton, our farm being less than 2 miles from the site. After much research and attendance at many meetings listening to the experts speak, and Kinder Morgan, it would seem that no reasonable person would willingly allow this polluting station to be built here. Your office holds the power to stop it, and it seems unthinkable that this office would forgo its duty to protect the health of its citizens, and vote to allow it. ESPECIALLY in the way it's being proposed, which is the cheapest and most polluting way it could possibly be built.

Please do what's in your power to protect us. We have worked all our lives to build our place by hand, from home to barn. And now will be forced to leave to protect our health. And even in doing that, our property value will be SEVERELY impacted. Please. The majority of our council did not buckle to KM. Please stand up for us also.

Mark and Julie Sloan

Sent from my iPhone

From:	Maloney, Hannah M
To:	Finke, John (Health)
Subject:	TGP- public comments
Date:	Wednesday, August 03, 2016 5:45:50 AM

Dear Mr Finke,

I am writing with my concerns about the natural gas compressor station proposed for Joelton.

1) How does the Health department plan to monitor the public for health issues caused by the emissions from the compressor station?

2) Is there definitive evidence that the combination of chemicals emitted in the quantity they are emitted from compressor station which burn fracked gas are safe for the public? Are they safe for vulnerable populations-children, citizens with chronic illnesses, the elderly, and pregnant women?

3) If the answer the previous question is not known why allow TGP to build? Why not require safety evidence?

4) How are the emissions from "blowdowns" measured? When are the measured? During the event? After the event? If so how long after the event?

5) Who is responsible for monitoring emissions from the compressor station? Is it possible to revoke the permit and stop the compressor station from functioning if it violates emissions? If future studies suggest/prove the emissions are harmful?

6) If a citizen has pre/post testing that confirms they have developed an illness related to toxic substances emitted from the compressor station will it be the health department that is held accountable since the permit was issued by them?

7) Does the health department have a plan to provide care for the 42% of people that live below the poverty line whos health will very likely be negatively effected by the compressor station?

8) Why is the onus on the people to prove that the emissions from compressor stations are harmful rather than on the company emitting to prove that they are safe?

Hannah Maloney MSN, ACNP-BC
Assistant in Anesthesiology
Division of Anesthesiology Critical Care Medicine
Vanderbilt University Medical Center

From:	Brian Kirkpatrick
To:	Finke, John (Health)
Subject:	TGP - Public Comment
Date:	Wednesday, August 03, 2016 5:24:57 AM
Attachments:	Compressor letter.rtf

Brian Kirkpatrick
2679 Morgan Road
Joelton, TN 37080

To all concerned in the current permitting process for Kinder Morgan:

My name is Brian Kirkpatrick. My son Daniel, age 40, and I own and principally occupy a home on 4 plus acres, 3 of which are wooded, at 2679 Morgan Road in Joelton. We purchased this property in August of 2015 not only for the excellent dwelling itself but primarily for its quiet, beautiful, and healthy *rural agriculturally zoned* location.

At the time we had never heard of a pipeline compressor having never experienced circumstances to stimulate such awareness.

However, we are most certainly no longer uninformed as to what these monstrosities are and the formidable dangers they present to heath, environment, and life itself not to mention the indisputably *documented* immediate damage they do without question to the day to day quality of life in any vicinity in which they are operated.

Having attended the public hearing at Metro Public Health Department on July 27 I see no need to restate any of the information so thoroughly and clearly presented there by the many speakers representing not only the immediately located areas to be impacted by this atrocity but all of the Nashville area itself because it seems quite reasonable to assume that you are now, if not previously, all well informed and therefore fully aware of the many and, again, *documented* risks and hence clearly indisputable dangers presented by these installations. Adding insult to injury is the intended destination for the gas itself the result being that no benefits whatsoever are to be enjoyed by those who stand only to lose.

Therefore, with all concerned also knowing full well that permitting such requires that existing zoning ordinances as well as mandated air quality standards legislation already in place be violated, my concerns, opinions, and related questions to you are simply as follows:

1) How could it even be considered to disregard such ordinances in order to permit this abomination into our neighborhoods of Joelton and Cane Ridge? In other words, if such ordinances do not apply when a threat of this mind boggling magnitude is proposed when, precisely, ARE they intended to apply? Until some entity has enough money to introduce into the equation as to simply eclipse the science behind the reasons why they were put in place?
2) How could any elected or appointed public servant or entity whose designated and mandated duty is to protect the environment for the well being of its citizenry entertain for a moment allowing such a blatantly perilous installation to be placed in such proximity to not only a residential and rural agriculturally zoned area but, as is the case in Joelton, *directly adjacent to a public recreation park* against which particular circumstance even exists additionally *prohibitive ordinance?* The only logical answer is they could not and *would* not unless pressured and/or actually intimidated or otherwise mysteriously motivated to do so. (Could we actually be expected to conclude otherwise?)
3) If so “motivated” what, pray tell, could the source of that motivation possibly be that could lead you to vote “yes” on this obviously horrendously destructive installation?
4) Are you able and willing to articulate this “motivation” clearly and in no uncertain terms and post same publicly for all to see and evaluate and if not why not?

5) It is maintained by Kinder Morgan that as "good corporate citizens" they assure this facility presents no risks to the health of the surrounding population or environment. This claim would be laughable were it not so tragically absurd but, be that as it may, one thing that is absolutely certain is that it *undeniably* presents a *perceived* risk that will, without question, I repeat... *without question* have one definite and easily documented result and that result is the *guaranteed devaluation* of all property in proximity. Without due compensation what is this but oppression and backhanded theft? Even with due compensation it is still, quite simply stated, *wrong.* These are our homes and, in some cases, our businesses. No one should be forced to experience unwanted circumstances of any kind at the hands of any form of for profit only entity. I eagerly await any rebuttal on this point.

Therefore my question here is what is being demanded by any faction of our government from city to county to state, if the morality and integrity is lacking in FERC to properly regulate these people, to *at the very least* demand that Kinder Morgan be obligated by law to establish policy to quantify and justly compensate all adversely impacted property owners for these losses should this ridiculous affair tragically end in approval?

I strongly urge all involved in this decision to carefully consider whether you are prepared to live with the responsibility for the predictably certain negative consequences of an approval and I assure you that, should you rule in favor of the "good corporate citizen" Kinder Morgan and against the good private citizens of your jurisdiction and allow this grotesque violation of our rights to go forward, you will not see anything good come of it and you will be anything but proud of the legacy you leave.

It is your responsibility to the people of the entire Nashville area whose health and safety it is *your* duty to protect to force this project to be appropriately relocated and it is in your power to do so.

Your call.

Sincerely:

Brian Kirkpatrick

P. S. You will find a very interesting and pertinent story if you Google "lightening strike gas plant Powell County Ky". You all need to read of this event that took place this past Monday BEFORE you make your decision. Keep in mind as you read the elevation level of the Joelton area.

From:	Jessy Karns
To:	Finke, John (Health)
Subject:	TGP: Public Comment
Date:	Wednesday, August 03, 2016 12:45:25 AM

Dear Mr Finke,

I am a lifelong Joelton resident and I implore you to please read this linked article below.

https://www.washingtonpost.com/news/energy-environment/wp/2016/05/12/obama-administration-announces-historic-new-regulations-for-methane-emissions-from-oil-and-gas/?utm_term=.7a68517a27eb

The EPA with our President Obama himself signed a bill in May of THIS year to limit methane emissions due to health and environmental reasons. This proposed station is SO close to homes; anywhere from 900-1100 feet away. Homes with children and elderly. Crops are grown in this community. In the article a FEDERAL government official, an EPA employee states that methane emissions are dangerous for all citizens and the environment. This air permit does not promote the care that Davidson County requires for all citizens. We are better than this. This compressor could be put in a MUCH MORE rural area north of here but this company has chosen to compromise our health for convenience.
I truly hope you read this and put yourself in our shoes. My son is 2 years old; he plays outside daily. We live in the country for clean air and PEACE & QUIET for happy mental health as well as physical health, this project does NOT make this a place I want to raise my child. My husband is contemplating moving further north over this. Please listen and read SCIENCE from government officials on this matter AND the president HIMSELF.

Joelton and Antioch communities do not need our health compromised.

Thanks for your civil service to our community.

Sent from my iPhone

From:	Christina & James Wright
To:	Finke, John (Health)
Subject:	Preposed Joelton gas compressor
Date:	Tuesday, August 02, 2016 9:08:53 PM

Dear Mr. Finke,
This is what you need to protect us from. The health effects of an explosion like this are still unknown. Please do your job and protect Nashville!

Sincerely,

Mrs. Christina Wright

Lightning Hits Gas Plant In Powell Co., Residents May Leave

From: Virginia Team
To: Finke, John (Health)
Cc: Council Members; Mayor (Mayor"s Office); Matthews, Lonnell (Mayor"s Office)
Subject: Kinder Morgan Compressor Station
Date: Tuesday, August 02, 2016 8:08:55 PM

Dear Mr. Finke,

Why do the citizens of Joelton have to prove the compressor station

is dangerous rather than **Kinder Morgan having to prove it is safe**?

I would very much appreciate a response to this.

Thank you, Virginia Team

From:	Stephanie
To:	Finke, John (Health)
Subject:	TGP: Public Comment
Date:	Tuesday, August 02, 2016 1:28:57 PM

Good afternoon
I would like to express my concern and general disapproval of the operating permit under consideration for Tennessee Gas Pipeline Company, LLC.

This land is some of the last 'pristine' land we have near Nashville and a wonderful community.

I have serious concerns about the potential impact on water and air quality near and around my home in Nashville (already suffer from breathing issues and inexplicable headaches on bad air quality days and I'm a normal weight and of good health). I can't imagine if I actually had asthma or some other diagnosed breathing issue.

I do not agree that this would fit within national or local goals for air quality considering the emissions are not consistent throughout the year and the potential pathways are of serious concern not only in the immediate area but also since Nashville, itself, sits in a basin that already tends to hold a lot of smog on the many stagnant days we have throughout the year.

Couldn't we instead focus not on high paying, low payoff fossil fuel/gas industries and move toward a more progressive platform of solar energy which can produce many more jobs in production/installation?

Thank you for your time, we appreciate your consideration,

--
Stephanie Dennis
615-482-1991

From: Brant Miller
To: Finke, John (Health)
Subject: TGP - Public Comment
Date: Tuesday, August 02, 2016 11:41:59 AM

Dear Mr. Finke,

Thank you for the opportunity to comment regarding the proposed Kinder Morgan gas compressor station in Joelton.

My comment pertains to the fact that the tons per year figure given in Kinder Morgan's specifications do not account for what's commonly called fugitive emissions, which are leaks in the system. The EPA states that "leaks can be a significant source of methane and VOC emissions in the oil and gas industry" (see below, from EPA's Air Rules for the Oil & Natural Gas Industry, https://www3.epa.gov/airquality/oilandgas/may2016/nsps-gas-transmission-fs.pdf). These air pollutants adversely affect the surrounding human and non-human population, and indeed, the EPA has adopted new regulations this year requiring careful monitoring of these emissions from gas compressor stations (see below).

I strongly believe that Kinder Morgan should be required to include fugitive emissions in its tons-per-year figures, as there are certain to be leaks that will occur and that will emit pollutants before they are discovered and sealed, over the course of the life of the proposed Joelton compressor stations.

Thank you for your attention to this matter.

Sincerely,

Brant Miller, Chair

Friends of Mill Creek Greenway

13566 Old Hickory Blvd.

Cane Ridge, Tennessee 37013

Finalvinyl@comcast.net

The following is from the above-referenced EPA document:

Finding and Repairing Leaks (Fugitive Emissions)

•Leaks, also known as "fugitive emissions," can occur at a number of points at a compressor station when connections are not properly fitted or when seals and gaskets start to deteriorate. Leaks can be a significant source of methane and VOC emissions in the oil and

gas industry.

•The updated NSPS requires that owners/operators of compressor stations develop and implement a leaks monitoring plan. Owners/operators must use a technology known as optical gas imaging to conduct a leaks survey. Optical gas imaging equipment uses a special camera to “see” emissions of methane and VOCs.

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Owners/operators may use “Method 21” as an alternative to optical gas imaging.

Method 21 is an EPA method for determining VOC emissions from process equipment. The method is based on using a portable VOC monitoring instrument, such as an organic vapor analyzer (sometimes referred to as a “sniffer”).

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For new and modified compressor stations, owners/operators must conduct the initial survey within one year after the final rule is published in the Federal Register or within 60 days of the startup of a new or modified compressor station, whichever is later.

Monitoring must be repeated quarterly following the initial survey.

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The survey covers a number of components, including valves, connectors, pressure-relief devices, open-ended lines, flanges, compressors, and thief hatches on controlled storage tanks, among others.

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Any leaks found during the surveys must be repaired within 30 days, unless the repair would require shutting down. In that case, owners/operators are required to fix the leak at the next scheduled shutdown, or within two years.

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Equipment that vents natural gas as part of normal operation is not considered to be leaking and is not be covered by this requirement; however, leaks surveys can also help operators detect malfunctions in these devices, such as pneumatic controllers.

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The final rule also creates a path for EPA to allow use of alternative leaks monitoring technology, which is developing rapidly. The rule outlines the information owners/operators

must submit to show that using the alternative technology is capable of

achieving equivalent methane and VOC reductions that can be achieved by using optical gas imaging or Method 21 to find leaks, and then repair them.

From: Julie Sloan
To: Finke, John (Health)
Subject: Gas compressor
Date: Tuesday, August 02, 2016 11:31:35 AM

Wonder what the fire dept. has to say about this . One engine with about 15 min response time on help if something did explode. Also there are some wells in the area , what about poisoning well water?

Sent from my iPhone

From:	Chris Tuley
To:	Finke, John (Health)
Subject:	TGP--Public Comment
Date:	Tuesday, August 02, 2016 11:27:08 AM

Dear Mr. Finke,

My question regarding the Joelton compressor station concerns the overall air quality to middle Tennessee. If this permit were to be issued, it would greatly affect the air quality in the counties surrounding Davidson county. Does that go into the decision making process? I ask that you and the Health Department do your civic duty and deny this permit.

Sincerely,

Chris Tuley
Vice President
Keep Southeast Nashville Healthy
chris@christuleydesign.com

From: Lindsay Pace
To: Finke, John (Health)
Subject: Comments On Proposed Gas Compressor Station
Date: Tuesday, August 02, 2016 10:18:39 AM

Dear Mr. Finke,

Thank you again for the opportunity to speak last week at the Metro Nashville Public Health hearing on the proposed Gas compressor station in Joelton, Tennessee. As I reminder, I am the Tennessee Field Manager for Moms Clean Air Force, a national organization with over 700,000 members who fight against air pollution for our children's health.

The development of unconventional natural gas has pollution emitted throughout the entire process. And Gas compressor stations are constant emitters of toxic pollution since they operate all hours of the day, every day of the year.

Of the pollutants they emit, we know that Methane is a potent greenhouse gas that contributes to climate change and VOCs impact the health of those who live nearest the compressor station. Toxic pollutants such as benzene and formaldehyde can be found around compressor stations from fugitive leaks, blowdowns, and accidents. Benzene is a potent neurotoxin that is linked to childhood leukemia and formaldehyde has been associated with childhood asthma as well as causing cancer.

We know that children are especially sensitive to air pollution because their bodies are still developing, they breathe more rapidly when compared to an adult, and they're more likely to be playing outside at their homes and at Paradise Ridge Park on days with high emissions.

Even under normal operating conditions gas compressor stations have been shown to not emit uniformly. This causes periods of high exposure of toxic pollutants to individuals living nearest the compressor station. The "ton per year" measurement, while appropriate for measuring and determining regional air quality, lacks the ability to determine individual health risks during these periods of high exposure.

When looking through existing data collected from families living near compressor stations you see that the youngest respondents (1.5-16 years of age) report higher rates of throat irritation and severe headaches. They also have the highest occurrence of frequent nosebleeds and experience conditions not usually associated with children: such as severe headaches, joint and lumbar pain, and forgetfulness.

Under EPA Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks – the proposed gas compressor facility should receive special EPA scrutiny because the property is immediately adjacent to Paradise Ridge Park, which is a Metro

Nashville public park. This park is not only a recreational spot for the community, it also hosts a variety of programs for children, including structured after-school activities.

Given the lack of substantive data on Hazardous Air Pollutants from the proposed facility, the air permit should at the very least be withheld until the long-term cumulative effect of HAPs on the adjacent park population can be evaluated.

In rejecting this permit from Tennessee Gas Pipeline Company for Compressor Station 563 you will be protecting the residents of Joeltons health, and their children's health.
1. Compressor Station Emissions and Health Impacts
http://www.environmentalhealthproject.org/files/Summary%20Compressor-station-emissions-and-health-impacts-02.24.2015.pdf

Sincerely,
Lindsay Pace

Tennessee Field Manger
Moms Clean Air Force

From:	nancy winters
To:	Finke, John (Health)
Subject:	Joelton pipeline compressor
Date:	Monday, August 01, 2016 8:52:33 PM

I would like to propose to delay the air permit until a study can be performed on the toxics that will be emitted into the air, not one at the time , but comprehensively! In a published statement by the State of Colorado Air Quality division, "the current state of science cannot assess the potential risk of combinations of different chemicals" people are exposed to from natural gas compressor stations. Studies performed on workers in the gas/oil industry who have been exposed to toxic mixtures like BTEX (benzene,toluene, ethylbenzene and xylene) have experienced mental and behavioral problems, a range of health problems, and some changes in color vision and perception. Together, these toxic pollutants have the potential to dramatically impact every organ in the body,and can act together to increase the toxic potential of other chemicals like prescription medicines.

Sincerely,
Nancy Winters

From: Thames_Jackson@Dell.com
To: Finke, John (Health)
Subject: TGP - Public Comment
Date: Monday, August 01, 2016 3:23:56 PM

Dell - Internal Use - Confidential

Air and Water Quality Concerns

With the amount of traffic that we already get from the airline industry, I do not believe that we need to compound the air/noise pollution by adding this station. I also understand that there is a water quality concern and with the growth that Nashville and surrounding areas are experiencing today, we do not need additional water quality issues that may affect our health in the Nashville surrounding areas. Thx, tj

Thames Jackson
CSO Direct Senior Sales Trainer - Americas
Dell | Global Sales Learning & Development
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thames_jackson@dell.com

To provide feedback, please contact my manager Jennifer_Rainwater@dell.com.

From:	Richelle Deharde
To:	Finke, John (Health)
Subject:	TGP - Public Comments - My Health issues
Date:	Monday, August 01, 2016 3:14:11 PM
Attachments:	image.png

I was physically affected by toxins released from the oil and gas industry. Before moving to Mid-TN, I had two seizures, Chronic Fatigue, difficulty focusing, and recurring burning throat. These health issue are real. Please protect my neighbors and friends from:

HEALTH IMPACTS

Reported by People Living 50 feet to 2 miles from Compressor Stations and Metering Stations.

Wilma Subra- ex-Vice-chair of EPA National Advisory Council for Environmental Policy and Technology
http://www.earthworksaction.org/files/publications/SUBRA_3_Shale_Gas_Plays-Health_Impacts_sm.pdf

Frequent Nausea*	Throat Irritation*	Eyes Burning*	Nasal Irritation*
Sinus Problems*	Bronchitis*	Persistent Cough	Weakness*
Tiredness*	Chronic Eye Irritation*	Shortness of Breath	Muscle Aches*
Dizziness*	Ringing in Ears	Sores & Ulcers in Mouth	Urinary Infections
Depression*	Decreased Motor Skills*	Falling, Staggering*	Frequent Irritation*
Brain disorders*	Severe Headaches*	Frequent Nose Bleeds	Sleep Disturbances
Difficulty Concentrating	Joint Pain	Nervous System Impacts	Forgetfulness
Irregular/Rapid Heart Beat	Strokes	Allergies	Easy Bruising
Severe Anxiety*	Excessive Sweating	Abnormal EEG*	Spleen
Lump in Breast	Pre-Cancerous Lesions*	Amnesia	Thyroid Problems

*61% of Health Impacts Associated with Chemicals present in Excess of Short and Long Term Effects Screening Levels in the air

Additional Resources with extensive reports:

http://www.environmentalhealthproject.org/wp-content/uploads/2012/03/Compressor-station-emissions-and-health-impacts-0

http://www.otsego2000.org/wpcontent/uploads/2012/08/Madison_County_DOH_Comments_-_Docket_No._CP14-497-000.pdf

From: Richelle Deharde
To: Finke, John (Health)
Subject: TGP - Public Comments National Support
Date: Monday, August 01, 2016 3:09:56 PM
Attachments: image.png

Here are some of the organizations who too are fighting to keep gas compressors from being built in their communities. Read about their experiences and also reach out to them to learn how to oppose the proposed plan.

NoCompressorStation.Org (NJ)

Roseland, NJ to fight the building of a compressor station by the **Williams/Transco** gas company

StopThePipelineNow (NJ)

Chesterfield, NJ residents against Transco Gas Compressor Station

www.Responsible-Pipeline.com (NJ)

Responsible-Pipeline.Com exists to educate the communities that are along the Southern Reliability Link, a natural gas transmission pipeline proposed by the New Jersey Natural Gas Company.

Sierra Club NJ Chapter

The Sierra Club is a national, member-supported environmental organization, which seeks to influence public policy in both Washington and the state capitals through public education and grass-roots political action.

NoPipelines.Org (Ohio)

Contains lot of good information on why pipelines and compressor stations should not be built near residential areas.

NoCompressor.Com (MA)

Fore River Residents Against Compressor Stations.

NHPipelineAwareness.Org (NH)

Contains very good information on Compressor Stations.

From: Sheryl Evans
To: Finke, John (Health)
Subject: no pipeline, please
Date: Monday, August 01, 2016 12:34:30 PM

From: Richelle
To: Finke, John (Health)
Subject: TGP - Comment w/ picture
Date: Monday, August 01, 2016 12:26:24 PM
Attachments: 39729.255000000005

Mr. Finke we are not alone here:

Energy | May 06, 2016

People Power Over Corporate Power = Canceled Pipeline Projects

By **Marc Yaggi**

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A long-standing fight for the public's right to their land and waterways came to an end April 22 when Gov. Cuomo's New York State Department of Environmental Conservation denied the Clean Water Act Section 401 Water Quality Certification for the proposed Constitution Pipeline. The pipeline was proposed to run for 124 miles and require the destruction of nearly 700,000 trees.

Further, the pipeline would have carried fracked natural gas through the Hudson River estuary, crossing 289 waterbodies, multiple public drinking water sources and three watersheds. There was no expected public benefit from the pipeline. While the pipeline's proponents alleged they would ship the fracked gas to New England, it was clear that the gas pipes leaving the pipeline's terminus are all constrained, leaving no other option but to ship the gas to a Nova Scotia LNG facility before ultimately shipping it to Europe and Asia. Thankfully, New York State recognized the applicant's failure to demonstrate how they would mitigate or avoid impacts to the state's waterways.

From:	Michael Younger
To:	Finke, John (Health)
Subject:	Joelton Compressor Station Draft Air Permit Deliberations
Date:	Monday, August 01, 2016 10:56:26 AM
Attachments:	madison_county_doh_comments_-_docket_no._cp14-497-000.pdf 2015 FIELD STUDY OF GAS PIPELINE SAFETY IN TENNESSEE May 27th 2016.pdf

---

Me. Finke,

I am writing you today in the hope that your office may yet come down on the side of the community in regards to the safety of the proposed compressor station in Joelton and its impact on the air quality for all Metro Nashville residents.

Although I did not work alone, I have spent the last year and a half photographing and documenting the dilapidated and disgraceful pipeline infrastructure this company in question "maintains" here in Middle Tennessee. Although our local and state government officials were ambivalent or even defiant about what our study uncovered, we have been able to secure primary and secondary inspections from the federal regulators that oversee interstate pipeline infrastructure(PHMSA) and those inspections raised serious questions about local pipeline infrastructure. Congressman Jim Cooper has also reviewed the study and found it prudent to call for congressional hearings on pipeline safety. The tide is turning on this company and the undue influence it has exerted on public policy. The public safety issues brought to light by the pipeline study raise even more questions about the coziness of the relationship between industry and regulators under current policy.

I offer you this context for your current review of the compressor station review because it has come to my attention that your office has been disseminating misleading information to the public regarding the size and scale of the project proposed for Joelton. Officials from your office have falsely claimed that a natural gas compressor of the same scale has already been constructed and operating safely at Vanderbilt University. Although I will not get into the specifics, a gas compessor pushing through 4-6" distribution lines is an entirely different proposition than a gas compressor transporting the volume of gas that move through 30" interstate transmission lines. For officials fom Metro Health Dept to equate the two is both disingenuous and dishonest. There are, at this time, numerous written testimonies from callers who have been given false and misleading information about this compressor station from officials in your office over the past year that would tend to indicate a predisposition to downplaying the concerns of the community and promoting the narrative of the operator. This is very troubling to the community and an unfortunate and pervading part of the current regulatory environment in the State of Tennessee. Again, our local situation raises these much bigger and deeper public policy questions which may also need to be subject to more public scrutiny.

I have attached below the comprehensive report that the New York Dept of Health entered into FERC proceedings in 2014 on the emissions from Gas Comoressor Stations that was one of the preliminary studies that led to the outright rejection of Natural Gas infrastructure expansion in the state of New York based on the public health risks involved. The New York Department of Health takes it's mission of protecting the public interest seriously enough to conduct thorough and transparent studies into these matters, which I would point out has not happened in the Joelton case. Air modelling, while a component of such a comprehensive study, is no substitute for a real multi-level analysis of the emissions, the health impacts in

the near and long-term etc.
Taking the operator's word at face-value about the emissions and safety protocol is hardly worthy of any regulatory agency paid for by the tax-paying public. Don't feel singled out. Tennessee and Metro Nashville's other regulatory agencies have also shrugged with ambivalence at situations that federal regulators find unacceptable.

I would like to ask you how you plan to assuage the people of Metro Nashville that the long list of toxins documented by the New York Dept of Health to cause another long list of health impacts in the surrounding community are of no concern to the Davidson County Dept of Health?

Please take the time to fully appreciate the gravity of the deliberations before you at this time. The community needs their Health Department to take a stand in their defence. Thanks,

Mike Younger
Author, 2015 Field Study Of Gas Pipeline Safety in Tennessee

PS I have also attached an e-copy of the 2015 pipeline study and a photo of the preliminary pipeline inspections conducted by PHMSA on May 3rd 2016.

FIELD STUDY OF GAS PIPELINE SAFETY IN TENNESSEE

Conducted between July 13th and October 18th 2015

Research and field study:
Michael Younger and John Henry Armstrong, III (pictured below)

This study is inspired and dedicated to the memory of John Henry Armstrong III, pictured here standing over a 26" gas pipeline exposed in a Davidson County waterway. John grew up in the Middle Tennessee community of Joelton and was familiar with the terrain. He wanted to draw attention to the alarming vulnerability of his community due to the aging pipeline infrastructure. John was tragically lost on September 29, 2015 in a car accident at the age of 62 before this study was concluded. He and his work will not be forgotten.

Field Study of Pipeline Safety in Tennessee

11.05.2015

Introduction

The purpose of this study is to present a case to the appropriate state and federal agencies showing that the citizens of the state of Tennessee have just cause for concern regarding the intrusive expansion of natural gas activity in our communities. We are expected to place our trust and faith in the regulatory processes at the state and federal level and have found numerous questionable instances in our immediate area which put that faith and trust at risk and draw into question the depth and degree of oversight. The aging, corroded and otherwise deteriorating pipeline infrastructure in our midst will soon be under new pressures and demands, the exact specifications of which remain largely out of public view. This study seeks to shed light on the status of local gas transmission pipelines currently seeking expansion at the federal level, with the objective of acquiring heightened levels of scrutiny from appropriate independent authorities and a tougher level of standards, inspections and enforcement to protect the public interests and safety.

Acknowledgements

This report benefited from the assistance provided by:

- Terezia Betancourt, B.Eng., M.Eng., ret. Senior Corrosion Scientist at a major Research Institute
- Osmundo Betancourt, B.Eng., M.Eng., ret. Director of Environmental Programs at a major electric utility, and former external lecturer in Chemical Engineering at a Technical University.
- William M Robertson Ph.D. and MTSU Professor of Physics
- Charles "Mac" Wilson, President Davidson Co. Council of Community Clubs
- Attorney at Law: Dominic J. Leonardo
- Rebecca Armstrong, Edit Assistant

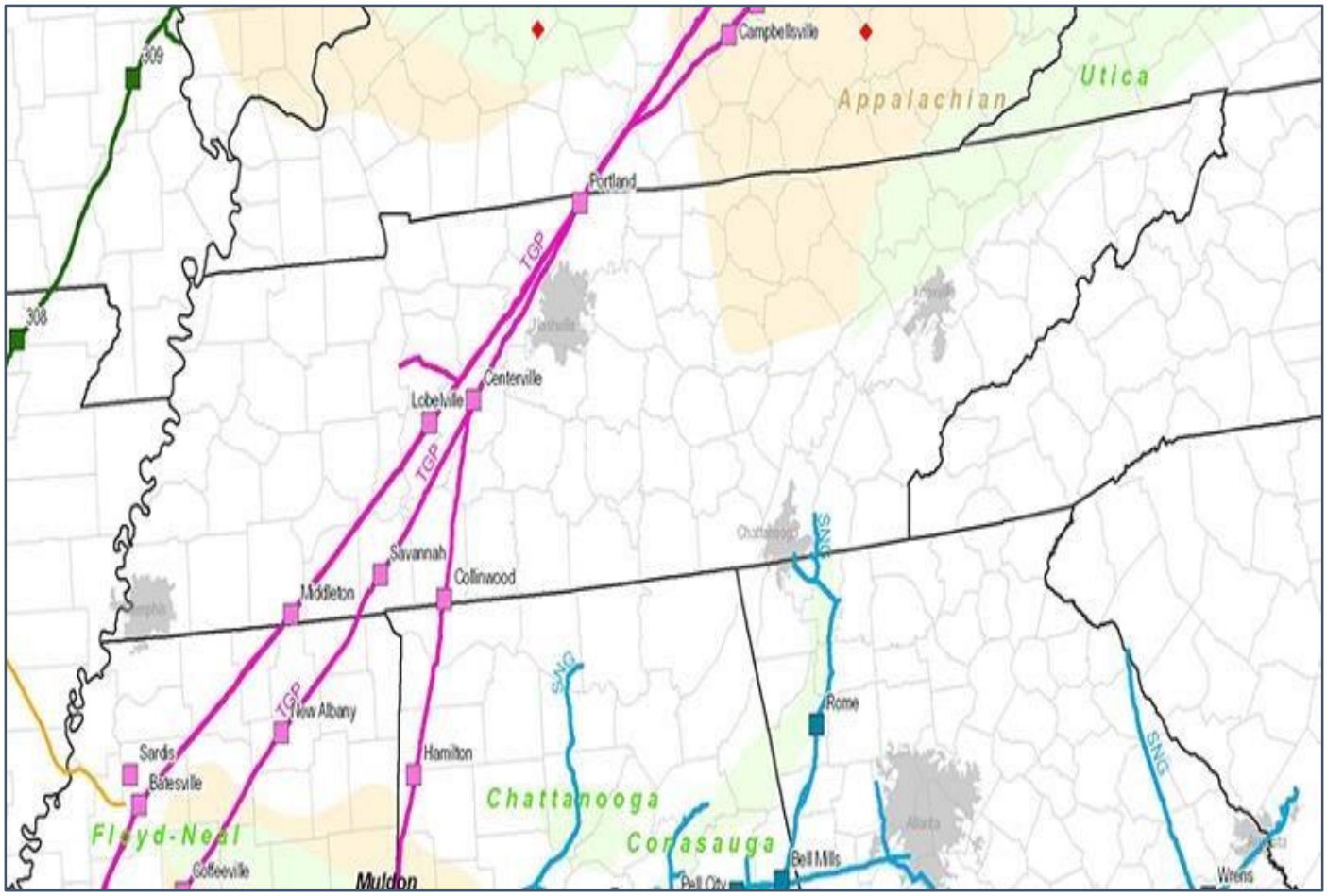
Disclaimer:

"This report was compiled by the author using information gathered through research and on-site investigations. Any views or opinions presented in this report are solely those of the author and do not necessarily represent those of any company or organization mentioned herein. Although the author believes that the information contained herein is true and accurate to the best of his abilities, the author is not a geologist, physicist, engineer or architect and the information in this report may be outdated, inaccurate or conflict with other studies regarding the same subject matter."

Historical Context of the Tennessee Gas Pipeline:

Kinder Morgan's Tennessee Gas Pipeline is an approximately 11,900-mile pipeline system that transports natural gas from Louisiana, the Gulf of Mexico and south Texas to the northeast section of the United States. The pipeline system was started by Tennessee Gas & Transmission Company, incorporated in 1940. The first of the lines was completed in1944 to supply natural gas to the northeast section of the United States where gas was in short supply at a critical time when the defense industry was required to produce armaments to meet the demands of the country during WWII. With time, the pipeline system undertook expansions in the 1950s and 1960s. The company name changed to “Tennessee Gas Transmission Company” in 1947 and to “Tenneco” in 1966. In October of 2011 Kinder Morgan acquired El Paso Corp., then owner of Tennessee Gas Pipeline.

Three branches of the system enter the state of Tennessee from Mississippi and Alabama at Madison, Savannah, and Colinwood, and converge at Portland TN before exiting into the state of Kentucky; see map below.



Recent Activity:

On January 30, 2015, the Tennessee Gas Pipeline Company, a subsidiary of Kinder Morgan, Inc., filed an application with the Federal Energy Regulatory Commission (FERC) requesting authority

to construct and operate the Broad Run Expansion Project under the FERC docket number CP 15-77-000. In the state of Tennessee, the application includes the construction of a new 60 000 hp compressor, Station 563, in Davidson County, referred to by TGP as The Pinnacle Compressor Station. The period available for public comments for this project expired on June 1st, 2015, just as the local community was first hearing about it.

In addition, on February 13th 2015 the Tennessee Gas Pipeline Company filed another application with FERC requesting approval to carry out the Abandonment and Capacity Restoration Project under FERC docket number 15-88-000. In the state of Tennessee this project includes the repurposing of one of the earliest lines in the TGP 100 system (TGP 100-1) to carry Natural Gas Liquids (NGLs) in a north-south direction. It is worth emphasizing that once the line is abandoned and then used for transporting NLGs the project will not fall under FERC's jurisdiction and therefore will not be subjected to FERC's review procedures. PHMSA has issued an advisory bulletin *"to alert operators of hazardous liquid and gas transmission pipelines of the potential significant impact flow reversals, product changes and conversion to service may have on the integrity of a pipeline.* ***Failures on natural gas transmission and hazardous liquid pipelines have occurred after these operational changes.*** *This advisory bulletin describes specific notification requirements and general operating and maintenance (O&M) and integrity management actions regarding flow reversals, product changes and conversion to service. The bulletin also recommends additional actions operators should take when these operational changes are made including the submission of a comprehensive written plan to the appropriate PHMSA regional office regarding these changes prior to implementation".* Detailed guidance published in the document "Guidance to Operators Regarding Flow Reversals, Product Changes and Conversion to Service", provides operators with PHMSA's expectations with respect to complying with existing regulations and also contains recommendations that operators should consider prior to implementing these changes. The document addresses flow reversals, product changes and conversion to service individually.
*http://phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Pipeline/Regulations/GORRPCCS.pdf.**

All of these existing pipelines, without material change, are expected to continue to be part of the operation of the Tennessee Gas Pipeline and/or its subsidiaries.

> **At the time of writing of this review, there is significant opposition to the NGLs reversed pipeline in the state of Kentucky. The main issues of concern are potential water quality contamination and proximity to farmland and institutional facilities among others. The pipeline runs 256 miles through 18 Kentucky counties, from Greenup County in the northeastern corner through Simpson County on the Tennessee state line. In the state of Tennessee, as reported by The Tennessean on 2015 03 27, the Greater Dickson Gas Authority has joined with the other 25 utility districts to intervene in the project to "protect the interest of our customers," said Robert Durham, general manager of the Greater Dickson Gas Authority, who also said to The Herald, in an email, that "the additional compression is to continue to move gas volumes to customers north of (Portland) and will increase transportation cost on (Tennessee Gas Pipeline) due to additional fuel cost to operate the new compression".*

Scope of Pipeline Field Study:

The field study presented in this document does not encompass the broader scope of the Broad Run Expansion Project or the Abandonment and Capacity Restoration Project. It focuses, rather, on the ongoing use of the gas pipelines and their potential for environmental, health and safety impacts on people and the environment in the state of Tennessee. While not exhaustive, the information contained herein provides a good foundation for the understanding of the potential risks that can be expected from the operation of natural gas pipelines in general, and specifically when such lines have been in use and exposed to the environment for several decades, as is the case with Tennessee Gas Pipeline. The information might be considered "a primer" on the causes of pipeline failure. The items discussed include:

- Recent, and not so recent, accidents involving gas pipelines in the state of Tennessee and across the United States
- Most common causes of pipeline failure
- Microbiological impact of sulphate-reducing bacteria that accelerate pipeline corrosion processes, and documentation of the presence of such bacteria on local pipelines
- Field documentation of corroded, exposed, submerged, and deteriorated pipelines
- Insufficient remediation of erosion and corrosion control, past and present
- Current guidelines and standards as set forth by the Pipeline and Hazardous Materials Safety Administration (PHMSA) and the US Department of Transportation (USDOT) as they pertain to control and prevention of corrosion caused by atmospheric conditions as well as water exposure of submerged pipes, and the phasing out of cast iron pipeline materials
  - Current oversight of gas pipelines in the state of Tennessee
  - Adequacy - or inadequacy - of regulatory oversight of pipeline operations

Recent Safety Record of Kinder Morgan and Tennessee Gas Pipeline:

The **Pipeline and Hazardous Materials Safety Administration** (**PHMSA**) of the United States Department of Transportation agency was formed in 2004 for the purpose of developing and enforcing regulations for the safe, reliable, and environmentally sound operation of the 2.6 million mile pipeline transportation in the United States. Its scope includes nearly 1 million daily shipments of hazardous materials by land, sea, and air. It oversees the nation's pipeline infrastructure, which accounts for 64 percent of the energy commodities consumed in the United States.

To illustrate the real risks associated with gas pipelines, we show a very brief summary of accidents and safety violations involving Kinder Morgan in the period 2003 – 2014.*

> **The list also includes a very small sample of documented incidents involving gas pipelines owned and operated by others. This information is readily available in the literature and in press reports.*

In 2009, PHMSA cited Kinder Morgan for violating safety standards regarding the distance between a natural gas pipeline and a "high consequence area" such as a school or hospital; the pipeline was too close for safe operation in case of a leak. In 2011, PHMSA cited Kinder Morgan for these safety violations:

- Failing to maintain updated maps showing pipeline locations
- Failing to test pipeline safety devices

- Failing to maintain proper firefighting equipment
- Failing to inspect its pipelines as required
- Failing to adequately monitor pipes' corrosion levels

In 2013, the headline "Wall Street Worries About Kinder Morgan's Safety Record: BC pipeline operator slashes and defers maintenance spending" was a concern to anyone who lived or worked near a Kinder Morgan pipeline (September 19, 2013).

The *Wall Street Journal* asked, "Is Kinder Morgan Scrimping on its Pipelines?" after an investment analyst charged the company with starving its pipelines of routine maintenance spending in order to return more cash to investors. (September 27, 2013). Deferred maintenance may account for the high number of Kinder Morgan pipeline accidents in the last decade.

Close examination of PHMSA's incident reports for Kinder Morgan's onshore gas transmission pipelines shows that faulty infrastructure causes 45% of onshore gas transmission pipeline significant leaks. Failure of the pipe, **a cracked weld**, and faulty pipeline equipment together account for 28.3% of pipeline leaks, and corrosion of the pipe causes 16.8%.

- **2003**
  In August 2003, in Caddo County, Oklahoma, a Kinder Morgan Natural Gas Pipeline of America failed in a rural farming area about just east of the town of Stecker. A 26" diameter pipe exploded, throwing a 54-foot long section of pipe 30 feet from the ditch. The cause was **environmental cracking** along the length of the failed section parallel to the longitudinal weld seam. (PHMSA Corrective Action Order, CPF No.4-2003-1008H).

- **2005**
  In May 2005, a Kinder Morgan Natural Gas Pipeline of America 30" diameter pipe exploded near Marshall, Texas, sending a giant fireball into the sky and hurling a 160-foot section of pipe onto the grounds of an electric power generating plant. Two people were hurt, 40 evacuated. The cause was **stress corrosion cracking**.
  (http://primis.phmsa.dot.gov/comm/reports/enforce/documents/420051011H/cpf_420051011H.pdf?nocache=8618).

- **2006**
  On July 22, 2006, near Campbellsville, Kentucky, a Kinder Morgan Tennessee Gas Pipeline exploded. A 25-foot chunk of pipe blew out of the ground and landed 200 feet away, the pipe twisted and mangled, its external coating burned off. The 24" pipeline ruptured due to **external corrosion** more than two feet long at the bottom of a valley in an area of wet shale, known to cause corrosion on buried pipelines in this part of Kentucky. (PHMSA Corrective Action Order, CPF No. 2-2006-3 007 H, aka CPF 220061007H.)

- **2008**
  On September 23, 2008, a Kinder Morgan pipeline exploded and burned for more than ten hours at Pasadena, Texas. One person died; another was injured. (Eric James, "Pipeline at Pasadena plant explodes," September 24, 2008, ABC Eyewitness News, Houston, Texas). http://abc13.com/archive/6408372/, accessed June 17, 2014.

The cause of this “significant event” was **corrosion.** The Pasadena pipeline experienced at least 18 "significant incidents" 2004 to 2013. (“Texas Significant Incidents Listing,” 2003-2014, PHMSA Pipeline Safety Stakeholder Communication, U.S. DOT, http://primis.phmsa.dot.gov/comm/reports/safety/IncDetSt_st_TX_flt_sig.html?nocache=8751, accessed June 17, 2014).

- **2009**

In May 2009, near Palm City, Florida, a Kinder Morgan Florida Gas Transmission Company 18" diameter natural gas pipeline ruptured in a sparsely populated rural area of Martin Co. and "displaced" about 106 feet of buried pipe onto the right-of-way between Interstate 95 and the Florida Turnpike (SR-91). About 106 feet of pipe weighing about 5,000 pounds was blown out of the ground. The rupture was near a high school that was within the 366-foot potential impact radius (PIR). Injuries included two people in a car that ran off the road and a Sheriff's deputy treated for inhaling gas (NTSB pipeline accident brief DCA09FP007).

In July 15, 2009, a pipeline accident at Sylvarena, Mississippi involved Boardwalk Pipeline Partners, Southern Natural Gas and Kinder Morgan in an explosion that killed one person and injured three ("Pipeline explosion kills 1, injures 3 in Smith county". MS News. Retrieved 23 January 2014.)

- **2010**

On November 30, 2010, a 30" diameter Kinder Morgan / Tennessee Gas Pipeline failed in a semi-rural area between Highway 1 and State Road 3191, two miles NW of Natchitoches, Louisiana, 1/4 mile NE of a country club, and 200' south of a residential subdivision. Louisiana state police evacuated 100 homes. Pipe cracked: 52.5 inches long & about 0.5 inches in maximum width. The failure site is near where TGP had a previous failure in 1965, with multiple fatalities. That failure was attributed to **stress corrosion cracking**. (NTSB pipeline accident brief DCA09FP007).

- **2011**

On August 17, 2011, Kinder Morgan’s Natural Gas Pipeline Company of America had a flash fire and explosion south of Herscher, Illinois. Five employees went to the hospital. Kinder Morgan was cited for **pipeline and workplace safety violations.**
(Kinder Morgan, owner of Illinois Natural Gas Pipeline Co. where explosion occurred, has lengthy record of pipeline, workplace safety violations,” August 17, 2011, NaturalGasWatch.org, http://www.naturalgaswatch.org/?p=817; “Gas plant explosion injures five,” Hazardex, August 17, 2011). (http://www.hazardexonthenet.net/article/44270/Gas-plantexplosion-injures-five.aspx?AreaID=2, accessed June 2014).

On November 16, 2011, near Glouster, Ohio, a weld failed on a Kinder Morgan Tennessee Gas Pipeline 36" diameter pipe; the leak exploded, leaving a blast crater 30 feet across and 15 feet deep. Three homes were destroyed by the fire. (The leak was caused by **"displacement produced by a landslide and an inadequate understanding by (TGP) of the influence of the geotechnical threats on the pipeline in this location”**. A girth weld failed due to earth movement, inadequate design, materials or workmanship, exceeding operational limits & gaps in integrity management.

The above highlights real incidents caused by Kinder Morgan gas pipelines and shows a less than stellar environmental, health, and safety management performance at its facilities.

How serious these incidents can be is illustrated by the 2010 San Bruno pipeline explosion of a Pacific Gas and Electric Company (PG&E) gas line in San Bruno, California, a suburb south of San Francisco which killed eight people, injured 58 and destroyed much of a subdivision. Investigators from the National Transportation Safety Board (NTSB) found weak state and federal oversight. (Pacific Gas and Electric Company Natural Gas Transmission Rupture and Fire). (Pipeline Accident Report NTSB Number: PAR-11-01. National Transportation Safety Board. 9 September 2010. Retrieved 11 May 2014).

The judgment by the California Public Utilities Commission ruled that the long term costs for pipeline inspection and safety upgrades was to be borne at 55% by electricity rate payers. (Leff, Lisa (Dec 20, 2012). ("PG&E customers to foot part of pipe safety costs". Associated Press. Retrieved 12 May 2014.)

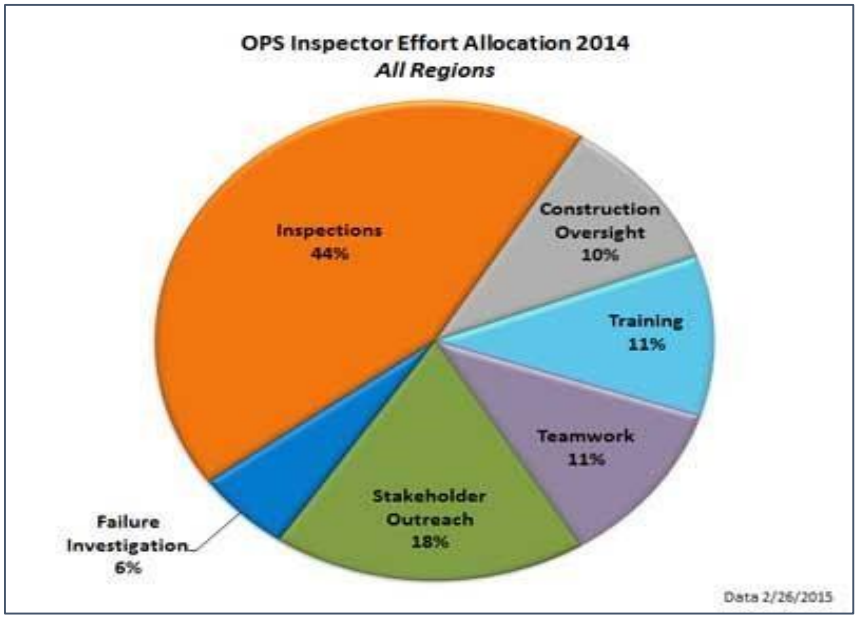
On 1 April 2014 PG&E was indicted in U.S. District Court, San Francisco, California, for multiple violations of the Natural Gas Pipeline Safety Act of 1968 relating to its record keeping and pipeline "integrity management" practices.

In addition to the above incidents documented by regulatory agencies not in existence during earlier days of TGP predecessors, a search of media reports yielded information on other serious pre-PHMSA incidents.

- The explosion, in July 1948, of a 26 inch gas pipeline (today TGP 100) owned then by Tennessee Gas Transmission Company - predecessor to TGP - approximately 2 1/2 miles southwest of Ashland City, in Area #5 described in the Field Inspection section of this report. This incident was reported by the Ashland City Times on July 15, 1948. The glare in the sky from the burning gas was reported to have been visible for a distance of 35 to 40 miles. A Tennessee Gas Transmission Company engineer - identified by name in the papers - stationed at Portland, TN, stated that *"the break in the pipeline had occurred because of either a* ***defective pipe or a defective job of welding****"*.

- The Palm Beach Post, FL, of Friday December 16, 1949, referring to a major explosion in Carthage TN, carried the news that *"a huge natural gas pipeline - 22 inches - to the Oakridge atomic plant exploded Thursday shooting 1,000 feet into the air. The blast, set fire to a farmhouse, burned two women, knocked several school children to the ground and peppered the countryside with flying rocks. Smoke was visible 20 miles away.* The East Tennessee Natural Gas Company's President said *"the blast came during a* ***pressure test****".*

Adequacy/Inadequacy of regulatory oversight of gas pipeline operations:



PMHSA reports that as of 2014 its 139 federal inspection and enforcement staff and over 300 state inspectors are responsible for regulating nearly 3,000 companies that operate 2.6 million miles of pipelines, 118 liquefied natural gas plants, and 6,970 hazardous liquid breakout tanks. The pie chart shown above provides the allocation of PHMSA staff time.

It seems worth noting from the PHMSA resource pie-chart that **2.6 million miles of pipes assigned to 439 inspectors for the whole country produces a ratio of approximately 6000 miles per inspector**.

Preventing Pipeline Failure:

With the benefit of reports documenting pipeline failures, the best way forward is to give thoughtful consideration to the findings in these reports, and to incorporate design, installation and operating procedures that strive for best practices.

As we have learned from the PHMSA's incident reports for Kinder Morgan's onshore gas transmission pipeline above, and other reports, the cited causes of pipeline failure in these incidents were varied:

- faulty infrastructure caused by a number of factors such as poor design, installation and workmanship; poor welds; faulty pipeline equipment including choice of pipe material
- poor maintenance practices including failure to adequately inspect pipelines and their safety devices; failure to record pipes' corrosion levels and immediately correct any problems
- failure to maintain updated maps showing pipeline locations
- poor choice of pipeline location, exposing the pipes to geotechnical threats such as displacement from landslides, earth movement and frost heaving
- poor record keeping
- pipe pressure testing

Summary of the most common causes of pipeline failure:

The most important message of this review is to pinpoint the conditions that result in pipeline failure, in many cases with severe material and environmental losses and loss of lives, and draw attention to action that can be taken in the state of Tennessee to minimize risks from the ongoing operation of the Tennessee Gas Pipeline. For this reason we make a short pause to summarize the most common causes of pipeline failure. Most of these conditions were present when the accidents cited above occurred.

- Environmental/external corrosion, caused by conditions affecting the external integrity of the pipe, **particularly when the pipe does not have appropriate corrosion protection such as anticorrosion coating and/or cathodic protection.** Proper anticorrosion coating ensures against the penetration of corrosive agents, even at the molecular level, to the surface of the metal
- **Stress corrosion cracking.** The pipe is under internal stress, e.g., pressure inside the pipe, or uneven external loading, e.g., sagging - even microscopic sagging – affecting the molecular structure of the metal in discreet areas
- **Natural catastrophes.** Flooding, earth movement, frost heaving, and landslide conditions can physically break up the pipe and cause severe explosions
- **Machine operator error**, e.g., excavation and work with heavy machinery in the vicinity of pipelines
- Acceleration of corrosion by the **microbiological impact of sulphate-reducing bacteria**
- **Weld failure**, caused by poor quality of welding procedures and by earth movement, landslides, and frost heaving at the pipeline location
- **Internal corrosion** caused by condensed moisture inside the pipe. The reader can readily understand this phenomenon by visualizing the exhaust pipe and muffler of an automobile as it disintegrates from inside out as a result of its contact with acidic moisture condensation present in the engine exhaust gases
- **Pressure testing** of the pipe

Microbiologically Influenced Corrosion (MIC) of Pipeline Steel Materials:

The field inspection, discussed below, identifies the presence of a reddish gelatinous substance with an oily sheen typically found where microbiologically influenced corrosion of pipelines is taking place. To ensure the reader understands this corrosion-enhancing agent, a brief discussion of this phenomenon is included.

Microbiologically influenced corrosion is caused by specific genera of bacteria which feed on nutrients and other elements found in waters and soils. An environment containing metals, nutrients, water, and oxygen is a primary source of sulphate reducing bacteria (SRB). The biological activities modify the local chemistry (acid-producing) and render it more corrosive to the metals. Once any of a variety of corrosion mechanisms begins to attack the pipeline metal, the biochemical reaction caused by bacterial microbes becomes a significant accelerator of the corrosion process. While it is not difficult to recognize the reddish color and consistency of the bacterial colony, positive identification of microbiologically influenced corrosion requires chemical, biological and metallurgical analysis of the waters, soils and the metal samples.

The first image shows a typical colony of the bacterial microbes.

The other three images were gathered at the Sycamore Creek area #2. They show a microbial colony on the creek-bed, another colony of bacterial microbes next to the 26" TGP100 pipeline submerged in the creek, and another colony in the immediate vicinity.

Continued Use of the Existing Pipeline Infrastructure of TGP:

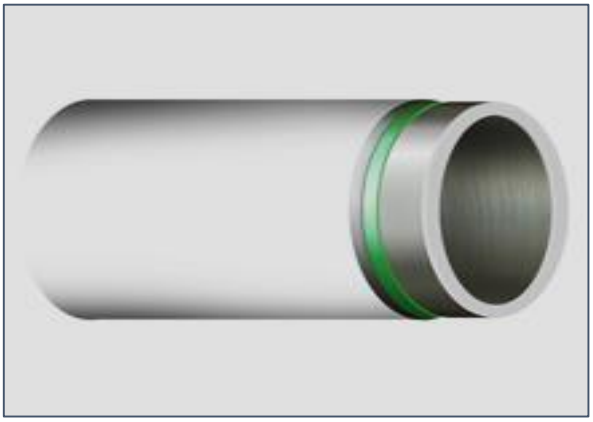
Given that the TGP lines are already in place and will continue to be part of the gas transportation operation, and to better understand the findings of field inspections done on lines 100, 500, and 800 in the summer/fall of 2015 (discussed below), this report describes measures that, if properly implemented, will minimize the risks of pipeline failure.* *The PMHSA advisory with guidance for pipeline flow reversal is discussed above, page 6.

<u>Anticorrosion coating and cathodic protection.</u>
A very important factor influencing the long-term integrity of a pipeline is its coating system. As pipelines age - as is the case with TGP (operation started in 1944) - the anti-corrosion coating deteriorates. This condition is similar to automobile undercarriage rustproofing intended to fend off corrosion in aggressive environments such as in areas where salt is sprayed on roads during the winter, and it is the reason why automobile rustproofing systems include an annual inspection and

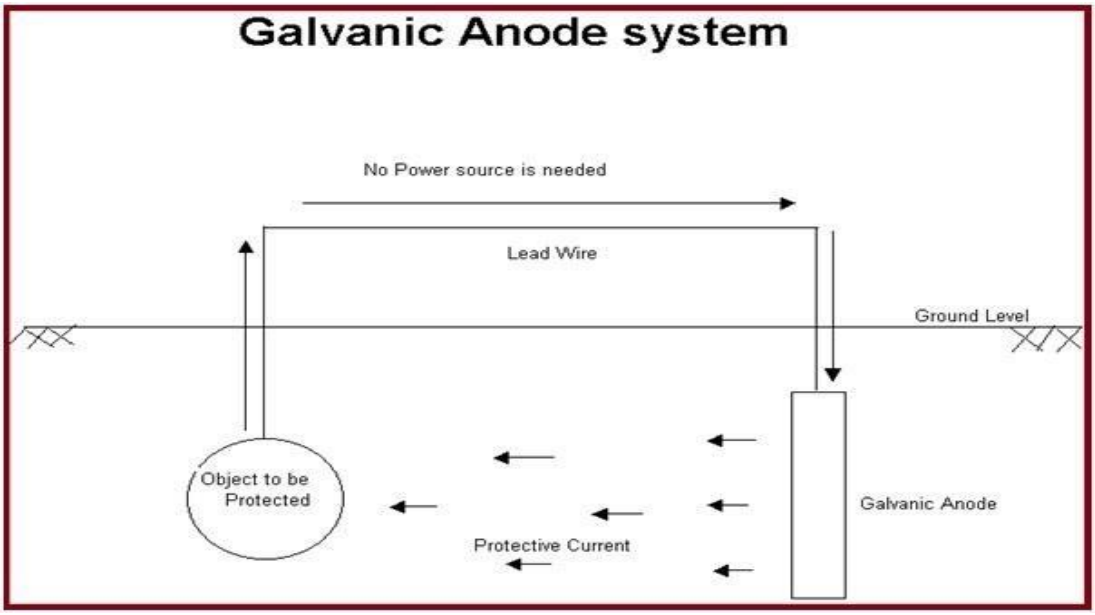
necessary “touch up” as part of a lifetime-warranty. It is also the reason why increasingly more parts of a modern automobile are made of plastic materials that do not undergo corrosion.

Pipelines buried in wet environments are subject to corrosive attack. Since no coating system is defect free, particularly as the coating ages with the pipeline, cathodic protection is used to provide supplementary protection to pipeline systems. Cathodic protection is used to control corrosion by making the metal surface the cathode of an electrochemical cell. The metal to be protected is connected to a more easily corroded sacrificial metal acting as an anode. The sacrificial metal then corrodes instead of the protected metal. For structures such as long pipelines, where passive galvanic cathodic protection may not be adequate, an external DC electrical power source is used to provide sufficient current. A word of caution, **CATHODIC PROTECTION IS WORTHLESS IN COMBATTING CORROSION THAT HAS ALREADY FIRMLY TAKEN HOLD.**

The images below show a typical anticorrosion coating, and cathodic protection systems.



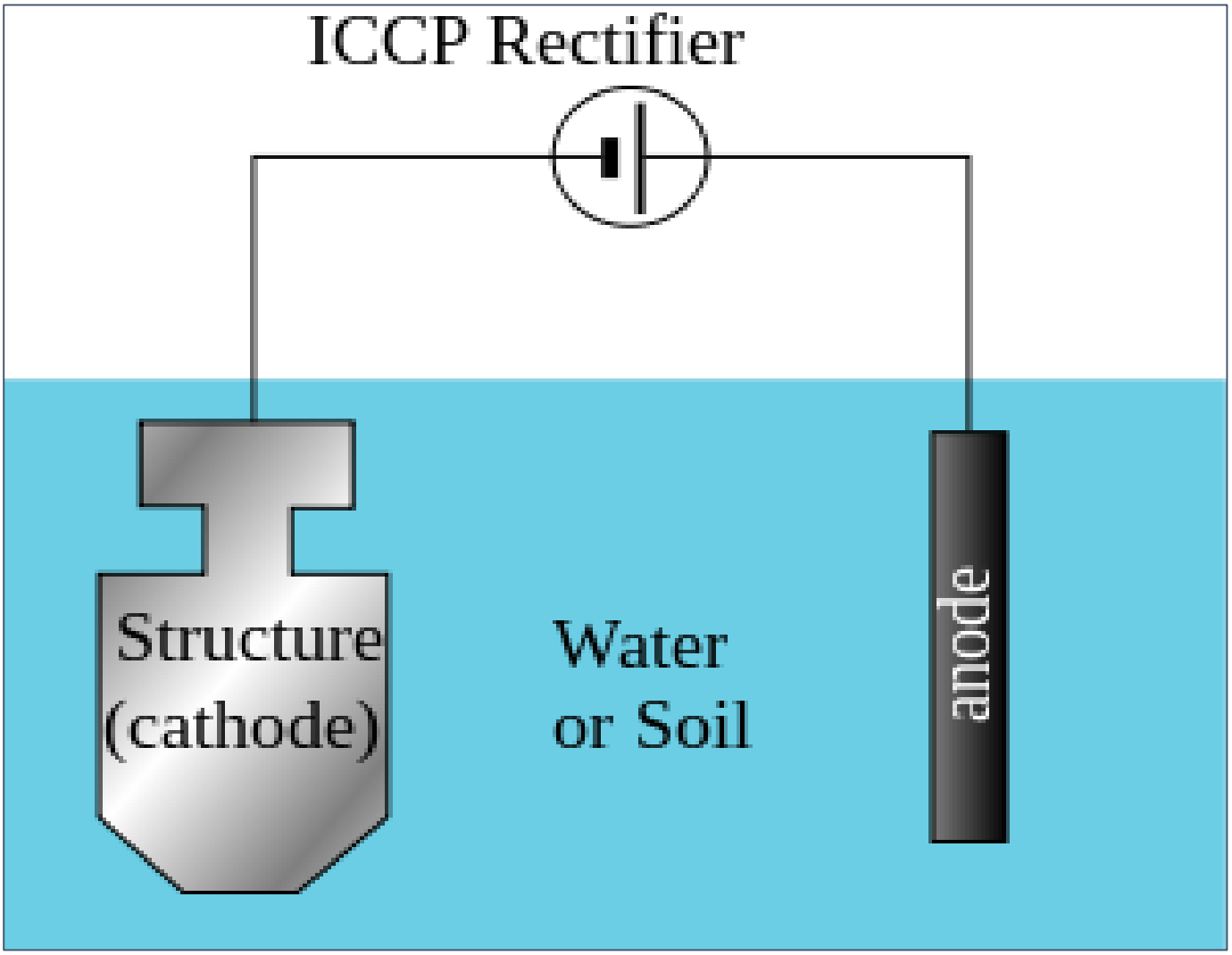
Typical three-layer pipeline coating



Passive galvanic cathodic protection

ICCP Rectifier

Impressed current cathodic protection (ICCP) system. A DC power source is used to increase the current between the metal pipe and the sacrificial anode.



Results of Field Inspection:

Between July 13th and October 18th a series of field studies were conducted to examine exposed pipelines of the TGP100, TGP 500 and TGP800 systems in Davidson, Robertson and Cheatham counties. At this time the following areas 1 through 5 were identified as some of the most alarming within the geographical scope of this study but it is worth noting that the study produced hundreds of images of exposed pipelines in close proximity to populated areas and it is quite reasonable to assume similar conditions exist all along these pipeline systems from the Gulf of Mexico to the Northeast corridor.

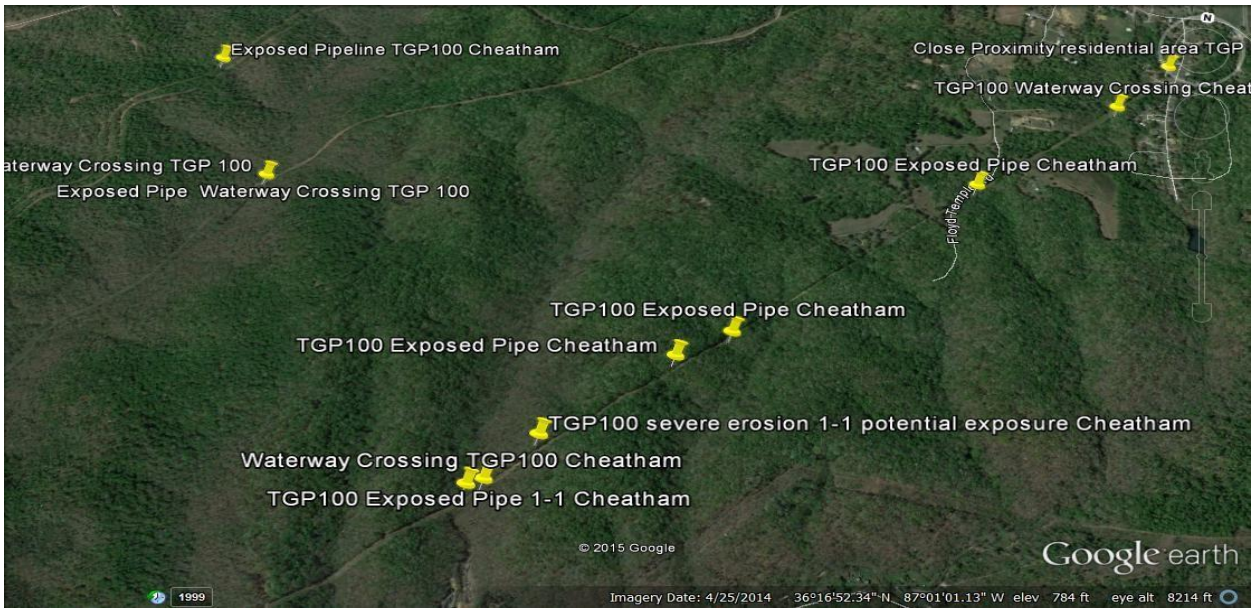
TGP 800 Area #1 August 18 2015. Little Marrowbone.

Anticorrosion coating has peeled off and no longer protects the pipe in the pictures below.

TGP 100 Area #2 July 13 and September 25, 2015. Sycamore Creek

Submerged pipes, no anticorrosion coating, sagging with the risk of metal fatigue failure and stress corrosion cracking. The longitudinal weld, bottom two photos, offers additional exposure to pipe failure, cracked weld.

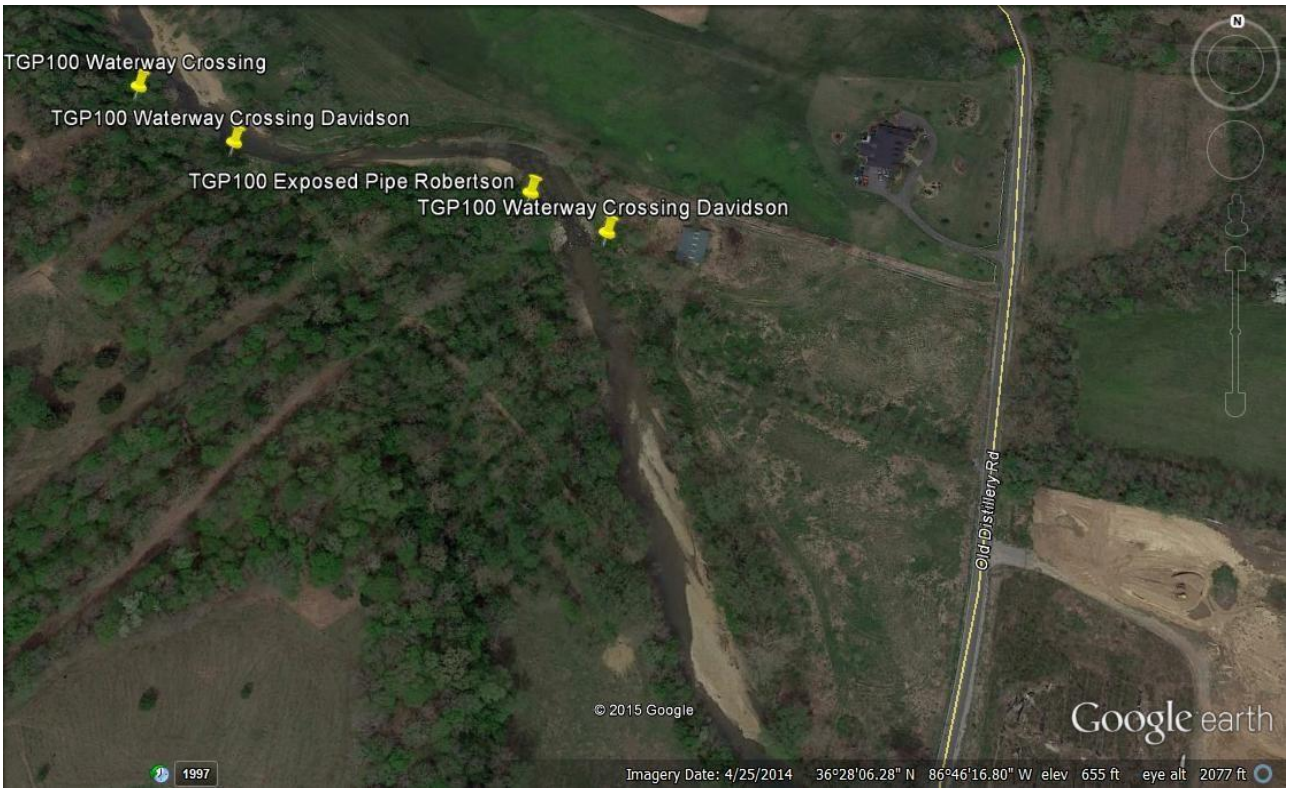
TGP 100 Area # 3 October 18 2015. Dry Fork Creek Road.



Pipe with corroded outer surface being painted over. No verification of the quality of surface preparation - mainly sandblasting to bare metal - was possible.

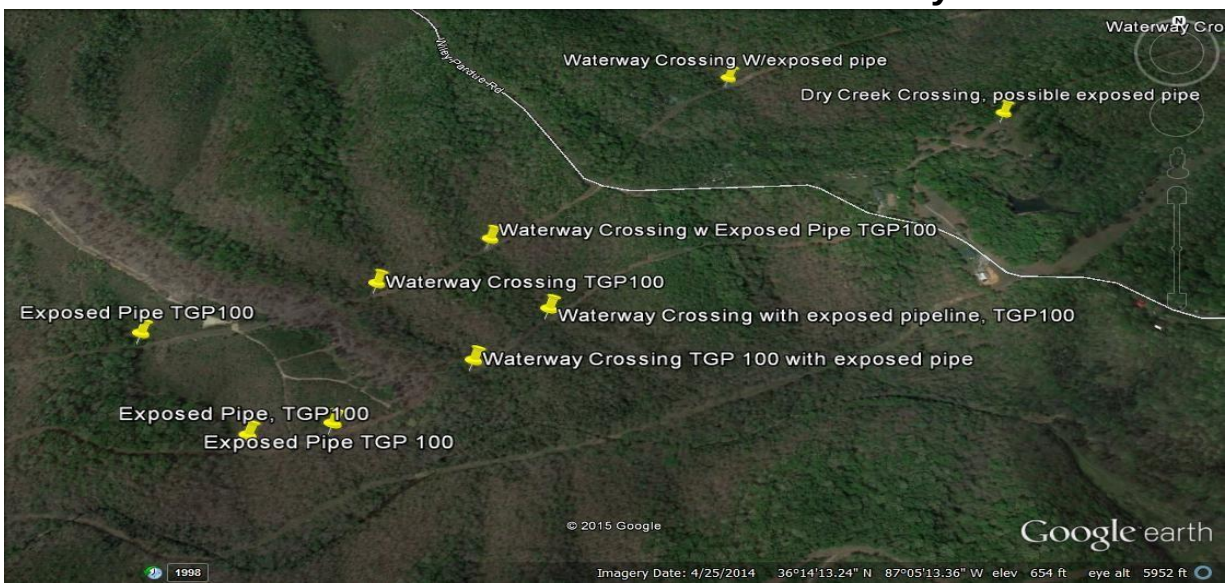
Severe rusting, no anticorrosion coating.

TGP 100 Area #4 August 21 2015. Old Distillery Road.



Submerged pipe with cracks in the anticorrosion coating.

TGP 100 Area #5 October 1st and 4th 2015. Wiley Pardue Road.



Cathodic protection serves no purpose on heavily corroded pipes.

Unsupported, sagging pipes:

Unsupported or insufficiently supported, sagging pipes located at stream crossings and/or in areas of undulating terrain deserve a special mention due to the risk of stress corrosion cracking and/or metal fatigue which may ultimately result in catastrophic failure of the pipe. The first two images below show a 30" pipe in with poor support and non-existent support and curvature of the pipe is clearly visible. The images come from a populated area in Davidson County. The next two show properly built structures for short and medium distance crossings.

Local, unsupported pipelines

.

The two examples above are structures built to support pipelines when properly installed.

Inadequate erosion control measures:

The images below were gathered from local waterways where erosion control has been allowed to fall into a state of disarray since the flooding of 2010. Similar remediation has failed in other areas nearby. Kinder Morgan has acknowledged this is a serious concern as mentioned in the Appendix on page 27.

Discussion of field inspection findings:

There is no need to explain the images captured in the five areas chosen for inspection. It is easy for the reader who does not have a technical background to understand the issues and to relate to those factors highlighted on page 12 as having the potential to cause pipeline failure. Because the material used to build pipelines is central to their long-term integrity, a brief outline of the evolution of materials used over the years is useful.

Cast iron gas pipes have been in use in the US since the 1830s. Most existing manufacturing plants transitioned to carbon steel material during the 1970s and 1980s. There is currently almost no new manufacture of cast iron pipe. The transition recognized the superior ductility* of carbon steel compared to the more brittle cast iron.

> ***Ductility** is a solid material's ability to deform under tensile stress; this is often characterized by the material's ability to be stretched, and its plasticity or the extent to which it can be deformed without fracture. For some detail about the manufacture of various kinds of carbon steel and different types of pipes the reader can go to the link http://www.omegasteel.com/products-carbon-steel-pipe.php.
>
> Ductility allows carbon steel pipes to offer a degree of insurance against pipe failure due to accidental heavy machinery contact, as well as the impact of natural phenomena such as earth movement, frost heaving, and landslide conditions that can negatively affect the integrity of the pipe and cause severe explosions.

The Omega Steel website, cited above, shows a seamless carbon steel pipe which provides additional insurance in pipes at higher pressures*.

> **Seamless carbon steel pipe has, as its name implies, no longitudinal weld seam**. It is, in essence, one solid homogeneous piece of steel. A solid billet is simply heated and then stretched over a series of mandrels until the pipe has achieved its desired diameter and wall thickness. Typically seamless carbon steel pipe fourteen inches and greater in diameter are*

rolled from shells which expand the diameter and reduce the wall until the desired dimensions are achieved. Sizes smaller than fourteen inches in diameter are typically stretch reduced whereby the diameter is gradually reduced and the wall relatively increased via a series of rolls. There is also a cold forming process for seamless pipe production, but such manufacturing processes are typically reserved for different alloys. Being that there is no seam, ***seamless carbon steel pipe is typically used in high pressure applications****. Common seamless specs include; API5LB, A106, A333. ** See picture on page 17, longitudinal weld seam, Area # 2, Sycamore Creek.*

The potential for pipeline failures has been recognized by the former Secretary of Transportation and the former Administrator of PHMSA. The following excerpt taken from the announcement of the "Call for Action" recognizes the Federal Government's awareness of the issues, and issues an invitation to states and communities near pipelines to join the "Call for Action".

In March 2011, former Secretary of Transportation Ray LaHood and the former Administrator of the Pipeline and Hazardous Materials Safety Administration (PHMSA), Cynthia Quarterman, issued a Call to Action to engage all the state pipeline regulatory agencies, technical and subject matter experts, and pipeline operators in accelerating the repair, rehabilitation, and replacement of the highest-risk pipeline infrastructure. The Call to Action addressed many concerns related to pipeline safety, such as ensuring pipeline operators know the age and condition of their pipelines; proposing new regulations to strengthen reporting and inspection requirements; and, making information about pipelines and the safety record of pipeline operators easily accessible to the public. In response to the Call of Action, the Pipeline Safety Update (Attachment 13) provides the actions taken by the U.S. Department of Transportation, the states, communities and pipeline operators.

For more information on "The Call for Action" go to:

http://www.phmsa.dot.gov/pv_obj_cache/pv_obj_id_D34C3172D6FA8DB53E0F337FC1303FFF3E F83F00/filename/CALL_TO_ACTION.pdf

On the matter of management and replacement of cast iron gas pipelines, the "Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011", http://www.gpo.gov/fdsys/pkg/PLAW112publ90/pdf/PLAW-112publ90.pdf , SEC. 7. CAST IRON GAS PIPELINES reads:

a) *FOLLOW-UP SURVEYS.—Section 60108(d) is amended by adding at the end the following:*
b) *"Not later than December 31, 2012, and every 2 years thereafter, the Secretary shall conduct a follow-up survey to measure the progress that owners and operators of pipeline facilities have made in adopting and implementing their plans for the safe management and replacement of cast iron gas pipelines.".*

c) *STATUS REPORT.—Not later than December 31, 2013, the Secretary of Transportation shall transmit to the Committee on Transportation and Infrastructure and the Committee on Energy and Commerce of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate a report that—*

    1) *identifies the total mileage of cast iron gas pipelines in the United States; and*

2) *evaluates the progress that owners and operators of pipeline facilities have made in implementing their plans for the safe management and replacement of cast iron gas pipelines.*

"The Call for Action" and the above mentioned "Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011" have set the stage for action.

Current Oversight of Gas Pipelines in the State of Tennessee:

Federal oversight: Under section 7 of the Natural Gas Act, the Federal Energy Regulatory Commission (FERC) reviews applications for the construction and operation of natural gas pipelines. In its application review, FERC requires that the applicant has certified that it will comply with Department of Transportation safety standards. FERC has no jurisdiction over pipeline safety or security, but actively works with other agencies with safety and security responsibilities.

The development and enforcement of regulations for the safe, reliable, and environmentally sound operation of the pipeline transportation system in the United States falls under the jurisdiction of the Pipeline and Hazardous Materials Safety Administration (PHMSA) of the United States Department of Transportation agency. The Office of Pipeline Safety (OPS), within the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA), has overall regulatory responsibility for hazardous liquid and gas pipelines under its jurisdiction in the United States.*

**Recently PHMSA has come under criticism for "being lax in enforcing existing rules and slow to promulgate new ones". An article by Hunton & Williams LLP published on May 1, 2015 in Practice Pointers discusses a harsh evaluation of PHMSA offered by Politico.com. http://www.politico.com/story/2015/04/the-little-pipeline-agency-that-couldnt-117147 which points out (among other things) that the Agency has been lax in enforcing existing rules and slow to promulgate new ones. The agency is accused of lacking "the manpower to enforce the rules and the willpower to write stronger ones". Several members of the House Subcommittee on Railroads, Pipelines, and Hazardous Materials have asked "why the Agency has been so slow to issue the crude-by-rail and pipeline safety rules that were pending when the Subcommittee convened hearings on these rulemakings last year". Further the article argues that "PHMSA's Office of Pipeline Safety has indeed been given a huge charge by Congress, but Congress has not provided the Agency with the budget or staff sufficient to implement all of the directives that fall to it". http://www.pipelinelaw.com/2015/05/01/criticism-phmsa-downplays-constraints-industryachievements/*

State oversight: While the federal government is primarily responsible for developing, issuing, and enforcing pipeline safety regulations, the pipeline safety statutes provide for states to assume intrastate regulatory, inspection, and enforcement responsibilities under an annual certification. The majority of pipeline inspections in the nation are carried out by state inspectors who work for state agencies. If a state has a certified pipeline safety program, a state agency is responsible for conducting inspections of intrastate pipelines that lie entirely within a state's borders. The pipeline safety statutes provide for state acceptance of the intrastate regulatory, inspection, and enforcement responsibilities under an annual certification. To qualify for certification, a state must adopt the minimum Federal regulations and may adopt additional or more stringent regulations as long as they are not incompatible with the Federal regulations. A state must also provide for injunctive and monetary sanctions substantially the same as those authorized by the Federal

pipeline safety statutes. The state must also encourage and promote the establishment of a program designed to prevent damage by demolition, excavation, tunneling, or construction activity to the pipeline facilities to which the certification applies, that subjects persons who violate the applicable requirements of that program to civil penalties and other enforcement actions. PHMSA names thirty three states (including Tennessee) and Puerto Rico under the State Agencies Under Section 60105(a) Certification (51) - STATES PARTICIPATING IN THE FEDERAL/STATE COOPERATIVE GAS AND HAZARDOUS LIQUID PIPELINE SAFETY PROGRAMS, NATURAL GAS PROGRAM.

The state of Tennessee is well placed to exercise its regulatory responsibility under the PHMSA certification program. The fact that the Tennessee Regulatory Authority and the Pipeline Information Transportation and Safety Committee are already in place should facilitate a smooth entry into a state/federal pipeline safety partnership. An opportunity that should not be missed.

Conclusions and Recommendations:

The information presented above provides a background to the past use of gas pipelines crossing the state of Tennessee; their present condition and their foreseen future use; the potential environmental, health and safety risks associated with these lines; and weaknesses in the operation of such pipelines by Kinder Morgan, owners and operators of TGP.

Kinder Morgan possesses a less than stellar record on environmental and health and safety performance in their operation of gas pipelines. A significant number of citations by regulatory agencies has been reported above, pages 7 to 10. Images of weaknesses - pages 16 to 21 - that could potentially lead to pipeline failure at several locations along the pipelines in the state of Tennessee show:

- The state of deterioration of sections of the pipes. These include failed protection coating and the resulting corrosion of the metal.
- Damaged structures intended to protect the integrity of pipes at water crossings.
- Pipes submerged in water crossings.
- Pipes, originally buried, which have become exposed due to soil erosion at water crossings.
- Presence of sulphate-reducing bacteria thriving in the immediate vicinity of submerged pipes.
- Inadequate support of pipes at crossings, waterways and undulating terrain.

Based on the information discussed above, this report draws attention to corrective measures that can be taken to address obvious weaknesses with the objective of moving Tennessee Gas Pipeline to put in place operating measures aimed at placing environmental, health, and safety considerations at the same level of priorities of the company as return on investment and shareholder profits. Under its oversight authority, the state of Tennessee and PHMSA are asked to give strong consideration to placing Tennessee Gas Pipeline on a schedule, in a manner similar to what other states have done, to: 1. provide above-ground, above-water, pipeline support structures at all waterways and undulating terrain crossings.

1. Remove from service all sections of cast iron pipe in operation in the state, and replace them with corrosion protected carbon steel or plastic, taking into consideration that in certain cases improperly installed metal/plastic unions have caused unsafe conditions. PHMSA has mentioned this replacement measure as part of making pipelines safer. A number of states/cities has placed pipeline companies within their jurisdiction on schedules to complete this task, e.g., Georgia, Washington DC. When state authorities mandate the pipe replacement program, operators are generally assured that they will recover their costs through their rate base.
2. Inspect the complete pipeline system operating in the state for integrity, both internal and external, with the aim of identifying sections requiring an upgrade and provide corrective measures that meet today's standards.
3. Repair damaged structures intended to protect the integrity of pipes at water crossings which have fallen into a state of disrepair.
4. Implement a compulsory monitoring and reporting program that will keep the state agency informed on all regulated activities.
5. From design, installation, and maintenance records, report sections in the state of Tennessee where cast iron pipes are still in place.

Based on all of the information available at this time, the overarching conclusion of any objective analysis of the 2015 Field Study of Pipeline Safety in Tennessee is that the current depth and degree of oversight of Tennessee Gas Pipeline and Kinder Morgan in the state of Tennessee is alarmingly insufficient. A new approach to inspection and enforcement of pipeline safety standards must be established in a way that guarantees to the citizens of Tennessee that the state is dutifully fulfilling its obligation and responsibility for oversight of pipeline infrastructure, particularly with the knowledge that the Federal agencies lack the manpower and resources necessary to maintain the level of safety and standards that Tennessee deserves. Whatever the current provisions for inspection and enforcement, this study's conclusion can be none other than that they are not sufficient. Pipeline accidents are preventable, but they require action and that action must be sustained. Where the jurisdiction and effectiveness of Federal agencies to ensure the safe operation of this infrastructure fails or falters, the state of Tennessee must have in place an effective and vigilant apparatus to prevent the potential for accidents in our communities. Anything less would be a great disservice to current and future residents, property owners and citizens of Tennessee.

APPENDIX

Kinder Morgan: In Their Own Words

In 2010 the Middle Tennessee area and Davidson County in particular experienced historic flooding which swept away erosion control measures put in place to support the various pipeline systems and protect them from impact etc.

On July 18th 2011, the Tennessee Department of Environment and Conservation's Division of Water Pollution Control received an "Application for Aquatic Resource Alteration Permit & State 401 Water Quality Permit" from Kinder Morgan & Tennessee Gas Pipeline regarding areas of local waterway Sycamore Creek which were left in disarray after the flooding. The application states: "If no restoration activities were conducted then the pipeline exposure would grow and increase the potential for structural failure." Also in the same paragraph the application states: "Failure to create bank stabilization and protection of the pipeline could result in damages to the pipeline causing a potential explosion and impact an approximate area of 1/2 mile in diameter".

It is therefore important to point out to the reader that the photos on page 22 of the 2015 Field Study of Pipeline Safety in Tennessee were taken July 13th of 2015 and clearly show little or no remediation has taken place in the five years since the flood of 2010.

The purpose of this Appendix is to enter into the public record, if such record exists, that Kinder Morgan and Tennessee Gas Pipeline have a poor record of maintaining even the most basic protections for aquatic resources and public safety concerns in the State of Tennessee.

Attachment 1

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2011 JUL 12 PM 1:

NASHVILLE FIELD OFFICE RECEIVED

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER POLLUTION CONTROL
APPLICATION FOR AQUATIC RESOURCE ALTERATION PERMIT (ARAP)
&
STATE §401 WATER QUALITY PERMIT

Section 1: Applicant Information An application submitted by a corporation must be signed by a principal executive officer; from a partnership or proprietorship, by the partner or proprietor respectively; from a municipal, state, federal or other public agency or facility, the application must be signed by either a principal executive officer, ranking elected official or other duly authorized employee.

Name: Steve Hockett		**Title or Position:** Principal Field Project Manager		
Company Name: Tennessee Gas Pipeline Company				
Mailing Address: 750 Old Hickory Boulevard, Suite 190		**City:** Brentwood	**State:** TN	**Zip:** 37027
Phone: 615.221.1525	**Fax:** 615.661.5001	**E-mail:** steve.hockett@elpaso.com		
Section 2: Alternate contact within your organization (not required)				
Name:		**Title or Position:**		
Mailing Address:		**City:**	**State:**	**Zip:**
Phone:	**Fax:**	**E-mail:**		
Section 3: Consultant Information (a consultant is not required)				
Name: Garland Stone*		**Title or Position:** Principal		
Company Name: Trestles, LLC				
Mailing Address: 100 Main Street, Suite 203		**City:** Portland	**State:** TN	**Zip:** 37148
Phone: 615.403.1377	**Fax:** 615.325.3128	**E-mail:** gstone@trestlesllc.com		

→ Place a * next to the individual's name listed above that should be the primary contact during the application process ←

Section 4: Fee (check appropriate box and submit appropriate fee with application)

Amount of fee:
$50.00 **$1,000.00** **$2,500.00** **no fee required**

Requests for General Permit coverage require no fee. Requests for Individual Permit alterations on private farms and residences require a $50.00 application fee. Requests for Individual Permit alterations less than 1,000 feet of stream or less than 10 acres of wetland require a $1,000.00 application fee. Requests for alterations over 1,000 feet of stream and greater than 10 acres of wetlands require a $2,500.00 application fee. (Checks payable to Treasurer, State of Tennessee.)

Section 5: Project Details (fill in information and check appropriate boxes)

Project / Site Name: Sycamore Creek Restoration

Nearest City, Town or Major Landmark: Huffman Road, Joelton, Tennessee

County: Davidson County

Resource Proposed for Alteration:
Stream **Wetland** **Reservoir**

Name of Resource: Sycamore Creek

Type of proposed alteration(s):
Road Crossing
Utility Line
Intake/Outfall Structure
Stream or Wetland Restoration
Wetland Fill/Excavation
Other:
Dredging
Launching Ramp
Bank Stabilization
Maintenance Activities
Water Withdrawal

Latitude: (decimal degrees, NAD83): 36° 23' 25"
Longitude: (decimal degrees, NAD83): 86° 53' 6.2" West

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continued

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Attachment 2

Brief Project Description (a more detailed description is requested in Section 8):
The project area and Nashville Davidson County, Tennessee area received significant amounts of rainfall from the May 2010 storm event. The flood waters eroded soils covering a natural gas pipeline which crosses Sycamore Creek. The pipeline has been exposed within the creek and along the banks. For safety reasons, the pipeline needs to be recovered and the improvements made to minimize future occurrences of exposure. The exposed pipe shall be recoated and covered with natural material. A gabion wall structure is proposed to be constructed along the bank to protect the pipeline from large storm events. Grading will be conducted to restore the creek to its natural flowline and facilitate low flow conditions. Temporary diversion and erosion control measures shall be implemented in accordance with site specific SWPPP.

Do any other alterations require approval from any other state, federal, or local government agency associated with the project site? If yes, provide brief description and status of approval.
No

Section 6: Directions to Project Site

From Nashville, Tennessee, take I-24 West toward Clarksville,TN.
Take Exit 35.
Turn right onto Whites Creek Pike .
Turn right on Edgar Dillard Road/Greenbrier Road.
Turn left on Huffman Road.
Sycamore Creek is on the right along Huffman Road.

Section 7: Project Schedule (fill in information and check appropriate boxes).

How long will it take to perform the proposed activity?
5 days

Is any portion of the activity complete now? Yes No
If yes, describe the extent of the completed portion below:

The required information in sections 8 - 12 must be submitted on a separate sheet(s) and submitted in the same numbered format as presented. If you believe that a certain request does not pertain to your project, explain the reason.

Section 8: Project Description

8.1 A narrative description of the scope of the project
8.2 USGS topographic map indicating the exact location of the project (can be photographic copy)
8.3 Photographs of the resource(s) proposed for alteration with location description (photo locations should be noted on map)
8.4 A narrative description of the existing stream and/or wetland characteristics including, but not limited to, dimensions (e.g., depth, length, average width), substrate and riparian vegetation
8.5 A narrative description of the proposed stream and/or wetland characteristics including, but not limited to, dimensions (e.g., depth, length, average width), substrate and riparian vegetation
8.6 In the case of wetlands, include a wetland delineation with delineation forms and site map denoting location of data points

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Section 9: Purpose and Justification

9. Describe the purpose for the proposed activity and overall project

Section 10: Alternatives

10. Describe all practicable alternatives considered, including what has been done to avoid or minimize impacts to streams or wetlands. For activities not covered by General Permit, each alternative must include the following: (1) feasibility, (2) environmental consequences and (3) social and economic benefits of each alternative.

Attachment 3

Section 11: Mitigation	
.1	A detailed discussion of the proposed mitigation, if required
.2	If you believe mitigation is not required, state the reason or cite the regulation to support this position
.3	A detailed discussion of why you believe the mitigation would result in no net loss of resource value
.4	A detailed description of the proposed monitoring plan for the mitigation site
.5	A discussion of long term protection measures for the mitigation site

Section 12: Technical Information	
.1	Detailed plans, blueprints, or legible sketches of present site conditions and the proposed activity. Plans must be 8.5 x 11 inches. Additional larger plans may also be submitted to aid in application review. The detailed plans need to include dimensions of the existing and proposed stream or wetland such as depth, length, average width, substrate and riparian vegetation.
.2	If mitigation is proposed, submit detailed plans, blueprints, or legible sketches of the proposed mitigation
.3	For both the proposed activity and mitigation, provide a discussion regarding the sequencing of events
.4	Location and type of erosion prevention and sediment control measures for the proposed alterations
.5	A discussion on how the proposed activity will be performed (construction methods)
.6	A copy of all hydrologic or jurisdictional determination documents issued for the water resources on the project site.

Section 13: Certification and Signature:

I certify under penalty of law that this document and all attachments were prepared at my request or under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Steve Hockett Printed Name	Principal Field Manager Official Title	Signature: Steve Hockett	Date: 6/23/2011

Section 14: Where do I send my application?

For General Permit coverage, submit the original completed and signed application to the local Environmental Field Office (EFO) for the county of your activity. Addresses of the EFOs are listed below. Mark the application ATTN: Water Pollution Control. Submit all applications for Individual ARAPs to the Natural Resources Section at the following address, and send a copy to the appropriate EFO.

Tennessee Department of Environment and Conservation
Water Pollution Control - Natural Resources Section
7th Floor L&C Annex
401 Church Street
Nashville, TN 37243

Jackson EFO	Nashville EFO	Cookeville EFO	Johnson City EFO
1625 Hollywood Drive 38305 Phone: 731-512-1300 Counties: Benton, Carroll, Chester, Crockett, Decatur, Dyer, Gibson, Hardeman, Hardin, Haywood, Henderson, Henry, Lake, Lauderdale, Madison, McNairy, Obion, Weakley	711 R. S. Gass Boulevard 37243 Phone: 615-687-7000 Counties: Cheatham, Davidson, Dickson, Houston, Humphreys, Montgomery, Robertson, Rutherford, Stewart, Sumner, Trousdale, Williamson, Wilson	1221 South Willow Ave. 38506 Phone: 931-432-4015 Counties: Cannon, Clay, Cumberland, Dekalb, Fentress, Jackson, Macon, Overton, Pickett, Putnam, Smith, Van Buren, Warren, White	2305 Silverdale Road 37601 Phone: 423-854-5400 Counties: Carter, Greene, Hancock, Hawkins, Johnson, Sullivan, Unicoi, Washington
Memphis EFO	**Columbia EFO**	**Chattanooga EFO**	**Knoxville EFO**
2510 Mt. Moriah Road STE E-645 Perimeter Park 38115 Phone: 901-368-7939 Counties: Fayette, Shelby, Tipton	2484 Park Plus Drive 38401 Phone: 931-380-3371 Counties: Bedford, Coffee, Franklin, Giles, Hickman, Lawrence, Lewis, Lincoln, Marshall, Maury, Moore, Perry, Wayne	540 McCallie Avenue STE 550 State Office Building 37402 Phone: 432-634-5745 Counties: Bledsoe, Bradley, Grundy, Hamilton, Marion, McMinn, Meigs, Polk, Rhea, Sequatchie	3711 Middlebrook Pike 37921 Phone: 865-594-6035 Counties: Anderson, Blount, Campbell, Claiborne, Cocke, Grainger, Hamblen, Jefferson, Knox, Loudon, Monroe, Morgan, Roane, Scott, Sevier, Union

Section 15: Administrative Information (Official Use Only).

Date Received:	File# assigned	Fee paid: Yes No N/A Ck #	Application administratively complete: Yes No	Complete Application date: RECEIVED JUL 18 2011 Natural Resources

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Attachment 4

Section 10: Alternatives

10. Describe All Practicable Alternatives Considered

The nature of this project required the restoration work to provide pathways for low and high flow conditions while maintaining an aquatic habitat. If no restoration activities were conducted then the pipeline exposure would grow and increase the potential for structural failure. The second alternative considered was backfilling the area with natural material to the pre-flood elevations. This alternative would temporarily protect the natural gas pipeline; however, large storm events and/or normal weather patterns would eventually expose the pipeline again. Failure to create bank stabilization and protection of the pipeline could result in damages to the pipeline causing a potential explosion and impact an approximate area of ½ mile in diameter. The potential social and economic costs of this alternative could be significant including potential human fatalities in the adjacent community.

The proposed project is both preventative and remediative in nature; thus, providing short and long term benefits to both the community and environment.

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Section 11: Mitigation

11.1 A detailed discussion of the proposed mitigation, if required

11.2 If you believe mitigation is not required, state the reason or cite the regulation to support this position

11.3 A detailed discussion of why you believe the mitigation would result in no net loss of resource value

11.4 A detailed discussion of the proposed monitoring plan for the mitigation site

11.5 A discussion of long term protection measures for the mitigation site

Section 12: Technical Information

12.1 Detailed Plans, Blueprints, or Legible Sketches of Present Site Conditions and the Proposed Activity.

Design drawings that illustrate existing and proposed conditions have been attached.

12.2 If mitigation is proposed, submit detailed plans, blueprints, or legible sketches of the proposed mitigation

12.3 For both the proposed activity and mitigation, provide a discussion regarding the sequencing of events

The pipeline protection and stream bank restoration/stabilization activities will be performed over the course of five to ten days in the following order:

- Mobilize equipment and materials to the site
- Clear and grub areas as necessary

Madison County, New York

Department of Health

Comments to the Federal Energy Regulatory Committee

Concerning Docket No. CP14-497-000, Dominion Transmission, Inc.

Submitted by
Madison County Department of Health
Madison County, New York

October 15, 2014

Executive Summary

The following comments are addressed to the Federal Energy Regulatory Commission in response to the permit application (Docket No. CP14-497-000) filed June 2, 2014, by Dominion Transmission, Inc. of Richmond, Virginia. The Madison County Department of Health has concerns that impacts to public health have not been adequately addressed in this permit, specifically in regard to the Sheds compressor station in Madison County. The National Environmental Policy Act requires that FERC take into account potential environmental impacts and that FERC address public concerns in its permit review. The Madison County Department of Health's concerns are based in part on the report from the United States Environmental Protection Agency (USEPA) Inspector General that documents a lack of emissions data from oil and gas facilities which, in turn, casts doubt on the accuracy of projected air quality impacts. This brings into question the appropriateness of using the National Ambient Air Quality Standards to establish health safety risk near the Sheds compressor station. There are also documented correlations between health impacts and residential proximity to unconventional natural gas development facilities, including compressor stations.

Section II of these comments reviews what is known from the literature about compressor station emissions. Information specific to compressors is very limited. The types of chemicals that have been identified include VOCs, carbonyls and aldehydes, HAPs, aromatics and particulate matter. In particular, there is a lack of information on the intensity, frequency and duration of emission peaks that occur during blowdowns and large venting episodes that are a normal part of compressor operations. Blowdowns, on average, release 15 Mcf of gas into the atmosphere. Fugitive emissions and accidents are also of concern. One study from Fort Worth, Texas reported 2,126 fugitive emission points from a set of compressor stations. Radioactive chemicals are present in natural gas pipelines and can be released into the atmosphere, though little is yet known about exposure profiles for communities near compressor stations.

Section III reviews known health risks from known chemicals emitted, while acknowledging that there are data gaps in both chemicals emitted and potential health effects. Health risks from VOCs in the short term include eye and respiratory tract irritation, headaches, dizziness, visual disorders, fatigue, loss of coordination, allergic skin reaction, nausea, and memory impairment. Effects from long-term exposure include loss of coordination and damage to the liver, kidney, and central nervous system as well as elevated risk of cancer. Health effects from particulate matter affect both the respiratory and cardiovascular systems. Inhalation of PM2.5 can cause decreased lung function, aggravate asthma symptoms, cause nonfatal heart attacks and high blood pressure. Diesel emissions from truck traffic (primarily during construction of the compressor) can irritate the eyes, nose, throat and lungs, and can cause coughs, headaches, lightheadedness and nausea. Short-term exposure to diesel exhaust also causes inflammation in the lungs, which may aggravate chronic respiratory symptoms and increase the frequency or intensity of asthma attacks. Long-term exposure can cause increased risk of lung cancer. Chemical exposure to vulnerable populations is a particular concern. The problem of chemical mixtures and how these might affect health needs further research.

Health effects associated with compressor stations are summarized in section IV. This set of research relies primarily on self-reported data from public health surveys. The symptoms identified are associated with health impacts on respiratory, neurological and cardiovascular body systems. These health effects correlate with the impacts associated with many of the chemicals emitted from compressor stations.

Madison County residents have reported numerous concerns to FERC and to the MCDOH (Section V). Primary concerns are for health safety and food/crop safety. Concerns about the safety record of compressors and pipelines, impact on community character and home values, emergency response preparedness, air quality and other environmental impacts were also raised.

Recommendations for framing and scoping public health issues (Section VI) includes information on relevant health data sources. Methods for assessing environmental health determinants include baseline data collection on air emissions, soil, and water quality.

Data gaps and other challenges to the implementation of a public health analysis are identified in section VII. These are: a lack of previous health studies that address compressor stations; limited data on chemical constituents of compressor air emissions including intensity, frequency and duration; the problem of poorly identified chemical mixtures and potential health effects; unidentified related emissions from metering stations and pipelines; the lack of data on potential radioactive chemical emissions; inadequate assessment of the effect of local weather patterns on dispersal of air pollutants (air dispersion modeling); and very limited information on the exposure pathway of air pollutants entering soil and food crops, and the potential for human health impacts.

Recommendations are also provided in the event that the permit is granted, as follows:

- Perform a baseline health study to establish population health status before the compressor station is built.
- Require best practices to ensure that effective emissions control measures are kept up to date.
- Establish an alert system for blowdowns or other large emissions and/or noise events.
- Put Emergency Plans in place.
- Institute a monitoring strategy at the Sheds compressor station and surrounding locations.
- Institute a health registry.

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I. Introduction

On June 2, 2014, Dominion Transmission, Inc. (DTI), of Richmond, Virginia filed an application with the Federal Energy Regulatory Commission (FERC), pursuant to Section 7(c) of the Natural Gas Act, to "construct, install, own, operate and maintain certain compression facilities that comprise the New Market Project located in Chemung, Herkimer, Madison, Montgomery, Schenectady, and Tompkins Counties, New York." One new compressor station, known as the Sheds compressor station, would be located in Madison County. The Madison County Department of Health (MCDOH) submits the following comments to FERC in regard to public health concerns relating to the Sheds compressor station and associated infrastructure. These comments are submitted for the FERC Scoping Process which opened for comments on September 18, 2014. The National Environmental Policy Act (NEPA) requires that FERC take into account potential environmental impacts in its permit review. NEPA also requires FERC to discover and address public concerns, which in this case focus on risks to public health.[1]

While the Madison County Department of Health understands that FERC has determined that the New Market Project (of which the Sheds compressor station is included) would follow an Environmental Assessment (EA) review process, instead of FERC's more comprehensive Environmental Impact Statement process, there remain many unanswered questions pertaining to the impacts on public health from the installation and operation of the Sheds compressor station along with concerns that the application of the EA process may fail to consider such health impacts in its review of the Sheds compressor station.

A recent report from the United States Environmental Protection Agency (USEPA) Inspector General states that there is inadequate information available on direct measurement emissions from oil and gas production activities.[2] The report finds that incomplete datasets lead to underestimates of air quality impacts from these sources. The report further notes that "Limited data could affect decision-making impacting human health and the environment." Health effects such as cancer risk, birth outcomes, skin rashes and respiratory problems have been correlated to production activities in peer-reviewed literature.[3] These findings, in addition to our review of the current literature on compressor emissions and potential health impacts frames the MCDOH concern that there is an underestimation of risk by DTI.

Currently available literature suggests that emissions produced during the construction and operation of the proposed Sheds Compressor station will have

the potential to put nearby residents at risk for health effects (see sections II, III, IV below). The MCDOH believes that a more comprehensive public health analysis is needed because:

1. There is incomplete information on the content of compressor emissions
2. Important aspects of the air emissions are not explicitly addressed in the DTI application (DTI permit application Section 9) such as episodic periods of very high emissions, including but not limited to blowdowns, which can adversely affect human health
3. Standards by which estimated emissions are evaluated (DTI permit application p.9-11) for health risk were not intended to be health protective at an individual or neighborhood level
4. Madison County residents have documented concerns about health risks

Table 1 shows the types and distribution of land parcels surrounding the proposed compressor station within a three mile radius. Local residents and the MCDOH are concerned that health impacts may be experienced by individuals in the vicinity of the station (sections IV and V).

Table 1. Land parcel distribution within three miles of proposed Sheds compressor station*

Parcel Category	1/2 Mile Radius	1 Mile Radius	3 Mile Radius
Agricultural Land	**5**	**9**	**60**
Residential Year Round	17*	30	207
Seasonal	2	3	21
Vacant Rural Residential Land	4	22	161
State/County Owned Forest	0	1	53
Private Forest	**0**	**0**	**1**
Utility Land	**1**	**1**	**1**
Cemeteries	**0**	**0**	**3**
Miscellaneous	**0**	**0**	**4****
Notes:			
* Closest Residential Structure Approx. 1,150 feet			
** Reputed Amish School Approx. 6,700 feet			

*Data courtesy of Madison County Real Property. Adapted by the Madison County Department of Health, Environmental Division. August 2014

The MCDOH recommends that if the more comprehensive EIS process is considered for this project it should take into account the following public health analysis component:

1. Data collection of baseline prevalence of relevant diseases including asthma, cancer, COPD, birth outcomes, as well as data on vulnerable populations in Madison County
2. Identification of impact pathways, susceptibility analysis, and cumulative impact factors
3. Consideration of local concerns in the assessment of health and environmental impacts

The remaining sections of these comments provide background information on four areas of public health concern for MCDOH (sections II – V), information on current data gaps (section VI), recommendations (section VII), and a summary of critical questions (section VIII):

Section II – Compressor station emissions - There are known emissions from compressor stations, as well as unidentified emissions. Frequency, intensity and duration of emissions at the proposed compressor station are not documented, yet these factors will determine the impact on nearby residents' health.
Section III – Health risks from relevant air contaminants - The full array of possible health effects is not known, but there are known health effects from some of the chemicals emitted. A review of some known chemical effects on health is provided.
Section IV – Reported health effects specific to compressors - Some health effects have been documented in the vicinity of other compressor stations and associated pipelines and metering stations. A review of available research is provided.
Section V - Concerns of Madison County residents – A review of comments submitted to FERC ad MCDOH is provided.
Section VI - Recommendations for framing and scoping the public health issues for the Sheds compressor station.
Section VII – Data gaps and other challenges to the implementation of a public health analysis are identified.
Section VIII – Recommendations and mitigation (if permit granted) - MCDOH suggests several recommendations for mitigation specific to the Sheds compressor station.
Section IX - A summary of questions for FERC to address in assessing risks to public health.

II. **Compressor station emissions**

Compressor station emissions fall into two categories: construction emissions and operational emissions. Within operational emissions there are three types that warrant individual attention – blowdowns, fugitives and accidents. DTI provides a set of emissions projections for both the construction and overall operational phases of the Sheds compressor station (Resource Report 9 of DTI's Application). This section of our comments reviews those projections and provides perspective on the aptness of the method of estimation (in tons per year) and need for further detail about the VOC and PM estimated emissions to better consider health risk. Discussion of the health risks produced by compressor station emissions will be presented in Sections III and IV.

Construction emissions

DTI reports the dust and other air contaminant emissions projections in its Abbreviated Application for a Certificate of Public Convenience and Necessity[4]. The Application states that of the six sites in the New Market Project, only three – the new compressor stations at Horseheads and Sheds, and adding combustion equipment to the existing Brookman Corners site – are large enough to require pre-construction permits. The other three are small and exempt from the Air State Facility Permit that the larger projects require.[5]

Fugitive Dust Emissions from Construction Activities[6]

Construction-related fugitive dust emission projections are required for the three larger facilities mentioned above. It is not clear whether the totals provided in the Application are for all six sites or just the three that require pre-permitting. The estimates are based on the extent and duration of active surface disturbance and are provided in tons per year (tpy).[7]

Table 2. Fugitive Dust Emissions (tpy) for multiple New Market locations

	2015	2016
PM	2.90	21.44
PM 10	2.90	21.44
PM 2.5	0.29	2.14

These aggregated estimates tell us nothing specific about the construction phase of the Sheds compressor site. Because construction dust exposures at homes nearby would increase residents' risks for respiratory and cardiac illness, we believe a set of estimates specific to Sheds is needed to adequately evaluate health risk.

Total construction emissions for Sheds project

Total emissions estimates for construction-related engines are provided specifically for the Sheds project. These construction emissions are, in part, the result of diesel powered vehicles and equipment.

Table 3. Sheds non-road and on-road construction engine emissions (tpy)[8]

	2015	2016
CO	2.12	3.45
NOx	3.76	4.70
SO2	0.01	0.02
VOC	0.37	0.60
PM10	0.27	0.39
PM2.5	0.27	0.38
CO2	959.44	1288.86
CH4	0.05	0.06
N2O	0.02	0.02
CO2e	966.80	1297.69

When thinking about exposures in the vicinity of the Sheds construction site, it is important to note the particulate matter (PM) numbers. Table 3 includes only the PM10 and PM2.5 emissions from construction engines. For a total estimate, those numbers would need to be added to the PM10 and PM2.5 dust emissions (Table 2). Additionally, the estimates in tons per year raise concerns that will be addressed in conjunction with the operational emissions below.

<u>Operational emissions</u>

DTI presents a summary of its estimated operational emissions for the Sheds Compressor Station.[9] The Sheds combustion turbine will be fired exclusively with natural gas.[10] The operational emissions estimates are:

NOx	24.4 tpy	SO2	0.7 tpy
CO	6.6 tpy	Formaldehyde	0.1 tpy
PM10/PM2.5	6.4 tpy	Other HAPs	0.1 tpy
VOCs	2.9 tpy	Total HAPs	0.3 tpy

Perspective on emissions projected by DTI

The Sheds construction and operational phases are projected to produce emissions below the NAAQS standards. They are presented in *tons per year*. This measure of emissions is used for NAAQS purposes which determine the air quality designation over a region and over long periods of time. The problem posed by estimating tons of contaminants emitted per year is that over the course of a year emissions will vary, often greatly. As phases of construction and operation change so will emissions content and concentrations. For a resident living near a compressor station, the concern is not simply PM2.5 emissions over the course of a year, but is PM2.5 emissions during the peak construction time when it's at its most intense.

Even during normal operations compressor stations have been shown not to emit uniformly ("blowdown" and accident events will be discussed separately).[11] The measurement *tons per year*, while common in the industry and common in the environmental field where regional air quality is at issue, is not an appropriate measure to determine individuals' health risks which increase during episodes of high exposures.

Table 4 shows the day to day and morning to evening variability in emissions at one compressor station near Hickory, Pennsylvania. It comes from a Pennsylvania Department of Environmental Protection. We present this case to show documentation of fluctuations not captured by averages.[12] Note how much relevant emissions information is lost when relying on averages, even of just three days. When extending this logic across a year, there is little doubt that there will be times of high levels of contaminants released and these high levels can increase health risks to residents. It is also notable that the EPA inhalation reference concentration (RfC) for ethylbenzene is 1 mg/m3 (equivalent to 1,000 ug/m3).[13] Some of the reported emissions exceed this standard of health safety.

Table 4. Variation in ambient air measurements of five VOCs near a compressor station reported in ug/m^3 *[14]

Chemical	May 18		May 19		May 20		3 day average
	morning	evening	morning	evening	morning	evening	
Ethyl-benzene	No detect	No detect	964	2,015	10,553	27,088	6,770
n-Butane	385	490	326	696	12,925	915	2,623
n-Hexane	No detect	536	832	11,502	33,607	No detect	7,746

*The PA DEP collected data on many more chemicals than those listed above; the authors of this paper have chosen these chemicals specifically to highlight variation in emissions.

Without knowing the characteristics of peak exposures expected from the Sheds project, an accurate estimate of health risk cannot be made. Discussion of those health risks is found in Sections IV and V of this report.

Documented compressor emissions

It is important to know, with more specificity, what chemicals will be emitted by the proposed Sheds facility so that a targeted assessment can be made about its potential health impacts.

There is a small but growing body of literature on emissions from shale gas extraction, processing and transport activities. In its early stages of inquiry, the focus was predominantly on drill pad activity, but there are now some reports on natural gas compressor station emissions. Below are examples of chemicals that have been found at or near compressor stations during operations. These emissions reports – whether from public databases or from a private sector firm or organization – do not provide relevant background levels of the chemicals detected. Without a "control" location it is not possible to say with certainty that the chemicals found are the result of the compressor station, although these facilities are often the only industrial activity in the areas where they are found.

Emissions from two compressor stations (Stewart and Energy Corps), published by the Pennsylvania Department of Environmental Protection (DEP)[15] are:

MTBE	2-methyl butane
CO	2 methyl pentane
iso-Butane	3 methyl pentane
methyl mercaptan	ethyl benzene
n-Butane	benzene
n-hexane	ethane
n-octane	propane
nitrogen dioxide	methanol
nitrous-acidstyrene	napthlelene

The Texas Commission on Environmental Quality (TCEQ), as part of its Barnett Shale Formation Area Monitoring Projects found the following chemicals downwind from two monitored compressor stations[16]:

- Downwind of Devon Energy Company LP's Justin compressor station the TCEQ reports propane, isobutene, n-butane, ethane, cyclohexane, benzene, n-octane, toluene, m+p-xylene, n-hexane.
- Downwind of Targa North Texas LP's Bryan Compressor Station the TCEQ reports: ethane, propane, isobutene, n-butane, cyclohexane, n-octane, toluene, isopentane, n-pentane + isoprene, benzene.[17]

Officials in DISH, TX commissioned a study of compressor station emissions in its vicinity. Wolf Eagle Consultants performed whole air emissions sampling for VOCs, HAPs as well as Tentatively Identified Compounds (TICs). Chemicals identified as *exceeding* Texas's ESLs include: [18]

benzene
dimethyl disulfide
methyl ethyl disulphide
ethyl-methylethyl disulfide
trimethyl benzene
diethyl benzene
methyl-methylethyl benzene
tettramethyl benzene
naphthalene 1,2,4-trimethyl benzene
m&p xylenes
carbonyl sulfide
carbon disulfide
methyl pyridine
dimethyl pyridine

In 2011 and 2013, Earthworks, a non-profit organization, collected air samples within 0.33 miles of two compressor stations: Springhill compressor in Fayette County and the Cumberland/Henderson compressor station in Greene County, Pennsylvania.[19] Results from samples collected include:

1,1,2-Trichloro-1,2,2-trifluoroethane,
1,2-dichlorobenzene
2-butanone
benzene
carbon tetrachloride
chloromethane
dichlorodifluoromethane
ethylbenzene
methane
methylene chloride
tetrachloroethylene
toluene
trichloroethylene
trichlorofluoromethane

Anecdotally, we know that people living near compressor stations report episodic strong odors as well as visible plumes during venting or blowdowns. Residents often report symptoms that they associate with odors such as burning eyes and throat, skin irritation, and headaches. These are simply anecdotes but they are fairly consistently reported. It should be noted that residents in southwest Pennsylvania where these anecdotes were collected, often live near drill pads and in some instances processing plants along with compressor stations.[20]

Emissions pathways

In addition to the emissions produced during the normal operations of a compressor station there are several other ways that emissions might be dispersed from the site. These include fugitive releases, blowdowns, and accidents. Trucks play a significant

role in the emissions profile during construction but are not common once the facility is complete and on line.

Fugitive emissions

Fugitive emissions are uncontrolled or under-controlled releases. They occur from equipment leaks and evaporative sources. DTI includes fugitive emissions in its estimate of VOC emissions. Other categories of fugitive pollutants such as PM likely would increase if they were included in emissions projections. It has been suggested that fugitive emissions will increase over time as machinery begins to wear.[21]

There does not appear to be a central publically available source of information of these emissions. There are, however, many opportunities for fugitive emissions to be released from a compressor station. We were able to locate only one study on natural gas compressor station fugitive emissions. In that study, conducted in the Fort Worth, TX area, researchers evaluated compressor station emissions from eight sites, focusing in part on fugitive emissions. A total of 2,126 fugitive emission points were identified in the four month field study of 8 compressor stations: 192 of the emission points were valves; 644 were connectors (including flanges, threaded unions, tees, plugs, caps and open-ended lines where the plug or cap was missing); and 1,290 were classified as Other Equipment. The Other category consists of all remaining components such as tank thief hatches, pneumatic valve controllers, instrumentation, regulators, gauges, and vents. 1,330 emission points were detected with an IR camera (i.e. high level emissions) and 796 emission points were detected by Method 21 screening (i.e. low level emissions). Pneumatic Valve Controllers were the most frequent emission sources encountered at well pads and compressor stations.[22]

Blowdowns

The largest single emission at a compressor station is the compressor blowdown.[23] They can be scheduled or accidental. As the natural gas rushes through the blowdown valve, a gas plume extends upward of 30 to 60 meters. The most forceful rush of air occurs at the very beginning, then the flow gradually slows down. The first 30 to 60 minutes of the blowdown are the most intense, but the entire blowdown may last up to three hours.[24] One blowdown vents 15 MCf gas to atmosphere on average. Isolation valves leak about 1.4 Mcf/hr on average through open blowdown vents.[25]

It is not possible to know what exactly would be emitted in a given natural gas compressor station blowdown as there is no data available. We know that it will include whatever is in the pipeline when the blowdown occurs. This would undoubtedly include the constituents of natural gas: methane, ethane, etc., and various additional constituents would be present during different episodes. We are especially concerned about the presence of radioactive material during a blowdown

[see Radioactivity section]. Anecdotally, there are reports of odors and burning eyes, headaches and coughing associated with the events.[26]

In addition to uncertainty about *what* would be emitted and therefore what nearby residents would be exposed to, there is no special mention of *how much* is emitted under different circumstances in the DTI Application. There is attention paid to these episodic events in terms of noise disturbance, but not in terms of air contamination and subsequent exposure to individuals nearby. Because DTI does not address blowdown emissions separately, we cannot know at this point if blowdown emissions are included in the annual TPY emissions projections. This should be clarified. Whether they are or are not, their potency, when they are underway, is not known although the emission is extreme.

In Section III we show why averaging over a year such extreme emission events will underestimate the risks posed by them. An exposure to blowdown concentrations of contaminants would have different health implications than a long-term lower level exposure (i.e. yearly average) to the same contaminants when the compressor is on line.

Accidents

In addition to planned emissions, fugitive emissions and blowdowns there is also the possibility of accidents at the compressor station. There are no central national or state inventories of compressor station accidents that we were able to locate. In their absence we turned to local news accounts of individual accidents (which are generally in the form of fires). Without knowing what precisely is in the pipeline nor what else (if anything) may be housed on the site, it is not possible to estimate emissions from a fire at the compressor station. The possibility, however, is very real. A gas compressor station exploded near Godley, TX. That fire destroyed the compressor station where it started and also the one next to it. The fire burned for several hours.[27] In a compressor station fire in Madison County, TX volunteer firefighters from four towns were dispatched to the site. First responders blocked roads near the site and evacuated three homes.[28] In Corpus Christi, TX a fire broke out at a compressor station which then spread to nearby brush before being extinguished.[29]

The possibility of fire or other accidents raises the concern over whether the localities surrounding the proposed Sheds compressor station have the resources available to contain a fire or explosion adequately and whether first responders and hospitals are able to care for injured workers or others nearby or whether an evacuation plan could be implemented. In Wheeler County, TX four contractors were performing maintenance activities near a compressor station when a flash fire occurred. The workers were brought to a nearby hospital. Two were treated and released; the other two were transferred to a burn unit in Lubbock.[30] In Carbon County, UT an explosion and fire damaged a natural gas compressor station and other buildings on the site

injuring two workers and engulfing the facility in flame. Firefighters from every city in the county responded to the emergency. Injured workers had to be evacuated by medical helicopters.[31]

This is of particular concern for Madison County where the ambulatory squads and first response units are operated with volunteers and it has become increasingly difficult for communities in Madison County to keep these emergency medical services fully staffed and trained in advanced medical techniques and response activities.

Overall, there is little information on the division of responsibility between the company operating the facility and the locality. This should be clarified if the Sheds compressor station moves forward.

The question of radioactivity

A 2008 publication of the International Association of Oil & Gas Producers has laid out the discussion on radioactive material in the natural gas extraction and production process.

> During the production process, naturally occurring radioactive material (NORM) flows with the oil, gas and water mixture and accumulates in scale, sludge and scrapings. It can also form a thin film on the interior surfaces of gas processing equipment and vessels. The level of NORM accumulation can vary substantially from one facility to another depending on geological formation, operational and other factors.
>
> [R]adionuclides such as Lead-210 and Polonium-210 can … be found in pipelines scrapings as well as sludge accumulating in tank bottoms, gas/oil separators, dehydration vessels, liquid natural gas (LNG) storage tanks and in waste pits as well as in crude oil pipeline scrapings.[32]

The gas which flows through the pipeline likely carries gaseous radon with it, and as radon decays within the pipeline, the solid daughter elements, polonium and lead, accumulate along the interior of the pipes. There is a concern that the gas transiting, and being compressed and regulated, will have radioactivity levels which will put at risk not only the workers at these stations and along the pipeline, but potentially also to the residents.[33] Radon, a gas, has a short half-life (3.8 days) but its progeny are lead and polonium, and these are toxic and have relatively long half-lives of 22.6 years and 138 days respectively.[34] There is no data that we can turn to in order to assess the risk of radioactive exposures in our community.

III. Health risks from relevant air contaminants

Averages, peaks and health events

As stated in the Operational Emissions section, one of our primary concerns is the poor fit of a *tons per year* measurement to the assessment of risk to the public's health near the proposed Sheds compressor station. Furthermore, the National Ambient Air Quality Standards (NAAQS) used by DTI as a benchmark for air quality were not created to assess the air quality and safety in a small geographic area with fluctuating emissions. NAAQS effectively address regional air quality concerns. But these standards do not adequately assess risk to human health for residents living in close proximity to polluting sources such as unconventional natural gas development (UNGD) sites, where emissions can be highly variable. Generally, it has been shown that:

1. Current protocols used for assessing compliance with ambient air standards do not adequately determine the intensity, frequency or durations of the actual human exposures to the mixtures of toxic materials released regularly at UNGD sites, including compressor stations.
2. The typically used periodic 24-hour average measures can underestimate actual exposures by an order of magnitude.
3. Reference standards are set in a form that inaccurately determines health risk because they do not fully consider the potential synergistic combinations of toxic air emissions.[35]

Thus estimates of yearly totals of contaminants released by the Sheds compressor station do not allow for an assessment of the physiological impact of those emissions on individuals.

About the construction emissions, DTI says:

> Operations associated with Project facilities will not exceed any NAAQS. At the Sheds Compressor Station, modeling results indicate that all resultant pollutant concentrations (baseline concentration plus impact of the new compressor station) would be less than approximately 55 percent of any NAAQS. However, because of the relatively large margin between modeled concentrations and NAAQS limits, it is unlikely that any NAAQS would be exceeded from the cumulative impacts in the Project area.

NAAQS reflects what, over a region, over time, is deemed safe population-wide. This is very different than what is safe within for instance 1200 feet of this compressor station (which is how close the nearest residence is). As already stated, averaging over a year can wash out important higher spikes in emissions (thus exposures) that may occur at various points throughout the year. These high spikes can put residents at risk for illnesses caused by air toxics.

Toxicity and characterization of exposures

Toxicity of a chemical to the human body is determined by the concentration of the agent at the receptor where it acts. This concentration is determined by the intensity and duration of the exposure. All other physiological sequelae follow from the interaction between agent and receptor. Once a receptor is activated, a health event might be produced immediately or in as little as one to two hours.[36 37] In some instances, where there is a high concentration of an agent, a single significant exposure can cause injury or illness. This is the case in the instance of an air contaminant induced asthma event. On the other hand, after an initial exposure, future exposures might compound the impact of the first one, in time, producing a health effect. Repeated exposures will increase, for instance, the risk for ischemic heart disease.[38]

Peak exposures

Researchers have demonstrated the wisdom of looking at peak exposures as compared to averages over longer periods of time. Darrow et al (2011) write that sometimes peak exposures better capture relevant biological processes. This is the case for health effects that are triggered by, short-term, high doses. They write, "Temporal metrics that reflect peak pollution levels (e.g., 1-hour maximum) may be the most biologically relevant if the health effect is triggered by a high, short-term dose rather than a steady dose throughout the day. Peak concentrations … are frequently associated with episodic, local emission events, resulting in spatially heterogeneous concentrations…."[39]

Delfino et al (2002) posited that maxima of hourly data, not 24-hour averages, better captured the risks to asthmatic children, stating, "it is expected that biologic responses may intensify with high peak excursions that overwhelm lung defense mechanisms." Additionally, they suggest that "[o]ne-hour peaks may be more influenced by local point sources near the monitoring station that are not representative of regional exposures…."[40]

Because episodic high exposures are not typically documented and analyzed by researchers and public agencies, natural gas compressor stations emissions are rarely correlated with health effects in nearby residents. However, examination of published air emission measurements shows the very real potential for harm from industry emissions.[41] Reports of acute onset of respiratory, neurologic, dermal, vascular, abdominal, and gastrointestinal sequelae near natural gas facilities contrast with research that suggests there is limited risk posed by unconventional natural gas development.

Health Effects from exposures to VOCs

VOCs, present at compressor station construction and operation, are a varied group of compounds which can range from having no known health effects to being highly toxic. Short-term exposure can cause eye and respiratory tract irritation, headaches, dizziness, visual disorders, fatigue, loss of coordination, allergic skin reaction, nausea, and memory impairment. Long-term effects include loss of coordination and damage to the liver, kidney, and central nervous system. Some VOCs, such as benzene, formaldehyde, and styrene, are known or suspected carcinogens.[42] The case for elevated risk of cancer from UNGD VOC exposure has been made by McKenzie et al (2012) and others.[43]

The inhalation of the VOC, benzene, produces a number of risks including

> [acute (short-term)] drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation, and, at high levels, unconsciousness. Chronic (long-term) inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings. Reproductive effects have been reported for women exposed by inhalation to high levels, and adverse effects on the developing fetus have been observed in animal tests. Increased incidence of leukemia (cancer of the tissues that form white blood cells) have been observed in humans occupationally exposed to benzene. EPA has classified benzene as known human carcinogen for all routes of exposure.[44]

Benzene, which is documented at compressor stations by the States of Pennsylvania and Texas, carries its own risk, including risk for cancer.[45] [46] There is growing evidence that benzene is associated with childhood leukemia. Benzene affects the blood-forming system at low levels of occupational exposures, and there is no evidence of a threshold. It has been argued in the literature that "[t]here is probably no safe level of exposure to benzene, and all exposures constitute some risk in a linear, if not supralinear, and additive fashion.[47]

Another substance that is detected near compressor stations is methylene chloride. According to the EPA

> The acute (short-term) effects of methylene chloride inhalation in humans consist mainly of nervous system effects including decreased visual, auditory, and motor functions, but these effects are reversible once exposure ceases. The effects of chronic (long-term) exposure to methylene chloride suggest that the central nervous system (CNS) is a potential target in humans and animals. Human data are inconclusive regarding methylene chloride and cancer. Animal studies have shown increases in liver and lung cancer and benign mammary gland tumors following the inhalation of methylene chloride.[48]

The VOC formaldehyde is also considered a Hazardous Air Pollutant (HAP) by the US EPA (EPA).[49] It is one of the emissions chemicals that the natural gas development industry is required to report, for instance to the PA DEP. According to these reports, compressor stations are the highest UNGD source for formaldehyde.[50] For the year 2012, emissions of formaldehyde from compressor stations in Pennsylvania ranged from 0.0 TPY to 22.5 TPY. [51]

A recent study of air emissions in the Barnett shale region of Texas found concentrations of formaldehyde at sites with large compressor stations.[52] Some of these concentrations were greater than the Texas Commission on Environmental Quality's health protective levels (page 62). Formaldehyde was one of 101 chemicals found in association with methane in this study. The research showed that aromatics in particular were associated with compressor stations.

Air exposures to formaldehyde target the lungs and mucous membranes and in the short-term can cause asthma-like symptoms, coughing, wheezing, and shortness of breath. The EPA classifies it as a probable human carcinogen.[53] The World Health Organization classifies it as carcinogenic to humans.[54] It has also been associated with childhood asthma.[55] The California Office of Environmental Health Hazard assessment (OEHHA) has "identified formaldehyde as a Toxic Air Contaminant and gives it an inhalation Reference Exposure Level (REL) of 55 ug/m^3 for acute exposures and 9 ug/m^3 for both 8-hour and chronic exposures.[56] The acute REL is 74 ppb based on irritation of asthmatics.[57] It has also been linked with adverse pregnancy outcomes and reproductive and developmental toxicity.[58]

More recent investigations on formaldehyde near compressor stations are focused on the chemical reaction between methane and sunlight.[59] While it is well known that stationary compressor station engines emit formaldehyde, it is less well known that formaldehyde may also be formed at these sites through this chemical reaction. While the research is ongoing, it suggests that health hazards associated with formaldehyde may be greater than previously thought. Because reported health symptoms near compressor stations, such as respiratory impacts and shortness of breath, can be caused by exposure to formaldehyde, targeted monitoring of this chemical at these sites would be recommended.

<u>Effects from exposure to particulate matter</u>

In addition to the VOC exposure presented above, PM2.5 also poses a significant health concern and interacts with the airborne VOCs increasing their impact. In fact, at a compressor station PM2.5 may pose the greatest threat to the health of nearby residents. Fine particles are expected to reach a total of 1.136 tons for 2015 and 2016.

The size of particles determines the depth of inhalation into the lung; the smaller the particles are, the more readily they reach the deep lung. Particulate matter (PM10,

PM2.5 and ultrafine PM), in conjunction with other emissions, are at the core of concern over potential effects of UNGD.

High particulate concentrations are of grave concern because they absorb airborne chemicals in their midst. The more water soluble the chemical, the more likely it is to be absorbed onto a particle. Larger sized particles are trapped in the nose and moist upper respiratory tract thereby blocking or minimizing their absorption into the blood stream. The smaller PM2.5 however, is more readily brought into the deep lung with airborne chemicals and from there into the blood stream. As the particulates reach the deep lung alveoli the chemicals on their surface are released at higher concentrations than they would in the absence of particles. The combination of particles and chemicals serves, in effect, to increase in the dose of the chemical. The consequences are much greater than additivity would indicate; and the physiological response is intensified. Once in the body, the actions between particles and chemicals are synergistic, enhancing or altering the effects of chemicals in sometimes known and often unknown ways.[60]

Reported clinical actions resulting from PM2.5 inhalation affect both the respiratory and cardiovascular systems. Inhalation of PM2.5 can cause decreased lung function, aggravate asthma symptoms, cause nonfatal heart attacks and high blood pressure.[61] Research reviewing health effects from highway traffic, which, like UNGD, has especially high particulates, concludes, "[s]hort-term exposure to fine particulate pollution exacerbates existing pulmonary and cardiovascular disease and long-term repeated exposures increases the risk of cardiovascular disease and death."[62] PM2.5, it has been suggested, "appears to be a risk factor for cardiovascular disease via mechanisms that likely include pulmonary and systemic inflammation, accelerated atherosclerosis and altered cardiac autonomic function. Uptake of particles or particle constituents in the blood can affect the autonomic control of the heart and circulatory system."[63]

Ultrafine particles (<0.1) get less attention in the literature than PM2.5 but is found to have high toxic potency.[64] These particles readily deposit in the airways and centriacinar region of the lung.[65] Research suggests increases in ultrafine particles pose additional risk to asthmatic patients.[66] Ultrafine particles are generally produced by combustion processes. They, along with the larger PM2.5, are found in diesel exhaust.

Diesel is prevalent during the construction phase of compressor station site. High levels of diesel exhaust from construction machinery as well as trucks increase the level of respirable particles. Health consequences of diesel exposure have been widely studied and include immediate and long term health effects. Diesel emissions can irritate the eyes, nose, throat and lungs, and can cause coughs, headaches, lightheadedness and nausea. Short-term exposure to diesel exhaust also causes inflammation in the lungs, which may aggravate chronic respiratory symptoms and

increase the frequency or intensity of asthma attacks. Long-term exposure can cause increased risk of lung cancer.[67]

PM2.5 acute effects

There is an abundance of research on the health effects of short term PM2.5 exposure. Mills et al demonstrate that one to two hours of a diesel exhaust exposure, which occurs during the construction phase of development, includes reduced brachial artery diameter and exacerbation of exercise-induced ST-segment depression in people with pre-existing coronary artery disease; ischemic and thrombotic effects in men with coronary heart disease;[68] and is associated with acute endothelial response and vasoconstriction of a conductance artery.[69] Fan He et al. suggest that health effects can occur within 6 hours of elevated PM2.5 exposures, the strongest effects occurring between 3 and 6 hours. Such an acute effect of PM2.5 may contribute to acute increase in the risk of cardiac disease, or trigger the onset of acute cardiac events, such as arrhythmia and sudden cardiac death.[70]

Numerous epidemiological studies have demonstrated a consistent link between particulate matter and increased cardiopulmonary morbidity and mortality (Brook et al. 2004; Mann et al. 2002; Pope et al. 2002; Samet et al. 2009; Schwartz 1999).[71] Previous studies have suggested that PM2.5 exposure is significantly associated with increased heart rate and decreased heart rate variability (HRV; Gold et al., 2000; He et al. 2010; Liao et al. 1999; Luttmann-Gibson et al. 2006; Magari et al. 2001; Park et al. 2005).

In addition to short term exposures and associated effects, there is evidence of health impacts from long-term exposures.[72] An HIA reviewing data from a number of European cities found that nearly 17,000 premature deaths from all causes, including cardiopulmonary deaths and lung-cancer deaths, could be prevented annually if long-term exposure to PM2.5 levels were reduced. Equivalently, this reduction would increase life expectancy at age 30 by a range between one month and more than two years in the study cities. A Canadian national cohort study found positive and statistically significant associations between non-accidental mortality and estimates of PM2.5, the strongest association being with ischemic heart disease. Associations in this study were with concentrations of PM2.5 as low as only a few micrograms per cubic meter.[73] Research has also shown that there is an association between PM2.5 and hospitalization for COPD in elderly people.[74]

There is also a considerable literature on the health effects specifically from diesel emission that include PM2.5 along with chemical components. Mills et al conclude that even dilute diesel emissions can induce risk and point to ischemic and thrombotic

mechanisms for the adverse cardiovascular events associated with diesel exposure.[75] After an extensive review The EPA concluded that

> long-term inhalation exposure is likely to pose a lung cancer risk to humans. Estimation of cancer potency from available epidemiology studies was not attempted…. A noncancer chronic human health hazard is inferred from rodent studies showing dose-dependent inflammation and histopathology in rats. Short-term exposures were noted to cause irritation and inflammatory symptoms of a transient nature these being highly variable across an exposed population. The assessment also indicates that there is emerging evidence fro the exacerbation of existing allergies and asthma symptoms.[76]

Children, pregnant women and air contaminants

Children and pregnant women are especially sensitive to pollution. Many studies confirm a range of adverse effects of air pollution on children's lung function and respiratory symptoms, especially for asthmatics. Recent studies have found statistically significant associations between the prevalence of childhood asthma or wheezing and living very close to high volume vehicle roadways.[77] Other research aimed specifically at children's PM2.5 exposure has found that PM2.5 and several of its components have important effects on hospital admissions for respiratory disease, especially pneumonia. The authors count among the sources for this exposure diesel exhaust, motor vehicle emissions, and fuel combustion processes.[78] While those living near the proposed Sheds compressor station are not on what would be consider typical high volume vehicle roadways, during the construction phase of the project residents along the access roads will be exposed to heavy emissions. And even once the construction phase is completed and compressor station is up and running there are similarities in what Dominion projects it will emit and those emissions from high volume vehicle traffic.

Health effects have been found in pregnant women from high particulate highway pollution. Such particle pollution "may provoke oxidative stress and inflammation, cause endocrine disruption, and impair oxygen transport across the placenta, all of which can potentially lead to or may be implicated in some low birth weight … and preterm births." The consequences do not stop with low birth weight and preterm births because these conditions can negatively affect health throughout childhood and into adulthood.[79]

Mixtures and sequential exposures

Mixtures of pollutants are a critically important topic in addressing the public health implications of UNGD broadly and compressor stations in this case. While this report

has focused primarily on three pollutants (VOCs, formaldehyde as one example, and PM2.5), in fact, a very large number of chemicals are released together. Medical reference values are not able to take the complex nature of the shale environment, its multiple emissions and interactions into full consideration.[80] Although the shale gas industry is not unique in emitting multiple pollutants simultaneously, this industry is unique in doing so as close as 500 feet from residences.

Chemicals that reach the body interfere with metabolism and the uptake and release of other chemicals, be they vitally important biochemical produced and needed by the body or other environmental chemicals with potentially toxic effects. Some chemicals attack the same or similar target sites creating an additive effect. This is the case with chemicals of similar structure such as many in the class of VOCs. Some mixtures like PM and VOC act synergistically to increase the toxicity of the chemicals. Other chemicals released environmentally are rapidly absorbed and slowly excreted. These slowly excreted chemicals will interfere with subsequent actions of chemicals because the body has not yet cleared the effects from the earlier exposure.

Noise

Excessive noise has been associated with an array of psychological and physical effects. A review article on noise exposure and health risk published in *Noise and Health* claims that the evidence for a causal relationship between community or transportation noise and cardiovascular risk has risen in recent years. In sum, the author finds limited evidence for a causal relationship between noise and biochemical effects; limited or sufficient evidence for hypertension; and sufficient evidence for ischemic heart disease.[81]

According to a World Health Organization assessment of research, excessive noise can also increase risk of cognitive impairment in children, sleep disturbance, tinnitus, and high levels of annoyance.[82] Researchers have found associations between elevated sound levels – including community sounds levels – and hearing loss, reduced performance and aggressive behavior.[83] Additionally some attention is being paid to the health effects of vibration exposure which is connected with but distinct from noise itself.[84]

Noise exposures are associated with construction activities and during blowdown episodes. Although noise estimates were provided by DTI, we believe the effects of these exposures as well as vibration exposures should be evaluated by outside experts in the field. As with air exposures, the periods of extreme exposures (in this case noise exposures) can cause different and sometimes more serious effects than low-level exposures.

Summary

In sum, we know that a number of different chemicals as well as PM2.5 are present during the construction phase of compressor stations and they are present in close proximity to compressor stations that are on line. Some, although not all, have documented health effects on vulnerable populations and on the population at large. What we do not know, in the case of the proposed Sheds compressor station, is the precise mix and concentration of chemicals that will be released into the air. Without that information it is not possible to assess the compressor station's full impact on area residents. A thorough community health study could, however, reveal important risks specific to residents in Madison County, NY.

IV. Reported health effects specific to compressor stations

There is a growing body of research on emissions and health impacts from UNGD generally, though few studies specifically address health impacts from compressor stations. This is partly due to the fact that many compressors are sited in proximity to other UNGD sites such as well pads, impoundments, condensate tanks and processing stations. As the infrastructure for transporting natural gas continues to expand, more pipelines, metering stations and compressor stations will be sited away from other UNGD facilities.

Recent research that has been conducted near compressor stations in different parts of the country shows consistencies in the types of symptoms experienced by those living near these sites. These symptoms are associated with health impacts on respiratory, neurological and cardiovascular body systems. It should be noted that in each of the studies cited here health survey forms were filled out by residents and, as such, the findings are self-reported. To date there have been no epidemiological studies performed to identify health impacts from compressor stations.

A peer-reviewed article, *Investigating Links Between Shale Gas Development And Health Impacts Through A Community Survey Project In Pennsylvania* (2014) is one of the few publications that explicitly addresses health impacts from compressors.[85] The report states:

> In the Pennsylvania study, distance to industrial sites correlated with the prevalence of health symptoms. For example, when a gas well, compressor station, and/or impoundment pit were 1500-4000 feet away, 27 percent of participants reported throat irritation; this increased to 63 percent at 501-1500 feet and to 74 percent at less than 500 feet. At the farther distance, 37 percent reported sinus problems; this increased to 53 percent at the middle distance and 70 percent at the shortest distance. Severe headaches were reported by 30 percent of respondents at the farther distance, but by about 60 percent at the middle and short distances. [86] P.62

Age groups also responded differently in terms of health symptoms:

> Among the youngest respondents (1.5-16 years of age), for example, those within 1500 feet experienced higher rates of throat irritation (57% vs. 69%) and severe headaches (52% vs. 69%). It is also notable that the youngest group had the highest occurrence of frequent nosebleeds (perhaps reflective of the more sensitive mucosal membranes in the young), as well as experiencing conditions not typically associated with children, such as severe headaches, joint and lumbar pain, and forgetfulness.
>
> Among 20- to 40-year-olds, those living within 1500 feet of a facility reported higher rates of nearly all symptoms; for example, 44 percent complained of frequent nosebleeds, compared to 29 percent of the entire age group. The same pattern existed among 41- to 55-year-olds with regard to several symptoms (e.g., throat and nasal irritation and increased fatigue), although with smaller differences and greater variability than in the other age groups.
>
> The subset of participants in the oldest group (56- to 79-year-olds) living within 1500 feet of facilities had much higher rates of several symptoms, including throat irritation (67% vs. 47 %), sinus problems (72% vs. 56%), eye burning (83% vs. 56%), shortness of breath (78% vs. 64%), and skin rashes (50% vs. 33%).
>
> In sum, while these data do not prove that living closer to oil and gas facilities causes health problems, they do suggest a strong association since symptoms are more prevalent in those living closer to facilities than those living further away. Symptoms such as headaches, nausea, and pounding of the heart are known to be the first indications of excessive exposure to air pollutants such as VOCs [36], while the higher level of nosebleeds in the youngest age group is also consistent with patterns identified in health survey projects in other states [9, 10]." P.64

Earthworks, a non-profit organization, conducted the Pennsylvania study referred to above, (Gas Patch Roulette 2012) in which they surveyed residents about health symptoms and conducted air and water tests near residences in Pennsylvania and New York[87]. In their report, specific mention is given of a residence 800 feet from a compressor station. Health symptoms experienced by the residents (parents and children) were extreme tiredness, severe headaches, runny noses, sore throats and muscle aches, as well as dizziness and vomiting by one individual.

Based on data from the Town Assessor's office (Table 1), 17 year-round residences are located within ½ mile (2,640 feet) of the proposed compressor station and 30 residences are within 1 mile (5,280 feet). The nearest residence is 1,150 feet from the site. Symptoms reported in the Pennsylvania study, primarily throat irritation, sinus problems and headaches could potentially be experienced by town residents within

these distances. Numerous additional symptoms are possible and would vary depending upon the age and overall health of individuals.

Earthworks also conducted a health survey in Dish, Texas in 2009.[88] The health symptoms reported to be associated with compressors were: burning eyes, nausea, headaches, running nose, sore throat, asthma, sinus problems and bronchitis. Odors experienced by residents near compressor stations were described as: sulfur smell, odorized natural gas, burnt wire, strong chemical-like smell and ether.

Wilma Subra[89], an environmental chemist and consultant who is on the Earthworks Board of Directors, has compiled information on health symptoms experienced near compressor stations based on her research with communities concerned about health impacts from UNGD[90]. Subra has served as Vice-Chair of the Environmental Protection Agency National Advisory Council for Environmental Policy and Technology (NACEPT), and recently completed a five year term on the National Advisory Committee of the U.S. Representative to the Commission for Environmental Cooperation and a six year term on the EPA National Environmental Justice Advisory Council (NEJAC) where she served as a member of the Cumulative Risk and Impacts Working Group of the NEJAC Council. While her research on health impacts associated with compressor stations is reported back to communities, most of the data shown here have not been published in peer-reviewed journals (she is an author on the above-mentioned peer-reviewed article on Pennsylvania data).

Subra has reported the following health impacts in association with compressor stations:

Table 2. Most Prevalent Medical Conditions In Individuals Living in Close Proximity to Compressor Stations and Metering Stations

Medical Conditions:	% of Individuals (71)
Respiratory Impacts	58
Throat Irritation	55
Weakness and Fatigue	55
Nasal Irritation	55
Muscle Aches & Pains	52
Vision Impairment	48
Sleep Disturbances	45
Sinus Problems	42
Allergies	42
Eye Irritation	42
Joint Pain	39
Breathing Difficulties	39
Severe Headaches	39

Swollen & Painful Joints	32
Frequent irritation	32

The full list of health impacts "Reported by Community Members Living 50 feet to 2 miles from Compressor Stations and Gas Metering Stations Along Gas Transmission Pipelines" is available at the Luzerne County Citizens for Clean Air website[91]. It is notable that Subra reports that 61% of health impacts are associated with the chemicals present in the air that were in excess of short and long term effects screening levels.

Subra further reports that the following units at compressor stations and gas metering stations release emissions into the air:

Compressor Engines
Compressor Blowdowns
Condensate Tanks
Storage Tanks
Truck Loading Racks
Glycol Dehydration Units
Amine Units
Separators
Fugitive Emission Sources

She reports that 90% of individuals surveyed reported experiencing odor events from these facilities. Based on her analysis, the following health symptoms are associated with the chemicals detected in the air at compressor stations:

Allergies
Persistent Cough
Shortness of Breath
Frequent Nose Bleeds
Sleep Disturbances
Joint Pain
Difficulty in Concentrating
Nervous System Impacts
Forgetfulness
Sores and Ulcers in Mouth
Thyroid Problems

Subra reports that both the construction and production phases of compressor stations can cause acute and chronic impacts. In the construction phase impacts come from diesel truck emissions and from dust particles. In the production phase impacts are derived from constant emissions, venting, blowdowns, accidents/malfunctions and from the effects of noise, light and stress. She considers respiratory health impacts of particular concern, and vulnerable groups such as pregnant women, children, the elderly and sensitive individuals to be at greatest risk. Acute and chronic health impacts that Subra has documented are listed below.

Acute Health Impacts Experienced by Individuals Living and Working near Compressor Stations

Tense and nervous
Joint and muscle aches and pains
Vision Impairment
Personality changes
Depression, Anxiety
Irritability
Confusion
Drowsiness
Weakness
Irregular Heartbeat

Irritates skin, eyes, nose, throat and lungs
Respiratory impacts
Sinus problems
Allergic reactions
Headaches
Dizziness, Light headedness
Nausea, Vomiting
Skin rashes
Fatigue
Weakness

Chronic Health Impacts Experienced by Individuals Living and Working near Compressor Stations

Damage to Liver and Kidneys
Damage to Lungs
Damage to Cardiovascular System
Damage to Developing Fetus
Reproductive Damage
Mutagenic Impacts
Developmental Malformations

Damage to Nervous System
Brain Impacts
Leukemia
Aplastic Anemia
Changes in Blood Cells
Impacts to Blood Clotting Ability

Radioactive elements: a long-term health threat

The possibility of exposure to radiation from natural gas pipelines and compressor stations is also a concern, especially for long-term health effects. The New York public health group, Concerned Health Professionals of New York, describes the problem in their report, Compendium Of Scientific, Medical, And Media Findings Demonstrating Risks And Harms Of Fracking (Unconventional Gas And Oil Extraction) (July 10, 2014): "Unsafe levels of radon and its decay products in natural gas produced from the Marcellus Shale, known to have particularly high radon content, may also contaminate pipelines and compressor stations, as well as pose risks to end-users when allowed to travel into homes."(P.5). Health impacts from exposure to radioactive materials in compressor station emissions have not been documented, but the risk of exposure to these carcinogens are a serious public health concern.

V. Concerns from residents

FERC is required by NEPA to address concerns reported by local residents in the permitting process. Engaging community members in this process can effectively inform decision-making that ultimately improves public safety.[92,93]

In the public comments submitted to FERC by residents and in comments submitted to the MCDOPH, concerns about health risk are a priority. In reviewing these comments we found that of the 15 individuals who submitted comments to FERC the top 10 concerns mentioned were:

Food safety (risks to crops/farms/gardens and consumers)	10
Health risks (including risks to children)	9
Home values (resale, insurance, mortgage)	9
Air pollution	8
Environment	8
Water pollution	7
Noise pollution	7
Safety record of compressors	7
Rural character of community disruption	7
Wildlife	7

Of the 21 comments written to the MCDOPH during and following two public information meetings the top ten concerns were[94]:

Health Risks (including risks to children)	19
Food safety (Risks to crops/farms/gardens and consumers)	16
Air pollution	15
Noise pollution	14
Safety record of compressors	11
Water pollution	11
Emergency response	9
Rural character of community disruption	7
Home values (resale, insurance, mortgage)	7
Pipeline safety	5

Health safety and food safety are the top concerns for these residents. While the risks to health from potential chemical exposure is documented (and summarized above in relation to compressors), less is known about the route of exposure from air emissions through soil and food pathways. There are reports of soil contamination from UNGD caused by spills, leaks and underground contamination[95,96]. For this industry, we found no documentation of soil and plant contamination from air pollutants, but the pathway for contamination through air is well documented.[97 ,98 ,99] Thus concerns about food safety related to air emissions should not be discounted.

There is evidence of loss of property values near UNGD sites, though not specifically addressing to compressor stations.[100,101] Risks to wildlife and local habitats from UNGD has been addressed in the literature by Kiviat (2013).[102] Concern about accidents,

emergency response, compressor safety records and pipeline safety are related issues that bear on public health. In fact, each of the concerns listed above is related, directly or indirectly to public health. From the broad scope of "environment" and "rural community character" to the specifics of safety records and emergency response, these issues impact the health and wellbeing of the local community. These concerns can best be addressed through a thorough assessment of health risks.

VI. Recommendations for framing and scoping the public health issues for the Sheds compressor station:

FERC should consider expanding the scope of its public health analysis on the Sheds compressor station to address the concerns raised in this report to ensure that public health is not endangered in Madison County. To protect public health it is necessary to know whether dangerous spikes in pollutants will ever occur at this compressor station, how often, and what the health effects would be for nearby residents in the short and the long term. The important impact of local weather conditions on exposure profiles also needs to be considered.

To adequately assess human health impacts public health professionals and analysts would need to know:

- The pathways of exposure (air, water, soil)
- The intensity of the exposure
- The frequency of the exposure
- The duration of the exposure
- Interaction of components of the chemical mixture
- Length of time living near the compressor station

Public health professionals understand that:

- Chemical toxicity in the human body can occur within minutes or hours of exposure.
- Repeated episodic exposures increase the damage.
- High exposures to chemicals increase the seriousness of the damage.
- Understanding the variability of exposure is essential.

The need for a public health perspective in the process of regulating UNGD including transportation infrastructure has been presented in peer-reviewed journals, at scientific conferences and in public comments to State officials. See the following references:

A. Wernham, "Health Impact Assessment for Shale Gas Extraction," www.healthimpactproject.org/resources/health-impactassessment-for-shale-gas-extraction (accessed July 30, 2014).

Adgate, JA, Goldstein, BA and Mckenzie, LM. Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development Environmental Science and Technology. 2014. [103]

Adgate et al (2014) report that :
"… pollution from UNG development originates from (1) direct and fugitive emissions of methane and nonmethane hydrocarbons from the well and associated infrastructure (e.g., production tanks, valves, pipelines, and collection and processing facilities); (2) diesel engines that power equipment, trucks, and generators; (3) drilling muds, fracturing fluids, and flowback water; and (4) deliberate venting and flaring of gas and related petroleum products." (page D)[104]

They further state that:
"Pilot studies in Colorado's Piceance Basin, Pennsylvania's Marcellus, and Texas's Barnett Shale indicate that VOCs, including C2− C8 alkanes, aromatic hydrocarbons, methyl mercaptan, and carbon disulfide, are emitted during well completions as well as from compressors, condensate storage tanks and related infrastructure." (page E)[105]

The lack of environmental public health expertise on advisory panels at the state and federal levels has also been addressed by:

Goldstein, B., Kriesky, J., Pavliakova, B. "Missing from the Table: Role of the Environmental Public Health Community in Governmental Advisory Commissions Related to Marcellus Shale Drilling." Environmental Health Perspectives. Vol 120(4)483-486, 2012. [106]

<u>Baseline health data and environmental data: where to find it</u>

Baseline health data provides the foundation for effective public health assessments. Numerous sources are available to develop a baseline dataset for specific locations and to identify susceptible populations. Primary resources are listed below.

The gathering of environmental data for assessment of health impacts would, in the case of compressor station air emissions, require accessing data on a subset of known chemicals emitted at similar sites (e.g. a similar size compressor station during normal operation including blowdowns and venting). The monitoring protocols at existing sites would need to address the realtime variations at compressor stations, capturing peak emissions as well as duration of peaks. Public health officials could then more accurately estimate health impacts for both acute and cumulative exposures to the local population.

Local baseline health statistics are necessary so that risk can be assessed in relation to a specific population. Baseline data sources include County, State and Federal health statistics databases. Nongovernmental resources include the American Lung

Association, American Cancer Society and the National Cancer Institute. Recommended baseline health topics and sources of data are listed below.

Physical health determinants:

- Major causes of morbidity and mortality: CDC Wonder; National Cancer Institute
- Life expectancy: CDC's Community Health Status Indicators
- Poor physical health days: Behavioral Risk Factor Surveillance System (BRFSS)
- Chronic disease: BRFSS
- Identification of vulnerable populations: County level health data and sociodemographic data
- Birth outcomes: Health Indicators Warehouse and National Vital Statistics System
- School data: New York State Department of Health, Health Data NY, Schools, Statistics and Chronic Diseases
- Hospital data: New York State Department of Health, Health Data NY, Hospital reports

Environmental health determinants:

- Baseline local air quality: requires targeted monitoring in addition to current NAAQS data
    - To estimate the impact of compressor station air emissions MCDOH suggests site specific air monitoring from comparable compressor stations to capture the intensity, duration and frequency of peak emissions that could impact public health (including blowdowns). A subset of known chemicals could be tested for including but not limited to BTEX, methylene chloride, formaldehyde, $PM_{2.5}$ and ultrafine particles.
    - This can be followed by the modeling of emissions dispersion that takes local topographic and meteorological data into consideration. In this way the potential for spikes in exposures can be estimated for different locations.
- Soil health: perform baseline soil tests for relevant chemicals to establish baseline levels in case of future potential contamination of local yards, play areas and gardens as well as local agricultural fields and farm products.
    - To be followed by periodic soil tests if permit is granted.
- Baseline local water quality: requires targeted testing of local wells and surface waters [of concern to residents]
    - To be followed by periodic monitoring of local water resources if permit is granted.
- Noise levels: compare current and projected levels.
- Traffic: compare current and projected levels.
- Construction: assess projected impacts from dust and diesel emissions.

Suggested references of reports that assess health impacts, including cumulative risks, related to UNGD

University of Maryland: Potential Public Health Impacts of Natural Gas Development and Production in the Marcellus Shale in Western Maryland. Maryland Institute for Applied Environmental Health School of Public Health University of Maryland, College Park. July 2014.[107]

New Brunswick, Canada: Chief Medical Officer of Health's Recommendations Concerning Shale Gas Development in New Brunswick. Office of the Chief Medical Officer of Health, New Brunswick Department of Health. 2012.[108]

Colorado School of Public Health: Battlement Mesa Health Impact Assessment, Colorado School of Public Health, February, 2011 [109]

State of Alaska: Health and Social Services Alaska Health Impact Assessment Program[110]

VII. Data gaps and other challenges for implementing a health assessment:

There are a number of knowledge gaps that make it difficult to perform a thorough public health analysis, yet each such effort contributes to the broader challenge of understanding the health consequences of living near UNGD installations, including compressor stations.

1. Baseline health studies: Studies on health status before infrastructure development are lacking, yet are critical for measuring health impacts.[111] Currently little is known about the direct consequences of living near these sites. Baseline studies in relation to UNGD are needed and should be followed by health status monitoring during development and production phases.

2. Chemical constituents: More site specific monitoring is needed to quantify and qualify the chemical constituents of compressor station emissions. Emissions can vary between sites as well as over time at each site. Normal operations will produce different emissions from venting, blowdowns or accidental releases. Targeted monitoring can help address this gap by providing information on the chemical identities and quantities along with timeline and duration of emissions that may lead to exposures.

3. Chemical toxicity and chemical mixtures: information on toxicity is lacking for some chemical constituents that have yet to be thoroughly studied. With no health standards, risks are difficult to assess. Even when health standards for each chemical

are known, understanding risks to chemical mixtures in air emissions poses a greater challenge. Research on how chemicals react with each other, as well as how mixtures then affect the human body are sorely lacking. These data gaps can be mitigated to some extent by conducting health impact assessments.

4.: Pipeline and metering station emissions: In addition to compressor stations, pipelines and metering stations also emit chemicals into the air. These emissions contribute to both environmental and public health impacts. Targeted monitoring would help in assessing regional air quality impacts, as well as local impacts for residential areas.

5., Radioactive emissions: Natural gas sourced from shale plays is known to contain radioactive elements. These elements build up in pipeline scale. The extent to which radioactive materials are emitted during venting, blowdowns or other events is not well known. Monitoring specifically for harmful radioactive substances is needed.

6. Air dispersion modeling: Determining how emissions travel from a source to nearby residents is an important part of understanding human exposure. The topography and the weather patterns of each local environment affect dispersal patterns. Consequently some residents may be impacted more than others. Targeted air dispersion modeling for specific industrial sites can contribute to anticipating local health impacts.

7. Soil and farm products: With the increased placement of natural gas transmission infrastructure through rural farming communities, the need for monitoring soils and farm products for chemical contamination also increases. As chemical constituents are identified, targeted soils and food testing can help bridge this knowledge gap.

VIII. Recommendations and mitigation (if permit granted)

In the event that the DTI New Market project is permitted by FERC, MCDOH would make the following recommendations so that public health can be adequately addressed :

1. Perform a baseline health study to establish population health status before the compressor station is built.

- A baseline health study would allow MCDOH to monitor and measure health impacts over time and support the development and initiation of mitigation for health consequences if any are found.
- A baseline study that includes air pollution monitoring would provide data to distinguish between background and additional impacts from compressor station emissions. With indoor air monitoring in residences, distinctions could be made between the use of natural gas in the home on a regular basis and the potential impact of emissions dispersing into residences. For example, a measure of spikes

that might occur from cooking (short-term) would look different from longer-term spikes that result from outdoor air pollution, or nighttime spikes that might occur due to weather conditions.

2. Require best practices to ensure that effective emissions control measures are kept up to date.
Technology is rapidly changing in this industry and while some improvements have been made in emissions controls and environmental impacts, there is room for more improvement. To protect public health, MCDOH recommends that upgrades to equipment be required for continued operation of the compressor station. [112]

The health effects of living near compressor stations include impacts from this constant source of noise. To reduce these health effects MCDOH requests the implementation of special noise abatement measures such as those in use at the Minisink Compressor Station. These include the addition of an "internal mass septum layer for the compressor building walls and roof; additional baffle length for the first and second stage exhaust silencers; high performance turbine exhaust and air inlet systems; low noise turbine lube oil coolers; and unit blowdown silencers." [113] It should be noted, however, that some residents near the Minisink Compressor station continue to report that noise and vibrations interfere with their quality of life. Continued upgrades would help to mitigate ongoing effects.

3. Establish an alert system for blowdowns or other large emissions and/or noise events. These types of events, while considered a normal part of compressor station operations, can potentially cause health effects for nearby residents. A system that alerts residents to the intensity and duration of these events is recommended.

4. Put Emergency Plans in place. The application filed by DTI states that the company is not required by the USEPA to prepare a risk management plan for the New Market Project. Because of the risk of chemical accidental (or intentional) release at levels that could harm human health, MCDOH recommends that emergency plans be put in place for both pipeline release events, metering station events and compressor station accidents. In association with emergency plans, MCDOH further recommends that :

- First responders be properly trained for these specific scenarios
- Local health providers receive training for specific environmental exposures
- An evacuation plan is put in place

5. Institute a monitoring strategy at the Sheds compressor station and surrounding locations. To adequately protect public health it is necessary to measure air emissions at the source and to determine air pollution impacts locally. MCDOH recommends monitoring air emissions such as formaldehyde, VOCs and particulate matter at residences within one mile of the compressor station. MCDOH also recommends monitoring impacts to soil and crops within one mile of the compressor station to

assess impacts on farm products. With realtime monitoring in place, DTI would have the capability to respond to events that jeopardize human health and adjust venting events accordingly.

6. Institute a health registry. MCDOH recommends that a regional health registry be established so that long-term health effects from natural gas infrastructure, including the Sheds compressor station, can be adequately assessed. Ideally this registry would be part of a larger state and/or national level registry, since the infrastructure for natural gas energy is increasing across the USA.

IX. Summary of Questions for FERC to address in assessing risks to public health

1. What is the health status of the local population?
2. What chemicals will be emitted, at what concentrations and in what mixtures?
3. How often do releases occur (frequency), how long do they last (duration) and at what intensities? What times of day do they occur?
4. What is the health effect downwind, especially at night for residences within 1 mile of the compressor?
5. Will radioactive material be emitted (intentionally, as fugitives or accidentally) and if so, at what levels?
6. Are adequate emergency/notification plans in place?
7. Are adequate mitigation strategies in place?

X. Glossary of Abbreviations

CDC	Centers for Disease Control
DTI	Dominion Transmission, Incorporated
EPA	Environmental Protection Agency
HAP	Hazardous Air Pollutants
MCDOH	Madison County Department of Health
NAAQS	National Ambient Air Quality Standards
PM	Particulate Matter
REL	Reference Exposure Level
UNGD	Unconventional Natural Gas Development
VOC	Volatile Organic Compound
USA	United States of America
USEPA	United States Environmental Protection Agency

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From: kar6of6@comcast.net
To: Finke, John (Health); Birckhead, Lori
Subject: TGP Public Comment
Date: Sunday, July 31, 2016 8:25:58 PM

Under the DOE CEQ NEPA regulations, section 1508.27, the word 'significantly' "requires considerations of both context and intensity". Referring to context, "the significance of an action must be analyzed in several contexts, such as society as a whole, the affected region, the affected interests, and the locality". "Both short-term and long-term effects are relevant". And with regard to intensity, "this refers to the severity of impact". "The degree to which the proposed action affects public health or safety", "unique characteristics of the geographic area such as...ecologically critical areas", the "degree to which the effects on the quality of human environment are likely to be controversial", and "the degree to which the possible effects on the human environment are highly uncertain or involve unique risks" are all poignantly relevant and of the highest importance when considering the potentially harmful impacts of TGP's proposed CS563 will have not only affect Joelton, but Nashville and areas beyond, as well. A leak at this station has the capability of negatively impacting the drinking water of an entire area, as it sits atop karst-ridden geology permeated by underground streams. This station will "permanently changing the ambient air", and has the capability of harming the citizens of an entire town with its polluting toxicants for decades. This station will also impact the soil by removing forest areas and allowing for increased runoff that will also pollute streams that feed major water sources like the Cumberland River. However, you, the Health Department could use "the degree to which the action may establish a precedent for future actions" for Nashville's good, by denying the Title V air permit TGP is requesting, thus negating all the negative impacts before they are established. But if you decide to proceed, you may wish to check Section 1508.18, Major Federal Action, "actions that include the circumstance where the responsible officials fail to act". Because if something catastrophic should happen, and you were warned ahead of time but failed to act, "that failure to act is reviewable by courts or administrative tribunals under the Administrative Procedure Act". Thank you for your attention to this matter.

Kathy Rodgers

From:	Christina & James Wright
To:	Finke, John (Health)
Subject:	Health concerns re: Joelton"s preposed gas compressor
Date:	Sunday, July 31, 2016 7:53:23 PM

Dear Mr. Finke,

I am writing you today because I am a concerned citizen and lifetime resident of Nashville. I am concerned about the future of our city and the health of the residents.
The following statements I have pulled from the Environmental Assessment from FERC regarding the proposed Joelton Gas Compressor.
Thank you for your time and attention to these matters.
<!--[if !supportEmptyParas]--> <!--[endif]-->
Sincerely,
<!--[if !supportEmptyParas]--> <!--[endif]-->
Mrs. Christina Wright
<!--[if !supportEmptyParas]--> <!--[endif]-->
My concerns are as follows:
<!--[if !supportEmptyParas]--> 2.6.2 Transportation and Traffic pg 83
Our area, where the proposed site for the Compressor Station 563 is, we are called, “sparsely populated, rural area.” In reality we are a residential community with only a few small farms scattered through out the neighborhoods. This compressor station would have a road frontage on to Tennessee Route 65/US Highway 431, which is a major thoroughfare from Springfield, TN to Nashville, TN. This highway is heavily traveled especially during rush hours. The current traffic is already too much for this 2-lane highway. According to Tennessee Department of Transportation (TDOT) website the Annual Average Daily Traffic count from 2013 was 11,390 and 2014 was 11,241. This is hardly what I call a rural area. This highway has frequent wrecks often with fatalities. This added construction traffic has a great potential for grave disaster on an already over crowded highway. When compared to the other sites which include Compressor Station 118A and 875, both are stated to be on an unpaved, one-lane roads. It does not seem logical to consider this site for a compressor station at all.
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2.6.3 Property Values
I appreciate the fact that I can appeal to the local assessor’s office if I feel I have overpaid my property taxes. However, what if I choose to sell my property and no one wants to buy it? Who will compensate me then? Would Tennessee Gas be willing to buy my property at “fair market value” as valued before the gas compressor’s construction?
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2.11.10 Air Quality page 119
States “Operation of Compressor Station 563 would exceed the Title V major threshold for Nox. Cumulative actions within Davidson County would be required to comply with federal, state, and local air regulations…” Due to the bowl shape topography of Nashville, we already have a problem with air quality in the summer. The air pollution lingers over the city. It is in unreasonable to think this problem is one that Davidson County needs to bear when a location to another site, that is not bowl shaped, would solve this problem. Also, once built, Compressor 563 will produce no jobs for the area. The presence of this Compressor will prohibit another industry from coming here, which will provide jobs for local people, because we will have exceeded the pollution level.
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Bats: On page 70 the EA states: “Due to habitat loss, we conclude the Project would likely adversely affect northern long-eared bats in Tennessee. In a letter dated December 15, 2015, the Tennessee Field Office of the FWS agreed with this conclusion and stated that consultation under Section 7 of the ESA is complete for the northern long-eared bat in Tennessee.”
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Also, on page 69 it states, “The FWS listed the northern long-eared bat as threatened under the ESA on April 2, 2015 due to dramatic population declines attributed to white nose syndrome, a fungus-

caused disease affecting hibernating bats. White nose syndrome has caused extensive mortality of northern long-eared bats, especially throughout the northeast where the species has declined by up to 99 percent from pre-white nose syndrome levels at many hibernation sites (FWS, 2015g). The FWS has identified counties where white nose syndrome is known to exist as part of an interim rule under Section 4(d) of the ESA. All compressor station sites are within counties with verified occurrences of white nose syndrome (FWS, 2015c).” With the emergence of the Zika virus and the danger it poses to humans, why is it all right to reduce the bat population further when a mosquito born illness is on the rise? Currently, the CDC has issued an alert that the Zika Virus is spreading.
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From: kar6of6@comcast.net
To: Finke, John (Health); Birckhead, Lori
Subject: TGP Public Comment
Date: Sunday, July 31, 2016 7:36:00 PM

In its filings to FERC, Tennessee Gas Pipeline/Kinder Morgan only devoted eight (8) pages to "Reliability and Safety" with regard to CS563. It is supposed to, according to 18 CFR 380 Regulations, discuss "the environmental impact" that could ensue from failure of plant - TGP does not do this. TGP is supposed to "describe measures used to exclude the public from hazardous areas" - it does not, except for stating the building of a fence topped with razor wire. However, once this compressor station is built, the bearing of a Title V classifies the whole station area as a "hazardous air polluter" capable of having a negative impact on the air for up to thirty miles from the plant. How then do we the people of Joelton avoid this hazard? What TGP does state are the following: "Natural gas transmission facilities are designed and maintained in accordance with USDOT regulations and industry standards and have an excellent record of public safety and reliability. For the Project, Tennessee will employ all applicable system design, construction, operation, and maintenance practices in order to maintain this excellent record." Yet, from 1994 to 2013, there were 2,120 "incidents" that resulted in fatalities. TGP admits that "The greatest hazard of a natural gas transmission line is a major pipeline leak or pipeline rupture that results in a fire or explosion." Most of these "incidents" involved explosions. TGP then states, "Minimum standards are established" for their pipelines - **not maximum, only minimum**. TGP states that CS563 will be equipped with "system monitoring equipment, unit/station shutdown protection, and a number of “fail-safe” systems". Yet, if they are as failsafe as TGP claims, why 2,120 "incidents"? "USDOT regulations (49 CFR Part 192) specify that compressor stations must have an emergency shutdown system that can be manually operated from at least two points". Yet, TGP states in their EA that there is only going to be one person hired for CS563, and unless that person plans to live there year-round, there will be no one 24-7 at this station to handle a manually operated shutdown. TGP states that "If an emergency situation requires depressurization of the piping to and within the compressor station, venting of the gas would take less than ten minutes", however in the EA, these emergency blowdowns only last a minute. But what toxicants are vented with this 'gas' and at what quantities? Are these emissions counted in your air control studies? "Stations will be equipped with standard fire protection (dry chemical fire extinguishers), first aid, and safety equipment. Personnel will be trained in proper first aid application, as well as proper use of fire protection and safety equipment". Yet, again, as there may be no one there at the station, what happens then? Who takes ultimate responsibility for this, TGP or Metro? And lastly, TGP states that its pipelines are "designed to safely handle the additional gas volumes that Tennessee proposes to transport through the system", and "will continue to operate and maintain its belowground pipeline facilities in accordance with USDOT regulations". But several questions have been raised as to the safety of the old pipelines and the pressurized high speeds that TGP plans to use - what happens if these old pipes that are "minimal' at best can't handle the high speeds placed on them? Also, TGP has many exposed pipes in the area that they have been made aware of and still haven't repaired, one in Portland that was aired on channel 17 news - the lady said she'd

called TGP three years ago and they still hadn't repaired the hole and exposed pipe. TGP isn't the good neighbor they profess to be - this should prove it. I hope that you will look into the above questions and consider carefully when weighing your decisions about this massively important Title V permit. Thank you.

Kathy Rodgers

From: kar6of6@comcast.net
To: Finke, John (Health); Birckhead, Lori
Subject: TGP Public Comment
Date: Sunday, July 31, 2016 6:55:22 PM

Dear Mr. Finke,

According to a Tennessean article Monday, August 17, 2015 on the fears of a leg of the same TGP line running through Kentucky and close to Mammoth Cave, it states "While natural gas used in homes is methane, natural gas liquids are separated at the well site and can include a variety of hydrocarbons, including ethane, propane and butane...Under the plan, Kinder Morgan would move natural gas liquids from fracking zones in OH and PA more than 900 miles through a repurposed pipeline to...Louisiana and Texas." This is the same pipeline that runs through Joelton. KM/TGP also tells Kentucky the same thing it told us Wednesday, in that they are "committed to public safety, protection of the environment", yet they clearly want to do the opposite by pushing this unnecessary pipeline through KY and TN to export our natural resources overseas. We in Joelton have the same karst geology as KY, which is porous limestone with sinkhole potential, and contains many clean underground streams that many families pull their drinking water; the streams on the Joelton property at CS563 meet to form headlands to the Cumberland River where Nashville gets their drinking water. The Mammoth Cave park superintendent states that "The National Park Service is concerned about the potential for a catastrophic failure of the pipeline" which would endanger many fragile, rare species. The park service recommends using "intensive groundwater dye-trace studies to determine potential harm" for waterways, for if there is a leak, it can quickly spread for miles and threaten valuable, irreplaceable water sources, and our water cannot be replaced. There are several local and one state park of "regional interest and value" that the FERC EA left out - it mentioned Mammoth Cave, but totally ignored the smaller Dunbar Cave in Clarksville (about 34 miles from CS563), Beaman Park (not 8 miles from CS563) and local fishery Marrowbone Lake (about 8 miles from CS563). This compressor station not only has the potential to ruin our local water supplies, but to also "permanently change our ambient air" as stated in FERC's EA. Before issuing the Title V air permit that would allow this nightmare to become a reality, perhaps now is the time to look at this with a new set of objective eyes and consider what this station and all its toxicants will really do to this area of our great state. Thank you.

Kathy Rodgers
4060 Bernard Rd.
Joelton, TN

PS, Kinder Morgan/TGP claimed to be a good neighbor in Wednesday night's meeting, yet, in the same article mentioned above states this about the 70 year old pipeline they're planning on using to send this mess through: "For its part, Kinder Morgan promised 'to review data and records' to find 'unacceptable' imperfections in the pipeline and would **'where necessary'** upgrade sections to bring them up to current code". They won't replace all the old pipe, but only a bit of it...I wonder how

long that old pipe will hold out when they increase the speeds of the gas with the 60,000HP machinery they're planning on using at CS563? How safe do you believe that to be? And do you still think of them as 'good neighbors'?

From:	kar6of6@comcast.net
To:	Finke, John (Health)
Subject:	TGP Public Comment
Date:	Sunday, July 31, 2016 6:32:26 PM
Attachments:	Response to the Health Department.docx

Please find attached a letter on the Broad Run Compressor station 563. Thank you.
Kathy Rodgers

My name is Kathy Rodgers. I was in attendance at the Lentz public hearing on Wednesday and turned in a report I compiled of research studies done on the health effects associated with unconventional natural gas facilities, including compressor stations. I was unable to fully explain my interest in doing such an undertaking because of time constraints, so I will do this now. My family has lived in Joelton for over a hundred years, so you might say I have a vested interest in what goes on in my town. That is one reason why I became involved in fighting this proposed compressor station planned for Joelton. I have done much research as a private citizen on the kinds of toxins these stations can emit into the air, soil and water, toxins like formaldehyde, benzene, hexane, methane, sulfur dioxide, nitrogen dioxide, etc. These toxins can produce immediate and chronic symptoms that involve nearly every system in the body. These toxins can cause cancers and diseases of nearly every organ in the body. In other normal circumstances, these toxins would have already been either severely restricted or banned from use by the EPA based on the widespread damage they can cause. When the local citizens group, CCSE asked me to look into the health effects that exposure to compressor station toxins produce, I gladly accepted, because I and my family have been impacted by chemical exposure to toxins and I know first-hand what physical ailments they can cause.

My father was in the pest control industry for over forty-five years before his death in 1994. Unintentionally through his work, my family were exposed directly and indirectly to such poisons as DDT, 1080, chlordane, pentachlorophenol, and thallium sulfate to name a few, chemicals that were later banned or severely restricted by the EPA because of their cancer-causing and toxicant properties. While chlordane and DDT were known carcinogens, they, like the others also caused cardiovascular, neurological, immunological, respiratory, gastrointestinal and endocrine damage. By the time he was fifty, my father had developed severe tremors, COPD, and cardiovascular disease. Two of my sisters died, one at 31 from liver failure, the other at 41 from ovarian cancer. My mother died of cardiovascular disease in 1998. My brother has tremors, lost his leg to bone cancer, and has psoriatic arthritis and heart disease. My oldest sister has cardiovascular disease, COPD and rheumatoid arthritis, and I am battling severe systemic lupus. I, my other two living sisters, and a niece have had complete hysterectomies by the age of 40 (I was the youngest at 29). And no one in our family histories has ever had cancer, COPD, or autoimmune problems. So I guess you might understand my concern about a Title V hazardous air emitter coming to my hometown and the reason behind the report I produced.

As I stated, you will find in the bibliography 105 citations from various respected health journals and government agencies like the EPA, Environmental Health, the CDC, the World Health Organization and so on, citations that back up the research that proves natural gas compressor stations are emitters of toxicants that cause physical harm to humans, toxicants similar to those my family and I have been exposed to, toxicants that can harm and even kill. I have only one question to ask again, and that is with all the evidence at hand, why would the Metropolitan Health Department allow the issuance of a permit that would allow such a facility to be built that can and will cause so much harm to so many? Thank you for your time.

Sincerely,

Kathy A. Rodgers
4060 Bernard Road, Joelton 615-876-2858

From:	Hawkins Management
To:	Finke, John (Health)
Cc:	Lillian Hawkins
Subject:	TGP - public comment
Date:	Sunday, July 31, 2016 3:51:49 PM

How many compressor stations would be too many to permit in Davidson County? If all of these stations "are within federal guidelines" does that mean that Davidson County could theoretically end up with dozens, or even hundreds of natural gas compression stations? How many is too many?

Based on the estimated toxins that will be emitted by this compressor station, will this prevent other types of future development such as single family homes, apartments and businesses, particularly businesses that may have some level of emission?

What is the mechanism to enforce Davidson Co. TN Local Implementation Plan, SECTION 10.56.280, which is entitles "Start-ups, Shutdowns, and Malfunctions," which requires the source to take all reasonable measures to keep emissions to a minimum during start-ups, shutdowns and malfunctions. Failures that are caused entirely or in part by poor maintenance, careless operation, or other preventable upset condition or preventable equipment breakdown shall not be considered a malfunction and shall be
considered a violation of the applicable emission standards.

Will the NOx, carbon monoxide (CO), and CO2e (greenhouse gases) from the proposed Joelton gas compression station exceed Title V maximum thresholds, as indicated by the NOx Dispersion Study conducted by Dr. William Robertson?
(http://media.wix.com/ugd/719f5a_a479988a4d114fb681ae073eee790252.pdf)

Emissions from gas compressor stations will include methane, nitrogen oxides, formaldehyde, methylene chloride, and volatile organic compounds, collectively called BTEX (benzene, toluene, ethylbenzene, and xylenes). Radon-222 and formaldehyde are other chemicals emitted, and a State University of New York (SUNY) at Albany study reports that formaldehyde is a known carcinogen
(http://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-13-82)

Carnegie Mellon University published a study on methane gas emissions from compressor stations
(http://media.wix.com/ugd/719f5a_3bf568a2c86c4273a754861459a01817.pdf)

The Madison County, New York Health Department filed concerns with the Federal Energy Regulatory Commission (FERC) in regards to a proposed compressor station project. The Madison County Department of Health's concerns were based in part on the report from the United States Environmental Protection Agency (USEPA) Inspector General that documents a lack of emissions data from oil and gas facilities which, in turn, casts doubt on the accuracy of projected air quality impacts. This brings into question the appropriateness of using the National Ambient Air Quality Standards to establish health safety risk near the compressor station. There are also documented correlations between health impacts and residential proximity to unconventional natural gas development facilities, including compressor stations.

Research published in the journal Environmental Health includes

formaldehyde emissions at compressor stations in five states.
(https://sape2016.files.wordpress.com/2014/01/env_health_air_quality_unconvetional_oil_gas-2.pdf)

Southwest Pennsylvania Environmental Health Project did both an extensive study and a briefer summary on the health effects associated with gas compressor stations
(http://www.environmentalhealthproject.org/healthcare-providers/resources/research-factsheets
&
http://www.environmentalhealthproject.org/files/Summary%20Compressor-station-emissions-and-health-impacts-02.24.2015.pdf).

We, the citizens of Davidson County, Tennessee, are being put in a position where we must rely on our Health Department protect our right to breath. We expect the Nashville Health Department to do the right thing for the people that live in Davidson County and deny the air permit for the proposed Joelton gas compressor station.

--
All the best,
Lillian Hawkins
Hawkins Management for
Oak Highlands/Deer Valley HOA
PO Box 455
Antioch, TN 37011
(615) 838-2876
www.oakhighlands.com

From: sekis321@comcast.net
To: Finke, John (Health)
Subject: TGP - Public Comment
Date: Sunday, July 31, 2016 3:24:00 PM

Mr. Finke,

With the possibility of two gas compressor stations being built, one in Joelton and the other in Cane Ridge, I am extremely concerned about the air quality and health for all citizens in the Nashville/Davidson county area.

Please see that your department does all it can concerning the proposed gas compressor stations to ensure the health and well-being of us all.

Sincerely,

Catherine Sikes

From:	Carolyn Kennedy
To:	Finke, John (Health)
Subject:	TGP - Public Comment
Date:	Sunday, July 31, 2016 12:25:16 PM

Each summer Nashville has days that the air quality is unsafe for persons with health issues, if the gas compression station in Joelton (and Cain Ridge) is built will that increase these days? Our air quality is important to all Nashville.

Thank you for your attention to this issue.
Carolyn Kennedy

From: sjata@comcast.net
To: Finke, John (Health)
Subject: opposed to gas pipeline project in Joelton
Date: Sunday, July 31, 2016 10:34:40 AM

Dear Mr. Finke,

Just a short note to express my opposition to the proposed gas turbine and compressor project in Davidson County/Joelton area. I voice my opposition along with my friends who live in that vacinity i.e. Whites Creek and Joelton. I would have attended the hearing last week if I could, however my job responsibilities prevented me from doing so.

Thank you for your time.

Susan Jata
3920 Oxbow Dr.
Nashville TN 37207

Facility Name and Address	Opening Date	Closing Date	Description of Action
Tennessee Gas Pipeline Company, LLC 7650 Whites Creek Pike Joelton, Tennessee	06/21/2016	08/03/2016	Two Gas Turbines One Process Heater One Emergency Generator Fugitive Emissions

From:	Scott Webb
To:	Finke, John (Health)
Subject:	TGP-public comment
Date:	Saturday, July 30, 2016 2:45:28 PM

Regarding the proposed pipeline compressor station in Joelton:

I attended the public hearing last Wednesday evening and was somewhat shocked at how articulate and wise the people were who gave public testimony regarding the dangers surrounding this generally ill-conceived venture. If such a thing were to come to your neighborhood, I would imagine you would articulate the identical concerns, and in fact, IT IS coming to YOUR neighborhood because an 8-story smokestack will spew these chemicals directly across the Nashville land basin, measurable, specific, known, dispersed into the winds, and unacceptable.

I note that Nashville is experiencing a huge spike in growth, and popularity, and once this news fully gets out, why taint our reputation as a wonderful place to live? Why risk our air quality to this degree for a private venture with zero benefit to the people living here: fracked gas from elsewhere passing through to somewhere else for private gain and in our air. Clearly all win, all lose. And if one listens to the residents of other previous locations where such compressor stations have gone in, what sorrow, grief, regret, loss. These people were fooled once; must we be? They have no recourse, nowhere to turn, because the violators of that public trust now say: we have done no wrong and whatever harm has been done, can't be proved in court nor in a lab. In fact, there is no lab that can measure damages from chemicals in combination because there are just too many deadly chemical combinations to replicate for testing in a lab for how it affects human tissue and internal organs like the lungs and the liver, brain and blood.

What's been done to those people, is done. *Suckers!* That's what those now ill American citizens receive for thanks, for nothing.

This is a form of new silent terrorism and the people of Joelton have done their research and filled a room full of informed residents warning the health department to be equally as informed now, not later, because the reversal of these damages are not undone. The people who have suffered from these type of (smaller) compressor stations cannot undo what should be stopped now here while we have the power to stop the public's harm from the calculated, blind-eye of all-private gain.

That 8-story smokestack is not for nothing because it blows something out the top into the prevailing winds like a silent bio-attack projectile launcher. If such a thing were proposed by an anti-American terrorist state, spewing known toxic poisons across high density populations, it would be the perfect insidious silent killer. Just because Americans are willing to subject other Americans to such a thing does not reduce the implied evil of it. Those who were previously fooled, beg us not to be! Their stories are in the news. It's real. It's a specific reduction in the quality of life for those within a 30 to 50 mile radius. With an epicenter. And it spreads outward, silently, people coughing. Live next door to it? Forget it! Play in a Joelton park? Not you!

So where does such a compressor station go? Who has a neighborhood ready and willing to pay such a costly price? Nobody. Not one person, not one child is willing on any level. Why must there be collateral damage anywhere for anybody -- who otherwise gains nothing for the certain-risks? If the current technology cannot not eliminate the poisons emitted from the smokestack, shame on them for not inventing a way to clean up their toxic contribution to society before it happens. Shame on us for not holding them accountable in every way possible to protect ourselves from their disregard. This is a new problem facing us, the transportation of fracked gas within our borders, and it is upon all of us, to be paying attention, counting the costs, now.

The public is merely a feedback loop for private venture requiring neighborhoods to bend to the profit-motive. We might suggest, humbly so, that citizenship comes with rights of protection.

The wake-up call from around America is that such projects are being stopped from going forward because American citizens are demanding reasonable protections. For every one letter you receive, there are one thousand more local citizens who would write you if they understood what is happening, like the people of Joelton do. There is nothing special about the people who live here. Joelton residents are just like those who also live in the surrounding towns and across Davidson County. For every letter your receive, there are ten thousand children also nearby who beg for your protection. For Nashville to ignore the dangers to air quality on the brink of such (perpetual, silent) disaster is in stark contrast to other places in America who have woken up and stopped it. This is not like Nashville, to be behind the green-trend and the times in which we live, to

be caught unaware. Even for the short term: unacceptable and not like Nashvillians to just be stupid, ever.

Forget the bike trails if we can't safely breathe the air! And what is the distance between that smokestack and a packed Titan's stadium during a compressor station blow-out?

Lots of important questions were asked during the recent public hearing regarding this pending matter. In answering them, I trust you will fully get what the people of Joelton understand. And you already know what that is. No sense in repeating it over and over and you know exactly what that is, smart like us, so God be with you! And God be with Kinder-Morgan, because they are people like us too and know we have good cause for concern and so are gaining in respect because they have families too, children, grandchildren, pets, neighbors, etc. and care about their health and air quality impacts too. They can invent a safe way to get their job done, not anything like this current methodology. Surely they can!

Complex issues though. And super serious. The future waits in the balance. No rubber stamp for this one!

Sincerely,

Scott W. Webb
8440 Whites Creek Pike
Joelton, TN 37080

From:	Kevin Sykes
To:	Finke, John (Health)
Subject:	TGP - public comment
Date:	Saturday, July 30, 2016 2:36:19 PM

I live in the Joelton area and work both as a naturalist at Beaman and Bells Bend Park as well as manage a small organic farm. I think that the pipeline and compressor would be an awful addition to the neighborhood, both from a health standpoint (including air pollution) as well as noise, potential decreased property values, etc. The proposed location of the station is not in an industrial or even commercial area, but rather a residential and agricultural area, so it is completely unsuitable for the proposed use. Please listen to the public who will be negatively impacted rather than private interests. Thanks.

Kevin Sykes

From:	Sharon Felton
To:	Finke, John (Health)
Subject:	TGP -- Public Comment
Date:	Saturday, July 30, 2016 9:28:35 AM

I know that the focus of your division, John Finke, is air pollution. However, I have a concern to be sent to the appropriate Health Department official.

What cautions are in place to prevent those of us who utilize **well water** from having our water supply contaminated if the compressor station is constructed? My husband and I have lived on our property for 21 years -- and we do not welcome having to plug into a municipal water supply..... We like our well water.

--Sharon Felton
sharonfelton@yahoo.com

From:	Sharon Felton
To:	Finke, John (Health)
Subject:	TGP -- Public Comment
Date:	Saturday, July 30, 2016 9:23:27 AM

I have talked with Mr. Fred Lieb, a pipeline engineer who spoke at the Health Department public meeting, at some length. He's worked in this industry for some 35 years, so he has a substantial amount of knowledge of the potential dangers.

What studies have been done to determine whether flow reversal is damaging to pipelines? Does flow reversal impact aging pipelines more traumatically? Have the existing pipelines (60+ years old) been tested to ensure that they can handle a) flow reversal; b) increased gas pressure, c) a greater quantity of gas flowing through, and d) all three changes at once?

The pipeline runs through my backyard. My home, indeed our master bedroom, lies about 60 feet from the pipeline, so I am especially concerned about the safety of clearly-deteriorated, badly maintained pipelines.

--Sharon Felton
sharonfelton@yahoo.com

From:	Sharon Felton
To:	Finke, John (Health)
Subject:	TGP -- Public Comment
Date:	Saturday, July 30, 2016 9:17:37 AM

The tons-per-year figures for NOx, CO, VOCs, and other toxins stated in Kinder Morgan's specifications do not account for what's commonly called "fugitive" emissions. How are fugitive emissions determined? Because fugitive emissions are variable -- and hence are not counted in the quantities of known toxins to be emitted -- how can the air permit possibly be approved?

Let me present an analogy. I want to keep my monthly budget to $2,000. I spend $1,500 on my mortgage, $300 on my car payment, and $199 on my student loan. I *know* an electric bill will be coming in (i.e., fugitive emissions), but the amount of that bill varies each month. It should be a surprise that my anticipated budget is regularly exceeded.

My understanding is that there are new EPA guidelines on fugitive emissions. How will these new guidelines impact this proposed project? How often and by what method will fugitive emissions from valves, etc. be measured? Who is responsible for these measurements, and how will Metro Health Department verify their accuracy?

--Sharon Felton
sharonfelton@yahoo.com

From:	Sharon Felton
To:	Finke, John (Health)
Subject:	TGP--Public Comment
Date:	Saturday, July 30, 2016 9:03:26 AM

The Federal level specified for the Prevention of Significant Deterioration (PSD) is, I believe, 100,000 tons per year for greenhouse gas emissions. Yet the compressor station proposed for Joelton will emit, by Kinder Morgan's own statements, over twice that amount: at almost 219,000 tons per year. Why has this facility been exempted from having to meet PSD standards?

--Sharon Felton
sharonfelton@yahoo.com

From:	Sharon Felton
To:	Finke, John (Health)
Subject:	TGP -- Public Comment
Date:	Saturday, July 30, 2016 6:31:49 AM

Within the Clean Air Act, the Environmental Protection Agency establishes three class distinctions to prevent the deterioration of air quality. Class I areas are those defined as having "special national or regional value due to their natural, scenic, recreational, and/or historic worth, where almost no change from the current air quality is allowed." The nearest cited Class I entity to the 37080 zip code seems to be Mammoth Cave in Kentucky, which would likely be deemed a "natural" site. But how about the other kinds of sites mentioned in the EPA definition?

We realize that the park adjoining the proposed compressor site, Paradise Ridge Park, would likely not be reconfigured as a Class I site. But because all of Nashville is included within the 50 km range of the Joelton site, why not reclassify the Parthenon, the Ryman Auditorium, Riverfront Park, Bicentennial Mall, or a thousand other "natural, scenic, recreational, and/or historic worth" sites as being embraced within the Class I restrictions? The Parthenon, the Ryman, for instance, certainly boast "historic worth."

What procedure might we follow to get, for instance, the Parthenon reclassified as a Class I site, a step that would necessarily prohibit this compressor station from being constructed?

--Sharon Felton
sharonfelton@yahoo.com

From: Chris Strong
To: Finke, John (Health)
Subject: TGP - Public Comment
Date: Friday, July 29, 2016 7:46:56 PM

Dear Mr. Finke,

As an acute asthmatic, and the mother of asthmatic children, I am very concerned about the present air quality in Metropolitan Davidson County where we live. I suspect that it is soon to be negatively impacted by the pending approval of the operation of a gas compression station in the Joelton area. Not only will this affect the already poor air quality in Nashville, but will certainly be compounded with the proposed station that is seeking approval for the Cane Ridge area in South Nashville. I hope you will agree that these types of installations are completely unsuitable for such densely populated urban areas such as Nashville. In addition to the high population density, as a Nashville resident, you most certainly know that due to the natural topography of the area we **already** experience poor air quality days during the year.

I am not sure what your role is regarding this installation or the approval of it, but I am fairly certain that you do not wish to impose this adverse health burden on the citizens of Davidson County. I have faith in our government and I believe that when faced with the facts that people will do the right thing. The right thing in this case is to deny this permit and not allow this compressor station to be build and operated on this site. Thank you for your time and for your kind consideration.

Sincerely,

Chris Strong
6323 Pettus Road,
Cane Ridge, TN 37013
Cell: (615) 397-0971

please consider the environment before printing this e-mail

From:	Michael (Mike) Roberts
To:	Finke, John (Health)
Subject:	Pollution from proposed compressor station in Joelton
Date:	Friday, July 29, 2016 5:29:39 PM

Dear John:
I have been living in Joelton for nearly 15 years and loved it.
The reason I moved into Joelton was primarily for health concerns. I have suffered with breathing problems caused by pollutants in the air. Nashville, it being in a geographical "bowl" was hard on me. The difference was dramatic when I moved into Joelton on the ridge.
I really thought I was safe from industrial pollution; now I learn that arrogant Tennessee Gas Pipeline and Kinder-Morgan could care less about my health or the welfare of Joelton area residents
THE FACTS ARE UNDENIABLE - THIS PROJECT MUST BE STOPPED!
Respectfully,
Mike Roberts
.
The facts are undeniable, this project should be stop

From:	Heather Hixson
To:	Finke, John (Health)
Subject:	TGP--Public Comment
Date:	Friday, July 29, 2016 3:15:09 PM

Good afternoon! I am a Cane Ridge resident who lives in the Stanford Village complex which sits directly across from the proposed CPG Gas Compressor Station in our area. Due to the two proposed stations in Joelton and Cane Ridge being in such an unprecedentedly densely populated area of Nashville which already contains many businesses and sits in a bowl, I am extremely concerned about what this will do to our already compromised air quality. Saying yes to even one of these stations in an area such as Nashville seems risky but to then approve two? I am very concerned about how this will not only affect the air quality of those who are currently residing in Nashville and the surrounding areas but how it will affect future business coming in to the area. How will we be able to guarantee that the pollutants coming from these Stations will not elevate the level to such heights that we will have to say no to potentially many other businesses that would like to build in Nashville and would subsequently bring hundreds of jobs to our local community but are unable to build because of these two stations which will provide less than twelve jobs between the two total?

Thank you for your time and for hearing our voices and for addressing our concerns-

Heather L. Hixson
Keep Southeast Nashville Healthy
541-704-8998
heatherhixson@live.com

From:	Richelle Deharde
To:	Finke, John (Health); ccsenow@gmail.com
Subject:	TGP - Puboic Comment Health Experience
Date:	Friday, July 29, 2016 10:03:11 AM

Mr Finke.
I am from Lousiana, where oil and gas are processed and transported regularly. During the years before I moved to TN, I began to experience dizziness, had 2 seizures, and developed Chronic Fatigue Syndrome (I had to nap, in my workplace every 2 hours just to have the strength to make it through a regular workday)
The doctors, at MY EXPENSE, did a multitude of tests and studies but could not find anything wrong with me physically. I was 27-30 years old at that time.
Today, I am 53 and am healthier today than I was 23 years ago before I moved to rural Middle Tennessee. I have not changed anything in my lifestyle other than moving from that very toxic environment, and I am now enjoying excellent health.
Please do not put my friends, neighbors, and myself through the health horrors that I experienced in Louisiana.

From:	Richelle Deharde
To:	Finke, John (Health); ccsenow@gmail.com
Subject:	TGP- Public comments - Health concern
Date:	Friday, July 29, 2016 9:53:31 AM

Mr. Finke.
Kinder and Morgan would like for us to believe that the sound of the compressor station is like a 2 person conversation. Even if that were true, conversations don't drone on for 24 hours a day and 7 days a week. People stop talking to breathe, sleep and eat. The compressor won't stop talking, ever.
In your own home you can say 'QUIET' when everyone is talking and you need peace. How many times do you go home and just want a few minutes of silence? We won't have that opportunity with the compressor station. It will run incessantly. Please take a moment to listen to a compressor station for just 15 minutes. I promise, you will be miserable in just a few minutes. Please consider the folks who have to hear that noise 24 /7. No matter how low the sound, even the sound of a dripping faucet will eventually drive a homeowner nuts.
https://www.youtube.com/watch?v=WtSH5V1YQvQ

From:	Elizabeth Williams
To:	Finke, John (Health)
Subject:	TGP-public comment
Date:	Friday, July 29, 2016 9:31:06 AM
Attachments:	CCSENOW.docx

Attached are our comments about the proposed Pipeline compressor in Joelton, TN.

Roger and Elizabeth Williams

Sent from Mail for Windows 10

Roger and Elizabeth Williams July 29, 2016

5558 Huffman Rd.

Joelton, TN 37080

RE: TBP-public comment (CCSENOW)

We have lived in our home for 28 years. When we built we knew we would have to dig a well. Yes, even in today's times houses are still using well water. In fact, there are 40+ houses on Huffman Rd using well water. I feel that if the Pipeline Compressor is built, it could affect our water supply. Then what would be do for water? We have been unsuccessful in getting city water. We get electricity, phone and mail from Metropolitan Nashville. We live in Robertson County and pay only taxes to them. We have been told our water would come from the White House district. They would have to cross metro water to get to us. We have metro water at each end, within a two mile stretch of road we live on. Can Metro Nashville connect those two ends to give us city water? I'm in my 70's and fear should my husband die before me, I would be at a disadvantage in taking care of the well and the process that he does to keep the water drinkable and fit to use.

Our neighbor at this very time has sulfur in his water. He is unable to use it for drinking or cooking. Within the last two years, Kinder-Morgan dug a well next to this house to put in test rods to stop the rust on the pipes. These rods are placed about every 5' in about 100' well. As a result, the stream which supplies his water was affected by this well and now he is unable to use it for personnel use. When getting water from the faucet, there is a black ring around the top of the glass.

Last year, Kinder-Morgan came across the front of our property to get to the back. We live on 17 acres. They needed to replace a portion of pipe that was defective. They said it was put in place in 1944. I remember because that is when I was born. Now, if that pipe is 72 years old, then the rest of the pipes are at least that age. It the new pipeline compressor is put in place then that will put much stress on the already aging pipes. Also, we purchased additional property to put our driveway in on the upper side of the gas line, hoping that if the pipeline needed to be dug up it wouldn't affect our driveway.

We knew when we purchased this property a gas line ran through it. We knew we would be on a well, even in this day and time. But we didn't know that Kinder-Morgan would want to put a major compressor station within miles of our house. These fragile pipelines are just that Frail gas lines.

PLEASE DO NOT GRANT KINDER-MORGAN A HEALTH PERMIT TO CONTINUE WITH THIS PROJECT.

If you would like to talk to us about our situation of being on a well, please get in contact with us. We would love to hear from you and know that you are concerned about our well being.

Thanks for listening to our concerns,

Roger and Elizabeth Williams

Home # 615-876-9934 Cell # 615-516-0479

From:	Staci Bishop
To:	Finke, John (Health)
Subject:	TGP Title V air permit comment
Date:	Thursday, July 28, 2016 6:20:33 PM

My husband and I have been looking at property in Joelton. We really think the area has great potential in the next 5 years. Once we learned more about the compressor station, we have curbed our search until a decision is made. I have huge health concerns about placing such a facility in a residential area and we are unwilling to buy in an area that would subject it's residents to this type of air pollution and noise. It seems that KM has found some type of loophole but there has to be a way to prevent them from building so close to families. I look forward to seeing the outcome and hope that we can resume our search soon. Otherwise, I fear that property values are going to quickly decline and all of the potential for this city will be wasted.

Thanks.
Staci

Sent from my iPhone

From: Durwood Edwards
To: Finke, John (Health)
Subject: TGP compressor
Date: Thursday, July 28, 2016 4:32:09 PM

Dear Mr. Finke,

As a resident of Davidson County, I am very concerned about the impact which the proposed gas pipeline compressor will have on the air quality not only in the immediate area around the compressor site but also the impact on downtown Nashville as the pollutants settle into the basin containing our city.
I understand that in order to cut costs, a model of compressor is proposed that is minimally effective at controlling the release of toxic air pollutants, even though there are much better choices that could be made to radically reduce these emissions. I believe Kinder-Morgan should be required to install the best pollution controls available and not simply the cheapest.

Thank you,
Durwood Edwards
6324 Lake Road
Joelton, TN 37080

From:	Butka, Brenda
To:	Finke, John (Health)
Subject:	Gas Pipeline Compressor
Date:	Thursday, July 28, 2016 3:24:35 PM

As a pulmonologist, I am very concerned about the prospect of these compressors anywhere near human habitation. There have been documented releases of significant air pollutants and unknown radiation risks, plus, as you know, concerns about poor pipeline maintenance, noise and many other issues.

Thank you.

Brenda Butka, M.D.

From: Marrow Bone
To: Finke, John (Health)
Subject: TGP-Public Comment
Date: Thursday, July 28, 2016 3:14:50 PM

I am worried that the proposed Tennessee Pipeline compressor station will pose a very real threat of the release of VOCs and other harmful atmospheric contaminants during blow-downs and leaks. Kinder Morgan is employing the cheapest available technologies on this project. This fracked gas will not be used by people in the US. The people of Nashville should not be put at risk in order for Kinder Morgan to make money by providing their 50 year old corroded pipeline to send gas to the gulf coast where it will be shipped to Asia. Please continue to help protect the health of the people of Nashville.

Thanks for all you do!

Sincerely,

M. Theroux
5200 Eatons Creek Rd.
Nashville TN 37218

From: Kelley Lewis
To: Finke, John (Health)
Subject: TGP- public comment and question
Date: Thursday, July 28, 2016 12:27:49 PM

The Tennessee State Wildlife agency is a state agency whose mission is to preserve the state's endangered wildlife and manage its woods and waters. They warn that the "reduction of forestlands can negatively impact water quality and quantity, the health and diversity of habitats, and other land values such as recreation, timber, and forest products." They declare that upland forests are a benefit to each citizen of Tennessee by reducing soil runoff, thereby maintaining higher water quality in other waterbodies from ephemeral streams to lakes and rivers across the state. "Forests also filter pollutants and improve water absorption and retention, which increases groundwater recharge. Forest cover influences local temperatures, improves air quality, and, may play an important role in mitigating climate change."
The Environmental Assessment, on Table 2-10, FERC states that TGP will 'temporarily' impact 34.6 acres and 'permanently' impact 20.5 acres of upland forests to construct CS563.

My question: How can a local metropolitan jurisdiction override the intent and wishes of a major state agency such as the Tennessee Wildlife Resources who sees it necessary and vital to the citizens of the state to protect these lands for the health and well-being of all Tennesseans?

Kelley Lewis
8410 Sycamore Creek Rd
Joelton, TN

From:	Beth
To:	Finke, John (Health)
Subject:	TGP--Public Comment
Date:	Thursday, July 28, 2016 9:17:51 AM

Mr. Finke, I attended the public hearing on the Joelton compressor station last night but did not speak. I appreciate your department's willingness to hear everyone out. Though I live in Bellevue, some 20 miles from the proposed station, I am still worried. I have seen the map depicting the spheres of air pollution influence with overlapping circles from the Joelton and Cane Ridge proposed stations. My family lives in the double shaded area. I have several relatives with respiratory conditions living in this blast zone, including my 90-year old father, a daughter-in-law, and two grandchildren. Nashville already has several days every summer where it is not safe for them to be outside. How much worse will it be if these industrial facilities are allowed to be built here? Please do the right thing and turn down Kinder Morgan's application. Thank you,

Eric Lewis
7978 Highway 100
Nashville, TN 37221

From:	Lyle Harvey
To:	Finke, John (Health)
Subject:	TGP-public comment
Date:	Thursday, July 28, 2016 8:02:38 AM

Dear Mr. Finke, I urge you to help block the approval of the Kinder Morgan compressor in Joelton. The more I have learned about the environmental and public health impact of the project, I am horrified and outraged that this huge compressor will be put in the backyard of Nashville (which already had a very poor air quality rating.)

As may already know here are some facts about the compressor station:

-The compressor station engines burn the natural gas emitting the fracking chemicals, which do not burn, into the air.

- serious health concerns surrounding the chemicals. The safety of chemicals such as: formaldehyde, methylene chloride, benzene, toluene, ethylbenzene, and xylenes (the last four are collectively called BTEX). These pollutants can result in serious health impacts such as cancer, respiratory disease, reproductive problems (in humans and animals), neurologic disorders (Alzheimer's and Parkinson's diseases), and birth defects to name a few.

-The compressor station will be one of the largest in the country (its in the top 5%)

-It is equal to >900 average cars running ALL THE TIME (but with worse emissions)

-Nashville has an "F" rating for air quality

-The compressor station is unmanned thus creates NO jobs or income (other than land tax)

-All of the gas is going to be exported (this is not for public good although the company is using the rules for public utilities for obtaining permits)

-There are other more suitable places where the compressor station can be built. These places are much more rural. Although my hope is Kinder Morgan scraps the whole project.

I urge you to do everything in your power to stop this compressor and protect the health of the community and our precious children. We already live in a world with too many toxins; we do not need another giant environmental polluter and health risk in our backyard.

Thank you for your consideration.

Sincerely,
Lyle Harvey

Lyle Cates Harvey, M.S.OM, L.Ac
Licensed Acupuncturist and Chinese Medicine Practitioner

The Nesting Place Acupuncture and Wellness
3112 Lakeland Drive
Nashville, TN 37214
615-684-5874
www.nestingplaceacupuncture.com
lyle@nestingplaceacupuncture.com

Creek Bend Farm
www.creekbendfarm.org

From:	Lori Rochelle
To:	Finke, John (Health)
Subject:	TGP-public comment
Date:	Wednesday, July 27, 2016 8:25:59 PM

Mr Finke,

I live in the Joelton/ Whites Creek area. We do not want this gas pipeline/compressor in our area. This will damage air quality for a 50 mile radius, including downtown Nashville. Please stop this company from coming to our precious Nashville!

Lori Rochelle

From: Betsy garber
To: Finke, John (Health)
Subject: Comments on Tennessee Gas Pipeline, LLC air pollution permits
Date: Wednesday, July 27, 2016 8:07:34 PM

Dear Mr. Finke,

I would like to write in opposition to granting air pollution permits for the Joelton compressor station. Not only has Kinder Morgan failed to use available technology to decrease the amount of pollution released, it has also chosen an inappropriate location. The thriving Metropolitan Nashville is no place for a compressor station.

Thank you,
Elizabeth C. Garber
1327 Otter Creek Road
Nashville, TN 37215

From:	Joseph Maloney
To:	Finke, John (Health)
Subject:	TGP-public comment
Date:	Wednesday, July 27, 2016 5:36:03 PM

How will compliance with maximum noise levels (i.e., a maximum of 55dBA) be guarenteed? What happens if residents observe even one instance of noise exceeding 55 dBA level? What steps should a resident take in such cases --is calling the Police the appropriate response?

Very respectfully,
Joseph Maloney
Joseph.maloney@live.com

Sent from my iPad

From: Jennifer Mayo
To: Finke, John (Health)
Subject: Jennifer Mayo wants to share the file Document.docx with you
Date: Wednesday, July 27, 2016 3:03:22 PM

My name is Jennifer Mayo. I am a 5th generation resident of Joelton and reside at 2887 Morgan Road in Joelton. I live approximately ½ mile from Paradise Ridge Park. I am speaking to you today as a citizen that is concerned about the potential for damage to the air quality in my neighborhood.

In November of 2011, my father, also a resident of Morgan Road, was diagnosed with Stage 4 lung cancer. In addition, I have a 4 year old son with breathing issues. He has had to undergo breathing treatments since he was 6 weeks old, and has been diagnosed with asthma. Given our medical conditions, we have to monitor the air quality very carefully. I have never been overly concerned about this given where we live, and would never have dreamed that something like a compressor station could be located in our rural setting. When I learned of this venture, I was devastated given the potential health risks for my family members and the fact that I was only a few weeks into the construction of our new home.

On Kinder Morgan's own website, they have listed potential hazards associated with pipeline leaks. The possible leaks of those chemicals range from harmful to fatal if inhaled. According to the Environmental Protection Agency, "VOCs (Volatile Organic Compounds) are released during the production of oil and natural gas. The chemicals in VOCs can form ground level ozone (smog) which can cause breathing difficulties, especially with those who are young, elderly, or have existing respiratory problems such as asthma".

While I am sure that Kinder Morgan can cite many instances of safety and emissions that meet guidelines and standards, I do not feel comfortable with the "What if?" gamble some are willing to take on the lives of my father, son, or other residents of the Joelton community that are highly impacted by any changes to the air quality. People choose where they live for many reasons. For some it is convenience or preference, but for many, factors like air quality play a significant role in that choice. I am asking you to protect that choice. Thank you.

From:	Jennifer Mayo
To:	Finke, John (Health)
Subject:	Concern-compressor station in Joelton
Date:	Wednesday, July 27, 2016 2:29:22 PM

Please read my attached concerns about how the proposed compressor station affects the potential health of my family!

Thanks,
Jennifer Mayo
2887 Morgan Road
Joelton, TN 37080

From: rliletrent2@aol.com
To: Finke, John (Health)
Subject: Joelton Compressor Station
Date: Wednesday, July 27, 2016 2:00:39 PM

Good afternoon, Mr. Finke. I sent an email last night to the Dept. of Health (not knowing exactly where to send it). I think it finally made its way to you, but just in case, I have copied my email below with my concerns about the purposed compressor station. Also, I'm not sure that the embedded photo in the first email sent correctly, so I have attached the photo of me from 2014 when I discovered health conditions in my body. I can't describe it as well as I can show you. I can tell you that when I went to my doctor's office and the dermatologist that the nurse and nurse practitioner gasped when they saw me. Thank you so much for your help in the matter of our health concerns and the environment in our neighborhood.

Original email sent...

Good evening. Unfortunately, I will be unable to attend tomorrow night's meeting. But, I want to voice my concern about the proposed compressor station in Joelton, TN. This is located about two-tenths of a mile from my home and even closer to our cattle (grass-fed organic beef) located on By Faith Farm. My concern is from a health standpoint. I am 48 years old and found out two years ago I had a mixture of health issues. I was diagnosed with an autoimmune disease, Sjogren's Syndrome, as well as MTHFR, which means my body doesn't detox itself like it is supposed to. I have included a photo of what happened to my body in Sept. 2014 when all these things came to light in my body. From then, I changed to organic foods, drinking fresh juice every morning. We raise our own beef, organically grown. I also must periodically soak in an Epsom salt bath to help detox my body due to swelling. If the compressor station is allowed to build that close to our home (of 24 years), it will force us to leave. I recently wrote a research paper on natural gas compressor stations. The health effects and testimonies of those currently living near these stations is just astounding. It will literally force us from our home. I ask you, please, to consider those who live near this site and help us keep these pollutants out of our neighborhood.

Rhonda Trent - September 2014 (this lasted for more than 8 weeks, under a doctor's care)....SEE ATTACHED PICTURE

Sincerely,
Rhonda Trent
7834 Whites Creek Pike
Joelton, TN 37080
rliletrent2@aol.com

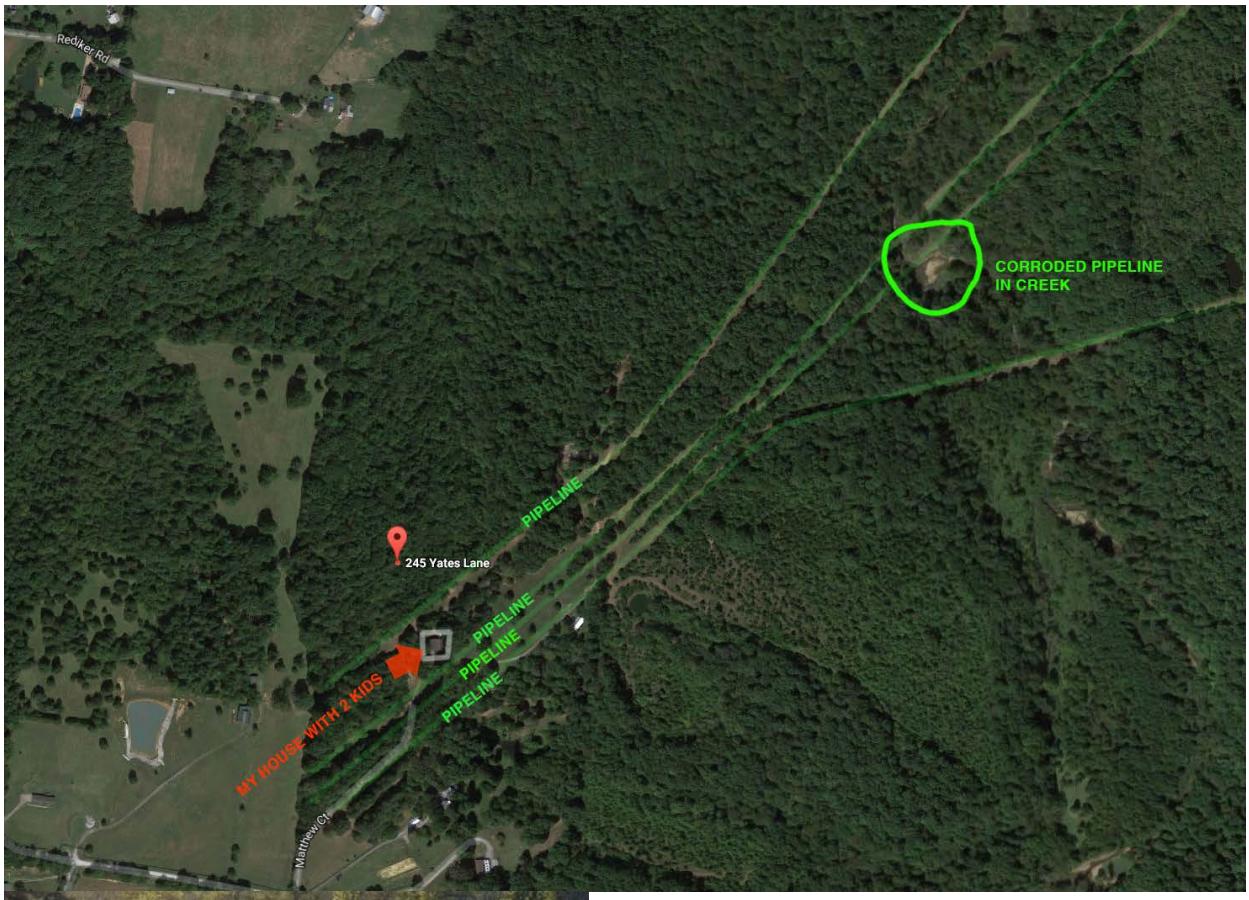
From: Bequette, Alicia
To: Finke, John (Health)
Subject: TGP - public comment
Date: Wednesday, July 27, 2016 12:41:36 PM
Attachments: joeltonPipeline.png
Screen Shot 2016-07-27 at 12.17.16 PM[2].png
joeltonPipeline.png
Screen Shot 2016-07-27 at 12.17.16 PM.png

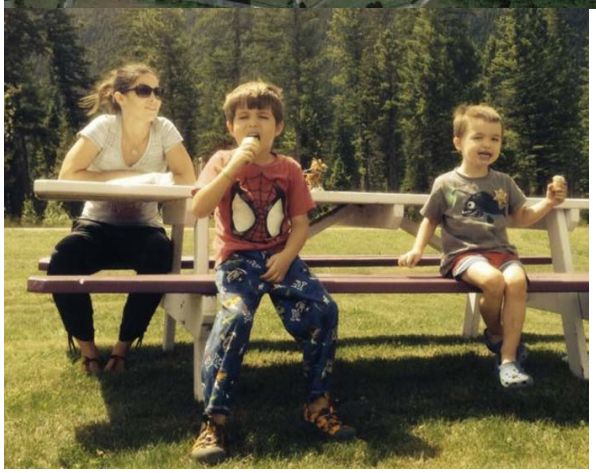
Hi John,
I have a vested interest in the pipeline decision because, as you can see by the attached map, all pipeline and pipeline compressor decisions affect me and my family TEN FOLD. My house sits just yards away from the pipeline on BOTH sides of my house. My dream house, out in the country, that I thought would be exceptional for raising two young boys - with ample woods and creeks has now become a possible target for the worst news possible. Last year, I walked and drove to all my neighbor's houses to make them aware of what was happening in our area, and do you know how many knew Kinder Morgan plans? Zero.

I drove down my driveway this morning to find full crews of pipeline men, trucks and large equipment getting ready to repair corrosion on what I now know as VERY OLD, over 50 years, very corrosive pipes that didn't use the same technology for interior coating as they would today. Specifically they are trying to fix the one that runs through our creek, because we all know what will happen once it starts leaking, if it hasn't already.

Once this compressor goes in, not only will it affect our air quality, our water (my neighbors are still on well water), our creeks, our fish & wildlife, our personal health, our soil for our gardens, our quiet peaceful location, our property values, but also COULD EXPLODE! Exploding pipelines affect areas up to 5 miles or more. If one of these 50-80 year old pipeline seams is not able to handle the newly reversed flow (a flow direction that has not been implicated for decades) under newly increased pressure that is has never been tested on these lines, then my kids and I, and my house and property, are gone. DEAD gone. And Kinder Morgan is fine with apologizing later. But as you know, later is too late.

Please help me and my family continue to have the quality of life you would want for your own, by making the right moral decision for our neighborhood.
Thank you,
Alicia Bequette
245 Yates Lane
Joelton, TN 37080
615-948-0668





From: Wendy Wilson
To: Finke, John (Health)
Subject: Proposed Joelton Compressor station
Date: Wednesday, July 27, 2016 10:08:12 AM

I stand in opposition to the proposed Joelton compressor station and the compressor station proposed for Antioch for health, environment and zoning reasons. I am concerned about the emotional and physical health effects of the noise and the air pollution. The noise especially from the blowdowns will increase stress levels and health consequences related to increased stress. Well documented consequences to air quality are also of great concern as these can increase respiratory distress, asthma and other respiratory illnesses. I am also concerned about the health consequences of increased air pollution to those who are living with compromised respiratory and compromised immune systems. I am concerned about the potential for catastrophic accidents related to poorly maintained infrastructure/ pipelines. I am concerned about the potential for increased costs to metro budget related to the health consequences from this compressor station. I am asking I am asking that the Metro Health Department refuse the air-quality permits that would allow construction of the compressor stations. Wendy K Wilson 4898 Bull Run Rd. Ashland City TN 37015

Sent from my iPhone

From: Donovan Grimwood
To: Ask Tdec; "rliletrent2@aol.com"; "loricabo@gmail.com"; Finke, John (Health)
Subject: TGP-public comment (RE: Ask TDEC Request 61717)
Date: Wednesday, July 27, 2016 10:07:02 AM
Attachments: image001.png

Ms. Trent,

Thank you for voicing your concern and contacting the State of TN. The Department of Health forwarded your message to the Department of Environment and Conservation. The local air program for Metro/Davidson County is the program with jurisdiction over the matter of the Tennessee Gas Pipeline Joelton Gas Compressor Station air construction permit. As such, I am forwarding your message to Mr. John Finke for inclusion in the public comment for the meeting on July 27, 2016.

Sincerely,

Donovan Grimwood | Small Business Environmental Ombudsman
Office of External Affairs - Small Business Environmental Assistance Program
William R. Snodgrass Tennessee Tower, 2nd Floor
312 Rosa L. Parks Avenue
Nashville, TN 37243
Phone: (615) 532-4966
Donovan.Grimwood@tn.gov
tn.gov/environment

TN Department of Environment & Conservation

Tell us how we're doing! Please take 5-10 minutes to complete TDEC's Customer Service Survey

From: rliletrent2@aol.com [mailto:rliletrent2@aol.com]
Sent: Tuesday, July 26, 2016 10:20 PM
To: TN Health
Cc: loricabo@gmail.com
Subject: July 27th Meeting - Joelton Compressor Station

Good evening. Unfortunately, I will be unable to attend tomorrow night's meeting. But, I want to voice my concern about the proposed compressor station in Joelton, TN. This is located about two-tenths of a mile from my home and even closer to our cattle (grass-fed organic beef) located on By Faith Farm. My concern is from a health standpoint. I am 48 years old and found out two years ago I had a mixture of health issues. I was diagnosed with an autoimmune disease, Sjogren's Syndrome, as well as MTHFR, which means my body doesn't detox itself like it is supposed to. I have included a photo of what happened to my body in Sept. 2014 when all these things came to light in my body. From then, I changed to organic foods, drinking fresh juice every morning. We raise our own beef, organically grown. I also must periodically soak in an Epsom salt bath to help detox my body due to swelling. If the compressor station is allowed to build that close to our home (of 24 years), it will force us to leave. I recently wrote a research paper on natural gas compressor stations. The health effects and testimonies of those currently living near these stations is just astounding. It will literally force us from our home. I ask you, please, to consider those who live near this site and help us keep these pollutants out of our neighborhood.

Rhonda Trent - September 2014 (this lasted for more than 8 weeks, under a doctor's care)

Thank you for your time,

Rhonda Trent
7834 Whites Creek Pike
Joelton, TN 37080
rliletrent2@aol.com

From: Leslie, Melanie M LRN
To: Finke, John (Health)
Subject: Joelton Gas Compressor Plant Air Permit Questions (UNCLASSIFIED)
Date: Tuesday, July 26, 2016 8:46:06 PM

CLASSIFICATION: UNCLASSIFIED

Mr. Finke,
It may be too late to provide questions on the air permit. I mistakenly thought the day of the hearing (July 27) was the deadline for the questions. If it is not too late, may I present my comments on the air permit request for Kinder-Morgan Gas Compressor Plant in Joelton, TN.

Kinder-Morgan is stating the only air monitoring they will be performing is right at the station and does not take into account the vent blowout events which will disperse pollutants in a much wider plume than during "normal" operations. Yet this vent blowout is a regularly scheduled event that occurs every 24 hours, as part of the "normal operations". Does their air monitoring program have a quality assurance/quality control check to ensure they are monitoring according to state guidelines? Do they have guidelines for data validation? There is no mention of it in Section 1.3(a), will data validation be required? Without results that are trustworthy, how can proper monitoring and protecting the surround environment be accomplished.

Will Kinder-Morgan have air monitoring stations around the plant only or will they be scattered throughout the affect area? How will they know the Volatile Organic Compounds; Benzene, Toluene, Ethylbenzene, and Xylenes; and other pollutants in the natural gas liquid they are transporting are not spreading off their property. Section 1.21 states nothing objectionable will go "beyond the property line". How will Kinder-Morgan know this is true without air monitoring stations placed throughout their property or do they simply expect the emissions to "magically" drop out of the air at the fence line? And if this happens what about the soil, surface water, and eventually groundwater?

Sections 1.24 and 1.25 speak of the permittee not allowing emissions beyond certain limits. What are these limits? How will they sampling to ensure those limits are not exceeded? What will they do if the limits are exceeded?

Kinder-Morgan states they don't have to monitor because their station does not fall under EPA headings for facilities that do require air monitoring. However, the state can and often does have more stringent guidelines, will Kinder-Morgan be meeting those requirements?

The Compressor Station will not be operating in a vacuum. Its everyday operations which includes the vent blowout events will affect the community in multiple ways - none of them beneficial to the community.

Thank you and I truly hope it is not too late to include these questions,
Melanie Leslie
Geologist
Phone: 615-736-7526
CLASSIFICATION: UNCLASSIFIED

From:	Richelle Deharde
To:	Finke, John (Health)
Subject:	Actual sounds of a compressor station - Please listen!
Date:	Tuesday, July 26, 2016 6:43:45 PM

Mr. Finke,
Please watch the Youtube clip from a gentleman who lives near a compressor station: You will be able to hear what he hears, see the dead trees on his property and possibly smell the air pollution.

https://www.youtube.com/watch?v=tA5cnlJCyBA

We need desperately for you to protect our community from this:
Thank you for your time.
Richelle Deharde
Joelton, TN

From:	Virginia Team
To:	Finke, John (Health)
Subject:	Tennessee Gas Pipeline Broad Run Expansion Compressor Station 563 projected for Davidson County
Date:	Tuesday, July 26, 2016 8:43:47 AM

Dear Mr. Finke,

I can not be at the Lentz on Wed. afternoon, but wanted to share my **deep concern and opposition** to the Kinder Morgan proposed Compressor Station in Joelton.

WHO will benefit from it? Kinder Morgan, and the people that sold the land to Kinder Morgan??

Who will suffer and have toxic pollution of our air quality and ill health because of it?
The residents, environment, animals, and agriculture of the Joelton and surrounding areas!

"The safety of chemicals such as: formaldehyde, methylene chloride, benzene, toluene, ethylbenzene, and xylenes (the last four are collectively called BTEX). These pollutants can result in serious health impacts such as cancer, respiratory disease, reproductive problems (in humans and animals), neurologic disorders (Alzheimer's and Parkinson's diseases), birth defects. "

How such a **toxic situation could have even been considered for anything less than an industrial area** is just unbelievable and inconceivable !!!

Please ... **Do NOT** issue this permit!!! The degradation of air quality in the this area is just NOT Acceptable!

Thank you,
Virginia Team

Virginia Team
5596 Higdon Road
Joelton, TN 37080

h: (615) 876-3277
c: (615) 260-6868

From:	Martin Holsinger
To:	Finke, John (Health)
Subject:	No compressor station, please!
Date:	Sunday, July 24, 2016 10:18:42 PM

Dear Mr. Finke,

If somebody moved into Joelton and started poisoning random citizens, occasionally dumping oil into waterways, and creating a constant very loud noise, we would call the police on them as quickly as possible. That is exactly what this pipeline compressor station is going to to do, and its emissions wouldn't just hurt people in Joelton, they would affect people all over northern Davidson County. It would be difficult to trace these health effects directly back to the compressor station, so it would bear no financial responsibility for the medical expenses of those it harmed. Why should we, the citizens of Davidson County, pay such a high price so this company can "make a profit"?

Furthermore, the whole business the company is in, the fossil fuel industry, is one that the best scientific minds of our time tell us we must shut down as soon as possible, or we will make life on this planet very difficult for our children and grandchildren. Encouraging more fossil fuel infrastructure is very bad from a long-term public health standpoint.

I am a 67-year old retiree, with a heart condition. One of the reasons I live in NW Davidson County is because it's less polluted--air pollution is hard on my system. The recent "Nashville Next" county plan recognizes the special nature of NW Davidson County, and states Metro's intention to preserve the rural character of the area. Let's not screw it up by locating a noisy, heavily polluting industrial facility up here.

Thank you very much for your attention in this matter.

Martin Holsinger
5155 Drake's Branch Rd.
Nashville 37218

From:	Tristan Charles
To:	Finke, John (Health)
Subject:	TGP - Public Comment
Date:	Thursday, July 21, 2016 5:15:37 PM

Mr. Finke,

I write to you today to express my opposition to the TGP natural gas compressor station. As you've no doubt heard several times already, the construction and use of such a facility raises a variety of legitimate health concerns (and some illegitimate ones - I doubt noise pollution causes Alzheimer's) related to the release of known carcinogens into the air we breathe. At best, contact with those carcinogens should be accidental. Kinder Morgan's deliberate use of them, then, should be considered a manifestation of a flagrant disregard for the health and welfare of Middle Tennessee. I humbly and respectfully urge you to do your part in preventing such irresponsible behavior, as I am doing mine.

Sincerely,

Tristan Charles

From:	Joelton Shopper on behalf of Eva Green
To:	Finke, John (Health)
Subject:	TGP - public comment
Date:	Thursday, July 21, 2016 8:32:43 AM

Mr. Finke,

I wanted to write and request that you consider the negative consequences that we all face if this compressor station (the largest in the U.S.) is built in the middle of a growing community in Davidson County, (Joelton).

I know your office is receiving a lot of pressure from lobbyist for Kender Morgan and others who have lots of influence. However, all of Davidson County will be effected by this air pollution, water contamination and loss of life if there is an explosion. The families that live directly around (we are 1.5 miles) are at the greatest risk.

There is a new community Park, Paradise Ridge that is less than a mile. After school programs for middle school & elementary students spend the afternoons there waiting for their parents to get off work.

If you have seen the report of the corroded exposed pipes (50+ years old) they intend to use (I hope you have) there is sure to be a major catastrophe happen.

PLEASE DO NOT ALLOW THIS PROJECT TO BE BUILT.

Respectfully,

Eva Green
7456 Bidwell Rd.
Joelton, TN. 37080

From:	Jay Rummage
To:	Finke, John (Health)
Subject:	Joelton compressor station
Date:	Thursday, July 21, 2016 6:06:00 AM

Hello Mr. Finke,

I am writing you today regarding the proposed compressor station in Joelton. 8189 people live in Joelton, 29% of them under the age of 20. Studies have been done on the air quality around these stations and I don't think we should take a chance on our health. Below I have an excerpt from one study in 2014.

RESEARCH
OPEN ACCESS | OPEN PEER REVIEW

Air concentrations of volatile compounds near oil and gas production: a community-based exploratory study

Gregg P Macey [1], Ruth Breech [2], Mark Chernaik [3], Caroline Cox [4], Denny Larson [2], Deb Thomas [5] and David O Carpenter [6]

Environmental Health 2014 **13**:82 | **DOI:** 10.1186/1476-069X-13-82 |
© Macey et al.; licensee BioMed Central Ltd. 2014
Received: 16 July 2014 | **Accepted:** 10 October 2014 |
Published: 30 October 2014

Community-based monitoring near unconventional oil and gas operations demonstrates elevations in concentrations of hazardous air pollutants under a range of circumstances. Of special concern are high concentrations of benzene, hydrogen sulfide, and formaldehyde, as well as chemical mixtures linked to operations with observed impacts to resident quality of life.

Please act in the best interest of the population. This station is not in the best interest of the Joelton or Nashville population and needs to be denied. Please consider the impact of the kids.

Jay Rummage
Nashville

Sent from my iPhone

From:	Melinda Perricone
To:	Finke, John (Health)
Subject:	TGP - public comment
Date:	Wednesday, July 20, 2016 8:00:04 PM

July 20, 2016

I am extremely concerned for the air quality in the Nashville area and the health consequences from the operation of a Gas Compressor Statation if the Construction Permit and Operating Permit from Tennessee Gas Pipeline for the construction of a Gas Compressor Station is granted. I urge the Metro Public Health Department to protect our air quality and our public health by dening this request.

The cumulative impact it will have is a great concern for our community. The possibilities for health, safety or environmental harm resulting from natural gas compressor stations are many and serious. The toxic emissions released by this massive industrial facility will have grave affects both long and short term on the families surrounding it. The most prevalent, by far, is the intentional (routine) “blow-downs”. Accidental releases of VOCs and NOx also occur.

Compressor stations are loud. “Blow-downs” can last from 20 minutes to 2-3 hours, from 12 to 40 times a year. The noise is comparable to a commercial jet taking off. They often occur in the middle of the night. The sound of regular compressor station operation has been compared to four diesel locomotive engines running 24/7. Residents as far as a mile away can hear the racket.

There is a Metro Public Park less than half a mile away from the proposed site that children use for daycare camps and outdoor family recreations. Our community prides itself on our rural setting and the benefits of a peaceful, environmentally safe environment.

The health of the citizens of this county will be at risk if these permits are granted. Please deny the application by Tennessee Gas Pipeline for a Construction Permit and Operating Permit for the Gas Compressor Station.

Thank you,

Melinda Perricone
7349 Bidwell Road
Joelton, TN 37080
615-876-0692 (h)
615-838-7298 (c)

From:	Christina & James Wright
To:	Finke, John (Health)
Subject:	Air Quality in Nashville
Date:	Wednesday, July 20, 2016 1:45:44 PM

Dear Mr. Finke,
<!--[if !supportEmptyParas]--> <!--[endif]-->
I am writing you today because I am a concerned citizen and long time resident of Nashville. I am concerned about the future of our city and the health of the residents.
<!--[if !supportEmptyParas]--> <!--[endif]-->
At first no one, not even Kinder Morgan or Columbia Gas, knew the effects of living near a gas compressor however, now, there is evidence that it's presence is detrimental to people living nearby. Gas compressors emit chemicals such as ethyl benzene, formaldehyde, methylene chloride, benzene, toluene, and xylenes. All have been shown to cause cancer, respiratory problems, neurological disorders and/or birth defects.
<!--[if !supportEmptyParas]--> <!--[endif]-->
I am appealing to you to do your job and protect the residents of our city. Nashville's topography is unique in the fact that it is bowl shaped. The air pollution hangs over the city in the summer like a thick gray blanket. Breathing warnings already appear on the interstate signs to warn the sensitive.
<!--[if !supportEmptyParas]--> <!--[endif]-->
It is a known fact, that people that never had breathing or sinus problems move to Nashville and start having problems. My 90-year-old Mother-in-Law has lived in Massachusetts, Upstate New York, and Vermont. She never had nosebleeds in her entire life. Since moving to Nashville in May 2014, her nose has bled frequently. The doctors we have seen are totally unhelpful. This tells me that Nashville's air quality is already bad and the doctors do not know what to do to help the patients. The presence of a gas compressor(s) will only make it worse.
<!--[if !supportEmptyParas]--> <!--[endif]-->
I beg you, do your job and protect the citizens of Nashville by not allowing them to build here!
<!--[if !supportEmptyParas]--> <!--[endif]-->
Sincerely,
<!--[if !supportEmptyParas]--> <!--[endif]-->
<!--[if !supportEmptyParas]--> <!--[endif]-->
Mrs. Christina Wright
<!--[if !supportEmptyParas]--> <!--[endif]-->

From: BRCOLLIER
To: Finke, John (Health)
Subject: TGP-public comment
Date: Tuesday, July 05, 2016 11:30:05 AM

Thank you for advising what is going on with this compressor pipeline. I am very concerned after reading what these compressor stations omissions being released into the atmosphere- volumes of contanimants such as methane, foraldehyde-carbon monoxide, particulate matter and cancer causing viotatile organic compounds.
Metro government spent a lot money a few years ago, for a metro park in Joelton. The location of this park called Paradise Ridge Park on Morgan Rd, is just a mile from this proposed compressor station.
This park is providing after care from Joelton Elem. also summer day camp for children. All the contaminants listed above is such a danger not only to children but all the Joelton area. This pipeline/compressor station will be to close for the childrens safety.
Please consider not NO PERMITS for the TGP.
Thank you for your help
Bill Collier
7626 Bidwell Rd
Joelton TN 37080
615-876-0893

From:	Joelton Shopper on behalf of Eva Green
To:	Finke, John (Health)
Subject:	"TGP-Public
Date:	Friday, July 01, 2016 8:16:44 AM
Attachments:	50 km Two radii map.pdf

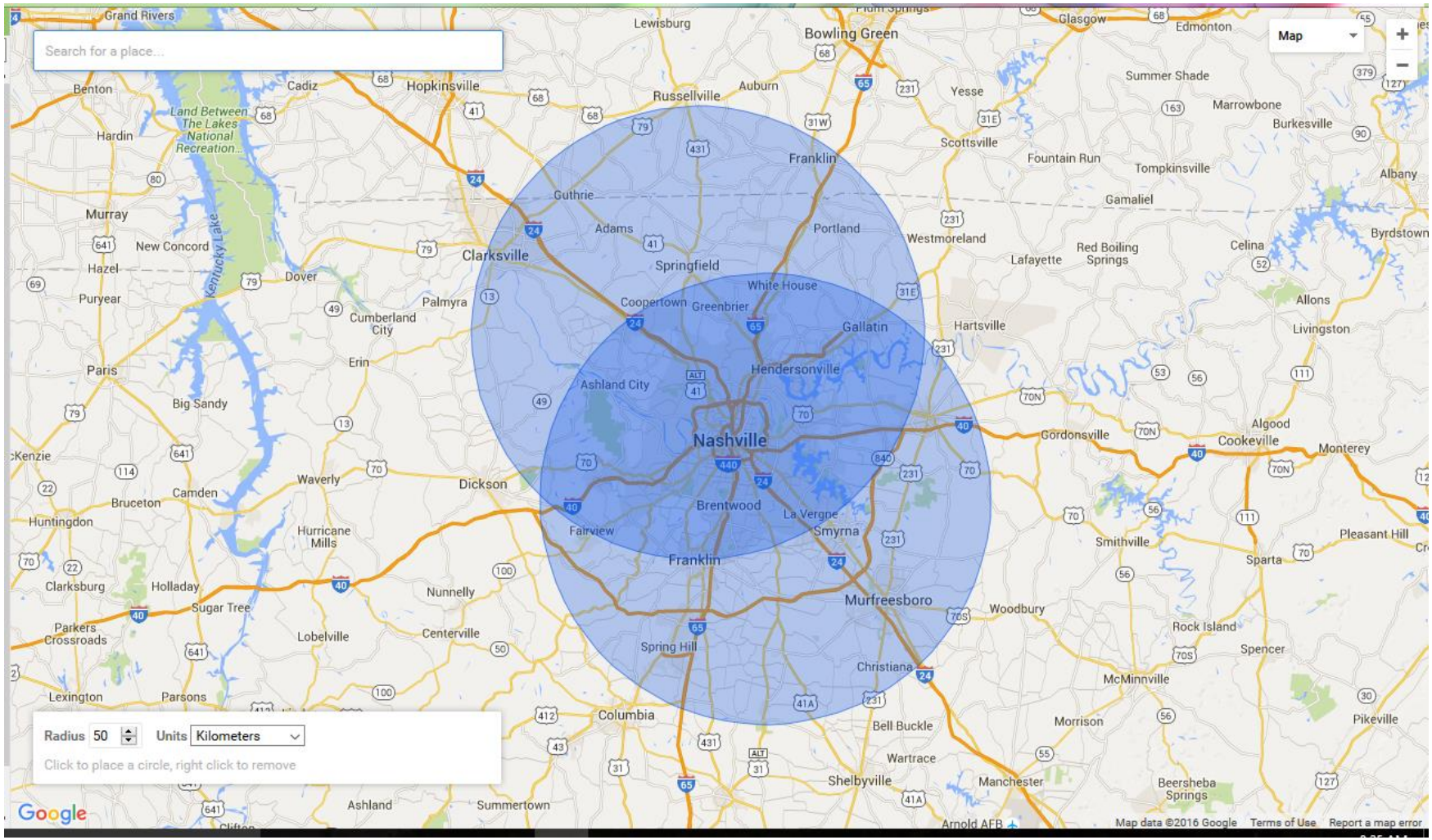
Mr. Finke,

We are contacting you regarding the requested permit by Tennessee Gas Pipeline to build a compressor station in Joelton, less than a mile from our new Paradise Ridge Community Center.

We live in the Joelton Community and are opposed to the building of this compressor station and are very worried about the hazards that it brings to Joelton and All of Davidson County. We have seen the conditions of these 60 year old pipes they intend to use and it's not in the best interest on anyone living in or around them.

Please do not issue this permit.

Eva & Wayne Green
7456 Bidwell Rd.
Joelton, TN. 37080
615-319-4518



This map identifies the 50km (~31 mile) radius of cumulative impact on air quality if two proposed natural gas compressor stations are built in Davidson County. The northern map centers on Kinder Morgan's proposed 60,000 HP station for 7650 Whites Creek Pike; the southern map centers on Columbia's proposed 34,000 HP station for 906 Barnes Road.

From:	Lainie Marsh
To:	Finke, John (Health)
Subject:	TGP-Public Comment
Date:	Monday, June 27, 2016 11:35:39 AM

Dear Mr. Finke,

As regards the request by Kinder-Morgan (KM), in the guise of the Tennessee Gas Pipeline Company, LLC (TGP), for a permit to begin construction in Joelton of a 60,000 hp compressor station, I beseech you and all persons functioning authoritatively as agents in the Metropolitan Nashville Health Department to deny such request.

There is a preponderance of evidence that the proposed operations of TGP will place the public's health at risk. Whereas, you may find a plethora of stipulations allowing or disallowing this evidence, e.g. evidence from court cases against KM in cities all over the United States, evidence from field studies, evidence from expert analyses, and the evidence suggested by the governing bodies of other cities and states across the country that have denied KM a green light, you nonetheless are charged with the ethical responsibility to protect the citizens of Davidson County from ANY potential public health risk, and therefore, *must* take this evidence into consideration.

It is obstructionist for the Health Department to present hurdle after hurdle for the residents of Joelton and the surrounding areas to overcome in their efforts to preserve the environmental integrity of their communities. To their credit, however, the members of those communities, known together as Concerned Citizens for a Safe Environment, have done an astonishing job of delivering the goods demanded of them by the governing bodies of Nashville and the State of Tennessee at every juncture for nearly two years now. As a result, it is clear that the clean air and water of this longstanding agricultural zone will certainly, without any doubt, regardless of whatever chicanery has been, or may be, employed to manipulate the truth, be jeopardized by a fracked gas compression and pipeline operation in the midst of its farmlands. You know there is truth is that statement, John. A five-year old would immediately reason that the picture of an industrial operation like the TGP is not compatible with the picture of rolling acres of crop rows.

WHY DO PEOPLE HAVE TO GET SICK FIRST? This story is not new. It goes back to the beginnings of the coal industry, of which the TGP and its kind are latter-day extensions, and has been continuously running in the theaters of the American judicial system for over a century. Miners dying of black lung have met with the same type of company rhetoric that we hear from the TGP: it cannot be proven that the damages to your health are connected to the mining industry.

This moment in time will not come again. If the Health Department grants this construction permit, it will have issued a death certificate for northwest Davidson County, i.e. tacit approval for a big energy bully to ravage the eco-system of one of the State of Tennessee's most pristine and agriculturally valuable landscapes <u>strictly for its own profit</u>. Moreover, the issuance of this construction permit will set a dangerous precedent for such permits to be issued elsewhere. For a Health Department of a major metropolitan area to take such self-destructive action makes no sense. Rural areas MATTER and for Nashville to sacrifice the health of its outlying rural communities to corporate greed would be tantamount to dismemberment of its

whole self.

PLEASE, PLEASE do the right thing. The future health of tens of thousands of Davidson County residents is on you.

Lainie Marsh
3891 Knight Drive
Whites Creek, TN 37189

From:	Bill Smith
To:	Finke, John (Health)
Subject:	Comment on Air Permit
Date:	Sunday, June 26, 2016 3:20:49 PM

I wish to submit the following comment on the draft air permit for Tennessee Pipeline Company.

My wife and I have lived for 17 years adjacent to the property now proposed for construction of a pipeline compressor station. Our property is on Greenbrier Road in Joelton.

My wife has asthma. We moved out of the city to rural Joelton not simply for peace and quiet, but also to find clean, healthy air to breathe.

We have heard that the compressor station, as proposed, will put significant toxins into the air, affecting a radius of many miles. So we have tremendous concern for how this polluting facility right next to our house will impact our health.

We do not have resources that allow us to simply sell and move. Besides, just the threat of a compressor station has created a real estate bust in the area. We are trapped in a potential future environment that will likely shorten our lives.

And, so, for the sake of our very survival, we oppose this permit.

William Smith
Resident and property owner
7736 Greenbrier Road
Joelton 37080

From:	Martin Holsinger
To:	Finke, John (Health)
Subject:	TGP-Public Comment
Date:	Saturday, June 25, 2016 8:40:53 PM

Dear Mr. Finke,

I am extremely concerned about the possibility of not one but two gas compressor stations bracketing Davidson County. I live somewhat close to the proposed Joelton plant and have cardiopulmonary issues that are exacerbated by poor air quality. Living in the NW quarter of Davidson County has helped me deal with these issues, but approval of this proposal will bring the pollution to me. Why should Tennessee Gas Pipeline Company's desire for profit trump my need for clean air?

At a broader level, Nashville is, geologically speaking, a basin, and pollution tends to "pool" in that basin. The overlap zone of these two plants' pollution footprint will lie directly over downtown Nashville, and detract seriously from everybody's quality of life, increasing medical expenses that the gas companies will not be liable for. Why should the citizens, and the city, of Nashville have to pay for this "externality" so the pipeline companies can profit?

I am not just concerned with the aromatic hydrocarbons that these plants will emit. Natural gas is a fossil fuel, and its production and use releases carbon dioxide into the atmosphere, raising the planet's temperature and creating a whole host of other, mostly negative, effects. The best scientific minds of our time are telling us that we need to leave most, if not all, of our planet's "fossil fuel reserves" in the ground, or we are at serious risk of making the planet very inhospitable to the likes of us. Creating infrastructure that will facilitate the extraction and use of more fossil fuels seems, in that light, like a very ill-advised move.

Thank you for taking the time to consider my comments.

Martin Holsinger
5155 Drake's Branch Rd.
Nashville TN 37218

From:	David Robertson
To:	Finke, John (Health)
Subject:	TGP - public comment
Date:	Thursday, June 23, 2016 8:15:24 PM

We strongly oppose the construction of the proposed Kinder Morgan/Tennessee Gas Pipeline LLC Gas Compressor Station at **7650 Whites Creek Pike, Joelton Tennessee.**

This is a commercial facility proposed at a location zoned as rural/residential within 1000ft of an organic farm, less than a mile from a park/community center, and close to a Wildlife Rehabilitation Center.

The construction of this facility will destroy 86 acres of pristine woodlands, potentially pollute air and water in the area, and, produce noise pollution.

This facility will serve no purpose for residents of Joelton, or of Tennessee. It is our understanding that the increased capacity is contracted to another company and will be exported overseas.

The pipeline infrastructure is poorly maintained and Kinder Morgan/Tennessee Gas Pipeline LLC has a poor record of maintenance and safety.

There is no reason to build this facility at this location other than it is most likely the lowest cost and most profitable location for Tennessee Gas Company LLC.

Please do not let the greed of a corporation ruin the idyllic setting and peaceful lifestyle of the Joelton area.

Thank You,

David Robertson
Angie Robertson
1342 Roberts Road
Goodlettsville TN 37072
615-851-7345

From: Dan Lain
To: Finke, John (Health)
Subject: TGP-Public Comment
Date: Thursday, June 23, 2016 6:47:30 PM

John-

The compressor station is bad for Joelton and all of Davidson County.

Please do what you can to protect our community and the air we breathe.

Respectfully,

Dan Lain
Founder
TN HomeBuyers Inc.
(615) 299-8852
(615) 876-9973 Fax
www.WeBuyHousesTN.com

1216 Bending Creek Drive
Cane Ridge, Tenn. 37013
404-583-1508
July 20, 2016

Pollution Control Division
2500 Charlotte Avenue
Nashville, Tennessee 37209

and

Mr. Robert Skagg, CEO
Columbia Pipeline Group
5151 San Felipe, Suite 2400
Houston, Texas 77056

Re: Davidson County, Tennessee residents and businesses and Columbia Pipeline Group - Gulf Express Project – Docket No. CP16-361-000 and Joelton Pipeline Project – Kinder Morgan -

Gentlemen:

Please be advised that I now have uncovered the fact that I am not the only resident of Davidson County subdivisions who could be affected by your two proposed pipelines, if they are approved by the authorities. It has come to my attention that in one subdivision alone, most of the residents still have not been notified of any of your impending meetings. It is my understanding that these procedures and meetings have been on-going for months without all of the residents in these subdivisions even being told about it. This is "Dirty Tricks"! Tennessean and websites are not sufficient. We did not receive letters or notifications of these meetings or proceedings.

As far as the Joelton Project, it is also my understanding that pipes owned by them that were damaged in the 2010 flood, still have not been taken care of. Further, in the recent 15 year study of gas pipeline explosions, it appears there were 408 accidents in 15 years (45 were from natural gas pipelines) and many, many times Kinder Morgan was named as the owner. So far I have uncovered 3 due to Columbia; however, I am still researching. It should be known here that 45 natural gas pipeline accidents over a 15 year period of time amounts to 3 accidents per year. Many were with injuries. Even one is too much!

As far as the Columbia Pipeline Project, I have received a 2 page letter from Columbia officials recently telling me they would be back in touch with me and of course they have not. They tell me how they try to keep a good safety record and own a 90 acres buffer to protect the public; however, on July 19, 2016 I had to contact the Davidson County Public Works Department due to the fact that the property owned by Columbia Pipeline (or have they already sold it to a Canadian company?) at the intersection of Barnes Road and Old Hickory Boulevard, in Cane Ridge, Tennessee appeared to be a danger to drivers and passengers alike due to the overgrown and apparently unattended condition the grass, weeds, etc. were in. This prevented a good view of oncoming traffic on Old Hickory Boulevard.

I thought these 2 pipeline companies stated they were going to keep the public safe. How many accidents have already occurred at the Barnes Road/Old Hickory Blvd. Already? We need to check the public records! These companies appear to not care about public safety at all and should be kept from our very large population community of Cane Ridge and Joelton, Tenn.

I gave the County the name, address and phone number of Columbia so they could get their money back. This should not be the taxpayers expense. Apparently the Green- way also was a waste of the taxpayers funds, as it cannot be enjoyed with the noise from trucks coming in and out, trees being torn down, as well as even a non-stop threat to the neighborhood of an explosion at any time. Again, both of these pipeline projects within the Davidson County area need to be rejected and no more time wasted. No permission needs to be granted here to them!

The following is part of a recent letter to Robert Skagg, CEO of the Columbia Pipeline Group. This letter shows part of the results of my recent study: "As a follow-up to my letter to you under date of June 21, 2016, I have done some research concerning the accident rates of gas pipeline problems over the last 15 years and 4 months in the United States.

It appears that there were approximately 408 accidents, which includes all types of gasoline accidents such as pipeline worker related accidents, tornadoes, lightning strikes, negligence, old pipelines, as well as other type of pipeline accidents. It also appears that approximately 45 of these pipeline accidents were related to natural gas pipelines. There appeared to be 89 fatalities; 223 + injuries. It would appear that Columbia was responsible for some of these problems. That is if Columbia Transmissions is one and the same as Columbia Pipeline Group. Perhaps I need to do a further study to unravel any information that I have missed during my first research of the problem.

What is also shocking is the fact that there appears to be only 14 fines, 3 citations, 2 consent orders, and 1 criminal complaint against any of those responsible for the deaths, human injuries, as well as damage to properties. Most of the study that I did does not give names of the pipeline owners who caused the problem; however, I have to-date located at least 3 apparently attributed to Columbia. One 2009, 2011, and February 13, 2014. Even one accident would be too much for my backyard!

The following is also another copy of my letter to you dated June 21, 2016, with no response to date:

"On Tuesday, June 21, 2016 I received a call from a neighbor asking if I would like to attend a FERC scoping meeting concerning the Columbia Pipeline (Gulf Express) project @ 6:00 P.M. At the Cane Ridge High School in Cane Ridge, Tenn.

Needless-to say I was shocked at this message as I, as an 87-year old recent TSU Master's Degree recipient, had never received any type of information or literature concerning this imminent danger to health, property value, Green-way tranquility, or quiet enjoyment of property in my neighborhood.

As a retired real estate agent in another state, I am floored at this news as well as the fact that I obviously was deliberately singled out (due to my age) from being notified. This is a serious breach of my rights as a taxpayer in Davidson County and as a United States citizen.

The meeting appeared to be nothing more then a "done deal" being pushed before poor unsuspecting public, and with the guise of attempting to allay fears of the community and as a good future partner. It all appeared to be nothing more then "contrived" and I did not believe a word of it either from the staff of the FERC or the representatives of the Columbia Pipeline, who I talked to after the meeting. The Columbia Pipeline representatives were not apparently available during the meeting but only in the foyer afterwards.

The only conclusion that could be reached is that the Green-way project built around Davidson County appears to be nothing but a waste of taxpayers monies as it will be worthless to the residents after your project enters our area. Noise pollution alone would ruin tranquility not to mention environmental harm. The homeowners attending the meeting the other night, were painted a "pretty picture" of no harm; however, the information given was from areas not affected by your pipeline project due to the fact that they were in very low population areas, and not like Davidson County that has a very large population. The Cane Ridge area alone probably represents at least 200,000. This whole meeting appeared to be a deliberate cover-up of a deal already "done".

The only comment I will have about my suspicions being true,would be that if I were the CEO of a large pipeline company, I would not want to subject myself, my personnel, representatives, employees, or any or all entities that would help or provide help to start or run my project to the possible future hostility, or even perhaps legal actions against them. Am I right? As the owner and officer of a former chemical corporation for years, I am aware of these pitfalls.

Further, the literature indicates that the pipeline project can even bring about condemnation with eminent domain against our properties. This means that we could end up receiving only a small portion of what our properties are worth. At almost 88 years of age, this would be devastating, as well as having to pack up and make a move. Please be advised that I have already been faced with a move to work on my doctorate; however, will not do so due to the moving.

As you are probably aware if you follow the news around the world, my graduation from TSU on May 6, 2016 with my Master's went around the world and it was viral on almost every station including the BBC. I am also already well known for being the lead singer, (opening all the shows for the Atlanta County Music Hall of Fame) in Atlanta, Georgia for the past 24 years. I was voted "Entertainer of The Year 2006" for Georgia. I was inducted into Phi Kappa Phi National Honor Society on April 17, 2015; was inducted into Alpha Lamba Delta at Georgia State University; National Honor Society at Greenwich High School in Greenwich, Conn.; attended law school 2 years maintaining a 104 grade on a cite test @ age 77; received an 80-hour Private Investigator Certificate from college; and a real estate license in Georgia. I am told by the media that I had one of the highest scores in the Master's program. I still maintain a 4bedroom home by myself; detail my Lexus myself; and 2 weeks ago traveled to Georgia by myself to open a show in Macon, Georgia for the Atlanta Country Music Hall of Fame, and will open the "Entertainer of the Year Show" in Atlanta, Ga. on August 21, 2016 at age 88. I also formerly owned 2 aircraft.

I have filed actions against doctors (settled one of the first malpractice suits in the U.S. in 1958) collecting from Lloyds of London; filed against insurance companies; utility companies; lawyers; credit reporting companies; dishonest auto mechanics; dishonest contractors; and even dishonest new car dealers, so now you know part of my background. I was a paralegal for 15 years also.

I am shocked and appalled that the Mill Run Homeowners as well as other homeowner associations have not notified the homeowners of the problems that I have related above, as well as having not attempted to put a STOP to the project before it ever escalated to the level it now has. Now it is like"locking the barn door after the horse has escaped". It apparently already is too late to stop it.

The pictures in the literature that I have been given at the June 21st meeting, shows a very ugly landscape with your pipes and buildings on the property. It is a disaster ready to happen apparently!

I have no choice but to copy the FERC, Governor Haslam, Nashville, Tennessee Mayor, the President of the Tennessee Board of Realtors, the Chamber of Commerce, the CEO of the Management company for the Mill Run Homeowners Association and will request to know the exact time they were informed of this apparent disaster to our area. If they knew prior to my being notified, then there obviously should be consequences as a result of any possible harm to me or my finances. Correct?"

It has come to my attention that Columbia is sold or being sold to a Canadian company. Is that apparently in order to avoid any or all types of legal action?

With kindest regards, I remain

Lorraine Guth Parker

cc: Barack Obama, President of the United States
1600 Pennsylvania Avenue NW
Washington, D.C. 20004

cc: Kimberly D. Bose, Secretary - Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, DC 20426

cc: Governor of Tennessee, Bill Haslam
State Capitol,1st floor
600 Charlotte Avenue
Nashville, Tenn. 37243

cc: Nashville Mayor, Megan Barry
1 Public Square
Nashville, Tennessee 37201

cc: Tennessee Association of Realtors
c/o Nashville Association of Realtors
4540 Trousdale Drive
Nashville, Tennessee 37204

cc: Kenyon M. Rush, President

Chamber of Commerce
c/o 211 Commerce Street, Suite 100
Nashville, Tennessee 37201

cc: Director, Public Works
City of Nashville
750 South 5th Street
Nashville, Tennessee 37206

cc: TerryCobb, Director
Public Standards
City of Nashville
800 2nd Avenue South
Nashville,, Tennessee 37219

cc: Dan Henning, CEO
Community Management Association
as management company for:
Nashville Mill Run S.D.
1465 Northside Drive NW
Atlanta, Georgia 30218

cc: President, PBS TV
161 Rains Avenue
Nashville, Tennessee 37202-8330

cc: President, TV Fox 17
631 Mainstream Drive
Nashville, Tennessee 37228

cc: President, CBS News Channel 5 TV
474 James Robertson Parkway
Nashville, Tennessee 37219-1212

cc: President, NBC WSMV TV 4
5700 Knob Road
Nashville,Tennessee 37209-4523

cc: President, ABC WKRN News 2
441 Murfreesboro Road
Nashville, Tennessee 37210

Gmail

lorraine guth <guthlorraine@gmail.com>

Air Permit Hearing - July 27

1 message

Hawkins Management <HawkinsManagement@comcast.net> Tue, Jul 19, 2016 at 7:02 PM
To: guthlorraine@gmail.com

Interested persons may submit written comments prior to or within seven days subsequent to the public hearing. Comments should be submitted to:

Pollution Control Division
2500 Charlotte Avenue
Nashville, Tennessee, 37209

We need TONS of people to attend A VERY IMPORTANT public hearing about

the Air Permit for the Joelton gas compressor station.

Wednesday, July 27, 2016
Lentz Public Health Center
2500 Charlotte Avenue
4:30 p.m (Please arrive at 4:00pm if possible.)

Draft permits have been issued and are currently out for public comment.
Final Permits for the proposed Joelton site have not been issued...yet.
Additional details regarding the public hearing can be found here:

The Lentz Health Center holds 500 people - and ideally we would like to get every single seat filled! Concerned citizens plan to assemble outside the Lentz Health Center about a half-hour before the meeting starts. Be ready with ANY and ALL questions you might have!!!

A lawyer from North Carolina is coming in, as well as an air expert from Colorado.

It's going to be a big deal and we NEED YOU there!

All the best,
Lillian Hawkins
Hawkins Management

2 attachments

Air-Quality-Impact-2-Compressor-Stations.png
720K

Joelton-Air-Permit-Hearing.docx
109K

August 2, 2016

Metro Public Health Department
Pollution Control Division
2500 Charlotte Avenue
Nashville, TN 37209

To Whom it May Concern:

I wish to make three points, plain and simple:

1) It should go without saying that you exist to serve and protect the people who pay your salaries. According to your letterhead you are all about "Protecting, Improving, and Sustaining Health." This proposed Gas Compressor Station is a serious, hazardous, and life-threatening matter. We need you to advocate for us; therefore, your loyalty should be to protecting the citizens of Metro Nashville, and not succumbing to Kinder Morgan's willful deception, bullying, and pressure tactics.

2) Research has shown that the level of toxic emissions from CO2E alone is more than **double** the Title V Air Permit Maximum Threshold!! Would you want your family breathing this stuff? And dying from it?! And that's just for starters!
So why is Kinder Morgan's proposal even being seriously considered? What right do they have to put our safety at risk, for no good reason other than their own profits? Please do not allow yourself be an accomplice to their unscrupulous schemes!

3) Kinder Morgan's lamentable safety record should also certainly be a huge red flag. Just on this basis alone, how could any responsible Metro government agency allow them free rein to put the people of Metro Nashville at further health risk?

Please do the right thing and say "NO!" to Kinder Morgan!! If after all you have heard and read, this serious situation is still no big deal to you, I have a house here in Joelton to sell you — for real cheap [No one else will buy it!] Come live with us and — take a DEEP breath!!

Thanks for listening!

Respectfully,

Roger E. Senechal

Roger E. Senechal
Homeowner and Resident at:
7601 Harper Road
Joelton, TN 37080

July 25, 2016

John Finke, Director
Air Pollution Control Division
Tenn Public Health Department
2500 Charlotte Pike
Nashville, TN 37209

Sir:

I write you to oppose the pipeline compressor station proposed for 7650 White Creek Pike by the Tennessee Gas Pipeline Company. That project would be within 1.5 miles of my home and would definitely affect me adversely.

Thirty years ago, I bought 2.5 acres of land on Ridgewood Rd. and built a house there. I chose that plot because of its clear, quiet rural character and its abundant wildlife (goldfinches, bluebirds, turkeys, deer, coyotes, etc.).

Now, the compressor station proposes to ruin all of that. It would pollute the air with unacceptable levels of NOx, CO and CO_2e, all higher than the Clean Air Act allows. Not only does this destroy the clean air I presently enjoy, but it adds to the greenhouse gases which threaten our environment generally (global warming). They may have adverse effects on local farmers.

Wildlife and human life too would be affected by the noise generated by such a compressor station. It is estimated that normal operation causes the noise of 4 railroad locomotives 24/7. That would certainly reach my property and would make it difficult for birds and other wildlife to find one another for mating purposes.

Besides these problems gas compressor stations & pipelines are explosive. Recently, Pacific Gas & Electric was fined $1.6 billion for blowing up 38 homes in San Bruno, CA, killing 8 people. Fairly recently a compressor station near Castalian Springs, TN, blew up when a tornado hit it. Besides being explosive, natural gas installations are dangerous due to massive leaks — witness Porter Ranch, CA's experiences!

over

What can Metropolitan Government do to prevent Tennessee Gas Pipeline Company from polluting the air and water with noxious gases and noises? For example, can Metro force Tennessee Gas Pipeline Company to soundproof nearby homes to protect people from the 24/7 noise as has been done near the Nashville airport? Will Metro constantly monitor water and air quality in the local neighborhoods and at Joelton Middle School? I do not trust Tennessee Gas Pipeline Company to do the monitering since they do not maintain their pipelines now.

Sincerely,

Lynn E. Dwyer

Lynn Dwyer
7995 Ridgewood Rd
Goodlettsville, TN 37072

Aug 1, 2016

To: Ladies & gentlemen of Metro Public Health

Re: Follow up letter from my comments on 7-27-16
you have my card.

I am Paulette Miller and I live at 3572 Bowlin Rd, Joelton, Tn 37080. I live less than a mile from the proposed compressor station. I have lungs which could be greatly affected by all these toxic chemicals. Our six year old grandson lives staying at the Paradise Ridge Park next door but he has asthma. My husband also has asthma & will be adversely affected. We moved to Joelton from near downtown Nashville 40 years ago for our air here is purier than it was there, partly due to higher elevation.

I'm proud to be a Nashvillian and being referred to as the IT city, I hope you saw the TV coverage showing our pollution from Joelton will overlay downtown Nashville if the plant is allowed to proceed. "The biggest one in the USA" The IT city is going to add this to our accolades. Do you think this will increase tourism? This same gas company has several pipes lines exploded since the 2010 flood and has been cited numerous times.

Stand up for Joelton! Stand up for Nashville! Stand up for our grand state of Tennessee!

Please help us.

Sincerely,
Paulette Miller
615-876-9401

August 1, 1016

Dear Mr. Finke and Metro Health Department Members,

I am impressed with your beautiful building. Congratulations on your LEED Silver Award and your decision to have a healthy smoke-free campus!

After Wednesday night's gas compressor station permit hearing, I assume you will continue your efforts to keep our city healthy by deciding to revoke your draft air and construction permit. Either this was the first time you heard of the dangers of toxic particulates settling in Nashville's geological bowl from both the Joelton and Cane Ridge stations (if so, SHAME on you for not doing your homework before issuing the draft permit) or you have known about these dangers to human health, animal health, the two creeks on the property in question which lead to our drinking water (not to mention wells in surrounding residences) and the many nearby farms (farms, not just backyard gardens) where our food is now grown in healthy air. If you already knew about the health hazards caused or exacerbated by routine emissions from gas compressor stations, then DOUBLE SHAME on you for issuing a draft air and construction permit.

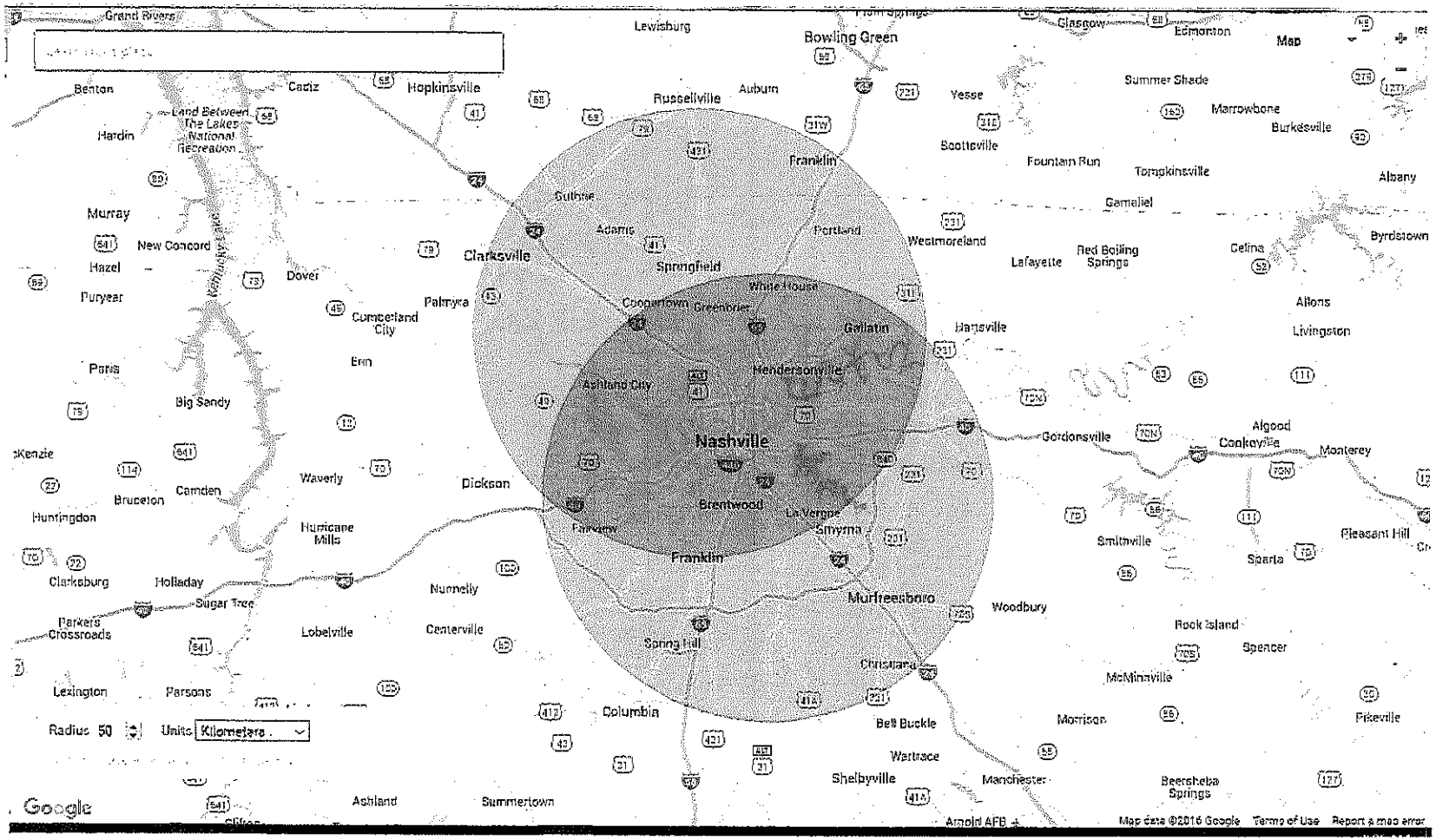
You are faced with a difficult decision and I understand that it would be embarrassing to revoke a permit whose draft edition has already been issued. However if you weigh the health of the community you are being paid to protect against the pressure of a greedy corporate giant, I don't see how you can justify this permit. Kinder Morgan is WRONG to irresponsibly endanger the millions of Americans living above their old and poorly maintained pipe infrastructure just to get richer by selling their gas to foreign markets. And I have to say Metro Health would be WRONG to partner with them by granting this permit. If you are honest, courageous and devoted to your responsibilities, YOU CAN STOP THIS at least in Metro Nashville and thereby set an example to encourage other cities to do the right and healthy thing. Did you know the mayor of Weymouth, Massachusetts refused $45 million to keep away an unhealthy 7,700 hp compressor station that was to be linked a year later with a 10, 320 hp compressor yielding only a total of 18,020 hp? By the way, Kinder Morgan's proposed Joelton compressor station will be 60,000 hp!!!

I chose not to question your due diligence publicly on Wednesday because I am trusting you when you say that you will read all submitted comments. I am challenging you to do your job conscientiously and protect the air we must all breathe from any unnecessary pollutants. Very likely all of you live within these blue circles on the enclosed map below taken from p. 118 of the Environmental Assessment for Kinder Morgan's proposed gas compressor station in Joelton.

Thank you for listening to us. Thank you for being interested in healthy air for all of Metro to breathe. Rejecting this permit would be much more difficult if the gas in question were needed to heat our homes or to generate additional electricity for our new buildings. Still not an easy choice for you, I pray you will have the integrity to stand up for our good health. I can promise you that you will sleep better at night and breathe better by day,

Diana J Senechal

Diana Senechal, Joelton homeowner and resident
dianasenechal@gmail.com
(615) 942-7723



This map identifies the 50km (~31 mile) radius of cumulative impact on air quality if two proposed natural gas compressor stations are built in Davidson County. The northern map centers on Kinder Morgan's proposed 60,000 HP station for 7650 Whites Creek Pike; the southern map centers on Columbia's proposed 34,000 HP station for 906 Barnes Road.

A Review of Research Done on the Adverse Effects to Public Health from Pollutants Emitted by Unconventional Natural Gas Facilities Including Compressor Stations

June 23, 2016

K.A. Rodgers

According to the U.S. Energy Information Administration's 2016 Annual Energy Outlook Report, the growth projection for natural gas liquid production in the United States between 2014 to 2040 is net 1.7%, or 4.99 million barrels per day.[1] Exports of natural gas jump from 1.51 Tcf (trillion cubic feet) in 2014 to 8.9 Tcf in 2040, for a net growth of 6.7%.[2] Much of this exported unconventional natural gas will come from fracking operations in shale plays like the Marcellus and Utica that run beneath Ohio, Pennsylvania, West Virginia and New York, the Barnett/Fort Worth and Eagle Ford formations in Texas, the Fayetteville play in Arkansas and the Bakken play in North Dakota.[3] With more formations lying under thirty-plus states that contain an estimated 2,200 Tcf of "recoverable" gas, the gas and pipeline industries are busily building the vast infrastructure necessary to pump out and deliver product to consumers in the US and abroad before the plays 'play out' in the next 84 years.[4] This gas production infrastructure consists of well pads, interconnected gathering and transport pipelines that crisscross the country, storage tanks, evaporation ponds, dehydrators, compressor stations and terminals. While all this production growth seems to beam brightly in this business sector, rumors sprouted about a dark side to unconventional natural gas development (UNGD), rumors about toxic emissions from industry facilities that befouled the water, soil and air and harmed people and communities... rumors that were largely ignored until they finally became published unvarnished facts, as in this excerpt from the 2013 report of the Inspector General of the Environmental Protection Agency:

"Recent and projected growth in the oil and gas production sector has underscored the need for the EPA to gain a better understanding of emissions and potential risks from this industry sector. Harmful pollutants emitted from this industry include air toxins such as benzene, toluene, ethylbenzene, and xylene; criteria pollutants and ozone precursors such as NOx and VOC's; and greenhouse gases such as methane. These pollutants can result in serious health impacts such as cancer, respiratory disease, aggravation of respiratory illnesses, and premature death."[5] [6]

Though there were many research studies done prior to the Inspector General's 2013 report, hundreds more have been produced since and are continuing to emerge, some performed by states that host multiple UNGD sites like Colorado[7] and New York[8]. "Eighty-four percent of public health papers contain documented rises in adverse impacts to health, 69% show water quality impacts and 87% of air quality studies show increased elevations of air pollutants, studies that should lay the empirical groundwork for necessary policy change".[9] From a peer-reviewed assessment of 31 criteria-selected research studies focused on public health between 2009-2015, "26 (or 84%) revealed elevated risks and adverse public health outcomes; out of 58 studies on water quality, 40 (or 69%) indicated incidences of water contamination associated with [UNGD]; and of 46 studies on air quality, 40 (or 87%) found that [UNGD] increased air pollutant

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[1] http://www.eia.gov/forecasts/aeo/data/browser/#/?id=14-AEO2016&cases=ref2016~ref_no_cpp&sourcekey=0

[2] http://www.eia.gov/forecasts/aeo/data/browser/#/?id=76-AEO2016&cases=ref2016~ref_no_cpp&sourcekey=0

[3] https://www.eia.gov/energy_in_brief/article/shale_in_the_united_states.cfm

[4] http://www.eia.gov/forecasts/aeo/data/browser/#/?id=76-AEO2016&cases=ref2016~ref_no_cpp&sourcekey=0

[5] The United States Environmental Protection Agency, Office of the Inspector General, "EPA needs to improve air emissions data for the oil and natural gas production sector", February 20, 2013. Report No. 13-P-0161.

[6] "Understanding Exposure from Natural Gas Drilling Puts Air Standards to the Test", *Environmental Health*, Vol. 29, Issue 4, December 2014, pp. 272-292, D. Brown, B. Weinberger, C. Lewis, H. Bonaparte.

[7] http://www.colorado.gov/airquality/report.aspx

[8] http://www.health.ny.gov/press/reports/docs/high_volume_hydraulic_fracturing.pdf

[9] Webinar "Outdoor Air Toxics – Unhealthy Air", Physicians for Social Responsibility, 5/24/2016, speaker L. Dryszka, M.D.

emissions and/or atmospheric concentrations."[10] Some of these article bylines read more like indictments: "Implications of [UNGD] - a global public health concern"[11], "EPA needs to Improve Air Emissions Data", "Highly elevated atmospheric levels of [VOC's] in the Uintah Basin, UT", "Birth outcomes and maternal residential proximity to [UNGD] in rural CO"[12], "Estimation of regional air-quality damages from Marcellus [UNGD] in PA"[13] and "Five State Study Finds Unsafe Levels of Airborne Chemicals Near Oil and Gas Sites."[14] However, these shocking headings are based upon much scientific research that indicates that people and communities are being harmed by the chemical-laced emissions discharged from UNGD facilities and their transport systems. A complete list of identified chemicals and their exposure pathways is updated regularly and available at the Center for Disease Control. Some of the chemicals listed that are associated with UNGD emissions are acetaldehyde, acrolein, benzene, carbon tetrachloride, ethylbenzene, formaldehyde, hexane, methylene chloride, phenol, toluene, and xylene.[15] Most of these are classed as 'known' carcinogens (like benzene), while others are 'probable' (formaldehyde) or 'likely' cancer-causers; yet, no matter the classification, exposure to these chemicals is definitely not good for the body.

Wilma Subra, an environmental chemist from New Iberia, Louisiana, a MacArthur 'genius' fellow, and former vice-chair of the EPA's National Advisory Council for Environmental Policy has earned respect among the oil and gas industries she commonly fights against for change. Subra has documented case studies of people living near UNGD compressor stations and has compiled a list of over forty symptoms that include nasal or throat irritations, nausea, respiratory irritations or aggravation of respiratory illnesses like asthma, nosebleeds, increased pulse and/or rapid heartbeat and vertigo. These symptoms shared by sufferers who have been exposed by proximity to UNGD facilities and their emissions have been linked through research to a chemical cocktail of toxics the oil and gas industries admit to emitting in their applications to federal, state and local governments as they seek approval for projects from agencies like the Federal Energy Regulatory Commission and permits from local metropolitan air quality departments. These lists of toxins give an approximation of not only what kind of pollutants will be released in annual tonnage and, in the case of the New Market Project, the possible "target organ" potential to harm, but also how much volume can be expected in hourly and eight-hour increments by UNG facilities like natural gas compressor stations.[16] [17] "[UNGD] and production involve multiple sources of physical stressors [like] noise, light…toxicants…and

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[10] "Toward an Understanding of the Environmental and Public Health Impacts of Unconventional Natural Gas Development: A Categorical Assessment of the Peer-Reviewed Scientific Literature, 2009-2015"; J. Hays, S.B.C. Shonkoff, 4-20-2015; http://journals.plos.org/plosone/article?id=info:doi/10.1371/journal.pone.0154164

[11] "The implications of unconventional drilling for natural gas: a global public health concern", *Science Direct*, 9 October 2013, M.L. Finkel, J. Hays; http://www.sciencedirect.com/science/article/pii/S0003335061300241 2

[12] "Air Concentrations of Volatile Compounds Near Oil and Gas Production: a Community-based Exploratory Study", *Environmental Health*, 30 October 2014, G.P. Macey, R. Breech, M. Chernaik, C. Cox, D. Larson, D. Thomas, D.O. Carpenter; http://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-13-82.

[13] "Estimation of regional air-quality damages from Marcellus Shale natural gas extraction in Pennsylvania", *Environmental Research Letters*, Vol. 8, No. 1, 31 January 2013, A. Litovitz, A. Curtright, S. Abramzon, N. Burger, C. Samaras; http://iopscience.iop.org/article/10.1088/1748-9326/8/1/014017/meta;jsessionid

[14] "Five State Study Finds Unsafe Levels of Airborne Chemicals Near Oil and Gas Sites", *Inside Climate News*, 30 October 2014, J. Smith-Hopkins; http://www.gcmonitor.org/5-state-study-finds-levels-of-airborne-chemicals-near-oil-and-gas-sites/

[15] http://www.atsdr.cdc.gov/mrls/mrllist.asp

[16] Broad Run Expansion Project Environmental Assessment, Office of Energy Projects, pp 93-104.

[17] New Market Project Environmental Assessment, FERC, Office of Energy Projects, Human Health Risk Assessment, pp 12.

radiological materials... including air emissions", with new sources being discovered at various stages of transmission cycles.[18]

The five-state study of Arkansas, Colorado, Ohio, Pennsylvania, and Wyoming mentioned before found heavy concentrations exceeding healthy risk levels of such toxicants as benzene, formaldehyde, hexane, and hydrogen sulfide near UNGD sites. David O. Carpenter, the senior author of the study published October 30, 2014 said, "The implications for health effects are just enormous." Samples were collected from differing UNGD sites that included compressor stations; when tested, 40% revealed levels well over the federal safety limits for either short- or long-term exposures for benzene, formaldehyde and other toxics. (Carpenter et.al., 2014, [19]) Exposure to benzene (long- or short-term) has been linked to increased risks of blood cancers[20] [21] [22] [23], neural tube and congenital heart defects in newborns when residing within a 10-mile radius of UNGD facilities[24], and increased respiratory effects such as pulmonary edema, acute granular tracheitis, laryngitis, and bronchitis[25]. Released in fugitive emissions from compressor stations, benzene can linger in the atmosphere for days.[26] [27] Community members exposed to such volatile organic compounds (VOC's) that include benzene exhibit adverse health symptoms or illness immediately, particularly after a major UNG event like flaring or emergency gas releases (blowdowns) at compressor stations; conducted shortly after one such event, lab tests revealed elevated blood profiles, including liver enzymes.[28] [29] According to the Colorado Department of Public Health, "acute exposure to benzene can cause drowsiness, headaches, eye, skin and respiratory tract infections" while chronic exposures "can cause blood disorders, including aplastic anemia, as well as reproductive effects. Benzene is also a known human blood cancer carcinogen".[30] A thirteen-year study (1994-2006) of emissions from oil and gas industries' production facilities in Alberta, Canada (Canada's largest hydrocarbon processing center)

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[18] "Air Concentrations of Volatile Compounds Near Oil and Gas Production: A Community-based Exploratory Study"; *Environmental Health*, 30 October 2014; Macey, Gregg P., Breech, Ruth, Chernaik, Mark, Cox Caroline, Larson, Denny, Thomas, Deb, and Carpenter, David O.; https://ehjournal.biomedcentral.com/articles/10.1186/1476-069X13-82

[19] http://www.gcmonitor.org/5-state-study-finds-unsafe-levels-of-airborne-chemicals-near-oil-and-gas-sites/ Oct 30, 2014; J.S. Hopkins, *InsideClimate News*.

[20] http://energyindepth.org/wp-content/uploads/2012/05/Australian-Institute-Health-Survey.pdf

[21] "Occupational benzene exposure and the risk of lymphoma subtypes: a meta-analysis of cohort studies incorporating three study quality dimensions." Vlaanderen J, Lan Q, Kromhout H, Rothman N, Vermeulen R: *Environ Health Perspect.* 2011, 119: 159-167.

[22] "Advances in understanding benzene health effects and susceptibility." Smith MT: Ann Rev Public Health. 2010, 31: 133-148. 10.1146/annurev.publhealth.012809.103646.

[23] https://www.publicintegrity.org/2014/12/11/16396/health-worries-pervade-north-texas-fracking-zone

[24] "Birth Outcomes and Maternal Residential Proximity to NGD in Rural Colorado", *Environ. Health Persp.* V22, Issue 4, April 2014; L. McKenzie, R. Guo, R. Witter, D.A. Savitz, L.S. Newman, J.L. Adgate. http://ehp.niehs.nih.gov/1306722/

[25] USATSDR: Toxicological Profile for Benzene. 2007, United States Agency for Toxic Substances and Disease Registry Division of Toxicology and Environmental Medicine/Applied Toxicology Branch: Atlanta, GA

[26] "The use of health impact assessment for a community undergoing natural gas development." Witter RZ, McKenzie L, Stinson KE, Scott K, Newman LS, Adgate J: *Am J Public Health.* 2013, 103: 1002-1010. 10.2105/AJPH.2012.301017.

[27] "Analysis of BTEX groundwater concentrations from surface spills associated with hydraulic fracturing operations." Gross SA, Avens HJ, Banducci AM, Sahmel J, Panko JM, Tvermoes BE:. *J Air Waste Manag* Assoc. 2013, 63: 424-432. 10.1080/10962247.2012.759166.

[28] "Health effects of benzene exposure among children following a flaring incident at the British Petroleum refinery in Texas City." D'Andrea MA, Reddy GK, FACRO: *Pediatr Hematol Oncol.* 2014, 31: 1-10. 10.3109/08880018.2013.831511.

[29] "*Natural Gas Compressor Stations: Addressing Community Concerns, Assessing Emissions and Health Impacts*.pdf"; Southwest Pennsylvania Environmental Health Project, 30 Jan. 2016, D. Brown, C. Lewis, B. Weinberger

[30] Colorado Department of Public Health and Environment, 2009: http://www.garfield-county.com/air-quality/documents/airquality/Garfield_County_Emissions_Inventory-2009.pdf

revealed "remarkably strong enhancements of 43 VOC's, including benzene; the rate of male blood cancers was found to be elevated'. Though not definitive, the study concludes that there is enough research evidence to warrant a reduction of known carcinogenic emissions like benzene and butadiene.[31]

Another VOC and a Center for Disease Control 'probable' carcinogen, formaldehyde is emitted as a result of "incomplete combustion by natural gas-fired reciprocating engines at compressor stations".[32] It is also chemically formed in the presence of sunlight from methane (also a fugitive emission of compressor stations). In the previously mentioned five-state study, elevated levels of formaldehyde were present at 14 compressor stations in three states.[33 34 35] Capable of affecting nearly every tissue in the body, immediate exposure to formaldehyde can cause dermatitis and asthma, while long-term exposure results in neurological, reproductive, hematological, genetic and pulmonary cell death and/or damage from toxicity.[36] While a few states have lowered safe limits for exposure rates, some levels still exceed the safety margins by alarming degrees, particularly those measured at or near compressor stations (Colborn 2013, Shonkoff). "For the year 2012, emissions of formaldehyde from compressor stations in Pennsylvania ranged from 0.0 TPY to 22.5 TPY", while air studies around Texas' Barnett Shale area revealed "high concentrations of formaldehyde at sites with large compressor stations".[37] Facts such as these on benzene and formaldehyde exposures and the detrimental health risks that can occur once exposed prompted a total review of the fracking industry and facilities including compressor stations by the New York Department of Health and the Department of Environmental Conservation in 2015. Their findings were substantial enough to cause the Medical Society of the State of New York and the American Medical Association to call for "comprehensive health impact assessments regarding the health risks associated with fracking infrastructure, including natural gas pipelines and compressor stations."[38] Yet, even with it's potential to cause major physical harm to those exposed, formaldehyde emissions are still not monitored in most air studies; in fact, the EPA in 2015 elected not to include well sites, compressor stations, pipelines and other smaller UNGD polluting facilities that employ less than ten people in its decision to require natural gas processing plants to report toxic pollution.[39]

Hexane is a liquid byproduct of gas production that can be used as a solvent or degreaser; while useful in a liquid state, hexane gas can be dangerous when inhaled. In Wyoming, hexane emissions were detected at compressor stations there (Colborn 2013, Shonkoff). The elevated

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[31] "Air Quality in the Industrial Heartland of Alberta, Canada and Potential Impacts on Human Health", *Atmospheric Environment,* Volume 81, December 2013, Pages 702–709 Isobel J. Simpson[a,*], Josette E. Marrero[a], Stuart Batterman[b], Simone Meinardi[a], Barbara Barletta[a], Donald R. Blake.

[32] USEPA: Natural Gas-Fired Reciprocating Engines. 2000, Washington, DC: United States Environmental Protection Agency, AP-42 Section 3.2: [http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s02.pdf

[33] "Environmental public health dimensions of shale and tight gas development." Shonkoff SB, Hays J, Finkel ML *Environ Health Perspect.*

[34] "Assessment and risk analysis of casing and cement impairment in oil and gas wells in Pennsylvania." Ingraffea AR, Wells MT, Santoro RL, Shonkoff SBC: 2000–2012. *Proc Nat Acad Sci*

[35] USATSDR: Report on Carcinogens, Twelfth Edition. 2011, Research Triangle Park, NC: United States Agency for Toxic Substances and Disease Registry, National Toxicology Program.

[36] "Exposure to formaldehyde and its potential human health hazards." Kim K, Jahan SA, Lee J: *J Environ Sci Health Part C Environ Carcinog Ecotoxicol Rev.* 2011, 29: 277-299. 10.1080/10590501.2011.629972.

[37] http://www.environmentalhealthproject.org/files/Summary%20Compressor-station-emissions-and-health-impacts-02.24.2015.pdf, D. Brown, et.al.

[38] http://ecowatch.com/2015/10/14/health-risks-fracking/

[39] http://environmentalintegrity.org/archives/8096

levels of hexane indicated a possible combination of leaks and/or fugitive emissions. "Acute exposure to hexane affects the central nervous system, causing dizziness, nausea, and headache; chronic exposure effects include neurotoxicity."[40]

Other combustion-related criteria pollutants that can cause physical harm and are emitted by UNGD operations such as compressor stations are methane, hydrogen sulfide, nitrogen oxides, carbon monoxide, particulate matter (2.5 and 10), sulfur dioxide, and other VOC's.[41] Nitrogen dioxide is a brownish-red gaseous byproduct emitted by compressor stations. Hitching a ride on this emission are tiny microscopic particles called particulate matter. When exposed to sunlight, these particles chemically interact with nitrogen dioxide or other VOC pollutants to create ground-level, or tropospheric ozone, a known lung irritant. Even low levels of ozone can have detrimental effects on infants and the elderly, as well as those with compromised immune systems. Ozone exposure has been known to harm delicate lung tissue, and cause vasculitis and heart disease in otherwise young, healthy adults. (Werner, Vink, Watt, Jagals, 2015) Ozone can spread beyond the originating hot spot to cover hundreds of miles. Ozone aggravates those who have preexisting lung diseases like chronic obstructive pulmonary disorder (COPD) and can worsen asthma symptoms; it can also cause poor fetal development and impact infant mortality particularly in urban areas where poorer populations are concentrated.[42] Studies from 2003-2006 show increased ozone impacts children with asthma, raising emergency room visits and/or hospitalization.[43]

As mentioned above, an important component of smog is particulate matter. Particulate matter (PM) is so small it is measured in microns; PM_{10} is particulate matter that is 10 microns in diameter or less, whereas $PM_{2.5}$ is 2 ½ microns in diameter or less. A human hair follicle is between 50 to 70 microns wide, while a single grain of fine sand is 90 microns. It would take a chain of 7 PM_{10} particles to wrap the diameter of one human hair follicle, while only 4 $PM_{2.5}$ particles could encircle one particle of PM_{10}. Therefore, the finer PM particles like 2.5 or less, once inhaled pass easily through the usual barriers that protect delicate throat, lung, and heart tissues, and can even breach the difficult blood/brain barrier. Particulate matter can contain carbon and heavy metals like lead and have been linked in a March 2016 study to over 16,000 preterm infant births. (Dryszka 2016). Consistent collected data reveal that PM exposures "disproportionately affects susceptible populations including children and the elderly. The body of literature reviewed is sufficient to conclude that with even small increases in airborne particulate matter exposure, human risks increase." (Witter et.al., 2008) These risks include many already mentioned: cardiovascular diseases (including premature deaths); respiratory diseases (also including premature deaths); increased neonatal problems, including death; elevations of childhood allergies, ear/nose/throat and respiratory infections, including cystic fibrosis, with increased ER visits and/or hospitalizations; and worsening of COPD, congestive

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[40] USEPA: Integrated Risk Information System, n-Hexane. 2005, United States Environmental Protection Agency: Washington, DC.

[41] "Environmental Health Impacts of Unconventional Natural Gas Development: A review of the current strength of evidence"; by Angela K. Werner, Sue Vink, Kerrianne Watt, and Paul Jagals; *Science of The Total Environment* Volume 505, 1 February 2015, Pages 1127–1141; http://www.sciencedirect.com/science/article/pii/S0048969714015290

[42] Webinar on "Outdoor Air Toxics – Unhealthy Air", Physicians for Social Responsibility, 5/24/2016, speaker L. Dryszka, M.D.

[43] "Potential Exposure – Related Human Health Effects of Oil and Gas Development A Literature Review 2003-2008, by R. Witter, MD MSPH; K. Stinson, MSPH; H. Sackett, MSPH; S. Putter, BA; G. Kinney, MPA; D. Teitelbaum, MD; L. Newman, MD; 08-01-2008; University of Colorado Denver; Colorado State University; https://www.nrdc.org/sites/default/files/hea_08091702b.pdf

heart failure, heart attacks and coronary artery disease, diabetes and increased mortality among the elderly. (Witter et.al., 2008)

Other byproducts of incomplete gas burns called polycyclic aromatic hydrocarbons (PAH) are a mixture of chemical components, many of which are known carcinogens. Typically, PAH's degrade in sunlight and dissipate within days to weeks of emission; however, exposure has been known to take place before this process takes places. PAH's enter the body with particulate matter via inhalation from emissions like those detected at or near compressor stations. Once inside the body, the PAH's are stored in fatty tissues like breast tissue, and over time begin to mimic estrogen, thus causing increased incidences of breast cancer in both women (particularly premenopausal)[44], and men specifically exposed to diesel fuel PAH's who already have the BRCA1 or BRCA2 genetic mutation[45]. "Chemicals formed by combustion are among the largest sources of mammary carcinogens in the environment", including PAH's and methylene chloride.[46]

Radon is another CDC-listed carcinogenic air pollutant recently added to health problems from exposure at or near UNG compressor stations and pipelines. Radon is a colorless, odorless gas that forms during the degradation process of naturally-occurring radioactive elements like uranium buried deep in the ground. Radon gas moves through soil and rock via waterways and usually only causes a problem when it is either disturbed by digging or it seeps through a crack into a basement where it can collect. It is found in karst-prone areas like Joelton[47], rivers or lake-fed water systems, and deep water wells. Radon gas has also been known to seep into pipelines and hitch rides with liquid natural gas. As radon gas degrades, it turns to solid radioactive particulates called radon progeny; these particulates can attach to other PM matter to enter the lungs. Trace particles of radon progeny have been detected in pipeline scrapings, LNG tanks and used water storage tanks at compressor facilities. Pigs used to clean sludge from gas pipelines during conversion can release these radon progeny particles as the sludge dries and is picked up for transport to disposal sites; handling of this dried sludge releases the particles into the atmosphere, where they are picked up by wind currents. Exposure to radon gas or its progeny particles, including workers in natural gas piping facilities, has been linked to increased cases of lung cancer (Dryszka 2016, [48,49]). Because of their reduced lung size and higher rate of breathing, children exposed to radon have two times the risk of getting lung cancer as adults.[50]

Yet, communities surrounding UNG facilities like compressor stations are not just suffering the effects of one emission component (like radon gas or benzene) at one particular

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[44] "Risk of premenopausal breast cancer in association with occupational exposure to polycyclic aromatic hydrocarbons and benzene."; Petralia, S., Vena, J., Freudenheim, J., Dosemeci, M., Michalek, A., Goldberg, M., ... Graham, S; *Scand J Work Environ Health*, (1999), 25, 215–221.

[45] "A gene-environment interaction between occupation and BRCA1/BRCA2 mutations in male breast cancer." Palli, D., Masala, G., Mariani-Costantini, R., Zanna, I., Saieva, C., Sera, F., ... Ottini, L. (2004) *Eur J Cancer*, 40, 2474–2479.

[46] "Exposure Biomarkers for Suspected Breast Carcinogens Scientists Identify Highest Priority Toxic Chemicals to Target for Breast Cancer Prevention"; Rudel RA, Ackerman JM, Attfield KR, Brody JG. 2014. **New Exposure Biomarkers as Tools for Breast Cancer Epidemiology, Biomonitoring, and Prevention: A Systematic Approach Based on Animal Evidence.** *Environmental Health Perspectives.*

[47] http://www.city-data.com/radon-zones/Tennessee/Tennessee.html

[48] http://www.cancer.org/cancer/cancercauses/othercarcinogens/pollution/radon

[49] "Assessment of Potential Radiological Health Effects from Radon in Natural Gas", U.S. EPA, Office of Radiation Programs, Washington, D.C., November, 1973, R. Johnson, Jr., D.E. Bernhardt, N.S. Nelson, DVM, H.W. Calley, Jr.

[50] http://www.atsdr.cdc.gov/csem/csem.asp?csem=8&po=7

time; they are being constantly exposed to multiple gases and chemical compounds, the like of which has not been properly evaluated for public health effects. A published statement by the air quality department of Colorado reads, "the current state of the science cannot assess the potential risk of combinations of different chemicals, and thus the risk screening estimates for benzene alone may underestimate cumulative risk."[51] While acute exposure illnesses or symptoms appear quickly, as can be the case with benzene or formaldehyde exposures, chronic exposures and the health issues that ensue, like cardiovascular disease, COPD, neurological effects (stroke), cancer and premature deaths, can take as long as thirty or more years to emerge. (Dryszka, 2016) According to D. Carpenter in a 2002 study, "Our findings of chemical mixtures are of clinical significance…chemical mixtures identified should be further investigated for their primary emissions sources as well as their potential cumulative and synergistic effects."[52] Having a wide-range of chemical mixtures in air samples also reveals a flaw in ambient air samples taken near UNG facilities including compressor stations. These mixes, though emitted during normal operations, can remain at ground level in areas where the geography "encourages air inversions".[53] Chemical mixture exposure, both acute and long-term is particularly worrisome with regard to children, pregnant women, and the elderly.[54] While impacts from chemical mixture pollutants (including ozone, ozone-causing particulate matter, noise and light pollution) emitted by UNG facilities like compressor stations may at first seem insignificant as exposure levels can appear to be within normal range; but the cumulative health effects of these 'normal levels' that accrue over decades have not been researched and are as yet unknown.[55]

However, the absence of proof of these potential long-term effects to chemical mixtures and outcomes does not mean that there won't be any problems. Existing research studies already reveal damages done to the body by exposures to toxic mixes like BTEX, which produces cognitive and behavioral problems and "alterations in special senses functions such as impairment of color vision and perceptions" in UNG workers. (Witter et.al., 2008) Research scientist Theo Colborn looked at 353 chemicals listed to be used in UNG production, a mix of chemicals that can have varied effects on the body at different exposure levels over time; half of these were found to impact the kidneys, heart, nerves or immune systems, while 37% impacted the endocrine system that regulates hormones, and 25% were found to be carcinogenic. (Colburn et.al., 2013, [56]) In his studies for the Southwest Pennsylvania Environmental Health Project, toxicologist David Brown, M.D. also concluded like D. Carpenter et.al. that the chemical mixtures emitted by UNG compressor stations "act synergistically" in the body, and that "the presence of one [chemical] agent can increase the toxicity of another by several fold".[57]

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[51] http://www.colorado.gov/airquality/report.aspx

[52] Carpenter DO, Arcaro K, Spink DC: Understanding the human health effects of chemical mixtures. *Environ Health Perspect.* 2002, 110: 25-42.

[53] Sexton K, Westberg H: Nonmethane hydrocarbon composition of urban and rural atmospheres. *Atmos Environ.* 1984, 18: 1125-1132. 10.1016/0004-6981(84)90144-6.

[54] Vandenberg LN, Colborn T, Hayes TB, Heindel JJ, Jacobs DR, Lee DH, Shioda T, Soto AM, vom Saal FS, Welshons WV, Zoeller RT, Myers JP: Hormones and endocrine-disrupting chemicals: low-dose effects and nonmonotonic dose responses. *Endocrinol Rev.* 2012, 33: 378-455. 10.1210/er.2011-1050.

[55] https://www.scribd.com/doc/56974467/Natural-Gas-Report-Supplements-Public-Health-Agriculture-Transportation#fullscreen "Public Health Concerns of Shale Gas Production" by Brian S. Schwartz, MD, MS and Cindy Parker MD, MPH

[56] http://womensenews.org/2013/04/fracking-natural-gas-fuels-health-worries/

[57] http://www.truth-out.org/news/item/18636-rural-new-jersey-township-fights-ferc-approved-gas-compressor

Though not chemical agents, noise and light pollution emitted by UNG compressor stations are just as harmful to those exposed as the pollutants discussed above. Constant exposure to noise emissions that can range as low as 35 decibels to over 75dcb can cause increased psychological problems and sleep disturbances, particularly among the chronically ill, young children, the elderly, and hearing-impaired persons.[58] According to the National Sleep Foundation, prolonged sleep disturbances interferes with the brain's ability to reach needed REM sleep leading to decreased cognitive abilities and attention span, lowered ability to learn new tasks and create memories, increased risks of developing depression, and can even cause a buildup of amyloid proteins in the brain that have been linked to Alzheimer's disease.[59] Also linked to low frequency noise pollution are increases in stress, fatigue, headaches and visual disturbances. (Witter et.al., 2008) The World Health Organization states that prolonged exposure to noise pollution "can cause permanent medical conditions, such as hypertension and heart disease." Low frequency noise (LFN) such as that produced by compressor stations has been linked to vibroacoustic disease.[60] Vibroacoustic disease is a systemic problem observed among those exposed to LFN; LFN exposure has been known to inflame and induce thickening of cardiovascular structures without raising the diastolic blood pressure, which is a hallmark of this disease. "LFN is a demonstrated genotoxic agent, inducing an increased frequency of sister chromatid exchanges in both human and animal models. The occurrence of malignancies among LFN-exposed humans, and of metaplastic and dysplastic appearances in LFN-exposed animals, clearly corroborates the mutagenic outcome of LFN exposure."[61] Though most of the power was handed over in 1981 to the individual states to control, the EPA still retains the power through Title IV of the Clean Air Act to examine and study noise and its effect and report adverse health effects to the public; answer queries relating to noise issues; and "evaluate the effectiveness of existing regulations for protecting the public health and welfare, pursuant to the Noise Control Act of 1972 and the Quiet Communities Act of 1978."[62]

Light pollution is an overexposure to artificial light during the night, such as that found at UNG facilities like compressor stations. A developing public health issue, light pollution has been linked to increased cancer risks because of its disturbance of the natural circadian rhythms of sleep. "Deregulation of the normal circadian rhythm…may increase the risk for development of multifactorial disease (best studied in cancer, but experimental proof exists also for metabolic syndrome/diabetes type 2, cardiovascular and neurological disease); may accelerate cancer progression and/or modify the outcomes for cancer patients."[63] Light pollution also inhibits the pineal gland from secreting the light-sensitive hormone melatonin. (Witter et.al., 2008).

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[58] http://phpa.dhmh.maryland.gov/OEHFP/EH/Shared%20Documents/Reports/081814%20MD%20Public%20Health%20Study

[59] https://sleep.org/articles/interrupted-sleep-what-happens-to-your-body/

[60] https://www.nrdc.org/experts/amy-mall/live-tape-dangerous-noise-emitted-natural-gas-compressor-stations-neighborhoods

[61] http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2004;volume=6;issue=23;spage=3;epage=20;aulast=Castelo;type=0 by NAA Castelo Bronco, M Alves-Pareira

[62] https://www.epa.gov/clean-air-act-overview/title-iv-noise-pollution

[63] "Deregulation of the Circadian Clock Constitutes a Significant Factor in Turmorigenesis: a Clockwork Cancer. Part 1: Clocks and Clocking Machinery", K. Uth, R. Sleigh; *Biotechnol Biotechnol Equip*, 2014 Mar 4; 28(2); 176-183. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4434034/

Melatonin helps maintain the sleep-wake rhythm as well as regulate hormones that control the proper growth and function of reproductive organs.[64]

While noise and light pollution aren't on the list of CDC chemical hazards emitted from UNG facilities like compressor plants, they are just as harmful to public health as studies indicate; however, according to a white paper by J.L. Adgate et.al., "despite the demonstrated contact with chemical and non-chemical stressors and broad public concern, no comprehensive population based studies of the public health impacts of UNG operations have been published".[65] As major incidences of stress to exposed workers and communities from increased air emissions, water contaminations, diesel traffic, and noise and light pollutions add to an already over-burdened public infrastructure like health care systems and emergency responders, it causes an additional burden of social and psychological stress to fall on those already suffering the exposures of increased UNG production and development, including additions of compressor stations into already cramped suburban districts or non-industrially zoned rural areas ill-equipped with public services to deal with such facilities. In a 2013 study of air quality damages that included not only the mortality and morbidity of people, but also damages to the environment with regard to crop and timber losses occurring in the areas around UNG production facilities including compressor stations in Pennsylvania in 2013, researchers concluded that "compressor station activities alone represent 60-75% of all extraction-associated damages". These monetary costs to districts were ongoing, and ranged from $4.4 million to $24 million.[66]

Major concerns about emissions control, potential mitigations, and in some cases, litigations like those filed in Minisink, NY[67] add to stress levels that negatively impact public health. (NRC, et.al). It is largely left to the EPA, state and local governments to develop appropriate measures to adequately monitor emissions of all sorts from these facilities. (Dryszka, 2016). Yet, as stated earlier, 87% of 46 published air quality research studies found evidence of increased harmful air pollutants. "The need for quantitative epidemiological research on this subject is widely recognized in the scientific community, but it is difficult to conduct until exposure parameters are better determined and reported cases of health outcomes are analyzed". (Hays, Shonkoff, 2015).

In Dr. D. Brown's SWPA-EHP study, Minisink, NY families living near the compressor station were shown to be exposed to increased particulate matter levels, with reported symptoms correlating to PM peaks when compared to regional air quality indices. These elevations of particulate matter would not have been captured if the air data was averaged over the 24-hour periods set by air quality indices for the area; only a review of hourly data would have captured the PM spikes missed by the regional air quality review. (Dryszka, 2016) In fact, air quality studies taken at compressor stations reveal they do not emit "uniformly", particularly during blowdowns and emergency release events. During these events, natural gas is allowed to shoot out an open valve with enough pressure to send up a plume of vapor 100 to 200 feet high for a

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[64] "Maintaining Circadian Rhythym", Robert M. Sargis, M.D., PhD, http://www.endocrineweb.com/endocrinology/overview-pineal-gland

[65] "NRC Shale Gas Committee Workshop #1: Extended Abstract to Proposed White Paper: Public Health Risks of Shale Gas Development"; J.L. Adgate, B.D. Goldstein, L. M. McKenzie, 17 May 2013, Colorado School of Public Health, University of Colorado, Denver; University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA.

[66] "Estimation of Regional Air-Quality Damages From Marcellus Shale Natural Gas Extraction in Pennsylvania", A. Litovitz, A. Curtright, S. Abramzon, N. Burger, C. Samaras; 31 Jan 2013, IOP Publishing, Inc., *Environ. Research Letters*, Vol. 8, No.1; http://iopscience.iop.org/article/10.1088/1748-9326/8/1/014017

[67] http://gazettenet.com/Opinion/Columns/Elaine-Ulman-The-Monster-of-Minisink-%E2%80%93-a-cautionary-tale-for-fracked-gas-era-1302383.

duration of up to three hours.[68] During this time, toxics from the contents of the UNG pipeline are likely released and added to toxics known to be emitted from the compressor stations in general, thereby increasing the amount of "tons per year" of contaminants listed by the UNG industry. "The measurement *tons per year*, while common in the [UNG] industry and common in the environmental field where regional air quality is at issue, is not an appropriate measure to determine individuals' health risks which increase during episodes of high exposures". (SWPA-EHP, Brown et.al)

In a National Public Radio interview with Al Armendariz, an environmental engineer at Southern Methodist University in Dallas, Mr. Armendariz was asked about the cumulative effect that exposure to chemical mixes from UNG facilities including compressor stations have had on the people of Dish, Texas. His response was, "If you were to aggregate the emissions from all of these eleven compressor engines and all of the associated piping and meters and valves and everything else at these facilities, you can get a significant source of emissions, hundreds of tons per year." He estimates that the air pollution within the Barnett Shale region is as heavily polluted as that of the entire Fort Worth region's vehicular traffic, and Texas state regulators verify his figures.[69]

With new emissions sources being identified and questions being raised by researchers about air quality monitoring procedures used by states and federal agencies, doubt is shed about how true the existing available data is on the collected emissions inventories used to track known emissions, particularly as it applies to compressor stations. One study suggests that outmoded emissions factors are used, and existing emissions counts are limited by "self-reporting and data collection".[70] These potentially flawed inventories make it difficult to properly assess public health risks and aid in necessary research.[71] It can also make it harder to accurately catalogue such phenomena as "photochemical ozone production" during the winter.[72]

Local or state air monitoring systems can also hamper modern data collection on UNG impacts to air quality by focusing comparative data on urban areas, where criteria pollutants like particulate matter and ozone precursors were of prime concern (Colborn et.al. 2013), where the design of recording stations were set to the National Ambient Air Quality Standards (NAAQS) for a short list of known toxics.[73] One federal roadblock in the way of collecting accurate data on air emissions and air quality is the exemption placed by Congress on vital parts of the Clean Air Act on behalf of the natural gas industry[74] [75], which spent nearly $8 million dollars in 2015

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[68] http://www.transcanada.com/docs/Our_Responsibility/Blowdown_Notification_Factsheet.pdf

[69] http://www.npr.org/templates/story/story.php?storyId=120043996

[70] Field RA, Soltis J, Murphy S: Air quality concerns of unconventional oil and natural gas production. *Environ Sci Process Impacts*. 2014, 16: 954-969. 10.1039/c4em00081a.

[71] "Potential public health hazards, exposures and health effects from unconventional natural gas development." Adgate JL, Goldstein BD, McKenzie LM: *Environ Sci Technol.*

[72] "Photochemical production of ozone at high concentrations in a rural site during winter." Schnell RC, Oltmans SJ, Neely RR, Endres MS, Molenar JV, White AB: Rapid Nat Geosci. 2009, 2: 120-122. 10.1038/ngeo415.

[73] "Big Oil, Bad Air: Fracking the Eagle Ford Shale of South Texas." Morris J, Song L, Hasemyer D 2014, Washington, DC: Center for Public Integrity

[74] "Natural Gas Plays in the Marcellus Shale: Challenges and Potential Opportunities." Kargbo DM, Wilhelm RG, Campbell DJ: *Environ Sci Technol.* 2010, 44:5679=5684. 10.1021/es903811p.

[75] "EPA Needs to Improve Air Emissions Data for the Oil and Natural Gas Production Sector." Beusse R, Dunlap C, Good K, Hauck E, McGhee-Lenart R, Narimatsu J: 2013, Washington, DC: Office of the Inspector General of the United States, Environmental Protection Agency, Report 13-P-0161.

lobbying state and local Pennsylvania politicians. Since 2007, the gas industry has spent over $55 million dollars to influence the Pennsylvania government representatives.[76]

Even the EPA seems to agree with the assessments regarding questionable air quality monitoring procedures. In the previously referenced 2013 report from the EPA's Inspector General, the EPA admits that it "has limited directly-measured air emissions data on criteria and toxic air pollutants for several important oil and gas production processes. [This] limited data, coupled with poor quality and insufficient emission factors and incomplete NEI data, hamper EPA's ability to assess air quality impacts from selected oil and gas production activities."

With all of this uncertainty about questionable air emissions data, it leaves a proverbial elephant in the room that no agency has yet wished to address, and that is what are the implications of this with regard to the risk levels to public health and safety from UNG facilities' emissions? Studies show that emissions levels are flawed in the fact that they do not even address the risk levels for vulnerable subpopulations like ethnic groups, young children and the elderly or chronically ill, nor do they look at the whole range of dangerous organic chemical compounds like VOC's that are known to be emitted by UNG facilities, including compressor stations, and can fluctuate "wildly" with each hour. Air samples taken in Arkansas in the afternoon in autumn near a compressor station found 17 VOC's and five TIC's (compounds not completely identified, but are related to UNG production, like compressor stations). (Macey et.al., 2014). Issues such as these should be addressed and implemented into a more uniform standard for both state and federal air quality monitoring before more UNG facilities like compressor stations are built. Current standards are lacking in "good pathophysiological evaluation" essential to protect the public from the risks of UNG emissions; they also lack data collection methods that are essential in providing the needed data "for determining an exposure's composition, intensity, duration, or frequency," which could thus avoid peak periods of intense exposures and the related illnesses that accompany them.[77]

Until such measures are implemented, the real risk to public health from these UNG facilities remains largely unknown, though the symptoms and resultant illnesses that acute and chronic exposure to their emissions are becoming well-documented. With exports of natural gas currently running high, UNG facilities like compressor stations are expected to continue to be built and operated for as long as thirty or more years; yet, all the while, contaminants from their emissions collect not only in the air, water and soil, but also in people.[78]

Appendix A of this paper contains forty instances of people who have been documented by physicians and state inspectors, as well as those listed in lawsuits as having developed symptoms and illnesses consistent with (but not positively linked to) exposures to toxic emissions from UNG compressor stations, or who have been impacted by NG compressor explosions.[79] A former resident of Flower Mound, TX, forty-year-old Lorrie Squibb is on the list. She was a resident of Flower Mound for seven years, from 2003 to 2010. Shortly after moving to Michigan, Squibb became ill and went to the doctor – she was diagnosed with multiple myeloma, a cancer of the blood associated with factory workers exposed to environmental exposure to toxins. The county Squibb resided in while in Texas was one of five others that

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[76] https://stateimpact.npr.org/pennsylvania/2016/06/20/report-gas-industry-spent-8-million-lobbying-pa-legislature-in-2015/

[77] "Understanding Exposure from Natural Gas Drilling Puts Air Standards to the Test." D. Brown, B. Weinberger, C. Lewis, H. Bonaparte: *Environ Health*, Vol. 29, Issue 4, Dec. 2014, 277-292.

[78] "Public Health Concerns of Shale Gas Production." Brian S. Schwartz, Cindy Parker: https://www.scribd.com/doc/56974467/Natural-Gas-Report-Supplements-Public-Health-Agriculture-Transportation#fullscreen

[79] https://pennsylvaniaallianceforcleanwaterandair.wordpress.com/the-list/

became known as a 'cluster' site for cancer according to a 2011 CDC report. Denton, Hood, Johnson, Parker, Tarrant, and Wise counties lie above the Ft. Worth/Barnett Shale deposit; not only do they have the most UNG production facilities (including compressor stations) and confirmed points of emissions, but also the highest documented level of breast cancer rates. When asked about their air monitoring procedures, TCEQ (Texas Air Quality Division) states that they limit their air monitoring analyses in these areas to short-term exposures, adding that "long-term comparisons are inappropriate".[80]

Ron Moss and his wife bought 20 acres about ten miles west of Gillette, Wyoming, where he retired fourteen years ago. He thought they would be safe from UNG activities, but he was wrong. A UNG compressor station went up with several wells east of his residence. The noise from the station was so bad, his dog refused to go outside anymore, and it drove he and his wife mad with its constant sound that never stopped. Then Moss' wife started suffering asthma attacks on four occasions, and was soon put on a Breathalyzer treatment machine for severe cases; she was also hospitalized on numerous occasions. Moss wrote, called and complained to state officials and even the governor, but was told there was nothing they could do.[81]

Pramilla Malick, along with her four children have suddenly developed asthma, yet none of them had any prior history of the illness; that is, until the Minisink, NY compressor station went on-line. Malick and her family was one of several families in the Minisink area that Dr. David Brown, a toxicologist, tested for exposure to UNG activities and documented her case. (Brown et.al. 2014, Truth-Out 18636).

Not appearing on the appendix, however, is Jerry Yeager of Pennsylvania. He and his wife live a few hundred feet away from a compressor station. He reports the odor he and his wife breathe in as "a horrific mix of bad Clorox, ammonia and turpentine". The Yeagers report shared symptoms of nausea, visual disturbances, respiratory and neurological disorders. Yet, Yeager reports that while many of his neighbors have experienced worse problems, some are "now keeping quiet – either out of fear of being ostracized from the community… or of losing paychecks from the industry", in the way of settlements that can range anywhere from a few hundred dollars to upward of a million, "depending on the property and 'how anxious the litigants are to settle'".[82]

Mickey Gniadek and other neighbors on Cardox Road in Finleyville, West Virginia Pennsylvania began to notice heavy, acidic odors coming from wells and a MarkWest compressor station. Then, Gniadek and others began to develop similar documented respiratory symptoms. Gniadek and some of his neighbors were offered $50,000 from the UNG company to resolve their claims, a settlement that included payments for "damages, annoyance, inconvenience, nuisance, and pain and suffering". While some folk took the offer, Gniadek refused, saying that he felt it was being offered money in exchange for his silence.[83]

Linda McCart and her husband, Dave, aren't on the 'list of harmed', either, but both people have experienced sore, swollen throats that seem to coincide with a "bad smell" like sulfur and Clorox that comes from the direction of a UNGD facility three miles to the east of their home. The McCarts reported the malodor to air quality officials in Dolores County, CO. Their neighbors, Cindy Tout and Earl Wenger, who are on the list have for four years experienced "headaches, nose bleeds and sore throats" and can no longer keep their windows

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[80] http://www.dentonrc.com/local-news/special-projects/gas-well-drilling-headlines/20110831-breast-cancer-rate-climbs-up

[81] http://www.nrdc.org/experts/amy-mall/live-tape-dangerous-noise-emitted-natural-gas-compressor-stations-neighborhoods

[82] http://www.huffingtonpost.com/2013/01/25/fracking-pennsylvania-natural-gas-lease-landman_n_2546824.html?utm_hp_ref=mostpopular

[83] http://www.observer-reporter.com/article/20140719/NEWS080101/140719418#.VAKMkFfiG2X

open due to the malodorous emanations coming from the Doe Canyon compressor facility that Kinder Morgan (KM) plans to expand. As the new expansion would bring "an additional $900,000 to $1.6 million in property tax revenues to Dolores County", the county commission voted unanimously to approve the project, even though there were odor reports on record about the old facility. When asked about the odor reports, Bob Clayton with KM stated that presence of odor "doesn't mean that there is a health issue involved… [the facility is] well within all regulatory requirements". Still, the Colorado Department of Public Health and Environment checked into the complaints and, upon arrival, detected "an odor that smelled like fertilizer". Commissioner Ernie Williams noted that there had been "gobs of complaints" regarding the facility's odors and noise. However, Jeff Layne, a Kinder Morgan lawyer accused Tout and others as being "motivated by greed and [wanting] compensation for [their] homes. I know it when I see it," he said, an accusation which Cindy Tout, a 22-year resident of the area, vehemently denied. "We have three acres, a couple hundred trees, an orchard. Where are we going to go and start over and have what we have now? It's not about the money."[84]

While these kinds of intimidation tactics may not be the norm by the gas industry or its representatives, the most troubling aspect of these reports is that they are reported to have happened at all. Yet, UNGD has a whole host of passionate supporters, with books, magazines, websites and blogsites devoted to the subject. These supporters write about what are perceived as a lack of facts that support the 'crazy' claims made by 'greenies', 'tree-huggers', or 'fractivists' who, as blogger Nick Grealy states "seem to permanently reside in unreality". He calls claims of UNG harm 'myths', and even compares a news item from the World Health Organization's website with the "infamous" 'List of the Harmed' – "…this truly ludicrous site is cited as proof by people who should know better. Here's only two random examples to balance risks – what's worse, 7 million deaths per year proved by [WHO] from air pollution or uncontrolled eyebrow twitching, dead people or dead parrots?" [85]

At *MarcellusDrilling.Com*, an online magazine devoted to reporting on news stories that are already somewhat tilted in pro-UNGD direction. A contributor once wrote about calling Jenny Lissac, the compiler of the List of Harmed and asking to be included, as he himself was one of the "harmed". As she was about to add his name, Victor Furman "fessed up that none of what he told her was true". He had only wanted to make a point to her that anyone could call up and get added to this list. Though the writer conceded that "while it may have a few legitimate cases of negative impacts", he still claimed that most of the List of Harmed was based on "false information".[86]

Energy In Depth (*EID*) is an online magazine started in 2009 by the Independent Petroleum Association of America. They claim that *EID* is "a research, education and public outreach campaign focused on getting the facts out about the promise and potential of responsibility developing America's onshore energy resource base", particularly fracked natural gas.[87] In one of these fact-based articles entitled "Who Says There Are No Natural Gas Health Studies?"[88], author N. Jacobs makes light of New York's recent halt of natural gas projects over health and environmental concerns for the public. As basis for her viewpoint, Jacobs uses a

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[84] http://fourcornersfreepress.com/?p=550 "Is Kinder Morgan a Good Neighbor?", May 5, 2012, G. Binkly.

[85] Nick Grealy, Administrator of *NaturalGas2.0*, posted on April 13, 2014 by Natural Gas Now Guest Blogger.

[86] http://marcellusdrilling.com/2013/04/so-called-list-of-the-harmed-exposed/

[87] http://energyindepth.org/about/

[88] http://energyindepth.org/marcellus/who-says-there-are-no-natural-gas-health-studies/

"Health Watch" study done on oil workers in Australia, a study commissioned by the oil and gas industry, and prepared by the University of Adelaide. Though Jacobs concludes that the Adelaide report contains "no negative health impacts" with regard to the question of whether or not gas/oil workers have a higher cancer rate over the normal populace, a closer check of the actual study reveals that Jacobs omitted some important facts that would have cast a shadow over her supposition.

The study interviewed workers in the oil and gas industries and found that rates of certain cancers like mesothelioma, skin melanoma and prostatic cancer are, in fact, *increased* among those interviewed when compared to the general population. The study also links an increase in deaths from heart disease to increased exposure to hydrocarbons, stating, "it is therefore likely that heart disease is the most important contributing factor to the overall increase in mortality with increasing hydrocarbon exposure." With regard to cancer rates, the study found 11 cases of acute non-lymphatic leukemia (ANLL): 8 acute myeloid, 1 erythredema, 1 acute myelomonocytic, and 1 unspecified. Though these cases of acute non-lymphatic leukemia were barely above the average rate of population, they found that the cases "were clustered in the middle to upper level [of hydrocarbon] exposure." Their conclusion on ANLL cases was twofold – either it was a coincidental finding "due to random variation", or that "benzene exposure has actually caused some of the ANLL cases in this cohort."[89] The benzene exposure amounts were found to be as little as 0.8 parts per million (ppm) and 2ppm/years within the control group of interviewees, an important piece of data in that it indicates that benzene is capable of doing more physical harm than previously thought, and at much lower doses of exposure.[90] Jacobs moves to a study by the Texas Commission on Environmental Quality (TCEQ) from 2009-2010 entitled, "Commitment to Air quality in the Barnett Shale". Again Jacobs declares this study to have no negative health concerns, however, her conclusions seem premature. (EID Jacobs).

From an article at the Center for Public Integrity's website (winner of 2014 Pulitzer Prize for journalism), Taylor Ishee relates his struggle with Burkitt's Leukemia. At nineteen, he was diagnosed with the cancer; he and his family lived for four years within one and a half mile from 37 natural gas wells and compressor stations. Ishee's best friend, Justin Eaklor, turned twenty-one when he was diagnosed with lymphatic leukemia. Eaklor lived two-thirds of a mile from 4 wells and a compressor station. When asked about the possibility of a link to exposure to benzene from emissions to the diagnoses of illnesses in the area, TCEQ spokesperson Terry Clawson replied, "TCEQ can't determine the cause of residents' health problems…but it is highly unlikely that chemicals are being emitted at levels high enough to cause adverse health effects such as cancer, kidney damage or liver damage…TCEQ has found no cause for alarm". While TCEQ has a vast monitoring network to capture UNG air emissions when compared to other heavily-producing oil and gas areas, "its networks can be sparse; there are five permanent monitoring stations in the Eagle Ford Shale region where there are 7,000 oil and gas wells" and UNGD production facilities".[91] Limited monitoring networks such as these "potentially mask hot spots, the effects of unique topography and fugitive emissions" while "local air movement

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[89] http://energyindepth.org/wp-content/uploads/2012/05/Australian-Institute-Health-Survey.pdf

[90] "Potential Exposure – Related Human Health Effects of Oil and Gas Development A Literature Review 2003-2008, by R. Witter, MD MSPH; K. Stinson, MSPH; H. Sackett, MSPH; S. Putter, BA; G. Kinney, MPA; D. Teitelbaum, MD; L. Newman, MD; 08-01-2008; University of Colorado Denver; Colorado State University; https://www.nrdc.org/sites/default/files/hea_08091702b.pdf

[91] Morris J, Song L, Hasemyer D: Big Oil, Bad Air: Fracking the Eagle Ford Shale of South Texas. 2014, Washington, DC: Center for Public Integrity

and mixing depth contribute to peak exposure to VOC's one mile from a compressor station".[92] During winter months, wind and landscape play a role in increased VOC concentrations.[93] Though TCEQ received 1,370 air quality complaints related to emissions like benzene from UNG facilities, they only issued violation notices for 27 over a five-year span from 2009 to 2014. TCEQ states the consequences of the lack of issuances to be "negligible".

Yet, the World Health Organizations states that "there is no safe level of exposure" to benzene. Up to the late 1940's, research produced for the American Petroleum Industry and Shell "concluded that no amount of benzene was safe". And in a confidential report, Shell in 1943 stated, "prolonged exposures to low concentrations [of benzene] may be the most dangerous". However, in 2007, TCEQ raised the amount of benzene considered "safe" to 54ppb for short durations and 1.4ppb for long durations.[94]

EID reporter Jacobs also wrote another article entitled, "Study Finds Radiation Exposure Unlikely from Oil and Gas Development", to announce the news that Pennsylvania's highly anticipated 2013-2015 study on their massive UNGD operations in their state to look for the potential of it causing increased radiation exposures from the disturbance of radon gas or radon progeny particles found "little potential" for exposure. Jacobs wrote, "This is great news for residents living near well sites or infrastructure".[95] But again, that isn't the whole story.

What the 2015 press release actually says is: "There is little or limited potential for radiation exposure to the public and workers from the development, completion, production, transmission, processing, storage, and end use of natural gas. There are, however, potential radiological environmental impacts from fluids if spilled. Radium should be added to the Pennsylvania spill protocol to ensure cleanups are adequately characterized. There are also site-specific circumstances and situations where the use of personal protective equipment by workers or other controls should be evaluated." The DEP report also states, "there are potential radiological environmental impacts that should be studied at all facilities in Pennsylvania that treat wastes to determine if any areas require remediation." Vince Brisini, DEP Deputy Secretary for Waste, Air, Radiation and Remediation said, "While the recommendations for future actions contained in the report call for *additional studies and efforts*, we now have data to inform the management of natural gas resources and resultant wastes for environmental and health protection."[96] Strangely, when National Public Radio tried to reach Brisini for comment, neither he nor any other contributors to the study could be reached, and the PA DEP "didn't return calls or emails".[97]

In a July, 2014 study 'update' to the PA DEP 2015 final study, the DEP revealed a much different view regarding radiation exposure potentials from Pennsylvania's oil and gas industries, in that it concludes that the "generation of TENORM has increased significantly". TENORM is short for technologically enhanced naturally occurring radioactive materials, or radon gas or progeny particle concentrations found in increased abnormal levels due to the influence of human activities (like UNGD production). This study update also states that "some adjustments

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[92] Brown D, Weinberger B, Lewis C, Bonaparte H: Understanding exposure from natural gas drilling puts current air standards to the test. Rev *Environ Health.*

[93] Colborn T, Schultz K, Herrick L, Kwiatkowski C: An exploratory study of air quality near natural gas operations. *Hum Ecol Risk Assess Int J.* 2013, 20: 86-105.

[94] https://www.publicintegrity.org/2014/12/11/16396/health-worries-pervade-north-texas-fracking-zone

[95] http://energyindepth.org/marcellus/study-finds-radiation-exposure-unlikely-from-oil-gas-development/

[96] http://files.dep.state.pa.us/oilgas/bogm/bogmportalfiles/RadiationProtection/rls-DEP-TENORM-01xx15AW.pdf

[97] https://stateimpact.npr.org/pennsylvania/2015/01/15/study-radioactive-gas-drilling-waste-not-a-threat-to-public-health/

and additions were made, with updates provided to the appropriate DEP Advisory Committees and other stakeholders."[98] One caveat to *EID* Jacobs' article: it ended with by stating, "While DEP did say further testing should be conducted, initial data still show a low risk of exposure." (*EID*, Jacobs)

Low risk or not, radon gas and its progeny particles are dangerous and potentially deadly. Studies reveal a rise in radon exposure health risks, even at UNG facilities, including compressor stations. The CDC admits that "for the most part, the general public thinks radon exposure does not pose a risk", but radon exposures account for an average of 21,000 deaths per year in the US from lung cancer.[99] Though exposure biomarkers to radon and its progeny can be found in bone, teeth, blood and hair, these can't be used as definitive exposure predictors; they must be backed up by accurate environmental air monitoring readings to prove exposure potentials and rates.[100]

However, until there is a way to accurately document and compile lists of those reporting health problems associated with UNGD and air quality effects, without fear of intimidation or reprisals, nothing much will change with regard to air monitoring. Just creating an internet-based site for reporting such problems, as has been suggested[101], would have to also include an actual physical location for those claiming harm to go be physically checked out and verified by laboratory tests performed by bona fide medical researchers, or the UNGD industry and its supporters will disclaim all results. And according to NPR, UNGD is "way out ahead of public health evaluations of any kind to date".[102] As biomarkers are recognized as definite exposure indicators, a national registry could be set up to help track exposure rates, but they would also have to include accurate environmental air monitoring readings to prove exposure (CDC, Witter et.al., 2008). But first, there would have to be trained medical professionals to recognize the potential for environmental exposures; however, most practitioners are not adequately trained to identify or have the time to investigate potential causes of reported symptoms. While exposure chemicals and pathways are being identified, "comprehensive studies like risk assessments are sorely lacking, though studies show that the majority of findings demonstrate the negative health effects associated with UNG production, extraction, and transportation". (Dryszka, 2016).

Over 600 existing research studies have been done to date on the subjects of hydrocarbon emissions from oil and UNGD facilities and their effects (Dryszka, 2016). These reports give support to evidence to the chemical mixtures and their effects that can create both acute and long-term adverse health problems. While these studies may not be able to pin the exact stage of UNGD production or transmission to the exact time to the exact moment that the harmful symptoms occur, the evidence itself of cumulative harmful impacts to public health should be sufficient to warrant investigations into UNGD air emissions and their effects on public health (Macey et.al., 2014). Studies that fully investigate the synergistic way the multiple chemical compounds emitted by UNG facilities like compressor stations react with the human body, thus making adverse health effects worse (Carpenter et.al., 2002, Brown et.al., 2014) are in progress and have not yet appeared in print – still, results from already published scientific reports don't

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[98] http://files.dep.state.pa.us/oilgas/bogm/bogmportalfiles/RadiationProtection/TENORM-Study-Update_generic-mtg_cut-down_ry_2July2014%20(3).pdf

[99] http://www.atsdr.cdc.gov/csem/csem.asp?csem=8&po=7

[100] http://www.atsdr.cdc.gov/toxguides/toxguide-145.pdf

[101] http://lib.law.virginia.edu/lawjournals/sites/lawjournals/files/2.%20Rawlins%20-%20Barnett%20Shale.pdf

[102] http://www.npr.org/2012/05/16/152204584/towns-effort-to-link-fracking-and-illness-falls-short

seem to make an impact into the Federal Energy Regulatory Commission's permitting processes for the UNGD industry.[103] [104]

With compressor station activities bearing over half of all UNGD associated damages including public health morbidity and mortality (Litovitz et.al, 2013), increasing healthcare costs from potential UNG exposures to emissions would likely strain overburdened public health systems, and could lead to a decrease in the quality, availability and access to medical services that would result in "net health effects associated with these exposures [that] may be greater than the simple sum of effects associated with individual exposures"[105].

It is therefore imperative that accurate research be done into UNGD chemical compound exposures, including a hard look at the way the air is currently being monitored to capture peak emissions that contain harmful VOC's and PAH's, and can fluctuate wildly from hour to hour with local weather conditions and topography (Brown et.al., 2014, Macey et.al., 2014). Current monitoring efforts and health standards do not adequately track these events, though health reports from persons living near these sites are consistent with episodic exposure (EHP, Earthworks). "The risk of developing chronic diseases due to exposures, especially by vulnerable populations, has yet to be determined" (Brown et.al., 2014); thus, these studies must not only cover the short-term of one to five years, as is currently the range for projections for gas pipeline studies (Broad Run EA), but long-term, as many diseases like cancer, COPD, or cardiovascular problems do not develop until up to twenty or more years after exposure (Dryszka, 2016).

Though all the current legitimate scientific research to date strongly suggests that there is enough public concern when coupled with considerable doubts about UNG exposures to toxic emissions that warrant investigation, UNG facilities like compressor stations are cropping up closer and closer to neighborhoods, schools, public parks (like Paradise Ridge Park in Joelton at only ¼ of a mile away from proposed CS 563 (Broad Run EA)), and business places. Though the UNGD industry cites research studies of their own, like the flawed DEP radon report that claims 'no harmful impacts' to the greater public health, or the lack of 'hard' evidence that ties UNG emissions at specific sites to chemical exposures, there is only one thing to be said in the latter defense: it is overly presumptive to conclude that a lack of specific evidence negates the facts that the UNG industry both uses and produces harmful toxic pollutants that have and can adversely affect public health, and that the absence of current data gives the UNG industry a clean bill of health. And for those in power to turn a blind eye toward the bulk of legitimate scientific research that proves the potentials for harm that is linked to UNGD production and transmission out of fear of reprisals or the loss of revenue is both unconscionable and harmful in and of itself.

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[103] http://www.earthworksaction.org/pubs/PetroleumExemptions1c.pdf

[104] http://www.citizenscampaign.org/PDFs/ccc_hrhf_wp_final.pdf

[105] http://phpa.dhmh.maryland.gov/DEHFP/EH/Shared%20Documents/Reports/081814

Appendix A

List of Harmed

Appendix A

Restricted to only natural gas compressor station incidents, the compiled list of harmed taken from https://pennsylvaniaallianceforcleanwaterandair.wordpress.com/the-list/ is as follows:

1. #1) **Pam Judy and family**; Carmichael, PA; compressor station 780 feet from home; air exposure; blood tests revealed benzene and compound chemicals; symptoms include neurological (headaches, vertigo, fatigue), nausea, nosebleeds
2. #5) **Phyllis Carr and family**; Fayette County, PA; 3 compressor stations and dehydrator; air exposure; blood tests revealed phenol and benzene; symptoms include neurologic (headache, vertigo), blisters, sore throats, respiratory distress; http://www.frackcheckwv.net/2011/01/17/a-good-whiff-will-put-blisters-up-your-nose/
3. #11) **Wayne and Angel Smith**; Bedford County, PA; compressor station, pipeline and storage; air and water exposures; dead animals (5 cows, 12 chickens, 3 dogs and 4 cats); http://www.altoonamirror.com/page/content.detail/id/543123/clearville-residents-blame-reduced-property-values-on-natural-gas-project.html ; http://www.accountability-central.com/nc/single-view-default/article/voices-from-the-shale-citizen-regulators-trade-incidents/
4. #25) **Lorrie Squibb**; Flower Mound, TX; heavy gas production facilities; air exposure; diagnosis of multiple myeloma; http://www.dentonrc.com/local-news/special-projects/gas-well-drilling-headlines/20110831-breast-cancer-rate-climbs-up
5. #28) **Megan Collins**, Dish, TX; 32YO pediatric nurse; compressor station; air exposure; multiple tests but no confirmed diagnosis; symptoms include respiratory, neurological, sore throat, nausea; http://www.npr.org/templates/story/story.php?storyId=120043996
6. #51) **Susan Haire**; Morrisania Mesa, CO; compressor station and wells; air exposure; symptoms include sinus/sore throat, itch/rash, respiratory distress, extreme leg (nerve) pain; http://www.hcn.org/water/16376 ; also, *High Country News*, "Health is a casualty on the fast track to gas drilling"; Rebecca Clarren, January 12, 2006
7. #67) **Lloyd Burgess**, horse rancher; Dish, TX; compressor stations, pipelines, gas facilities; air exposure; dead horse, mare blinded; http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav_n_827478.html
8. #68) **Charles Morgan**, retired engineer/rancher; Freestone County, TX; compressor station 12KHP; air and noise exposure; increased, intense noise twice ruptured his eardrums as well as his daughter's eardrums; http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav_n_827478.html
9. #70) **Sharon Ward** (deceased 2011); Freestone County, TX; 130 compressors in county; air exposure; documented headaches, tinnitus and sleep disturbances due to high noise levels
10. #82) **Warren and Rebekah Sheffield (and 17 and 19YO sons)**; Dish, TX; multiple compressor stations and pipelines; air exposure; symptoms include headaches, seizures, multiple chemical sensitivities; vertigo, nausea, hives, sore throats; http://dentonrc.com/local-news/special-projects/gas-well-drilling-headlines/20110328-atmosphere-of-concern (see for #s 82-84)
11. #83) **Chuck and Geri Pegg**; Dish, TX; compressor station within 300 feet from home; air and noise exposures; air samples indicate high levels of benzene and carbon disulfide per TX Department of Air Quality, which also revealed 4.8ppb (high) levels of formaldehyde; symptoms similar to other Dish, TX residents
12. #84) **Jim and Judy Caplinger**; Dish, TX; compressor stations; air and noise exposures; settled out of court with gas company for unnamed monetary amount in 2007

13. #209) **Mary Mack**; Bedford County, PA; compressor station; air and water exposures; arsenic and VOC's found; suffered dermatological and neurological symptoms; http://www.youtube.com/MaryMack#1.m4v
14. #308) **Ron Moss and wife**; gas production; air and water exposures; documented asthma; http://earthworksaction.org/files/publications/LOguideCh4.pdf?pubs/LOguideCh4.pdf
15. #573) **Louis, Bessie and daughter Lisa Vecchio**; Dunkard and Greene Townships, PA; five compressor stations; noise exposure; entered a 2011 lawsuit for excessive noise exposure; http://triblive.com/x/pittsburghtrib/news/regional/s_764486.html#axzz2CEGWAial
16. #574) **William Justiss**; Lamar County, TX; compressor station; air and noise exposures; nausea; one of 5 families in Supreme Court lawsuit ebrief #10/10045106.pdf
17. #575) **Tom and Judy Alspaugh**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms; see above ebrief
18. #576) **J.D. Mashburn and wife, Judy**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms; see above ebrief
19. #577) **J.D. Mashburn and Christine**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms; see above ebrief
20. #578) **J. Justiss**; Lamar County, TX; compressor station; air and noise exposures; ENT symptoms and cattle not feeding
21. #751) **Graham Feil**; compressor station; neurological symptoms; air exposure noted
22. #758/#759) **Doug Jenkins and Larry L. Joseph**; Carbon County, UT; compressor station; explosion; critical burns on bodies; crater formed 30 feet wide by 15 feet deep; http://www.bizjournals.com/denver/news/2012/11/21/2-injured-in-fire-at-bill-barrett-gas.html; *Denver Business Journal*; Mark Hardin
23. #766/#767) **Harriet Irby and Betty Clark**; Pentango, TX; compressor station; air exposure; ENT problems, respiratory distress; dead chickens; open valve venting NG and VOC's http://www.star-telegram.com/living/family/moms/article3828826.html; 9/2/2011; S. Schrock
24. #792) **Richard Usack**; Crawford County, PA; compressor station; noise and light exposure; http://www.tiogagaslease.org/images/BVW_11_03_09.pdf
25. #795) **Margaret Heinkel-Wolfe**; Denton County, TX; compressor station; air exposure; neurological and respiratory symptoms; #2010-40355362, November 3, 2010 lawsuit, *Heinkel v Wms Prod. Co., LLC*; suing for devalued property, formaldehyde, sulfur dioxide, benzene, toluene and xylene exposures emitted from compressor station caused documented illnesses
26. #888/#889) **Earl Wenger and Cindy Tout**; Dolores County, TX; air and noise exposures; neurological and ENT symptoms; http://fourcornersfreepress.com/?p=550 "Is Kinder Morgan a Good Neighbor?"; Gail Binkly, May 5, 2012
27. #890/#891) **Albert Nutgrass and Michael Brock**; Glenville, WVA; compressor station; fire on 10/6/2006; severely burned while replacing valves; lawsuit in Kanawha County #06-C-1749; http://wvrecord.com/stories/510590899-fireball-injured-workers-suit-says
28. #899) **Calvin Tillman and family**; Dish, TX; compressor stations and pipelines; air exposures; children suffered repeat nosebleeds; family moved away; http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav_n_827478.html
29. #1106) **Mandy Mobley and two sons**; Ft. Worth, TX; compressor station within 1000 feet of home; air exposure; allergies and related ENT symptoms, migraines, vertigo, fatigue; house has structural damage from constant vibrations; http://www.fwweekly.com/2013/01/16
30. #1204) **John Kurucz**, retired farmer; Wash County, PA; 27 drilling wells and countless compressor stations and pipelines; infrastructure placed on known 'slip' area and now hillside is

sliding away; Kurucz says the pipeline company is blaming his cattle for walking on the area!; http://www.youtube.com/watch?v=qoohCRCZvuY "From the Frontlines"

31. #1220) **Lisa Beck and Sonny Beck**; Blair County, PA; fracking well and compressor station; air and water exposures; headaches, fatigue, vertigo, rash; http://womensnews.org/2013/04/fracking-natural-gas-fuels-health-worries/
32. #1355 thru #1369 (**15 people**); Somerset, NJ; compressor station; **flash fire**; 2 hospitalized with 13 minor injuries; fire began in an inactive part of pipeline; "Multiple Injuries Reported at Branchburg Gas Pipeline Facility Flash Fire", Walter O'Brien, 05-30-2013, http://www.nj.com/somerset/index.ssf/
33. #1376 to #1378 (**3 people**); Logan County, OK; compressor station; **explosion** in building 4/5/2013; no injuries; 3 homes **evacuated** at night; http://www.news9.com/.../homes-evacuated-after-gas-explosion-in-eastern-logan-county ; story #21886634
34. #1379/#1380) **Benjamin Groover, Sr., wife and 2 sons; Robert Nicklow**; Franklin County, PA; compressor station; air and noise exposure; *Bloomberg News*, "Chevron Among Drillers Facing Gas Wells Nuisance Lawsuit", Sophia Pearson and Jim Esttathiou, Jr., 06-10-2013; people seek damages for effects of chemical exposure, noise – exposed to methane leaks and noise that forced Groover and family to abandon home June 2009; Nicklow subjected to 'screeching' noise continuously and exposed to benzene, methane, ethane and is forced to stay inside; *Headley v Chevron Appalachia LLC*, Court of Common Pleas of Allegheny County, PA
35. #2492) **Jessica and Andy Keyon and two children**; Hancock, DE; compressor station and pipeline; evacuation due to compressor station main line venting millions of gallons of natural gas from 10 mile stretch of 30" pipelines; had to vent station for safety for hours on 12-5-2013; incident not reported by Millenium Pipeline to proper state/federal agencies!; http://www.watershedpost.com/2013/hancock-family-evacuated-after-pipeline-accident
36. #2515) **David Crichton**; compressor station; flash fire; burns suffered on hands and face 12-26-2013; http://www.dailyranger.com/story.php?story_id_10585 by Katie Roenigk
37. #5070) **Pramilla Malick and family**; Orange County, NY; compressor station; air exposure; asthma; http://www.truth-out.org/news/item/18636-rural-new-jersey-township-fights-ferc-approved-gas-compressor
38. #6153) **Dan Bykens**; Washington County, PA; compressor station; air exposure; asthma; http://www.observer-reporter.com/article/20140719/NEWS080101/140719418#.VAKMkFfiG2X
39. #7474) **Rebecca Williams**, registered nurse; Tarrant County, TX; compressor station; air exposure; dermatologic, neurologic, ENT, and respiratory symptoms and nausea; http://www.publicintegrity.org/2014/12/11/16396/health-worries
40. Not on the list of harmed are the following: 19YO **Taylor Ishee** – diagnosed with Burkitt's Leukemia at 19, but exposed to 37 gas wells and compressor stations within 1½ mile of his home; Taylor's best friend, **Justin Ealdor**, 21YO, diagnosed with lymphatic leukemia – lived 2/3 mile from 4 wells and compressor station. Texas Air Quality's Terry Clawson said, "TCEQ can't determine the cause of residents' health problems…but it is highly unlikely that chemicals are being emitted at levels high enough to cause adverse health effects such as cancer, kidney damage or liver damage…TCEQ has found no cause for alarm". However, there are only 26 air monitoring stations are in place to monitor more than 6,000 compressor stations! At 11 stations, samples are taken only every six days. And of the 1,370 air quality complaints, TCEQ issued violation notices for 2% from 2009 to 2014 (five years). Yet, TCEQ states the consequences of this are negligible. According to the World Health Organization, "there is no safe level of exposure" with regard to benzene. However, TCEQ in 2007 raised the amount considered "safe" to 54ppb for short durations and 1.4ppb for long durations. Up to the late 1940's, research

produced for the American Petroleum Industry and Shell "concluded that no amount of benzene was safe". And in a confidential report, Shell in 1943 stated, "prolonged exposures to low concentrations [to benzene] may be the most dangerous".
https://www.publicintegrity.org/2014/12/11/16396/health-worries-pervade-north-texas-fracking-zone

Appendix B

NG Compressor Station Blowdown Emissions

1B

Natural Gas Compressor Stations

Addressing Community Concerns, Assessing Emissions and Health Impacts

SWPA-EHP Presentation

Deerfield, MA

January 30, 2016

David Brown, Sc.D

Celia Lewis, PhD

Beth Weinberger, PhD

SOUTHWEST PENNSYLVANIA ENVIRONMENTAL HEALTH PROJECT

Compressor Blowdowns

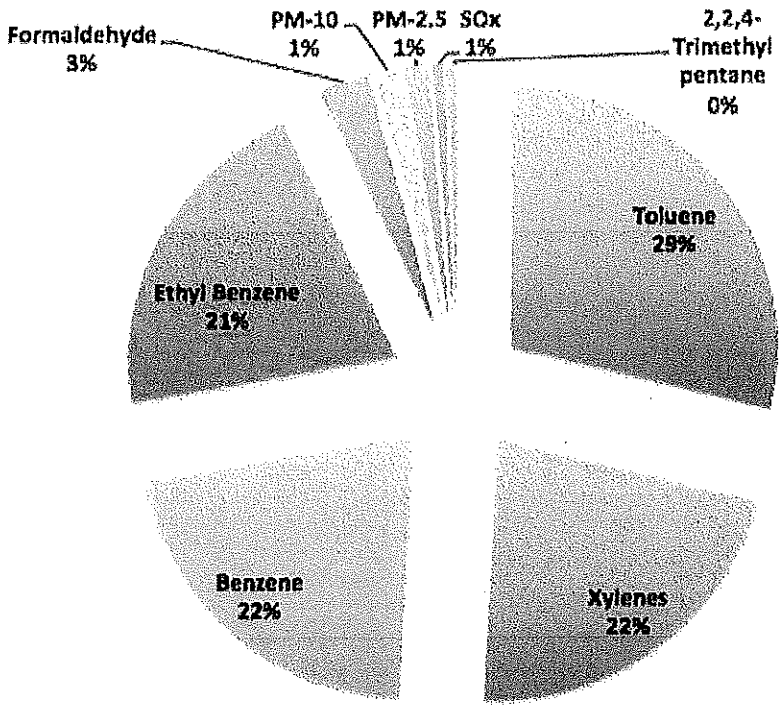

Table 4 HICKORY, PA

Compressor station
Estimated air exposure values of VOCs in ug/m³
(average hourly emission per day 900 grams/minute)

Weather and Stability Class	100 yds 0.1 km	360 yds 0.5 km	½ mile 1 km	1.2 miles 2 km	1.8 miles 3 km	3.1 miles 5 km	6.2 miles 10 km
Sky: clear day Wind: <5 mph A1	525	15	6	1	<1	<1	0
Sky: clear day Wind: 5-7 mph A-B2	400	20	9	1	<1	<1	<1
Sky: clear day Wind: 7-11 mph B3	275	25	8	1	<1	<1	<1
Sky: clear day Wind 11-13 mph C4	400	67	23	8	3	<1	<1
Sky: clear day Wind: >13 mph C5	350	58	20	5	2	1	<1
Sky: scattered clouds, day Wind: <5 mph A86	575	47	31	2	<1	<1	<1
Sky: scattered clouds, day Wind: 5-7 mph B7	450	40	17	5	1	<1	<1
Sky: scattered clouds, day Wind: 7-11 mph B-C8	375	52	18	4	2	<1	<1
Sky: scattered clouds, day Wind: 11-13 mph C-D9	550	84	30	10	3	2	<1
Sky: scattered clouds, day Wind: >13 mph D-10	550	87	31	13	6	2	<1
Sky: broken clouds, >50%, day Wind: <5 mph B11	600	50	18	3	1	<1	<1
Sky: broken clouds, >50%, day Wind: 5-7 mph C12	600	125	44	13	2	2	<1
Sky: broken clouds, >50%, day Wind: 7-11 mph C13	475	79	28	7	3	1	<1
Sky: broken clouds, >50%, day Wind: 11-13 mph D14	550	100	37	14	3	3	<1
Sky: broken clouds, >50%, day Wind: >13 mph D15	600	87	32	12	3	2	<1

SOUTHWEST PENNSYLVANIA ENVIRONMENTAL HEALTH PROJECT

Table 4- Hickory, PA

Sky: overcast > 80%, day Wind: <5 mph D16	1850	250	96	37	18	7	1
Sky: overcast > 80%, day Wind: 5-7 mph D17	1350	175	69	26	13	5	1
Sky: overcast > 80%, day Wind: 7-11 mph D18	850	100	44	17	8	3	<1
Sky: overcast > 80%, day Wind: 11-13 mph D19	733	100	37	14	7	2	<1
Sky: overcast > 80%, day Wind: >13 mph D20	633	87	32	12	6	2	<1
Sky: clouds > 50%, night Wind: <5 mph E21	2600	500	200	100	63	31	9
Sky: clouds > 50%, night day 5-7 mph E22	1850	350	150	75	40	22	7
Sky: clouds > 50%, night Wind: 7-11 mph D23	850	100	44	17	8	3	<1
Sky: clouds > 50%, night Wind: 11-13 mph D24	733	100	37	14	7	2	<1
Sky: clouds > 50%, night Wind: >13 mph D25	633	87	32	12	6	2	<1
Sky: clouds < 50%, night Wind: <5 mph F26	4200	723	350	150	99	46	19
Sky: clouds < 50%, night day 5-7 mph F27	3000	500	250	100	71	33	13
Sky: clouds < 50%, night Wind: 7-11 mph E28	1100	225	99	48	30	14	4
Sky: clouds < 50%, night Wind: 11-13 mph D29	733	100	37	14	7	2	<1
Sky: clouds < 50%, night Wind: >13 mph D30	633	87	32	12	6	2	<1

Appendix C

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