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RE Air Dispersion Modeling for Inhalation Risk Assessment
Shell Chemical Appalachia LLC
Application for Plan Approval 04-00740A
Proposed Petrochemicals Complex
Center Township and Potter Township, Beaver County

The Pennsylvania Department of Environmental Protection (DEP) received a Plan Approval Application from Shell Chemical Appalachia LLC (Shell) on May 1, 2014, for the proposed construction of a petrochemicals complex for the manufacture of ethylene and polyethylene in Center Township and Potter Township, Beaver County.

In accordance with *25 Pa. Code 127.12(a)(2)*, Shell provided an inhalation risk assessment for compounds of potential concern (COPC) as part of its Plan Approval Application, at the request of the DEP. The DEP received the inhalation risk assessment report¹ from Shell on January 28, 2015. The inhalation risk assessment report was prepared by RTP Environmental Associates, on behalf of Shell. The inhalation risk assessment utilized air dispersion modeling to estimate the COPC concentrations for use in the risk calculations.

The DEP's technical review concludes that Shell's air dispersion modeling to support the inhalation risk assessment is consistent with the U.S. Environmental Protection Agency's (EPA) relevant air quality modeling guidance. Additionally, Shell's air dispersion modeling is consistent with the methods and procedures described in the modeling portion of Shell's inhalation risk assessment protocol² established with the DEP.³

¹ Shell, 2015. Inhalation Risk Assessment for the Shell Chemical Appalachia LLC Petrochemicals Complex to be Located in Beaver County Pennsylvania. Letter with attachments from Ate Visser, Shell to Mark Wayner, DEP. Shell Chemical LP, Houston, TX 77002. January 26, 2015.

² RTP, 2015. Protocol for the Inhalation Risk Assessment Petrochemicals Complex Shell Appalachia LLC Beaver County, Pennsylvania. RTP Environmental Associates, Raleigh, North Carolina 27609. January 2015.

³ Email from Alan Binder, DEP to Phil May, RTP. January 12, 2015.

Shell's air dispersion modeling utilized the EPA's recommended near-field dispersion model, the American Meteorological Society / Environmental Protection Agency Regulatory Model (AERMOD).⁴ AERMOD was executed with regulatory default options.

Shell's proposed COPC emissions would be emitted to the atmosphere via typical stacks and flares, and also as fugitive emissions. In AERMOD, the stacks and flares, with the exception of a multipoint ground flare, are characterized as point sources. The multipoint ground flare and fugitive emissions are characterized as volume sources. The DEP concurred with the emission rate calculations provided in Shell's inhalation risk assessment report.⁵ The emission rates for each source and COPC entered in AERMOD are consistent with those provided in Shell's inhalation risk assessment report. Direction-specific downwash parameters, calculated by the EPA's Building Profile Input Program modified for the Plume Rise Model Enhancements algorithms (BPIPPRM), are entered in AERMOD for Shell's point sources.

Receptors were entered in AERMOD at locations defined to be ambient air⁶ to a distance of approximately 5 kilometers from the proposed location of the Shell facility. The extent and density of AERMOD's receptor domain is adequate to determine the location and magnitude of the maximum concentrations for each risk scenario. Receptor elevations and hill height scales were calculated by the AERMOD terrain preprocessor (AERMAP) using the U.S. Geological Survey National Elevation Dataset (NED).

AERMOD utilized a 5-year (2006 – 2010) meteorological dataset derived from primary surface data from FirstEnergy's Beaver Valley Nuclear Power Station and secondary surface data and upper air data from Pittsburgh International Airport. This dataset allows AERMOD to construct a representative vertical structure of the planetary boundary layer within the modeling domain under both convective and stable conditions in order to properly characterize plume transport and dispersion. The meteorological dataset was processed with the AERMOD meteorological preprocessor (AERMET).

In the air dispersion modeling for the acute risk scenario, AERMOD was executed separately for each COPC. The maximum 1-hour emission rates for the sources associated with each COPC were entered in AERMOD to calculate a maximum 1-hour concentration for each COPC.

In the air dispersion modeling for the chronic risk scenario, a "unit" emission rate of 1 pound per hour was entered in AERMOD for each emission source to calculate a 5-year average "unit" concentration for each source at each receptor in AERMOD. Receptors were removed from AERMOD in areas where chronic exposure would not occur (e.g., portions of the Ohio River, Shell's property adjacent to the Ohio River, along the railroad transecting Shell's property, and on the Vanport Bridge).

The DEP executed AERMOD to verify Shell's modeling results upon reviewing the appropriateness of all model input (emission data, downwash data, terrain data, and

⁴ *Code of Federal Regulations*. 40 CFR 51, Appendix W. Guideline on Air Quality Models. Subsections 4.2.2(b) and 4.2.2(c).

⁵ Email from Alan Binder, DEP to Andrew Fleck, DEP. February 19, 2015.

⁶ *Code of Federal Regulations*. 40 CFR 50(e)(1).

meteorological data). The DEP's model results, as well as a comparison with Shell's model results, were provided to the Air Toxic and Risk Assessment Section⁷ as a basis for calculating the acute and chronic risk associated with the COPCs. The DEP notes minor differences between its model results and those of Shell which are due to the DEP's rounding of emission rates and emission parameters in AERMOD for both the acute and chronic risk scenarios and the DEP's use of the PERIOD keyword, instead of Shell's use of the ANNUAL keyword, in AERMOD's control pathway to calculate the 5-year average concentrations for the chronic risk scenario. The DEP's model input/output files and data to support the DEP's technical review of Shell's air dispersion modeling for the inhalation risk assessment are available electronically on a disk upon request.

If you have any questions regarding the DEP's review of Shell's air dispersion modeling to support the inhalation risk assessment, you may contact me by e-mail at afleck@pa.gov or by telephone at 717.783.9243.

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⁷ Email from Andrew Fleck, DEP to Craig Evans, DEP. March 12, 2015.