

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION**

In The Matter Of:

Shell Chemical Appalachia, LLC	:	Violations of Air Pollution Control Act and
300 Frankfort Road	:	and regulations.
Monaca, PA 15061	:	

CONSENT ORDER AND AGREEMENT

This Consent Order and Agreement is entered into this 24th day of May 2023, by and between the Commonwealth of Pennsylvania, Department of Environmental Protection ("Department") and Shell Chemical Appalachia, LLC ("Shell").

The Department has found and determined the following:

A. The Department is the agency with the duty and authority to administer and enforce the Air Pollution Control Act, Act of January 8, 1960, P.L. 2119 (1959), *as amended*, 35 P.S. §§ 4001 – 4015 ("Air Pollution Control Act"); Section 1917-A of the Administrative Code of 1929, Act of April 9, 1929, P.L. 177, *as amended*, 71 P.S. § 510-17 ("Administrative Code"); and the rules and regulations ("rules and regulations") promulgated thereunder.

B. Shell is a Delaware limited liability company with a mailing address of 300 Frankfort Road, Monaca, PA 15061.

BACKGROUND

Plan Approvals

C. Shell is commissioning a petrochemical facility ("Facility") in Potter and Center Townships, Beaver County pursuant to Plan Approval No. 04-00740A, issued on June 18, 2015.

D. Two amendments of Plan Approval No. 04-00740A were subsequently issued: Plan Approval No. 04-00740B, issued March 1, 2021, and Plan Approval No. 04-00740C, issued September 12, 2022. Plan Approval No. 04-00740C is the operative plan approval (“Plan Approval”) for purposes of this Consent Order and Agreement.

E. The Facility is a major source of air contaminants for the ozone precursors, Nitrogen Oxides (“NOx”) and Volatile Organic Compounds (“VOC”), Nitrogen Oxides (“NO₂”), Carbon Monoxide (“CO”), particulate matter (“PM₁₀ and PM_{2.5}”), hazardous air pollutants (HAP), and carbon dioxide equivalents (“CO_{2e}”).

F. Because Pennsylvania is included in the Northeast Ozone Transport Region, all of Pennsylvania is considered to be in moderate non-attainment status for the ozone National Ambient Air Quality Standards (“NAAQS”).

G. VOC and NOx are precursors of ground-level ozone, which is a criteria pollutant.

H. Because Beaver County and all of Pennsylvania are in attainment status for the CO NAAQS, CO emissions from the Facility are not subject to nonattainment new source review.

I. Section C, Condition 5 of the Plan Approval states, in relevant part:

Emissions from the Facility shall not equal or exceed the following in any consecutive 12-month period:

Air Contaminant Emission Rate (tons)

NOx: 328.5
CO: 983.7
PM (filterable): 74.3
PM10: 168.9
PM2.5: 163.7
SOx: 22.4
VOC: 516.2
VOC (ERC)* 612

HAP: 32.0
Ammonia: 154
CO2e: 2,304,499

The emission limits set forth in Section C, Condition 5 of the Plan Approval shall be referred to as “Twelve-Month Emission Limitations.”

J. The Plan Approval authorizes temporary operation of the air contamination sources at the Facility and, per 25 Pa. Code § 127.12b(d), Shell has been authorized to operate air contamination sources at the Facility at all times since commencement of operation of air contamination sources.

K. Shell’s High-Pressure flaring system consists of two Totally Enclosed Ground Flares (TEGFs) (Sources C205A & C205B) and one Elevated Flare (Source C205C). The Elevated Flare is intended to be used as a backup to the TEGFs, and then only rarely, and the TEGFs are intended to be used for most upset events. The High-Pressure Flaring system has adequate capacity to handle an upset event even if one TEGF is out of service. However, if only one TEGF is in service the Elevated Flare will be used more frequently and for longer periods.

L. The High-Pressure Flaring System is the primary pollution control and safety control device for the Facility.

Commissioning and Emissions

M. Shell is currently Commissioning the equipment at the Facility. The Commissioning process includes installing, preparing, and testing equipment for normal production operations; activities include starting up air contamination sources and air cleaning devices.

N. Shell asserts that Commissioning is a necessary step in the start-up of any large petrochemical facility, and that operations and emissions occurring during Commissioning are often not representative of those that are expected during normal Facility operations.

O. From November 2019 through September 2022, the Facility's emissions of all air contaminants identified in Plan Approval Section C, Condition 5 were below the Twelve-Month Emission Limitations.

P. In September 2022, Shell determined that emissions of air contaminants were increasing, and that emissions of VOC, NO_x, and CO were approaching the Twelve-Month Emission Limitations. *See* Emission Data, attached as Exhibit A.

Q. As of the date of this Consent Order and Agreement, using the accepted destruction efficiencies for the High-Pressure flares, which are 99 % for compounds with up to 3 carbon atoms, and 98% for compounds with 4 or more carbon atoms ("98%/99%"), the following exceedances of the Twelve-Month Emission Limitations have occurred for the twelve-month periods ending in the following months:

VOC: October (2022), November (2022), December (2022), January (2023), February (2023), March (2023), April (2023);

CO: February (2023), March (2023), April (2023);

NO_x: December (2022), January (2023), February (2023), March (2023); April (2023);

HAP: December (2022), January (2023), February (2023), March (2023); April (2023).

R. Shell anticipates that additional exceedances of Twelve-Month Emission Limitations for VOC, NO_x, CO and HAP emissions may occur as a result of Commissioning and

that exceedances of the Twelve-Month Emission Limitations for CO_{2e} may occur as a result of Commissioning.

S. As of the date of this Consent Order and Agreement, Shell's reported Facility emissions of PM (filterable), PM₁₀, PM_{2.5}, oxides of sulfur (SO_x), CO_{2e}, and ammonia have not exceeded the Twelve-Month Emission Limitations of the Plan Approval for any twelve-month period.

T. A portion of the emissions from the Facility during Commissioning are attributable to "malfunctions," as that term is defined in Section C, Condition 18 of the Plan Approval. Shell is required to report malfunctions to the Department in accordance with Section C, Condition 18 of the Plan Approval, and has submitted malfunction reports to the Department. A list of malfunction reports submitted to the Department by Shell is attached as Exhibit B.

U. Because emissions during Commissioning showed a significant increase in September 2022, Shell began to implement corrective actions and measures to decrease emissions, such as those described in Paragraphs FFF, HHH, MMM and QQQ, below.

V. In addition, in January 2023, Shell conducted diagnostic testing with Zeeco and Providence Photonics to demonstrate the actual destruction efficiencies of its flares, as an alternative to the manufacturer's guarantees. In May 2023, Shell conducted further diagnostic testing via a bench test simulating the conditions of the TEGFs in combination with extractive sampling, an EPA-authorized alternative means of emission limitation, and Video Imaging Spectral Radiometry ("VISR") with Zeeco and Providence Photonics. Shell acknowledges that, for purposes of this Consent Order and Agreement, the Department is applying the manufacturer's guaranteed destruction efficiencies for its flares of 99/98% (depending on the gas composition);

however, Shell contends that the destruction efficiency of its flares is higher than the manufacturer's guaranteed percentage. The Department does not accept the test results described above. It is the Department's position that the technology used—VISR—is an unproven, emerging technology. It has not currently gained general acceptance and has not been accepted by EPA, the Department or other regulatory agencies for compliance purposes.

Ongoing Operations and Emissions

W. As of the date of this Consent Order and Agreement, using the 98%/99% destruction efficiencies, Shell projects that it would achieve compliance with all the Twelve-Month Emission Limitations by the following dates:

VOC: October 2023

CO: September 2023

NOx: November 2023

HAP: October 2023

X. Each of Shell's failures to meet the Twelve-Month Emission Limitations, as described in Paragraph Q, above, constitutes a separate violation of 25 Pa. Code § 127.25 for each air contaminant and each month in which the limit was exceeded.

Y. Any of Shell's failures to meet the Twelve-Month Emission Limitations after the date of this Consent Order and Agreement will constitute a separate and new violation of 25 Pa. Code § 127.25 for each air contaminant and each twelve-month period in which the limit was exceeded. This Consent Order and Agreement does not preclude the Department from seeking or imposing civil penalties for violations of 25 Pa. Code § 127.25 not covered or described in this Consent Order and Agreement.

VIOLATIONS

Flaring Violations

Z. Pursuant to Section D, Source 204, Condition 1 of the Plan Approval, visible emissions from both the Low-Pressure incinerator and Multipoint Ground Flare (“MPGF”) shall not exceed 0% except for a total of five (5) minutes during any consecutive two-hour period.

AA. On June 23, 2022, visible emissions from the MPGF exceeded 0% opacity for a period of approximately eleven (11) minutes from 1:35 p.m. to 1:46 p.m.

BB. Pursuant to Section D, Source 205, Condition 001 of the Plan Approval, visible emissions from both the TEGFs and the Elevated Flare shall not exceed 0% except for a total of five minutes during any consecutive two-hour period.

CC. On September 6, 2022, visible emissions from each of the two TEGFs exceeded 0% opacity intermittently for a period greater than five (5) minutes, from 10:50 a.m. to 12:40 p.m.

DD. On September 8, 2022, visible emissions from each of the two TEGFs exceeded 0% opacity intermittently for a period greater than five (5) minutes, from 10:22 a.m. to 11:22 a.m.

EE. On September 13, 2022, visible emissions from each of the two TEGFs exceeded 0% opacity for a period of seven (7) minutes, from 11:17 a.m. to 12:25 p.m.

FF. On September 18, 2022, visible emissions from the HP Elevated Flare exceeded 0% opacity for a period of approximately fifteen (15) minutes in a consecutive two-hour period.

GG. On February 13, 2023, visible emissions from TEGF-B exceeded 0% opacity for a period greater than five (5) minutes from 6:20 PM to 6:48 PM.

HH. On February 13, 2023, visible emissions from the HP Elevated Flare exceeded 0% opacity for a period greater than five (5) minutes from 3:26 PM to 6:13 PM.

II. On March 25, 2023, visible emissions from TEGF-A exceeded 0% opacity for a period greater than five (5) from 3:39 PM to 6:43 PM and visible emissions from TEGF-B exceeded 0% opacity for a period greater than five (5) minutes from 3:33 PM to 6:44 PM.

JJ. On April 5, 2023, visible emissions from TEGF-B exceeded 0% opacity for a period of 8 min 52 seconds from 8:14 AM to 8:36 AM.

KK. Section B, Condition 13 of the Plan Approval incorporates the requirements of 25 Pa. Code § 127.25 and states:

A person may not cause or permit the operation of a source subject to § 127.11 (relating to plan approval requirements), unless the source and air cleaning devices identified in the application for the plan approval and the plan approval issued to the source, are operated and maintained in accordance with specifications in the application and conditions in the plan approval issued by the Department. A person may not cause or permit the operation of an air contamination source subject to this chapter in a manner inconsistent with good operating practices.

LL. By failing to comply with the visible emissions limitations of the Plan Approval, as described in Paragraphs AA and CC through JJ, above, Shell violated Section B, Condition 13 of the Plan Approval and 25 Pa. Code § 127.25. Each occurrence of visible emissions in excess of the Plan Approval limitations constitutes a separate violation.

MM. On July 21, 2022, the Department sent a Notice of Violation to Shell for the June 23, 2022, visible emissions. On September 14, 2022, September 20, 2022, and October 27, 2022, the Department sent additional Notices of Violation to Shell covering the September 6, 8, 13, and 18, 2022 visible emissions. The Department sent a Notice of Violation to Shell for the February 13, 2023, visible emissions on April 3, 2023. The Department sent a Notice of Violation for the March 25, 2023, visible emissions on May 17, 2023. The Department sent a Notice of Violation for the April 5, 2023, visible emissions on May 17, 2023.

NN. By failing to operate sources and air cleaning devices in a manner consistent with good operating practices, Shell violated 25 Pa. Code § 127.25.

Wastewater Treatment Plant Violations

OO. From January 25, 2023, through February 16, 2023, malodorous emissions were detected outside of Shell's property. The malodor emissions were caused by hydrocarbons in the Wastewater Treatment Plant (WWTP) bio treaters. The WWTP malodors were caused by Shell leaving open a valve between the WWTP and a set of liquid hydrocarbon-containing drums associated with the Ethane Cracking Units, allowing hydrocarbons from the drums to be pumped to the WWTP. Leaving the valve open and allowing excess hydrocarbons to be directed to the WWTP violates Section B, Condition 13 of the Plan Approval and 25 Pa. Code § 127.25.

PP. On April 11, 2023, excess hydrocarbons were pumped into the bio treaters because of a malfunction in a wastewater storage tank, resulting in malodors that were detectible outside of the plant property and verified by the Department. The malodors from the WWTP violate 25 Pa. Code § 123.31. On April 18, 2023, Shell provided the Department with a revised report stating that it would generate approximately 60 Mg/year of benzene in its waste and wastewater and requested that the Department utilize the compliance option under 40 CFR § 61.342(e), which is known as the Benzene Quantity 6Mg/year (the "BQ6") option.

QQ. The violations described in Paragraphs AA, CC through JJ, NN, OO, PP, SS, TT, XX, and BBB constitute unlawful conduct under Section 8 of the Air Pollution Control Act, 35 P.S. § 4008; a statutory nuisance under Section 13 of the Air Pollution Control Act, 35 P.S. § 4013; and subject Shell to civil penalty liability under Section 9.1 of the Air Pollution Control Act, 35 P.S. § 4009.1.

Other Violations

RR. Section B, Condition 13 the Plan Approval incorporates the requirements of 25 Pa. Code § 127.25 and states, in relevant part “[a] person may not cause or permit the operation of an air contamination source subject to this chapter in a manner inconsistent with good operating practices.”

SS. On July 15, 2022, Shell reported to the Department that from July 4, 2022, through July 20, 2022, conditions existed so that emissions emanated from the spent caustic vent thermal oxidizer (“SCTO”) due to infiltration of vent gas from the High-Pressure Flare knock out drum into the recovered oil tank, which is inconsistent with good operating practices. Emissions estimates provided by Shell show 2.23 tons of VOC (among other pollutants) were released to atmosphere as a result of these conditions between July 4 and 20, 2022.

TT. By operating the SCTO and associated equipment in a manner inconsistent with good operating practices, Shell violated PA-04-00740, Section B, Condition 13 and 25 Pa. Code § 127.25. On August 31, 2022, the Department sent a Notice of Violation to Shell for the July 4 through 20, 2022 upset conditions.

UU. 40 C.F.R. § 61.145(a) states, in relevant part, “prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos.”

VV. 40 C.F.R. § 61.145(b)(1) states, in relevant part, “[e]ach owner or operator of a demolition or renovation activity to which this section applies shall [p]rovide the Administrator with written notice of intention to demolish or renovate.”

WW. On September 30, 2022, a Department inspection conducted at the Facility revealed an Asbestos Abatement and Demolition/Renovation Notification Form had not been submitted at least 10 days prior to the start of the demolition of an industrial building owned by Shell at 432 Frankfort Road. In addition, an inspection for the presence of asbestos was not conducted prior to commencement of demolition.

XX. By failing to submit an Asbestos Abatement and Demolition/Renovation Notification Form ten days prior to the commencement of demolition and failing to conduct an inspection for the presence of asbestos prior to the commencement of demolition, Shell violated 40 C.F.R. § 61.145(a) and 40 C.F.R. § 61.145(b)(1).

YY. 40 C.F.R. § 60.18(f)(1) requires that “Method 22 of appendix A to this part shall be used to determine the compliance of flares with the visible emission provisions of this subpart.”

ZZ. On March 25, 2023, Shell failed to conduct a Method 22 observation during a visible emissions event.

AAA. On April 5, 2023, Shell failed to conduct a Method 22 observation during a visible emissions event.

BBB. By failing to conduct Method 22 observations on March 25, 2023, and April 5, 2023, Shell violated 40 C.F.R. § 60.18(f)(1).

FACILITY OPERATIONS, REPAIRS AND PROJECTS

CCC. On or about March 25, 2023, Shell ceased production of ethylene and polyethylene at the Facility (“Spring 2023 Shutdown”) to undertake corrective actions, maintenance, and repairs.

High Pressure Flare System

DDD. The Liquid Seal that prevents flammable gas from reaching the Elevated Flare was bypassed because piping within the Seal Pot was damaged in a pressure swing on March 17, 2023.

EEE. Shell initiated the Spring 2023 Shutdown to address the damaged Seal Pot.

FFF. During the Spring 2023 Shutdown, Shell replaced piping within the Seal Pot pursuant to a Request for Determination (RFD) 10196.

GGG. The Elevated Flare requires steam assist to combust gases in a smokeless manner, meaning it would not exceed 0% except for a total of five minutes during a consecutive two-hour period. Shell's inability to direct an adequate amount of steam to the Elevated Flare promptly as the flaring event begins also has caused the Elevated Flare to emit smoke.

HHH. In the fourth quarter of 2022 and during the Spring 2023 Shutdown, Shell has made changes to its steam distribution system and control improvements in an effort to provide adequate steam to the Elevated Flare in a timely fashion to prevent smoking. Further, Shell is continuing to study the steam system. These improvements include:

1. Updated the steam assist control to the elevated HP flare based on the HP seal pot bypass valve position rather than the HP seal pressure transmitters to accelerate the response time of delivering steam to the elevated flare.
2. Performance of the steam supply system to the flare was assessed and improved using standard PID controller tuning methods to further accelerate the delivery of steam to the elevated flare.
3. During the current shutdown, Shell updated controls to enable SHP-HP (Super High Pressure to High Pressure) and HP-MP (High Pressure to Medium

Pressure) letdown stations to allow two stations to operate at once to increase the available steam required for the elevated flare to maintain smokeless conditions for less than 5 mins within a 2-hour period.

A summary of the steam system changes and evaluation of the steam systems ability to provide adequate steam to the Elevated Flare is attached as Exhibit C.

III. Flare tips on stages 1-3 the TEGFs have experienced coking and damage which degraded their functionality. Stages 1-3 in TEGF A and 1-4 in TEGF B, were taken out of service.

JJJ. Additionally, the steel enclosure of the TEGFs has experienced more heat than expected from the flares, causing hot spots and requiring it to be cooled by spraying water on the exterior of the steel enclosure during certain flaring events.

KKK. As a result of the hot spots and coking of stages 1-3, the amount of gas that each TEGF can handle has been reduced by 3-5% of the total capacity.

LLL. During some flaring events, visible emissions have been observed from the TEGFs.

MMM. During the Spring 2023 Shutdown, Shell has implemented the following temporary remedial measures:

1. Replacing Stage 2 in each TEGF.
2. Replacing Stage 4 tips as needed in each TEGF.
3. Adding multiple staging curves based on flare gas heating value to address opacity occurrences.
4. Removing and replacing damaged steel in the enclosure and protecting the steel with more heat resistant refractory material; and

5. Commencing Computational Dynamic Modeling, which Shell intends to use to optimize TEGF performance under various conditions including high wind conditions, fluctuating gas heat content, and different pressures for stages to open.

NNN. However, Stages 1 and 3 in each TEGF, which Shell previously took out of service because of coking and damage, were not replaced by Shell during the Spring 2023 Shutdown.

OOO. Following the temporary remedial measures implemented during the Spring 2023 Shutdown, the manufacturer of the TEGFs provided a guarantee that each TEGF in its current state, after implementing the corrective actions and measures identified in Paragraph MMM, above, will meet Plan Approval, Section D, Source 205, Condition Nos. 001 and 002 (visible emission and destruction efficiency) in its current condition and identified the bases for the guarantee. The manufacturer's written guarantee and the information identifying Shell's repairs and operational practices upon which the guarantee is based are attached as Exhibit D.

PPP. As a permanent remedial measure, Shell plans to undertake certain actions to restore the TEGFs to their original capacity: replacing and adjusting floor heights relative to the burner tips, replacing flare burner tips in-kind as needed to address coking to provide for the full utilization and reliability of the TEGFs and upgrading the refractory on the bottom third of the TEGFs to address potential hot spots. In addition, Shell may incorporate additional improvements as a result of the Computational Dynamic Modeling which will simulate air flow and wind speed conditions ("TEGF Repairs").

Wastewater Treatment Plant

QQQ. To reduce hydrocarbon loadings to the bio treaters at the WWTP and to comply with the Plan Approval, Shell has implemented the following interim actions:

1. Installed a WEMCO Depurator (DAF) pursuant to RFD 10119.

2. Commenced adding powdered activated carbon (PAC) at the bio treater as needed.
3. Installed and use as needed, activated carbon filters to further treat wastewater before discharge.
4. Installed additional level indication on the Flow Equalization and Oil Recovery (“FEOR”) tanks and the low-level alarm was raised.
5. Additional Source Control monitoring upstream of the WWTP.

RRR. Shell plans to evaluate the effectiveness of the corrective actions identified in Paragraph QQQ, above, and may undertake additional improvements to the WWTP.

SSS. Upon entering into this Consent Order and Agreement with the Department, Shell plans to restart production of ethylene and polyethylene at the Facility on May 24, 2023 (“May Restart”). This means Shell will resume ethane feed into the Facility from the Falcon Pipeline.

ORDER

After full and complete negotiation of all matters set forth in this Consent Order and Agreement and upon mutual exchange of covenants contained herein, the parties desiring to avoid litigation and intending to be legally bound, it is hereby ORDERED by the Department and AGREED to by Shell as follows:

1. Authority. This Consent Order and Agreement is an Order of the Department authorized and issued pursuant to Sections 4 and 10 of the Air Pollution Control Act, 35 P.S. §§ 4002, 4010; and Section 1917-A of the Administrative Code, 71 P.S. § 510-17.

2. Findings.

a. Shell agrees that the findings in Paragraph A through SSS are true and correct and, in any matter or proceeding involving Shell and the Department, Shell shall not challenge the accuracy or validity of these findings.

b. The parties do not authorize any other persons to use the findings in this Consent Order and Agreement in any matter or proceeding.

3. Totally Enclosed Ground Flares.

a. Repair of the TEGFs.

i. On or before August 31, 2023, Shell shall submit to the Department an administratively complete (defined in Paragraph 12) Request for Determination for the TEGF Repairs for TEGF-A and TEGF-B, which, in addition to all other requirements for the authorization, shall contain a schedule for the TEGF Repairs (“TEGF Repairs Schedule”);

ii. If a Request for Determination is deemed to be appropriate for the TEGF Repairs, Shell shall conduct the TEGF Repairs for TEGF-A and TEGF-B in accordance with the Department-approved TEGF Repairs Schedule;

iii. During the Department’s review of the Request for Determination required by Paragraph 3.a.i., Shell shall respond to requests for information from the Department within the time frame requested by the Department;

iv. The Department and Shell will confer about whether a request for determination or plan approval is appropriate, as necessary.

b. TEGF Interim Monitoring. Until the TEGF Repairs are completed under the conditions described in Paragraph 4.a, Shell shall monitor the TEGFs as follows:

i. Shell shall examine each TEGF daily for signs of coking, fouling, or other damage that might compromise the destruction efficiency of either TEGF as described in Exhibit D, to determine whether the guarantee from the manufacturer in Exhibit D, is still valid as to both TEGFs based on the condition of the TEGFs (“TEGF Inspection”).

ii. Monthly, on or before the fifteenth day of each month, Shell shall submit a report to the Department documenting the condition of the TEGFs and stating whether the guarantee from the manufacturer, attached as Exhibit D, is still valid as to both TEGFs based on the condition of the TEGFs.

iii. If any TEGF Inspection undertaken pursuant to paragraph 3.b.i., above, shows damage to one or both of the TEGFs, then within fifteen (15) business days, Shell shall provide the Department an updated guarantee from the manufacturer of the TEGFs that each TEGF in its current state will meet Plan Approval, Section D, Source 205, Condition Nos. 001 and 002 (visible emission and destruction efficiency) and the guarantee shall identify the bases for the guarantee.

iv. If the manufacturer will not provide the updated guarantee required by Paragraph 3.b.iii., above, Shell shall communicate the manufacturer's conclusion that the guarantee no longer applies to one or both of the TEGFs to the Department within twenty-four (24) hours of learning that the guarantee no longer applies to one or both of the TEGFs, and Shell shall either take the individual TEGF out of service for additional repairs, or—if both TEGFs are impacted by the lack of an updated guarantee—as soon as it is safely possible, cease the feed of ethane into the furnaces from the Falcon Pipeline until the required TEGF repairs can be completed allowing for the issuance of the manufacturer's updated guarantee.

4. Elevated Flare.

a. Within 45 days after the date of this Consent Order and Agreement, Shell shall complete all modeling to demonstrate that its steam system will, during upset conditions,

deliver an adequate amount of steam in a timely manner to the Elevated Flare to promote combustion and operate in a condition that complies with Plan Approval.

b. Within 60 days after the date of this Consent Order and Agreements, Shell shall submit to the Department a technical report that documents the results of the modeling required by Paragraph 4.a, above and that demonstrates Shell's steam system will, during upset conditions, deliver an adequate amount of steam in a timely manner to the Elevated Flare to promote combustion and operate in a condition that complies with the Plan Approval ("Steam Report"). The Steam Report, and all conclusions contained therein, shall be submitted under the seal of a qualified professional engineer licensed in Pennsylvania.

c. If within 120 days after the date of this Consent Order and Agreement, Shell cannot demonstrate to the Department that Shell's steam system will, during upset conditions, deliver an adequate amount of steam in a timely manner to the Elevated Flare to promote combustion and operate in a condition that complies with the Plan Approval, then the Department and Shell shall meet and confer within 10 business days to determine further corrective actions to be undertaken.

5. WWTP Controls.

a. Within 90 days after the date of this Consent Order and Agreement, Shell shall complete its engineering evaluation of the temporary controls installed at the WWTP, as described in Paragraph QQQ, and submit to the Department a report of its engineering evaluation of the temporary controls at the WWTP that includes, but is not limited to, recommendations for permanent controls, the use of existing controls (e.g. flares) to handle emissions from the

permanent controls, and an implementation schedule for obtaining any Department authorizations and completing the installation of such permanent controls (“WWTP Report”).

b. During the Department’s review of the WWTP Report, Shell shall respond to any requests for information from the Department within the time frame requested by the Department.

c. Upon the Department’s approval of the WWTP Report, Shell shall submit applications(s) for appropriate authorizations (as determined by the Department) and complete the implementation of the permanent controls (including use of existing controls) in accordance with the Department-approved WWTP Plan, including any schedules contained therein.

6. Monthly Emissions Reports.

a. Shell shall report emissions from the Facility to the Department on a monthly basis, until termination of this Consent Order and Agreement pursuant to Paragraph 29, by submitting an emission report to the Department in the same format and detail as shown on Exhibit A that also includes emissions for the preceding months’ and the current month’s cumulative twelve-month total emissions (“Monthly Emissions Report”).

b. For the purpose of determining emissions for the Monthly Emissions Report, Shell shall use the same methodology (i.e., emission factors, assumptions, calculations, data, etc.) as Shell used to compile Exhibit A, and the emissions from the TEGFs shall be based on a destruction efficiency of 98%/99%.

c. The Monthly Emissions Report shall be submitted to the Department on or before the 22nd day of the following month (or, if the 22nd day falls on a weekend or holiday, the first business day following the weekend or holiday).

d. Each Monthly Emissions Report shall be submitted with certification of a Responsible Official, as that term is defined in 25 Pa. Code § 121.1, stating the following “I certify that this data is accurate based on reasonable belief and inquiry.”

7. Emission Inventory. Within 30 days after the date of this Consent Order and Agreement, Shell shall update its emission reporting for 2022—required pursuant to 25 Pa. Code § 135.3 and Plan Approval, Section C # 19—to reflect 99/98% VOC destruction efficiency for the high-pressure flares.

8. Emissions Mitigation.

a. Shell shall take all reasonable and feasible measures to prevent exceedances of the Twelve-Month Emission Limitations—or reduce the magnitude of exceedances of the Twelve-Month Emission Limitations when it is not possible to avoid exceeding a Twelve-Month Emission Limitations—by reducing emissions of air contaminants.

b. When Shell submits the Monthly Emissions Report, *see* Paragraph 6, above, it shall also submit to the Department a Certification of a Responsible Official of Shell identifying the emission reduction measures employed in the preceding month and an estimate of the emissions avoided by these measures. The Certification shall state that “This information is accurate based on reasonable belief and inquiry.”

9. Commissioning Report and Flare Report

a. Within 180 days after the date of this Consent Order and Agreement, Shell shall submit a technical report (“Commissioning Report”), which evaluates the Commissioning process for the Facility, to the Department. The Commissioning Report shall:

i. identify the causes of the excess emissions;

- ii. identify sources where the excess emission occurred;
 - iii. identify measures that were employed to reduce or prevent excess emissions, and measures that were not, but could have been, employed to have reduced or prevented excess emissions;
 - iv. examine how frequently different pieces of process equipment and air pollution control equipment experienced upsets or malfunctions;
 - v. examine the operation of, and emissions from, TEGFs during Commissioning;
 - vi. evaluate whether the TEGFs control emissions to the degree predicted in Shell's applications for the plan approvals for the Facility;
 - vii. determine whether the flares were operated to reduce emissions to the maximum extent possible;
 - viii. identify how flare operations changed throughout Commissioning;
- and
- ix. identify causes of "black smoke," improper combustion, or non-optimal combustion observed from TEGFs and Elevated Flare.

b. Shell shall fully respond to any Department questions about, or comments on, the Commissioning Report within the time frame specified by the Department.

10. Malfunction Reporting and Evaluation.

a. When reporting malfunctions pursuant to Section C, Condition 18 of the Plan Approval, Shell shall follow the format in the document attached as Exhibit E. When the malfunction relates to flaring, Shell shall attach to the malfunction report gas flow data and GC/MS

data for the period of the malfunction and one hour before the event and one hour after. The GC/MS data shall identify the mole % and mass % for each constituent, and the heat value (BTU/ft³) for each constituent and for the combined gas stream.

b. For any malfunction reported pursuant to Section C, Condition 18 of the Plan Approval, Shell shall, within 30 days after written request of the Department, hire a third-party expert approved by the Department to review the malfunction report, conduct an inspection of the equipment involved in the malfunction, and provide the Department a report that: evaluates the root cause of the malfunction; identifies the resulting emissions or impacts of the malfunction; recommends corrective actions, if any; provides an opinion as to whether the Facility can continue to operate in accordance with the Plan Approval; and any other matters identified by the Department. The cost of the engagement of a third party by Shell on behalf of the Department required in this Paragraph 10.b. shall not exceed \$150,000 per year, unless otherwise agreed by the parties. An outstanding request, ongoing work, or a payment obligation under this Paragraph 10.b. shall not prevent termination of this Consent Order and Agreement under Paragraph 29, below, provided the parties enter into a separate agreement for the request, work, and/or payment.

11. Projects To Benefit Community Environment & Health (“Mitigation Projects”).

a. Shell shall set aside the sum of Five Million Dollars (\$5,000,000) to be used to fund or implement projects, which are determined in collaboration with the Department and with the participation of the Department’s Office of Environmental Justice, to benefit the environment, health and quality of life of the community near the Facility.

b. The Department may require that at least one of the projects shall provide for regular, independent, testing of the air quality in the vicinity of the Facility.

c. Within 60 days of the execution of this Consent Order and Agreement, Shell and the Department shall meet to develop a protocol for implementing Paragraph 11.a., above (“Community Project Protocol”). Among other things, the Community Project Protocol shall set forth Shell’s continuing roles in seeking, evaluating, and supporting projects, and Shell’s creation of a secure, interest-bearing escrow account with an escrow agent to be identified in the Community Project Protocol where the \$5,000,000 identified in Paragraph 11.a., above, shall be deposited.

12. Administratively Complete. For purposes of this Consent Order and Agreement, the term “Administratively Complete” means that the submission shall contain all applicable fees, modules, signatures, certifications/reports by applicable licensed professionals with all necessary laboratory analysis, plans, maps, drawings, specifications, and/or supporting calculations, and any other necessary information/documents of sufficient quality to merit a full technical review by the Department.

13. Submission of Documents. With regard to the TEGF Repairs Schedule, the Steam Report, the WWTP Report, and the Commissioning/Flare Report, the Department will review the document and will approve or disapprove the document, or portion thereof, in writing. If the Department disapproves the document, or any portion of the document, Shell shall submit a revised document to the Department that addresses the Department’s concerns within a time specified by the Department. The Department will approve or disapprove the revised document in writing. Upon approval by the Department, the document shall become a part of this Consent Order and Agreement for all purposes and shall be enforceable as such.

14. Civil Penalty Settlement.

a. Civil Penalty. Shell consents to the assessment of a civil penalty in the amount of \$4,935,023. This payment is in settlement of the Department's claim for civil penalties for the violations, as set forth below:

i. Exceedances of Twelve-Month Emission Limitations occurring prior to Execution of Consent Order and Agreement. For violations of the Twelve-Month Emission Limitations identified in Paragraph Q, above, Shell consents to the assessment of a civil penalty of \$ 4,775,023, as follows:

VOC: \$ 2,702,056

CO: \$ 1,028,362

NOx: \$ 802,440

HAP: \$ 242,165

ii. Visible Emissions, Failure to Follow Good Operating Practices and Other Violations. For Visible Emissions, Failure to Follow Good Operating Practices and other violations identified in Paragraphs NN, OO, PP, TT, XX, and BBB above, Shell consents to the assessment of a civil penalty of \$ 160,000.

iii. The amount of \$ 4,935,023 shall be paid in full within 20 business days of signing this Consent Order and Agreement. This payment is in settlement only of the Department's claim for civil penalties for the violations set forth in Paragraphs AA, CC through JJ, NN, OO, PP, TT, XX, and BBB. The payment shall be made by corporate check payable to the "Commonwealth of Pennsylvania – Clean Air Fund" and sent to the address identified in Paragraph 20, below, or by electronic funds transfer. Any costs of such electronic funds transfer

shall be Shell's responsibility.

Shell shall promptly inform the Department via e-mail when the transaction has been completed by electronic funds transfer. Notice shall be provided to the persons identified in Paragraph 20, below, and include the following information in the Notice:

- The name, address, phone number of the entity making payment;
- The Facility's permit number
- The Reference/Confirmation No. and Advice No. of the transmittal;
- The amount (\$) of the transfer;
- The date the transfer occurred; and
- The sending bank's Federal ID number

b. Exceedances of Twelve-Month Emission Limitations (other than CO_{2e}) occurring after Execution of Consent Order and Agreement. Shell consents to the assessment of civil penalties for future violations by the Department, as set forth below. The Department will not send a Notice of Violation to Shell for violations of the Twelve-Month Emission Limitations occurring between the date of this Consent Order and Agreement and December 2023.

For violations of the Twelve-Month Emission Limitations for periods ending in any month after April 2023, and before January 2024, Shell consents to the assessment of a civil penalty as follows:

For each air contaminant that exceeds the Twelve-Month Emission Limitation in a month the civil penalty shall be:

$$[(CER) \times PF \times F \times (1 + M/12)] = CP$$

CER – Portion of exceedance for each air contaminant attributable to the most recent month's emissions. CER equals the Twelve Month Cumulative Total Emissions for the prior month subtracted from the Cumulative Total Emissions for the current month. If the result is negative or zero, no penalty is due.

CP – Civil Penalty (in dollars).

PF – Penalty Factor (in dollars/pound)

VOC & NOx Emissions Exceedances

1. PF for Ozone Season (May 1 – September 30) 2.25/lb
2. PF for Non-Ozone Season 1.50/lb

CO Emissions Exceedances

PF = \$1.50/lb.

HAP Emission Exceedances

PF = \$6.00/lb.

Other Pollutants (excluding CO_{2e})

Use PF from TGD No. 273-4130-003 / June 2, 2012 / Page 5

F – Adjustment Factor = 1.1

M – Months in the past 12 months that Twelve-Month Emission Limitation was exceeded.

The payment shall be submitted to the Department when Shell submits the Monthly Emissions Report (*see* Paragraph 6.a., above), and payment shall be made by corporate check made payable to the “Commonwealth of Pennsylvania – Clean Air Fund” and sent to the address identified in Paragraph 20, below, or by electronic funds transfer as specified in Paragraph 14.a.iii., above.

15. Stipulated Civil Penalties.

a. In the event Shell fails to comply in a timely manner with any term or provision of this Consent Order and Agreement, Shell shall be in violation of this Consent Order and Agreement and, in addition to other applicable remedies, shall pay a civil penalty of \$1,000

per day for each violation within 30 days of the date of written notice from the Department. This Paragraph does not apply to any violations addressed pursuant to Paragraph 14.b.

b. Any payment under this paragraph shall neither waive Shell's duty to meet its obligations under this Consent Order and Agreement nor preclude the Department from commencing an action to compel Shell's compliance with the terms and conditions of this Consent Order and Agreement. The payment resolves only Shell's liability for civil penalties arising from the violations of this Consent Order and Agreement for which the payment is made.

16. Additional Remedies.

a. In the event Shell fails to comply with any provision of this Consent Order and Agreement, the Department may, in addition to the remedies prescribed herein, pursue any remedy available for a violation of an order of the Department, including an action to enforce this Consent Order and Agreement.

b. The remedies provided by this Paragraph and Paragraph 15 (Stipulated Civil Penalties) are cumulative and the exercise of one does not preclude the exercise of any other. The failure of the Department to pursue any remedy shall not be deemed to be a waiver of that remedy. The payment of a stipulated civil penalty, however, shall preclude any further assessment of civil penalties for the violation for which the stipulated penalty is paid.

17. Reservation of Rights. The Department reserves the right to require additional measures to achieve compliance with applicable law. Shell reserves the right to challenge any action which the Department may take to require those measures.

18. Liability of Operator. Shell shall be liable for any violations of the Consent Order and Agreement, including those caused by, contributed to, or allowed by its officers, agents,

employees, or contractors. Shell also shall be liable for any violation of this Consent Order and Agreement caused by, contributed to, or allowed by its successors and assigns.

19. Transfer of Site.

a. The duties and obligations under this Consent Order and Agreement shall not be modified, diminished, terminated or otherwise altered by the transfer of any legal or equitable interest in the Facility or any part thereof.

b. If Shell intends to transfer any legal or equitable interest in the Facility which is affected by this Consent Order and Agreement, Shell shall serve a copy of this Consent Order and Agreement upon the prospective transferee of the legal and equitable interest at least thirty (30) days prior to the contemplated transfer and shall simultaneously inform the Southwest Regional Office of the Department of such intent.

20. Correspondence with Department. All correspondence with the Department concerning this Consent Order and Agreement and any documents submitted under this Consent Order and Agreement shall be addressed to:

Mark Gorog, P.E. Air Quality Program Manager
Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222-4745
(412) 442-4000
mgorog@pa.gov

With a copy to:

Michael J. Heilman
Litigation Coordinator
Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive | Pittsburgh, PA 15222
Phone: 412.442.4262 | Fax: 412.442.4267
mheilman@pa.gov

21. Correspondence with Shell. All correspondence with Shell concerning this Consent

Order and Agreement shall be addressed to:

Kim Kaal, PG
Environmental Manager, Shell Polymers
Pennsylvania Chemicals Project
300 Frankfort Road, Monaca, Pennsylvania 15061
Phone: (724) 709-2467 | [REDACTED]
Email: Kimberly.kaal@shell.com
[REDACTED]

With a copy to:

Pierre M Espejo
Senior Legal Counsel
Shell USA, Inc.
LSPTIP – Safety, Environment & Asset Management
E0344E
150 N. Dairy Ashford
Houston, TX 77079
Phone: (832) 337-4611
Email: Pierre.Espejo@Shell.com

Shell shall notify the Department whenever there is a change in the contact person's name, title, or address. Service of any notice or any legal process for any purpose under this Consent Order and Agreement, including its enforcement, may be made by mailing a copy by first class mail to the above address.

22. Force Majeure.

a. In the event that Shell is prevented from complying in a timely manner with any time limit imposed in this Consent Order and Agreement solely because of a strike, fire, flood, act of God, or other circumstance beyond Shell's control and which Shell, by the exercise of all reasonable diligence, is unable to prevent, then Shell may petition the Department for an extension of time. An increase in the cost of performing the obligations set forth in this Consent Order and Agreement shall not constitute circumstances beyond Shell's control. Shell's economic inability to comply with any of the obligations of this Consent Order and Agreement shall not be grounds for any extension of time.

b. Shell shall be entitled only to the benefits of this paragraph if it notifies the Department within five (5) working days by telephone and within ten (10) working days in writing of the date it becomes aware or reasonably should have become aware of the event impeding performance. The written submission shall include all necessary documentation, as well as an affidavit from an authorized individual specifying the reasons for the delay, the expected duration of the delay, and the efforts which have been made and are being made by Shell to mitigate the effects of the event and to minimize the length of the delay. The initial written submission may be supplemented within ten working days of its submission. Shell's failure to comply with the requirements of this paragraph specifically and in a timely fashion shall render this paragraph null and of no effect as to the particular incident involved.

c. The Department will decide whether to grant all or part of the extension requested on the basis of all documentation submitted by Shell and other information available to the Department. In any subsequent litigation, Shell shall have the burden of proving that the

Department's refusal to grant the requested extension was an abuse of discretion based upon the information then available to it.

23. Severability. The paragraphs of this Consent Order and Agreement shall be severable and should any part hereof be declared invalid or unenforceable, the remainder shall continue in full force and effect between the parties.

24. Entire Agreement. This Consent Order and Agreement shall constitute the entire integrated agreement of the parties. No prior or contemporaneous communications or prior drafts shall be relevant or admissible for purposes of determining the meaning or extent of any provisions herein in any litigation or any other proceeding.

25. Attorney Fees. The parties shall bear their respective attorney fees, expenses, and other costs in the prosecution or defense of this matter or any related matters, arising prior to execution of this Consent Order and Agreement.

26. Modifications. No changes, additions, modifications, or amendments of this Consent Order and Agreement shall be effective unless they are set out in writing and signed by the parties hereto.

27. Titles. A title used at the beginning of any paragraph of this Consent Order and Agreement may be used to aid in the construction of that paragraph but shall not be treated as controlling.

28. Decisions Under Consent Order. Shell waives its rights to appeal to the Environmental Hearing Board any decision that the Department makes under the provisions of this Consent Order and Agreement, including a notice that stipulated civil penalties are due, which rights may be available under Section 4 of the Environmental Hearing Board Act, the Act of July

13, 1988, P.L. 530, No. 1988-94, 35 P.S. § 7514; the Administrative Agency Law, 2 Pa. C.S. § 103(a) and Chapters 5A and 7A; or any other provision of law. The Department agrees that any objection that Shell may have to any such decision may be raised as a defense in any Court where the Department enforces this Consent Order and Agreement.

29. Termination. The obligations but not the findings of this Consent Order and Agreement shall terminate when: (1) Shell has completed the obligations set forth in Paragraphs 3 through 10 of this Consent Order and Agreement; (2) Shell has demonstrated compliance with the Twelve-Month Emission Limitations for at least three (3) consecutive months; and (3) Shell has paid any outstanding civil penalties or stipulated penalties, and created an escrow for the Community Environmental Projects (Paragraphs 11, 14, and 15, above); or such earlier date if the Department determines in writing that termination is in the best interests of human health or the environment.

30. Execution of Agreement. This Consent Order and Agreement may be signed in counterparts, including counterparts transmitted by portable document format (.pdf), each of which shall be deemed to be an original and all of which together shall constitute one and the same instrument.

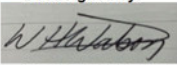
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IN WITNESS WHEREOF, the parties hereto have caused this Consent Order and Agreement to be executed by their duly authorized representatives. The undersigned representative of Shell certifies under penalty of law, as provided by 18 Pa. C.S. § 4904, that he is authorized to execute this Consent Order and Agreement on behalf of Shell; that Shell consents to the entry of this Consent Order and Agreement as a final ORDER of the Department; and that Shell hereby knowingly waives its right to appeal this Consent Order and Agreement and to challenge its content or validity, which rights may be available under Section 4 of the Environmental Hearing Board Act, Act of July 13, 1988, P.L. 530, 35 P.S. § 7514; the Administrative Agency Law, 2 Pa. C.S. § 103(a) and Chapters 5A and 7A; or any other provisions of law. Signature by Shell's attorney certifies only that the agreement has been signed after consulting with counsel.

FOR SHELL CHEMICAL APPALACHIA,
LLC:

FOR THE COMMONWEALTH OF
PENNSYLVANIA, DEPARTMENT OF
ENVIRONMENTAL PROTECTION:

William H. Watson
Operations Manager

DocuSigned by:

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Richard Negrin
Acting Secretary

Pierre M. Espejo
Senior Legal Counsel

DocuSigned by:

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Michael J. Heilman
Litigation Coordinator

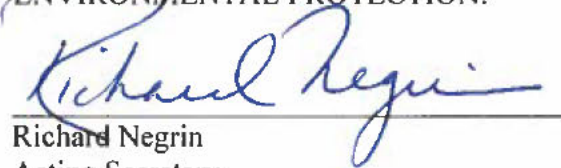
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FOR SHELL CHEMICAL APPALACHIA,
LLC:

William H. Watson
Operations Manager

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FOR THE COMMONWEALTH OF
PENNSYLVANIA, DEPARTMENT OF
ENVIRONMENTAL PROTECTION:



Richard Negrin
Acting Secretary

Michael J. Heilman

Michael J. Heilman
Litigation Coordinator

List of Malfunction Reports
Shell Polymers Monaca
Date: May 18, 2023

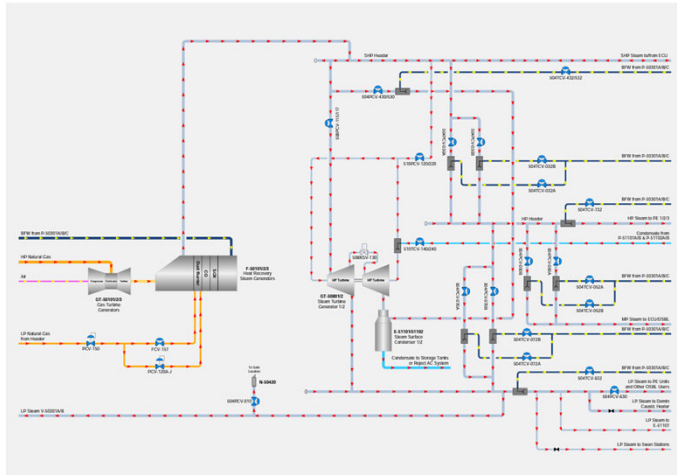
E&R ID	Unit Implicated	Incident Description	Incident Start Date	Incident Start Time	Incident End Date	Incident End Time	Initially Reported to PADEP Date	Date Final Malfunction Report Sent to PADEP
MAL1	PE3	PE3 reactor blowdown due to pump failure	9/3/2022	15:40	9/4/2022	17:15	9/16/2022	10/4/2022
MAL2	ECU	TEGF visible emissions	9/6/2022	~7:30	9/24/2022	09:00	9/6/2022	9/20/2022
MAL4-a/b	ECU	ECU Demethanizer Cold Drum 3 Leak During Startup - Flaring and Flange Leak	9/8/2022	14:25	9/8/2022	22:45	9/16/2022	10/7/2022
MAL5-a/b	ECU	ECU Cold Flare Drum Inlet Flange Leak V-19031 During Startup - Flaring and Flange Leak	9/8/2022	22:45	9/10/2022	9:26	9/16/2022	10/7/2022
MAL6-a/b	ECU	ECU ERC and CGC trip during startup and Reestablishing previous conditions	9/10/2022	9:26	9/13/2022	15:10	9/16/2022	10/11/2022
MAL7-a/b	ECU	ECU CGC Trip of 4th stage level transmitter failure and reestablishing previous conditions	9/15/2022	23:05	9/18/2022	12:02	9/16/2022	10/16/2022
MAL8-a/b	ECU	ECU P3R Compressor Low Suction P Trip and reestablishing previous conditions	9/18/2022	12:02	9/21/2021	2:01	9/18/2022	10/20/2022
MAL9-a/b	ECU	ECU AC Reactor Trip due to Methanol Drum High Level and reestablishing previous conditions	9/21/2022	2:01	9/24/2022	22:40	9/21/2022	10/22/2022
MAL10	UGF	Visible Emissions from CVTO Trip	9/25/2022	15:30	9/25/2022	16:50	9/26/2022	Report not submitted
MAL12	PE	PE3 reactor blowdowns due to circulation pump seal leak (HP Flare)	10/2/2022	14:30	10/2/2022	17:00	N/A	11/2/2022
MAL13-a-c	ECU	ECU Offspec Ethylene (Plugged C2 Inlet Strainer) Outage - Shutdown/Restartup	10/5/2022	19:15	10/22/2022	14:00	10/6/2022	11/16/2022
MAL15	ECU	Ethylene Tank BOG Compressor A & B Malfunction	10/17/2022	16:30	11/25/2022	08:15	10/21/2022	11/17/2022
MAL16	ECU	TEGF Smoke Malfunction	10/22/2022	15:34	10/22/2022	17:15	10/24/2022	Report not submitted
MAL17	ECU	ECU AC Reactor Malfunction (Elevated Flare)	10/24/2022	14:30	10/26/2022	16:30	10/24/2022	11/25/2022
MAL18-a	ECU	Furnace 2 Excess NOx	10/22/2022	14:00	10/23/2022	03:00	11/7/2022	11/23/2022
MAL18-b	ECU	Furnace 6 Excess NOx	10/22/2022	14:00	10/23/2022	04:00	11/7/2022	11/23/2022
MAL18-c	ECU	Furnace 4 Excess NOx	10/31/2022	4:47	10/31/2022	11:00	11/7/2022	12/1/2022
MAL20	UGF	Cogen Unit 2 Nox	11/5/2022	22:16	11/5/2022	23:16	11/7/2022	12/7/2022
MAL20	UGF	Cogen Units 1, 2, 3 Nox	11/7/2022	9:30	11/7/2022	10:30	11/7/2022	12/7/2022
MAL20	UGF	Cogen Unit 3 Restart Nox	11/17/2022	15:00	11/17/2022	20:00	11/21/2022	12/7/2022
MAL23	ECU/UGF	Malodor from WWTP (PFO)	11/7/2022	TBD	12/13/2022	TBD	11/7/2022	1/13/2023
MAL21	ECU	ECU AC Reactor Malfunction (Ground Flare)	11/15/2022	22:50	11/16/2022	5:32	11/17/2022	12/16/2022
MAL22	ECU	ECU C2 Offspec (Ground Flare)	11/20/2022	02:59	11/20/2022	07:17	11/21/2022	12/19/2022
MAL19	ECU/UGF	ECU SHP Steam Loss (Cogen Trip) AC Rx Offspec (Ground Flare)	11/28/2022	15:03	11/29/2022	23:50	11/29/2022	12/8/2022
MAL25	PE2	MPGF (PE1/2 Episodic) Visible Emissions During PE2 SD	12/14/2022	07:45	12/14/2022	08:30	12/15/2022	1/13/2023
MAL27	Site	Boiler Feedwater Loss and Site Shutdown Flaring (Elevated Flare)	12/24/2022	07:05	12/24/2022	11:50	12/24/2022	2/6/2023
MAL28	UGF	Cogen Units 1, 2, 3 CO (Recurring/Ongoing)	12/21/2022	00:00	12/28/2022	10:00	12/27/2022	1/23/2023
MAL29	UGF	Cogen Unit 3 Nox SCR Heater Trip	12/23/2022	13:15	12/23/2022	18:00	12/27/2022	1/23/2023
MAL30	UGF	Cogen Unit 2 Nox (Restart after Trip)	12/24/2022	11:38	12/24/2022	15:25	12/27/2022	1/23/2023
MAL31	UGF	Cogen Unit 1 Nox (Startup)	12/24/2022	5:50	12/25/2022	11:00	12/27/2022	1/23/2023
MAL32	UGF	SCTO Trip on Low Fuel Pressure (Regulator)	1/4/2023	20:38	1/10/2023	12:00	1/6/2023	2/9/2023
MAL33	ECU	ECU Demethanizer Malfunction (Ground Flare)	1/20/2023	7:17	1/20/2023	11:28	1/20/2023	2/6/2023
MAL34	ECU/UGF	Malodor from WWTP	1/25/2023	9:45	2/16/2023	13:58	1/25/2023	3/27/2023
MAL35	ECU	Furnace Nox Ammonia System Failure	2/1/2023	9:35	2/1/2023	10:35	2/3/2023	3/2/2023
MAL36	ECU	ECU AC Reactor Malfunction following Steam Generator SU	2/3/2023	2:17	2/3/2023	6:55	2/3/2023	3/6/2023

List of Malfunction Reports
 Shell Polymers Monaca
 Date: May 18, 2023

E&R ID	Unit Implicated	Incident Description	Incident Start Date	Incident Start Time	Incident End Date	Incident End Time	Initially Reported to PADEP Date	Date Final Malfunction Report Sent to PADEP
MAL37	PE	PE3 LPSR Blower Start CVTD Trip Shear Pin Passthrough NHV < 500 Btu/scf	2/11/2023	23:59	2/12/2023	9:21	2/13/2023	3/7/2023
MAL38-a-d and MAL39	ECU	ECU DCS Logic Issue CGC and AC Reactor Trip (Elevated Flare and TEGF B VE > 5 mins); UGF Cogen Unit 2 Nox (Site Steam System Upset)	2/13/2023	15:25	2/18/2023	3:33	2/13/2023	3/13/2023 and 3/15/2023
MAL42-a/b	ECU	ECU CGC High Level Trip Flaring (TEGF) (Shutdown/Restart Flaring)	3/14/2023	21:50	3/17/2023	15:30	3/15/2023	4/11/2023
MAL44	ECU	ECU Caustic Leak SD Flaring (TEGF) (VE > 5 Mins)	3/25/2023	14:00	3/26/2023	2:00	3/25/2023	4/25/2023
MAL45	ECU/UGF	Malodor from WWTP (FEOR A Low Level Hydrocarbons in Biotreater)	4/11/2023	15:30	4/20/2023	15:00	4/12/2023	5/18/2023
MAL46-a	ECU	UGF HPEF Liquid Seal Drum Damaged Downcomer Pipe (Blue Flame at HPEF/De-Inventory Plant)	3/17/2023	11:00	4/18/2023	9:00	4/22/2023	Forthcoming

Steam System on a Page

System Overview – Steam System Basics



- Combined cycle co-gen plant produces electrical power and steam from a single fuel source – natural gas.
- There are three Gas Turbine Generators (GTGs), three Heat Recovery Steam Generators (HRSGs), and two Steam Turbine Generators (STGs).
- The GTG produces electricity from natural gas and air, the HRSG recovers heat from GTG exhaust gas to produce SHP steam, and the steam is delivered to the STG to produce additional electricity and to start the Ethane Cracker Unit (ECU).
- Various control systems and let down stations supply the HP, MP, and LP steam header from the SHP steam source.

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Issues

- Steam system is extremely integrated and complex with multiple control inputs being able to handle steady state to multiple operating modes and trip events.
- When an upset occurs, steam has to get to the flare promptly to reduce visible emissions – it has to be in the right place, at the right time, in the right amounts (while not compromising the overall steam system and create larger upset event and emissions – which is very important to plant integrity and safety).
- Root cause for Elevated Flare smoking: There was insufficient steam pressure available to the flare stack due to response times and let down volumes available from high pressure steam to medium pressure steam (which is what feeds the flare stack).

Repairs to Address the Issues

- Steam to flare response reconfigured to seal pot bypass control valve rather than pressure control to accelerate the response time of delivering steam to the elevated flare.
- Performance of the steam supply system to the flare was assessed and improved using standard PID controller tuning methods to further accelerate the delivery of steam to the elevated flare.
- During the current shutdown, Shell updated controls to enable SHP-HP (Super High Pressure to High Pressure) and HP-MP (High Pressure to Medium Pressure) letdown stations to allow two stations to operate at once to increase the available steam required for the elevated flare to maintain smokeless conditions-(less than 5 mins smoke within a 2 hour period).
- Steam Simulation: In order to ensure the repairs have addressed the issue, two dynamic simulation tools (UniSim and DYNASIM) were used to simulate the amount of steam available and the time required for steam to be delivered between the SHP, HP and MP steam systems and eventually to the elevated flare. These simulations were calibrated against the Feb 13 smoking event to account for the actual conditions of the plant.
 - Simulation results suggest a minimum pressure requirement of 21.5 barg with steam delivered within the 5-minute requirement of the event triggering a flaring event at 84 T/h (maximum delivery of steam per design – worst case scenario).

EXHIBIT C



- Burners
- Flares
- Incinerators
- Combustion Systems

22151 East 91st Street
Broken Arrow, OK 74014 USA
Phone: 918-258-8551
Fax: 918-251-5519

www.zeeco.com
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Mark Gorog, P. E. Air Quality Program Manager
Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222-4745
(412) 442-4000
mgorog@pa.gov

May 18, 2023

Subject: Shell Monaca, PA Facility, Enclosed Ground Flares, Zeeco # 29205

Dear Mr. Gorog,

This letter is in specific reference to the two (2) enclosed ground flares that are currently installed at the Shell Monaca, PA facility. These enclosed flare systems were designed and supplied by Zeeco Inc. Zeeco has been working very closely with Shell in relation to some maintenance and repair work that was completed on this equipment, as well as planning for future permanent repairs. Zeeco are well aware of the current mechanical condition of these enclosed ground flares and considered them to be in good working order.

Considering the current mechanical condition of the flares, Zeeco can confirm both of these systems will achieve a minimum hydrocarbon destruction efficiency to meet Plan Approval Section D, Source 205, Condition 002 when operated in accordance with current Zeeco and other accepted industry guidelines for this type of equipment. As long as the current mechanical condition of the flares is maintained, destruction efficiency to meet Plan Approval Section D, Source 205, Condition 002 will be achieved, at least until the time that Shell makes permanent repairs to the enclosed ground flares, which Zeeco understands will occur within the next twelve (12) months. Zeeco makes this statement knowing that some of the burner stages are currently out of service; however, Shell is compensating for those stages that are out of service by derating the capacity of the flare systems. Even with those few stages out of service, Zeeco believes the enclosed ground flares will still meet Plan Approval Section D, Source 205, Condition 002 requirements.

As support for the above statements regarding destruction efficiency, in January 2023, Shell have performed optical testing at the jobsite using the Flare Guardian VISR technology, which showed very high destruction efficiencies. In addition, simultaneous optical and extractive sampling testing was performed during the week of May 8, 2023 on a smaller enclosed ground flare in the test facility at Zeeco Inc. using specific Shell Monaca burners, which show similarly high destruction efficiencies. Furthermore, the specific burner castings used in the flare systems at Shell Monaca have been sourced tested in the past for other projects under controlled conditions using extractive sampling per EPA guidelines when burning similar gases and achieved a HC DRE of over 99% consistently.

We hope the above information is helpful in demonstrating our view that the enclosed ground flares are in good working order at this time. Please let us know if you have any questions.

Sincerely,

Scot K. Smith
Director, Flare Division

EXHIBIT D

Exhibit D: Totally Enclosed Ground Flare System Overview

Dated May 23, 2023

System Overview:

- Each of the Totally Enclosed Ground Flares (TEGFs), A & B, consist of multiple burners that are arranged within an internally insulated radiation shield (enclosure). The shield conceals the flame and reduces noise, heat radiation, and protects the burner from the wind.
- Flare gas can be relieved from equipment at any time during operation. Therefore, it is important to have an ignition system that can initiate and maintain stable burning of flare gas.
- Flare gas is relieved in stages, every stage has multiple burners with different orifice diameters and burner quantity depending on the stage. Combustion waste is spread over 11 stages of burners to provide thorough mixing with air and promote smokeless combustion. The burners are activated based on flaring load driven by pressure.

Shell Polymers Monaca's (SPM) current operating and monitoring practices for TEGFs:

1. On a daily basis, visually check presence of flame in all burner tips on stages that are in service.
 - a. If flames cannot be confirmed in all the tips:
 - i. Escalate to Heat Transfer Engineer/Specialist;
 - ii. Heat Transfer Engineer/Specialist Possible Action: Contact drone company to help troubleshoot; and/or
 - iii. If Heat Transfer Engineer/Specialist confirms there is no presence of flame or determines the flame is unstable, Operations is given instructions to close and isolate the affected stage.
2. Look for coke build up in all stages from walkway above staging valves
 - a. If coke is identified:
 - i. Escalate to Heat Transfer Engineer/Specialist;
 - ii. Heat Transfer Engineer/Specialist Possible Action: Contact drone company to help troubleshoot if coke build up is affecting the flame stability; and/or
 - iii. If Heat Transfer Engineer/Specialist confirms the flame is unstable due to coke, Operations is given instructions to close and isolate the affected stage.
3. Look for damaged tips (i.e. cracks, bulging).
 - a. If damage is observed:
 - i. Escalate to Heat Transfer Engineer/Specialist; and/or
 - ii. If Heat Transfer Engineer/Specialist confirms the tip is damaged, Operations is given instructions to close and isolate the affected stage.
4. Listen for abnormal sounds coming from inside of the enclosure.
 - a. If abnormal sounds are identified:
 - i. Escalate to Heat Transfer Engineer/Specialist; and/or
 - ii. Heat Transfer Engineer/Specialist assists with troubleshooting and determines the course of action.
5. Look for discoloration of the coating on outside shell of the enclosure.
 - a. If discoloration is identified:
 - i. Escalate to Heat Transfer Engineer/Specialist;

- ii. Heat Transfer Engineer/Specialist assists with troubleshooting and monitor the casing temperatures using Infra-Red (IR) Thermography; and/or
- iii. If a hot spot is confirmed and identified by the Heat Transfer Engineer/Specialist then:
 - A Management of Change (MOC) is initiated to spray water on the affected area.
 - Operators monitor the position of the water on a daily basis, if wind has moved the location of the water stream, operators ensure the water is relocated to the affected area.
 - Heat Transfer Engineer/Specialist coordinates a drone inspection as necessary to determine the extent of refractory ceramic fiber modules (internal lining) damage.
 - Heat Transfer Engineer/Specialist works with maintenance to plan an outage to perform repairs as needed.

Issues:

- Floor to tip deviation: TEGF floors were built up to 6 inches lower compared to design causing a discrepancy in location of the floor with respect to the top of each burner tip. The improper location of the burner tips is due to construction errors as well as minor sagging caused during the initial start-up with the following impacts:
 - Overheating of the burner tip due to higher exposure to the flame radiation leading to
 - tip fouling (stages 1- 4)
 - coke formation of the tip
 - Ability to properly mix flare gas and air, leading to visible emissions (opacity)
 - Refractory ceramic fiber issues – Prevalent wind from the west is causing the flames to lean against the west side of the enclosure leading to overheating of the refractory ceramic fiber and metal enclosure producing hot spots.
- Visible Emissions (VE) are more prevalent during staging and de-staging.
 - Controls systems implemented led to staging and de-staging based on one simplified curve leading to unnecessary opening and closing of stages not intended per original design.

Actions to address issues to comply with Section D, Cond. No. 001, 002:

- During operator rounds some stages were found with coke build up and cracks.
 - After troubleshooting and evaluation of the condition, the following stages were blocked and isolated a couple of days after the findings:
 - Stages 1-4 in TEGF A
 - Stages 1-3 in TEGF B
- A specified flow rate was introduced as a result of taking stages 1-4 out of service. The specified flow rate continuous base load promotes the draft required for proper air and fuel mixing for flare gas combustion to maintain a high DRE.
- Replaced tips in stages two (2) and four (4) in both TEGF's. In stage 2, the tip heights were adjusted to align with the floor heights to minimize the risk of coking.
- The refractory was replaced and upgraded to address hot spots.
- Flare control systems were updated to allow for staging and de-staging based on multiple flare gas heating values. This control systems correction meets the intent of the original design

reducing the amount of stages open at one time therefore reducing visible emissions and reducing overheating of the refractory ceramic fiber.

- The flame stability is initially verified by Fired Equipment Engineer/Specialist using drones to ensure the stability of the flames is adequate.
- Computation Fluid Dynamics modeling is being utilized to determine any required improvements that might need to be implemented to prevent hot spots, coking and visible emissions in the future.

Conclusions:

- As set forth in the attached Zeeco letter dated May 18, 2023, DRE in accordance with Plan Approval Section D, Source 205, Condition # 002 is met during operation and the TEGFs are in good working order.
- The instances of intermittent visible emissions (VE) in form of light discoloration does not impact the ability to meet the minimum DRE in accordance with Plan Approval Section D, Source 205, Condition # 002 .
- The risk of coking in stages 4 -11 is low because the orifice size in burner tips stages 4-11 are much larger compared to stages 1-3, and are less susceptible to flame instability due to coke formation or tip damage. Replaced Stage 2 is located at the correct height, which should avoid coking and damage of flare tips.
- Hot spots that are mitigated with the use of water do not impact the ability to meet the DRE. The use of water is a common industry practice of mitigation prior to being able to repair the damaged refractory.
- The staging control systems correction based on multiple heating values meets the intent of the original design reducing the amount of stages open at one time therefore reducing visible emissions in accordance with Plan Approval Section D, Source 205, Condition #001.



Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

May 18, 2023

Director
Air Protection Section
Mail Code 3AP00
U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Mark Gorog P.E., Regional Manager Air Quality Program
Pennsylvania Department of Environmental Protection (PADEP)
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: Malfunction Report as per PA-04-00740C and National Response Center Report Incident ID# 1364790 for Malodors and Excess Emissions from Wastewater Treatment Plant (WWTP) Shell Chemical Appalachia LLC

Dear Mr. Gorog,

Shell Chemical Appalachia LLC (“Shell”) is submitting this Malfunction Report to the Pennsylvania Department of Environmental Protection (PADEP) for malodors detectable outside the property from the waste water treatment plant (WWTP) (Source ID 502).

This malfunction did not pose danger to the public health and safety or the environment. Shell initiated offsite observations by Shell personnel, and also third-party contractors both on the river and surrounding community areas. Odors were reported offsite periodically throughout the duration of the malfunction. However, no sheen or other indications of impaired water quality was observed on the river at the outfall indicating that hydrocarbons were not entering the environment to the river. A third party contractor monitored the condition of the river during the times when Shell was discharging through Outfall 001. And, a separate third-party contractor conducted offsite odor surveys and hydrocarbon sampling encompassing Route 18 west to Raccoon Creek and east to Beaver Valley Mall area, 376 south to Route 18 and North to Vanport area, and Route 68 west to Lockhouse 6 restaurant and east to Vanport and Beaver areas. Offsite community monitoring with portable analyzers did not indicate the presence of VOCs greater than the background threshold and minimum detection levels.

- **Name and location of the facility**
Shell Polymers Monaca
300 Frankfort Road, Monaca PA, 15061
- **Nature and cause of the incident**
Malodors were detected outside the property. Cause of the odors was hydrocarbons in the WWTP biotreaters.

- **Time when the malfunction or breakdown was first observed**
April 11, 2023 at ~16:30 when a malodor was first detected offsite
- **The date and time that the malfunction started and ended**
April 11, 2023 at 14:30 and ending on April 20, 2023 at 15:00 when a malodor was last detected offsite
- **An estimate of the emissions associated with the malfunction**

Pollutant	Emission Rate (tons) ^a	Emission Rate (lbs)
VOC	1.82	3,633
HAP (Total)	1.09	2,182
Benzene	0.22	444 ^b
Toluene	0.85	1,705
Napthalene	0.01	24

a – Emissions estimate undergoing final QC.

b – The initial estimated 24-hr benzene release was 300 lbs as described in the calculations below. The final estimated 24-hr benzene release was 219 lbs and a subset of the total 444 lbs based on the final calculations.

- **The calculations that were used to determine that quantity**

Excess emissions for this malodor event have been calculated by applying biotreater aeration rates to concentrations of VOC and benzene measured on top of the biotreaters during the malfunction. Aeration rate represents the volumetric rate of flow of air introduced at multiple points across the bottom of the biotreater aeration basins and then flowing up through liquid contained in the biotreaters and exiting at the surface level. This flow is converted to standard cubic feet per minute (scfm) using the average measured air temperatures from the on site meteorological station. VOC and benzene concentrations are parts per million by volume (ppmv) as measured periodically by handheld photoionization detector (PID) analyzer. Measured hydrocarbon concentrations and the known aeration rate are then converted to a mass emission rate through multiplication of the molecular weight (MW) of benzene or surrogate representative MW for VOC and division by the standard volume of air in a pound mole (lbmol). Fenceline monitoring data results during the incident period have been applied to estimate other hazardous air pollutants (HAPs) released during the event including toluene and naphthalene.

Use of the WATER9 WWTP emissions estimation model was not considered to be viable for this calculation due to the lack of a representative inlet water sample to the biotreaters. An inlet sample was not able to be taken as the initial discovery of the incident did not occur until flow into the biotreaters had already ceased and this was outside of regularly scheduled periodic water sampling. Additionally, water flow into the biotreaters ceased during this incident and WATER9 does not produce an emission rate under zero flow conditions.

Initial emission estimates were performed using a Shell internal dispersion model known

as FRED (for fire, release, explosion, dispersion consequence modelling) with the measured VOC and benzene concentrations on top of the biotreaters and at the fence line continuous VOC monitors as inputs and guiding data. This is a gaussian model treating the biotreaters as the point of release and modeled a max release rate of 0.02 kg/s of VOC of which 10% was estimated as benzene based on the ratio of monitored benzene to VOC at the time. Max rates were assumed for a 12-hour period and then reduced by 50% for the subsequent 12 hours consistent with the timeline for observed reductions in measured concentrations. This arrived at a 24-hour benzene release quantity of 300 lbs (with a small margin added for conservatism). It was checked against prior worst case WATER9 model runs, found to be reasonably close to those prior worst case results, and considered to be acceptable for purposes of initial reporting. It was not considered acceptable for purposes of final reporting as the FRED model relies on simplified terrain and other assumptions, and estimating the release directly from the source was considered to be the more accurate approach with the available data.

The reportable quantity (RQ) per CERCLA and EPCRA for benzene is 10 lbs within a 24-hour period. While the WWTP is a permitted air emissions source of benzene to the atmosphere, this release was sudden and unplanned and the estimated 24-hr emission rate was determined to be exceeding the expected maximum under the air permit basis.

Calculations have been included as Attachment A.

- **A detailed analysis that sets forth the Root Cause of the malfunction, to the extent determinable**

Root cause has been determined to be failure of the liquid level indicator in FEOR A to read accurately at low liquid levels. Liquid level indication maintained steady at approximately 2.8 meters of liquid level within FEOR A while normal pumping of FEOR A out to the biotreaters continued and actual liquid level continued to drop (FEOR B was being filled with incoming wastewater at this time). This resulted in pumping higher levels of hydrocarbons from FEOR A into the biotreaters. The liquid level indication of 2.8 meters was higher than both of the low level alarms and the pump interlock level setting in place which are above the designed minimum level indication. Alarm would have alerted the operator of the low liquid level in time to take preventative action while interlock would have automatically shut down the biotreater feed pump to prevent the FEOR A tank dropping to this low level. These alarm and interlock levels were set at 1.57 meters and 1.5 meters, respectively.

The liquid level indication is provided by guided wave radar instrumentation (597LIT-100) transmitting a microwave pulse down a probe spanning the top to bottom of the tank internally. Design minimum accurate level indication is 0.2 meters, however it does not actually read below ~2.8 meters. The root cause of the frozen and inaccurate liquid level indication is still under investigation pending full inspection of the level indicator to determine the deeper root cause.

- **The steps, if any, that the facility took to limit the duration and/or quantity of emissions associated with the malfunction**

Odors were minimized through the isolation of both FEOR Tanks A and B from the biotreaters until the situation could be assessed. This prevented introducing any

additional hydrocarbon-containing wastewater into the biotreaters immediately after the initial discovery. Initial discovery was upon tripping biotreater feed pump (P-59704B) offline due to low flow and Operations detecting increased odors at the biotreaters. The inlet flow of relatively low-hydrocarbon wastewater to the FEOR tanks was switched from FEOR B to FEOR A. This allowed the actual liquid level in FEOR A to raise above 2.8 meters and reestablish what was believed to be a reliable level indication for operational control. Liquid level in FEOR A was further raised to 5.0 meters and then flow of relatively low-hydrocarbon wastewater from FEOR A into the biotreaters was reestablished while maintaining a higher level indication.

Odors were minimized also through ongoing vacuuming of the top of the biotreaters by third party contractor to remove excess oils and hydrocarbons. Excess oils and hydrocarbons were transported from the site for eventual disposal as a waste at a non-Shell site.

- **An analysis of the measures, if any, that are available to reduce the likelihood of a recurrence of a malfunction resulting from the same Root Cause or contributing causes in the future**
 1. FEOR tank liquid level indicator low level alarms and interlock settings have been raised above the actual minimum accurate liquid level indication of 597LIT-100. These are now set at 4 and 3.5 meters respectively, and will mitigate and prevent the recurrence of this incident. This will provide early operational awareness to correct FEOR levels before low level is reached. This will automatically shut off pumps from FEOR to biotreater and prevent pumping to a low level where higher levels of oils and hydrocarbons could be present.
 2. Shell intends to continue this investigation and make repairs or replacement of the liquid level instrument to restore it to the full design range. This will be contingent upon final determination of the root cause of the failure. Additionally, a second level indicator is under design for installation as a redundant indication. This is also contingent upon final determination of the root cause of the failure of the original instrument. Both actions will reduce the likelihood of a recurrence.
 3. Prior to this incident, Shell commissioned a project to design and install a temporary enclosed induced nitrogen flotation (INF) system to improve and increase hydrocarbon/oil removal capacity in the WWTP. This includes some N₂ stripping functionality that further enhances the remove any volatile hydrocarbons. Separated hydrocarbons will be routed to the recovered oil tank and overhead vapors from the enclosed system routed to the spent caustic thermal oxidizer consistent with the original design intent of the WWTP. Approval has been received from the PADEP Water Quality Program and Air Quality Programs for this temporary installation. The WEMCO Depurator had been received and undergoing on-site installation at the time of this incident. It has since completed installation and functionality testing and been placed into service. Odors in the future will be minimized by the reduction of hydrocarbons entering the biotreaters and destruction of vapors in the thermal oxidizer. Performance of this temporary project is being evaluated for potential design of a similar permanent system.
- **To the extent that investigations of the causes and/or possible corrective action(s) still are underway on the due date of the report, a statement of the anticipated date**

by which a follow-up report will be submitted

Investigation into this malfunction is not yet final and a follow up report will be submitted no later than July 1, 2023

- **Corrective action is final or timeline for implementation**
 1. Liquid level low alarms are final and interlock corrective actions are expected to be completed by June 1, 2023.
 2. Installation of a second liquid level indicator is pending final design and identification of the specific cause of failure of the original indicator. This is expected to be completed by June 1, 2023.
 3. Installation and operation of the temporary INF (WEMCO Depurator) unit is final. (This is under temporary approval by the PADEP Water and Air Quality Programs pending evaluation and permitting for a permanent future addition)

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly J. Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Beth Speicher, Environmental Group Manager

Attachment A
Emissions Calculations

WWTP Aeration Rate Emission Calculation

Basis:

Emissions were calculated by applying hydrocarbon concentration measurements on top of the biotreaters to the aeration rate of the biotreaters. Measured concentrations are periodic readings by portable PID analyzer. Calculations begin at 14 30 as the approximate earliest time of abnormal levels of hydrocarbons entering the biotreaters. Hydrocarbon concentration inputs are not changed until a new reading is taken. This adds conservatism to the estimate as measured concentrations decay over time. The initial actual VOC reading was taken at approximately 19 30 and was extrapolated backwards to 14 30 based on the 19 30 benzene to VOC ratio applied to the earliest actual benzene reading. Other HAP emissions are estimated using the ratios of 4/13 fenceline PAMS results which sampled during the peak release. The MW of VOC is applied as toluene as it is the highest concentration measured at the fenceline. This calculation is continued until benzene readings at the top of the biotreaters reach 0 ppmv and VOC readings reach single digit ppmv upon which time WATER9 model calculations will resume based on representative water inlet samples as normal operations.

Formula:

$$Em = (Ec * Q * 60 * MW) / (385.3 * 10^6)$$

Where:

Em Mass emissions rate in lb/hr

Ec Measured emissions rate in ppmv

Q Volumetric flow rate in scfm

MW Molecular weight in lb/lb-mol

Constants:

78.11	lb/lb-mol (Benzene MW)
92.14	lb/lb-mol VOC MW (as toluene)
1.711	m3/s (biotreater aeration rate, per biotreater)
35.3147	R3/m3 standard conversion
60.4234517	R3/s (biotreater aeration rate, per biotreater)
3625.407102	cfm (biotreater aeration rate, per biotreater)
385.3	scf/lb-mol standard @ 68F and 1atm
528	R (standard temperature 460R + 68)
60	min/hr
1000000	ppmv
2	# of biotreaters

Fenceline PAMS 4/13 HAP Ratios:

0.781	Toluene
0.204	Benzene
0.011	Naphthalene
0.002	1,3-Butadiene
0.002	Hexane

Emission Calculations:

Start Time	End Time	Hours	Measured Benzene Concentration	Measured VOC Concentration	Biotreater Top Air Temperature Avg	Aeration Rate	Benzene Mass Rate	VOC Mass Rate	Benzene Mass Total	VOC Mass Total	Benzene/VOC Ratio	PAMS Benzene Ratio	Napthalene Mass	1,3 Butadiene Mass	Toluene Mass	Hexane Mass	Remaining Unspectiated VOC Mass
MM/DD/YYYY TT TT	MM/DD/YYYY TT TT	#	ppmv	ppmv	F	scfm	lb/hr	lb/hr	lbs	lbs	#	#	lbs	lbs	lbs	lbs	lbs
4/11/2023 14 30	4/11/2023 19 30	5	199	1931	72.15	3597.10	8.71	99.68	87.07	996.76	0.09	0.20	4.66	1.03	334.19	0.90	568.92
4/11/2023 19 30	4/12/2023 3 00	7.5	105	1019	54.69	3719.16	4.75	54.38	71.25	815.66	0.09	0.20	3.81	0.84	273.47	0.74	465.55
4/12/2023 3 00	4/13/2023 10 00	31	100	494	61.97	3667.28	4.46	25.99	276.56	1611.62	0.17	0.20	14.80	3.26	1061.51	2.86	252.63
4/13/2023 10 00	4/16/2023 20 00	82	1.1	23	67.92	3625.92	0.05	1.20	7.96	196.24	0.04	0.20	0.43	0.09	30.54	0.08	157.15
4/16/2023 20 00	4/17/2023 10 00	14	1	6	49.44	3757.47	0.05	0.32	1.28	9.06	0.14	0.20	0.07	0.02	4.91	0.01	2.77
4/17/2023 10 00	4/18/2023 10 00	24	0	1.4	42.40	3810.17	0.00	0.08	0.00	3.67	0.00	0.20	0.00	0.00	0.00	0.00	3.67
Sum Total									444.12	3633.02			23.77	5.23	1704.62	4.59	1450.69