THE FACILITY WILL PRODUCE RELATIVELY FEW HAZARDOUS COMPOUNDS AND ALL AT LEVELS BELOW STATE AND FEDERAL BENCHMARKS ESTABLISHED TO BE PROTECTIVE OF PUBLIC HEALTH.

PROJECT POTENTIAL-TO-EMIT HAZARDOUS AIR POLLUTANTS (HAPS)

Air Pollutant	Project Potential to Emit (tons per year)	Updated Calculations*
Hexane	17.3	26.9
Formaldehyde	7.2	1.4
Naphthalene*	N/A	0.3
Benzene	0.5	1.0
Toluene	1.2	0.3
Butadiene*	N/A	0.3
Unspeciated/Other	14	0.6
Total	Approximately 42	Approximately 31

*At the request of DEP, Shell conducted a more detailed calculation of fugitive emissions as part of an Inhalation Risk Assessment. Potential to emit estimates are required by law and assume the facility will run at 100 percent of capacity, 24 hours a day, every day of the year; actual emissions will be below these numbers.

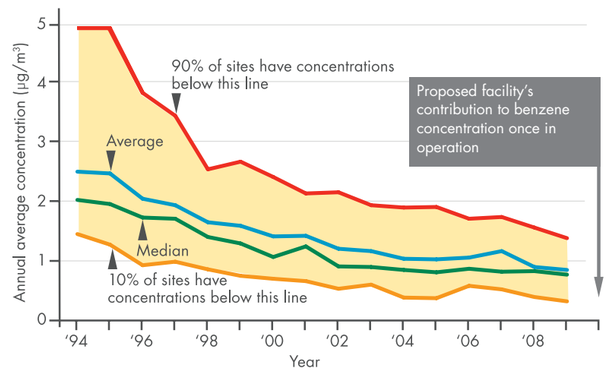
WHAT ARE HAPs?

Hazardous air pollutants (HAPs) are pollutants known to cause or are suspected of causing cancer or other serious human health effects or ecosystem damage. Some HAPs are released from natural sources such as volcanic eruptions and forest fires. Most HAPs originate from mobile sources (cars, trucks, buses) and stationary sources (factories, refineries, power plants).

To learn more about air pollutants, visit www.epa.gov/learn-issues/learn-about-air and www.dep.pa.gov/Business/Air/BAQ/PollutantTopics/Pages/default.aspx

AVERAGE U.S. BENZENE CONCENTRATIONS

Exhibit 2-43. Ambient benzene concentrations in the U.S., 1994-2009*



*Coverage: 22 monitoring sites nationwide that measure benzene.
Data Source: U.S. EPA, 2010

MINIMIZING AIR EMISSIONS

The facility's design, operation and pollution controls will minimize potential air emissions in the following ways:

- *Facility use of ethane* – Using ethane from natural gas as the raw material to make ethylene (and then polyethylene) produces fewer emissions than other potential feedstocks.
- *Facility use of natural gas* – The choice of natural gas and tail gas – which is approximately 85% hydrogen by volume – as fuel for the ethylene production process results in fewer air emissions. Natural gas also will fuel the facility's cogeneration plant to produce electricity and steam on site; excess electricity will be sold to the grid for regional use, potentially displacing higher-emission sources.
- *Facility design* – The proposed facility is designed using current technologies (2010s design vs. 1970s when most existing U.S. plants were built) resulting in improved energy efficiency and lower emissions. This includes a combination of:
  - BAT/BACT – best available technology/best available control technology and practices
  - LAER – lowest achievable emission rates for VOCs, NOx and $PM_{2.5}$
  - MACT – maximum achievable control technology.
- *Facility operations* – Efficiencies in operations, equipment choices and workplace practices will minimize adverse environmental effects by reducing or controlling emissions, such as:
  - Storing ethylene and other measures to eliminate visible flaring except during initial start-up and emergency situations such as a total regional power failure. (In instances where the elevated flare is used, it would act as a safety device to relieve pressure build-up.)
  - Incorporating multiple levels of control on some equipment, including two or, in some cases, three different emission barriers.
  - Designing one of the most stringent leak detection and repair (LDAR) program in the country, with low leak thresholds for all equipment in the facility that could produce fugitive emissions, including pumps, valves and compressors.

REGULATORY CONTROLS

The facility's air emissions are governed by state and federal regulations. The U.S. Clean Air Act gives the Environmental Protection Agency broad authority to develop and implement programs to reduce air pollutant emissions. The Pennsylvania Department of Environmental Protection Bureau of Air Quality Southwest Regional office will have the primary responsibility to carry out inspection and monitoring of the project to assure that the facility meets regulatory and permit requirements. The requirements are designed to prevent deterioration of air quality for certain pollutants in parts of Pennsylvania and to contribute to improved air quality.

The facility's air and other permits are available at http://www.dep.pa.gov/About/Regional/SouthwestRegion/Community%20Information/Pages/Shell.aspx

OUR GOAL IS TO PROVIDE INFORMATION ON THE PROJECT AND ITS POTENTIAL IMPACTS SO THE COMMUNITY CAN ACTIVELY PARTICIPATE IN THE DECISION-MAKING PROCESS AND WELCOME THE FACILITY AS A NEIGHBOR.

Let us hear from you!

Visit: www.shell.us/poly-e
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November 2016

SHELL PENNSYLVANIA CHEMICALS

Potter Township, Beaver County

AIR QUALITY

SHELL PENNSYLVANIA CHEMICALS
AIR QUALITY

PROTECTING THE ENVIRONMENT

Shell* is committed to keeping people safe, protecting the environment and being a good neighbor. With respect to air quality, this means designing, building and operating our petrochemical complex to minimize air emissions and limit community impacts to the extent possible. The facility will meet all applicable federal and state air emission standards established to protect public health and the environment. Regulations also require that Shell demonstrate that the project will not impact air quality and will help improve it for ozone and fine particulates.

PROJECT EMISSIONS

Federal regulations establish emission thresholds at levels considered safe and protective of people and the environment. Many of the compounds the facility will produce will be emitted in amounts below these thresholds, including all compounds regulators categorize as hazardous. While not directly comparable, most of the petrochemical facility emissions will be lower than those publicly reported by the zinc smelter that previously had operated on the site for decades. Some emissions, including particulates and sulfur dioxide, will be lower and others, such as lead, will not be emitted. The facility will generate more volatile organic compounds than the zinc smelter, primarily due to the nature of the process. Shell will comply with applicable federal and state air quality regulations.

CRITERIA POLLUTANTS

The table to the right reports the facility's "potential to emit" quantities. Potential to emit estimates are required by law and assume the facility will run at 100 percent of capacity, 24 hours a day, every day of the year; actual emissions will be below these numbers. Regulatory definitions and requirements can get complicated, but in general:

- The facility will produce almost no sulfur dioxide (SO_2), a contributor to acid rain, or heavy metals.
- Required modeling shows that emissions of carbon monoxide (CO) and larger particulates (PM) will be below levels that would cause or contribute to a violation of ambient air quality standards.
- Emissions of fine particulates, nitrogen oxides (NOx) and volatile organic compounds (VOCs) must meet "lowest achievable emission rates" and then be offset in amounts greater than what the facility would produce.

NONATTAINMENT STATUS

The project is located in an area designated "nonattainment" for ozone and particulates**, meaning that EPA has determined that local air quality doesn't meet national standards for these pollutants. Therefore, Shell is required to first reduce emissions of these compounds to the lowest possible levels using the best commercially available technology. In addition, the company must obtain emission reduction credits (ERCs) at rates greater than or equal to the facility's potential to emit. Shell has submitted plans to obtain the ERCs in the local Pittsburgh-Beaver Valley Area. This will reduce the total amount of nitrogen oxides (NOx) and volatile organic compounds (VOCs) – both of which contribute to ozone formation – and $PM_{2.5}$ (fine particulates), helping improve regional air quality.

WHAT ARE CRITERIA POLLUTANTS?

Criteria pollutants are six categories of common air emissions that the Environmental Protection Agency (EPA) regulates through the National Ambient Air Quality Standards (NAAQS) Under Title 1 of the Clean Air Act. The EPA has developed national ambient air quality standards for criteria pollutants. Criteria pollutants include particulate matter (PM), ground-level ozone (created by NOx and VOCs), carbon monoxide (CO), sulfur oxides ($S0_2$), nitrogen oxides (NOx) and lead. EPA regulates criteria pollutant emissions by developing human health-based and/or environmentally based criteria (science-based guidelines) for setting permissible levels in the ambient air to protect people and the environment.

For more information, go to www.epa.gov/learn-issues/learn-about-air

PROJECT POTENTIAL-TO-EMIT CRITERIA POLLUTANTS

EPA has established a "significant impact level" for each criteria pollutant that determines what additional actions, if any, a facility would be required to take to protect air quality.

- The project is below this level for SO_2. No further action required for permitting.
- For $PM_{2.5}$ and ozone precursors NOx and VOCs, the project will reduce to lowest possible levels and obtain ERCs.
- For carbon monoxide and larger particulates, the project was required to conduct air dispersion modeling to prove that its emissions will not cause or contribute to an exceedance of the national ambient air quality standards for those compounds.

Air Pollutant	Project Potential to Emit (tons/year)	Comments
Sulfur Dioxide (SO_2)	21	Projected SO_2 emissions are well below regulatory threshold; no modeling required.
Carbon monoxide (CO)	1012	Air modeling shows no exceedance of CO National Ambient Air Quality Standard (NAAQS).
Particulate Matter <10 micrometers in diameter (PM_{10})	164	Cumulative air modeling demonstrates that project does not cause or contribute to a violation of the ambient air quality standard.
Particulate Matter <2.5 micrometers in diameter ($PM_{2.5}$)	159	Project is required to obtain ERCs to offset emissions.
Nitrogen Oxides (NOx)	348	Given site is in a nonattainment area for ozone, project is required to obtain offsets at 1.15 to 1.3 to 1 for stack and fugitive emissions, respectively (15% to 30% greater than potential to emit). Cumulative air modeling demonstrates that project does not cause or contribute to a violation of the 1-hour NO_2 standard.
Volatile Organic Compounds (VOCs)	522	Given site is in a nonattainment area for ozone, project is required to obtain offsets at 1.15 to 1.3 to 1 for stack and fugitive emissions, respectively (15% to 30% greater than potential to emit).***
Lead (Pb)	~0	

Emissions based on Shell's Air Quality Plan Approval issued by the Pennsylvania Department of Environmental Protection.

HOW DO EMISSION REDUCTION CREDITS WORK?

Credits are created by industrial facilities that reduce their emissions by equipment, process or operational changes. These credits can then be sold or traded to other companies for expansions or new facilities. However, new emissions must be offset with reductions greater than or equal to the increase in emissions; the amount depends on the region's air quality and the compound. For example, at an offset ratio of 1.15 to 1, the facility would buy 115 tons of offsets for every 100 tons it has the potential to emit, reducing overall emissions in the region by 15 percent (or more, as actual emissions will be lower than the potential-to-emit amounts). Regulators created this approach to lower the total amount of these emissions over time, helping improve air quality while protecting jobs and local economies. Since the U.S. Clean Air Act was passed in 1970, this approach has significantly improved air quality across the U.S.

CARBON DIOXIDE (CO_2)

Like any project involving hydrocarbons, this facility will emit carbon dioxide and other greenhouse gases (GHGs). If built, most of its CO_2 emissions will be produced by its natural gas-fired cogeneration plant that makes steam and electricity, and by the equipment used in ethylene production. The cogeneration plant is designed to meet EPA's CO_2 regulatory limit for a gas-fired electric utility.

Shell is taking a number of measures to minimize CO_2 emissions, including:

- incorporating energy efficient combustion turbines and cracking furnaces to minimize the emissions of GHGs (CO_2, N_2O and methane);
- focusing on energy efficiency across the plant to minimize fuel use, which directly impacts the amount of GHGs emitted;
- using low-carbon fuels like hydrogen-rich tail gas in the cracking furnaces reduces CO_2 emissions by approximately 50 percent compared to natural gas;
- using a low carbon feedstock such as ethane will reduce the emissions of GHGs (CO_2, N_2O and methane); and
- building an onsite natural gas-fired cogeneration plant to supply electricity and steam, rather than buying power from the region's primarily coal-fired grid.

Once the facility is in operation, Shell will implement a Greenhouse Gas Management Plan in order to set and track goals and targets pertaining to emissions.

HAZARDOUS EMISSIONS & POTENTIAL HEALTH EFFECTS

Shell estimates that at full capacity – running all equipment 24 hours a day, 365 days a year – the facility has the potential to emit approximately 31 (30.8) tons per year of hazardous air pollutants (HAPs).

Based on its potential-to-emit numbers, the facility would rank 39th among Pennsylvania manufacturing facilities as reported in the 2015 Toxic Release Inventory (TRI). The TRI report is based on actual emissions (not permitted amounts) and Shell's actual emissions are expected to be less than its potential-to-emit amounts.

Of the facility's HAP emissions, benzene is considered to have the greatest potential health impact. At a potential-to-emit level of approximately one ton per year, the facility's benzene emissions are predicted to contribute at most 0.08 parts per billion (ppb) or 0.26 µg/m3. This level is much less than what is found in a typical home or backyard based on EPA measurements. The graph on the next panel shows that benzene concentrations have decreased over time at the 22 areas across the U.S. where the EPA conducts ongoing monitoring of this compound.

*References to the facility, plant and project contained herein relate specifically to Shell Chemical Appalachia LLC.

**On October 2, 2015, the U.S. Environmental Protection Agency revised the region's status, based on improved air quality, and determined that it now meets federal standards for particulates. However, because the project applied for and received its Air Quality Plan Approval from the Pennsylvania Department of Environmental Protection when the area was deemed in nonattainment for fine particulates, or $PM_{2.5}$, the project is required to meet the standards for lowest achievable emission rate for $PM_{2.5}$ and obtain offset emission credits.

***DEP has approved Shell's request to substitute NOx ERCs for a portion of the required VOC offset credits. The Ozone Transport Commission, along with other reputable authorities, has determined that NOx emissions increases or decreases have a greater impact on ozone concentrations in the Pittsburgh-Beaver Valley Area than do VOC emissions. Shell has obtained all applicable ERCs within the local air shed.