Public Health Assessment of Expected Airborne Emissions from the Proposed Lambert Compressor Station Pittsylvania County, Virginia

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Lambert Compressor Station

Introduction and overview

This report addresses the question, "What are the expected effects on public health from airborne emissions from the proposed Lambert Compressor Station?" The proposed site for this facility is in Pittsylvania County, three miles east of Chatham, Virginia — an area that is "mostly rural consisting of a mix of forest and open land" (*Resource Report 9*, 2018). The nearest residential property is 3,200 feet from the proposed site, with fewer than 200 people living within one mile of this site (EJScreen, 2019).[1] Despite this substantial buffer-area (which would act to minimize noise-impacts from above-ground equipment, for example), it is important to determine whether airborne emissions from the proposed Lambert Compressor Station would or would not be expected to harm the public health.

Moreover, since two other compressor stations currently operate in the immediate area, it is important to determine whether adding a third such station would or would not constitute an environmental injustice (Malin, 2020).

To estimate public health-risks, we have relied and expanded upon air quality modeling performed by AECOM (2020) in support of the air permit application. We have also examined the current quality of ambient air, and report here both on the incremental impacts predicted from the proposed new source, and on the expected future quality of ambient air, given all air quality-impacts, including those from the other two compressor stations, acting in concert.

[1] Pittsylvania County is the largest county in Virginia, by area, covering about 982 square miles. Historically, the County had a large enslaved population, with an economy based on tobacco (https://www.familysearch.org/wiki/en/Pittsylvania_County,_Virginia_Genealogy). The estimated 2019 population of the County is about 60,000 residents, of whom about 76% are White and about 22% are African-American (https://www.census.gov). Within a one-mile radius of the proposed site, the population skews toward the elderly (with 25% being 65 years of age or older), 33% of the population are low income, and 22% are classified as minority (EJ Screen, 2019).

We focus first on two gaseous pollutants, nitrogen dioxide (NO_2) and sulfur dioxide (SO_2), each of which can, at and above threshold concentrations in inhaled air, provoke bronchoconstriction and associated symptoms in some people who have asthma. In this context, we also address fine particulate matter ($PM_{2.5}$).

We also examine current and expected future concentrations of carbon monoxide (CO), since this chemical, if present at high concentrations in inhaled air, can provoke symptoms of angina in people who have various cardiovascular diseases.

Next, we evaluate the risks to health associated with current, and expected future, concentrations of potentially hazardous air pollutants (HAPs) in neighborhood air. Following convention, we categorize health-risks in two ways, namely (i) theoretical risks of developing cancer from air pollutants, and (ii) theoretical risks of developing any other adverse health-effect from air pollutants. And we assess these risks assuming (i) that nearest residents will reside at their current locations for their entire lifetimes; (ii) that the facility at issue will remain operational throughout, and (iii) other worst-case assumptions about operations, locations, and meteorology.

Our goal is to determine, using these various assumptions, whether current air quality threatens public health; and whether future air quality would or would not do so.

As shown below, relevant measurements and models, and health risk-estimates show that the quality of neighborhood air:

- near the proposed site is currently quite good[2]; and
- would remain so were the proposed Lambert Compressor Station to be built and operating.

Notably, as shown below, health-risks from all potentially hazardous air pollutants (HAPs), assessed cumulatively and conservatively,[3] over an entire lifetime's worth of exposures, are, and would remain, well within safe limits.

[2] Air quality is typically better in rural areas than it is in urban and suburban areas. In the census tracts at issue here, as detailed below, all potentially hazardous air pollutants are present at concentrations smaller than their respective, health-protective, Virginia Significant Ambient Air Concentrations (SAACs).

[3] In the context of health risk-assessment, "conservative" assumptions and methods are those intended to address uncertainties by erring on the side of public health. For example, we assume, conservatively, that any and all levels of ambient air-exposures to all known or potential carcinogens (such as formaldehyde), however small, increase our risks of developing cancer, despite no reliable evidence that this assumption is correct.

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Impacts from gas compressor stations

In general, when natural gas is piped through compressor stations, the gas is compressed to facilitate its flow through a pipeline. Airborne emissions from the proposed natural-gas-fired turbines that power the compressors and from a gas-fired heater, and fugitive emissions from various pieces of compression equipment, pipes, fittings, and tanks are expected to occur. Predicted, "worst-case" impacts to ambient air from these ducted and fugitive emissions from the proposed Lambert Station have been extensively modeled (AECOM, 2020); and we use and extend the results of those air dispersion models in much of what follows.

Determinants of asthma prevalence and symptom-triggers

Asthma is a set of respiratory diseases determined by both genetic and environmental factors. Mutations in several different genes appear to significantly increase people's risks of developing asthma. Among different ethnic groups in United States, Puerto Ricans are the group at highest risk for asthma, followed by African-Americans, followed by non-Hispanic Whites, with Mexicans having the lowest rates so far identified (Akinbami et al., 2012).

Early childhood exposures affect people's risks of developing asthma. For example, growing up on a farm appears to be protective against developing asthma; as explained by Depner and colleagues (2020):

> The inverse relationship of microbial exposure and immune-mediated diseases, such as allergies and asthma, is the basis for the hygiene hypothesis and its amendments explaining the epidemic of inflammatory diseases in a world that has abandoned traditional lifestyles …. A proposed mechanism by which a traditional lifestyle may grant strong protective effects against asthma involves sustained microbial exposure on farms …This protective effect has mainly been attributed to the consumption of farm milk and exposure to a variety of environmental microbiota in animal sheds…

In people with allergic asthma, respiratory symptoms may be provoked by various antigens, including the biological chemicals found in, for example, dust mites, cat dander, pollens, and molds. Respiratory viruses are also important triggers for airway inflammation and symptoms in children and other people with asthma[4] (Hussain et al., 2018; Martorano et al., 2018; Priante et al, 2018).

[4] And persons with asthma appear to be at increased risk of severe disease if they become infected with SARS-CoV-2, the virus that causes COVID-19.

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The proposed compressor station would not emit antigens or viruses, but it would emit some combustion gases that, if present at sufficiently high concentrations in inhaled air, can provoke symptoms of asthma.[5] As a matter of public health-protection, then, it is important to determine whether the incremental impacts of these gases, combined with existing airborne concentrations, would or would not be expected to potentially provoke asthmatic symptoms.

Sulfur Dioxide (SO_2)

Some people with asthma are very sensitive to the broncho-constrictive effects of high concentrations of sulfur dioxide (SO_2; Sheppard, 1988). To protect exercising asthmatics (the most sensitive group, so everyone else is also protected) from risks posed by this pollutant, the U.S. EPA limits the legally permissible concentration of this chemical in outdoor air (based on its primary national ambient air quality standard, NAAQS) to essentially no more than 75 parts per billion by volume (which equals about 196 micrograms of SO_2 per cubic meter of air), as a one-hour average.[6]

Of course, SO_2 is already present in ambient air near the proposed project-site (as it is essentially everywhere). Current concentrations of SO_2 in ambient air at the nearest representative monitors are quite small — no more than about 13 micrograms per cubic meter (5 parts per billion, averaged over one-hour).[7] This very low concentration of SO_2 is due to the absence of nearby sources of this pollutant — such as coal-fired power plants — and to generally tighter regulatory and engineering controls on these and other sources of SO_2 located farther afield.

Under worst-case conditions (ambient temperature below 0°F, full power operations) and unfavorable meteorological conditions that would minimize dispersion — our estimates (based on air dispersion modeling using AERMOD with the same inputs as used by AECOM, 2020) found that the proposed compressor station could add no more than 0.33 micrograms per cubic meter of SO_2 to outdoor air at the residential location most highly affected by the proposed facility, during the worst-case hour of the entire year (that is, when dispersion in the

[5] Of course, different people will respond to different pollutant-concentrations, with more and more people potentially adversely affected as concentrations increase; although at sufficiently low concentrations, nobody will be adversely affected, regardless of whether they do or do not suffer from asthma. In other words, there are some concentrations of sulfur dioxide and nitrogen dioxide, for example, in inhaled air that, based on clinical studies, are too low to provoke bronchoconstriction even in the most susceptible asthmatics.
[6] Compliance with this NAAQS is measured as the 3-year average of the 99th percentile of 1-hour daily maximum-readings.
[7] This value is the highest of the latest available 3-year average of the 99th percentile of 1-hour daily maximum-readings (so-called "design value") among the five nearest relevant ambient air quality monitors to the SW, SSE, NW, NNE, and ENE, specifically that to the SW in Forsyth County, NC (https://deq.nc.gov/about/divisions/air-quality/air-quality-data/data-archives-statistical-summaries/sulfur-dioxide).

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atmosphere is at its minimum).[8] By definition, impacts during all other hours of the year, and at all other residential locations, would be smaller still.

In other words, if the proposed facility were built and operating, concentrations of SO_2 in outdoor air at the most affected residence would change from at most 13 micrograms per cubic meter to, at most, 13.33 micrograms per cubic meter, while the health-based limit for allowable concentrations of SO_2 in ambient air is, as noted above, 196 micrograms per cubic meter.

Accordingly, regardless of whether the proposed facility is or is not permitted, concentrations of SO_2 in neighborhood air are, and would remain, acceptably small, and not harmful to children or others with asthma. This result is not unexpected, given the small concentrations of hydrogen sulfide and other sulfur-based compounds in natural gas.

Nitrogen Dioxide (NO_2)

Another pollutant of potentially similar concern for people with asthma is nitrogen dioxide (NO_2; Brown, 2015).[9] The short-term, health-based, NAAQS for NO_2 in outdoor air is 188 micrograms per cubic meter of air (equivalent to 100 parts per billion, ppb, by volume) as a one-hour average.[10]

For NO_2, the one-hour, worst-case condition for the proposed compressor station corresponds (AECOM, 2020) to operation at 100% load and 0°F combined with startup or shutdown. Under these assumptions, the proposed compressor station could add up to 1.5 micrograms per cubic meter of NO_2 at the most affected residence near the proposed station, and the combined effect of background and nearby sources including the two Transco Compressor stations does not exceed 87 micrograms per cubic meter at the most affected residence.[11] Thus, concentrations of NO_2 in neighborhood air would remain well within health-based limits.

Fine particulate matter ($PM_{2.5}$)

The proposed compressor station would also emit fine particulate matter ($PM_{2.5}$); and some forms of particulate matter exacerbate asthma. In particular, traffic-related air pollution appears to trigger asthma; and levels on the order of 300 micrograms per cubic meter of diesel engine exhaust particles (DEEP) provoke airway inflammation in volunteers who have been examined in controlled studies (Carlsten et al., 2016). In contrast to DEEP, particles from

[8] As for all the worst-case hourly concentrations in this report, this was the highest single hourly modeled concentration over the 5 years of meteorological data (2012–2016 inclusive) included in the modeling.

[9] Gas-fired cooking stoves are a source of NO_2; and it is recommended that such appliances not be used inside asthmatics' homes (Breysse et al., 2010).

[10] See footnote 7; the same formula is used for SO_2 and NO_2, except that, *per* the relevant regulation, the 98th percentile is used to determine compliance with the NAAQS for NO_2.

[11] These results were obtained using the AERMOD modeling described above, incorporating the EPA ARM2 estimate of conversion of NOx to NO_2, with 5 years (2012–2016 inclusive) of meteorological data and seasonal hourly NO_2 concentrations provided by VA DEQ (AECOM, 2020).

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combustion of natural gas are primarily incompletely combusted hydrocarbons (U.S. EPA, AP-42, 1998)[12] that are not known or expected to aggravate asthma; and the predicted 24-hour $PM_{2.5}$ impacts from the proposed facility are less than 1 microgram per cubic meter of air — at the worst-case location (AECOM, 2020). Concentrations of this type, and magnitude, of particulate matter are neither known nor reasonably expected to provoke asthma or to otherwise threaten health.[13]

Carbon monoxide: background concentrations and predicted impacts from the proposed compressor station

The NAAQS for carbon monoxide (CO) — 40,000 micrograms per cubic meter (35 parts per million, ppm) as a 1-hour average, and 10,300 micrograms per cubic meter (9 parts per million, ppm), as an 8-hour average[14] — are health-based limits designed to protect people with ischemic heart disease who may experience symptoms of angina at and above threshold concentrations of CO in inhaled air (Anderson et al., 1973; Barn et al., 2018). Based on measurements at the nearest relevant ambient air monitors, current concentrations of CO are no more than about 2,300 micrograms per cubic meter (2 parts per million, ppm), as a 1-hour average, and about 1,380 micrograms per cubic meter (1.2 parts per million, ppm) as an 8-hour average (AECOM, 2020, Section 3.7).

During worst-case operations (startup of both turbines) and the worst-case hour with regard to atmospheric conditions over the 5-year period modeled, the proposed compressor station could add up to 40 micrograms per cubic meter of CO at the worst-case residential location; and the worst-case total concentration of CO in outdoor air at the worst-case residential location during any hour would be less than 2,740 micrograms per cubic meter, including background, the two neighboring Transco compressor stations, and the other sources modeled by AECOM (2020). Eight-hour average concentrations would necessarily be less than these values.

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[12] As explained by U.S. EPA (1998), "Because natural gas is a gaseous fuel, filterable PM [particulate matter] emissions are typically low. Particulate matter from natural gas combustion has been estimated to be less than 1 micrometer in size and has filterable and condensable fractions. Particulate matter in natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted." The scientific literature does not demonstrate that this form and amount of PM in ambient air threatens public health. Further, because of the air pollution control devices planned for the proposed compressor station, the inorganic fraction of the emitted PM will likely be dominated by ammonium sulfate (Brewer et al., 2016). This airborne salt-particle, at the concentrations of interest, is not known or reasonably expected to threaten public health.

[13] Airborne particulate matter refers to countless different particle-types, including viruses, bacteria, pollens, dander, soot, metals and metalloids, wood smoke, fossil fuel combustion particles, dusts, and so on. Clearly, the toxicity of any given set of particles depends not only on its size-range (which in turn dictates the extent to which particles may be inhaled) but also on its specific chemical and biological make-up. Just as one cannot talk sensibly about the toxicity of gases as a single class (since oxygen differs from ozone; carbon monoxide differs from carbon dioxide, etc.), neither can one do so about particles as a single class.

[14] These are concentrations not to be exceeded more than once per year.

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Thus, regardless of whether the proposed facility is or is not permitted, CO concentrations in neighborhood air are, and would remain, acceptably small, and not harmful to people with ischemic heart disease or otherwise unusually susceptible to the adverse effects of inhaled CO.

Potentially hazardous air pollutants (HAPs): risks of cancer and other adverse health-effects

Essentially all activities — industrial, commercial, transportation, farming, and some residential — emit potentially hazardous air pollutants (HAPs) to ambient air; and it is important to examine the effects of those emissions on air quality, and hence on public health.

To do so, we started by compiling and evaluating data provided by U.S. EPA in its latest National Air Toxics Assessment (2014 NATA; U.S. EPA, 2018). The NATA estimates average concentrations of 175[15] potentially hazardous air pollutants (HAPs) in each census tract in the U.S., using a combination of measurements at ambient air monitors and dispersion modeling applied to the emissions from all large enough sources in a comprehensive emissions database maintained by U.S. EPA. Emission source characteristics are supplied by each of the states, using the information obtained during their air permitting procedures. The effects of various smaller sources, along with collectively large sources that do not require air permits (notably, fossil fuel-powered motor vehicles) are taken into account by incorporating area averages of their emissions.

Several of these HAPs have been found to increase people's risks of developing one or more kinds of cancer, when present at high airborne concentrations (such as in poorly ventilated factories, typically in decades past). Whether these chemicals also pose risks of cancer at their typically much lower concentrations in outdoor, ambient air is unknown. Regardless, to err on the side of public health, analysts at U.S.EPA (and the Virginia DEQ) assume that all exposures to these chemicals, however small, could also be carcinogenic. Accordingly, theoretical, non-zero risks of cancer can be estimated for all such air pollutants at essentially any concentration, however small, based on extrapolations from cancer-risks observed in groups of people (and/or laboratory rodents) chronically exposed to much higher airborne concentrations.

For residents in the census tract that would be home to the proposed compressor station (tract 51143010500), modeled, current, ambient air-concentrations of known or suspected carcinogens (such as acetaldehyde, benzene, carbon tetrachloride, and formaldehyde) have been translated, by analysts at U.S. EPA, into theoretical lifetime risks[16] of cancer. Thus, U.S. EPA estimates that existing levels of air pollution (from all chemicals combined) pose a theoretical risk of cancer of about 30 in one million, assuming lifetime residence in this census tract. Essentially identical risk-estimates obtain for residents of the three neighboring census tracts, as tabulated below.

[15] This undercounts the number of HAPs evaluated, since the public files we used combine some groups of HAPs under a common name (for example, NATA's PAH/POM name combines 48 PAH chemicals)
[16] These theoretical, lifetime, risk estimates are deliberately biased high, so as to likely over-estimate risks.

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Census Tract	Estimated, lifetime cancer-risk (per one million)
51143010500	29.5
51143010600	28.2
51143010700	30.2
51143010900	29.3

For perspective on risk-estimates like this, note that each of us has a lifetime risk of developing cancer (from all causes) of about 405,000 in one million if we are male, and about 389,000 in one million if we are female).[17]

The question next becomes, "By how much would residents' risks of cancer increase were the proposed compressor station up and running?"

Based on the results of our air dispersion modeling, under worst case conditions and assumptions, the increased risk from airborne emissions from the Lambert Compressor Station would be quite small. In particular, a person living at the most highly affected residence (about 6,700 feet from the proposed site) would incur an estimated, increased cancer-risk of 0.057 in one million, over his or her entire lifetime. Perhaps needless to say, an increased risk of this magnitude is negligible. Cancer risk-estimates for people at this residence and elsewhere are indicated, as isopleths in units of per one million, on Figure 1. Thereon, we apply the notations used in *Resource Report 9*, and so denote the nearest residences as NSA [noise sensitive area] 1, NSA 2, NSA 3, NSA 4; and we mark R [residence] 1, R2, and R3 as three other nearby residences in other directions.

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[17] https://seer.cancer.gov/explorer/application.html?site=1&data_type=6&graph_type=8&compareBy=sex&chk_sex_3=3&chk_sex_2=2&stat_type=10&race=1&hdn_age_range=300&advopt_precision=1&advopt_display=2; select the "Data Table" for numbers.

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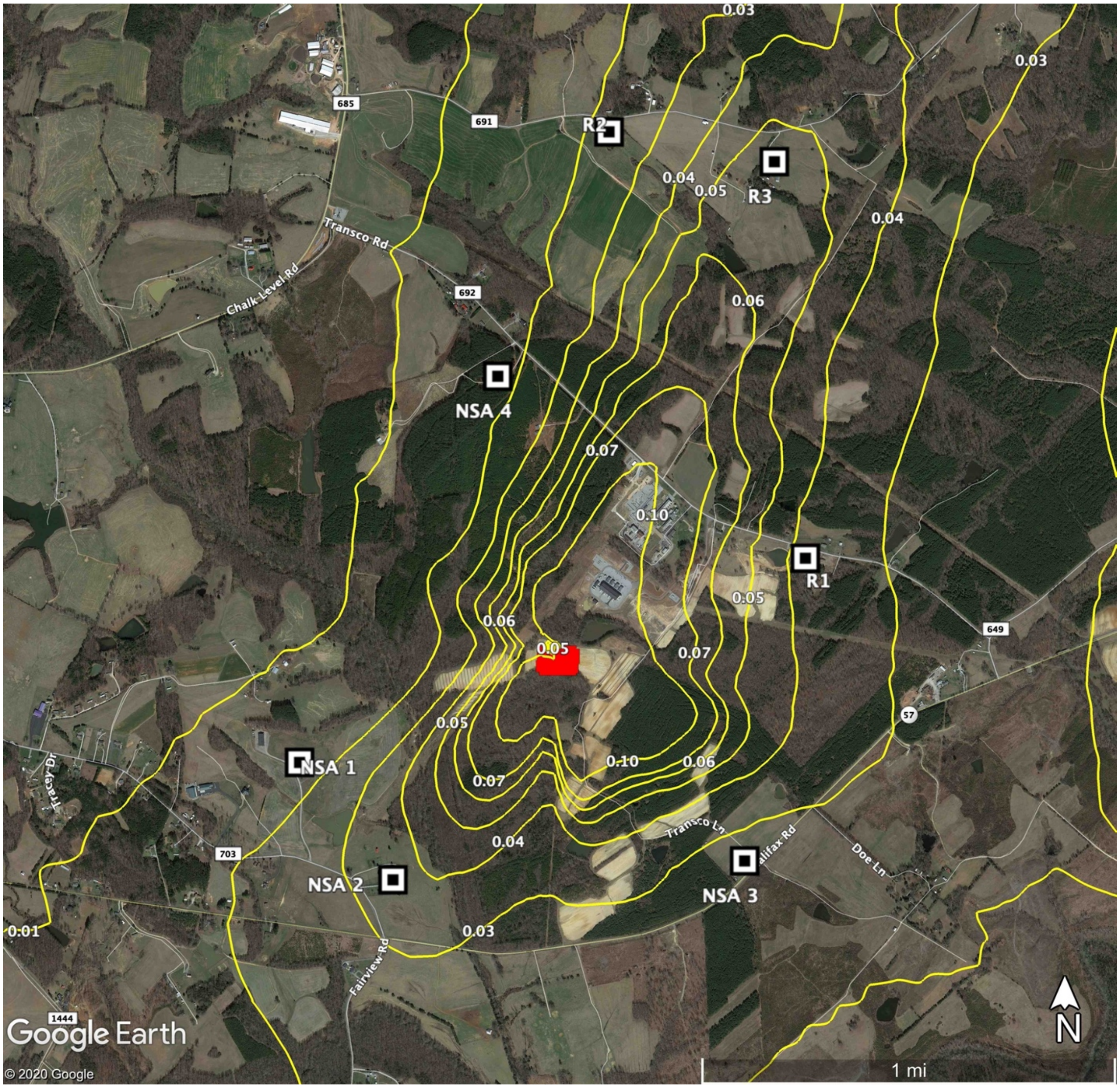

Figure 1. Isopleths of estimated, theoretical increments in cancer-risk (*per* million) from lifetime exposures to all hazardous air pollutants from emissions from the proposed Lambert Compressor Station. Please see text for additional explanation.

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Next, we turn to risks of developing any other adverse health-effect from air pollutants. As above, we first evaluate current air quality with regard to such risks, and then estimate by how much these risks would increase were the proposed compressor station built and operating.

One difference, though, is that rather than expressing risks as chances of some number in one million, by convention, we express all "non-cancer" health risks (posed by air pollutants) as a "hazard quotient," which is the ratio of an inhaled concentration compared with an acceptable (that is, safe) airborne concentration. Thus, a hazard quotient of 1 or less is acceptably small (see, for example, https://www.epa.gov/national-air-toxics-assessment/nata-frequent-questions#risk3).

In other words, if, through ambient air, we inhale Chemical A at an airborne concentration of 1 part per billion; and the safe concentration (based on toxicological studies/observations of people, or on the results of studies of laboratory rodents) of the chemical is 10 parts per billion, then the hazard quotient is 0.1, which is acceptably small. By the same token, were Chemical A present in our ambient air at 200 parts per billion, then the hazard quotient would be 20, which would be deemed unacceptably large.

One more detail: when estimating non-cancer health risks posed by two or more chemicals, we add up each of the individual hazard quotients to calculate a "hazard index," again checking to determine whether this index remains below 1.0 (indicating no harm to health).

Tabulated below are the hazard indices, estimated by U.S. EPA, associated with current concentrations of HAPs in ambient air in the four census tracts of interest. As shown, all indices are comfortably below 1.0, and so acceptably small.

Census Tract	**Hazard index**
51143010500	0.46
51143010600	0.44
51143010700	0.46
51143010900	0.45

As above, we next ask, "By how much would residents' risks of non-cancer health effects increase were the proposed compressor station up and running?"

Again, based on the results of our air dispersion modeling, using conservative assumptions[18], the incremental hazard index from airborne emissions from the Lambert Compressor Station would be quite small. In particular, for a person living at the most highly affected residence,

[18] That is, using the potential to emit estimates in Appendix B of the Application, combined with the conservative (low) estimates for safe concentrations used in U.S. EPA's NATA.

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the incremental hazard index would be only 0.00065. Again, this increment is negligible. Hazard indices for people at this residence and elsewhere are indicated, as isopleths, on Figure 2.

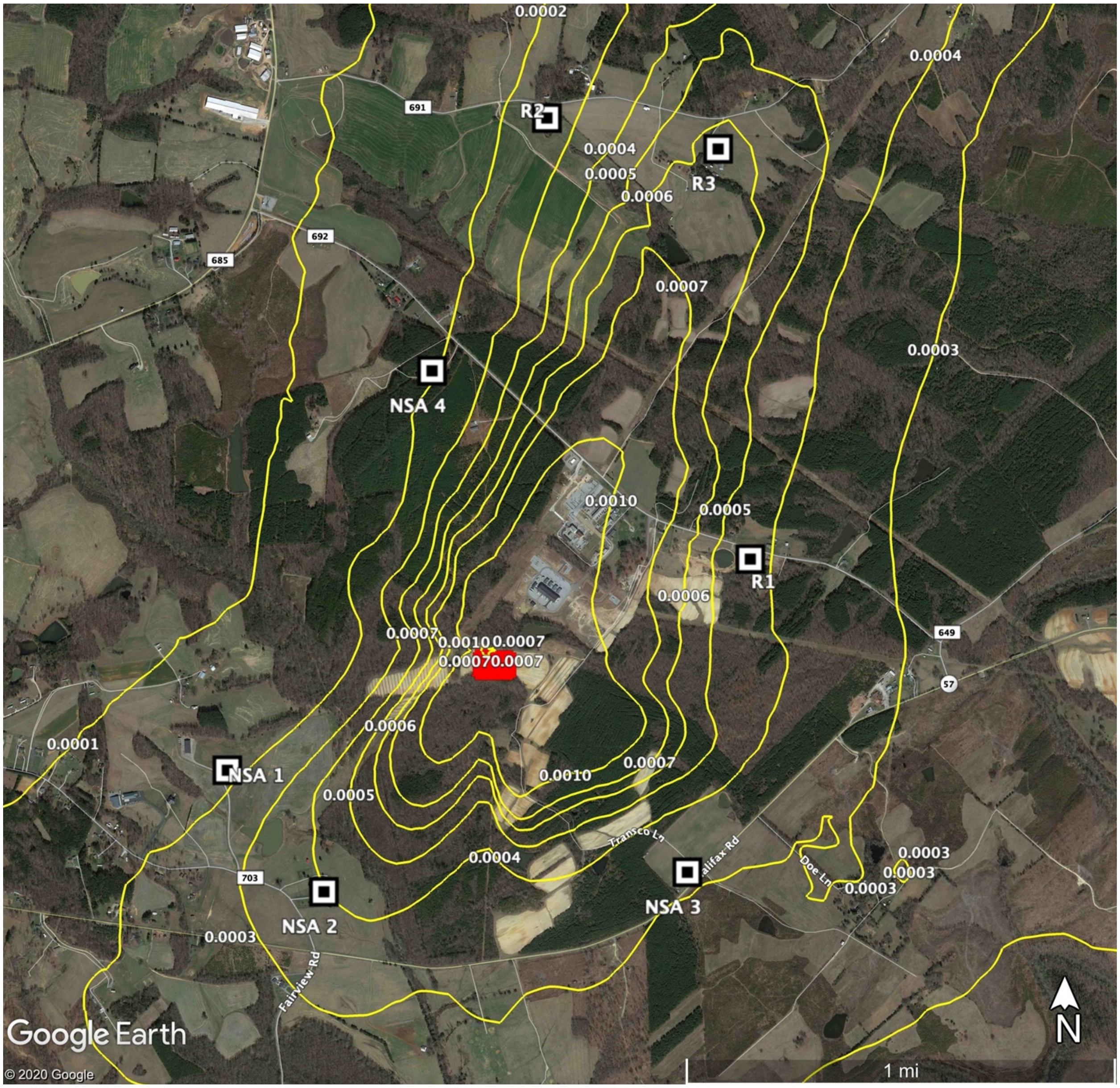

Figure 2. Isopleths of estimated hazard index-increments from impacts to ambient air from the proposed Lambert Compressor Station, for all hazardous air pollutants combined. Please see text for additional explanation.

Comparison with Virginia's Significant Ambient Air Concentrations (SAACs)

As an alternative method of evaluating the potential health hazards from HAPs emissions from the Lambert compressor station, we compared the background concentrations (as estimated in the 2014 NATA[19]), the increment from the proposed Lambert compressor station at the worst-case residential location, and the combined effect, with Virginia's Significant Ambient Air Concentrations (SAACs). According to Virginia DEQ, "The SAAC is the concentration of a toxic pollutant in the ambient air that, if exceeded, may have an adverse effect to human health."

For each chemical with non-zero estimated concentration in census tract 51143010500 in the 2014 NATA for which Virginia has derived an annual SAAC (110 chemicals), the estimated concentration (plus, for formaldehyde, the AERMOD-estimated long-term average effect of the Transco stations at the most affected residences) is less than the annual SAAC. In other words, as might be expected in a rural area, despite the universal presence of myriad sources of pollution, both local and regional, air quality in the area is good.

Adding the estimated annual average contribution of the proposed compressor plant to the background levels of HAPs (for all HAPs known to be emitted by the plant), all resulting concentrations also remained below the SAACs.

We performed a similar exercise for worst-case[20] short-term maximum impacts at the most-affected residential location (117 chemicals common to NATA-estimated annual background and SAACs), and compared these with the short-term SAACs, for which the averaging time is one hour, rather than one year. U.S. EPA's NATA does not provide estimates for maximum hourly values for background air-quality; for all chemicals, except formaldehyde (as explained below), we can estimate these using a modeling "rule of thumb," which holds that 1-hour maxima can be estimated to be 10 times higher than annual maxima (U.S. EPA, 2016).

Formaldehyde is ubiquitous in ambient air, and typically present at concentrations that approach the SAAC. This is because formaldehyde derives from countless sources, both natural and man-made. For example, formaldehyde is generated (i) naturally in soils when plant-residues decompose; (ii) from the atmospheric oxidation of methane; (iii) from photochemical oxidation of various volatile organic compounds; and (iv) from combustion sources such as gasoline and diesel-powered engines, turbines, and appliances, wood stoves and forest fires, and so on. Further, formaldehyde is an essential metabolic intermediate, produced

[19] For formaldehyde, we added to the NATA-estimated background the AERMOD-estimated effect of the Transco stations at the residential locations with highest concentration due to the proposed Lambert station and due to the combination of proposed Lambert station and the Transco stations.

[20] This worst-case is the extremely unlikely co-occurrence of an unscheduled emergency shutdown of the entire station, combined with a shutdown or startup of the compressors, combined with the worst-case meteorology that occurred over the five year period 2012–2016, all within the same hour.

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endogenously in all of our body's cells, entirely independently from our environmental exposures to this chemical (ATSDR, 1999; Albertini & Kaden, 2017).

In the census tract of interest here, the 2014 NATA estimate for source contributions to the annual average formaldehyde concentration was 77.3% from secondary formation in the atmosphere (which is primarily via photochemical oxidation), 18.5% from biogenic emissions, 1.4% from fires, 0.2% from stationary point sources, and 2.5% from all other (anthropogenic) sources (including on- and off-road vehicles). Because formation via photochemical oxidation dominates, formaldehyde concentrations in the atmosphere tend to vary both diurnally (being highest when the sun is shining) and seasonally (being highest in the summer, when ozone and other oxidative species are highest).

To estimate a worst-case, short term formaldehyde ambient background concentration, we examined the most recent five years of daily average measurements at the formaldehyde monitors operating from 2015 to 2019 in Virginia (one at the Carter G. Woodson Middle School, in Hopewell, and two at the MathScience Innovation Center, in East Highland Park). The highest ratio of 24-hr average to annual average in the five years and the three monitors was 3.37 in 2019 at the Carter G. Woodson Middle School. For shorter-term concentrations, we used the 2- and 4-hour measurements[21] of Martin et al. (1991) obtained over 39 summer days. In these the highest measured (2-hour average) concentration was 3.53 times the (time-weighted) daily average. The product of these two ratios is 11.9, so we took the 1-hour ambient background concentration to be 11.9 times the 2014 NATA estimate for annual average.[22]

In addition, since the effect of the Transco stations in NATA is averaged over the entire county, we also added to ambient background the local effect of the Transco stations using the AERMOD modeling previously described, since this approach provides a conservative estimate of the effective, local, background concentration to which the proposed Lambert station would be added. As a conservative estimate for the Transco contribution to background, we first modeled the worst-case 1-hour concentrations for the proposed Lambert station, and separately for the combination of the Transco stations plus the proposed Lambert station. Then at both the most-affected residential locations (with regard to the proposed compressor station alone, and to the combination of the proposed station with the Transco stations) we estimated the background contribution of the Transco stations by subtracting the worst-case concentration due to the proposed station from the combination worst-case concentration (even though these two worst cases may have occurred at different times). We added these Transco contributions to the NATA-estimated background to estimate local background at these worst-case locations.

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[21] We located no suitable 1-hour measurements.

[22] Our approach is conservative, since the highest formaldehyde-concentration would occur during strong sunlight in summer, whereas the worst-case dispersion of emissions from the Lambert and Transco stations would occur at night during winter.

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For formaldehyde and other potentially hazardous air pollutants, our results are shown in the two tables provided after the Conclusions section, below. Therein, we tabulate:

i. current ambient air concentrations of each of these potentially hazardous air pollutants (again, as estimated by U.S. EPA in NATA for the long-term, and as estimated using the rule of thumb for the short-term; except for formaldehyde, as described above) as a percentage of the corresponding SAAC;
ii. predicted worst-case maximum incremental concentrations of these pollutants at the most highly affected residential location due to the proposed compressor station as a percentage of the corresponding SAAC;
iii. predicted worst-case future concentrations (that is, background concentrations plus maximum facility impacts) at the most affected residential location as a percentage of the corresponding SAAC; and
iv. corresponding SAAC values.

The chemicals are listed in descending order relative to the first of these metrics — that is, the percentage of each current concentration relative to its respective SAAC.

As shown in both tables, outdoor air near the proposed compressor station location contains only small concentrations of potentially hazardous air pollutants (relative to all respective, health-based SAACs); and the incremental impacts from the proposed compressor station, even at their maxima, would range from none to negligible.

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Indirect effects on public health

Indirect effects on public health also merit consideration. For example, new, unwanted intrusions on people's neighborhoods, even if many acres away, may engender feelings of anxiety and stress; and these in turn may harm their sense of well-being (Downey & Van Willigen, 2005; Malin, 2020). Thus, regardless of whether an intrusion (environmental, social, or otherwise) is directly harmful, it may indirectly affect local residents' sense of well-being.

In this case, the existence of two compressor stations nearby means that at least some, perhaps most, residents within a mile or so of the site may be already familiar with these facilities; and if these existing facilities have not proved problematic, then perhaps the proposed additional facility might not be expected to engender local anxiety. On the other hand, those who feel imposed upon by the two existing, above-ground facilities may resent the introduction of another such facility. Community engagement would be especially important in such a case.

As another example, most people are well aware of the combustibility of natural gas; and they may have read about, or even seen first-hand, fires and/or explosions associated with natural gas-facilities, including compressor stations. Anxieties that such accidents could happen at the proposed Lambert Compressor Station might, again, be expected to harm some people's mental health. However, community engagement and awareness as to the many safety and fire-prevention aspects of this specific, proposed facility may work to mitigate against this anxiety.

As noted above and elsewhere, the proposed Lambert Station is in a sparsely populated area, with the nearest residence some 3,200 feet from the proposed station, and fewer than 200 people living within a one-mile radius of the proposed site. These rural site-features would also be expected to mitigate against indirectly adverse effects on area residents' mental health, physical health, and overall well-being.

Conclusions

Taken together, the available air quality data, models, and estimated risks to health from air emissions indicate that the health of people living near the proposed Lambert Compressor Station is not currently being compromised by the quality of outdoor air; and if the proposed station were to be built and operating, this situation would not change. Indirect effects are possible; but (i) the rural site-features, (ii) distance to nearest neighbors, and (iii) familiarity with two other compressor stations — combined with productive communication with local stakeholders — would be expected to mitigate these effects.

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Acknowledgement
This analysis was sponsored by Mountain Valley Pipeline, LLC for their MVP Southgate Project - Lambert Compressor Station, and is based on the data provided in the VA Minor New Source Article 6 Permit Application, with revisions and updates. The analysis and views are our own, however, and we take responsibility for any errors.

Table 1. Estimated long-term average concentrations of chemicals and chemical-mixtures in ambient air, and maximum long-term incremental impacts from emissions from the proposed compressor station, at the most-affected residential location, expressed as fractions of the Virginia annual Significant Ambient Air Concentrations (SAACs).

Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) Annual	Current Ambient Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	MICROGRAMS PER CUBIC METER (µG/M³)	AS A FRACTION OF EACH CORRESPONDING SAAC		
Formaldehyde (Lambert + Transco worst-case location)	2.4	66.09%[23]	0.11%[24]	66.21%
Formaldehyde (Lambert worst-case location)	2.4	65.11%[25]	0.17%[26]	65.29%
Acrolein	0.46	4.02%	<0.01%	4.03%
Mercury Compounds	0.1	1.62%	---	1.62%
Carbon Tetrachloride	62	0.86%	---	0.86%
Methyl Chloride	206	0.57%	---	0.57%
Benzene	64	0.45%	<0.01%	0.45%
Acetaldehyde	360	0.37%	<0.01%	0.37%
Methanol	524	0.22%	---	0.22%
Maleic Anhydride	2	0.14%	---	0.14%
Dibenzofurans	0.003	0.11%	---	0.11%
Beryllium Compounds	0.004	0.11%	---	0.11%
Lead Compounds	0.3	0.10%	---	0.10%
Nickel Compounds	0.2	0.09%	---	0.09%
Methyl Bromide	38	0.07%	---	0.07%
Chloroform	98	0.07%	---	0.07%
Toluene	754	0.06%	<0.01%	0.06%

[23] This is the NATA background plus the highest combined effect of Lambert and Transco at any residential location, minus the effect of Lambert at that combined highest location.
[24] Effect of Lambert at the combined highest residential location.
[25] NATA background plus the combined effect of Lambert and Transco at the residential location with highest Lambert effect, minus that highest Lambert effect.
[26] Highest effect of Lambert at any residential location.

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Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) Annual	Current Ambient Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	MICROGRAMS PER CUBIC METER (µG/M³)	AS A FRACTION OF EACH CORRESPONDING SAAC		
Methylene Chloride	348	0.06%	---	0.06%
Hexachlorobenzene	0.004	0.05%	---	0.05%
Cyanide Compounds	10	0.04%	---	0.04%
Hexane	352	0.03%	<0.01%	0.03%
1,3 Butadiene	44	0.02%	<0.01%	0.02%
Methylene Diphenyl Diisocyanate	0.102	0.02%	---	0.02%
Phenol	38	0.02%	---	0.02%
Xylenes	868	0.02%	<0.01%	0.02%
Chromium Vi	0.1	0.02%	---	0.02%
Cadmium Compounds	0.1	0.01%	---	0.01%
Phthalic Anhydride	12.2	0.01%	---	0.01%
Arsenic Compounds	0.4	0.01%	---	0.01%
Cresols/Cresylic Acid	44	0.01%	---	0.01%
Naphthalene	104	0.01%	<0.01%	0.01%
Acrylic Acid	11.8	0.01%	---	0.01%
Hydroquinone	4	0.01%	---	0.01%
2,4-Toluene Diisocyanate	0.072	<0.01%	---	<0.01%
2,2,4-Trimethylpentane	700	<0.01%	---	<0.01%
Manganese Compounds	10	<0.01%	---	<0.01%
2,4-D, Salts and Esters	20	<0.01%	---	<0.01%
Ethyl Benzene	868	<0.01%	<0.01%	<0.01%
Chlorine	3	<0.01%	---	<0.01%
Acetonitrile	134	<0.01%	---	<0.01%
Hexamethylene-1,6-Diisocyanate	0.068	<0.01%	---	<0.01%
Bis(2-Ethylhexyl) Phthalate	10	<0.01%	---	<0.01%
Selenium Compounds	0.4	<0.01%	---	<0.01%

Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) Annual	Current Ambient Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	MICROGRAMS PER CUBIC METER (µG/M³)	AS A FRACTION OF EACH CORRESPONDING SAAC		
Ethylene Oxide	3.6	<0.01%	---	<0.01%
Ethylene Dibromide	0.692	<0.01%	---	<0.01%
Acrylonitrile	8.6	<0.01%	---	<0.01%
Tetrachloroethylene	678	<0.01%	---	<0.01%
Carbon Disulfide	62	<0.01%	---	<0.01%
1,3-Dichloropropene	9	<0.01%	---	<0.01%
Trichloroethylene	538	<0.01%	---	<0.01%
Methyl Isobutyl Ketone	410	<0.01%	---	<0.01%
Aniline And Homologues	15.2	<0.01%	---	<0.01%
Methyl Chloroform	3820	<0.01%	---	<0.01%
Captan	10	<0.01%	---	<0.01%
1,1,2,2-Tetrachloroethane	13.8	<0.01%	---	<0.01%
Cobalt Compounds	0.1	<0.01%	---	<0.01%
4-Nitrophenol	2	<0.01%	---	<0.01%
Vinyl Chloride	26	<0.01%	---	<0.01%
Dibutyl Phthalate	10	<0.01%	---	<0.01%
Catechol	46	<0.01%	---	<0.01%
Phosphorus	0.2	<0.01%	---	<0.01%
2,4,6-Trichlorophenol	0.62	<0.01%	---	<0.01%
Ethylene Dichloride	80	<0.01%	---	<0.01%
Vinyl Acetate	70	<0.01%	---	<0.01%
Carbaryl	10	<0.01%	---	<0.01%
Acetophenone	98.28	<0.01%	---	<0.01%
Methyl Methacrylate	820	<0.01%	---	<0.01%
Triethylamine	82	<0.01%	---	<0.01%
Biphenyl	2.6	<0.01%	---	<0.01%
Ethyl Acrylate	40	<0.01%	---	<0.01%

Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) Annual	Current Ambient Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	MICROGRAMS PER CUBIC METER (μG/M³)	AS A FRACTION OF EACH CORRESPONDING SAAC		
Cumene	492	<0.01%	---	<0.01%
Dimethyl Sulfate	1.04	<0.01%	---	<0.01%
Dimethyl Phthalate	10	<0.01%	---	<0.01%
Chlorobenzene	92	<0.01%	---	<0.01%
1,4-Dichlorobenzene	902	<0.01%	---	<0.01%
Carbonyl Sulfide	24.6	<0.01%	---	<0.01%
2,4-Dinitrotoluene	3	<0.01%	---	<0.01%
Diethanolamine	26	<0.01%	---	<0.01%
Polychlorinated Biphenyls	1	<0.01%	---	<0.01%
Antimony Compounds	1	<0.01%	---	<0.01%
Alpha-Chloroacetophenone	0.64	<0.01%	---	<0.01%
Acetamide	64	<0.01%	---	<0.01%
Benzyl Chloride	10.4	<0.01%	---	<0.01%
2,4-Dinitrophenol	0.2	<0.01%	---	<0.01%
Propylene Dichloride	694	<0.01%	---	<0.01%
Pentachloronitrobenzene	1	<0.01%	---	<0.01%
1,4-Dioxane	180	<0.01%	---	<0.01%
Bromoform	10.4	<0.01%	---	<0.01%
1,1,2-Trichloroethane	110	<0.01%	---	<0.01%
Propylene Oxide	96	<0.01%	<0.01%	<0.01%
Vinylidene Chloride	40	<0.01%	---	<0.01%
N,N-Dimethylaniline	50	<0.01%	---	<0.01%
1,2-Epoxybutane	41.2	<0.01%	---	<0.01%
Pentachlorophenol	1	<0.01%	---	<0.01%
Allyl Chloride	6	<0.01%	---	<0.01%
Methyl Iodide	24	<0.01%	---	<0.01%
Hexachlorocyclopentadiene	0.22	<0.01%	---	<0.01%

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Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) Annual	Current Ambient Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	MICROGRAMS PER CUBIC METER (μG/M³)	AS A FRACTION OF EACH CORRESPONDING SAAC		
Hexachlorobutadiene	0.42	<0.01%	---	<0.01%
Ethylidene Dichloride	1620	<0.01%	---	<0.01%
4,6-Dinitro-O-Cresol, and Salts	0.4	<0.01%	---	<0.01%
Methyl Tert Butyl Ether	360	<0.01%	---	<0.01%
Beta-Chloroprene	72	<0.01%	---	<0.01%
Nitrobenzene	10	<0.01%	---	<0.01%
Ethyl Chloride	5280	<0.01%	---	<0.01%
Epichlorohydrin	15.2	<0.01%	---	<0.01%
O-Toluidine	17.6	<0.01%	---	<0.01%
Quinone	0.88	<0.01%	---	<0.01%
2-Nitropropane	72	<0.01%	---	<0.01%
Styrene	426	<0.01%	---	<0.01%
Ethylenimine	1.76	<0.01%	---	<0.01%
Calcium Cyanamide	1	<0.01%	---	<0.01%

Notes:

1. Chemicals and chemical-mixtures are tabulated here if (i) ambient air concentrations have been estimated as non-zero by U.S. EPA (2018) in the Agency's 2014 National Ambient Air Toxics Assessment, and (ii) Virginia has established a Significant Ambient Air Concentration (SAAC).
2. — indicates that the chemical or mixture is not known to be emitted by the power plant.
3. All incremental impacts are modeled using a series of worst-case assumptions in terms of facility operations, meteorological conditions, and off-site residential locations. By definition, more realistic assumptions would result in estimated ambient air impacts that are smaller still.

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Table 2. Estimated maximum, 1-hour average, concentrations of chemicals and chemical-mixtures in ambient air, and maximum, 1-hour average, incremental impacts from emissions from the proposed compressor station, at the most-affected residential location, expressed as fractions of the 1-hour Virginia Significant Ambient Air Concentrations (SAAC).

Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) 1-hour	Estimated Current Ambient 1-hour Maximum Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	MICROGRAMS PER CUBIC METER (μG/M^3)	AS A FRACTION OF EACH CORRESPONDING SAAC		
Formaldehyde (Lambert + Transco worst-case location)	62.5	53.29%[27]	2.96%[28]	56.25%
Formaldehyde (Lambert worst-case location)	62.5	39.10%[29]	3.88%[30]	42.98%
Acrolein	17.25	1.07%	<0.01%	1.08%
Mercury Compounds	2.5	0.65%	---	0.65%
Hydrochloric Acid	187.5	0.53%	---	0.53%
Carbon Tetrachloride	1550	0.34%	---	0.34%
Methyl Chloride	5175	0.23%	---	0.23%
Acetaldehyde	6750	0.20%	<0.01%	0.20%
Benzene	1600	0.18%	<0.01%	0.18%
Methanol	8200	0.14%	---	0.14%
Maleic Anhydride	50	0.06%	---	0.06%
Ethylene Glycol	3175	0.05%	---	0.05%
Dibenzofurans	0.075	0.04%	---	0.04%
Beryllium Compounds	0.1	0.04%	---	0.04%
Lead Compounds	7.5	0.04%	---	0.04%
Nickel	5	0.03%	---	0.03%

[27] This is the NATA background plus the highest combined effect of Lambert and Transco at any residential location and time, minus the highest effect of Lambert at that residential location (at a time which is different from the time of highest combined effect).
[28] Highest effect of Lambert at any time at the residential location of highest combined effect.
[29] NATA background plus the highest combined effect of Lambert and Transco at any time at the residential location with highest effect of Lambert at any time (which is different from the time with highest combined effect), minus the highest effect of Lambert at any residential location and time.
[30] Highest effect of Lambert at any residential location and time.

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Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) 1-hour	Estimated Current Ambient 1-hour Maximum Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	MICROGRAMS PER CUBIC METER (µG/M³)	AS A FRACTION OF EACH CORRESPONDING SAAC		
Toluene	14125	0.03%	<0.01%	0.03%
Methyl Bromide	950	0.03%	---	0.03%
Chloroform	2450	0.03%	---	0.03%
Methylene Chloride	8700	0.02%	---	0.02%
Hexachlorobenzene	0.1	0.02%	---	0.02%
Cyanide Compounds	250	0.02%	---	0.02%
Hexane	8800	0.01%	2.57%	2.59%
Xylenes	16275	<0.01%	<0.01%	<0.01%
1,3 Butadiene	1100	<0.01%	<0.01%	<0.01%
Methylene Diphenyl Diisocyanate	2.55	<0.01%	---	<0.01%
Phenol	950	<0.01%	---	<0.01%
Chromium Vi	2.5	<0.01%	---	<0.01%
Naphthalene	1975	<0.01%	<0.01%	<0.01%
Cadmium Compounds	2.5	<0.01%	---	<0.01%
Phthalic Anhydride	305	<0.01%	---	<0.01%
Arsenic Compounds	10	<0.01%	---	<0.01%
Cresols/Cresylic Acid (Isomers)	1100	<0.01%	---	<0.01%
Acrylic Acid	295	<0.01%	---	<0.01%
Hydroquinone	100	<0.01%	---	<0.01%
Ethyl Benzene	13575	<0.01%	<0.01%	<0.01%
2,2,4-Trimethylpentane	17500	<0.01%	---	<0.01%
Manganese Compounds	250	<0.01%	---	<0.01%
2,4-D, Salts and Esters	500	<0.01%	---	<0.01%
2,4-Toluene Diisocyanate	3.5	<0.01%	---	<0.01%
Acetonitrile	2525	<0.01%	---	<0.01%
Chlorine	72.5	<0.01%	---	<0.01%

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Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) 1-hour	Estimated Current Ambient 1-hour Maximum Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	MICROGRAMS PER CUBIC METER (µG/M³)	AS A FRACTION OF EACH CORRESPONDING SAAC		
Hexamethylene-1,6-Diisocyanate	1.7	<0.01%	---	<0.01%
Bis(2-Ethylhexyl) Phthalate	250	<0.01%	---	<0.01%
Hydrogen Fluoride	65	<0.01%	---	<0.01%
Selenium Compounds	10	<0.01%	---	<0.01%
Ethylene Oxide	90	<0.01%	---	<0.01%
Acrylonitrile	215	<0.01%	---	<0.01%
Ethylene Dibromide	25	<0.01%	---	<0.01%
Methyl Isobutyl Ketone	7675	<0.01%	---	<0.01%
Carbon Disulfide	1550	<0.01%	---	<0.01%
1,3-Dichloropropene	225	<0.01%	---	<0.01%
Tetrachloroethylene	33925	<0.01%	---	<0.01%
Methyl Chloroform	61500	<0.01%	---	<0.01%
Aniline and Homologues	380	<0.01%	---	<0.01%
Isophorone	700	<0.01%	---	<0.01%
Captan	250	<0.01%	---	<0.01%
1,1,2,2-Tetrachloroethane	345	<0.01%	---	<0.01%
Methyl Hydrazine	9.5	<0.01%	---	<0.01%
Trichloroethylene	26750	<0.01%	---	<0.01%
Cobalt Compounds	2.5	<0.01%	---	<0.01%
4-Nitrophenol	50	<0.01%	---	<0.01%
Vinyl Chloride	650	<0.01%	---	<0.01%
Dibutyl Phthalate	250	<0.01%	---	<0.01%
Catechol	1150	<0.01%	---	<0.01%
Phosphorus	5	<0.01%	---	<0.01%
2,4,6-Trichlorophenol	15.5	<0.01%	---	<0.01%
Ethylene Dichloride	2000	<0.01%	---	<0.01%
Vinyl Acetate	1750	<0.01%	---	<0.01%

Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) 1-hour	Estimated Current Ambient 1-hour Maximum Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	Micrograms per cubic meter (µg/m³)	As a fraction of each corresponding SAAC		
Carbaryl	250	<0.01%	---	<0.01%
Triethylamine	1550	<0.01%	---	<0.01%
Acetophenone	2457	<0.01%	---	<0.01%
Methyl Methacrylate	20500	<0.01%	---	<0.01%
Biphenyl	65	<0.01%	---	<0.01%
Cumene	12300	<0.01%	---	<0.01%
Dimethyl Sulfate	26	<0.01%	---	<0.01%
1,4-Dichlorobenzene	16525	<0.01%	---	<0.01%
Ethyl Acrylate	1525	<0.01%	---	<0.01%
Dimethyl Phthalate	250	<0.01%	---	<0.01%
Chlorobenzene	2300	<0.01%	---	<0.01%
Carbonyl Sulfide	615	<0.01%	---	<0.01%
2,4-Dinitrotoluene	75	<0.01%	---	<0.01%
Diethanolamine	650	<0.01%	---	<0.01%
Polychlorinated Biphenyls	25	<0.01%	---	<0.01%
Antimony Compounds	25	<0.01%	---	<0.01%
Alpha-Chloroacetophenone	16	<0.01%	---	<0.01%
Acetamide	1600	<0.01%	---	<0.01%
Propylene Dichloride	12700	<0.01%	---	<0.01%
Benzyl Chloride	260	<0.01%	---	<0.01%
2,4-Dinitrophenol	5	<0.01%	---	<0.01%
Pentachloronitrobenzene	25	<0.01%	---	<0.01%
1,4-Dioxane	4500	<0.01%	---	<0.01%
Bromoform	260	<0.01%	---	<0.01%
1,1,2-Trichloroethane	2750	<0.01%	---	<0.01%
Propylene Oxide	2400	<0.01%	<0.01%	<0.01%
1,2,4-Trichlorobenzene	925	<0.01%	---	<0.01%

Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) 1-hour	Estimated Current Ambient 1-hour Maximum Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	MICROGRAMS PER CUBIC METER (µG/M³)	AS A FRACTION OF EACH CORRESPONDING SAAC		
N,N-Dimethylaniline	1250	<0.01%	---	<0.01%
Vinylidene Chloride	1975	<0.01%	---	<0.01%
1,2-Epoxybutane	1030	<0.01%	---	<0.01%
Pentachlorophenol	25	<0.01%	---	<0.01%
Allyl Chloride	150	<0.01%	---	<0.01%
Methyl Iodide	600	<0.01%	---	<0.01%
Hexachlorocyclopentadiene	5.5	<0.01%	---	<0.01%
Ethylidene Dichloride	25250	<0.01%	---	<0.01%
Hexachlorobutadiene	10.5	<0.01%	---	<0.01%
4,6-Dinitro-O-Cresol, and Salts	10	<0.01%	---	<0.01%
Methyl Tert Butyl Ether	9000	<0.01%	---	<0.01%
Beta-Chloroprene	1800	<0.01%	---	<0.01%
Nitrobenzene	250	<0.01%	---	<0.01%
Ethyl Chloride	132000	<0.01%	---	<0.01%
Epichlorohydrin	380	<0.01%	---	<0.01%
O-Toluidine	440	<0.01%	---	<0.01%
Quinone	22	<0.01%	---	<0.01%
2-Nitropropane	1800	<0.01%	---	<0.01%
Styrene	10650	<0.01%	---	<0.01%
N-Nitrosodimethylamine	2.38	<0.01%	---	<0.01%
Ethylenimine	44	<0.01%	---	<0.01%
Calcium Cyanamide	25	<0.01%	---	<0.01%

Notes:

1. Chemicals and chemical-mixtures are tabulated here if (i) ambient air concentrations have been estimated as non-zero by U.S. EPA (2018) in the Agency's 2014 National Ambient Air Toxics Assessment, and (ii) Virginia has established a Significant Ambient Air Concentration (SAAC).
2. The estimated current 1-hour maximum air concentrations are assumed to be 10 times the averages estimated in the 2014 National Ambient air Toxics Assessment, except for formaldehyde, for which, as noted in the text, we apply a factor of 11.9.

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Chemical compound or mixture	Significant Ambient Air Concentration (SAAC) 1-hour	Estimated Current Ambient 1-hour Maximum Air Concentration	Incremental Impact from the Proposed Compressor Station	Predicted Future Ambient Air Concentration (current + increment)
	MICROGRAMS PER CUBIC METER (μG/M^3)	AS A FRACTION OF EACH CORRESPONDING SAAC		

3. --- indicates that the chemical or mixture is not known to be emitted by the power plant.
4. All incremental impacts are modeled using a series of worst-case assumptions in terms of compressor facility operations, meteorological conditions, and off-site residential locations. By definition, more realistic assumptions would result in estimated ambient air impacts that are smaller still.

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