COMMONWEALTH OF PENNSYLVANIA
Department of Environmental Protection
Southwest Regional Office

MEMO

TO Air Quality Permit File PA-04-00740A

FROM Alan A. Binder, P.E. AAB
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THROUGH Mark R. Gorog, P.E.
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DATE October 31, 2016

RE Plan Approval Modification Application
Shell Chemical Appalachia LLC
Petrochemicals Complex, Ethylene and Polyethylene Manufacturing
Potter and Center Townships, Beaver County
APS # 913256, Auth # 1133789, PF # 775836

BACKGROUND

Arcadis has submitted a plan approval modification application on behalf of Shell Chemical Appalachia LLC ("Shell") received by the Pennsylvania Department of Environmental Protection ("Department") on April 20, 2016. This application has been submitted to incorporate NO_x, VOC, and $PM_{2.5}$ emission reduction credits ("ERCs") into PA-04-00740A[1] as required by Section C. Conditions #037 and #038. No new or modified air contamination sources or air cleaning devices are proposed with this application.

Shell has submitted supplemental requests dated April 27, 2016, and May 10, 2016, requesting Department and United States Environmental Protection Agency ("EPA") approval for interprecursor offset trading between NO_x and VOC to use NO_x ERCs to partially satisfy VOC offsetting requirements. Shell later updated and submitted these supplemental requests as a single package dated August 15, 2016. A letter of summary evaluation, approval, and request for EPA (Region III) evaluation was sent to EPA on September 14, 2016. EPA responded in a letter dated October 17, 2016, also approving the interprecursor trading on a case-by-case basis.

[1] PA-04-00740A Issued June 18, 2015, and expiring June 18, 2019.

REGULATORY ANALYSIS

Per Section C. Condition #037 of PA-04-00740A: "The Owner/Operator shall secure 400 tons of NO_x, 620 tons of VOC, and 159 tons of $PM_{2.5}$ ERCs. ERCs shall be properly generated, certified by the Department and processed through the registry in accordance with 25 Pa. Code §127.206(d)(1). Upon transfer, the Owner/Operator shall provide the Department with documentation clearly specifying the details of the ERC transaction. This facility may not commence operation until the required emissions reductions are certified and registered by the Department."

Shell has secured the following ERCs for use to satisfy the above condition:

Table 1: ERCs Secured by Shell

Generating Source	Expiration Date[a]	$PM_{2.5}$ (tons)	VOC[b] (tons)	NO_x[b] (tons)
Horsehead Corporation, G.F. Weaton Power Plant	9-11-21	24.05	9	899.6
Horsehead Corporation, Monaca Zinc Smelter	4-26-24	34.10	64	211
FirstEnergy Solutions Corp., Armstrong Power Plant Unit 1	8-31-22	49[c]	10.18	-
FirstEnergy Solutions Corp., Mitchell Power Plant Unit 3	10-4-23	91	13	-
FirstEnergy Solutions Corp., Armstrong Power Plant Unit 2	7-21-22	-	10.82	-
Total ERCs Secured	-	198.15[c]	107.00	1,110.6

[a] Applicable expiration dates if not used in a plan approval or operating permit.

[b] Shell requested approval for interprecursor trading to substitute NO_x ERCs in place of VOC ERCs as ozone precursors to satisfy the remainder of required VOC offsets.

[c] As-submitted. This value is later proportionally reduced for compliance with 40 CFR Part 63 Subpart UUUUU.

All secured ERCs have been verified to be contained within the Department's ERC registry system and have therefore been properly generated and certified by the Department. Transfer of these ERCs to Shell has previously been approved by the Department and separately documented through ERC transfer letters generated between September 22, 2015, and April 7, 2016.

Per Section C. Condition #038 of PA-04-00740A, and in accordance with 25 Pa. Code §127.208(10), "An owner or operator of a facility shall acquire ERCs for use as offsets from an ERC generating facility located within the same nonattainment area." Shell's proposed petrochemicals complex and each ERC generating facility are located within the Pittsburgh-Beaver Valley, PA nonattainment area for annual (1997) and 24-hour (2006) $PM_{2.5}$ and 8-hour (1997 and 2008) ozone.[2] Additionally, Horsehead Corporation's former G.F. Weaton Power Plant and Monaca Zinc Smelter previously occupied the same site as Shell's proposed petrochemicals complex, and the entirety of the Commonwealth of Pennsylvania is located

[2] See http://www.dep.pa.gov/Business/Air/BAQ/Regulations/Pages/Attainment-Status.aspx

within the Northeast Ozone Transport Region and is therefore treated like a moderate ozone nonattainment area.

Proportional Reduction

Per 25 Pa. Code §127.206(c), "ERCs shall be proportionally reduced prior to use in a plan approval in an amount equal to the reductions that the generating facility is or would have been required to make in order to comply with new requirements promulgated by the Department or the EPA, which apply to the generating facility after the ERCs were created." Two new regulations have been promulgated (one by the Department and one by EPA) after ERCs were created for these generating facilities and that require further consideration. Requirements under 40 CFR Part 63 Subpart UUUUU may potentially affect $PM_{2.5}$ ERCs. Requirements under Reasonably Available Control Technology ("RACT") in 25 Pa. Code Chapter 129 may potentially affect NO_x and VOC ERCs.

National Emission Standards for Hazardous Air Pollutants ("NESHAPS"): Coal- and Oil-Fired Electric Utility Steam Generating Units from 40 CFR Part 63 Subpart UUUUU [otherwise known as Mercury Air Toxics Standards ("MATS") for Powerplants] was promulgated on February 16, 2012. Per 40 CFR §63.9980, "This subpart establishes national emission limitations and work practice standards for hazardous air pollutants (HAP) emitted from coal- and oil-fired electric utility steam generating units (EGUs) as defined in §63.10042 of this subpart..." The following table lists each ERC generating facility proposed to secure $PM_{2.5}$ ERCs and the applicability determination.

Table 2: $PM_{2.5}$ ERC Generating Facility NESHAPS UUUUU Applicability

$PM_{2.5}$ ERC Generating Facility	Coal- or Oil-Fired?	EGU?[a]	Subject to NESHAPS UUUUU?
G.F. Weaton Power Plant	Yes	Yes[b]	Yes[b]
Monaca Zinc Smelter	No	No	No
Armstrong Unit 1	Yes	Yes	Yes
Mitchell Unit 3	Yes	Yes	Yes

[a] Any of these ERC generating facilities which are classified as an EGU would be an existing EGU under this subpart

[b] EPA and Zinc Corporation of America ("ZCA") (as the former owner/operator of the G.F. Weaton Power Plant) executed a settlement agreement on August 23, 2000, which eliminated the "industrial utility-units" exemption under 40 CFR §72.14 of the Acid Rain Program. G.F. Weaton Power Plant was removed from the Acid Rain Program entirely as it no longer qualified as an "affected unit" under 40 CFR §72.6 and did not need a Phase II Acid Rain Permit. "Affected unit" under the Acid Rain Program is a utility unit that serves a generator in any State that produces electricity for sale. It is likely that G.F. Weaton Power Plant Units would not qualify as an EGU under MATS if they did not qualify as utility units under the Acid Rain Program. However; for the purpose of this review they are considered to be an EGU and compliance with the MATS filterable particulate matter limit is examined.

Per 40 CFR §63.9991(a)(1), "You must meet each emission limit and work practice standard in Table 1 through Table 3 to this subpart that applies to your EGU, for each EGU at your source..." Table 2 to 40 CFR Part 63 Subpart UUUUU includes emission limitations for existing EGUs that are relevant to this application. Existing EGUs that are coal-fired units firing not low rank virgin coal are subject to a filterable particulate matter ("FPM") limit not to exceed

0.03 lb/MMBtu. (Total non-Hg HAP metals or Individual HAP metals limits are provided as alternatives but data is not available to determine compliance with these alternative limits and the majority of EGUs are expected to choose compliance with the FPM limit. My analysis will evaluate whether each ERC generating facility was in compliance with the MATS FPM limit (and reported actual emissions derived from a FPM rate that was in compliance with MATS) during the baseline period used to generate the $PM_{2.5}$ ERCs. Any ERCs which were generated based upon a rate which was not in compliance with MATS will then be adjusted downwards proportionally considering the ratio of filterable $PM_{2.5}$ to FPM and excluding the condensable PM portion of the generated ERCs.

G.F. Weaton Power Plant

Per 40 CFR §63.10042, "*Electric utility steam generating unit (EGU)* means a fossil fuel-fired combustion unit of more than 25 megawatts electric (MWe) that serves a generator that produces electricity for sale. A fossil fuel-fired unit that cogenerates steam and electricity and supplies more than one-third of its potential electric output capacity and more than 25 MWe output to any utility power distribution system for sale is considered an electric utility steam generating unit." G.F. Weaton Power Plant consisted of two coal-fired boilers and electric generating turbines rated at 60 MW each. These were not cogeneration units. Electricity was generated primarily for the purpose of supplying the commonly controlled Monaca Zinc Smelter, but a portion of the generated electricity was sold to the grid. No lower threshold is provided in regards to how much electricity must be sold for a non-cogeneration unit; only that the combustion unit is greater than 25 MWe and electricity is sold. Therefore, G.F. Weaton Power Plant Units 1 & 2 would have been classified as [existing] EGUs and subject to the requirements of 40 CFR Part 63 Subpart UUUUU.

Table 3: G.F. Weaton Power Plant MATS Compliance

ERC Generating Unit	Baseline Period	FPM Rate (lb/MMBtu)	MATS Limit (lb/MMBtu)	In Compliance?	$PM_{2.5}$ Adjustment?
Unit 1	2009-2010	0.004[a]	0.03	Yes	No
Unit 2	2009-2010	0.002[a]	0.03	Yes	No

[a] Based upon April 29 and May 29, 2009, test results for filterable particulate and condensable particulate emission rates. The PM_{10} and $PM_{2.5}$ emission inventory was updated, and applicable Title V emission fees were paid.

Armstrong Unit 1

Armstrong Unit 1 was a coal-fired dry bottom boiler and electric generating turbine with a rated output of 180 MW. Electricity was generated for sale to the grid. Therefore, Armstrong Unit 1 would have been classified as an [existing] EGU and subject to the requirements of 40 CFR Part 63 Subpart UUUUU.

Table 4: Armstrong Unit 1 MATS Compliance

ERC Generating Unit	Baseline Period	FPM Rate[a] (lb/MMBtu)	MATS Limit (lb/MMBtu)	In Compliance?	$PM_{2.5}$ Adjustment?
Unit 1	2010-2011	0.045	0.03	No	Yes

[a] Based upon the average of 2003, 2009, and 2010 test results for filterable particulate and condensable particulate emission rates . The PM_{10} and $PM_{2.5}$ emission inventory was updated, and applicable Title V emission fees were paid.

Table 5: Armstrong Unit 1 PM2.5 ERC Adjustment

$PM_{2.5}$ ERCs Generated[a] (tons)	Filterable $PM_{2.5}$[b] (tons)	Condensable $PM_{2.5}$[b] (tons)	Filterable $PM_{2.5}$ / Total $PM_{2.5}$	$PM_{2.5}$ ERCs Purchased (tons)	Filterable $PM_{2.5}$ ERCs Purchased[c] (tons)	MATS Limit / Actual FPM Rate	Adjusted Filterable $PM_{2.5}$ ERCs Purchased[d, e] (tons)	Condensable $PM_{2.5}$ ERCs Purchased[c] (tons)	Adjusted Total $PM_{2.5}$ ERCs Purchased (tons)
102.37	55.32	47.05	0.54	49	26.48	0.67	17.65	22.52	40.17

[a] Total amount of $PM_{2.5}$ ERCs generated by the shutdown of Armstrong Unit 1.

[b] Filterable and condensable $PM_{2.5}$ average emissions during the ERC baseline period.

[c] Purchased $PM_{2.5}$ ERCs are in the same filterable and condensable fractions as the generated $PM_{2.5}$ ERCs.

[d] Filterable $PM_{2.5}$ was reported as 29% of FPM consistent with AP-42 Table 1.1-6 for dry bottom boilers firing pulverized bituminous and subbituminous coal controlled by ESP.

[e] There is no effect on the $PM_{2.5}$ / FPM ratio as the 2003 FPM test results showed compliance with the MATS FPM limit and the ESP control device was capable of complying with the new applicable limit.

Mitchell Unit 3

Mitchell Unit 3 was a coal-fired dry bottom boiler and electric generating turbine with a rated output of 44 MW. Electricity was generated for sale to the grid. Therefore, Mitchell Unit 3 would have been classified as an [existing] EGU and subject to the requirements of 40 CFR Part 63 Subpart UUUUU.

Table 6: Mitchell Unit 3 MATS Compliance

ERC Generating Unit	Baseline Period	FPM Rate[a] (lb/MMBtu)	MATS Limit (lb/MMBtu)	In Compliance?	$PM_{2.5}$ Adjustment?
Unit 3	2011-2012	0.027	0.03	Yes	No

[a] ERC baseline period emissions were reported using "AP-42 latest available" emission factors. I back-calculated an average FPM emission rate of 0.0272 lb/MMBtu with historical coal usage and ash content during the baseline period and the AP-42 Table 1.1-4 FPM emission factor of 10A (lb/ton). The FPM emission rate was also measured to be in compliance (0.026 lb/MMBtu) with the MATS FPM limit during the last, 2009, FPM test of Unit 3.

25 Pa. Code §§129.96 – 129.100 Additional RACT Requirements for Major Sources of NO_x and VOCs was promulgated on April 23, 2016. In accordance with 25 Pa. Code §129.96(a), G.F. Weaton Power Plant, Monaca Zinc Smelter, Armstrong Unit 1, and Mitchell Unit 3 were each major NO_x and/or VOC emitting facilities in existence prior to July 20, 2012, for which a requirement or emission limitation has not been established in §§ 129.51 - 129.52c, 129.54 - 129.69, 129.71 - 129.73, 129.75, 129.77, 129.101 - 129.107 and 129.301 - 129.310. However, per 25 Pa. Code §129.96(d), "This section and §§129.97 - 129.100 do not apply to the owner and operator of a facility which is not a major NO_x emitting facility or a major VOC emitting facility on or before January 1, 2017. ERCs that will be used in a Plan Approval by no later than January 1, 2017, to satisfy the requirements of 25 Pa. Code Chapter 127, Subchapter E will not be affected by the new RACT requirements.[3]

NO_x and VOC Interprecursor Trading

Per 25 Pa. Code §127.206(o), "Except as provided under §127.210 (relating to offset ratios), an ERC created for a regulated criteria pollutant shall only be used for offsetting or netting an emissions increase involving the same criteria pollutant unless approved in writing by the Department and the EPA." Shell has submitted a supplemental request to this application for approval of interprecursor trading between NO_x and VOC to use NO_x ERCs to partially satisfy VOC emission offsetting requirements. In addition to the emission offsetting requirements and ERC generation and location information described above, the determinative points included in this request are as follows:

[3] A cursory review indicates that NO_x emission rates from the G.F. Wheaton Power Plant during the ERC baseline period ranged between 0.22 lb/MMBtu and 0.28 lb/MMBtu on average as measured by CEMS. This was below the presumptive RACT NO_x emission limitations for tangentially-fired and other coal-fired combustion units of 0.35 lb/MMBtu and 0.40 lb/MMBtu respectively. There would be no reduction of the ~900 tons of NO_x ERCs in this case.

- Shell's request that NO_x ERCs be substituted in place of VOC ERCs at a ratio of 1:1 requires a demonstration that NO_x emission has an equal or greater impact on the *Pittsburgh-Beaver Valley Area* ozone attainment status as VOC emissions. The relative magnitude of that impact is otherwise irrelevant.
- Shell will first utilize all 107 tons of secured VOC ERCs in the *Pittsburgh-Beaver Valley Area* in accordance with standard requirements.
- Shell has secured sufficient NO_x ERCs to completely satisfy the 400 ton NO_x emission offset requirement as well as the remainder of the 620 ton VOC emission offset requirement if this precursor pollutant trade is approved at the requested 1:1 ratio.
- Shell's supporting references are products of or originated from recognized educational institutions, regulatory agencies, or regional modeling groups including the University of Maryland, Maryland Department of the Environment, New York State Department of Environmental Conservation, the Ozone Transport Commission, and New Hampshire Department of Environmental Services. These supporting references have been verified.
- Shell's supporting references utilize recognized photochemical modeling tools to demonstrate the impacts of NO_x and/or VOC emission changes in the *Pittsburgh-Beaver Valley Area.*
- Shell's letter of request and supporting references demonstrate that NO_x emission increases or decreases have a greater impact on ozone concentrations in the *Pittsburgh-Beaver Valley Area* than increases or reductions in VOC emissions.

Shell's request has been evaluated and approved by both the Department and EPA. EPA's analysis and conclusions are summarized in part as follows:

- "EPA's review and analysis of PADEP's approval request supports that air quality modeling shows the Pittsburgh-Beaver Valley, Pennsylvania nonattainment area is NO_x-limited. Generally, this means the area where the Shell construction project is located has a greater ozone reduction benefit when current and future NO_x emissions are decreased versus when current and future VOC emissions are decreased.
- EPA approves and supports Shell's use of an IPT [interprecursor trade] ratio of 1:1 for this project. Such a ratio will provide equivalent or improved air quality results compared to a scenario without an IPT.
- PADEP is seeking approval for Shell to offset 620 tons VOC emissions by using a combination of 107 tons VOC ERCs and 513 tons NOx ERCs. EPA supports this IPT.
- Based on our analysis of regulatory requirements and information provided by PADEP and Shell, EPA approves PADEP's request to allow Shell to do an IPT for this construction project.
- EPA approves Shell's completing and IPT at a NO_x:VOC ratio of 1:1.
- EPA approves Shell using a total of 107 VOC ERCs and 913 NO_x ERCs to fulfill their obligation to offset 1,020 tons of NO_x and VOC emissions at their facility covered by Plan Approval Permit PA-04-00740A."

Table 7: Adjusted ERCs Secured by Shell and Applied to PA-04-00740A

Generating Source	$PM_{2.5}$ (tons)	VOC (tons)	NO_x (tons)
Horsehead Corporation, G.F. Weaton Power Plant	24.05	9	899.6
Horsehead Corporation, Monaca Zinc Smelter	34.10	64	211
FirstEnergy Solutions Corp., Armstrong Power Plant Unit 1	40.17[a]	10.18	-
FirstEnergy Solutions Corp., Mitchell Power Plant Unit 3	91	13	-
FirstEnergy Solutions Corp., Armstrong Power Plant Unit 2	-	10.82	-
Adjusted Total ERCs Secured	189.32[a]	107.00	1,110.6
ERCs Required by PA-04-00740A	159	620	400
		1,020[b]	
Total ERCs applied to PA-04-00740A	159	107	913[b]
Remaining ERCs Required by PA-04-00740A	**0**	**0**	**0**
Remaining ERCs Secured by Shell	30.32	0	197.6

[a] This value has been proportionally reduced for compliance with 40 CFR Part 63 Subpart UUUUU.

[b] Shell has been approved to substitute NO_x ERCs in place of VOC ERCs to satisfy the remainder of required VOC offsets.

RECOMMENDATIONS

Shell Chemical Appalachia LLC has secured sufficient NO_x, VOC, and $PM_{2.5}$ ERCs to meet all emission offsetting requirements of PA-04-00740A. Shell Chemical Appalachia LLC has also sufficiently demonstrated that the *Pittsburgh-Beaver Valley Area* is NO_x-limited for ozone at this time, and that NO_x ERCs may be used in place of VOC ERCs in this case for PA-04-00740A. I recommend modification of PA-04-00740A as follows:

SPECIAL CONDITIONS

Modified Conditions (additions denoted by brackets and bold font)

1. Section C. Condition #037 - The Owner/Operator shall secure 400 tons of NO_x, 620 tons of VOC, and 159 tons of $PM_{2.5}$ ERCs. ERCs shall be properly generated, certified by the Department and processed through the registry in accordance with 25 Pa. Code §127.206(d)(1). Upon transfer, the Owner/Operator shall provide the Department with documentation clearly specifying the details of the ERC transaction. This facility may not commence operation until the required emissions reductions are certified and registered by the Department. **[All required ERCs have been secured by the Owner/Operator and incorporated into this Plan Approval in accordance with 25 Pa. Code §127.208(2)]** [25 Pa. Code §127.206].

New Conditions

1. The Owner/Operator is approved to use NO_x ERCs in place of VOC ERCs at a 1:1 ratio to satisfy VOC emission offsetting requirements in this Plan Approval [25 Pa. Code §127.206(o)].

2. The Owner/Operator has secured 24.05 tons of $PM_{2.5}$, 9 tons of VOC, and 899.6 tons of NO_x ERCs from the shutdown of the G.F. Weaton Power Plant in a transfer from Horsehead Corporation to Shell Chemical Appalachia LLC. All of these ERCs have been applied to this Plan Approval and are no longer subject to expiration under 25 Pa. Code §127.206(f) except as specified in §127.206(g) as long as they remain in this Plan Approval [25 Pa. Code §127.208(2)].

3. The Owner/Operator has secured 34.10 tons of $PM_{2.5}$, 64 tons of VOC, and 211 tons of NO_x ERCs from the shutdown of the Monaca Zinc Smelter in a transfer from Horsehead Corporation to Shell Chemical Appalachia LLC. Amounts of 3.78 tons of $PM_{2.5}$ ERCs, 64 tons of VOC ERCs, and 13.4 tons of NO_x ERCs have been applied to this Plan Approval and are no longer subject to expiration under 25 Pa. Code §127.206(f) except as specified in §127.206(g) as long as they remain in this Plan Approval. Amounts of 30.32 tons of $PM_{2.5}$ ERCs and 197.6 tons of NO_x ERCs remain secured by Shell but are not applied to this Plan Approval because they would exceed the total emissions offsetting requirement of this Plan Approval. Expiration of these ERCs remains April 26, 2024 [25 Pa. Code §127.208(2)].

4. The Owner/Operator has secured 40.17 tons of adjusted $PM_{2.5}$ and 10.18 tons of VOC ERCs from the shutdown of Armstrong Power Plant Unit 1 in a transfer from FirstEnergy

Solutions Corporation to Shell Chemical Appalachia LLC. All of these ERCs have been applied to this Plan Approval and are no longer subject to expiration under 25 Pa. Code §127.206(f) except as specified in §127.206(g) as long as they remain in this Plan Approval [25 Pa. Code §127.208(2)].

5. The Owner/Operator has secured 91 tons of $PM_{2.5}$ and 13 tons of VOC ERCs from the shutdown of Mitchell Power Plant Unit 3 in a transfer from FirstEnergy Solutions Corporation to Shell Chemical Appalachia LLC. All of these ERCs have been applied to this Plan Approval and are no longer subject to expiration under 25 Pa. Code §127.206(f) except as specified in §127.206(g) as long as they remain in this Plan Approval [25 Pa. Code §127.208(2)].

6. The Owner/Operator has secured 10.82 tons of VOC ERCs from the shutdown of Armstrong Power Plant Unit 2 in a transfer from FirstEnergy Solutions Corporation to Shell Chemical Appalachia LLC. All of these ERCs have been applied to this Plan Approval and are no longer subject to expiration under 25 Pa. Code §127.206(f) except as specified in §127.206(g) as long as they remain in this Plan Approval [25 Pa. Code §127.208(2)].