The INGAA Foundation, Inc.

How The Regulatory Process Protects Those Living Near Natural Gas Transmission Compressor Stations

Prepared by: Trinity Consultants

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9111 Jollyville Road
Suite 255
Austin, Texas 78759
512-349-5800

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Acknowledgements:

Trinity Consultants	Georgette Reeves, MPA – Director, Oil and Gas Sector Services
Trinity Consultants	Michael Ballenger, P.E. – Principal Consultant
Trinity Consultants	Elizabeth Gorman, P.E. – Senior Consultant

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EXECUTIVE SUMMARY

This report summarizes the impacts of natural gas compressor stations and reviews the current permitting process. Specifically, this report documents the regulations, rules, and laws which govern the siting and operation of interstate natural gas compressor stations, and how compliance with such regulations protects the health and safety of those living near a compressor station. Statutes addressed in this report include the Clean Air Act (CAA), Clean Water Act (CWA), the Natural Gas Pipeline Safety Act (NGPSA), and reviews conducted in compliance with the National Environmental Policy Act (NEPA). This report also discusses how the agencies with jurisdiction over these health and safety issues establish standards based on scientific studies, promulgate associated regulations that are subject to public input, and implement the permitting processes to ensure new projects comply with the standards and associated regulations.

The natural gas moved (and combusted) in natural gas transmission compressor stations has already been processed, as necessary, prior to receipt to meet high quality standards suitable for pipeline quality natural gas. This segment of natural gas transmission does not include gathering lines nor petroleum liquids pipelines. Natural gas pipeline companies take steps to reduce losses from the pipeline system, and air emissions of pipeline-quality natural gas are of predictable composition.

As explained throughout this report, the regulatory and permitting process for interstate natural gas transmission compressor stations is robust, and it protects the health and safety of the public living near compressor stations because:

- Compressor stations are subject to federal, state, and local air quality, safety and other regulations promulgated to provide protections for the environment, public health and welfare;
- Multiple government agencies provide both direct review and oversight of compressor stations, ensuring a detailed evaluation of the project with checks and balances;
- The Federal Energy Regulatory Commission (FERC) and other government agencies have oversight before, during, and after compressor stations are constructed. The pre-construction permitting process ensures that only those projects that are safe for the public are allowed to move forward, and these permits provide the government with the authority to take enforcement action against permittees both during and after construction (e.g., inspections);
- Agencies have authority to, and have established, construction- and operation-related air pollution limits in accordance with their statutory requirements (e.g., conformance with a State Implementation Plan); and National Ambient Air Quality Standards (NAAQS) are re-evaluated every five years to protect public health.
- Pre-construction review allows opportunities for the public and other stakeholders to raise concerns unique to specific projects during the public notice and comment process.

In addition to regulatory air dispersion modeling, which is required under the Clean Air Act, state and local air quality agencies have the authority to require modeling as needed to ensure that emission sources do not exceed the NAAQS for a given air pollutant.[1] Contrary to some suggestions made by the public during the compressor project approval process, requiring FERC to review additional modeling would be duplicative, time-consuming and unnecessarily burdensome. Rather, it is appropriate for FERC to defer to EPA and its federally delegated state air quality agencies on these issues because EPA has the responsibility and the expertise to implement these modeling regulations in accordance with the Clean Air Act.

[1] Under the CAA each state has primary responsibility for assuring the air quality within its geographic area is in compliance with the NAAQS. See Section 101(a)(3) of the Clean Air Act.

1. INTRODUCTION

Natural gas compressor stations enable U.S. interstate natural gas pipelines to provide a continuous flow of natural gas between supply areas and consumers. Compressor stations are above-ground facilities that are typically located every 50 to 100 miles along interstate pipelines and they compress gas to “push” it through the pipeline to ensure that gas continues to move at sufficient volumes for reliable service at delivery points. Natural gas transmission pipelines are critical to the U.S. economy because they supply natural gas to local distribution companies (for residential end users, among others), manufacturing, and power generation.

Recently, a number of stakeholders, including landowners, community groups, non-governmental organizations, permitting agencies, and politicians have submitted comments about the siting and operation of proposed compressor stations during the certificate process conducted by the FERC. These commenters raised a number of potential health and safety concerns about living, working and recreating near compressor stations. Some of the concerns voiced referenced transport of petroleum liquids (e.g., crude oil). While also transported in pipelines, the mechanical processes at pump stations, potential health and safety concerns, regulations, and permitting process are different for petroleum liquids transmission and gas transmission. This report focuses only on natural gas compressor stations for interstate pipelines and storage facilities.

The INGAA Foundation requested that Trinity Consultants, Inc. (Trinity) develop a report to identify the common concerns that were raised in the comments submitted to FERC. The INGAA Foundation asked Trinity to examine how the existing regulatory and permitting process, specifically the federal and delegated state regulatory agencies’ processes, addresses those concerns and protects those living, working and recreating near interstate natural gas transmission compressor stations (hereinafter referred to as either “interstate natural gas transmission compressor stations” or “natural gas compressor stations”).

Trinity analyzed nearly 500 comments in 22 FERC proceedings, both in the pre-filing and certificate process. These concerns were raised by landowners, concerned citizens, environmental groups, governmental entities and non-governmental organizations over the past 10 years in the context of siting and the operation of an interstate natural gas compressor station. The comments, in general, raised concerns regarding the following issues:

- Air emissions impacts from interstate natural gas transmission compressor stations;
- Climate change impacts from interstate natural gas transmission compressor stations;
- Safety of interstate natural gas transmission compressor stations, and coordination with local firefighting personnel;
- Mechanical noise and vibration from interstate natural gas transmission compressor stations;
- Odors from interstate natural gas transmission compressor stations;
- Spill prevention and reporting of chemicals used in natural gas transmission compressor stations; and
- Stormwater runoff or other concerns relating to water impacts from interstate natural gas transmission compressor stations.

In addition, some comments addressed unique site-specific issues related to property rights, impacts to tourism and aesthetics, or geographically unique concerns (e.g., a stream crossing) associated with a specific project that could not be generalized, and, therefore, these site-specific concerns are not addressed in this report.

This report documents the regulations, rules and laws that govern the siting and operation of interstate natural gas compressor stations, and how such regulations address health and safety concerns of those living near a compressor station. This report also summarizes the impacts of natural gas compressor stations and reviews how the current permitting process ensures that these impacts will not adversely harm public health.

Specifically, this report discusses: (1) The laws that ensure protection of health and safety; (2) The regulatory bodies that ensure compliance with these laws; (3) How agencies establish health protections through regulations based on scientific studies that are subject to public input; and (4) How the permitting process ensures accountability with these requirements.

The INGAA Foundation intends for this report to be used by a variety of stakeholders to inform them of the depth and scope of the regulatory review and permitting protections in place that protect the health and safety impacts of those living, working and recreating near a natural gas transmission compressor station.

1.1. ORGANIZATION OF THIS WHITE PAPER

This report is organized in the following sections:

Section 2: Natural Gas Transmission Compressor Station Overview

This section provides a general overview of the purpose and basic operations of interstate natural gas compressor stations. This section explains the equipment located and activities commonly conducted at natural gas transmission compressor stations, and their associated impacts. This section also details the composition of natural gas that is transported through, combusted in, and emitted by natural gas transmission compressor stations.

Section 3: The Permitting Process for Natural Gas Transmission Compressor Stations

Natural gas transmission compressor stations are regulated by a variety of federal and federally delegated state regulatory agencies. Under federal law, these federal and local agencies are charged with protecting those living near natural gas compressor stations from impacts resulting from the construction and ongoing operation of such a facility. This section describes the FERC permitting process, and how other state and other federal agencies (such as the U. S. Environmental Protection Agency and the Department of Transportation) are required by federal mandate to protect public health and safety.

Section 4: The Permitting Process: How It Protects Those Living Near Compressor Stations

Section 4 examines how the permitting process addresses concerns typically raised by stakeholders during the FERC certificate process. This section does not address concerns that were site-specific (i.e., concerns regarding a specific waterway or habitat potentially impacted by a specific project).

This section of the report discusses the agencies' authority to develop health-based emission standards and to restrict emissions impacts and their toxicity levels through permitting.

The following issues are discussed in this section:

Air Quality Impacts from Natural Gas Transmission Stations. This section identifies the air emissions associated with activities conducted and equipment commonly found at natural gas transmission compressor stations. This section also discusses how those emissions are regulated and controlled. This section additionally explains how agencies evaluate emission standards for transmission compressor station pollutants and determines that they are protective of human health.

Greenhouse Gas (GHG) Emissions and Climate Change. Natural gas transmission compressor stations transport and combust pipeline-quality natural gas, which is primarily comprised of methane, a regulated greenhouse gas.

Therefore, this section outlines the GHG quantification and reporting requirements for interstate natural gas transmission compression, and clarifies that this information is publicly available and transparent.

Pipeline Safety. The U.S. Department of Transportation (DOT) regulates the safety of natural gas transmission pipelines and associated compressor stations. Specifically, the Department's Pipeline and Hazardous Materials Safety Administration (PHMSA) has jurisdiction over pipeline safety. This section outlines how DOT establishes pipeline safety and design standards, as well as requirements to develop written plans and maintain communications with local emergency responders.

Mechanical Noise and Vibration. Natural gas transmission compressor stations are a source of mechanical noise and vibration. This section outlines the specific noise and vibration requirements that compressor station projects must meet. It also explains how FERC developed those limits and determined that the limits ensure the safety of those living, working or recreating near compressor stations.

Odor. Natural gas is an odorless, transparent gas. This section describes why companies may be required to odorize gas used at natural gas compressor stations and how the use of an odorant is evaluated during the permitting process.

Stormwater, Drinking Water, Runoff and Spill Protection. This section outlines the federal agencies involved in storm water, drinking water, runoff spill protection and the regulations that ensure the safety and protection of drinking and surface water.

Section 5: Conclusion

Section 6: Frequently Asked Questions (FAQs) Regarding the Protection of the Health and Safety of Those Living Near Natural Gas Compressor Stations

This section outlines common themes raised during the public participation process of the FERC permitting process, and the general responses provided by project proponents, which are further detailed throughout this report. This table reflects the basis for the project proponent's response, and the section number(s) within this report where a more complete and thorough analysis is provided.

2. INTERSTATE NATURAL GAS TRANSMISSION COMPRESSOR STATIONS

This section provides an overview of the basic operation of a natural gas compressor station, and the common equipment and processes associated with these stations. This information helps provide background to understand the potential health and safety impacts associated with equipment and processes at compressor stations and to correlate such concerns with specific regulatory and permitting protections.

2.1. WHY ARE COMPRESSOR STATIONS NEEDED?

Interstate natural gas compressor stations are above-ground facilities that facilitate the transportation of natural gas across the country. The purpose of a compressor station is to maintain the pressure of the gas inside the pipe at a level that enables natural gas to move at sufficient speed and volumes for reliable service to delivery points. As natural gas travels through interstate natural gas pipelines, some pressure is lost due to friction. As a result, the gas expands and moves more slowly through the pipe. Therefore, compression must occur approximately every 50-100 miles to overcome this natural pressure drop created by friction. The distance between compressor stations depends on a variety of factors, such as the diameter of the pipe, the volume of gas to be transported, terrain and altitude.[2] Because the demand for natural gas is not constant on an annual basis, most pipeline compressors do not run at full capacity year-round. Compressor stations are designed to deliver natural gas to meet customer demand during peak gas consumption periods (e.g., winter heating and summer cooling peak periods).

Interstate natural gas compressor stations are critical for ensuring the delivery of natural gas to local distribution companies, and ultimately, end-users. Simply put, natural gas compressor stations receive, compress and occasionally dehydrate pipeline-quality natural gas so that natural gas can travel over long distances of pipeline to those who need it. The natural gas transported in interstate pipelines is the same natural gas that is burned in stoves, heaters, and other equipment found in homes and businesses.

2.2. WHAT EQUIPMENT IS AT A COMPRESSOR STATION?

While the equipment used at a natural gas compressor station can vary slightly, a compressor station typically consists of a building housing the compressors unit(s), some yard piping, coolers, a gas or electric power source, and safety systems. Some station yards may include small storage tanks and odorization equipment. The major operating equipment at a compressor station is enclosed in security fencing to allow for safe, controlled access only by natural gas compressor station authorized personnel. Depending on the compression capacity installed, a compressor station typically occupies approximately five (5) to thirty (30) acres of land.[3] When additional land is available, a compressor station may be placed on larger parcels, often 10 to 40 acres, with some greater than 100-150 acres.[4] Interstate natural gas companies use these larger parcels, as well as landscaping and other visual design considerations, to provide additional visual or space buffer from the local community and minimize noise, visual, and air impacts to neighbors. Typical interstate natural gas transmission compressor stations do not dehydrate natural gas received into the facility. In this sector of the natural gas industry, most dehydration equipment is located at natural gas storage facilities (which may operate compressors on-site or have nearby compression). Natural gas storage facilities contribute to the reliability of pipeline-quality natural

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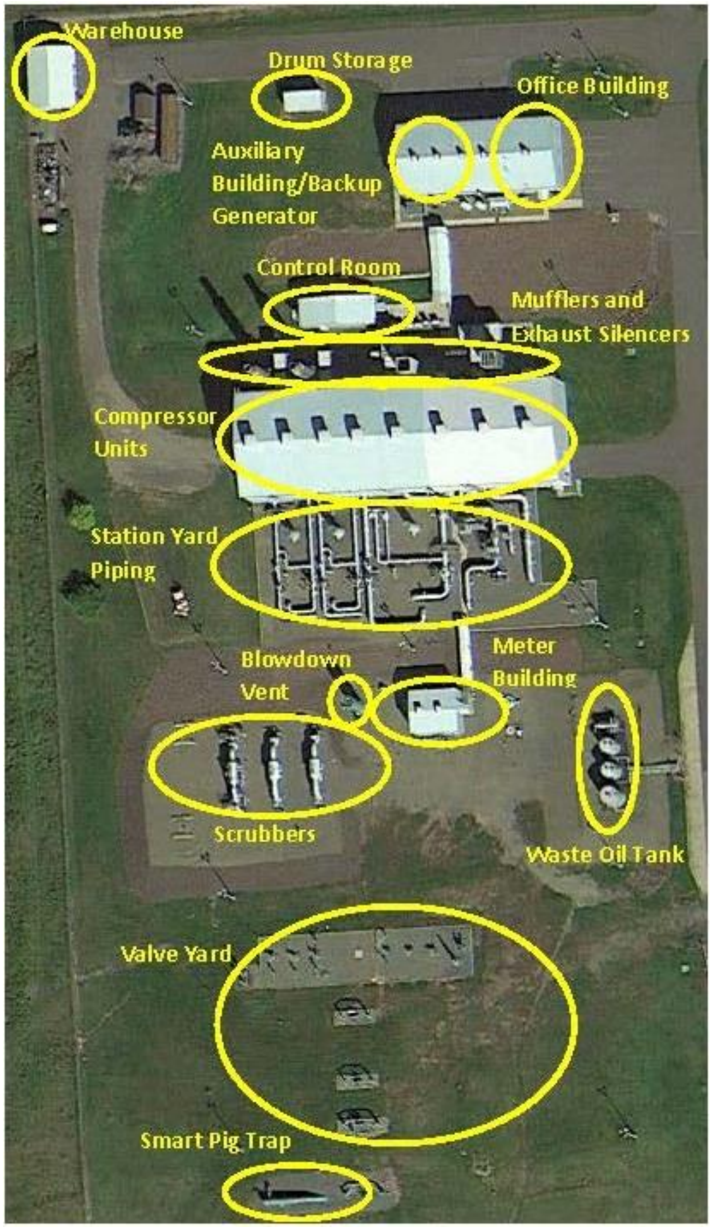
[2] Energy Information Administration, Office of Oil and Gas, "Natural Gas Compressor Station on the Interstate Pipeline Network: Developments Since 1996". November 2007.

[3] In comparison, a typical small-market grocery store and parking lot occupies approximately four acres. See: Economic Development Committee, Town of Harvard, Mass. "Grocery Store White Paper". April 10, 2013.

[4] Federal Energy Regulatory Commission, Office of Energy Projects, "An Interstate Natural Gas Facility on My Land? What Do I Need to Know?" August, 2006.

gas supplies by both leveling off daily gas consumption fluctuations and allowing the ability to meet peak demands with in-transit storage of the pipeline quality natural gas in underground formations.

Figure 2-1. Typical Compressor Station



A typical compressor station is depicted above in Figure 2-1 and generally includes the following equipment:

1. Station Yard Piping: Yard piping moves natural gas between the pipeline and compressor station.

2. Filter Separators / Scrubbers Filter / Dehydration (in some cases): Separators or scrubbers remove solids or liquids from the natural gas that enters the compressor station. Small amounts of liquids (water and heavy hydrocarbons) can condense out of the natural gas stream due to pressure and temperature changes over long distances between compressor stations. These liquids enter the natural

gas transmission compressor station and drop to the bottom of the separator or scrubber, before being drained to a storage tank. While not typically part of a transmission pipeline compressor station (and not shown in Figure 2-1), dehydrators may be present at some compressor stations. For example, a compressor station that is associated with withdrawal from underground storage of pipeline-quality gas at a storage field may have a natural gas dehydration system to remove additional liquids, commonly by using dewatering agents (e.g., glycol).

3. Compressor Units: The compressor station operates compressor units of a sufficient size and quantity to re-pressurize the volume of gas flowing through the pipeline. Natural gas compression is achieved through either positive displacement (PD) or centrifugal compression. Positive displacement compressors usually are reciprocating compressors, which typically are driven by natural gas-fired reciprocating engines. Centrifugal compressors often are driven by natural gas-fired turbines. Both reciprocating and centrifugal compressors may be driven by electric motors. Turbines, engines and motors often are referred to as "prime movers" or "drivers". These units power the compressors.

4. Gas Cooling System: When natural gas is compressed, its pressure and temperature increase. The gas may be cooled before its return to the pipeline to protect the pipeline's coatings and increase its transmission efficiency. The coolers are an indirect heat exchanger (i.e., non-contact cooling).

5. Lube Oil: System Compressor units have lube oil systems to lubricate and protect moving parts.

6. Mufflers and Exhaust Silencers: Mufflers decrease the noise level of operating compressor units. In many cases, companies use exhaust silencers or other mitigation methods to meet FERC noise limitations in areas that are sensitive to noise.

7. Backup Generators: Backup generators stand ready in case of an electrical outage. The backup generators are necessary to provide reliable operation of a compressor station control systems, including emergency shutdown systems.

8. Odorization Equipment (when installed): In some cases, transmission companies are required to deliver odorized natural gas so that the end user can detect potential leaks in their home or business. Not all interstate pipeline compressor stations include odorization equipment. When odorization equipment is required, small odorant tanks and injection equipment are included in the site design.

9. Blowdown Vents: It is necessary for a pipeline operator to remove the natural gas from one or more compressor units, certain equipment or, at times, the entire compressor station for operational or safety purposes. This activity is called a "blowdown". A blowdown can be planned as part of expected maintenance to the station, or can be unplanned, such as an abnormal operating condition. As a safety measure, compressor stations are designed to evacuate the natural gas within the compressor station during emergency situations.

10. Natural Gas Fired Heaters: Some facilities may use natural gas-fired heaters. These heaters, like the other combustion equipment at a natural gas transmission compressor station, use pipeline-quality natural gas. These heaters may be used as standalone heaters, or may be used in conjunction with a natural gas dehydration system.

The purpose and function of natural gas transmission compressor stations is typically the same regardless of the size of the station. This has enabled regulators to establish safety standards and permitting procedures utilizing data that is representative of compressor station operations and to develop industry-wide standards and permitting approaches.

2.3. WHAT IS PIPELINE-QUALITY NATURAL GAS?

Emissions from natural gas transmission compressor stations are primarily from the combustion of pipeline-quality natural gas and blowdown of pipeline-quality natural gas. In order to understand the potential impacts from these emissions (as detailed in Section 4 of this report), it is important to define "pipeline-quality natural gas". This section also details how natural gas quality standards are met across different geographical areas and maintained by pipeline operators.

Many comments submitted to FERC raised concerns regarding the variability of emissions from geographic locations citing documents which note geographic variation in hydrogen sulfide (H_2S) concentration. Other comments suggested that site specific studies were necessary because federal rules could not provide protection from the variability of air impacts. To address these concerns and to define the impacts that are characteristic of a natural gas compressor station, this section discusses the characteristics of "pipeline-quality natural gas". The permitting process assures protection of public health from possible compressor station impacts because the characteristics of "pipeline-quality natural gas" are well understood to be:

- Very low in composition of hazardous substances because they are removed upstream in gas processing plants – prior to receipt; and
- Maintained at consistent quality specifications by tariff and contract requirements.

Some comments submitted to FERC regarding natural gas transmission compressor stations appear to confuse the natural gas moved (and combusted) in natural gas transmission compressor stations with unprocessed natural gas received by processing plants. Emissions from natural gas processing plants, while understood and regulated by the state according to the equipment, are different in quantity and emit different types of pollutants than interstate natural gas transmission.

Because the gas is processed, as necessary, prior to receipt in a transmission pipeline, the impacts and corresponding regulatory oversight for compressor stations are appropriately focused on 1) the impacts from combustion of consistent natural gas in compressor drivers and 2) the potential impacts of methane (the primary constituent of pipeline-quality gas) from gas releases (gas releases include various blowdowns and purges, case vents, actuation of pneumatic devices, compressor seal leaks , etc. – generally described in public comments and, as such, in this report as "blowdowns"). More details are provided in the following section regarding the composition of natural gas in a transmission pipeline.

2.3.1. Composition of Pipeline-Quality Natural Gas

Natural gas transported and compressed through interstate natural gas compressor stations has been treated and purified, as necessary, prior to receipt by an interstate pipeline for shipment to pipeline shipper's delivery points (e.g., local gas utilities for continued transport to homes and businesses, industrial consumers, gas marketers, and gas-fired power generators). This "ready-for-the-end-user" natural gas is inherently odorless and its gas quality specifications are transparent. Before natural gas is delivered to distribution customers, mercaptan, an odorant, is added to this natural gas as a safety factor so it can be detected in the event of a leak.

Natural gas is primarily a mixture of low molecular-weight hydrocarbon compounds. The average natural gas composition of pipeline quality natural gas is nearly 93% methane and 3% ethane, neither of which are hazardous air pollutants. Furthermore, due to their "negligible photochemical reactivity," EPA does not consider methane or ethane to be volatile organic compounds (VOCs), a group of chemicals that are specifically regulated as precursors to the formation of ground-level ozone.[5] The remainder of pipeline quality natural gas is

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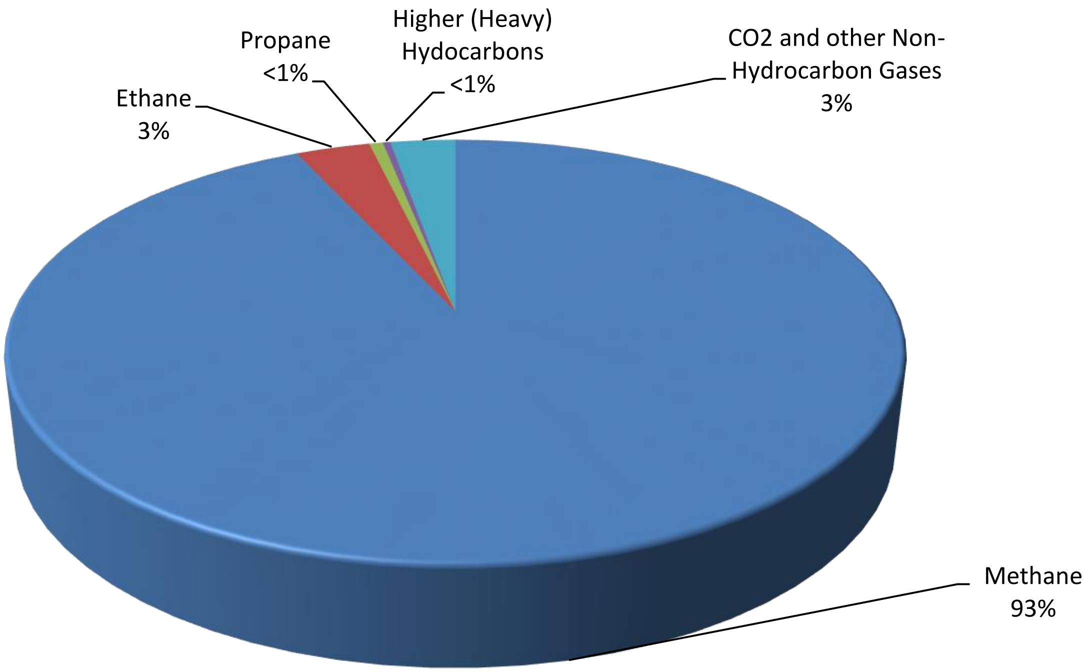
[5] 40 C.F.R. §51.100(s).

approximately 0.6% propane, 0.3% heavier hydrocarbons, and about 3% CO_2 and other non-hydrocarbon gases (e.g., helium, nitrogen, water vapor).[6]

Figure 2-2. Average Composition of Pipeline Quality Natural Gas



Section 4 of this report provides details regarding the federal and state regulations and the safety protections they afford. For example, states have State Implementation Plan (SIP) requirements for toxic air pollutants which help ensure safe emissions for workers and the public at the local level. Additional air permit and regulatory limits (with compliance verification requirements) help ensure that releases of pipeline-quality natural gas resulting from station maintenance or planned activities, including the trace constituents, are protective of public health.

To ensure that the composition of pipeline-quality natural gas remains consistent, pipelines frequently sample and analyze the gas to ensure that all quality specifications are met. This data is publicly available in company-specific "Gas Quality" reports.[7] Gas Quality reports often show daily samples, including chemical composition.

As demonstrated in Figure 2-2, long-term average pipeline quality natural gas has minimal hazardous air pollutants and only in trace amounts (often 0.01% or less).[8] For example, higher hydrocarbons constitute less

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[6] US EPA (2014), U.S. EPA, "U.S. Greenhous Gas Inventory Report: Annex 2 Methodology and Data for Estimating CO_2 Emissions from Fossil Fuel Combustion". April 2016, Table A-42. Results of extended gas quality lab analyses can provide additional understanding of the individual compounds and their precise concentration in each sample, which have some variation between discreet samples.

[7] Two examples of daily "Gas Quality" reports are readily-available on-line and can be referenced at: http://www.1line.williams.com/SCADAData/jsp/GasQualityFilterTransco.jsp or https://escript.dom.com/jsp/info_post.jsp?&company=dti.

[8] Mole percent.

than 1% of pipeline natural gas on average. These higher hydrocarbons are sometimes denoted as C6+, meaning chemicals with 6 or more Carbon atoms, which includes benzene (a federally regulated hazardous air pollutant, and a locally regulated toxic). Although methane is non-toxic and non-VOC, it is a greenhouse gas (GHG) and is regulated for its potential to contribute to climate change. This issue is addressed in Section 4.[9]

Low levels of hydrogen sulfide (H_2S) can be present in pipeline-quality natural gas. Hydrogen sulfide is controlled for both environmental and operational consideration, as discussed in Section 4.1.

2.3.2. Consistency of Pipeline-Quality Natural Gas

Because the composition of pipeline-quality natural gas is consistent, any emissions from pipeline-quality natural gas are of a consistent nature. As a result, air quality experts and engineers at reviewing agencies are familiar with the potential impacts from natural gas compressor stations, and they have mature, broad-based regulatory programs in place to protect public health.

Natural gas transported via natural gas transmission pipelines is largely consistent in its chemical make-up because it must meet the quality and interchangeability specifications in FERC-approved gas tariffs. Pipeline-quality natural gas must meet minimum quality levels in FERC-approved tariffs set for each pipeline, which require high gas quality prior to receipt, regardless of the source of the gas. Tariffs for all FERC-regulated pipelines can be found online.[10]

FERC tariffs regulate the consistency and composition of natural gas to be transported in each interstate pipeline. EPA builds on these tariffs to define a "subcategory" of emissions sources with similar emissions and impacts – enabling the establishment of regulations that are representative of the entire subcategory and that can ensure achievable protections.

EPA also describes the use of pipeline-quality natural gas (or "sweet natural gas") as a fuel. Through this definition, EPA "subcategorizes" the equipment that utilizes pipeline-quality natural gas, and differentiates the sources at interstate natural gas compressor stations from other segments, such as processing.[11]

Furthermore, it is common for air quality authorizations to specifically require the use of pipeline-quality natural gas to meet well understood, demonstrated air quality impacts that the federal or delegated state agency have evaluated as a sufficient limitation to confirm the emissions are protective of public health.

In summary, the natural gas at natural gas transmission stations are within tight standards, measured and of consistent quality. As a result, regulatory agencies have collected significant data and conducted detailed evaluations of the potential impacts from gas releases or where the pipeline-quality natural gas is used as fuel (for prime movers of the compressors) to develop appropriate regulations for natural gas transmission compressor stations.

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[9] 40 C.F.R. §98. *See also* http://www3.epa.gov/climatechange/ghgemissions/gases/ch4.html.

[10] http://www.ferc.gov/industries/gas/gen-info/fastr/htmlall/index.asp.

[11] Pipeline-quality natural gas is defined in 40 C.F.R. Subpart JJJJ as "a naturally occurring fluid mixture of hydrocarbons (e.g., methane, ethane, or propane) produced in geological formations beneath the Earth's surface that maintains a gaseous state at standard atmospheric temperature and pressure under ordinary conditions, and which is provided by a supplier through a pipeline. Pipeline-quality natural gas must either be composed of at least 70 percent methane by volume or have a gross calorific value between 950 and 1,100 British thermal units per standard cubic foot." This definition is consistent with the definition of "natural gas" in 40 C.F.R. 60 Subpart KKKK.

2.3.3. Trace Chemicals found in Natural Gas

As outlined in sections 2.3.1 and 2.3.2, pipeline-quality natural gas consists predominantly of methane and ethane, and its composition is consistent within pipeline systems. Various concerns are sometimes raised during the compressor station permitting process regarding the potential presence of trace chemicals in natural gas and their potential health impacts for those living and recreating near the stations. Chemicals of concern that have been mentioned by the general public include:

- 1,3-Butadiene
- n-Butyl Alcohol
- Carbon Disulfide
- Carbonyl Sulfide
- Chlorobenzene
- Chloromethane
- 1, 2-Dichloroethane
- Diethyl Benzene
- Dimethyl Disulfide
- Methyl Ethyl Disulfide
- Lead
- Naphthalene
- 1,1,1, 2-Tetrachloroethane
- Trichloroethylene
- Trimethyl Benzene
- 1,2,4-Trimethyl Benzene
- Styrene

Each of these chemicals above is specifically regulated with many rules and regulations. These regulations are implemented by EPA, state, and local agencies, and their emissions must be controlled when the potential exists for emissions at levels determined to be impactful to health and human safety. Some of the chemicals listed above are not present in pipeline quality natural gas, or, if present, are at levels so low they are undetectable and are not addressed in this paper. However, some of these chemicals may potentially be present in natural gas (and, therefore, occasionally emitted). Actual emissions of these chemicals from compressor stations are often *de minimis,* (i.e., below thresholds requiring chemical-specific analyses for permitting). The requirements for chemical-specific analyses in permitting are based on conservative permitting assumptions developed by state/local engineers, epidemiologists, and air quality experts. This is discussed further in Section 4.1.2.

The small quantity of these emissions are supported by the fact that natural gas transmission compressor stations account for only a tiny fraction of the nation's air emissions of the listed chemicals.[12] Of the chemicals listed above, only 1,3-Butadiene, Chlorobenzene, Lead, Styrene, and Tetrachloroethylene (not Trichloroethylene) have any reported emissions from compressor stations.[13] The total of all emissions of these chemicals attributed to compressor stations in the National Emissions Inventory (NEI) represents less than a tenth of a percent of the total national emissions of these chemicals. For a basis of comparison, residential wood fireplaces and wood stoves account for 5% of the nation's emissions of 1,3-Butadiene alone.[14] At nearly 100

[12] 2011 National Emissions Inventory (NEI) Data. Accessed at: https://www.epa.gov/air-emissions-inventories/2011-national-emissions-inventory-nei-data.

[13] *Id*. Based on reported emissions for NAICS codes 4862, 48621, and 486210.

[14] *Id*. Total sector emissions for "Fuel Comb – Residential – Wood".

times less than the emissions of unregulated and unpermitted home fireplaces, the emissions of these chemicals from natural gas transmission compressor stations do not require further scrutiny.

Emissions of these chemicals from a typical compressor station are below permitting thresholds developed by regulating agencies identifying the sources with risk to public health and welfare. Even so, the Clean Air Act permitting process requires pipeline companies to estimate the potential emissions of these chemicals and include them in permitting documents for agency review when permitting is triggered, providing full disclosure and consideration of any necessary controls by air pollution agencies.

Chemicals potentially in natural gas that may be present in amounts requiring regulation or control include benzene, toluene, ethylbenzene and xylenes (BTEX). As described subsequently in this report, BTEX is largely removed in upstream sectors, prior to receipt in a natural gas transmission pipeline. When present in the transmission sector, BTEX concentrates at dehydration systems, emissions impacts from which are well-understood and subject to specific regulation and control developed to ensure protection of "residual risk".

The NEI helps provide a basis of comparison to capture the proportionality of emissions from all natural gas transmission compressor stations to the magnitude of other emissions-generating sectors. The total of all BTEX reported in EPA's 2011 NEI from compressor stations represents less than a tenth of a percent to the nation's total BTEX releases. In contrast, motor gasoline stations accounted for over 4% of the nation's BTEX, or 36% of the nation's total when summed with emissions from the on-road cars being fueled at those stations.[15] Despite BTEX emissions from interstate natural gas transmission compressor stations being an order of magnitude less, compressor stations are still subject to significant local, state, and federal emissions control regulations and permitting requirements for BTEX.

As discussed in Section 4, federal, state, and local permitting processes and existing regulations ensure the protection of neighbors to compressor stations for all chemicals potentially present in natural gas.

2.3.4. Particulate Matter from Natural Gas Compressor Stations

Some commenters have expressed concern regarding particulate matter (PM) emissions from natural gas compressor stations, noting that elevated PM in produced natural gas from some underground formations can lead to higher PM emissions from transmission compressor stations. However, possible variations in PM within produced gas is removed from the gas stream prior to receipt at natural gas compressor stations in the transmission sector. There is the potential for a small amount of condensed PM to form in the gas stream during transmission, as well as entrainment of dust and scale from the interior walls of the pipeline. Because PM in the transmitted natural gas affects pipeline operating equipment (such as compressors) typical compressor stations include filtration and separation to remove and capture PM and condensed liquids from the transported gas stream at the suction side (i.e., entry) of a compressor station. PM variations in the gas stream do not correlate to variations of PM impacts from compressor stations.

While still very small, PM emissions are possible from compressor stations as a byproduct of combustion, such as from compressor drivers or fuel gas heaters. PM emissions from combustion are heavily regulated, including requiring detailed evaluations through the permitting process, as discussed in greater detail in Section 4. Concerns regarding PM emissions are based on a perception of high "background" values of ambient PM and then erroneously attribute the small PM emissions from natural gas compressor stations as the driver of the existing air quality. In other words, PM concerns cite "high" PM concentrations that already exist in outdoor air

[15] *Id.* Total sector emissions for "Gas Stations", and then summed with "Mobile – On-Road non-Diesel Light Duty Vehicles" and "Mobile – On-Road non-Diesel Heavy Duty Vehicles".

as a result of all existing natural and anthropogenic sources. These concerns can be addressed in two ways: 1) as a criteria pollutant, PM is statutorily required to have health-based criteria established and maintained by states for all ambient air, and 2) PM emissions from natural gas compressor stations are a small fraction of the larger sources which drive the ambient concentration of PM.

1. PM is a criteria pollutant required to have health-based criteria established and maintained by states for all ambient air. As required by EPA regulations developed in accordance with the Clean Air Act, states operate and maintain many ambient air quality monitors adhering to very specific quality assurance measures to track the concentrations of PM in air across the country. The states identify appropriate areas for monitoring and often have large departments within agencies dedicated to ensuring the quality and appropriate calculations to compare to the corresponding NAAQS for PM – the maximum permissible concentration level for PM in the ambient air based on current scientific data and designed specifically to ensure protection of the public health (see Section 4.1.1.1). High quality data from state-approved monitors is utilized to discern whether the existing "background" air quality is safe. It is not appropriate nor scientific to draw conclusions on short-term samples without the additional benefit of monitoring plans and quality assurance protocols. Furthermore, background monitoring does not directly discern impacts from compressor stations, from which particulate matter emissions are minute in comparison to other activities with higher PM emissions.

2. Emissions of PM from natural gas transmission compressor stations are a small contributor of the overall national PM emission footprint. EPA's 2011 NEI shows that direct reported PM emissions (as total PM_{10}) from all industrial combustion of natural gas (of which natural gas transmission compressor stations are only a small subset) is ~0.1% of all PM emissions nationwide.[16]

There are well-defined health based maximum standards for PM in ambient air (i.e., outdoor air) that are based on current, scientific analysis (further described in Section 4.1.1.1). States are required by law to monitor the air and implement and enforce regulations to maintain air quality that is safe in comparison to these statistical PM criteria. States ensure protection from unhealthy PM concentration through permitting and compliance assurance, verified through their quality-assured monitoring network and engineering analyses in permit applications. PM concentrations in raw natural gas do not correlate to PM impacts from interstate natural gas transmission compressor stations, which contribute only a very small amount of total industrial PM emissions (not including natural sources, mobile sources, or residential sources).

2.4. ARE NATURAL GAS COMPRESSOR STATIONS SAFE?

Several commenters have raised concerns to FERC about the safety of natural gas compressor stations and the risk of fire or explosions from a potential accident at the station. Commenters also raised concerns relating to the capabilities of local fire fighters to handle an accident, should one occur. As discussed below, various federal agencies oversee the safety of compressor stations. Furthermore, natural gas compressor station operators take safety seriously. Pipeline operators work with trade organizations such as INGAA to foster a culture of safety at all levels of leadership and to ensure that each employee "makes safety personal".[17]

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[16] U.S. EPA, "2011 National Emissions Inventory (NEI) Data". Accessed at: https://www.epa.gov/air-emissions-inventories/2011-national-emissions-inventory-nei-data. Based on a comparison of national total "PM_{10}-PRI" emissions from the "Fuel Comb – Industrial Boilers, ICEs – Natural Gas" (27,049 tons) to the sum total of all sectors (20,721,756 tons).

[17] The Interstate Natural Gas Association of America (INGAA), "Integrating Culture and Leadership: Making Safety Personal". July 2015.

Companies are required to meet safety requirements to ensure the protection of those living near or those working at a natural gas compressor station. In addition to adhering to pipeline design specifications and safety requirements mandated by FERC and U.S. Department of Transportation (USDOT), detailed in the following pages, all compressor stations are equipped with emergency shutdown systems that can detect abnormal conditions such as an unanticipated pressure drop or natural gas leakage. These systems are designed to automatically shut down the prime movers, isolate and clear the affected piping, and re-direct the natural gas flow away from the affected part of the station.

Under the Pipeline Safety Act, as amended (49 U.S.C. § 60101 et. seq.), the USDOT is exclusively authorized to promulgate pipeline safety and design standards for pipelines and compressor stations. DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) has jurisdiction over pipeline safety under Title 49, U.S.C. Chapter 601. Natural gas transmission compressor stations must be designed, constructed, operated, and maintained in accordance with the USDOT Minimum Federal Safety Standards in 49 C.F.R. Part 192. The DOT regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. DOT inspections are conducted during the design, construction and operation phases of pipelines and compressor stations.

All companies must file pipeline and compressor station incidents with PHMSA. Complete incident data is publicly available on PHMSA's website.[18] PHMSA's "Natural Gas Transmission and Gathering Incident Data January 2010 to present" shows that no incidents where a member of the public was injured were reported in this period at compressor stations. The same is true for the 2002 to 2009 data set; prior to 2002, injuries with the public were not recorded.[19]

More generally, the natural gas transmission sector has a strong safety record. According to PHMSA data, over 99.99% of natural gas was transmitted safely in 2014 and 2015.[20] The National Transportation Safety Board (NTSB)[21] and Government Accountability Office (GAO)[22] have acknowledged that pipelines are relatively safe when compared to other modes of transporting hazardous goods (e.g., highway and rail).

USDOT requires each natural gas pipeline operator to develop a written emergency plan that establishes and maintains liaisons with appropriate fire, police and public officials to learn the resources and responsibilities of each organization that may respond to a pipeline emergency, and to coordinate mutual assistance.[23] The

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[18] Pipeline incidents are reported through PHMSA, and logged on their website, https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages&NQUser=PDM_WEB_USER&NQPassword=Public_Web_User1&PortalPath=%2Fshared%2FPDM%20Public%20Website%2F_portal%2FSC%20Incident%20Trend&Page=Serious&Action=Navigate&col1=%22PHP%20-%20Geo%20Location%22.%22State%20Name%22&val1=%22%22.

[19] Pipeline incident data is reported through PHMSA and available on their website, http://www.phmsa.dot.gov/pipeline/library/data-stats/distribution-transmission-and-gathering-lng-and-liquid-accident-and-incident-data . For purposes of the PHMSA F7100.2 Incident Reporting form, "injury" is defined as "requiring inpatient hospitalization". General public fatalities (PHMSA designation "NUM_GP_FATALITIES" and "NUM_GP_INJURIES") and injuries at onshore compressor station equipment and piping (PHMSA designation "SYSTEM_PART_INVOLVED").

[20] *Id.* In this context, "safely" means without release (intentional or unintentional). INGAA estimates 2,000,428.62 MCF released in 2014 and 2,074,076.34 MCF released in 2015. This is compared to a total of 24,463,435,736 MCF 23,163,035,048 MCF transmitted in 2014 and 2015, respectively.

[21] National Transportation Safety Board (NTSB), "Integrity Management of Gas Transmission Pipelines in High Consequence Areas". Document No. NTSB/SS-15/01. January 2015. Accessed at: http://www.ntsb.gov/safety/safety-studies/Documents/SS1501.pdf.

[22] Government Accountability Office (GAO), "Pipeline Safety: Better Data and Guidance Needed to Improve Pipeline Operator Incident Response". Document No. GAO-13-168. January 2013. Accessed at: http://www.gao.gov/assets/660/651408.pdf.

[23] 49 C.F.R. 192.615

pipeline operator must also establish a continuing education program to enable its customers, the public, government officials, and those engaged in excavation activities to recognize and report a gas pipeline emergency to appropriate public officials.[24]

Beyond regulatory requirements, pipeline operators are continuously working to ensure the safety of those living and working around compressor stations, and they keep the public informed in the rare event of an incident. Many operators also participate in collaborative programs at the state and national levels to engage emergency responders, as outlined in the American Petroleum Institute (API)'s Recommended Practice 1162.[25] Operators provide facility tours, conduct tabletop drills, and coordinate full-scale emergency response exercises with the appropriate agencies.

Industry associations, like INGAA and the INGAA Foundation, solicit feedback from groups of emergency responders, and this survey data is used to enhance stakeholder engagement. For example, the INGAA Foundation conducted two surveys at emergency response workshops in 2011.[26] The INGAA Foundation found that more than half of the emergency responders surveyed had met, or were familiar with, their local pipeline representative. The INGAA Foundation also learned that nearly half of emergency responders surveyed indicated that they desired more information and resources from the pipeline industry to successfully respond to an incident. As a result of this feedback, INGAA and others within the natural gas transmission industry successfully encouraged PHMSA to revise the Emergency Response Guidebook (ERG) section on natural gas in 2012 to communicate more information about natural gas pipeline properties to emergency responders. The ERG "provides first responders with a go-to manual to help deal with hazmat transportation accidents during the critical first 30 minutes. To date, nearly 14.5 million free copies have been distributed to the emergency response community through state emergency management coordinators."[27] The "Pipeline Emergencies" training manual is also available to first responders at no cost; "Pipeline Emergencies" was produced through a cooperative agreement between PHMSA and the National Association of State Fire Marshals and was released in May 2011.

INGAA, at the request of emergency responders and with participation by API, the Association of Oil Pipelines, PHMSA and state regulators, created a series of videos to educate emergency responders on different types of pipelines, understand their roles in an emergency and prepare for emergencies. The video series, called *Shoulder to Shoulder*, focuses on both oil and natural gas pipelines (and facilities) and features actual emergency responders. The six videos are: a general pipeline overview; natural gas pipelines and hazards of natural gas; liquids pipelines and hazards of liquids; emergency response roles; preparation and resources; and incident management best practices.

The videos, plus a 30-second teaser, are available to all members on the INGAA and INGAA Foundation websites, www.ingaa.org/emergencyresponse, and on a separate You Tube microsite: https://www.youtube.com/channel/UCLQv4arPbGIuPt7j_JuETWw. Members can use the video during emergency responder meetings and events or provide video links via email campaigns, promote the video in baseline public awareness procedures or spread the word through other supplemental public awareness

[24] 49 C.F.R. 192.616

[25] API, "Public Awareness Programs for Pipeline Operators, Second Edition". December 2010.

http://www.techstreet.com/api/standards/api-rp-1162?product_id=1757546.

[26] INGAA, "Integrating Culture and Leadership: Making Safety Personal". July 2015. http://www.ingaa.org/Foundation/Foundation-Reports/24281.aspx.

[27] http://www.phmsa.dot.gov/hazmat/outreach-training/erg.

outreach. Pipeline contractors can make the videos available to employees to inform them of safety and preparedness for a pipeline emergency.

3. THE PERMITTING PROCESS FOR NATURAL GAS TRANSMISSION COMPRESSOR STATIONS

FERC and USDOT have established, respectively, rigorous permitting and safety requirements for interstate pipeline compressor stations. EPA, as well as the state and local environmental agencies, closely regulate compressor station emissions.

As detailed below, the permitting process for interstate natural gas transmission compressor stations is robust in protecting the health and safety of individuals living near a compressor station because it:

> Involves multiple government agencies, providing both direct review and oversight, ensuring a detailed evaluation of the project with "checks and balances;"
> Ensures that FERC and other government agencies have oversight before, during, and after compressor stations are constructed. Pre-construction permitting ensures only projects safe for the public are allowed to move forward, and these permits provide for government responsibility to enforce regular compliance assurance during and after construction (e.g., inspections);
> Identifies the federal, state, and local regulations applicable to the project which were promulgated to provide protections for health and welfare;
> Provides the agency with a vehicle to require construction- and operation-related air pollution limitations in accordance with statutory requirements (e.g., conformance with a State Implementation Plan); and
> Presents an opportunity for public comment on unique project-specific concerns.

Natural gas compressor stations are required to meet all applicable federal regulations prior to, during construction, and during the operation of the facility. In many cases, facilities must also adhere to state and local laws which are compatible with, or more stringent than, federal requirements.

Pre-construction approvals of interstate natural gas transmission compressor stations are subject to a comprehensive independent environmental evaluation performed by FERC in accordance with NEPA. This process is far more comprehensive than the permitting process for other industries and commercial development projects. The following sub-sections outline the requirements of NEPA and the subsequent permitting process driven by FERC. Stakeholders can monitor the status of such projects by reviewing the documents filed online in FERC's e-library system.

3.1.1. Federal Energy Regulatory Commission Permitting of Natural Gas Compressor Stations

FERC is an independent federal agency that regulates the siting and operation of interstate pipeline and storage facilities, including interstate natural gas compressor stations. FERC also regulates the abandonment of pipeline facilities. In accordance with Section 7 of the Natural Gas Act, FERC performs a rigorous review of applications for the construction and operation of interstate natural gas compressor stations. FERC provides protections for public health and welfare two ways: 1) by determining whether a project will meet public convenience and necessity and 2) by assessing whether projects that require federal approvals will cause a significant environmental impact.

With regard to assessing the need for a project, the Natural Gas Act provides that no natural gas company shall transport natural gas or construct any facilities for such transportation without a Certificate of Public Convenience and Necessity issued by FERC. In reaching a determination on whether a project will meet the public convenience and necessity, FERC considers the proposal's market support, economic, operational and competitive benefits, and environmental impact.[28] FERC is required by law to determine the need for a pipeline and new/modified natural gas compressor station prior to issuing a certificate authorizing its siting, construction and operation. In determining the public convenience and necessity, FERC's goal is to give appropriate consideration to the enhancement of competitive transportation alternatives, the possibility of overbuilding, subsidization by existing customers, the applicant's responsibility for unsubscribed capacity, the avoidance of unnecessary disruptions of the environment, and the unneeded exercise of eminent domain in evaluating new pipeline construction.[29] As such, this evaluation defines at the outset whether a project is in the best interest of the public and looks beyond whether the impacts of a proposal are significant.

While FERC does determine that a project is in the best interest of the public, it also serves in the lead role to assess whether projects will cause a significant impact on the environment. This process includes a consideration of the public health protections of environmental laws and regulations. FERC is responsible for conducting a review of the potential environmental impacts associated with a proposed new or modified natural gas compressor station in accordance with the National Environmental Policy Act of 1969 (NEPA). In enacting NEPA, Congress recognized that nearly all federal activities affect the environment in some way and mandated that before federal agencies make major decisions, they must consider the effects of their actions on the quality of the human environment. Accordingly, NEPA requires that all federal agencies assess the environmental effects and related social and economic effects of proposed actions.

NEPA requires that the lead agency (e.g., FERC) make an informed decision regarding the environmental consequences of a project as it evaluates proposals and alternatives.

In 2005, the Energy Policy Act of 2005 designated FERC as the lead agency for coordinating all applicable federal authorizations and for NEPA compliance review during pipeline certificate applications.[30] FERC also coordinates with other federal and delegated state agencies during the permitting process. A pipeline applicant must apply for all applicable state and federal environmental permits and approvals before it can build its facilities.

3.1.2. FERC's Detailed Assessment of Potential Environmental Impact

As part of the certificate process for proposed natural gas compressor stations, FERC prepares an independent environmental review, with input from other stakeholders that details the potential environmental, health and safety impacts and identifies mitigation steps required to minimize any impacts. An illustration of the FERC permitting process is provided below.

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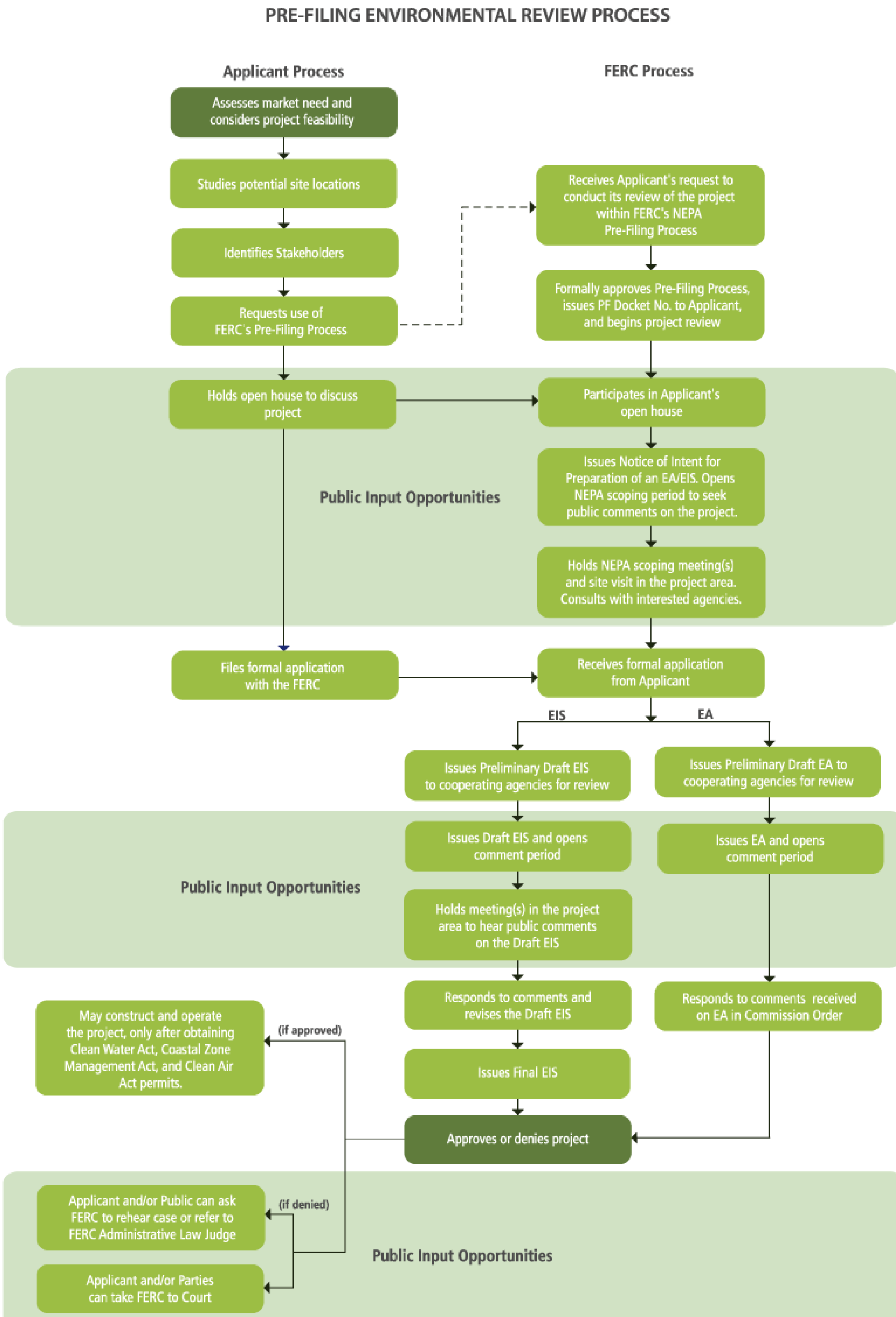
[28] FERC Statement of Policy, issued September 15, 1999, Docket No. PL99-2-000, http://www.ferc.gov/legal/maj-ord-reg/PL99-3-000.pdf.

[29] *Id.*

[30] http://www.ferc.gov/industries/gas/indus-act/pipelines.asp.

Figure 3-1. FERC Certificate Process



FERC requires that a project applicant prepare a broad, detailed assessment of the project's potential impacts. For example, an applicant may be required to submit up to thirteen "Resource Reports" that evaluate potential impacts such as air, water and noise quality. An applicant must justify its proposed siting location of the compressor station, whether the proposed construction will cause environmental harm, and if so, what it proposes to do to mitigate impacts from its project.

As part of FERC's responsibility to perform an independent environmental review, FERC also consults with stakeholders, identifies environmental issues through public scoping meetings, issues the applicant follow up data requests on how it plans to address stakeholder and environmental concerns, and prepares an environmental report – either an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). The assessment of environmental impacts is an important and integral part of the FERC's decision-making process.

An EA is used to determine whether a proposed federal action has the potential to cause significant environmental impacts. If the assessment determines that no significant impacts will occur, then FERC issues a "Finding of No Significant Impact" (FONSI). This means that the proposed project (with appropriate mitigating measures, if necessary) would not constitute a major federal action significantly affecting the quality of the human environment. If the assessment determines that significant impacts will occur, FERC must prepare an EIS to analyze and disclose the significant impacts. Alternatively, FERC may choose to bypass the EA entirely and proceed directly with the preparation of an EIS. An EIS/EA must include:

- A description of all reasonable alternatives to meet the stated purpose and need;
- A description of the environmental impacts associated with each alternative; and
- An analysis of direct and indirect effects of the alternatives, including cumulative impacts.

These components and the independent analysis by FERC (supplemented by other cooperating federal agencies) offer protections to the public during the review of compressor station projects.

After preparing its draft EA or EIS, FERC shares the document with cooperating federal agencies (i.e., those that elect to be an official part of FERC's review process as prescribed under NEPA) for their review, and considers their comments prior to issuing a final EA or EIS for public comment. This process provides the opportunity for agencies to provide additional information for FERC's consideration so it has a complete and balanced record of scientific information. FERC also may issue a data request to a project applicant about a specific issue if it needs additional information. FERC considers any additional comments from stakeholders or the project applicant before issuing a final EA or EIS. FERC also posts the final document on its public website. This iterative process allows for an evaluation of project impacts, impacts of identified alternatives, as well as impacts of a "no action" alternative – all of which FERC weighs in considering whether to issue a certificate.

FERC issues an order either approving or denying the project sponsor's request for a certificate to construct and operate a compressor station. In doing so, FERC responds to the comments it received during the public comment period and explains the basis for its decision.

As part of an order issuing a certificate, FERC often imposes conditions that mitigate or eliminate potential impacts attributed to the proposed project. For example, FERC may require that a company install specific compressor station noise control equipment or use a certain construction procedure. Also, a company must file additional documentation to meet conditions of the certificate. These items include details of the implementation plan for construction and any necessary mitigation procedures. Companies are required to file status updates with FERC until all construction and land-restoration activities are complete. Doing so ensures a company's continued compliance with all environmental requirements. Companies must maintain detailed records to demonstrate compliance with all applicable federal regulatory requirements. FERC also conducts compliance inspections during construction and restoration to ensure compliance with a company's proposed project, FERC's Plan and Procedures, and environmental conditions in the project's certificate.

3.2. OTHER PERMITS AND AUTHORIZATIONS REQUIRED FOR COMPRESSOR STATIONS

Before a company files its certificate application with FERC and during the review process, the company must apply for other required permits and authorizations from various other governmental agencies. For example, a company also must comply with all applicable regulations and/or obtain permits and authorizations from the U.S. Environmental Protection Agency (EPA), the U.S. Army Corps of Engineers (USACE), and the U.S. Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA). Often, these regulatory agencies will agree to be "cooperating agencies" as part of the FERC's NEPA review process. These agencies have jurisdiction by law or special expertise with respect to environmental resource issues associated with the project.

The table below provides examples of the additional federal permits and authorizations that may be required for a new or modified interstate compressor stations; the list for a given project will vary depending on the individual compressor station project and the state where it is located.

Table 3-1 Major Permits, Authorizations, and Consultations

Agency	Permit/Authorization /Consultation	Agency Action
EPA	Section 404, Clean Water Act	Review section 404 wetland dredge and fill applications to the USACE with §404(c) veto power for wetland permits issued by the USACE
	Clean Air Act	Determination of General Conformity applicability. Review and provide comments on the environmental impacts of major federal actions. Provide oversight of permitting of new and modified facilities by states acting under delegated authority.
National Oceanic and Atmospheric Administration (NOAA)'s National Marine Fisheries Service	Section 7 Endangered Species Act (ESA) Consultation	Finding of impacts on federally listed or proposed threatened and endangered marine species and their habitat
United States Fish and Wildlife Service (USFWS)	Section 7 ESA Consultation, Biological Opinion	Finding of impacts on federally listed or proposed species. Provide Biological Opinion if the project is likely to adversely affect federally listed or proposed species or their habitats
	Fish and Wildlife Coordination Act	Provide comments to prevent loss of and damage to wildlife resources
	Migratory Bird Treaty Act (MBTA)	Provide comments to prevent taking or loss of migratory birds and habitat for migratory birds

Agency	Permit/Authorization /Consultation	Agency Action
Advisory Council on Historic Preservation	Section 106 Consultation, National Historic Preservation Act (NHPA)	Comment on the Project and its effects on historic properties; includes consultation with affected federally-recognized Indian tribes
U.S. Army Corps of Engineers	Section 404 Clean Water Act; Section 10 Rivers and Harbors Act	Approval of wetland and waterbody crossings
State: Environmental Agency (may include delegated federal authority)	Section 401, Clean Water Act	Issue Water Quality Certification
		Consultation with Freshwater Wetlands, and Protection of Waters
	National Pollution Discharge Elimination System Program	Issue Pollution Discharge Elimination System Permit for Hydrostatic Test Water Discharge and Trench Dewatering
		Issue General Permit for Discharges of Stormwater and Dewatering Wastewater from Construction Activities
		Issue Pollution Discharge Elimination System Construction Stormwater General Permit; Stormwater Pollution Prevention Plan (SWPPP)
	State Threatened and Endangered Species Program	Consultation on state-listed threatened and endangered species
		Consultation on inland fisheries
	Clean Air Act	Review, evaluate, and issue air permits for compressor station installations and/or modifications
State: Department responsible for Coastal Zone Management	Coastal Zone Consistency Program	Review project for consistency with coastal zone plans and issue determination
State: Office of Parks, Recreation, and Historic Preservation	Section 106, NHPA	Review and comment on the project and its effects on historic properties
	State Parks Program	Consultation on potential encroachment on state lands
State: Department of Transportation	Work within roadways	Review and issue permits and plans for construction within state road right–of-ways

A pipeline's obligation to apply for and satisfy the requirements of multiple agencies with subject-matter expertise provides the opportunity for expert review of the potential impacts from a proposed compressor station project and the imposition of necessary mitigation measures. Furthermore, collaboration with multiple government agencies provides both direct review and oversight, ensuring a detailed evaluation of the project.

The process of many of the above-referenced federal permits requires state (and sometimes local) agencies to conduct detailed review of proposed facilities, with oversight by the federal agencies. For example, under the Clean Air Act, the federally delegated state air quality agencies take the lead in carrying out the regulations developed under the law. By placing this responsibility on states' air quality agencies, EPA is acknowledging that local and regional agencies will have the particular understanding of the local regulated community, geography, housing, transportation, and other factors that allow for location-appropriate regulation, control, and accountability.[31] Therefore, while all state and local regulatory requirements must meet the requirements found within the Clean Air Act, it is not uncommon that states will adopt more stringent requirements to address specific local issues.

The National Ambient Air Quality Standards (NAAQS) are set by EPA for pollutants that are considered harmful to public health and the environment, and states are required to develop a plan to implement standards that are at least as stringent as those required by EPA. EPA sets the NAAQS based on scientific analysis. States adopt the NAAQS for each of these pollutants and issue permits to ensure that the standards are being met. This section details this process, and highlights the administrative process under which each state must undergo in order to ensure air quality standards meet EPA's requirements. Details regarding NAAQS development can be found in Section 4.1.1 of this report.

Each state must develop a State Implementation Plan (SIP), which is a compilation of state rules and regulations that outline how the state will control air pollution and ensure its ambient air meets or exceeds the NAAQS. Much like an industrial facility's permit which requires monitoring, recordkeeping and reporting to demonstrate compliance with emission limitations, a SIP must include the general infrastructure (monitoring, regulations, programs, and policies) that a state adopts to attain, maintain, and enforce the NAAQS.[32] This includes all existing emission sources including compressor stations. SIPs include state-level permitting programs for minor sources that are too small to otherwise trigger air permitting requirements. These state-level minor source permits are the mechanism by which state agencies can ensure an appropriate inventory of emissions to ensure that the state can continue to maintain the health-protective NAAQS.

While states may choose different approaches, each SIP is reviewed by EPA (and is subject to public input as well) to ensure it meets the requirements of the Clean Air Act. As such, the SIP is like a state's "permit" from EPA, with EPA providing the oversight to ensure each State carries out the purpose of the Clean Air Act "to promote the public health and welfare and the productive capacity of its population."[33]

In addition to federal oversight of state environmental agencies, federal agencies are also charged with reviewing each other's determinations. For example, EPA reviews and provides comments on the adequacy of other agencies' major determinations, including those of FERC.[34] PHMSA inspects projects for compliance with federal safety regulations and FERC inspects for compliance with its certificates. Through this oversight, the potential project impacts and methods to protect public health are carefully reviewed by the agencies that have expertise in the relevant subject matters and there is oversight by other agencies to confirm the review and determinations.

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[31] U.S. EPA, "The Plain English Guide to the Clean Air Act". Publication No. EPA-456/K-07-001, April 2007, page 3.

[32] http://www3.epa.gov/airquality/urbanair/sipstatus/overview.html, referenced February 22, 2015.

[33] Clean Air Act, Section 101(b)(1).

[34] Clean Air Act 42, U.S.C. §7609.

4. THE PERMITTING PROCESS: HOW IT PROTECTS THOSE LIVING NEAR COMPRESSOR STATIONS

There is a federal regulatory framework in place to regulate the health, safety, and noise impacts from natural gas transmission compressor stations built along interstate natural gas pipelines. These regulations seek to protect the health and safety of those who live, work or recreate near natural gas transmission compressor stations. A compressor station is required to meet these regulations, which ensures that the operation of the compressor station is consistent with federal health and safety objectives. A proposed station that cannot comply with these regulations cannot obtain a FERC certificate to operate.

These regulatory programs are designed to ensure that:

- Emissions from the compressor station will meet existing air quality standards (state agencies, EPA);
- The facility's operation is safe (PHMSA/DOT);
- Surface and groundwater will remain protected (local agencies, EPA);
- Surface area impacts are mitigated (local agencies, EPA);
- The compressor station is designed and operated in a safe manner (PHMSA/DOT);
- Fish, wildlife and vegetation will be protected (USFWS);
- The station will adhere to noise standards (FERC); and
- The station is necessary (FERC).

The following sections in this report explain how each of these regulatory bodies address the health and safety of those living, working or recreating near natural gas transmission compressor stations, including how they ensure that any limitations are set in a manner that accounts for the best available data, science and technology. These sections describe the common impacts associated with natural gas compressor stations, as well as impacts that are not generally associated with a typical natural gas transmission compressor station. They also address general concerns often raised in comments submitted to FERC regarding proposed natural gas compressor stations.

This section of the report discusses how these potential impacts are addressed during the permitting and construction process and in rules and regulations governing the on-going operation of compressor stations.

4.1. AIR QUALITY IMPACTS FROM INTERSTATE NATURAL GAS COMPRESSOR STATIONS

During its operation, air emissions from a natural gas transmission compressor station are primarily produced by combustion of pipeline quality natural gas (unless electric motor driven compressors are used). Small quantities of air emissions are produced by other equipment and fugitive emissions. Natural gas transmission compressor stations are also a source of mechanical noise. While the impacts from a natural gas compressor station typically vary based on location, the site of the property, and types of equipment used at the facility, a compressor station may have the following impacts:

- Operating air emissions from combustion of pipeline quality natural gas in natural gas fired engines and turbines (discussed in more detail in Sections 4.1.1 and 4.1.2).
- Operating air emissions from combustion of pipeline quality natural gas in natural gas fired heaters (discussed in more detail in Sections 4.1.1 and 4.1.2).
- Air emissions from release vents (e.g., blowdowns) and fugitive leaks (discussed in more detail in Section 4.1.3).
- GHG emissions from natural gas combustion, releases, and fugitive leaks (discussed in Section 4.2).
- Odor at stations transporting odorized natural gas (discussed in more detail in Section 4.4).

- In unique circumstances, air emissions such as Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) from glycol natural gas dehydration (discussed in more detail in Section 4.1.2).

Some comments submitted during the FERC permitting process for proposed interstate natural gas compressor stations raised concerns that air emissions at compressor stations may impact the public health and safety of those living, working or recreating near such stations. These comments generally focused on two categories of emissions: (1) emissions from natural gas combustion and (2) emissions of hazardous air pollutants and greenhouse gases from natural gas blowdowns.

As discussed above, equipment located at compressor stations may vary slightly depending on the number of compressor units and the type of ancillary equipment installed at each compressor station. The majority of emissions from most natural gas compressor stations are nitrogen oxides (NO_X), carbon monoxide (CO), CO_2, water vapor, and some volatile organic compounds (VOCs), which are by-products from the combustion of pipeline quality natural gas in engines and turbines used to compress and move the natural gas through the compressor station. The VOCs emitted from a compressor station include some EPA-designated Hazardous Air Pollutants (HAPs) generated through the use of natural gas dehydration equipment, engines and turbines. The most common HAPs at a natural gas compressor station are formaldehyde from natural gas combustion in engines and turbines, and BTEX compounds from natural gas dehydration or blowdowns.

The Clean Air Act requires EPA to create and enforce regulations to limit emissions from facilities such as interstate natural gas compressor stations. Regulations for criteria pollutants (e.g., CO, NO_X, and VOCs) and HAP (e.g., formaldehyde and benzene) emissions often require compliance with federally enforceable emission limits or reduction targets as well as the protection of the National Ambient Air Quality Standards (NAAQS). The subsequent sections of this report address how interstate natural gas compressor stations demonstrate compliance with requirements under the Clean Air Act, and how those air emissions limits are determined to protect those living near interstate natural gas compressor stations.

Several comments submitted to FERC about proposed natural gas compressor stations raised concerns and issues that mischaracterize natural gas transmission compressor station operations and impacts. The following list responds to these concerns and corrects misconceptions about compressor station operations and impacts.

- Visible emissions during operation: Some commenters raised concerns about whether the compressor station operations would generate visible emissions, such as dust or smoke (i.e., filterable particulate matter). Typically, natural gas compressor station operations do not generate visible emissions such as dust or smoke due to the clean-burning natural gas used for fuel.

- Emissions or chemical storage of hydraulic fracturing materials: Some commenters raised concerns about whether hydraulic fracturing activities occur at compressor stations. Natural gas transmission compressor stations are not part of the natural gas exploration and production segment, which is where hydraulic fracturing takes place. Hydraulic fracturing only takes place at oil and natural gas wellheads. There are no oil or natural gas wellheads at a natural gas transmission compressor station; therefore, compressor stations do not produce air emissions or store chemicals associated with hydraulic fracturing.

- Emissions from oil and natural gas wells: Some comments submitted to FERC expressed concerns with emissions from oil and natural gas wells. An interstate natural gas transmission compressor station does not produce natural gas or oil from wells. Accordingly, there are no emissions associated with oil and natural gas wells at compressor station facilities.

- Emissions from natural gas processing: Some comments submitted to FERC expressed concern regarding emissions associated with processing natural gas. Processing natural gas is a complex process designed to clean raw natural gas by separating impurities and other products (e.g., propane and ethane) to produce pipeline-quality natural gas. Natural gas processing also involves the extraction of natural gas liquids (NGL) from the natural gas stream. As previously discussed, natural gas transmission compressor stations move pipeline quality natural gas, which consists primarily of methane and ethane, along interstate pipelines. Processing plants, which often are located many miles upstream from compressor stations, remove the majority of non-methane and non-ethane gases prior to the gas reaching the interstate natural gas pipeline. No natural gas processing activities or associated emissions occur at a mainline natural gas transmission compressor station.

- Hydrogen sulfide: Some commenters expressed health concerns about the potential presence of hydrogen sulfide at a natural gas transmission compressor station. Impacts from hydrogen sulfide are not characteristic of compressor stations for interstate natural gas pipelines. Hydrogen sulfide can be present in the natural gas produced in a low percentage of wells,[35] or "sour gas wells," but once the natural gas has reached the natural gas transmission compressor station, any sulfur compounds must conform to very low concentrations for both environmental and operational reasons. Sulfur compounds (such as hydrogen sulfide) in natural gas can wreak havoc on equipment and pipelines, and are required to be below the Occupational Safety and Health Administration's (OSHA's) threshold for safe exposure of 10 ppm.[36] Therefore, the maximum concentration of hydrogen sulfide allowed to be received by an interstate natural gas transmission pipeline is generally a quarter grain/100 cubic feet or less (approximately 4 parts per million or 4/10,000th of a percent). In the pipeline – not considering dissipation from a release – this concentration is below the OSHA threshold for safe exposure. Additionally, the low levels of hydrogen sulfide would be further reduced by combustion of the natural gas as fuel for the compressor station equipment. Combustion of natural gas reduces hydrogen sulfide by nearly 99 percent.[37]

- Radon: Occasionally, a commenter submitted a comment to FERC raising a concern regarding the levels of radon in natural gas. There is no documentation that attributes impacts from naturally occurring radioactive material (NORM), such as radon (Rn), to natural gas transmission compressor stations. Concerns of radon exposure stem from the belief that natural gas sourced from the Marcellus Shale formation has elevated levels of radon, and that the elevated radon will propagate through production, processing, transmission and into the downstream use of natural gas, including burning gas in homes (e.g., at a stovetop). Scientific studies of radon exposure in the home have shown the risk to be "nonexistent."[38] FERC has previously calculated conservative extrapolations of domestic exposure based on radon measured in samples of natural gas transmission in the Marcellus Shale region and shown exposure levels three orders of magnitude less than EPA's indoor action level (and two orders of magnitude below average outdoor levels).[39] In a study of compressor station impacts, Pennsylvania noted that "there is little potential for additional Rn exposure to workers and the members of the public at or from natural gas compressor stations."[40]

[35] Less than 25% of natural gas wells in the U.S. contain H_2S. Gas Research Institute. Hugman, R.H., Springer, P.S. and Vidas, E.H. Gas Research Institute, "Chemical Composition of Discovered and Undiscovered Natural Gas in the United States: 1993 update". Document No. GRI-93/0456, page 1-3.

[36] 29 C.F.R. 1926.55, Appendix A. The National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) also is based on a 10 ppm concentration for H_2S.

[37] H_2S converts to SO_2 during the combustion process. EPA guidance generally allows for 100% conversion of fuel sulfur to SO_2 when calculating emissions from natural gas combustion in AP-42, Chapter 1.4 – natural gas combustion.

[38] Van Netten, C., K. Kan, J. Anderson, and D. Morley. 1998. Radon-222 and Gamma Ray Levels Associated with the Collection, Processing, Transmission, and Utilization of Natural Gas. American Industrial Hygiene Association Journal 59(9):622-628.

[39] FERC, "Final Environmental Impact Statement – Vol. 1, Constitution Pipeline and Wright Interconnect Projects". Docket Nos. CP13-499-000, CP13-502-000, PF12-9-000, October 2014, pages 4-187 through 4-188.

[40] PermaFix Environmental Services, Inc., for the Pennsylvania Department of Environmental Protection, "Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) Study Report, January 2015, page 9-10.

4.1.1. Criteria Pollutants – NO_X, CO and VOC

EPA has deemed six common air pollutants "criteria" pollutants: particle pollution (dust or particulate matter), ground-level ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead. The term "criteria" indicates their representativeness of overall air quality, such that by comparing the concentrations of these six criteria pollutants to standards, the air can be considered healthy or unhealthy. Some comments submitted to FERC raised concerns about possible emissions of criteria pollutants from compressor stations and whether emissions from proposed natural gas transmission stations had been evaluated and considered. In fact, the standards set by EPA for criteria pollutants are derived from human health and environmental studies, utilizing science-based guidelines to set protective levels.[41]

Of the combustion emissions potentially released by natural gas transmission compressor stations, NO_X, CO, and VOC represent the largest portions. Compressor station operations generally do not emit significant amounts of SO_2 or dust (i.e., filterable PM emissions).

The public is expressly protected from the emissions of criteria air pollutants through the development of national ambient air quality standards (NAAQS) under Section 109 of the Clean Air Act. The NAAQS serve as the cornerstone of the Clean Air Act, from which permitting programs are structured and for which federal actions must conform (e.g., General Conformity).

Section 109 of the Clean Air Act directs EPA to establish NAAQS for criteria pollutants which cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare.[42] Primary NAAQS are developed to protect public health. Secondary NAAQS are developed to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the ambient air.[43]

The following four processes protect the public from possible criteria pollutants emitted from interstate natural gas compressor stations:

- Development and revision of National Ambient Air Quality Standards;
- Pre-construction review and scientific studies often required by the air permitting authority (i.e., EPA, state, or local agency, as appropriate) to confirm acceptable impacts, protective of public health;
- Emission control technology requirements for new or modified major emitting facilities; and
- Promulgation of New Source Performance Standards that require the "best system of emissions reduction".

In addition, the Clean Air Act is buttressed by a very robust enforcement regime. EPA has extensive authority to inspect and request information from facilities on their compliance with laws and regulations.[44] The agency has broad powers to bring enforcement actions against suspected violators; and, in some circumstances, citizens may file suit on their own, including when a facility that has a Prevention of Significant Deterioration permit has violated the conditions of that permit.[45] A facility found to be in violation of the Clean Air Act is subject to severe

[41] U.S. EPA, "The Plain English Guide to the Clean Air Act". Publication No. EPA-456/K-07-001, April 2007, page 4.

[42] 42 U.S.C. § 7408(a)(1).

[43] 42 U.S.C. § 7409(b).

[44] 42 U.S.C. § 7414.

[45] 42 U.S.C. § 7604(a)(3).

penalties, including a fine of up to $37,500 per violation per day.[46] Criminal prosecution is also possible.[47] This strict enforcement regime acts as a powerful ongoing incentive for facilities to comply with the conditions of their permits and with applicable emission standards.

4.1.1.1. Health Protections from Criteria Pollutants - National Ambient Air Quality Standards

The Clean Air Act requires EPA to establish NAAQS for pollutants that are common in outdoor air, can be harmful to public health and environment at high concentrations, and that result from numerous and diverse sources. EPA has developed NAAQS for carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), and sulfur dioxide (SO_2). O_3 is created by the reaction of oxides of nitrogen (NO_X) and volatile organic compounds (VOC). As such, regulations created to address O_3 address NO_X and VOC as "precursors". NAAQS have been established for particulate matter with an aerodynamic diameter of less than 10 microns (PM_{10}) and particulate matter with an aerodynamic diameter of less than 2.5 microns ($PM_{2.5}$). The hazardous air pollutants reviewed in the Section 4.1.2. are individual compounds that also are included in the makeup of VOC and PM; thus, EPA provides additional protections from HAPs because they are regulated both individually and collectively.

NAAQS with short averaging periods are established specifically to protect against acute health impacts, while NAAQS with long averaging periods are established to protect against chronic health impacts. The statistical "form" and the averaging period defined for each NAAQS are defined specifically in accordance with its potential health and welfare impact (e.g., welfare protections include visibility impairment, damage to crops, vegetation, and buildings). The form and average are as important to the protection of health and welfare as its numerical value. Epidemiological studies help to define all three of these components – form, averaging period, and numerical threshold. Instantaneous values that are not in the appropriate form or average do not provide relevant information of a NAAQS exceedance, and thus do not define healthy or unhealthy air.

NAAQS are maximum ambient concentration standards and relate directly to the quality of air and whether it is "healthy" for the public to breathe. NAAQS do not establish emissions limitations that are applicable to a particular facility or activity, nor are they "tons per year" thresholds as often apply in permitting programs. NAAQS are set for "criteria" pollutants because they define health-based criteria that set the foundation for air quality regulations and permitting programs. Because NAAQS reflect the maximum ambient air concentrations of pollutants that may be present while ensuring the public health of those breathing the air, permitting programs are used to regulate emissions from new projects that might lead to increases in ambient concentrations of pollutants. State and local agencies implement ambient monitoring programs for each NAAQS to monitor local and regional air quality and ensure the NAAQS continue to be or will be "attained" if the standards are not currently met in a given area. NAAQS can be viewed as the state or local area's "air quality limits". Existing, local ambient monitors are used to confirm whether the area is meeting the limits.

NAAQS are based on EPA's most up-to-date understanding of health impacts from the scientific community. EPA is required under the Clean Air Act to re-examine the NAAQS every five years for sufficiency in protecting the public health taking into consideration sensitive populations, such as those with pre-existing heart or lung disease (e.g., asthmatics), children, and older adults. The Clean Air Act mandates that every five years, EPA must complete a thorough review of the criteria pollutants and NAAQS and, if necessary, make revisions and develop new standards based on available data.[48] During the NAAQS review, EPA considers scientific assessments, risk and exposure assessments, policy assessments, and other technical documents to determine whether the

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[46] *See* EPA, Clean Air Act Stationary Source Penalty Policy (Oct. 25, 1991), *available at* https://www.epa.gov/enforcement/clean-air-act-caa-and-federal-facilities.

[47] Steven P. Solow, et al., "Clean Air Act Enforcement," *in* The Clean Air Act Handbook (4th ed.) 731 (Julie R. Domike and Alec C. Zacaroli eds., 2016),

[48] 42 U.S.C. § 7409(d).

existing NAAQS sufficiently protect public health and welfare. EPA relies heavily on the Clean Air Scientific Advisory Committee (CASAC) for this assessment.[49] If recent information indicates more rigorous standards are needed to sufficiently protect the public, then EPA revises the NAAQS. The NAAQS must be based purely on scientific data; EPA may not consider economic costs when developing and implementing the standards.[50] The five-year reviews have occurred since the initial NAAQS designations following the establishment of the Clean Air Act in 1970 and EPA has revised the standards several times to make them more stringent to reflect improvements in control technology, fuel quality, or as new scientific data warranted.

In summary, the NAAQS are set in accordance with law to ensure a complete and current protection of both health (including sensitive populations) and welfare (visibility, vegetation, and structures) of all criteria pollutants, including those collective pollutant categories and precursors. The NAAQS are based on the latest, independent scientific assessments, and EPA is prohibited from reducing the protections provided by the NAAQS based on the cost of compliance. Because of these focused, comprehensive, and current health-based protections, federal, state, and local environmental and health agencies have developed regulations and permitting programs to ensure that the NAAQS are attained or that air quality in nonattainment areas is improved at a pace that is in accordance with attainment deadlines. Attainment with the NAAQS ensures protection of health of neighbors to compressor stations. The manner of this demonstration is delineated in each of the following sections.

4.1.1.2. Health Protections from Criteria Pollutants – Pre-construction Review and Studies

During the permitting process, reviewing agencies (state agencies, EPA, and FERC) protect the public health and welfare by requiring that ambient air concentrations of criteria pollutants do not exceed the NAAQS. In order to ensure that emissions from new projects will not cause or contribute to ambient concentrations in excess of the NAAQS or allowable increases over baseline concentrations (known as Prevention of Significant Deterioration increments) in areas that are currently in attainment, reviewing agencies rely on air dispersion modeling for large projects. Air dispersion modeling is a mathematical simulation of emissions as they are transported through the atmosphere to determine the potential impacts of a proposed project.

Under the federal and state pre-construction approval programs, permit applicants may be required to conduct air dispersion modeling in order to obtain the necessary air quality pre-construction approvals. Under the air quality permit approval process, the New Source Review (NSR) program, major sources subject to pre-construction permitting for one or more criteria pollutants must conduct a modeling analysis to demonstrate that emissions of the subject pollutant or pollutants from the proposed project will not cause or contribute to air pollution in violation of any NAAQS or any applicable maximum allowable increase over the baseline concentration in an area.[51] With respect to a pollutant for which the area is in nonattainment with a NAAQS, the permitting agency must evaluate the extent to which a proposed project could aggravate nonattainment.

Each state and local air quality agency's SIP includes a NSR pre-construction approval program with modeling requirements. Some states adopt the federal program, while other states develop their own program that must be at least as stringent as (or more than) the federal program. Beyond regulatory modeling specifically required by the Clean Air Act, state and local air quality agencies have the authority to require modeling as needed to

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[49] CASAC was established under the CAA Amendments of 1977 at 42 U.S.C. § 7409(d)(2). The CASAC's purpose is to provide independent advice to EPA on any adverse public health or welfare, among other impacts which may result from criteria air pollutants, based on a review of medical studies and published epidemiological data. The CASAC is comprised of members of the National Academy of Sciences, physicians, and state air quality control agencies. The committee's members are the experts in air pollution and air quality related issues identified as qualified to set the foundational health-based standards that define "safe air" for all of the public.

[50] *Whitman v. American Trucking Associations, Inc.* 531 U.S. 457 (2001).

[51] 40 C.F.R. 52.21(k)(1).

ensure that emission sources do not contribute to exceeding the NAAQS, or exacerbating existing nonattainment.[52] These modeling requirements are included in regulations that are subject to public review and comment (e.g., Appendix W to 40 C.F.R. §51). It is appropriate for FERC to defer to EPA or its federally-delegated state air quality agencies who have the primary responsibility and the expertise to implement these modeling regulations in accordance with the extensive Clean Air Act modeling guidelines for the NAAQS.

EPA agrees that not all proposed projects or air pollutants require modeling. For example, projects with low levels of emissions of criteria pollutants do not warrant a time-intensive modeling study. Small projects are also not required to perform a modeling analysis under the federal permit program commissioned in the Clean Air Act. Utilizing an emissions threshold is appropriate as it is consistent with scientifically-derived regulation and significant research relied upon in the development of the Clean Air Act rules. As such, it is reasonable for reviewing agencies to conclude that a small project will not cause or contribute to NAAQS exceedances based on minor emissions. In accordance with their primary responsibility under the Clean Air Act, state and local air pollution control agencies evaluate regional emissions from all permitted sources (not limited to FERC jurisdictional projects such as interstate natural gas transmission compressor stations) as part of their SIP development.[53] As described previously in this report, EPA has oversight over a state's SIP to confirm it meets the requirements of the Clean Air Act. Further, EPA holds the states accountable in maintaining the NAAQS. When proposed compressor station projects demonstrate conformance to SIP requirements, under the corresponding state agency's review in the permitting process, the reviewing agency documents the protection of health from criteria air pollutants (as part of the technical evaluation developed by the state air quality permit engineer). The success of each SIP in assuring this protection is confirmed through improving air quality observed by ambient monitor trends, even in regions that only require pre-construction air modeling for major sources.[54]

For those projects where the air permitting authority requires a modeling study, it is helpful to understand what the "modeling" analysis provides. Air dispersion modeling is a mathematical simulation of emissions as they are transported through the atmosphere. Models seek to replicate atmospheric conditions for the specific geographical location of the compressor station (including unique and complex terrain, buildings, and observed weather phenomenon like inversion layers and calm wind speeds where fog may be present), and simulate a plume of exhaust as it disperses from the stack and throughout the atmosphere. The simulation results in an estimate of ground level concentrations of pollutants at locations around the emission source.

Because models are deterministic analyses conducted prior to implementation of a project, they over-estimate the impacts of emissions from a project (particularly when conducted as a "screening" model). Further, when a permitting process requires modeling, additional layers of conservatism are utilized in the pre-project model that add to the over-estimation of impacts, such as assuming the proposed units all operate simultaneously at maximum allowable emissions throughout the year. As such, where project-specific modeling is required by the air permitting agency (i.e., EPA or states) to demonstrate impacts less than the NAAQS, the over-prediction adds more than "ample margin of safety" to confirm that the project is protective of public health.[55]

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[52] Under the CAA, each state has primary responsibility for assuring the air quality within its geographic area is in compliance with the NAAQS. See Section 101(a)(3) of the Clean Air Act.

[53] Modeling is utilized by EPA and states as part of their air quality and land management responsibilities, including in evaluation of the sufficiency of SIP revisions for existing sources. See Appendix W to 40 C.F.R. § 51 Section 1.0.a.

[54] http://www3.epa.gov/airtrends/aqtrends.html.

[55] It is well documented that air dispersion modeling over-predicts emissions, and, in many cases, very substantially. *See, e.g.*, Pipeline Research Council International, Inc., "Plume Volume Molar Ratio Method (PVMRM) Assumptions that Lead to Conservative Model Over-Predictions". April, 2013. Also, a case study conducted by the Indiana Department of Environmental Management (IDEM) which compared modeled impacts to monitored impacts of existing sources concluded that air dispersion modeling (using AERMOD) shows "gross over-prediction" of impacts. Looking at modeled values greater than the NAAQS, nearly ¾ of the data points were over-predicted by at least one order of magnitude, with

These modeling studies should be performed and reviewed by the experts at state and local agencies for appropriateness, particularly when representing existing sources.

To determine air quality from existing sources, EPA or the federally-delegated state agency can accept a direct monitoring program in lieu of dispersion modeling.[56] Ambient monitoring allows for location-specific confirmation of actual measured pollutant concentration. For criteria pollutants, a vast network of 4,000 monitoring stations already exists, which provides hourly, daily, and annual concentrations of outdoor air under the oversight of states and local agencies.[57] This monitoring network provides the data that is used to support determinations of "attainment" – that is good air quality – versus areas that need air quality improvements to meet the requirements of the Clean Air Act.

Through the pre-construction evaluation of impacts, either through conformance with SIP requirements, project-specific studies completed with conservative dispersion modeling, and/or analysis of monitoring data, the permitting process provides well-documented protections of health from criteria air pollutants. Additional information regarding the technical details of air dispersion modeling can be found in Appendix B of this report.

4.1.1.3. Case-by-Case Determination of Emission Limits for New or Modified Major Sources

In addition to air modeling requirements, a state's pre-construction New Source Review permitting program must include provisions for making a case-by-case determination of the appropriate emission limits for the new or modified facility. These requirements apply to "major stationary sources" that either are newly constructed or undergo a "major modification" that results in a "significant" net increase in emissions.[58]

For such sources, the permitting agency conducts a case-by-case review to determine emission limits that must go into the source's permit. The review process is pollutant-specific and prescribes different pathways depending on whether the area in which the project is locating is in attainment or nonattainment with respect to the NAAQS for the pollutant.

For a pollutant for which the area is in attainment, the permitting agency must comply with the "Prevention of Significant Deterioration" (PSD) provisions of the Clean Air Act and related regulations. Under the PSD pathway, the permitting agency imposes an emission limit that reflects the application of "Best Available Control Technology" (BACT) for the emitting unit.[59] EPA regulations outline a process to follow in determining BACT, which involves the following five sequential steps: (1) identifying available pollution control options; (2) eliminating technically infeasible options; (3) ranking the remaining control technologies by pollution control effectiveness; (4) evaluating the most effective controls (considering energy, environmental, and economic impacts); and (5) making the BACT selections.[60]

6.5% over-predicted by two orders of magnitude. *See* Indiana Department of Environmental Management, Office of Air Quality, "An Assessment of the American Meteorological Society/U.S. EPA Regulatory Model's (AERMOD's) Accuracy: A Case Study". May 29, 2015, page 81. Additional studies also confirm over-prediction of theoretical models, such as AERMOD, and the conservatism is understood by EPA through issuance of revised modeling guidance. *See* EPA Memorandum from Tyler Fox, Air Quality Modeling Group, to EPA Regional Air Division Directors, "Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard," June 28, 2010.

[56] Appendix W to 40 C.F.R. §51, Section 10.1.b.

[57] https://www3.epa.gov/airdata/.

[58] 40 C.F.R § 52.21(b)(1)(i), (b)(23).

[59] 42 U.S.C. §§ 165(a)(4), 169(3).

[60] EPA, New Source Review Workshop Manual (draft) (1990).

For a pollutant for which the area is in nonattainment, the permitting agency must follow the "Nonattainment NSR" (NNSR) provisions. Under these provisions, the agency must impose a limit on emissions that reflects the "Lowest Achievable Emission Rate" (LAER) for that unit. LAER is a more stringent requirement than BACT. EPA regulations define LAER as:

> the most stringent emission limitation which is contained in the implementation plan of any State for such class or category of source, unless the owner or operator of the proposed source demonstrates that such limitations are not achievable; or the most stringent emission limitation which is achieved in practice by such class or category of source.[61]

Another NNSR requirement is that the source must obtain offsetting emission reductions from one or more other sources in the same area. Depending on the severity of nonattainment in the area, the source may need to obtain such emission offsets at a greater than 1:1 ratio.[62]

For New Source Review permitting, whether under the PSD or the NNSR pathway, there are ample opportunities for public comment, including on the determination of the BACT and LAER standards.

4.1.1.4. New Source Performance Standards – New Sources, More Stringent Requirements

EPA understands that emissions from new sources need to reflect modern-day technological advances. Through New Source Performance Standards (NSPS), EPA has promulgated requirements that will limit emissions from certain sources based on their date of construction, modification or reconstruction and require emissions control consistent with "best demonstrated technology". These federal standards were developed under Section 111 of the Clean Air Act which requires that EPA establish standards of performance for new, modified, and reconstructed sources within categories of sources that may cause, or contribute significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare.[63]

New Source Performance Standards ensure that companies use the best technology to reduce emissions from new sources and protect the public. In particular, in case-by-case New Source Review preconstruction permitting, any applicable NSPS will constitute the "floor" for the BACT or LAER Rate determination for the facility. In other words, when a permitting agency is setting the BACT or LAER standard for a facility, the standard may be no less stringent than the applicable NSPS.[64]

New or modified equipment must demonstrate that they can meet the NSPS before commencing operation. The typical equipment at a natural gas transmission compressor station that is subject to NSPS regulations include:

- Turbines (NSPS GG, KKKK): NO_X and SO_2 emissions reductions through the use of modern lean premix combustion turbines or add-on NO_X emissions controls (e.g., selective catalytic reduction), and low sulfur fuels (e.g., pipeline quality natural gas)
- Engines (NSPS IIII, JJJJ): NO_X and CO emissions reductions through the use of controls and maintenance schedule
- Pneumatic Controllers (NSPS OOOOa): reduction of methane and VOC through the use of low- or no-bleed pneumatic controllers

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[61] 40 C.F.R § 165(a)(1)(xiii).

[62] EPA, New Source Review Workshop Manual, at G.5-G.6.

[63] 42 U.S.C. § 7411 (b)(1)(A).

[64] *See, e.g.,* 42 U.S.C. § 7479(3).

- Compressors (NSPS OOOOa): reduction of VOC and methane through routine rod packing replacement or control of wet seal oil degassing systems
- Storage tanks (NSPS K, Ka, Kb, OOOO, OOOOa): reduction of VOC through the use of closed vent systems or other controls
- Leaks (NSPS OOOOa): reduction of methane and VOC through a leak detection and repair (LDAR) program

The standards developed under NSPS must reflect the degree of emission limitation achievable through the application of the best system of emission reduction (BSER), taking into account the cost of achieving such reductions and any non-air quality health and environmental impact and energy requirements.[65] EPA determines BSER for a source category by conducting a technology review to identify the emission reduction systems currently in place and the effectiveness of such systems. EPA reviews the costs, secondary air impacts from resulting energy requirements, and non-air quality impacts for each emission reduction system identified. With this information, EPA determines BSER, which is typically a numerical emission limit, expressed as a performance level (i.e., a rate-based standard or percent control).[66]

The existing emission standards are reviewed at least once every eight years to ensure consideration of any technological advances, additional health data, or public comments.[67] With regular review and update, EPA ensures that projects at compressor stations employ "best demonstrated technology" to mitigate emissions of criteria pollutants.

4.1.2. Hazardous Air Pollutants (HAPs) – Formaldehyde and Benzene (or BTEX)

Interstate natural gas compressor stations have the potential to emit certain HAPs. As detailed in this section, state and local agencies, EPA, and FERC must review emissions from new and modified compressor stations. As part of the EA/EIS and air permitting process, these agency reviews must ensure applicable regulations are met and that there are no significant impacts from HAP.

EPA regulates HAP emissions from source categories of equipment present at compressor stations through development of National Emission Standards for Hazardous Air Pollutants (NESHAP). EPA regularly revisits and updates standards developed under NESHAP to reduce the "residual risk" to public health. State air pollution control agencies develop and enforce compliance with NESHAP through SIP requirements, as deemed necessary for specific locales, including programs designed to ensure that emissions of toxics (a local-defined list of chemicals that often includes and expands upon the federally-regulated HAP) do not result in an unacceptable risk to human health.

The most common HAP at a natural gas transmission compressor station generally is formaldehyde, which is a byproduct of incomplete combustion from compressor engines and turbines. As explained throughout this report, interstate natural gas compressor stations utilize high quality natural gas with a consistent composition as fuel for engines and turbines. This high quality gas minimizes incomplete combustion and subsequent HAPs.

Although many compressor stations do not utilize dehydration equipment, benzene is another potential HAP that is emitted from compressor stations that utilize glycol dehydration. As detailed in Section 2.3 of this report, the natural gas dehydrated (or in gas releases such as the occasional blowdown) at natural gas transmission compressor stations has already been treated (or meets very prescriptive gas quality requirements) to a specification that has a very low concentration of HAPs. As a trace constituent of pipeline-quality natural gas, there is only a low potential for emissions of benzene from piping component leaks or gas releases performed as

[65] 42 U.S.C. § 7411(a)(1).

[66] *See* 76 Fed. Reg. 52,741 (Aug. 23, 2011).

[67] 42 U.S.C. § 7411(b)(1)(B).

part of station operations and maintenance, also discussed generally in Section 2 and in more detail in Section 4.1.3. However, as part of the natural gas dehydration process, these otherwise trace constituents of benzene (as well as toluene, ethylbenzene and xylenes, often referred together as BTEX) can become concentrated, which is why natural gas glycol dehydration systems emit these pollutants despite the fact that they are present in very small amounts of the natural gas stream.

BTEX emissions from natural gas glycol dehydration units are well understood by regulatory agencies, are evaluated, and must be either below limits determined by EPA to be protective of health, or they must be controlled with devices that ensure that BTEX compounds are reduced by the "maximum degree of reduction" required under the Clean Air Act.[68] EPA has set forth health standards for HAPs (including a suite of regulations specifically targeting glycol dehydration units at natural gas transmission compressor stations, detailed in Section 4.1.2.1), which are designed to protect those living or recreating near these sources. EPA has set forth health standards for HAPs (including a suite of regulations specifically targeting glycol dehydration units at natural gas transmission compressor stations, detailed in Section 4.1.2.1), which are designed to protect those living or recreating near these sources. The process by which HAP standards are developed and determined to be protective of human health is outlined in the subsequent sections of this report.

4.1.2.1. Health Protections from HAP through Development of Emission Standards

In drafting the Clean Air Act, Congress delineated all of the hazardous air pollutants that have been identified as a concern in the natural gas transmission and storage sector, such as benzene, toluene, ethylbenzene, xylene, and formaldehyde. HAP emission standards must be set at levels that provide an ample margin of safety to protect public health[69] and they are revisited every eight years[70] to ensure that advances in control technology, epidemiological data and other relevant data are taken into consideration.

HAP standards are set in a two-stage process: presumptive standards, and residual risk standards. In essence, stage one allows EPA to set presumptive standards for source categories (in this case, dehydrators, engines and turbines). Stage two requires EPA to investigate and report the risk to public health from those sources after the application of the presumptive standard. EPA's report includes information on the public health significance of the estimated remaining risk, the technologically and commercially available methods and costs of reducing such risks, the actual health effects with respect to persons living in the vicinity of sources, and recommendations as to legislation regarding such remaining risk.[71]

If a promulgated standard applies to a category of sources emitting a pollutant classified as a known, probable or possible human carcinogen and does not reduce lifetime excess cancer risks to less than one in one million, EPA must promulgate additional standards.[72]

HAP standards are technology-based emission standards commonly referred to as "Generally Achievable Control Technology" (GACT) or "Maximum Achievable Control Technology" (MACT) standards. These standards reflect measures, processes, methods, systems or techniques that:

- Reduce the volume of, or eliminate emissions of, such pollutants through process changes, substitution of materials or other modifications;
- Enclose systems or processes to eliminate emissions;

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[68] 42 U.S.C. § 7412(d)(2).

[69] 42 U.S.C. § 7412(c).

[70] 42 U.S.C. § 7412(c)(1) .

[71] 42 U.S.C. § 7412(f)(1).

[72] 42 U.S.C. § 7412(f)(2).

- Collect, capture or treat such pollutants when released from a process, stack, storage, or fugitive emission point;
- Are design, equipment, work practice, or operational standards (including requirements for operator training or certification); or
- Are combinations of the above.[73]

For non-major or "area" sources, standards require sources to use generally available control technologies or management practices to reduce HAP emissions.[74] The Clean Air Act acknowledges that emissions from individual area sources can be relatively small, but, collectively, emissions can add up (particularly when sources are concentrated in heavily populated areas[75]). To address this concern, the Clean Air Act regulates HAP emissions from area sources to ensure the protection of the public health with an adequate margin of safety to account for sources that impact heavily populated areas.

The most commonly applicable standards and requirements that apply to HAPs emitted from engines, turbines and dehydrators at natural gas transmission compressor stations and that require the reduction and/or control of HAP emissions are:

- HAP reduction requirements for turbines located at a major source[76] of HAP (40 C.F.R. Part 63, Subpart YYYY).
- HAP reduction requirements for new and existing engines (40 C.F.R. Part 63, Subpart ZZZZ).
- BTEX control requirements for new and existing glycol dehydrators (40 C.F.R. Part 63, Subpart HHH).
- HAP reduction requirements from process heaters located at major sources (40 C.F.R. Part 63, Subpart DDDDD).

This report describes in the following sections how EPA's standards are determined to be safe on an on-going basis.

4.1.2.2. Health Protections from HAP Through Review of Standards to Address Residual Risk

Through a residual risk and technology review and the resulting regulatory updates, EPA ensures that the regulations that control HAP emissions from interstate natural gas compressor stations provide an ample margin of safety to protect the public health, as required under the Clean Air Act.

EPA is required to perform residual risk and technology reviews for rules every eight years.[77] Based on its most recent assessment, EPA established emission standards for previously uncontrolled small glycol dehydrators.

EPA also revised and added certain testing and monitoring, as well as related notification, recordkeeping, reporting, and made certain other minor technical revisions.[78] EPA concluded that the existing MACT provisions under 40 C.F.R. part 63, Subpart HHH (coupled with the new MACT standard for small glycol dehydrators) provide an ample margin of safety to protect public health and prevent adverse environmental effects. Accordingly, the EPA re-adopted those standards.

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[73] 42 U.S.C. § 7412(d)(2).

[74] 42 U.S.C. § 7412(d)(5).

[75] http://www3.epa.gov/airtoxics/pollsour.html.

[76] Greater than 10 tons per year of a single HAP, or greater than 25 tons per year of all HAP combined.

[77] 77 Fed. Reg. 49,490 – 49,600 (Aug. 16, 2012). The most recent residual risk and technology review for the natural gas transmission and storage sector was published on August 16, 2012.

[78] 77 Fed. Reg. at 49,501-49,502.

4.1.2.3. Health Protections from HAP Through State SIP Requirements

As described previously, state and local agencies are charged under the Clean Air Act with protecting the public health and welfare. It is common for state SIPs to include an "air toxics program," as a state-delegated agency deems appropriate, based on the local geography and industry. As mentioned previously, air toxics are chemicals identified by a state or local agency that often includes and expands upon the federally-regulated HAP. The air toxics programs differ slightly by state, but generally include a pre-construction evaluation of proposed air toxic emissions or impacts in comparison to protective thresholds. This evaluation is designed to be conservative, as it includes:[79]

- Addition of safety factors built into acceptable ambient concentrations and/or risk levels; [80]
- Consideration of impacts derived from conservative screening model assessments; and
- Impacts based on maximum potential emissions, assuming the worst-case emissions occur continuously, 24 hours a day, 365 days per year.

Prior to receiving a Notice to Proceed from FERC to begin construction and operation, a proposed new or modified natural gas compressor station operator must first demonstrate conformance with acceptable toxic impacts for the respective state air toxics programs as part of state or local air permit applications. These toxics programs are specifically designed by the air quality engineers and epidemiological experts at state agencies to ensure that approved projects do not pose a health or environmental risk, either through demonstration of de minimis emissions or through project-specific impact analyses.[81] *De minimis* levels are small levels of emissions that individual states may determine are too small to pose a health or environmental risk, and therefore do not require regulation.

4.1.2.4. Health Protections from HAP Through Agency Review

Reviewing agencies, such as FERC and EPA, use state emission databases to both identify where additional regulatory limitations are warranted and to evaluate the regional impacts of potential emissions from a proposed project. By comparing proposed potential emissions to a regional inventory in existing databases, the reviewing agencies can get a macro-level understanding of the relative emissions, and thus impacts, on a regional scale. The regional inventories, databases, and tools that provide this evaluation are described below.

State emissions inventories feed the National Emissions Inventory (NEI) and National Air Toxics Assessment (NATA). The latest version of the NATA was released by EPA on December 17, 2015. The most recent NATA includes emissions inventories for 180 HAPs and provides both cancer and non-cancer effects in a risk characterization from inhalation of 138 of these toxics (those with chronic health impacts). EPA uses the NATA

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[79] New Jersey Department of Environmental Protection, Division of Air Quality, Bureau of Technical Services Air Quality Evaluation Section, "Methodology and Assumptions Used to Generate the Revised Level-1 Air Impact Values for the NJDEP Risk Screening Worksheet". April 3, 2007.

[80] For example, the New York Department of Environmental Conservation has a safety factor of 10 to 100, in defining the acceptable cancer risk (1-in-a-million to 10-in-a-million). "The acceptable cancer risk used by the DEC's Division of Air Resources to make regulatory permitting decisions about the need to consider further air pollution controls for sources ranges from 1-in-a-million to 10-in-a-million (1×10^{-5})." Referenced October 18, 2016 at: http://www.dec.ny.gov/chemical/89934.html.

[81] For example: "De minimis levels are small levels of emissions that Ecology has determined not to pose a health or environmental risk, and so don't require regulation." Department of Ecology, State of Washington, "Concise Explanatory Statement and Responsiveness Summary for the Adoption of WAC 173-400-110, General Regulations for Air Pollution Sources; Chapter 173-460 WAC, Controls for New Sources of Toxic Air Pollutants," May 19, 2009, Publication: 09-02-008, page 1. This agency is a delegated authority with a State Implementation Plan approved by EPA in accordance with the Clean Air Act.

to evaluate health risks over geographic areas of the country. EPA then prioritizes data refinement and subsequent rule making (also considered in the "residual risk review" of NESHAP) where the NATA suggests unacceptable levels of risks from air toxics.[82] The NATA risk assessment is very protective because it assumes individuals spend their entire lifetimes exposed to the air toxics. The NATA risk assessment also provides an additional margin of protection because it does not take into account any emissions reductions since 2011.[83] While the NATA is not an absolute measure of individual risk, it informs reviewing agencies of the potential on a regional basis.

FERC utilizes the NATA to characterize existing air quality of the geographical region under consideration for toxic pollutants with potential impacts. FERC then can compare the potential emissions magnitude and cumulative impacts from the proposed compressor station project with the NEI inventory and subsequent NATA risk results to assess if the project will result in a significant increase that requires additional, project-specific review. For new compressor station projects, the potential increase of HAP emissions is typically insignificant compared to the sum of regional emissions not associated with the proposed project (including both "point" sources, such as industrial facilities, on-road and non-road mobile sources, and even biogenic sources) that drive the risk considerations of NATA. For example, regional formaldehyde impacts – the HAP with the highest emissions potential from compressor stations – are predominantly from non-point sources and events. Biogenic formaldehyde emissions from vegetation and soil commonly account for over 70% of the total inventory of formaldehyde emissions in some states, and as high as 94% in Nevada.[84] These larger inventory sources account for the greatest component of the risk results in NATA. As such, the regional impacts of a proposed compressor station often are insignificant compared to the existing biogenic emissions of formaldehyde.

4.1.2.5. Health Protections from HAP Provided by Permits/Authorizations

Air quality permits or authorizations limit the amount of HAP emissions from interstate natural gas compressor stations. Failure to comply with emission limitations can result in fines or other penalties. Enforcing environmental requirements is a core component of EPA's Strategic Plan developed to protect human health and the environment.[85] Penalties are specifically designed to dis-incentivize non-compliance, ensuring that the cost of violating permit conditions exceeds the cost of compliance. EPA's penalty policy calls for the "most aggressive assumptions supportable" in calculating both the economic benefit of noncompliance and the gravity component which together form penalties for violations.[86]

Following the review of proposed projects, state and federal permits and authorizations delineate in air permits the requirements of applicable regulations, such as the NESHAP. Furthermore, permits can include project-

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[82] Unlike criteria pollutants and NAAQS, there is no universal, pre-defined risk levels for air toxics. As part of the 1989 Benzene NESHAP and in supporting documentation found in FAQs to the 1999 NATA, "EPA will generally presume that if the risk to the individual [the Maximum Individual Risk] is no higher than approximately 1 in 10 thousand, that risk level is considered acceptable and EPA then considers the other health and risk factors to complete an overall judgment on acceptability. Second, the benzene NESHAP rule set a target of protecting the greatest number of persons possible to an individual lifetime risk level no higher than approximately 1 in 1,000,000. In addition, these determinations called for considering other health and risk factors, including the uncertainty in the risk assessment, in making an overall judgment on acceptability." https://www.epa.gov/national-air-toxics-assessment/nata-frequent-questions#risk1.

[83] "Summary of Results for the 2011 National-Scale Assessment". Referenced October 18, 2016 at http://www.epa.gov/sites/production/files/2015-12/documents/2011-nata-summary-results.pdf.

[84] U.S. EPA, "2011 National Emissions Inventory, version 2 – Technical Support Document". August 2015, page 350-351.

[85] Goal 5: Protecting Human Health and the Environment by Enforcing Laws and Assuring Compliance, referenced February 22, 2015 at: http://www.epa.gov/planandbudget/strategicplan.

[86] U.S. EPA, "Clean Air Act Stationary Source Civil Penalty Policy", October 25, 1991.

specific emissions limits to ensure health protection and/or regulatory conformance. In accordance with reasonable assurance requirements, air permits must identify the monitoring, recordkeeping, and reporting that are necessary for a compressor station operator to confirm compliance with emission standards.[87] Within the permit, or outside of specific permit language, EPA as well as state and local agencies have the authority to request data to ensure operators are complying with all applicable requirements. Many large facilities are required to submit detailed emission reports annually to state or local agencies. Many state and local agencies conduct inspections of permitted facilities on a regular basis to assure compliance with permit conditions. State and local agencies also often have a process in place to launch an investigation in the event that a particular facility receives a complaint regarding odor, or visible emissions.

EPA-issued permits and authorizations include compliance assurance requirements. Furthermore, the negative reinforcement of potential penalties for violations ensures that permittees adhere to air pollution limitations and constraints, thereby providing assurance that the public will continue to be protected beyond the pre-construction evaluation.

4.1.3. Leaks, Fugitives and Blowdowns: Methane and HAP Emissions

Some commenters raised concerns to FERC about leaks, fugitives and blowdown emissions from natural gas transmission compressor stations. Specifically, commenters raised concerns regarding GHG emissions (methane) and HAP emissions (primarily benzene) from these types of sources. As mentioned in Section 2, natural gas transmission compressor stations can be a source of some leaks or fugitives, as well as emissions from compressor station blowdowns.

4.1.3.1. Leaks and Fugitives

Natural gas transmission compressor station equipment can be a source of unintentional leaks of pipeline-quality natural gas into the atmosphere. Natural gas transmission compressor stations are designed to operate at high pressures, and therefore it is important that components are not leaking as that could impact the station's ability to maintain high pressures necessary for the station to serve its primary purpose. If a leak does occur, the gas that is released is pipeline-quality natural gas. As detailed in 2.3, pipeline-quality natural gas mainly consists of non-VOC, non-HAP gases (primarily methane and ethane). Therefore, HAP emissions from leaking and fugitive components are a very small contributor to the overall emissions profile of a natural gas transmission compressor station.

Natural gas transmission compressor stations that are modified, constructed or reconstructed after September 18, 2015 are required to perform leak detection surveys quarterly using optical gas imaging (OGI), Method 21 or an alternative means (if approved by the EPA Administrator).[88] If leaks are discovered during the survey, operators must repair those leaks within 30 days of discovery, with very limited exceptions. There are extensive recordkeeping requirements associated with these surveys, as well as requirements to ensure those personnel performing the surveys are qualified to do so.

In addition to leak detection and repair requirements, this recently promulgated regulation will require the use of low-emitting pneumatic devices at new, modified or reconstructed compressor stations. The rule will also

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[87] 40 C.F.R. § 70.6(c).

[88] New Source Performance Standard (NSPS) OOOOa, published in 81 Fed. Reg. 35,823 (June 3, 2016). https://www.federalregister.gov/articles/2016/06/03/2016-11971/oil-and-natural-gas-sector-emission-standards-for-new-reconstructed-and-modified-sources.

require operators to take steps to reduce emissions vented from new or modified reciprocating and centrifugal wet seal compressors. These new requirements minimize natural gas leaks from compressor stations.

4.1.3.2. Blowdowns

At times, a compressor station operator may need to release pipeline-quality natural gas intentionally as part of safety procedures or in order to conduct maintenance on the facility. Natural gas transmission compressor station operators only perform blowdowns when necessary for safety reasons; they also have a financial incentive to minimize the number of blowdowns and the volume of gas released. This activity, often referred to as a "blowdown" event, can be part of operations or a planned maintenance event. For newly constructed or modified facilities, planned blowdown events are taken into account during the permitting process, and emissions from these events (including potential HAP emissions) are quantified as part of the permit action.

The primary material released during a blowdown event at a natural gas transmission compressor station is pipeline-quality natural gas, which is predominately methane and ethane (as detailed in Section 2.3). Pipeline-quality natural gas is lighter than air, and dissipates quickly into the atmosphere. Methane, the predominant constituent of the gas, is non-toxic. As outlined in Section 2.3.3 of this report, there are trace constituents in pipeline natural gas that can be released as a result of a blowdown. Through the permitting process, reviewing agencies (FERC, EPA and federally-delegated state environmental agencies) confirm that all emissions, including emissions from planned blowdowns, meet the requirements of regulations developed to protect public health and ensure compliance with the NAAQS – air concentrations of criteria air pollutants that define levels in the air that are safe to breathe.

Starting in 2016, interstate natural gas compressor station operators must quantify and report all blowdown events at compressor stations (planned and unplanned) to EPA through the GHG reporting program. The total number of blowdown events, the amount of GHG emissions resulting from those blowdowns, and the operator who performed the blowdowns will be publicly available starting in 2017.

4.2. GREENHOUSE GAS (GHG) AND CLIMATE CHANGE

The natural gas that is transported through natural gas transmission compressor stations consists primarily of methane, a known greenhouse gas. Additionally, natural gas transmission compressor stations combust natural gas, which creates CO_2, N_2O and some methane from combustion. Some commenters raised concerns to FERC regarding releases of methane into the atmosphere contributing to climate change.

Concerns have been raised that natural gas is more carbon intensive than coal when leaks and other losses are taken into consideration. However, studies performed to date[89] show that while leaks and losses can impact the carbon footprint of natural gas when compared to coal, it is not enough to negate the benefits of utilizing natural gas in place of coal. Thus, natural gas is overall the least carbon intensive fossil fuel.

The potential impacts of GHG emissions are assessed on a global scale. Because GHGs are a concern only on the macro-scale, permitting programs only address major sources of GHG emissions, and can include the consideration of broader net impacts. The following regulatory programs have been developed to address projects that may contribute to (or facilitate improvements to) climate change:

[89] http://science.sciencemag.org/content/343/6172/733.summary.

- The natural gas transmission segment is required to quantify, and in many cases, report GHG emissions annually. Reported information is publically available and easily accessible through EPA's online reporting program, known as the FLIGHT Tool;[90]
- Voluntary GHG Reduction Programs
- The OOOOa New Source Performance Standards for methane emissions from new, modified, and reconstructed facilities in the oil and gas sector; and
- Increased use of natural gas use by the power sector under the Clean Power Plan.

4.2.1. Greenhouse Gas Reporting

Natural gas transmission compressor stations must report GHG emissions to EPA as codified in 40 C.F.R. Part 98 Subparts C and W of the Mandatory Reporting Rule (MRR) if GHG emissions at the compressor station exceed 25,000 metric tons (MT) of CO_2 equivalent (CO_2e).[91] CO_{2e} is calculated as follows:

1 Metric Ton of CO_2 = 1 Metric Ton CO_2e

1 Metric Ton of Methane = 25 Metric Tons CO_2e

When evaluating the 25,000 MT threshold, natural gas transmission compressor stations must include the GHG emissions from various sources at each compressor station. If, after emissions from all of the subject activities and sources have been considered, the facility emits more than 25,000 MT CO_2e, the facility must report its emissions through EPA's Facility Level Information on GHGs Tool ("FLIGHT"). EPA estimates that 85-90% of total US GHG emissions (from various industries including the natural gas transmission sector) are reported under the MRR.[92] Reporters must verify their status under this rule annually; if a source becomes subject to the rule, its annual emissions must be reported no later than March 31st for the preceding year.[93]

EPA has worked to ensure transparency in GHG reporting. The FLIGHT website provides all non-confidential information provided by various industry segments, including the natural gas transmission compression segment. This tool is easily accessible and provides reported GHG data in a variety of formats. Facilities can be sorted by name, by state, or by reporting year.

Commencing in 2016, natural gas transmission operators must quantify emissions from pipeline blowdowns between natural gas compressor stations. As discussed previously, a compressor station operator occasionally removes (blows down) the natural gas from the station for safety or maintenance reasons. Each owner/operator must aggregate its blowdown volumes on a nation-wide basis; if that aggregated volume

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[90] http://ghgdata.epa.gov/ghgp/main.do.

[91] Compressor stations, through combustion, also emit small amounts of N_2O. 1 Metric Ton of N_2O = 298 Metric Tons CO_{2e}.

[92] http://www.epa.gov/sites/production/files/2014-09/documents/ghgrp-overview-factsheet.pdf.

[93] As of the writing of this White Paper, the following information is publically available on GHG reports: CO_2, CH_4 and N_2O emissions for each category applicable to the site; Count of pneumatic devices; Type of pneumatic devices (high bleed, low bleed or intermittent bleed); Number of blowdown events; Direct measurement data of compressor venting emissions; Compressor mode information (i.e., if the unit was operating, standby pressurized or not-operating, depressurized mode); and the number of leaks found during the survey, and type of component found to be leaking.

exceeds 25,000 MT CO_2e, the owner/operator must annually report those emissions through the FLIGHT website.

Given that GHG reporting data and trends are publically available, companies may consider measures to reduce the overall GHG footprint of an individual facility. Where feasible, solar energy can be used to power some of the smaller pieces of equipment at a compressor station. However, using solar or wind energy to generate the higher horsepower needed at a natural gas transmission compressor station is not practical because compression must be available 24-hours a day (not just during peak sunshine or wind). Solar or wind energy also require disturbing a much larger footprint of land on which the solar panels and/or wind turbines must be placed, requiring corresponding evaluation of other environmental impacts.

As more GHG emissions data is reported, EPA advances its understanding of actual air impacts. This data is presented in macro-level studies that drive EPA initiatives to define where regulations are and are not needed to continue their charge to protect public health under the Clean Air Act (e.g., NSPS Subpart OOOOa, discussed previously). In this way, EPA ensures that regulations do not become “out dated”.

4.2.2. Voluntary GHG Reduction Programs

EPA has established voluntary GHG emission reduction programs. Some natural gas compressor station operators participate in these programs. The Natural Gas STAR Program (including the Natural Gas STAR Methane Challenge) encourages industry participation to improve operational efficiency and reduce GHG emissions. EPA has released a Best Management Practice (BMP) Commitment Framework which provides a mechanism through which oil and gas companies can track commitments to reduce methane emissions. This program allows participants to report their actions to reduce methane emissions and to be publically recognized for their reduction achievements.

The Natural Gas STAR Program participants also provide data to EPA on the effectiveness of their voluntary reductions for consideration as “best demonstrated technology” in regulations.

The natural gas transmission industry is in a unique position because the commodity that it transports (natural gas, which is primarily methane) is a GHG. Therefore, natural gas transmission compressor stations are motivated through financial benefit in addition to voluntary programs to reduce releases of their product to the atmosphere.

4.3. MECHANICAL NOISE AND VIBRATION

Compressor stations produce mechanical noise and vibrations during their general operations. Some commenters raised concerns to FERC about the level of noise from compressor stations, and whether those living near compressor stations would hear the mechanical noise from the operation of a nearby compressor station.

Sound is caused by vibrations that generate waves of minute pressure fluctuations in the surrounding air. Sound levels typically are measured using a logarithmic decibel or dB scale. Human hearing varies in sensitivity for different sound frequencies. The ear is most sensitive to sound frequencies between 800 and 8,000 Hz and is least sensitive to sound frequencies below 400 Hz or above 12,500 Hz. Consequently, several different frequency weighting schemes have been used to approximate the way the human ear responds to noise levels. The dB(A) scale is the most widely used for this purpose.

FERC maintains the chief federal noise permitting role for the installation or modification of natural gas compressor stations. FERC requires that noise impacts from a new compressor station, compression added to an existing compressor station, or any modification, upgrade or update to an existing compressor station must not exceed an Ldn of 55 dB(A) at any pre-existing Noise Sensitive Areas (NSA). The Ldn is an average sound level (over a 24-hour period) where a penalty of 10 dB(A)has been added for noise that occurred during the nighttime hours (22:00 to 07:00 local). To put this sound level in context, a noise level of 55 dB(A) is similar to the noise generated by heavy rainfall or normal indoor conversation. FERC regulations codified at 18 C.F.R. § 380.12 (k)(4)(v) require operators to specify how the proposed facility will meet the noise requirements set by FERC.

As defined in FERC's regulations, the noise impact from projects are measured at noise sensitive areas (NSAs), which are defined as areas at which the population would be impacted by increased ambient noise. In practice, they are determined on a case-by-case basis through onsite assessment or review of aerial photography or public records. NSAs typically include residences (i.e., neighbors of compressor stations), schools, churches and hospitals located near the proposed project location.

Once NSAs have been identified, baseline noise conditions are assessed. The baseline can include the impact of existing compressor facilities (in the case of a facility modification) or the greenfield conditions (in the case of a new facility). Baseline noise conditions are assessed by completing an ambient noise survey. The surveys utilize the methods set forth in the American National Standards Institute (ANSI) publication S1.4 and S12.9 as well as applicable sections of the Code of Federal Regulations (C.F.R.). Typically, ambient noise measurements are made both during the day and at night at each NSA. The monitored data and logs of monitoring conditions are then used to develop an aggregate Ldn value for each NSA.

Once baseline conditions have been established, the impact of the proposed project can be determined. The impact assessment utilizes a simulation of atmospheric noise attenuation and diffusion as well as data regarding the noise generated by the equipment proposed for the project. FERC requires that impacts be assessed for both the construction and the operational phase of the facility. FERC does not require that a particular "model" be used for assessing impact, rather a range of options are available based on good scientific justification.

Assessments can be as simple as calculating the effects of sound propagation in a spreadsheet using the formulas found in "ISO 9613-2:1996 ISO Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation" or as robust as a three dimensional numerical simulation that includes the influences of topography, vegetation and land use such as SoundPlan or CadnaA (Computer Aided Noise Abatement). Regardless of the method selected to "model" impacts, FERC requires that the method used and all inputs be submitted for review and verification by the Commission. This is meant to ensure that the selected "model" is capable of accurately assessing the impacts and has been appropriately applied.

Based on the results of the baseline ambient assessment and the modeled noise impacts, FERC determines whether the project meets the FERC 55 db(A) Ldn threshold. If the project as designed complies, no additional requirements are introduced. If the "modeled" impacts suggest that the project would exceed regulatory thresholds, noise mitigation measures will be required to ensure compliance. This can include facility design changes, introduction of additional compressor silencers or additional berms or containment structures.

With stringent noise thresholds and project-specific scientific analysis required as part of the permitting process, FERC ensures acceptable protections of health for noise pollution for neighbors of compressor stations.

Certificate orders for new or modified compression will include a requirement to conduct a post-construction noise study within 60 days after the compressor is put in-service. If noise levels exceed the FERC requirements, the company has one year to install noise mitigation measures to reduce the noise level below the required level.

4.4. ODOR

Some commenters raised concerns with FERC about whether natural gas emitted from compressor stations will cause an unpleasant odor. The natural gas transported through interstate natural gas transmission compressor stations is generally odorless. However, federal Department of Transportation guidelines mandate that natural gas that is delivered to end users – residential, commercial and industrial users – is scented with an odorant to help identify potential leaks so that natural gas pipeline operators can conduct necessary maintenance quickly and accurately.

Applicants identify in their environmental reports during the EA review portion of the FERC certificate process whether or not the facility will odorize its gas. For example, natural gas used at a compressor station may be odorized if the station is located in a densely populated area. 49 C.F.R. Part 192.625 specifies when natural gas must be odorized so that it can be detected by someone with a normal sense of smell at one-fifth the concentration which could result in the threat of explosion.[94] When compressor stations are located in rural settings or a great distance from those who may be able to smell the natural gas (because the gas will dissipate prior to reaching those receptors), odorization is not beneficial and is not performed.

Per 49 C.F.R. Part 192.625, in the concentrations that an odorant is used, it must:[95]

- Not be harmful to persons, materials, or pipeline; and
- The products of combustion of the odorant may neither be toxic when breathed or corrosive/harmful to materials exposed to the potential products of combustion.

Most odorants are present in natural gas at concentrations of 0.5 – 1% by volume.[96] Primary odorants in use today include mercaptans, and thiopane (THT). Most often, odorants in the United States are mercaptans or mercaptan sulfide blends where tertiary butyl mercaptan is the main component.[97] The human nose is capable of detecting mercaptans at the one part per billion (ppb) level.[98] Therefore, even at very low concentration levels, odorants in natural gas are intended to cause an odor which some people may find unpleasant.

49 C.F.R. Part 192 requires that the odorant concentration be sufficient for leak detection at one-fifth (20%) the lower explosive limit (LEL) of natural gas. The lower explosive limit (LEL) of a gas is defined as the lowest concentration of a gas in air capable of igniting in the presence of an ignition source (i.e. flame, heat, etc). The primary component of pipeline quality natural gas is methane, which has a LEL of 5% by volume in air.[99] This means that, in accordance with the requirements in 49 C.F.R. Part 192, the natural gas odorant would be present at concentration of 50-100 ppmv at 20% of the LEL concentration of methane.

The lowest-observed-effect level (LOEL) is the lowest concentration of a substance that causes any alteration in morphology, functional capacity, growth, development, or life span of an experimental group under the same defined conditions of exposure.[100] The LOEL for tertiary butyl mercaptan is approximately 400 ppm for rats under chronic exposure conditions (i.e, exposure for more than six hours per day for nearly two weeks).[101] This concentration is well above the levels (50-100 ppmv) used to detect natural gas leaks. Therefore, health effects would be minimal.

[94] 40 C.F.R. Part 192.625(a).
[95] 40 C.F.R. Part 192.625(c).
[96] Pipeline and Hazardous Materials Safety Administration, *Guidance Manual for Operators of Small Natural Gas Systems*, June 2002.
[97] *Id.*
[98] *Id.*
[99] Engineering Toolbox, Gases – Explosion and Flammability Concentration Limits, http://www.engineeringtoolbox.com/explosive-concentration-limits-d_423.html, last accessed August 2016.
[100] National Institute of Health definition.
[101] Tertiary Butyl Mercapta, Chemical Abstract Number 75-66-1, Safety Data Sheet (SDS): http://www.cpchem.com/msds/100000013356_SDS_US_EN.PDF, last accessed August 2016.

4.5. STORMWATER, DRINKING WATER, RUNOFF AND SPILL PROTECTION

Some commenters raised concerns with FERC regarding the impact of runoff and spills at a proposed compressor station on local drinking water and other waterbodies. Generally, the comments submitted regarding runoff and spills were very project-specific, and addressed site-specific concerns regarding terrain, nearby bodies of water, and other items specific to a particular compressor station or its construction. Water quality impacts are included in the pre-construction reviews, and are addressed as part of the FERC permitting process. However, natural gas transmission compressor stations do not generally pose a significant risk of impact to stormwater and drinking water for several reasons:

1.) **Natural gas transmission compressor pipelines are generally not a source of spills.** Natural gas transmission compressor stations transport natural gas, not oil or natural gas liquids (NGL). While some liquids can enter a station, the amount of liquids is very small, and those liquids are removed (or "knocked out") of the natural gas stream at the inlet of the natural gas compressor station; therefore, the majority of the above-ground piping within the compressor station contains gaseous materials. Because the pipelines are in natural gas service, leaks from these pipelines pose little risk to drinking water or storm water (because the leaks would be gaseous in nature, not liquid). Furthermore, given that natural gas transmission compressor stations (and associated pipelines) are highly pressurized systems, it is important to the functionality of the site that all pipes, valves, flanges, connectors, etc. are in good working order and do not allow any material to escape the system.

2.) **Natural gas transmission compressor stations generally do not have the need for a large number of storage tanks onsite.** Natural gas transmission compressor stations do not generally store liquids in large quantities or large amounts of chemicals on-site. Lubricating oils and engine coolants necessary for the operation of the compressor engines and other station equipment are the most common chemicals stored at a compressor station. Natural gas transmission compressor stations can collect some oil and condensed hydrocarbons in water. When the liquids stored on-site exceed 1,320 gallons, the facility will follow the requirements of a site-specific Spill Prevention Control and Countermeasure (SPCC) plan. These tanks must be stored in a location with appropriate secondary containment (as verified by a licensed Professional Engineer) in order to minimize any impacts outside of the immediate area if spill occurs. While uncommon and small in volume, regulations specifically address the potential for liquid spills to prevent impacts to groundwater or surface water near natural gas transmission compressor stations.

Although natural gas transmission compressor stations do not pose a significant risk to stormwater, drinking water or spills, the protections to water resources as part of the permitting process are summarized below.

4.5.1. Protection of Drinking Water and Surface Water

Drinking water is regulated by EPA, as well as other state agencies who promulgate and enforce statutory provisions set forth under the Safe Drinking Water Act (SDWA)[102] and the Clean Water Act (CWA).[103] These statutes require that EPA ensures drinking water (regardless of its source) meets a set of very stringent health and welfare-based standards. The regulations also include requirements for protective, preventive, and mitigation measures geared at potential sources of groundwater or surface water pollution.

[102] 42 U.S.C. Subchapter XII, Part C (Protection of Underground Sources of Drinking Water).
[103] 33 U.S.C. §§1311 (Effluent Limitations) and 1312 (Water Quality Related Effluent Limitations).

According to current FERC and PHMSA[104] siting requirements, a potential location for a compressor station must meet certain geologic, hydrologic, and hydrogeologic criteria prior to its approval.[105] Projects must also employ protective and preventive measures to assure sources of drinking water are not significantly impacted by project construction or operation.

Even though direct protection and regulation of underground (and surface) drinking water resources falls under the SDWA, indirect effects on these resources can result from impacts not only to groundwater but also to surface waters due to hydrologic cycle connections. Groundwater recharge from streams, rivers and other bodies of water as well as from direct ground seepage is an integral part of the hydrologic cycle. As such, regulators rely upon some of the statutory provisions under the CWA to expand the protective blanket on drinking water resources.

4.5.1.1. Protection of Drinking Water Resources

EPA has identified drinking water Unusually Sensitive Areas (USAs) and drinking water areas of primary concern. Drinking water areas of primary concern are a subset of all surface intakes and groundwater based drinking water supplies that provide potable water for domestic, commercial, and industrial users. These include:

- Public water systems
- Source water protection areas/wellhead protection areas, and
- Sole source aquifers

The siting regulations under FERC (Resource Report 2 – Water Use and Quality), the Office of Pipeline Safety (OPS), and PHMSA require conducting an evaluation of potential impacts of proposed projects upon USAs or any other drinking water areas or primary concern prior to project approval. For projects that will be located on or adjacent to USAs, special protective and mitigation measures must be proposed and thoroughly discussed during the environmental review and siting process.

Siting approval of compressor station or pipeline projects is conditioned upon compliance with drinking water protective measures and standards.

4.5.1.2. Protection of Surface Waters

Discharges of wastewater, stormwater, and fill material from construction and operation of compressor stations are regulated under Section 301 of the CWA. Both EPA as well as state agencies have enacted discharge permitting mechanisms under the National Pollutant Discharge Elimination System (NPDES) program to regulate the amount and quality of wastewater discharges. Discharges of stormwater runoff from construction and site clearing, as well as stormwater runoff associated with an industrial activity also require permits under the NPDES program.

The Clean Water Act establishes designated uses for bodies of water, which are then tied to limitations on effluent concentrations for a myriad of pollutants.

Deposit of fill material and dredging activities unto or on "waters of the United States" (WOTUS) are also covered by the Clean Water Act under Section 404. EPA, the US Army Corps of Engineers and States regulate activities such as stream crossings and impacts on wetlands under a Section 404 permitting program. Projects that will be located upon a WOTUS must conduct evaluations of alternatives to minimize impacts on wetlands and other WOTUS.

[104] 49 C.F.R. Parts 192-195.
[105] FERC Resource Report 2 – Water Use and Quality.

The regulatory framework covering both underground and surface drinking water resources provides a framework to prevent pollutants from being discharged in concentrations that could pose a risk to human health.

4.5.1.3. Spill Prevention

40 C.F.R. § 112.7 establishes Spill Prevention, Control, and Countermeasure (or SPCC) regulations to prevent oil spills from reaching navigable waters of the United States or adjoining shorelines. These SPCC regulations apply to non-transportation related facilities with a total aboveground oil storage capacity of greater than 1,320 gallons or with a total buried oil storage capacity greater than 42,000 gallons. Lubricating oils and engine coolants necessary for the operation of the compressor engines and other station equipment are commonly stored at a compressor station. Natural gas transmission compressor stations can collect some oil and hydrocarbon-containing water, which are stored on site. If the storage capacities exceed those listed above, the facility must prepare and implement a full SPCC Plan in compliance with the applicable requirements of Title 40 of the Code of Federal Regulations and Subpart B. In addition, full SPCC Plans must be certified by a Professional Engineer (P.E.). These plans include detailed schematics of each site, the terrain, the storage capacity, and the containment requirements for the liquids that are stored on-site. The plan also includes countermeasures to contain, clean up and mitigate the effects of any potential spill.

EPA and state agencies have spill reporting requirements, including volumetric reporting thresholds and agency reporting requirements.[106] In the event of a spill at a compressor station, the station operator would be required to notify the appropriate state agency or EPA if the release volume exceeded the volumetric threshold. Agencies conduct facility inspections to assure compliance with the SPCC plan requirements and in the event of a spill or release, to assure spill containment and clean up. Overall the potential for any significant impact is very small.

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[106] Reporting requirements, thresholds and other details are codified in 40 CFR Part 110.3. Additional requirements may be applicable, as found in 40 CFR 68.42(a), (b) and 40 CFR part 68.60 and 68.81.

5. CONCLUSION

When natural gas transmission compressor stations are constructed or modified, various agencies at the federal and state level are required under law to ensure that the compressor station and its associated impacts will not pose a threat to the health and safety of those who live nearby.

The Clean Air Act, Clean Water Act, the Pipeline Safety Act and their associated regulations establish a system of checks-and-balances to ensure accountability throughout the permitting process. Pre-construction regulatory oversight of interstate natural gas transmission compressor stations is distinct from many other industrial facilities because it is subject to a comprehensive independent environmental evaluation performed by FERC in accordance with NEPA. This evaluation is far more comprehensive than the permitting process for other industries and commercial development projects.

While FERC is required to perform a comprehensive review of natural gas transmission compressor stations, other agencies must perform additional detailed reviews of the impacts from these facilities and must issue permits to allow the project to proceed. For example, EPA must ensure that emissions from natural gas compressor stations are safe. State and local agencies are also often heavily involved in the review of air emissions from natural gas transmission compressor stations. DOT is required to ensure the design of the pipeline and compressor station will be sound and will prevent pipeline or compressor station accidents or failures.

EPA, through state and local agencies, enforces the requirements of the Clean Air Act and regularly reviews emission standards based on current science and knowledge. Local air quality permitting authorities overlay additional protections appropriate to specific geographic concerns that may impact the emissions from a natural gas transmission compressor station. Furthermore, the gas consumed at and moved through natural gas transmission compressor stations is pipeline quality natural gas: a clean gas with a consistent composition that is comprised primarily of methane and ethane, both of which are non-VOC, non-HAP gases. Using this pipeline quality natural gas enables agencies and operators to accurately determine the emissions and associated impacts from combustion, as well as the impacts from gas releases such as blowdowns. Emissions from new or modified natural gas transmission compressor stations must meet air quality standards that are designed and implemented to be protective of human health.

Natural gas transmission operators also take safety very seriously. Under the Pipeline Safety Act, the USDOT is required to develop and enforce pipe safety and design standards for pipelines and compressor stations. Natural gas transmission compressor stations must be designed, constructed, operated, and maintained in ways that protect the public and prevent natural gas facility accidents and failures. Each operator's pipeline and compressor station incidents are on-file with DOT's Pipeline Hazardous Materials Safety Administration (PHMSA) and incident data is publicly available on PHMSA's website. This data shows that there are very few reportable accidents at compressor stations.

FERC specifically provides noise and vibration requirements that a compressor stations must meet before FERC will issue a certificate. This minimizes impacts to local residents.

Finally, EPA and state/local agencies evaluate drinking and surface water impacts prior to the construction or modification of a natural gas transmission compressor station. While natural gas transmission compressor stations do not generally have extensive groundwater/surface water impacts, they may have some small storage tanks that must meet standards which ensure the containment of any liquids in the event of a spill.

6. FREQUENTLY ASKED QUESTIONS (FAQS) REGARDING THE PROTECTION OF THE HEALTH AND SAFETY OF THOSE LIVING NEAR NATURAL GAS COMPRESSOR STATIONS

Question	Answer	Report Section Number
Are emission standards up-to-date?	EPA is subject to Clean Air Act requirements to regularly review and revise National Ambient Air Quality Standards (NAAQS) and standards for Hazardous Air Pollutants. For example, EPA recently revised two NAAQS that apply to pollutants emitted by compressor stations (or subsequently formed in the atmosphere). In 2015, EPA issued a new and more stringent NAAQS for ground-level ozone (for which nitrogen oxides and volatile organic compounds are "precursor" pollutants). In 2013, EPA issued a new and more stringent NAAQS for fine particulate matter.	4.1.1 4.1.2
How do we know that the formaldehyde and other hazardous air pollutant emissions from the proposed compressor station are safe?	Safe levels of formaldehyde are ensured in the following ways: 1. EPA limits formaldehyde and other hazardous air pollutant emissions from stationary engines and turbines through National Emission Standards for Hazardous Air Pollutants (NESHAP) codified in 40 C.F.R. Part 63. NESHAP standards are required by law to protect public health with an ample margin of safety. 2. State air pollution control agencies require conformance to formaldehyde limits and impact analyses that are part of their State Implementation Plan – or a state's set of rules that EPA approves "to promote the public health and welfare and the productive capacity of its population". 3. States, EPA, and FERC conduct pre-project reviews to ensure the project will emit safe levels of emissions. The agencies also issue permits with ongoing compliance requirements to provide ongoing conformance with air quality safety protections and conduct inspections to assure compliance.	4.1.2

Question	Answer	Report Section Number
Are the emissions from natural gas compressor stations safe for those living nearby?	Requirements of the Clean Air Act are implemented by state and local air quality authorities, with oversight by EPA. The explicit purpose of the Act is to protect and enhance the quality of the Nation's air resources to promote the public health and welfare and the productive capacity of its population. Each proposed project's emissions and associated air quality impacts are evaluated in detail as part of the permitting process by the state, EPA, and FERC. Hazardous air pollutants (HAPs) are regulated by emission standards that ensure maximum protections to health and human welfare based on best available and current data. HAP regulations are reviewed by EPA every 8 years. Criteria pollutants, such as nitrogen oxides (NO_X), volatile organic compounds (VOC), carbon monoxide (CO) and sulfur dioxide (SO_2) must meet national ambient air quality standards (NAAQS), which are set at levels necessary to ensure public health without consideration of cost. EPA must re-evaluate the NAAQS every five years. The agencies issue pre-construction permits with specific emission control requirements to ensure that air quality standards and protections are met and conduct facility inspections to assure ongoing compliance.	4.1.1 4.1.2
Can this project cause a fire or explosion at the compressor station?	Under the Pipeline Safety Act, as amended (49 U.S.C. § 60101 *et. seq*.), the U.S. Department of Transportation (USDOT) is exclusively authorized to promulgate pipe safety and design standards for pipelines and compressor stations. Natural gas transmission compressor stations must be designed, constructed, operated, and maintained in accordance with the U.S. DOT Minimum Federal Safety Standards in 49 C.F.R. Part 192. The DOT regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures.	2.4
How can I see a natural gas transmission operator's safety record?	Each operator's pipeline and compressor station incidents are on-file with DOT's Pipeline Hazardous Materials Safety Administration (PHMSA) and incident data is publically available on PHMSA's website. http://www.phmsa.dot.gov/pipeline/library/data-stats/distribution-transmission-and-gathering-lng-and-liquid-accident-and-incident-data.	2.4

Question	Answer	Report Section Number
How often will the facility perform blowdown activities, and how will we know?	Facilities address planned maintenance, startup and shutdown (MSS) activities as part of the air quality permit application. Blowdowns are most likely to occur during MSS activities. Any anticipated criteria pollutant and HAP emissions are included in the station's overall emissions footprint and analyses relating to compliance with the health-protective NAAQS. Natural gas transmission pipeline and compressor station operators track and report blowdown activities to EPA through the Greenhouse Gas (GHG) reporting program (and larger stations report emissions from these events in annual emissions inventories). This data can be found on EPA's website (called the FLIGHT Tool) and it is publically available for any interested parties.	4.1.3 4.2.1
Is the air safe to breathe after a blowdown event?	Pipeline quality natural gas is lighter than air, and dissipates quickly into the atmosphere. Methane, the predominant constituent of the gas used at a compressor station, is non-toxic. Through the permitting process, reviewing agencies (i.e., FERC, EPA and federally-delegated state environmental agencies) confirm that all air emissions, including emissions from planned blowdowns, meet the requirements of regulations developed to protect public health and ensure compliance with the NAAQS – air concentrations of criteria air pollutants that define levels in the air that are safe to breathe.	2.3 4.1.3
What requirements ensure that the local firefighting resources know what to do in the event of an emergency?	USDOT requires that each operator develop a written emergency plan to establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency, and to coordinate mutual assistance. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials. PHMSA also provides several tools for emergency responders, such as the Pipeline Emergencies training manual and the Emergency Response Guidebook. The Pipeline Emergencies training manual was produced through a cooperative agreement between PHMSA and the National Association of State Fire Marshals and was released in May 2011. The Emergency Response Guidebook was last revised in 2012.	2.4

Question	Answer	Report Section Number
Will the proposed compressor station perform any hydraulic fracturing activities?	A natural gas transmission compressor station is not part of the onshore oil and natural gas production segment, which is the segment that performs hydraulic fracturing activities. Hydraulic fracturing occurs at oil and natural gas wellheads; there are not any oil or natural gas production wellheads at transmission compressor stations.	2.2
Will the groundwater be impacted by the compressor station?	Natural gas transmission compressor stations do not pose a significant risk to groundwater because the operations do not handle significant amounts of liquids that can spill in contrast to an oil production facility or a natural gas processing plant that handles petroleum liquids or natural gas liquids. For compressor stations that store condensate or oil surpassing 1,320 gallons, operators are required to develop and implement a Storm Water Pollution Prevention Plan (SWPPP), Spill Prevention Containment and Control Plan (SPCC), and adhere to State or National Pollutant Discharge Elimination System (SPDES, NPDES) permit requirements. Site-specific groundwater impacts are evaluated as part of the NEPA evaluation.	3.1.1 3.1.2 4.5
Are oil or other liquid spills likely to occur at a compressor station?	A natural gas transmission compressor station is not an oil production facility, nor is it a gas processing facility; therefore, there will not be significant storage of natural gas liquids (NGL) or oil stored at the facility. However, compressor stations take steps to ensure that liquids that are stored on site are stored in a way to minimize any impacts from spills (through Spill Prevention Containment and Control Plans) as well as stormwater/runoff (through a Storm Water Pollution Prevention Plan).	2.2 4.5
Does the natural gas at the compressor station contain a large percentage of carcinogens?	Once natural gas enters the natural gas transmission pipeline, it has been treated and purified to a consistent composition which consists primarily of methane, and small amounts of ethane, propane, butane, carbon dioxide, nitrogen and oxygen. Benzene, along with other chemicals (collectively BTEX), are collected during liquids removal, such as in dehydration units. EPA specifically addressed "residual risk" for impact to health from dehydration units at natural gas transmission facilities (40 C.F.R. 63 Subpart HHH). EPA has set standards for interstate natural gas compressor stations that ensure ample margin of safety for public health from carcinogens such as benzene and other potentially hazardous air pollutants. Toxic chemicals that are considered carcinogens, such as benzene, are only present in pipeline natural gas at trace levels, typically less than one tenth of one percent. Other chemicals are present in trace amounts that are below thresholds that warrant regulatory controls.	2.3

Question	Answer	Report Section Number
What steps will be taken to survey and repair leaks?	Natural gas transmission compressor stations that are modified, constructed or reconstructed after September 18, 2015 must comply with the quarterly leak detection requirements found in the requirements codified in 40 C.F.R. Part 60, NSPS OOOOa. If leaks are found during a quarterly leak detection survey, operators must repair the leaks within 30 days of discovery and take additional steps to confirm repair of the leaking components.	4.1.3 4.2.1
Will the compressor station increase GHG emissions which can contribute to climate change?	Compressor stations are a source of GHG emissions, but the impacts of climate change can only be evaluated on a global scale. Overall, increasing natural gas use will result in a net decrease of total GHG emissions because natural gas has significantly lower GHG emissions compared to other fossil fuels. Because natural gas has a significantly lower carbon intensity than coal, the electric power sector is expected to substantially increase its natural gas consumption as part of the plan to meet the President's goal of reducing U.S. emissions of GHG by 30% by 2030 (finalized as a rule known as the Clean Power Plan). When developing this plan, EPA considered the GHG emissions (methane) from natural gas transmission. The rule is intended to aggressively reduce national GHG emissions.	4.2
Air pollution can settle in valleys or other low-lying areas of land; has this been taken into consideration?	It is common to model expected air quality impacts using AERMOD, a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. EPA prefers and recommends the use of AERMOD for modeling emissions at sources like the natural gas transmission compressor stations. AERMOD is used to demonstrate that the cumulative impact of background concentrations and project emissions are below the national ambient air quality standards (NAAQS), which are designed to protect human health and the environment. Because the model incorporates actual terrain and conservative meteorology, the impact of emissions in valleys has been considered.	4.1 Appendix B

Question	Answer	Report Section Number
Air dispersion modeling is imperfect and works only with flat terrain; has this been taken into consideration?	While it is correct to claim that air dispersion modeling is imperfect, it is incorrect to state that the analysis only works in flat terrain. AERMOD (EPA's preferred model) specifically takes into account terrain variation through a "preprocessor" and predicted impacts have been shown to be extremely conservative (i.e., orders of magnitude higher than measured concentration in some studies). The over-prediction of the model is understood, in addition to other considerations of conservatism when modeling. When modeling is used to demonstrate compliance with the health-based NAAQS, the public can be assured of protection with a wide margin of safety.	4.1 Appendix B
Why shouldn't FERC require air dispersion modeling of toxics for new or modified compressor stations?	EPA has established National Emission Standards to control hazardous air pollutants. Prior to receiving its Notice to Proceed to begin construction and operation, a proposed new or modified natural gas compressor station must first demonstrate conformance with these National Emission Standards, and the respective state air toxics programs as part of its state or local air permit applications. These air toxics programs are specifically designed by air quality engineers and epidemiological experts at EPA and state agencies to ensure that approved projects do not pose a health or environmental risk, either through demonstration of de minimis emissions or through project-specific impact analyses. Requiring FERC to repeat this exercise duplicates efforts and may not yield more accurate results.	4.1

APPENDIX A: LIST OF ACRONYMS

Below is a list of commonly used acronyms when discussing regulatory permitting and compliance. While not all of these acronyms are used in this paper, they are commonly used during the permitting process by a variety of agencies.

ACC	Annual Compliance Certification
ACE	Any Credible Evidence
ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos-Containing Material
AERMOD	AERMIC Model
AERMIC	In 1991, the American Meteorological Society (AMS) proposed to EPA the formation of a working group, the AMS/EPA Regulatory Model Improvement Committee.
AIRS	Aerometric Information Retrieval System
AP-42	Compilation of Air Pollutant Emission Factors
API	American Paper Institute/American Petroleum Institute
AQCR	Air Quality Control Region
ASTM	American Society for Testing & Materials
AWMA	Air & Waste Management Association
BACT	Best Available Control Technology
BAE	Baseline Actual Emissions
BART	Best Available Retrofit Technology
BDT	Best Demonstrated Technology
BID	Background Information Documents
BIF	Boilers and Industrial Furnaces (EPA's)
BMP	Best Management Practices
CAA	Clean Air Act
CALPUFF	CALPUFF dispersion model
CAM	Compliance Assurance Monitoring
CAS	Chemical Abstract Service
CEM	Continuous Emissions Monitoring
CEMS	Continuous Emission Monitoring System
CERCLA	Comprehensive Environmental Responsibility, Compensation and Liability Act
CFC	Chlorofluorocarbon
C.F.R.	Code of Federal Regulations
CIBO	Council of Industrial Boiler Owners
CMA	Chemical Manufacturers Association
CMS	Compliance Monitoring System
COM	Continuous Opacity Monitor
CTG	Control Technique Guideline CAA Section 183
CWA	Clean Water Act
DOE	Department of Energy
DOJ	Department of Justice
DOT	Department of Transportation
DSCF	Dry Standard Cubic Feet (or Foot)
DSCM	Dry Standard Cubic Meters
EA	Environmental Assessment
EHS	Extremely Hazardous Substances
EI or EIQ	Emissions Inventory
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency

EPCRA	Emergency Planning and Community Right-to-Know Act
FIP	Federal Implementation Plan
FR	Federal Register
FRP	Facility Response Plan
GACT	Generally Available Control Technology
GAQM	Guideline on Air Quality Models
GEP	Good Engineering Practice
GIS	Geographic Information System
HAP	Hazardous Air Pollutant
HHV	Higher Heating Volume
HON	Hazardous Organic NESHAP (see NESHAP below)
ICCR	Industrial Combustion Coordinated Rulemaking
IDLH	Immediate Danger to Life & Health
ISCST3	Industrial Source Complex Short-Term Model (Version 3)
IUR	Inventory Update Rule
LAER	Lowest Achievable Emission Rate
LEPC	Local Emergency Planning Committee
LDR	Land Disposal Restrictions
LHV	Low Heating Value
LQG	Large Quantity Generator
MACT	Maximum Achievable Control Technology
MMBtu	Million British Thermal Units
MON	Miscellaneous Organic NESHAP (see NESHAP below)
MPTER	Multiple Point Gaussian Dispersion Algorithm with Terrain Adjustment
MSDS	Material Safety Data Sheet
NA	Nonattainment
NAAQS	National Ambient Air Quality Standards Title I
NADP	National Atmospheric Deposition Program
NAICS	North American Industrial Classification System
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standard
NSR	New Source Review
NRC	National Response Center
OAQPS	Office of Air Quality Planning and Studies
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration
OTAG	Ozone Transport Assessment Group
PAE	Projected Actual Emissions
PAL	Plantwide Emissions Cap or Plantwide Emissions Limit
PBT	Persistent Bioaccumulative and Toxic
PEMS	Predictive Emissions Monitoring System
PSD	Prevention of Significant Deterioration
PSM	Process Safety Management
PTE	Potential To Emit
RACT	Reasonably Available Control Technology
RCRA	Resource Conservation and Recovery Act
RFP	Reasonable Further Progress
RICE	Reciprocating Internal Combustion Engine
RIM	Regulatory Interpretive Memorandum
RMP	Risk Management Program or Risk Management Plan
RMRR	Routine Maintenance, Repair, and Replacement
SCAQMD	South Coast Air Quality Management District (in California)

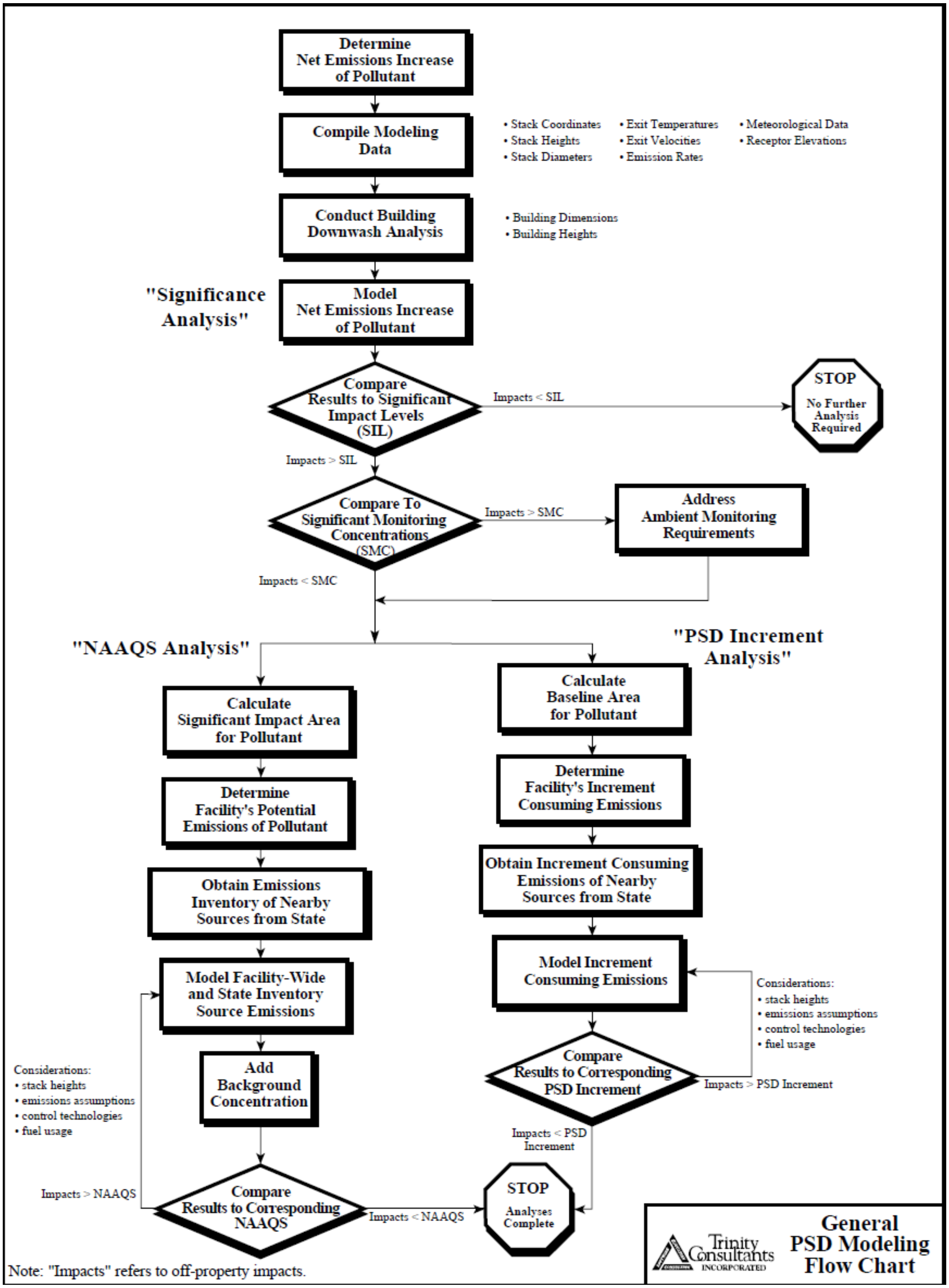
SCC	Source Classification Code/Source Category Code
SCR	Selective Catalytic Reduction
SIC	Standard Industrial Classification (replaced by NAICS in 1998)
SERC	State Emergency Response Commission
SIP	State Implementation Plan
SNCR	Selective Non-Catalytic Reduction
SPCC	Spill Prevention, Control, and Countermeasure
SSM	Start-up, Shut-down, Malfunction
SQG	Small Quantity Generator
TLV	Health Threshold Limit Value
TPQ	Threshold Planning Quantity
TPY	Tons Per Year
TRI	Toxic Releases Inventory
TRIS	Toxic Release Information System
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage or Disposal Facility
UAM	Urban Airshed Model
U.S.C.	United States Code
USGS	U.S. Geological Survey
UST	Underground Stoarge Tank

APPENDIX B: BASIC OVERVIEW OF AIR DISPERSION MODELING

Under Appendix W to 40 C.F.R. Part 51, EPA has published *Guidelines on Air Quality Models (Guidelines)*. In accordance with the *Guidelines*, an air quality analysis should begin with a screening model to determine the potential of the proposed source or control strategy to violate the PSD increment or NAAQS. If the concentration estimates from the screening techniques indicate a significant impact (i.e., modeled impacts greater than the pollutant and averaging time-specific modeling significance levels) or that the regulatory requirement may be approached or exceeded, then a more refined modeling analysis is appropriate.[107] The following figure presents the general approach to PSD modeling required under the Clean Air Act.

[107] 40 C.F.R. 51, Appendix W, Section 10.2.1.b-c.

Figure A-1. General PSD Modeling Flow Chart



The first modeling step includes only "Model Net Emissions Increase of Pollutant". This often is referred to as the significant impact levels analysis, or "SIL analysis". If the project's air emission increases alone show modeled impacts less than the corresponding SIL, modeling has demonstrated that the project will not "cause or contribute" to exceedances of the NAAQS. In this way, even when modeling is completed to assess the impacts of a compressor station project, it is protective of public health to model only a project's air emission increases in comparison to SILs.

When the SIL analysis cannot be met, permit applicants must incorporate the pollutant contributions of all sources into the analyses, possibly including emissions associated with growth in the area of impact of the new or modified source. As such, the air quality model may need to include existing or permitted sources in addition to the proposed project.[108] In this way, the cumulative impacts in the area surrounding the project are assessed. Note that in recent 1-hr NO_2 Guidance, EPA identified that due to a "significant concentration gradient," impacts from industrial facilities diminish quickly with distance from the site.[109] In general, EPA says that for most facilities, a distance of 10 km is very conservative for consideration of impacts. However, FERC requests evaluation for air quality impacts using an even-more conservative radius of 50 km around compressor stations.[110]

Available dispersion models vary in their complexity. The *Guidelines* state that there is no one model capable of properly addressing all conceivable situations even within a broad category such as point sources.[111] Screening models include SCREEN3 and CTSCREEN. "Preferred" models include AERMOD, BLP, CALINE3, CAL3QHC/CAL3QHCR, CALPUFF, CTDMPLUS, and OCD. Each model comes with its own strengths and drawbacks.

Recommended models utilize the Gaussian dispersion equation, in which ambient concentration is a function of emissions, downwind, lateral, and relative vertical distance from the source, cross-wise distance from the flow direction, wind speed, and stability class. In Gaussian dispersion, the effluent disperses horizontally and vertically, resulting in Gaussian (bell-shaped) concentration distributions of the time-averaged plume. Dispersion along the downwind axis of the plume in the downwind direction is assumed to be negligible because of the uniform continued replenishment of the plume contents by the source. Other assumptions in the Gaussian model include conservation of mass, steady-state emissions, and steady-state meteorology.

The *Guidelines* address the uncertainty that is inherent in even the most advanced air dispersion models. Models are more reliable for estimating longer time-averaged concentrations than for estimating short-term concentrations at specific locations. The models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area. Errors in highest estimated concentrations of 10 to 40 percent are found to be typical. Estimates of concentrations that occur at a specific time and site are poorly correlated with actually observed concentrations and are much less reliable. Uncertainties do not indicate that an estimated concentration does not occur – only that the precise time and locations are in doubt.[112]

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[108] 40 C.F.R. 51, Appendix W, Section 10.2.1.d.

[109] EPA Memorandum, *General Guidance for Implementing the 1-hr NO_2 NAAQS in PSD Program*, June 29, 2010.

[110] FERC *Guidance Manual for Environmental Report Preparation for Applications Filed Under the Natural Gas Act*, Volume I, Draft, December 2015, page 4-11.

[111] 40 C.F.R. 51, Appendix W, Section 1.0c.

[112] 40 C.F.R. 51, Appendix W, Section 9.1.2.