Region 2 Enforcement & Compliance Assurance Division
Air Compliance Branch

CAA Inspection Report

Inspection Date: 10/29/2021

Facility Name: PHILLIPS 66 CO BAYWAY REFINERY

Facility Address: 1400 PARK AVE, LINDEN, NJ 07036

ICIS-Air ID #: NJ0000003403941805

Facility Contact: Meghan Nolan, 908-523-5138, Meghan.E.nolan@p66.com

EPA Lead Inspector: Harish Patel, Environmental Engineer

EPA Asst. Inspector: Ralph Lonergan, Environmental Engineer

State Inspector(s): N/A

Pertinent Regulatory Requirements

The Bayway facility operates under a Title V operating permit (permit No. BOP200001), which became effective March 1, 2021. The permit specifies emission limits, testing, monitoring, recordkeeping, reporting, and other specific operating requirements. According to the permit, the facility is subject to federal regulations including, but not limited to:

- 40 Code of Federal Regulations (CFR) Part 60, Subparts Ka, Kb, J, Ja, VV, VVa, DDD, QQQ, and IIII
- 40 CFR Part 61, Subparts J and V
- 40 CFR Part 63 Subparts R, Y, CC, WW, UUU, and DDDD

According to EPA's Enforcement and Compliance History Online (ECHO) website, the last on-site inspection of Bayway for CAA requirements was conducted by the New Jersey Department of Environmental Protection (NJDEP) in January 2021.

Summary of Observations

From October 25-29, 2021, inspectors from U.S. Environmental Protection Agency (EPA) Region 2 and EPA's National Enforcement Investigations Center (NEIC) conducted a compliance investigation of the Phillips 66 (Phillips 66) Bayway Refinery (Bayway), located at 1400 Park Avenue in Linden, New Jersey. The regulatory scope was to evaluate compliance with requirements in the Title V permit and underlying applicable Clean Air Act (CAA) regulations. Below are tables of the EPA inspectors and the primary Phillips 66 representatives present during the inspection.

Table 1. EPA Inspectors	
Team Member	**Organization**
Harish Patel	EPA R2
Ralph Lonergan	EPA R2
Supriya Rao	EPA R2
Omer Sohail	EPA R2
Hans Buenning	NEIC
Armando Bustamante	NEIC
Laura Kanopkin	NEIC
Zel Nabiyar	NEIC
Matthew Schneider	NEIC

Table 2. FACILITY CONTACT INFORMATION		
Name, Title	**Phone No.**	**Email Address**
Meghan Nolan, Environmental Team Lead	908-523-5138	Meghan.E.nolan@p66.com
Sathish Pushpala, Environmental Engineer	908-523-5419	Sathish.Pushpala@p66.com
George Bakun, Environmental Engineer	908-523-5896	George.Bakun@p66.com
Chris Gallo, Refinery Manager	908-523-5896	Chris.J.Gallo@p66.com

A. FACILITY OPERATIONS SUMMARY

Bayway processes about 258,000 barrels per day of crude oil. Products include transportation fuels, petrochemical feedstocks, home heating oil, and residual fuel oil. Standard Oil originally commissioned the refinery in 1909 with a capacity 10,000 barrels per day. After a series of expansions, Phillips Corporation acquired the refinery in 2002. Then, following a series of corporate restructurings and name changes, Phillips 66 assumed ownership in 2012. Recent plant modifications include the construction of a new polypropylene plant in 2003 and refinery upgrades to meet Tier 3 gasoline requirements from 2017-2018.

Crude oil is supplied to Bayway by tanker from Canada and West Africa, and U.S.-advantaged crude is supplied by rail and marine transport. Products include transportation fuels (gasoline, diesel, and aviation fuel); petrochemical feedstocks; home heating oil; and residual fuel oil.

Bayway produces approximately 145,000 barrels per day of gasoline and 115,000 barrels per day of distillate fuel. Modes of transport of these products to various East Coast customers include marine vessel, truck, pipeline, and railcar. Normally, about one-third of the total product is shipped via Bayway’s two truck loading terminals (Linden and Tremley Point terminals), one-third via the Buckeye pipeline connection, and one-third via Bayway’s marine loading dock.

Phillips 66 stores crude oil in tanks prior to processing. Bayway refining units include two crude distillation units, one solvent de-asphalting unit, a fluid catalytic cracking unit (FCCU), three hydrodesulfurization units, a naphtha reformer (referred to as a powerformer), an alkylation unit, a polymerization unit, an isomerization unit, a benzene saturation unit, a light olefins recovery unit (LORU), and other associated processing units. The light fractions from distillation, such as propane, naphtha, kerosene, and diesel, are either processed further or used as finished-product blending stocks. An on-site sulfur recovery plant serves the refinery but is operated by a third party.

Phillips 66 uses six elevated flares located at the refinery–ABW, CLEU, poly, east side, ARV, and acid gas flares–to dispose of waste gas streams. Acid gases generated at Bayway are normally sent to the third-party sulfur recovery plant, which operates two separate flares. Phillips 66's acid gas flare is used to dispose of refinery acid gas only in emergency situations when both flares at the sulfur recovery plant are down. The remaining five flares operate as three separate systems, with some ability to interconnect in certain situations. The three non-acid gas flare systems are the main refinery flare grid, ARV flare, and east side flare.

The main refinery flare grid is composed of three flares in a cascaded flare system: ABW, CLEU, and poly. The ABW flare is the primary flare in this system, with the lowest seal height. During large flaring events, the flow also is directed to the secondary CLEU and poly flares. The main refinery flare grid primarily serves section A, section B, section C, and the oil movements areas of the refinery. These areas include most of the main process units in the refinery, the utilities, and storage caverns.

The ARV flare was constructed as part of an atmospheric relief valve mitigation project in 2014. Atmospheric relief valve discharges from 12 operating units throughout the refinery are collected and routed to a closed 36-inch flare header and combusted at the ARV flare. The ARV flare was installed to safely dispose of the discharges from these pressure relief valves in a scenario such as a power and cooling water failure.

The east side flare is typically not connected to the rest of the main refinery flare grid. It only provides an outlet for the following process units: propane-propylene fractionator (PRBW), butylene isomerization and fractionator (BIBW/BFBW), fuel gas units, LORU, and the polypropylene plant (PPBW). If the east side flare needs to be taken out of service for maintenance, the east side flare header can be lined up to the main refinery flare grid.

Phillips 66 employs a vacuum line system at Bayway that recovers excess gases from various low-pressure units throughout the refinery that feed the main refinery flare grid and east side flare. The vacuum line compressor and associated equipment compress and condense system gases and return them as high-pressure liquid and gas streams to selected refinery units for reprocessing. This system is designed to minimize process gas flow to flare headers, but since the recovered gas is collected upstream of the flare headers, the vacuum line system is not a traditional refinery fuel gas recovery system. According to Phillips 66, the vacuum line system captures most of the light end waste gases in the refinery. However, waste streams from certain processes do not have a viable outlet other than the flare grid headers downstream of the vacuum line compressor, because they do not have an outlet to the vacuum line system. According to Phillips 66, other streams not connected to the vacuum line are composed mostly of nitrogen and are not recoverable.

Phillips 66 manages oil-contaminated refinery wastewater by segregating the higher- concentration oily waste streams from the lower-concentration streams. Many of the higher- concentration streams are treated in the process wastewater stripper (also called the benzene stripper) prior to discharge into the sewer system. Higher-concentration waste streams treated in the benzene stripper include desalter effluent water, closed system equipment blowdown streams that are collected in the slop spheres (tanks 53 or 59), and a waste stream from the powerformer waste collection drum. Several other waste streams that contain higher benzene concentrations at the points of waste generation are managed and treated in tanks that separate the organic layer from the aqueous waste and return the organic layer to the process. These wastes include spent caustic waste (collected in tank 105) and tank water draws (collected in tanks 52, 134, and 595). Aqueous wastes separated from the organic layers in these tanks are discharged to the uncontrolled sewer system. Lower-concentration streams from throughout the refinery are also sent directly to the sewer system and managed in the facility wastewater treatment system.

The sewer system first routes wastewaters to an American Petroleum Institute (API) oil-water separator. The API oil-water separator forebay is covered with a fixed roof, the main bays are covered with concrete, and the afterbay is uncovered. Hydrocarbon vapors from the covered portions of the API oil-water separator are evacuated with nitrogen gas and routed to a thermal oxidizer, or carbon canisters if the thermal oxidizer is down. Neutralization, equalization, biological treatment, and clarification stages complete the treatment process prior to discharge.

B. FIELD ACTIVITIES SUMMARY

On October 25, 2021, EPA inspectors conducted an opening meeting and presented credentials to Meghan Nolan, Phillip 66's environmental team lead.

The scope of the CAA inspection was to determine compliance with applicable CAA regulations, including 40 CFR Part 63, Subpart CC (Refinery MACT), specifically sections related to emissions standards for equipment leaks, wastewater, storage vessels, gasoline loading racks, and flaring. NEIC also evaluated compliance with wastewater management unit requirements specified in 40 CFR Part 61, Subpart FF. NEIC inspectors performed LDAR monitoring using toxic vapor analyzers (TVAs) and conducted an infrared camera (IR camera) survey of several process units within the refinery.

1. Equipment Leaks

Phillips 66 contracts with ConSerTech, Inc. (ConSerTech) to perform monitoring of equipment subject to LDAR requirements. ConSerTech has been the LDAR contractor at the Bayway refinery for approximately 15 years. ConSerTech personnel perform monitoring using Thermo Scientific™ TVA 1000 flame ionization detection instruments. When leaks are identified, ConSerTech personnel are authorized to make a first attempt at repair on gate valves that are 6 inches in diameter or greater. For all other equipment leaks and leaks that cannot be addressed with a first attempt, a work order is generated to notify Phillips 66 operations personnel to perform these repairs. ConSerTech personnel re-monitor equipment following the first attempt at repair and to confirm final repair.

Phillips 66 is under a consent decree (Civil Action No. H-05-0258) that requires quarterly monitoring of valves and monthly monitoring of pumps using a leak definition of 500 parts per million (ppm) for valves and 2,000 ppm for pumps. Phillips 66 is using a 1,000-ppm leak definition for pumps, as required by the Title V permit ("Facility Specific Requirements," FG1, Ref. #2, NJAC 7:27-16.18 (d)). NEIC and EPA Region 2 inspectors conducted monitoring in three process areas. The LDAR monitoring effort in these units was used to provide training to EPA Region 2 and NEIC inspectors, so traditional comparative monitoring was not performed. EPA inspectors notified Phillips 66 escorts and ConSerTech personnel of each leak identified, and ConSerTech personnel verified all leaks with their instruments during the on-site inspection.

2. Wastewater

Phillips 66 has a total annual benzene (TAB) quantity in facility waste greater than 10 Megagrams (Mg) per year and, therefore, is subject to the control requirements of the Benzene Waste Operations National Emissions Standards for Hazardous Pollutants (BWON). The facility has chosen the compliance option in 40 CFR § 61.342(e), also known as the "6BQ" compliance option. Under the 6BQ compliance option, benzene containing waste streams must be controlled and treated such that the total benzene quantity in the treated waste plus any uncontrolled wastes at the facility is less than 6 Mg/year. For wastes to be considered controlled, they must be managed in compliant waste management units, as specified in 40 CFR §§ 61.343-§ 61.348. The total benzene quantity for each controlled waste is determined at the point it exits the last compliant waste management unit, while the total benzene quantity for uncontrolled wastes is determined at the individual points of waste generation.

As mentioned above, Phillips 66 manages the benzene waste by segregating the higher- concentration benzene waste streams from the lower-concentration streams. The higher- concentration streams are treated in the benzene stripper prior to discharge to the sewer system, which, for purposes of BWON compliance, Phillips 66 considers to be uncontrolled. The stripper effluent is considered treated wastewater and is the location where the benzene quantity in the waste is counted toward the 6 Mg/year limit.

Several other waste streams that contain higher benzene concentrations at the points of waste generation are managed in tanks that separate the organic layer from the aqueous waste and return the organic layer to the process. Most of the benzene in these wastes is contained in the organic layer, and the aqueous layer is considered uncontrolled at the discharge of the tank into the sewer system, where the benzene quantity is counted toward the 6 Mg/year limit.

These wastes include spent caustic waste (collected in tank 105) and tank water draws (collected in tanks 52, 134, and 595). Other waste streams throughout the facility are considered uncontrolled, and the benzene quantities counting toward the 6 Mg/year limit for those waste streams are determined at the individual points of waste generation.

EPA inspectors inspected various wastewater collection streams and process units, including the benzene waste sources managed in the process wastewater stripper; the stripper itself; tanks 52, 53, 105, 134, and 595; and the API oil-water separator. NEIC inspectors used IR cameras and TVAs to inspect and verify any emissions observed from these units.

3. Truck Loading Rack

Phillips 66 operates an 11-bay truck loading rack at the Tremley Point terminal. Nine bays are used for gasoline and diesel loading, and two bays are used for ethanol off-loading. A separate truck loading rack includes three additional bays for propane loading and one for butane loading. NEIC focused on vapor return lines from tankers and their connections, which are part of a closed-vent system. Vapors are normally routed to a vapor recovery unit (VRU) and vapor combustion unit (VCU), but due to maintenance on these units, vapors were being routed to a temporary portable VCU at the time of the inspection. NEIC inspectors used IR cameras and observed emissions from vapor return line connections while the trucks were being loaded with gasoline. NEIC inspectors used TVAs to confirm and establish leak concentrations at the vapor return line connections. NEIC inspectors also identified potential uncombusted hydrocarbons from the temporary VCU.

4. Storage Vessels/GMAP Follow-Up Area

In addition to the tanks used for managing wastewater streams (described above), EPA inspectors inspected several above-ground storage tanks at the refinery that store petroleum products. Access to some storage tanks was limited or not possible due to recent heavy rains, which filled tank berm areas with water. Two weeks before the inspection, NEIC conducted a Geospatial Measurement of Air Pollution (GMAP) survey of the facility. This inspection included a follow-up IR camera survey at ground level for two internal floating roofs tanks storing gasoline (tanks 608 and 609), where GMAP detected elevated concentrations of volatile organic compounds (VOCs) nearby. Although the sky background conditions were overcast and not favorable for IR camera surveys of these tanks, NEIC inspectors identified some emissions using an IR camera from tank 609. NEIC inspectors also conducted IR surveys of other tanks of interest, including a reformate tank (tank 238) and other intermediate petroleum product storage in the same tank farm. These were all external floating roof tanks, and NEIC inspectors used an IR camera to conduct optical gas imaging of external floating roofs and associated components for these storage tanks from the platform at the tank tops. NEIC inspectors did not observe notable emissions from these external floating roof tanks. Due to very limited tank berm access, NEIC inspectors could not perform LDAR monitoring of storage tank components and the covered drain systems for water draws for storage tanks.

5. Flaring

As noted above, Phillips 66 operates six elevated flares located at the refinery–ABW, CLEU, poly, east side, ARV, and acid gas–to dispose of waste gas streams. Each flare is designed as a steam-assisted elevated flare, except for the acid gas flare, which is an unassisted flare and is used only in emergency acid gas flaring situations. The five steam-assisted flares operate as three separate systems, with some ability to interconnect in certain situations. The three non- acid gas flare systems are the main refinery flare grid, ARV flare, and east side flare.

Each flare system generally serves different areas and process units within the refinery and is normally operated independently. Bayway personnel use a calorimeter to measure the heat content of flared gas at each individual flare. All flares are equipped with ultrasonic flow monitors. Bayway uses a gas chromatograph to measure hydrogen sulfide at the ABW flare (only for the cascading main refinery flare grid) and the ARV and east side flares. NEIC inspectors surveyed each flare using an IR camera to observe any potential uncombusted hydrocarbons. Based on NEIC's observations with the IR camera, there were not excessive uncombusted hydrocarbons during the time of those observations.

EPA inspectors visited the control room of the main refinery flare grid and observed live flare operating parameter data (e.g., fuel gas flow rate, hydrogen sulfide concentration, and net heating value of gases at the combustion zone) for the ABW, CLEU, and poly flares. EPA inspectors also interviewed control room operators and discussed how operational adjustments are made to keep operating parameters within their respective limits and courses of action when there are deviations from those limits. In addition, EPA inspectors asked how the "feed forward" calculation method that Phillips 66 uses to comply with the net heating value of gases at the combustion zone for flares under the Refinery MACT corresponds to any flare adjustments that are made as those values fluctuate. Phillips 66 personnel explained that the system is mostly automated at this point, so adjustments typically are not made by operators, except under certain circumstances. EPA inspectors also asked questions related to the vacuum line system Phillips 66 uses to minimize waste gas flaring. Bayway personnel explained that although not all waste gas streams are part of the vacuum line system, those waste gas streams containing higher concentrations of organics and are worth recovering are compressed and collected upstream of the flare headers for recovery.

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Lead Inspector

Assisting Inspector's Name: Ralph Lonergan, Environmental Engineer

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Assisting Inspector

Supervisor's Name: Robert Buettner

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Supervisor