Bradley J. Levi
Refining General Manager

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June 28, 2018

Mr. William F. Durham
West Virginia Department of Environmental Protection
Division for Air Quality
601 57th Street SE
Charleston, WV 254304

RE: Renewal Title V Permit Application
MPLX Terminal and Storage LLC
Neal Butane Cavern

Dear Mr. Durham:

MPLX Terminal and Storage LLC (MPLX) owns and operates a butane cavern in Neal, West Virginia. MPLX is a subsidiary of MPLX LP, which is a consolidated subsidiary of Marathon Petroleum Corporation (MPC). The butane cavern serves the Catlettsburg refinery by providing intermediate storage of excess butane. MPLX submitted an initial Title V Operating Application and received the Title V Operating permit (R30-09900112-2014) which became effective on January 17, 2014 and will expire on January 3, 2019. This submittal fulfills the permit renewal application requirements in section 2.3 of the current Title V Operating Permit and in accordance with 45 CSR 30-4.1.a.3. As documented in the *Title V Permit Application Checklist for Administrative Completeness* provided in Section 4 of the application, the application consists of two (2) hard copies and two (2) electronic copies burned to separate CDs. The application materials contain all of the required elements of a West Virginia initial Title V application including an area map, plot plan, process flow diagram, and signed copies of the relevant application forms.

Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. Through this letter and application, MPLX requests use of these procedures in accordance with 45 CSR30. If upon your review, you determine that any additional information is needed or if you have any questions regarding the planned changes, please do not hesitate to contact Robert Lyon of my staff at 606-921-3389 or rjlyon@marathonpetroleum.com.

Respectfully,

Bradley J. Levi
Vice President

Attachment
rjl/kmt/gdn

TABLE OF CONTENTS

1. INTRODUCTION

MPLX Terminal and Storage LLC (MPLX) owns and operates a butane cavern in Neal, West Virginia. MPLX is a subsidiary of MPLX LP, which is a consolidated subsidiary of Marathon Petroleum Corporation (MPC). MPLX LP's assets consist of a network of common carrier crude oil and product pipeline systems, and associated crude oil and product storage assets in the Midwest and Gulf Coast regions of the U.S. MPLX LP owns, leases or has ownership interest in approximately 2,800 miles of pipeline across nine states. This network of petroleum pipelines is one of the largest in the U.S., based on total annual volumes delivered. The butane cavern with one million barrels (MMbbl) of working capacity is part of the network of crude oil and product storage facilities (tank farms).

The butane cavern serves the Catlettsburg refinery by providing intermediate storage of excess butane produced in the HF Alkylation (HF Alky) Unit and De-Isobutanizer (DIB) Tower [part of the Sat Gas Plant (SGP)] during the summer months. The butane cavern may also receive purchased butane from outside suppliers delivered at the refinery's #2 Refinery Railcar Loading Rack. During the winter months, the cavern will supply butane to the Gasoline Blender to increase the vapor pressure of the gasoline ensuring engines will start during cold weather. Based on the links to equipment within the refinery, the butane cavern is considered part of a refining process unit subject to the New Source Performance Standards (NSPS) for Equipment Leaks of VOC in Petroleum Refineries (40 CFR 60 Subpart GGGa).

In a letter dated July 18, 2012, the West Virginia Department of Environmental Protection (WVDEP) requested that MPLX apply for a Title V permit so that WVDEP could document and enforce the leak detection and repair (LDAR) requirements under NSPS Subpart GGGa applicable to the butane cavern piping components located in West Virginia. As requested, MPLX submitted a complete Title V permit application by the submission deadline of August 6, 2013 (i.e., within 12 months after the date of commencement of operation) in accordance with 45 CSR 30-4.1.a.2. This submittal fulfills the permit renewal application requirements in section 2.3 of the current Title V Operating Permit (R30-09900112-2014) and in accordance with 45 CSR 30-4.1.a.3.

1.1. FACILITY DESCRIPTION

The Catlettsburg refinery produces butane all year from the HF Alky Unit and the DIB Tower, which separates n-butane from iso-butane. During summer operation, the refinery produces an excess of butane that is required to be stored until winter operation at which time the demand to blend it into gasoline is higher. The cavern will store mostly refinery produced butane, but it has the ability to accept purchased butanes delivered by railcar. The butane from the HF Alky Unit, DIB Tower, and #2 Refinery Rail loading racks located in Kentucky will be routed to the butane cavern in West Virginia via Tank 836 (also located in Kentucky). The industrial classifications for the butane cavern under the SIC and NAICS classification schemes are 2869 for Industrial Organic Chemicals, Not Elsewhere Classified and 325110 for Petrochemical Manufacturing, respectively.

Historically, the butane had been stored in railcars that were filled at the refinery in the summer months, routed to a rail yard for temporary storage, and returned to the refinery in the winter months for unloading to the gasoline blending operation. Historically, the refinery utilized as many as 325 railcars each summer season for storage at South Point, Ohio and Russell, Kentucky rail yards. With ever increasing security and safety concerns, rail yards have refused storage. In the period from 2007 until the Neal butane cavern was commissioned on August 6, 2012, the refinery transported butane to storage caverns in Canton and Marysville, Ohio rather than storing it in railcars. The proximity of the Neal butane cavern to the refinery makes it a far superior storage option than the much more distant caverns previously used by MPC.

1.2. RENEWAL TITLE V APPLICATION ORGANIZATION

The remainder of this Title V permit application is organized as follows:

- Section 2 contains an overview of regulatory applicability for the Neal butane cavern.
- Section 3 describes the potential emission calculation methodologies used to quantify hourly and annual potential emissions from the fugitive equipment leak components located in West Virginia and from the Lube Area Flare located at the Catlettsburg refinery in Kentucky.
- Section 4 contains the required WVDEP Renewal Title V Application General Form and the Title V Application Checklist for Administrative Completeness.
- Attachment A contains an area map.
- Attachment B contains a plot plan.
- Attachment C contains a process flow diagram.
- Attachment D contains the WVDEP Title V equipment table.
- Attachment E contains a WVDEP emission unit form covering the equipment leak components at the butane cavern.
- Attachment F is a placeholder for the Schedule of Compliance Form. This form is only required to be completed if noncompliance with applicable requirements in documented in the permit application. MPLX is in compliance with all applicable requirements for the butane cavern, so this form is not required to be included in the renewal Title V application.
- Attachment G is a placeholder for the Air Pollution Control Device Form. No air pollution control devices associated with the butane cavern are located in West Virginia.
- Attachment H is contains the Compliance Assurance Monitoring (CAM) Plan Form to formally document non-applicability of CAM requirements to the butane cavern (refer to Section 2.5).
- Attachment I contains supporting documentation for the facility-wide emission calculations discussed in Section 3.

2. AIR PERMITTING AND REGULATORY REQUIREMENTS

A key objective of a Title V operating permit application is to compile all applicable Clean Air Act-derived requirements into one document. The requirements can be categorized as (1) emission limits and work practice standards, and (2) testing, monitoring, recordkeeping, and reporting requirements. To compile a list of the requirements applicable to a facility, it is first necessary to determine which Federal and State air regulations apply to the facility as a whole, or to individual emission units located at the facility. This section discusses the applicability determinations made for Federal and State air quality regulations. Regulations potentially applicable to the butane cavern facility are detailed in the "*Applicable Requirements*" sections of Title V General Form provided by the WVDEP contained in Section 4 of this report.

The remainder of this section summarizes the air permitting requirements and key air quality regulations that apply to the operation of the butane cavern. Applicability or non-applicability of the following regulatory programs is addressed:

- Title V of the 1990 Clean Air Act Amendments;
- New Source Performance Standards (NSPS);
- National Emission Standards for Hazardous Air Pollutants (NESHAP);
- Compliance Assurance Monitoring (CAM);
- Risk Management Plan (RMP);
- West Virginia State Implementation Plan (SIP) regulations.

This review is presented to supplement and/or add clarification to the information provided in the WVDEP Title V General Form in Section 4 and the Emission Unit Form in Attachment E, which fulfill the requirement to include citations and descriptions of applicable statutory and administrative code requirements.

In addition to providing a summary of applicable requirements, this section of the application also provides non-applicability determinations for certain regulations, allowing the WVDEP to confirm that identified regulations are not applicable to the butane cavern facility. Note that explanations of non-applicability are limited to those regulations for which there may be some question of applicability specific to the operations at the butane cavern. Regulations that are categorically non-applicable are not discussed.

2.1. TITLE V OPERATING PERMIT PROGRAM

Title 40 of the Code of Federal Regulations Part 70 (40 CFR 70) establishes the federal Title V operating permit program. West Virginia has incorporated the provisions of this federal program in its Title V operating permit program in CSR 45-30. The major source thresholds with respect to the West Virginia Title V operating permit program regulations are 10 tons per year (tpy) of a single HAP, 25 tpy of any combination of HAP, 100,000 tpy for GHGs expressed on a carbon dioxide equivalent (CO_2e) basis, and 100 tpy of all other regulated pollutants. The WVDEP has requested that MPLX apply for a Title V permit for the butane cavern and the portion of the piping located in West Virginia to provide a mechanism for enforcing the LDAR requirements applicable to the fugitive equipment leak components located in West Virginia.

2.2. NEW SOURCE PERFORMANCE STANDARDS (NSPS)

New Source Performance Standards (NSPS) (40 CFR Part 60) require new, modified, or reconstructed sources in specific source categories to control emissions to the level achievable by the best demonstrated technology as specified in the applicable provisions. Moreover, any source subject to an NSPS is also subject to the general provisions of NSPS Subpart A, except where expressly noted. The following is a summary of applicability determinations for NSPS regulations of relevance to the butane cavern.

2.2.1. NSPS Subpart GGGa - Standards of Performance for Equipment Leaks of VOC in Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After November 7, 2006

NSPS Subpart GGGa applies to the group of all equipment leak components within a petroleum refining process unit for which construction, reconstruction, or modification commenced after November 7, 2006. The butane cavern equipment leak components that are located in West Virginia are part of the HF Alky petroleum refining process unit operated by the refinery and designated as FUG018, 2-036 in the refinery's current Title V Permit V-05-089 R8 issued by the Kentucky Division for Air Quality (KDAQ) on November 28, 2011. The HF Alky unit meets the definition of a process unit under NSPS GGGa and has already triggered applicability of Subpart GGGa. Therefore, the equipment leak components for the butane cavern are also subject to Subpart GGGa. The current definition of a process unit under Subpart GGGa is "components assembled to produce intermediate or final products from petroleum, unfinished petroleum derivatives, or other intermediates; a process unit can operate independently if supplied with sufficient feed or raw materials and sufficient storage facilities for the product."[1] The original definition of process unit in Subpart GGGa which is currently stayed included "any feed, intermediate and final product storage vessels (except as specified in §60.482–1a(g)), product transfer racks, and connected ducts and piping." While this definition of "process unit" in 40 CFR 60.591a that includes storage vessels is stayed indefinitely, Catlettsburg expects the final rule addressing the stay will retain equipment leak components at storage vessels as part of the affected facility definition, and therefore, Catlettsburg has implemented the LDAR program required under NSPS Subpart GGGa at the butane cavern (regardless of whether or not it is considered to fall under the current process unit definition that does not explicitly include all types of storage vessels). This regulatory interpretation is further supported by the United States Environmental Protection Agency (U.S. EPA) guidance discussed in the following paragraphs.

U.S. EPA has noted that, even before promulgating the new definition of process unit under NSPS Subpart GGGa, the agency had always intended to regulate storage vessels. In the Federal Register Preamble, U.S. EPA stated the following:

> *The amended definition of process unit clarifies EPA's original intent and is consistent with the language provided by the commenters from the January 1981 rulemaking. ...[T]he 1981 language also states that a process unit includes storage tanks and all fluid transport equipment. There is no specification that these components are only included if within the battery limits. There has been confusion in the past regarding the inclusion of components outside of the battery limits but within the property of the facility. To clarify this issue, EPA previously issued formal guidance (see April 6, 1994 letter from John Rasnic to Raymond Hiley in Docket ID No. EPA-HQ-OAR-2006-0699).*
>
> *We agree that the determination of whether a particular tank is a storage tank, feed tank, or intermediate tank and part of a process unit must be done on a site-specific basis, dependent on how the tank functions within a particular plant site. The physical proximity of the storage tank to the other processing equipment within a process unit is not a sole determinate in establishing whether a storage tank is part of the process or not.*[2]

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[1] 40 CFR 60.590a(e)

[2] 72 FR 64,860 at p.64,869, November 17, 2006.

In the April 6, 1994 Letter from John Ransic, cited above, U.S. EPA was asked to clarify the definition of process unit. U.S. EPA provided the following clarification:

> *Chemical manufacturing process unit means the equipment assembled and connected by pipes or ducts to process raw materials and to manufacture an intended product. For the purpose of this subpart, chemical manufacturing process unit includes air oxidation reactors and their associated product separators and recovery devices; reactors and their associated product separators and recovery devices; distillation units and their associated distillate receivers and recovery devices; associated unit operations (as defined in this section); and* ***any feed, intermediate and product storage vessels****, product transfer racks, and* ***connected ducts and piping****. A chemical manufacturing process unit includes pumps, compressors, agitators, pressure relief devices, sampling connection systems, open-ended valves or lines, valves, connectors, instrumentation systems, and control devices or systems. A chemical manufacturing process unit is identified by its primary product.* (Emphasis added).[3]

Because Subpart GGGa arguably applies to the butane cavern under the current process unit definition and will certainly apply once the stay is lifted, MPC has included the butane cavern piping components into the refinery's LDAR program. Attachment E documents the applicable provisions from NSPS Subpart GGGa to the butane cavern equipment leak components which WVDEP can reference in drafting the emission unit-specific requirements for the butane cavern's Title V permit.

2.3. NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP)

National Emission Standards for Hazardous Air Pollutants (NESHAP) are emission standards for major and area sources of HAP. 40 CFR Part 63 NESHAP allowable emission standards and/or work practices for HAP sources in designated source categories are established on the basis of a Maximum Achievable Control Technology (MACT) determination. NESHAP apply to sources in specifically regulated industrial source categories (Clean Air Act Section 112(d)) or on a case-by-case basis (Section 112(g)) for facilities not regulated as a specific industrial source type. The following is a summary of applicability determinations for NESHAP regulations of relevance to the butane cavern.

2.3.1. NESHAP Subpart CC – Petroleum Refineries

The standards and requirements for 40 CFR 63 Subpart CC apply to petroleum refining process units and related emissions points including equipment leaks at petroleum refinery process units. The butane cavern equipment leak components located in West Virginia are part of the HF Alky petroleum refining process unit operated by the refinery and are subject to NSPS Subpart GGGa. Pursuant to 40 CFR 63.640(p)(2), equipment leaks that are also subject to the provisions of Subpart GGGa are required to comply only with the provisions specified in Subpart GGGa. Therefore, the butane cavern equipment leaks are not required to comply with NESHAP Subpart CC.

2.4. COMPLIANCE ASSURANCE MONITORING

Under 40 CFR 64, the CAM regulations, facilities are required to prepare and submit monitoring plans for certain emissions units with the initial or renewal Title V operating permit application. CAM Plans are intended to provide an on-going and reasonable assurance of compliance with emission limits for sources that utilize active control devices where existing Title V permit requirements may not be considered sufficient.

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[3] Letter from Mr. John Rasnic, U.S. EPA in Docket ID No. EPA-HQ-OAR-2006-0699, April 6, 1994.

Pursuant to the general applicability criteria in 40 CFR 64.2, CAM only applies to emission units that use a control device (as defined in 40 CFR 64.1) to comply with a federally-enforceable requirement (e.g., emission limit) and whose pre-controlled emission levels exceed the major source thresholds under the Title V operating permit program. There are no control devices located at the butane cavern facility; therefore, CAM is not applicable.

2.5. CHEMICAL ACCIDENT PREVENTION REGULATIONS

Chemical accident prevention requirements established pursuant to Section 112(r) of the Clean Air Act are included in 40 CFR Part 68. Applicability of this part is determined based on the type and quantity of chemicals stored at a facility. MPLX has evaluated the amount of Section 112(r) substances stored at the butane cavern facility and has determined that the butane and butene stored in the cavern constitute a flammable mixture (CAS# 00-11-11) stored in a quantity that exceeds the applicable threshold listed in 40 CFR 68 Subpart F Tables 3 and 4 (i.e., 10,000 pounds). Pursuant to 40 CFR 68.10(d)(2), the butane cavern is subject to Program Level 3 requirements under the chemical accident prevention provisions because it is subject to the Occupational Safety and Health Administration (OSHA) process safety management standard (PSM) in 29 CFR 1910.119. Pursuant to the Risk Management Plan (RMP) submittal requirements in 40 CFR 68.150, MPC updated the RMP for the refinery to include a new process covering the butane cavern (Process 32 Butane Storage/System added to Section 1.17) on July 26, 2012 using EPA's *RMP*eSubmit* electronic submittal tool. MPC conducted an offsite consequence analysis (OCA) for both a worst-case and alternative release scenario from the butane cavern in accordance with the applicable requirements for flammable mixtures in 40 CFR 68.165 (added as Section 4 Scenario 2 of RMP for worst-case release scenario and Section 5 Scenario 2 for alternative release scenario). Finally, MPC has developed a Program Level 3 Process Hazards Analysis (PHA) for the butane cavern following the applicable requirements of 40 CFR 68 Subpart D (added as Section 7 Program 32 in the revised RMP).

2.6. PROTECTION OF STRATOSPHERIC OZONE

MPLX will comply with all applicable requirements of 40 CFR 82 for any consumption, recycling, and importing of controlled substances for the operation/maintenance of any applicable air-conditioning units.

2.7. WEST VIRGINIA SIP REGULATIONS

This section of the application highlights applicability of specific West Virginia State Implementation Plan (SIP) regulations that may apply to the butane cavern facility.

2.7.1. 45 CSR 4: To Prevent and Control the Discharge of Air Pollutants into the Air Which Causes or Contributes to an Objectionable Odor – State Only

Pursuant to 45 CSR 4-3: *No person shall cause, suffer, allow or permit the discharge of air pollutants which cause or contribute to an objectionable odor at any location occupied by the public.* The butane cavern facility is subject to this state only requirement.

2.7.2. 45 CSR 7: To Prevent and Control Particulate Matter Air Pollution from Manufacturing Processes and Associated Operations

45 CSR 7 does not apply to the butane cavern because it is not a source of smoke, particulate matter, or other gaseous matter and it is not considered to be a manufacturing process.

2.7.3. 45 CSR 11: Prevention of Air Pollution Emergency Episodes

Pursuant to 45 CSR 11-5.2: when requested by the Secretary, the permittee shall prepare standby plans for reducing the emissions for air pollutants in accordance with objectives set forth in Tables I, II, and III of 45 CSR 11. The butane cavern is located in West Virginia Air Quality Control Region (AQCR) 3 (U.S. EPA AQCR 103). This region is classified as Priority I for particulate matter and Priority III for sulfur oxides, carbon monoxide, nitrogen dioxide, hydrocarbons, and Photo-Chemical Oxidants according to Table A of 45 CSR 11.

2.7.4. 45 CSR 13: Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation

Pursuant to 45 CSR 13-5:

> *No person shall cause, suffer, allow or permit the construction, modification, relocation and operation of any stationary source to be commenced without notifying the Secretary of such intent and obtaining a permit to construct, modify, relocate and operate the stationary source as required in this rule or any other applicable rule promulgated by the Secretary.*

On July 18, 2012, WVDEP issued a construction permitting applicability determination concluding that a permit under 45 CSR 13 was not required for the butane storage cavern and associated piping.[4] In the event that MPLX would propose the construction of an additional unit at the butane cavern facility or modifications to existing units, the proper Rule 13 (R13) permit application procedures would be followed, if necessary.

2.7.5. 45 CSR 17: To Prevent and Control Particulate Matter Air Pollution From Materials Handling, Preparation, Storage and Other Sources of Fugitive Matter

Pursuant to 45 CSR 17-3:

> *No person shall cause, suffer, allow or permit fugitive particulate matter to be discharged beyond the boundary lines of the property on which the discharge originates which causes or contributes to statutory air pollution.*

The butane cavern facility is subject to this requirement.

2.7.6. 45 CSR 21: To Prevent and Control Air Pollution From the Emission of Volatile Organic Compounds

The only potentially applicable sections of this regulation are 45 CSR 21-26 for Leaks from Petroleum Refinery Equipment and 45 CSR 21-40 for Other Facilities that Emit Volatile Organic Compound (VOC). Pursuant to 45 CSR 21-26:

> *This section 26, applies to all equipment in volatile organic compound (VOC) service in any process unit at a petroleum refinery, regardless of size or throughput.*

The butane cavern is not a source within the definition of petroleum refinery. Although the cavern is a co-located source with the Catlettsburg refinery in that it is adjacent to the refinery and under common control, the cavern itself is

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[4] Letter from Mr. Joe R. Kessler, PE, Engineer WVDEP to Mr. James Cantrell, Manager, Marathon Petroleum Company LP, *RE: Permit Applicability Determination Marathon Petroleum Company, LP Butane Storage Cavern Plant ID No. 099-00112 Determination No. PD12-065*, July 18, 2012.

not a refinery. Petroleum refinery is defined as "any facility engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, lubricants, or other products through distillation of petroleum or through the redistillation, cracking, or reforming of unfinished petroleum derivatives."[5] The cavern is used for storage only, not the production of butane. Therefore, the source located in West Virginia is not a petroleum refinery that would trigger application of 45 CSR 21-26.

Pursuant to 45 CSR 21-40:

> *This section 40, applies to any facility that has aggregate maximum theoretical emissions of 90.7 megagrams (100 tons) or more of VOC's per calendar year in absence of control devices; provided that this section 40, applies to any sources within such facility other than those sources subject to regulation under sections 11 through 39 of 45 CSR 21.*

This requirement does not apply to the butane cavern facility because the aggregate maximum emissions of VOC from the facility are less than 100 tons per year.

2.7.7. 45 CSR 27: To Prevent and Control the Emissions of Toxic Air Pollutants

Pursuant to the definition of "chemical processing unit" in 45 CSR 27-2.4, the affected facility under West Virginia's air toxics program does not include "equipment used in the production and distribution of petroleum products providing that such equipment does not produce or contact materials containing more than 5% benzene by weight." The butane stored in the butane cavern is only expected to contain approximately 150 ppm benzene by weight (0.015 % by weight), so the butane cavern is not considered to be a chemical processing unit and is, thus, exempt from the requirements of 45 CSR 27.

Even if the butane cavern was considered to be a chemical processing unit, the annual potential emissions of all Table A toxic air pollutants expected to be emitted from the butane cavern (which includes only benzene and 1,3 butadiene, refer to Attachment I) are less than the Best Available Technology (BAT) thresholds. Furthermore, the equipment leak components associated with the butane cavern are not in "toxic air pollutant service" because they do not contain or contact process fluid containing more than 10% by weight of a toxic air pollutant.[6] Therefore, the butane cavern would not be subject to any requirements under 45 CSR 27 even if were considered to be a chemical processing unit.

2.7.8. 45 CSR 30: Requirements for Operating Permits

The butane cavern facility is subject to Title V operating permit requirements as discussed in Section 2.1 above. Pursuant to 45 CSR 30-4.1.a.3, this application is being submitted to fulfill the renewal permit application requirements.

2.7.9. Non-Applicability of Other SIP Rules

A thorough examination of the West Virginia SIP rule applicability to the butane cavern reveals many SIP regulations that do not apply or impose additional requirements on the butane cavern operations. Such SIP rules include those specific to a particular type of industrial operation that is categorically not applicable to the butane cavern facility.

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[5] 45 CSR 21-2.55
[6] 45 CSR 27-2.11

3. AIR EMISSIONS QUANTIFICATION

This section of the application provides a discussion of emission calculation methodologies used for the emission sources at the butane cavern. Detailed emissions calculations are provided in Attachment I to this report.

There are two sources of emissions from the butane cavern. Fugitive VOC emissions from piping components such as valves and connectors comprise an area source (1S) at the butane cavern facility. The second source of emissions is a point source which is the periodic vent from the cavern to the refinery's Lube Area Flare (2S).[7] Prior to the initial startup of the cavern, the cavern was air freed and pressure tested with nitrogen. Over the first few months of operation, liquid butane was pumped into the cavern to displace the gaseous nitrogen. The nitrogen has been pressured up to the target operating pressure of the cavern. The nitrogen saturated in butane will then be vented to the refinery flare (referred to as the Scenario #1 vent in Attachment I) in order to maintain proper operating pressure as the cavern is filled with additional butane. During routine operation of the cavern, it is expected that lighter non-condensable hydrocarbon gases (i.e., methane, ethane, propane, etc.) will collect in the cavern dome. In order to maintain proper operating pressure of the cavern, these light gases will have to be periodically vented to the refinery flare (referred to as Scenario #2 vent in Attachment I). Although the refinery flare is located in Kentucky, MPLX has prepared potential emission calculations for the flare emissions attributable to the intermittent, non-condensable gas venting scenarios associated with the operation of the butane cavern. As shown in Section I-1 of Attachment I, criteria pollutant and greenhouse gas (GHG) emissions from the Lube Area Flare are calculated based on process gas flow rate and composition data obtained from a chemical process simulation model output and from a combination of site-specific and U.S. EPA reference flare emission factors.

The cavern fugitive area source (from piping components such as valves and flanges) is the only emission point (1E) in West Virginia. The VOC emissions from fugitive sources are calculated based on the component count, refinery average emission factors from the EPA document tilted *Protocol for Equipment Leak Emission Estimates*, dated November 1995, and an assumed control efficiency for implementing the NSPS Subpart VVa LDAR program required by NSPS Subpart GGGa.

[7] The Lube Area Flare is designated as FL05, 1-14-FS-03 in the refinery's current Title V Permit V-12-026 R3 issued by the Kentucky Energy and Environment Cabinet, Department for Environmental Protection, Division for Air Quality on September 11, 2017.

4. RENEWAL TITLE V APPLICATION FORMS

The completed Title V Permit General Form and the Title V Permit Application Checklist for Administrative Completeness are included in this section.

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY

601 57th Street SE
Charleston, WV 25304
Phone: (304) 926-0475
www.dep.wv.gov/daq

INITIAL/RENEWAL TITLE V PERMIT APPLICATION - GENERAL FORMS

Section 1: General Information

1. **Name of Applicant (As registered with the WV Secretary of State's Office):** MPLX Terminals and Storage LLC	2. **Facility Name or Location:** Butane Cavern
3. **DAQ Plant ID No.:** 099-00112	4. **Federal Employer ID No. (FEIN):** 61-1683447

5. **Permit Application Type:**

☐ Initial Permit — When did operations commence? 08/06 /2012
☒ Permit Renewal — What is the expiration date of the existing permit? 01/03/2019
☐ Update to Initial/Renewal Permit Application

6. **Type of Business Entity:**

☐ Corporation ☐ Governmental Agency ☒ LLC
☐ Partnership ☐ Limited Partnership

7. **Is the Applicant the:**

☐ Owner ☐ Operator ☒ Both

If the Applicant is not both the owner and operator, please provide the name and address of the other party.

8. **Number of onsite employees:** 0

9. **Governmental Code:**

☒ Privately owned and operated; 0
☐ Federally owned and operated; 1
☐ State government owned and operated; 2
☐ County government owned and operated; 3
☐ Municipality government owned and operated; 4
☐ District government owned and operated; 5

10. **Business Confidentiality Claims**

Does this application include confidential information (per 45CSR31)? ☐ Yes ☒ No

If yes, identify each segment of information on each page that is submitted as confidential, and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's *"PRECAUTIONARY NOTICE-CLAIMS OF CONFIDENTIALITY"* guidance.

11. **Mailing Address**		
Street or P.O. Box: P.O. Box 1492		
City: Catlettsburg	**State:** Kentucky	**Zip:** 41129
Telephone Number: (606) 921-3389	**Fax Number:** (606) 921-3290	

12. Facility Location		
Street: 150 Big Sandy River Road	**City:** Kenova	**County:** Wayne
UTM Easting: 360.647 km	**UTM Northing:** 4,247.173 km	**Zone:** ☒ 17 or ☐ 18
Directions: From I-64 East take exit 1 for US-52 S toward Kenova Ceredo. On U.S. 52 S/W Virginia 75 E, turn right onto Co Hwy 1/16, turn left to stay on Co Hwy 1/16, turn left onto Novamount Rd, facility will be on the right.		
Portable Source? ☐ Yes ☒ No		
Is facility located within a nonattainment area? ☐ Yes ☒ No		**If yes, for what air pollutants?**
Is facility located within 50 miles of another state? ☒ Yes ☐ No		**If yes, name the affected state(s).** Kentucky
Is facility located within 100 km of a Class I Area[1]? ☐ Yes ☒ No **If no, do emissions impact a Class I Area[1]?** ☐ Yes ☒ No		**If yes, name the area(s).**
[1] *Class I areas include Dolly Sods and Otter Creek Wilderness Areas in West Virginia, and Shenandoah National Park and James River Face Wilderness Area in Virginia.*		

13. Contact Information		
Responsible Official: Bradley J. Levi		**Title:** Vice President
Street or P.O. Box: P.O. Box 1492		
City: Catlettsburg	**State:** Kentucky	**Zip:** 41129
Telephone Number: (606) 921-6200	**Fax Number:** (606) 921-3500	
E-mail address: bjlevi@marathonpetroleum.com		
Environmental Contact: Robert Lyon		**Title:** HES Professional
Street or P.O. Box: P.O. Box 1492		
City: Catlettsburg	**State:** Kentucky	**Zip:** 41129
Telephone Number: (606) 921-3389	**Fax Number:** (606) 921-3290	
E-mail address: rjlyon@marathonpetroleum.com		
Application Preparer: Same as Environmental Contact		**Title:**
Company:		
Street or P.O. Box:		
City:	**State:**	**Zip:**
Telephone Number: ( ) -	**Fax Number:** ( ) -	
E-mail address:		

14. Facility Description

List all processes, products, NAICS and SIC codes for normal operation, in order of priority. Also list any process, products, NAICS and SIC codes associated with any alternative operating scenarios if different from those listed for normal operation.

Process	Products	NAICS	SIC
Butane Storage	Butane	325110	NA

Provide a general description of operations.

The butane cavern in Neal, WV was built to store excess butane produced by the refinery during summer operation. Butane is used as a gasoline blend component in winter months to raise vapor pressure thus ensuring engines will start during cold weather. The Catlettsburg refinery produces butane all year from the HF Alkylation Unit and the DIB Tower, which separates n-butane from iso-butane. During summer operation, the refinery produces an excess of butane that is required to be stored until winter operation at which time the demand to blend it into gasoline is higher.

15. Provide an **Area Map** showing plant location as **ATTACHMENT A**.

16. Provide a **Plot Plan(s)**, e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is located as **ATTACHMENT B**. For instructions, refer to "Plot Plan - Guidelines."

17. Provide a detailed **Process Flow Diagram(s)** showing each process or emissions unit as **ATTACHMENT C**. Process Flow Diagrams should show all emission units, control equipment, emission points, and their relationships.

Section 2: Applicable Requirements

18. Applicable Requirements Summary	
Instructions: Mark all applicable requirements.	
☒SIP	☐FIP
☐Minor source NSR (45CSR13)	☐PSD (45CSR14)
☐NESHAP (45CSR34)	☐Nonattainment NSR (45CSR19)
☒Section 111 NSPS	☐Section 112(d) MACT standards
☐Section 112(g) Case-by-case MACT	☒112(r) RMP
☐Section 112(i) Early reduction of HAP	☐Consumer/commercial prod. reqts., section 183(e)
☐Section 129 Standards/Reqts.	☒Stratospheric ozone (Title VI)
☐Tank vessel reqt., section 183(f)	☐Emissions cap 45CSR§30-2.6.1
☐NAAQS, increments or visibility (temp. sources)	☐45CSR27 State enforceable only rule
☐45CSR4 State enforceable only rule	☐Acid Rain (Title IV, 45CSR33)
☐Emissions Trading and Banking (45CSR28)	☐Compliance Assurance Monitoring (40CFR64)
☐CAIR NO_x Annual Trading Program (45CSR39)	☐CAIR NO_x Ozone Season Trading Program (45CSR40)
☐CAIR SO_2 Trading Program (45CSR41)	

19. Non Applicability Determinations
List all requirements which the source has determined not applicable and for which a permit shield is requested. The listing shall also include the rule citation and the reason why the shield applies. Refer to the non-applicable regulations identified in Section 2 of the Application.
☒ Permit Shield

20. Facility-Wide Applicable Requirements

List all facility-wide applicable requirements. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number. (*Note: Title V permit condition numbers alone are not the underlying applicable requirements*).

Discharge of Air Pollutants of Objectionable Odor Not Allowed [45 CSR 4-3.1] (state enforceable only)

Standby Pan for Reducing Emissions [45 CSR 11-5]

Payment of Annual Fees [45 CSR 30]

Risk Management Plan [40 CFR 68]

Control Particulate Matter Air Pollution From Other Sources of Fugitive Matter [45 CSR 17-3]

☒ Permit Shield

For all facility-wide applicable requirements listed above, provide monitoring/testing / recordkeeping / reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number and/or citation. (Note: Each requirement listed above must have an associated method of demonstrating compliance. If there is not already a required method in place, then a method must be proposed.)

Discharge of Air Pollutants of Objectionable Odor Not Allowed [45 CSR 4-3.1]

The permittee shall maintain a record of all odor complaints received, any investigation performed in response to such a complaint, and any responsive action(s) taken.

Standby Plan for Reducing Emissions [45 CSR 11-5.2]

When requested by the Secretary, the permittee shall prepare standby plans for reducing the emissions for air pollutants in accordance with objectives set forth in Tables I, II, and III of 45 CSR 11.

Payment of Annual Fees [40 CSR 30]

The permittee shall submit a Certified Emissions Statement (CES) and pay fees on an annual basis in accordance with the submittal requirement of the Division of Air Quality.

Risk Management Plan [40 CFR 68]

The permittee shall submit a risk management plan (RMP) by the date specified in 40 CFR 68.10 and shall certify compliance with the requirements of Part 68 as part of the annual compliance certification as required by 40 CFR Part 70.

Control Particulate Matter Air Pollution From Other Sources of Fugitive Matter [45 CSR 17-3]

No person shall cause, suffer, allow or permit fugitive particulate matter to be discharged beyond the boundary lines of the property on which the discharge originates which causes or contributes to statutory air pollution.

Are you in compliance with all facility-wide applicable requirements? ☒ Yes ☐ No

If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.

21. Active Permits/Consent Orders		
Permit or Consent Order Number	Date of Issuance MM/DD/YYYY	List any Permit Determinations that Affect the Permit *(if any)*
NA	/ /	
	//	

22. Inactive Permits/Obsolete Permit Conditions		
Permit Number	Date of Issuance	Permit Condition Number
NA	/ /	
	//	

Section 3: Facility-Wide Emissions

23. Facility-Wide Emissions Summary [Tons per Year]	
Criteria Pollutants	Potential Emissions[3]
Carbon Monoxide (CO)	-
Nitrogen Oxides (NO_X)	-
Lead (Pb)	-
Particulate Matter ($PM_{2.5}$)[1]	-
Particulate Matter (PM_{10})[1]	-
Total Particulate Matter (TSP)	-
Sulfur Dioxide (SO_2)	-
Volatile Organic Compounds (VOC)	2.87
Hazardous Air Pollutants[2]	Potential Emissions
1,3-Butadiene	2.18E-04
Benzene	4.37E-04
Regulated Pollutants other than Criteria and HAP	Potential Emissions

[1]$PM_{2.5}$ and PM_{10} are components of TSP.

[2]For HAPs that are also considered PM or VOCs, emissions should be included in both the HAPs section and the Criteria Pollutants section.

[3]Only includes potential emissions from the fugitive equipment leak components in West Virginia and not flare emissions occurring in Kentucky attributable to the butane cavern (refer to Table 1-1 in Attachment 1).

Section 4: Insignificant Activities

24. Insignificant Activities (Check all that apply)		
☐	1.	Air compressors and pneumatically operated equipment, including hand tools.
☒	2.	Air contaminant detectors or recorders, combustion controllers or shutoffs.
☐	3.	Any consumer product used in the same manner as in normal consumer use, provided the use results in a duration and frequency of exposure which are not greater than those experienced by consumer, and which may include, but not be limited to, personal use items, janitorial cleaning supplies, office supplies and supplies to maintain copying equipment.
☒	4.	Bathroom/toilet vent emissions. **(One Port-a-let)**
☒	5.	Batteries and battery charging stations, except at battery manufacturing plants. **(Uninterruptable power supply for power backup to supply controls and critical lighting)**
☐	6.	Bench-scale laboratory equipment used for physical or chemical analysis, but not lab fume hoods or vents. Many lab fume hoods or vents might qualify for treatment as insignificant (depending on the applicable SIP) or be grouped together for purposes of description.
☐	7.	Blacksmith forges.
☐	8.	Boiler water treatment operations, not including cooling towers.
☐	9.	Brazing, soldering or welding equipment used as an auxiliary to the principal equipment at the source.
☐	10.	CO_2 lasers, used only on metals and other materials which do not emit HAP in the process.
☐	11.	Combustion emissions from propulsion of mobile sources, except for vessel emissions from Outer Continental Shelf sources.
☐	12.	Combustion units designed and used exclusively for comfort heating that use liquid petroleum gas or natural gas as fuel.
☒	13.	Comfort air conditioning or ventilation systems not used to remove air contaminants generated by or released from specific units of equipment.
☐	14.	Demineralized water tanks and demineralizer vents.
☐	15.	Drop hammers or hydraulic presses for forging or metalworking.
☐	16.	Electric or steam-heated drying ovens and autoclaves, but not the emissions from the articles or substances being processed in the ovens or autoclaves or the boilers delivering the steam.
☐	17.	Emergency (backup) electrical generators at residential locations.
☐	18.	Emergency road flares.
☐	19.	Emission units which do not have any applicable requirements and which emit criteria pollutants (CO, NO_x, SO_2, VOC and PM) into the atmosphere at a rate of less than 1 pound per hour and less than 10,000 pounds per year aggregate total for each criteria pollutant from all emission units. Please specify all emission units for which this exemption applies along with the quantity of criteria pollutants emitted on an hourly and annual basis:

24. Insignificant Activities (Check all that apply)		
☐	20.	Emission units which do not have any applicable requirements and which emit hazardous air pollutants into the atmosphere at a rate of less than 0.1 pounds per hour and less than 1,000 pounds per year aggregate total for all HAPs from all emission sources. This limitation cannot be used for any source which emits dioxin/furans nor for toxic air pollutants as per 45CSR27. Please specify all emission units for which this exemption applies along with the quantity of hazardous air pollutants emitted on an hourly and annual basis:
☐	21.	Environmental chambers not using hazardous air pollutant (HAP) gases.
☐	22.	Equipment on the premises of industrial and manufacturing operations used solely for the purpose of preparing food for human consumption.
☐	23.	Equipment used exclusively to slaughter animals, but not including other equipment at slaughterhouses, such as rendering cookers, boilers, heating plants, incinerators, and electrical power generating equipment.
☐	24.	Equipment used for quality control/assurance or inspection purposes, including sampling equipment used to withdraw materials for analysis.
☐	25.	Equipment used for surface coating, painting, dipping or spray operations, except those that will emit VOC or HAP.
☐	26.	Fire suppression systems.
☐	27.	Firefighting equipment and the equipment used to train firefighters.
☐	28.	Flares used solely to indicate danger to the public.
☐	29.	Fugitive emission related to movement of passenger vehicle provided the emissions are not counted for applicability purposes and any required fugitive dust control plan or its equivalent is submitted.
☐	30.	Hand-held applicator equipment for hot melt adhesives with no VOC in the adhesive formulation.
☐	31.	Hand-held equipment for buffing, polishing, cutting, drilling, sawing, grinding, turning or machining wood, metal or plastic.
☐	32.	Humidity chambers.
☐	33.	Hydraulic and hydrostatic testing equipment.
☐	34.	Indoor or outdoor kerosene heaters.
☐	35.	Internal combustion engines used for landscaping purposes.
☐	36.	Laser trimmers using dust collection to prevent fugitive emissions.
☐	37.	Laundry activities, except for dry-cleaning and steam boilers.
☐	38.	Natural gas pressure regulator vents, excluding venting at oil and gas production facilities.
☐	39.	Oxygen scavenging (de-aeration) of water.
☐	40.	Ozone generators.
☐	41.	Plant maintenance and upkeep activities (e.g., grounds-keeping, general repairs, cleaning, painting, welding, plumbing, re-tarring roofs, installing insulation, and paving parking lots) provided these activities are not conducted as part of a manufacturing process, are not related to the source's primary business activity, and not otherwise triggering a permit modification. (Cleaning and painting activities qualify if they are not subject to VOC or HAP control requirements. Asphalt batch plant owners/operators must still get a permit if otherwise requested.)
☐	42.	Portable electrical generators that can be moved by hand from one location to another. "Moved by Hand" means that it can be moved without the assistance of any motorized or non-motorized vehicle, conveyance, or device.
☐	43.	Process water filtration systems and demineralizers.

24. Insignificant Activities (Check all that apply)		
☐	44.	Repair or maintenance shop activities not related to the source's primary business activity, not including emissions from surface coating or de-greasing (solvent metal cleaning) activities, and not otherwise triggering a permit modification.
☐	45.	Repairs or maintenance where no structural repairs are made and where no new air pollutant emitting facilities are installed or modified.
☐	46.	Routing calibration and maintenance of laboratory equipment or other analytical instruments.
☐	47.	Salt baths using nonvolatile salts that do not result in emissions of any regulated air pollutants. Shock chambers.
☐	48.	Shock chambers.
☐	49.	Solar simulators.
☐	50.	Space heaters operating by direct heat transfer.
☐	51.	Steam cleaning operations.
☐	52.	Steam leaks.
☐	53.	Steam sterilizers.
☐	54.	Steam vents and safety relief valves.
☐	55.	Storage tanks, reservoirs, and pumping and handling equipment of any size containing soaps, vegetable oil, grease, animal fat, and nonvolatile aqueous salt solutions, provided appropriate lids and covers are utilized.
☐	56.	Storage tanks, vessels, and containers holding or storing liquid substances that will not emit any VOC or HAP. Exemptions for storage tanks containing petroleum liquids or other volatile organic liquids should be based on size limits such as storage tank capacity and vapor pressure of liquids stored and are not appropriate for this list.
☐	57.	Such other sources or activities as the Director may determine.
☐	58.	Tobacco smoking rooms and areas.
☐	59.	Vents from continuous emissions monitors and other analyzers.

Section 5: Emission Units, Control Devices, and Emission Points

25. Equipment Table
Fill out the **Title V Equipment Table** and provide it as **ATTACHMENT D**.
26. Emission Units
For each emission unit listed in the **Title V Equipment Table**, fill out and provide an **Emission Unit Form** as **ATTACHMENT E**.
For each emission unit not in compliance with an applicable requirement, fill out a **Schedule of Compliance Form** as **ATTACHMENT F**.
27. Control Devices
For each control device listed in the **Title V Equipment Table**, fill out and provide an **Air Pollution Control Device Form** as **ATTACHMENT G**.
For any control device that is required on an emission unit in order to meet a standard or limitation for which the potential pre-control device emissions of an applicable regulated air pollutant is greater than or equal to the Title V Major Source Threshold Level, refer to the **Compliance Assurance Monitoring (CAM) Form(s)** for CAM applicability. Fill out and provide these forms, if applicable, for each Pollutant Specific Emission Unit (PSEU) as **ATTACHMENT H**.

Section 6: Certification of Information

28. Certification of Truth, Accuracy and Completeness and Certification of Compliance

*Note: This Certification must be signed by a responsible official. The **original**, signed in **blue ink**, must be submitted with the application. Applications without an **original** signed certification will be considered as incomplete.*

a. Certification of Truth, Accuracy and Completeness

I certify that I am a responsible official (as defined at 45CSR§30-2.38) and am accordingly authorized to make this submission on behalf of the owners or operators of the source described in this document and its attachments. I certify under penalty of law that I have personally examined and am familiar with the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine and/or imprisonment.

b. Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

Responsible official (type or print)

Name: Bradley J. Levi	Title: Vice President

Responsible official's signature:

Signature: Bradley J Levi Signature Date: 6-27-18

(Must be signed and dated in blue ink)

Note: Please check all applicable attachments included with this permit application:

☒	ATTACHMENT A: Area Map
☒	ATTACHMENT B: Plot Plan(s)
☒	ATTACHMENT C: Process Flow Diagram(s)
☒	ATTACHMENT D: Equipment Table
☒	ATTACHMENT E: Emission Unit Form(s)
☐	ATTACHMENT F: Schedule of Compliance Form(s) N/A
☐	ATTACHMENT G: Air Pollution Control Device Form(s) N/A
☒	ATTACHMENT H: Compliance Assurance Monitoring (CAM) Form(s)

All of the required forms and additional information can be found and downloaded from, the DEP website at www.dep.wv.gov/daq, requested by phone (304) 926-0475, and/or obtained through the mail.

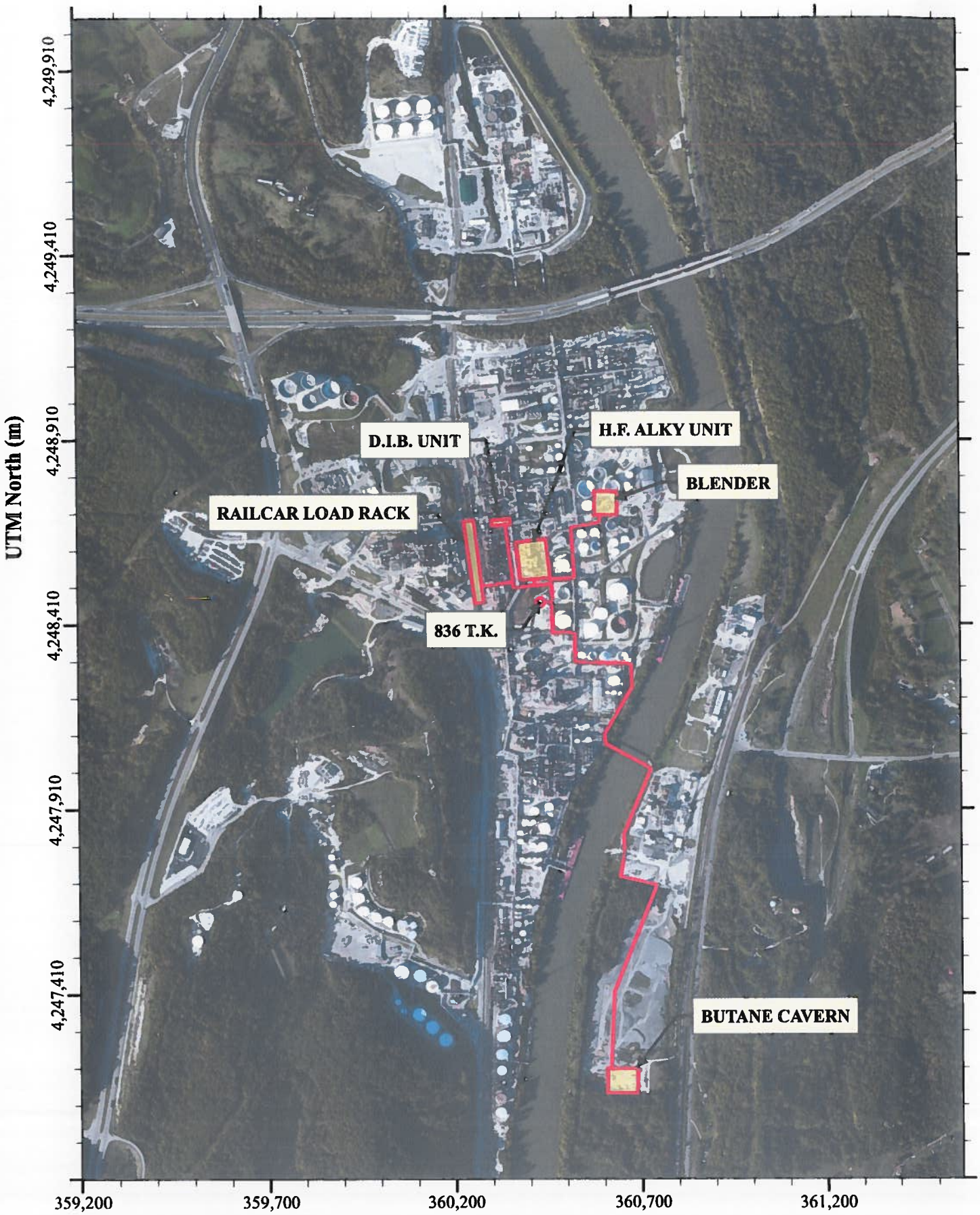
TITLE V PERMIT APPLICATION CHECKLIST
FOR ADMINISTRATIVE COMPLETENESS

A complete application is demonstrated when all of the information required below is properly prepared, completed and attached. The items listed below are required information which must be submitted with a Title V permit application. Any submittal will be considered incomplete if the required information is not included.*

☒	Two signed copies of the application (at least one must contain the original "*Certification*" page signed and dated in blue ink)
☒	Correct number of copies of the application on separate CDs or diskettes, (i.e. at least one disc per copy)
☒	*Table of Contents (needs to be included but not for administrative completeness)
☒	Facility information
☒	Description of process and products, including NAICS and SIC codes, and including alternative operating scenarios
☒	Area map showing plant location
☒	Plot plan showing buildings and process areas
☒	Process flow diagram(s), showing all emission units, control equipment, emission points, and their relationships
☐	Identification of all applicable requirements with a description of the compliance status, the methods used for demonstrating compliance, and a Schedule of Compliance Form (ATTACHMENT F) for all requirements for which the source is not in compliance
☐	Listing of all active permits and consent orders (if applicable)
☒	Facility-wide emissions summary
☒	Identification of Insignificant Activities
☒	ATTACHMENT D - Title V Equipment Table completed for all emission units at the facility except those designated as insignificant activities
☒	ATTACHMENT E - Emission Unit Form completed for each emission unit listed in the Title V Equipment Table (ATTACHMENT D) and a Schedule of Compliance Form (ATTACHMENT F) for all requirements for which the emission unit is not in compliance
☐	ATTACHMENT G - Air Pollution Control Device Form completed for each control device listed in the Title V Equipment Table (ATTACHMENT D)
☒	ATTACHMENT H – Compliance Assurance Monitoring (CAM) Plan Form completed for each control device for which the "Is the device subject to CAM?" question is answered "Yes" on the Air Pollution Control Device Form (ATTACHMENT G)
☒	General Application Forms signed by a Responsible Official
☐	Confidential Information submitted in accordance with 45CSR31

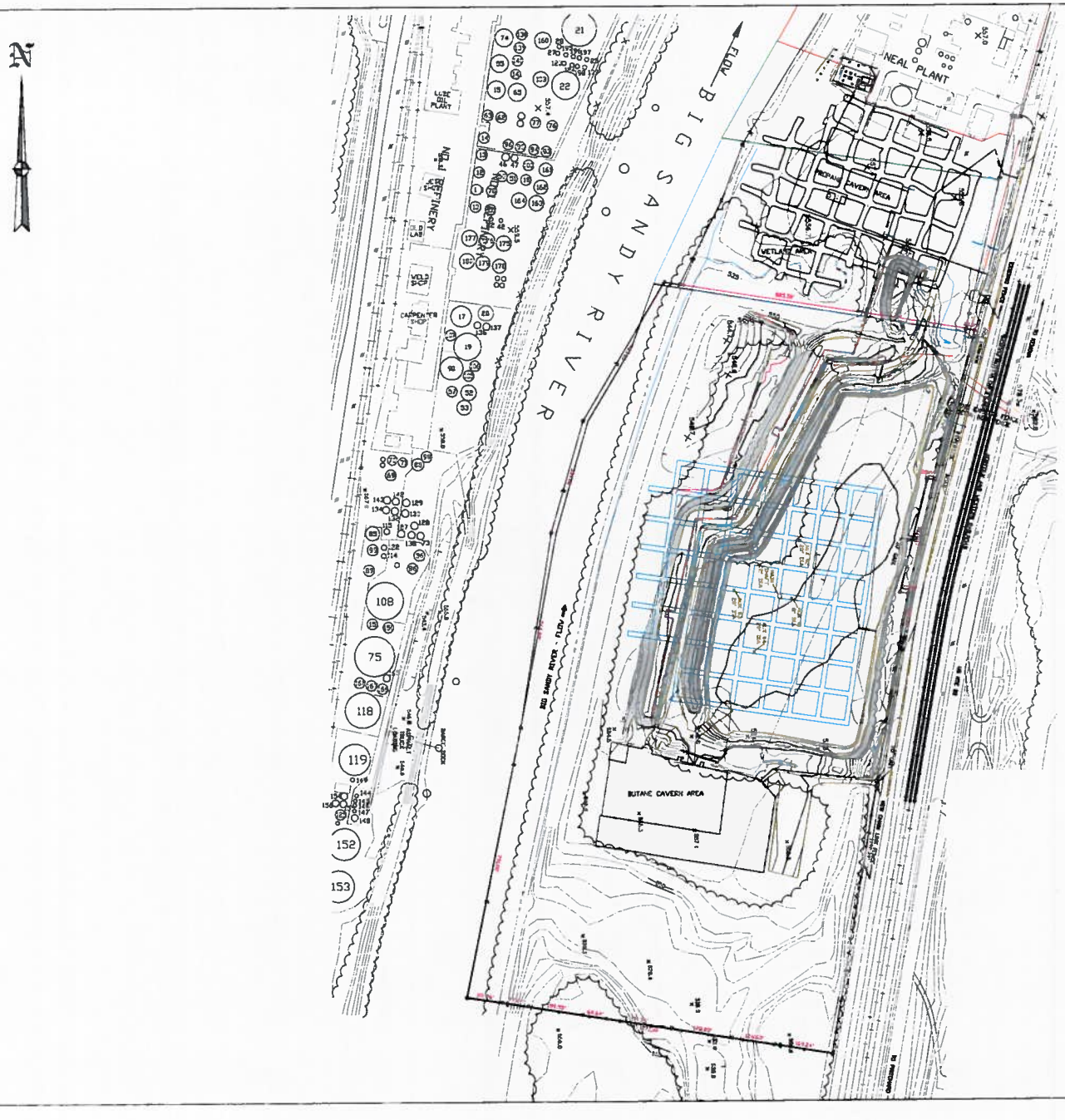
ATTACHMENT A: AREA MAP

Attachment A - Aerial Map of Butane Cavern



All Coordinates shown in UTM Coordinates,
Zone 17, NAD 83 Datum

ATTACHMENT B: PLOT PLAN



REV	DATE	BY	DESCRIPTION	APPR
DESIGN		DIG		
PROJECT		DIG		
ELEC		DIG		
SURVEYOR				

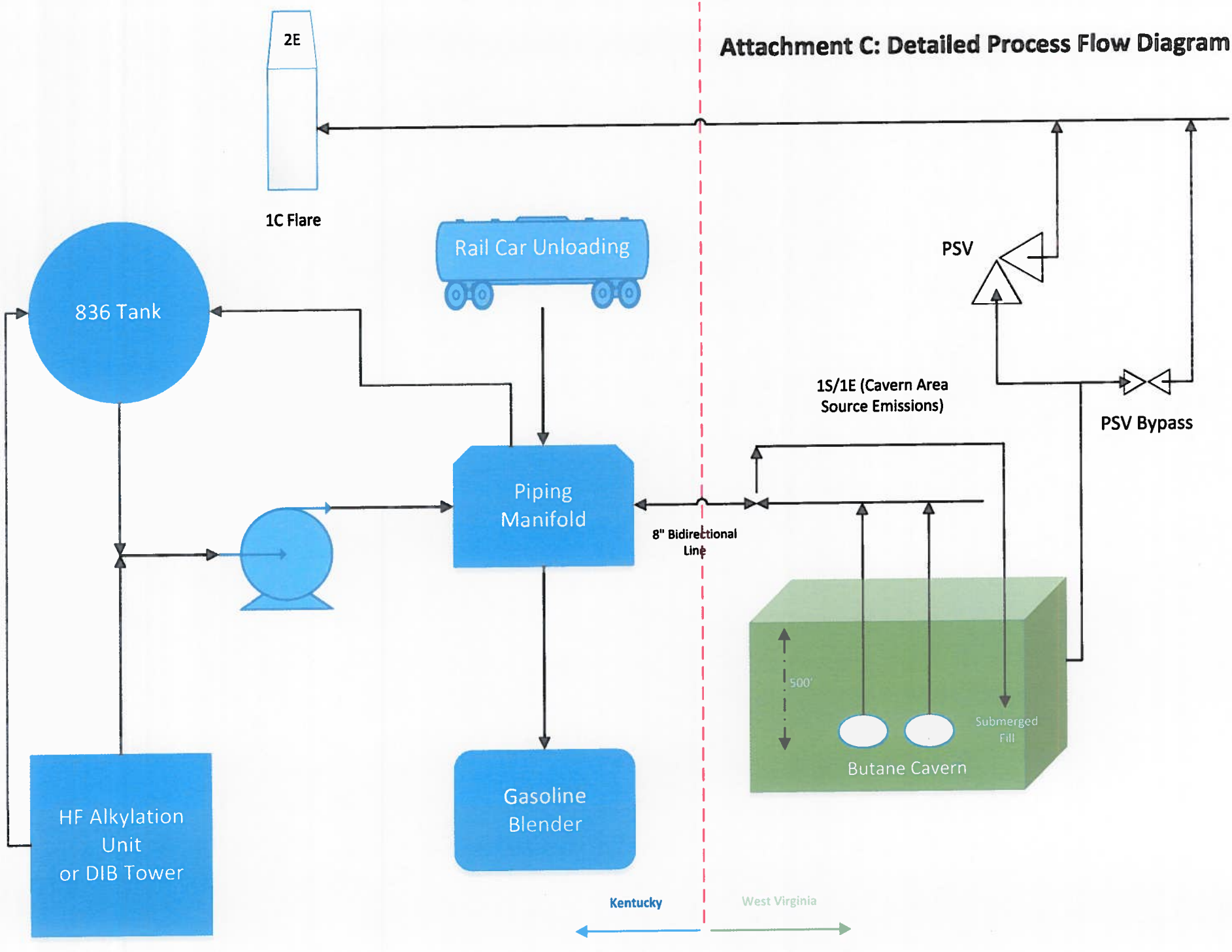
CATLETTSBURG REFINING LLC
SUBSIDIARY OF
MARATHON PETROLEUM COMPANY LLC

DETAILED PLOT PLAN OF NEAL WEST VIRGINIA

DRAWN: COOK	WG	
SCALE: 1"=150'	DWG. JRB	CK'D BY
DATE: 05/29/18	DWG. 2-1AA-1120-S-A	

ATTACHMENT C: PROCESS FLOW DIAGRAM

Attachment C: Detailed Process Flow Diagram



ATTACHMENT D: TITLE V EQUIPMENT TABLE

ATTACHMENT D - Title V Equipment Table

(includes all emission units at the facility except those designated as insignificant activities in Section 4, Item 24 of the General Forms)

Emission Point ID[1]	Control Device[1]	Emission Unit ID[1]	Emission Unit Description	Design Capacity	Year Installed/ Modified
1E	None	1S	HF Alky Unit Fugitive Emissions (WV Scope)		2012

[1]For 45CSR13 permitted sources, the numbering system used for the emission points, control devices, and emission units should be consistent with the numbering system used in the 45CSR13 permit. For grandfathered sources, the numbering system should be consistent with registrations or emissions inventory previously submitted to DAQ. For emission points, control devices, and emissions units which have not been previously labeled, use the following 45CSR13 numbering system: 1S, 2S, 3S,... or other appropriate description for emission units; 1C, 2C, 3C,... or other appropriate designation for control devices; 1E, 2E, 3E, ... or other appropriate designation for emission points.

ATTACHMENT E: EMISSION UNIT FORM

ATTACHMENT E - Emission Unit Form

Emission Unit Description

Emission unit ID number:	**Emission unit name:**	**List any control devices associated with this emission unit:**
1S	HF Alky Unit Fugitive Emissions (WV Scope)	NA

Provide a description of the emission unit (type, method of operation, design parameters, etc.):
Area source emissions from fugitive equipment leak components in West Virginia associated with the Butane Cavern.

Manufacturer:	**Model number:**	**Serial number:**
NA	NA	NA
Construction date:	**Installation date:**	**Modification date(s):**
September 2006 (Start of Construction)	September 2006 (Start of Construction)	NA

Design Capacity (examples: furnaces - tons/hr, tanks - gallons): NA

Maximum Hourly Throughput:	**Maximum Annual Throughput:**	**Maximum Operating Schedule:**
NA	NA	8,760 hours

Fuel Usage Data **(fill out all applicable fields)**

Does this emission unit combust fuel? ___Yes _X_ No	**If yes, is it? NA** ___ Indirect Fired ___Direct Fired
Maximum design heat input and/or maximum horsepower rating: NA	**Type and Btu/hr rating of burners:** NA

List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each.
NA

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max. Sulfur Content	Max. Ash Content	BTU Value
NA			

Emissions Data

Criteria Pollutants	Potential Emissions	
	PPH	TPY
Carbon Monoxide (CO)	-	-
Nitrogen Oxides (NO_X)	-	-
Lead (Pb)	-	-
Particulate Matter ($PM_{2.5}$)	-	-
Particulate Matter (PM_{10})	-	-
Total Particulate Matter (TSP)	-	-
Sulfur Dioxide (SO_2)	-	-
Volatile Organic Compounds (VOC)	0.66	2.87

Hazardous Air Pollutants	Potential Emissions	
	PPH	TPY
1,3-Butadiene	1.99E-05	2.18E-04
Benzene	9.97E-05	4.37E-04
Regulated Pollutants other than Criteria and HAP	Potential Emissions	
	PPH	TPY
NA		

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

VOC emissions are calculated based on the component count, refinery average emission factors from the EPA Protocol for Equipment Leak Emission Estimates, and an assumed control efficiency for implementing the NSPS Subpart VVa LDAR program required by NSPS Subpart GGGa. Emission factors are from Protocol for Equipment Leak Emission Estimates (EPA-453/R-95-017), U.S. EPA, November 1995, "Table 2-2: Refinery Average Emission Factors." Control efficiencies for light liquid and gas/vapor valves are taken from Protocol for Equipment Leak Emission Estimates (EPA-453/R-95-017), U.S. EPA, November 1995, "Table G-2: Determination of LDAR Control Effectiveness at Refinery Process Units" for HON LDAR rule (40 CFR Part 63 Subpart H) being developed at the time the protocol was drafted by EPA. The leak monitoring frequencies and leak detection thresholds under HON are similar to those under NSPS Subparts VVa, so the use of the HON LDAR control credits for the selected component types is appropriate.

Applicable Requirements

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number. (*Note: Title V permit condition numbers alone are not the underlying applicable requirements*). If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Pursuant to 40 CFR 60.592a(a), the permittee subject to the provisions of 40 CFR 60 Subpart GGGa shall comply with the requirements of 40 CFR 60.482–1a to 60.482–10a as soon as practicable, but no later than 180 days after initial startup. Pursuant to 40 CFR 60.592a(b), for a given process unit, the permittee may elect to comply with the following requirements as an alternative to the requirements in 40 CFR 60.482–7a. (1) Comply with 40 CFR 60.483–1a. (2) Comply with 40 CFR 60.483–2a. (3) Comply with the Phase III provisions in 40 CFR 63.168, except the permittee may elect to follow the provisions in 40 CFR 60.482–7a(f) instead of 40 CFR 63.168 for any valve that is designated as being leakless. Pursuant to 40 CFR 60.592a(d), the permittee shall comply with the provisions of 40 CFR 60.485a except as provided in 40 CFR 60.593a. Pursuant to 40 CFR 60.593a(g), connectors in gas/vapor or light liquid service are exempt from the requirements in 40 CFR 60.482–11a, provided the permittee complies with 40 CFR 60.482–8a for all connectors, not just those in heavy liquid service.

__X__ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation. (Note: Each requirement listed above must have an associated method of demonstrating compliance. If there is not already a required method in place, then a method must be proposed.)

Pursuant to 40 CFR 60.482-1a(e), equipment that the permittee designates as being in VOC service less than 300 hr/yr is excluded from the requirements of 40 CFR 60.482–2a through 60.482–11a if it is identified as required in 40 CFR 60.486a(e)(6) and it meets any of the conditions specified in paragraphs 40 CFR 60.482-1a(e)(1) through (3):

(1) The equipment is in VOC service only during startup and shutdown, excluding startup and shutdown between batches of the same campaign for a batch process.

(2) The equipment is in VOC service only during process malfunctions or other emergencies.
(3) The equipment is backup equipment that is in VOC service only when the primary equipment is out of service.

Pursuant to 40 CFR 60.482-6a(a)(1), each open-ended valve or line shall be equipped with a cap, blind flange, plug, or a second valve, except as provided in 40 CFR 60.482-6a(d) and (e).

Pursuant to 40 CFR 60.482-6a(a)(2), the cap, blind flange, plug, or second valve shall seal the open end at all times except during operations requiring process fluid flow through the open-ended valve or line.

Pursuant to 40 CFR 60.482-6a(b), each open-ended valve or line equipped with a second valve shall be operated in a manner such that the valve on the process fluid end is closed before the second valve is closed.

Pursuant to 40 CFR 60.482-6a(c), when a double block-and-bleed system is being used, the bleed valve or line may remain open during operations that require venting the line between the block valves but shall comply with 40 CFR 60.482-6a(a) at all other times.

Pursuant to 40 CFR 60.482-6a(d), open-ended valves or lines in an emergency shutdown system which are designed to open automatically in the event of a process upset are exempt from the requirements of 40 CFR 60.482-6a(a), (b), and (c).

Pursuant to 40 CFR 60.482-6a(e), open-ended valves or lines containing materials which would present an explosion, serious overpressure, or other safety hazard if capped or equipped with a double block and bleed system as specified in 40 CFR 60.482-6a(a) through (c) are exempt from the requirements of 40 CFR 60.482-6a(a) through (c).

Pursuant to 40 CFR 60.482-7a(a)(1), each valve shall be monitored monthly to detect leaks by the methods specified in 40 CFR 60.485a(b) and shall comply with 40 CFR 60.482-7a(b) through (e), except as provided in 40 CFR 60.482- 7a(f), (g), and (h) and 40 CFR 60.483–1a and 60.483–2a.

Pursuant to 40 CFR 60.482-7a(a)(2), a valve that begins operation in gas/vapor service or light liquid service after the initial startup date for the process unit must be monitored according to 40 CFR 60.482-7a(a)(2)(i) or (ii), except for a valve that replaces a leaking valve and except as provided in 40 CFR 60.482-7a(f), (g), and (h) and 40 CFR 60.483– 1a and 60.483–2a.

Pursuant to 40 CFR 60.482-9a(a), delay of repair of equipment for which leaks have been detected will be allowed if repair within 15 days is technically infeasible without a process unit shutdown. Repair of this equipment shall occur before the end of the next process unit shutdown. Monitoring to verify repair must occur within 15 days after startup of the process unit.

Pursuant to 40 CFR 60.482-9a(b), delay of repair of equipment will be allowed for equipment which is isolated from the process and which does not remain in VOC service.

Pursuant to 40 CFR 60.482-9a(c), delay of repair for valves and connectors will be allowed if:

(1) The permittee demonstrates that emissions of purged material resulting from immediate repair are greater than the fugitive emissions likely to result from delay of repair, and
(2) When repair procedures are effected, the purged material is collected and destroyed or recovered in a control device complying with 40 CFR 60.482–10a.

Pursuant to 40 CFR 60.482-9a(e), delay of repair beyond a process unit shutdown will be allowed for a valve, if valve assembly replacement is necessary during the process unit shutdown, valve assembly supplies have been depleted, and valve assembly supplies had been sufficiently stocked before the supplies were depleted. Delay of repair beyond the next process unit shutdown will not be allowed unless the next process unit shutdown occurs sooner than 6 months after the first process unit shutdown.

Pursuant to 40 CFR 60.482-9a(f), when delay of repair is allowed for a leaking valve or connector that remains in service, the valve or connector may be considered to be repaired and no longer subject to delay of repair requirements if two consecutive monthly monitoring instrument readings are below the leak definition.

Pursuant to 40 CFR 60.593a(g) and 40 CFR 60.482–8a(a), if evidence of a potential leak is found by visual, audible, olfactory, or any other detection method at connectors in gas/vapor or light liquid service, the permittee shall follow either one of the following procedures:

(1) The permittee shall monitor the equipment within 5 days by the method specified in 40 CFR 60.485a(b) and shall comply with the requirements of 40 CFR 60.482–8a(b) through (d) of this section.
(2) The permittee shall eliminate the visual, audible, olfactory, or other indication of a potential leak within 5 calendar days of detection. Pursuant to 40 CFR 60.592a(e), the permittee shall comply with the provisions of 40 CFR 60.486a and 60.487a.

Are you in compliance with all applicable requirements for this emission unit? _X_ Yes ___No

If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.

ATTACHMENT F: SCHEDULE OF COMPLIANCE FORM

This application form is required if a facility indicated noncompliance with any of the applicable requirements identified in the permit application. If the facility is in compliance with the applicable requirements, this form is not required, and as such, it has not been included in this application.

ATTACHMENT G: AIR POLLUTION CONTROL DEVICE FORM

This application form is to be completed for each control device listed in the Title V Equipment Table Form (Attachment D). There are no control devices located at the butane cavern facility, and as such, this form has not been included in this application.

ATTACHMENT H: COMPLIANCE ASSURANCE MONITORING PLAN FORM

As detailed in Section 2.4, CAM is not applicable to the butane cavern facility. A CAM Plan Form has been included in this application to formally indicate CAM is not applicable.

ATTACHMENT H - Compliance Assurance Monitoring (CAM) Plan Form

For definitions and information about the CAM rule, please refer to 40 CFR Part 64. Additional information (including guidance documents) may also be found at http://www.epa.gov/ttn/emc/cam.html

CAM APPLICABILITY DETERMINATION

1) Does the facility have a PSEU (Pollutant-Specific Emissions Unit considered separately with respect to **EACH** regulated air pollutant) that is subject to CAM (40 CFR Part 64), which must be addressed in this CAM plan submittal? To determine applicability, a PSEU must meet **all** of the following criteria (*If No, then the remainder of this form need not be completed*): ☐ YES ☒ NO

a. The PSEU is located at a major source that is required to obtain a Title V permit;

b. The PSEU is subject to an emission limitation or standard for the applicable regulated air pollutant that is NOT exempt;

LIST OF EXEMPT EMISSION LIMITATIONS OR STANDARDS:

- NSPS (40 CFR Part 60) or NESHAP (40 CFR Parts 61 and 63) proposed after 11/15/1990.
- Stratospheric Ozone Protection Requirements.
- Acid Rain Program Requirements.
- Emission Limitations or Standards for which a WVDEP Division of Air Quality Title V permit specifies a continuous compliance determination method, as defined in 40 CFR §64.1.
- An emission cap that meets the requirements specified in 40 CFR §70.4(b)(12).

c. The PSEU uses an add-on control device (as defined in 40 CFR §64.1) to achieve compliance with an emission limitation or standard;

d. The PSEU has potential pre-control device emissions of the applicable regulated air pollutant that are equal to or greater than the Title V Major Source Threshold Levels; AND

e. The PSEU is NOT an exempt backup utility power emissions unit that is municipally-owned.

BASIS OF CAM SUBMITTAL

2) Mark the appropriate box below as to why this CAM plan is being submitted as part of an application for a Title V permit:

☐ RENEWAL APPLICATION. **ALL** PSEUs for which a CAM plan has NOT yet been approved need to be addressed in this CAM plan submittal.

☐ INITIAL APPLICATION (submitted after 4/20/98). **ONLY** large PSEUs (i. e., PSEUs with potential post-control device emissions of an applicable regulated air pollutant that are equal to or greater than Major Source Threshold Levels) need to be addressed in this CAM plan submittal.

☐ SIGNIFICANT MODIFICATION TO LARGE PSEUs. **ONLY** large PSEUs being modified after 4/20/98 need to be addressed in this cam plan submittal. For large PSEUs with an approved CAM plan, Only address the appropriate monitoring requirements affected by the significant modification.

3) [a] *BACKGROUND DATA AND INFORMATION*

Complete the following table for **all** PSEUs that need to be addressed in this CAM plan submittal. This section is to be used to provide background data and information for each PSEU In order to supplement the submittal requirements specified in 40 CFR §64.4. If additional space is needed, attach and label accordingly.

PSEU DESIGNATION	DESCRIPTION	POLLUTANT	CONTROL DEVICE	[b] EMISSION LIMITATION or STANDARD	[c] MONITORING REQUIREMENT
EXAMPLE Boiler No. 1	Wood-Fired Boiler	PM	Multiclone	45CSR§2-4.1.c.; 9.0 lb/hr	Monitor pressure drop across multiclone: Weekly inspection of multiclone

[a] If a control device is common to more than one PSEU, one monitoring plan may be submitted for the control device with the affected PSEUs identified and any conditions that must be maintained or monitored in accordance with 40 CFR §64.3(a). If a single PSEU is controlled by more than one control device similar in design and operation, one monitoring plan for the applicable control devices may be submitted with the applicable control devices identified and any conditions that must be maintained or monitored in accordance with 40 CFR §64.3(a).

[b] Indicate the emission limitation or standard for any applicable requirement that constitutes an emission limitation, emission standard, or standard of performance (as defined in 40 CFR §64.1).

[c] Indicate the monitoring requirements for the PSEU that are required by an applicable regulation or permit condition.

CAM MONITORING APPROACH CRITERIA			
Complete this section for **EACH** PSEU that needs to be addressed in this CAM plan submittal. This section may be copied as needed for each PSEU. This section is to be used to provide monitoring data and information for EACH indicator selected for EACH PSEU in order to meet the monitoring design criteria specified in 40 CFR §64.3 and §64.4. if more than two indicators are being selected for a PSEU or if additional space is needed, attach and label accordingly with the appropriate PSEU designation, pollutant, and indicator numbers.			
4a) PSEU Designation:	**4b) Pollutant:**	**4c) [a] Indicator No. 1:**	**4d) [a] Indicator No. 2:**
5a) GENERAL CRITERIA Describe the MONITORING APPROACH used to measure the indicators:			
[b] Establish the appropriate INDICATOR RANGE or the procedures for establishing the indicator range which provides a reasonable assurance of compliance:			
5b) PERFORMANCE CRITERIA Provide the SPECIFICATIONS FOR OBTAINING REPRESENTATIVE DATA, such as detector location, installation specifications, and minimum acceptable accuracy:			
[c] For new or modified monitoring equipment, provide VERIFICATION PROCEDURES, including manufacturer's recommendations, TO CONFIRM THE OPERATIONAL STATUS of the monitoring:			
Provide QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC) PRACTICES that are adequate to ensure the continuing validity of the data, (i.e., daily calibrations, visual inspections, routine maintenance, RATA, etc.):			
[d] Provide the MONITORING FREQUENCY:			
Provide the DATA COLLECTION PROCEDURES that will be used:			
Provide the DATA AVERAGING PERIOD for the purpose of determining whether an excursion or exceedance has occurred:			

[a] Describe all indicators to be monitored which satisfies 40 CFR §64.3(a). Indicators of emission control performance for the control device and associated capture system may include measured or predicted emissions (including visible emissions or opacity), process and control device operating parameters that affect control device (and capture system) efficiency or emission rates, or recorded findings of inspection and maintenance activities.

[b] Indicator Ranges may be based on a single maximum or minimum value or at multiple levels that are relevant to distinctly different operating conditions, expressed as a function of process variables, expressed as maintaining the applicable indicator in a particular operational status or designated condition, or established as interdependent between more than one indicator. For CEMS, COMS, or PEMS, include the most recent certification test for the monitor.

[c] The verification for operational status should include procedures for installation, calibration, and operation of the monitoring equipment, conducted in accordance with the manufacturer's recommendations, necessary to confirm the monitoring equipment is operational prior to the commencement of the required monitoring.

[d] Emission units with post-control PTE ≥ 100 percent of the amount classifying the source as a major source (i.e., Large PSEU) must collect four or more values per hour to be averaged. A reduced data collection frequency may be approved in limited circumstances. Other emission units must collect data at least once per 24 hour period.

RATIONALE AND JUSTIFICATION

Complete this section for EACH PSEU that needs to be addressed in this CAM plan submittal. This section may be copied as needed for each PSEU. This section is to be used to provide rationale and justification for the selection of EACH indicator and monitoring approach and EACH indicator range in order to meet the submittal requirements specified in 40 CFR §64.4.

6a) PSEU Designation:	6b) Regulated Air Pollutant:

7) **INDICATORS AND THE MONITORING APPROACH**: Provide the rationale and justification for the selection of the indicators and the monitoring approach used to measure the indicators. Also provide any data supporting the rationale and justification. Explain the reasons for any differences between the verification of operational status or the quality assurance and control practices proposed, and the manufacturer's recommendations. (If additional space is needed, attach and label accordingly with the appropriate PSEU designation and pollutant):

8) **INDICATOR RANGES**: Provide the rationale and justification for the selection of the indicator ranges. The rationale and justification shall indicate how EACH indicator range was selected by either a COMPLIANCE OR PERFORMANCE TEST, a TEST PLAN AND SCHEDULE, or by ENGINEERING ASSESSMENTS. Depending on which method is being used for each indicator range, include the specific information required below for that specific indicator range. (If additional space is needed, attach and label accordingly with the appropriate PSEU designation and pollutant):

- COMPLIANCE OR PERFORMANCE TEST (Indicator ranges determined from control device operating parameter data obtained during a compliance or performance test conducted under regulatory specified conditions or under conditions representative of maximum potential emissions under anticipated operating conditions. Such data may be supplemented by engineering assessments and manufacturer's recommendations). The rationale and justification shall INCLUDE a summary of the compliance or performance test results that were used to determine the indicator range, and documentation indicating that no changes have taken place that could result in a significant change in the control system performance or the selected indicator ranges since the compliance or performance test was conducted.

- TEST PLAN AND SCHEDULE (Indicator ranges will be determined from a proposed implementation plan and schedule for installing, testing, and performing any other appropriate activities prior to use of the monitoring). The rationale and justification shall INCLUDE the proposed implementation plan and schedule that will provide for use of the monitoring as expeditiously as practicable after approval of this CAM plan, except that in no case shall the schedule for completing installation and beginning operation of the monitoring exceed 180 days after approval.

- ENGINEERING ASSESSMENTS (Indicator Ranges or the procedures for establishing indicator ranges are determined from engineering assessments and other data, such as manufacturers' design criteria and historical monitoring data, because factors specific to the type of monitoring, control device, or PSEU make compliance or performance testing unnecessary). The rationale and justification shall INCLUDE documentation demonstrating that compliance testing is not required to establish the indicator range.

RATIONALE AND JUSTIFICATION:

ATTACHMENT I: SUPPORTING EMISSIONS DOCUMENTATION

Attachment I. Supporting Calculations

Table I-1. Butane Cavern Annual Potential Emissions

Title V Emission Unit ID	Catlettsburg Unit ID	Emission Unit Description	GHG Emissions (tpy, CO_2e)	NO_X Emissions (tpy)	CO Emissions (tpy)	VOC Emissions (tpy)	$PM/PM_{10}/PM_{2.5}$ Emissions (tpy)	SO_2 Emissions (tpy)	Benzene Emissions (tpy)	1,3-Butadiene Emissions (tpy)	Total HAP/TAP Emissions (tpy)
FL05	1-14-FS-03	Lube Area Flare (KY Scope)	931	0.44	2.29	6.23	0.18	0.09	1.66E-03	8.31E-04	2.49E-03
1S	2-036	HF Alky Unit Fugitive Emissions (WV Scope)	-	-	-	2.87	-	-	4.37E-04	2.18E-04	6.55E-04
Total Annual Potential Emissions (KY Scope)			931	0.44	2.29	6.23	0.18	0.09	1.66E-03	8.31E-04	2.49E-03
Total Annual Potential Emissions (WV Scope)			-	-	-	2.87	-	-	4.37E-04	2.18E-04	6.55E-04
Total Annual Potential Emissions (KY and WV Scope)			931	0.44	2.29	9.10	0.18	0.09	2.10E-03	1.05E-03	3.15E-03

I-1. Butane Cavern Vent Potential Emissions Calculations

> Documentation of the process rates and emission factors used in the potential emission calculations for the butane cavern vents controlled by the Lube Area Flare is provided in this section.

I-1.1 Maximum Hourly and Annual Process Gas Flow Rates for Butane Cavern Vents

> The maximum hourly and annual process gas flow rates for the butane cavern venting are documented below.

Emission Unit	Title V EU ID	MPC ID	KyEIS Source ID	Operating Scenario	Maximum Hourly Flow Rate[1] (MMscf/hr)	Maximum Annual Flow Rate[2] (MMscf/yr)
Lube Area Flare	FL05	1-14-FS-03	EQPT045	Scenario #1	7.22E-03	10.66
Lube Area Flare	FL05	1-14-FS-03	EQPT045	Scenario #2	1.54E-03	1.85E-02

[1] The maximum hourly flare gas flow rate for the initial filling Scenario #1 is based on the flow capacity of the pump feeding liquid butane from the Tan 836 to the butane cavern since the maximum amount of vapor displaced from the cavern on an hourly basis is determined by the maximum fill rate of the cavern. The maximum hourly flare gas flow rate for the noncondensable gas venting Scenario #2 assumes that the full cavern dome volume (500 ft^3) will be vented in one hour at 30 psig and 60 DEGF.

[2] The maximum annual flare gas flow rate for Scenario #1 is based on the volume of nitrogen initially (2 psig and 65 DEGF) contained in the cavern's capacity (5,614,600 ft^3) plus the dome volume (500 ft^3) plus the amount of butane solubilized in the nitrogen at venting conditions (30 psig and 65 DEGF) assuming that one full cavern turnover will be required to remove the nitrogen from the cavern upon initial filling. The maximum annual flare gas flow rate for Scenario #2 assumes a noncondensable gas venting episode producing a displaced gas volume equivalent to the cavern dome capacity will occur 12 times year (i.e., 4 times per month for the 3 summer months).

I-1.2 Butane Cavern Vent Composition Data for Initial Filling (Scenario #1)

> The butane cavern vent composition data for the initial filling Scenario #1 is based on a chemical process simulation model output for the liquid butane product in equilibrium with a vapor space of gaseous nitrogen conducted at an operating temperature of 60 °F and an operating pressure of 30 psig.

E-1.2.1 Composition Data for Initial Filling (Scenario #1)

Chemical Compound	Molecular Formula	Molecular Weight (lb/lbmol)	Higher Heating Value (Btu/scf)	Carbon Number (#)	Mole Fraction	Molar Flow Rate in Vent (lbmol/hr)	Molar Flow Rate in Vent (lbmol/yr)	Mass Flow Rate in Vent (lb/hr)	Mass Flow Rate in Vent (lb/yr)	Carbon Mass Flow Rate in Vent (lb/hr)	Carbon Mass Flow Rate in Vent (lb/yr)
Methane	CH4	16.04	978	1	0	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	C2H6	30.07	1,713	2	0.0010	0.02	27.66	0.56	832	0.45	664
Ethylene	C2H4	28.05	1,549	2	0	0.00	0.00	0.00	0.00	0.00	0.00
Propane	C3H8	44.09	2,437	3	0.0276	0.52	763.32	22.8	33,655	18.6	27,502
Propene	C3H6	42.08	2,260	3	0.0010	0.02	27.66	0.79	1,164	0.67	996
Isobutane	C4H10	58.12	3,150	4	0.0217	0.41	600.15	23.6	34,880	19.5	28,831
n-Butane	C4H10	58.12	3,160	4	0.3310	6.20	9,154.30	360	532,048	298	439,773
trans -2-Butene	C4H8	56.1	2,985	4	0.0031	0.06	85.74	3.3	4,810	2.79	4,119
1-Butene	C4H8	56.1	2,985	4	0.0007	0.01	19.36	0.74	1,086	0.63	930
Isobutene	C4H8	56.1	2,985	4	0.0017	0.03	47.02	1.79	2,638	1.53	2,259
cis -2-Butene	C4H8	56.1	2,985	4	0.0018	0.03	49.78	1.89	2,793	1.62	2,392
Isopentane	C5H12	72.15	3,875	5	0.0035	0.07	96.80	4.7	6,984	3.93	5,813
n-Pentane	C5H12	72.15	3,882	5	0	0.00	0.00	0.00	0.00	0.00	0.00
Benzene	C6H6	78.11	3,555	6	0.0001	1.44E-03	2.12	0.11	165.83	0.10	153
1,3-Butadiene	C4H6	54.09	2,789	4	0.0001	1.04E-03	1.53	0.06	82.91	0.05	73.6
Nitrogen	N2	28	0	0	0.6067	11.36	16,779.20	318	469,818	0.00	0.00
Total for Scenario #1 Vent		39.45	1,222		1.0000	18.72	27,655	738	1,090,955	348	513,505

I-1.3 Butane Cavern Vent Composition Data for Noncondensable Gas Venting (Scenario #2)

> The butane cavern vent composition data for the noncondensable gas venting Scenario #2 is based on a chemical process simulation model output .

E-1.3.1 Composition Data for Noncondensable Gas Venting (Scenario #2)

Chemical Compound	Molecular Formula	Molecular Weight (lb/lbmol)	Higher Heating Value (Btu/scf)	Carbon Number (#)	Mole Fraction	Molar Flow Rate in Vent (lbmol/hr)	Molar Flow Rate in Vent (lbmol/yr)	Mass Flow Rate in Vent (lb/hr)	Mass Flow Rate in Vent (lb/yr)	Carbon Mass Flow Rate in Vent (lb/hr)	Carbon Mass Flow Rate in Vent (lb/yr)
Methane	CH4	16.04	978	1	0	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	C2H8	30.07	1,713	2	0.0024	0.01	0.12	0.29	3.48	0.23	2.78
Ethylene	C2H4	28.05	1,549	2	0	0.00	0.00	0.00	0.00	0.00	0.00
Propane	C3H8	44.09	2,437	3	0.0567	0.23	2.73	10.0	120	8.2	98
Propene	C3H6	42.08	2,260	3	0.0022	0.01	0.10	0.36	4.36	0.31	3.73
Isobutane	C4H10	58.12	3,150	4	0.0507	0.20	2.43	11.8	142	9.7	117
n-Butane	C4H10	58.12	3,160	4	0.8563	3.43	41.16	199	2,392	165	1,977
trans -2-Butene	C4H8	56.1	2,985	4	0.0083	0.03	0.40	1.87	22.4	1.60	19.2
1-Butene	C4H8	56.1	2,985	4	0.0018	0.01	0.09	0.41	4.89	0.35	4.19
Isobutene	C4H8	56.1	2,985	4	0.0042	0.02	0.20	0.94	11.2	0.80	9.6
cis -2-Butene	C4H8	56.1	2,985	4	0.0050	0.02	0.24	1.12	13.4	0.96	11.5
Isopentane	C5H12	72.15	3,875	5	0.0115	0.05	0.55	3.33	39.9	2.77	33.2
n-Pentane	C5H12	72.15	3,882	5	0.00003	1.36E-04	0.00	0.01	0.12	0.01	0.10
n-Heptane	C7H16	100.2	5,286	7	0.0007	2.97E-03	0.04	0.30	3.57	0.25	3.00
Benzene	C6H6	78.11	3,555	6	0.0001	4.47E-04	0.01	0.03	0.42	0.03	0.39
1,3-Butadiene	C4H6	54.09	2,789	4	0.0001	3.23E-04	3.87E-03	0.02	0.21	0.02	0.19
Nitrogen	N2	28	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
Total for Scenario #2 Vent		57.38	3,120		1.0000	4.01	48.1	230	2,758	190	2,280

I-1.4 Documentation of Criteria Pollutant Emission Factors Used

> Emission factors for CO, NO_X, and $PM/PM_{10}/PM_{2.5}$ are taken from the *Emission Estimation Protocol for Petroleum Refineries* ("Refinery Protocol") developed by RTI in September 2010 for the EPA refinery Information Collection Request (https://refineryicr.rti.org/) issued in March 2011. The VOC emission factor is based on the process gas composition data presented above and an assumed combustion efficiency for a properly operating flare of 98 percent. The SO2 emission factor is based on the worst-case flare gas sulfur content assuming complete conversion to SO2.

CO Emission Factor

Parameter	*Value*	*Units*	*Basis*
CO Heat Input-Based Emission Factor	0.3500	lb/MMBtu, HHV	Table 6-3 of the Refinery Protocol for low-Btu, steam-assisted flares
Process Gas Heating Value for Scenario #1	1,222	Btu/scf, HHV	Refer to Section E-1.2.1
CO Flow Rate-Based Emission Factor for Scenario #1	428	lb/MMscf	
Process Gas Heating Value for Scenario #2	3,120	Btu/scf, HHV	Refer to Section E-1.3.1
CO Flow Rate-Based Emission Factor for Scenario #2	1,092	lb/MMscf	

NOX Emission Factor

Parameter	*Value*	*Units*	*Basis*
NOX Heat Input-Based Emission Factor	0.0680	lb/MMBtu, HHV	Table 6-3 of the Refinery Protocol for low-Btu, steam-assisted flares
Process Gas Heating Value for Scenario #1	1,222	Btu/scf, HHV	Refer to Section E-1.2.1
NOX Flow Rate-Based Emission Factor for Scenario #1	83	lb/MMscf	
Process Gas Heating Value for Scenario #2	3,120	Btu/scf, HHV	Refer to Section E-1.3.1
NOX Flow Rate-Based Emission Factor for Scenario #2	212	lb/MMscf	

PM Emission Factor

Parameter	*Value*	*Units*	*Basis*
PM Heat Input-Based Emission Factor	0.0270	lb/MMBtu, HHV	Table 6-3 of the Refinery Protocol for low-Btu, steam-assisted flares
Process Gas Heating Value for Scenario #1	1,222	Btu/scf, HHV	Refer to Section E-1.2.1
PM Flow Rate-Based Emission Factor for Scenario #1	33.0	lb/MMscf	
Process Gas Heating Value for Scenario #2	3,120	Btu/scf, HHV	Refer to Section E-1.3.1
PM Flow Rate-Based Emission Factor for Scenario #2	84.2	lb/MMscf	

VOC Emission Factor

Parameter	*Value*	*Units*	*Basis*
Mole Fraction of VOC in Butane Cavern Vent for Scenario #1	0.39		Refer to Section E-1.2.1
Average Molecular Weight of VOC in Vent for Scenario #1	57.2	lb/lbmol	Refer to Section E-1.2.1
Molar Volume Conversion Factor for Scenario #1	385.5	ft^3/lbmol	Molar volume of an ideal gas used at 68 °F and 1 psig
Mole Fraction of VOC in Butane Cavern Vent for Scenario #2	0.998		Refer to Section E-1.3.1
Average Molecular Weight of VOC in Vent for Scenario #2	57.4	lb/lbmol	Refer to Section E-1.3.1
Molar Volume Conversion Factor for Scenario #2	385.5	ft^3/lbmol	Molar volume of an ideal gas used at 68 °F and 1 psig
Flare Combustion Efficiency	98.0%		Combustion efficiency for a properly operating flare

VOC Emission Factor

Parameter	*Value*	*Units*	*Basis*
VOC Emission Factor for Scenario #1	1,164	lb/MMscf	= 0.39 lbmol VOC/lbmol flare gas x 1/385.5 scf/lbmol flare gas x 57.2 lb VOC/lbmol VOC x (1 -98%) x 1E6 scf/MMscf
VOC Emission Factor for Scenario #2	2,973	lb/MMscf	= 1.00 lbmol VOC/lbmol flare gas x 1/385.5 scf/lbmol flare gas x 57.4 lb VOC/lbmol VOC x (1 -98%) x 1E6 scf/MMscf

SO_2 Emission Factor

Parameter	*Value*	*Units*	*Basis*
Maximum Process Gas Sulfur Content	100	ppmv	Worst-case sulfur content of butane cavern vent for both Scenario #1 and #2.
Molar Volume Conversion Factor for Scenario #1	385.5	ft^3/lbmol	Molar volume of an ideal gas used at 68 °F and 1 psig
Molar Volume Conversion Factor for Scenario #2	385.5	ft^3/lbmol	Molar volume of an ideal gas used at 68 °F and 1 psig
Molecular Weight of SO2	64	lb SO2/lbmol	
SO2 Flow Rate-Based Emission Factor for Scenario #1	16.6	lb/MMscf	= 1.00E-04 lbmol H2S/lbmol flare gas x 1/385.5 scf/lbmol x 1 lbmol SO2/1 lbmol H2S x 64 lb SO2/lbmol x 1.0E6 scf/MMscf
SO2 Flow Rate-Based Emission Factor for Scenario #2	16.6	lb/MMscf	= 1.00E-04 lbmol H2S/lbmol flare gas x 1/385.5 scf/lbmol x 1 lbmol SO2/1 lbmol H2S x 64 lb SO2/lbmol x 1.0E6 scf/MMscf

Benzene Emission Factor

Parameter	*Value*	*Units*	*Basis*
Mole Fraction of Benzene in Butane Cavern Vent for Scenario #1	7.68E-05		Refer to Section E-1.2.1
Molecular Weight of Benzene	78.11	lb/lbmol	
Molar Volume Conversion Factor for Scenario #1	385.5	ft^3/lbmol	Molar volume of an ideal gas used at 68 °F and 1 psig
Mole Fraction of Benzene in Butane Cavern Vent for Scenario #2	1.12E-04		Refer to Section E-1.3.1
Molar Volume Conversion Factor for Scenario #2	385.5	ft^3/lbmol	Molar volume of an ideal gas used at 68 °F and 1 psig
Flare Combustion Efficiency	98.0%		Combustion efficiency for a properly operating flare
Benzene Emission Factor for Scenario #1	0.31	lb/MMscf	= 7.68E-05 lbmol BZ/lbmol flare gas x 1/385.5 scf/lbmol flare gas x 78.11 lb BZ/lbmol x (1 -98%) x 1E6 scf/MMscf
Benzene Emission Factor for Scenario #2	0.45	lb/MMscf	= 1.12E-04 lbmol BZ/lbmol flare gas x 1/385.5 scf/lbmol flare gas x 78.11 lb BZ/lbmol x (1 -98%) x 1E6 scf/MMscf

1,3-Butadiene Emission Factor

Parameter	*Value*	*Units*	*Basis*
Mole Fraction of 1,3-Butadiene in Butane Cavern Vent for Scenario #1	5.54E-05		Refer to Section E-1.2.1
Molecular Weight of 1,3-Butadiene	54.09	lb/lbmol	
Molar Volume Conversion Factor for Scenario #1	385.5	ft^3/lbmol	Molar volume of an ideal gas used at 68 °F and 1 psig
Mole Fraction of 1,3-Butadiene in Butane Cavern Vent for Scenario #2	8.06E-05		Refer to Section E-1.3.1
Molar Volume Conversion Factor for Scenario #2	385.5	ft^3/lbmol	Molar volume of an ideal gas used at 68 °F and 1 psig
Flare Combustion Efficiency	98.0%		Combustion efficiency for a properly operating flare
1,3-Butadiene Emission Factor for Scenario #1	0.18	lb/MMscf	= 5.54E-05 lbmol BD/lbmol flare gas x 1/385.5 scf/lbmol flare gas x 54.09 lb BD/lbmol x (1 -98%) x 1E6 scf/MMscf
1,3-Butadiene Emission Factor for Scenario #2	0.23	lb/MMscf	= 8.06E-05 lbmol BD/lbmol flare gas x 1/385.5 scf/lbmol flare gas x 54.09 lb BD/lbmol x (1 -98%) x 1E8 scf/MMscf

I-1.5 Documentation of GHG Emission Factors Used

> GHG emission factors for butane cavern vent combustion are based on MRR Subpart Y Equation Y-1a for CO_2 emissions and MRR Subpart C Table C-2 for CH_4 and N_2O emissions. Equation Y-1a requires a calculation of the molecular weight and carbon content of the butane cavern vents routed to the flare. Since the process simulation model outputs presented above provide a breakdown of mass flow rates of each constituent present in the butane cavern vents routed to the flare, the molecular weight and carbon content was calculated from this data.

> The CO2 emission factor for process gas combustion in the flare is calculated based on Equation Y-1a shown below.

$$CO_2 = 0.98 \times 0.001 \times \left(\sum_{p=1}^{n} \left[\frac{44}{12} \times (Flare)_p \times \frac{(MW)_p}{MVC} \times (CC)_p \right] \right) \qquad \text{(Eq. Y-1a)}$$

where,
CO_2 = Annual CO_2 emissions for a specific fuel type (metric tons/year).
0.98 = Assumed combustion efficiency of a flare.
0.001 = Unit conversion factor (metric tons per kilogram, mt/kg).
n = Number of measurement periods (not used since calculation is not based on periodic process data measurements)
p = Measurement period index (not used since calculation is not based on process data measurements)
44 = Molecular weight of CO_2 (kg/kg-mole).
12 = Atomic weight of C (kg/kg-mole).
$(Flare)_p$ = Volume of flare gas combusted during measurement period (standard cubic feet per period, scf/period).
$(MW)_p$= Average molecular weight of the flare gas combusted during measurement period (kg/kg-mole).
MVC = Molar volume conversion factor (649.5 scf/kg-mole).
$(CC)_p$= Average carbon content of the flare gas combusted during measurement period (kg C per kg flare gas).

CO2 Emission Factor

Parameter	*Value*	*Units*	*Basis*
$(Flare)_p$ for Scenario #1	10,860,857	scf/yr	Refer to Section A-1.1
$(MW)_p$ for Scenario #1	39.45	kg/kg-mole	Refer to Section A-1.2.1
$(CC)_p$ for Scenario #1	0.47	kg C/kg gas	Refer to Section A-1.2.1
CO_2	837	mt/yr	From Eqn. Y-1a
	923	tpy	
CO2 Emission Factor for Scenario #1	173,157	lb/MMscf	
$(Flare)_p$ for Scenario #2	18,529	scf/yr	Refer to Section A-1.1
$(MW)_p$	57.38	kg/kg-mole	Refer to Section A-1.3.1
$(CC)_p$	0.83	kg C/kg gas	Refer to Section A-1.3.1
CO_2	3.72	mt/yr	From Eqn. Y-1a
	4.10	tpy	
CO2 Emission Factor for Scenario #2	442,426	lb/MMscf	

CH4 Emission Factor

Parameter	*Value*	*Units*	*Basis*
CH4 Heat Input-Based Emission Factor	3.0E-03	kg/MMBtu, HHV	Default CH4 emission factor for "Petroleum Products" from Table C-2 of Subpart C
	8.81E-03	lb/MMBtu	
Process Gas Heating Value for Scenario #1	1,222	Btu/scf	Refer to Section A-1.2.1
CH4 Flow Rate-Based Emission Factor for Scenario #1	8.08	lb/MMscf	
Process Gas Heating Value for Scenario #2	3,120	Btu/scf	Refer to Section A-1.3.1
CH4 Flow Rate-Based Emission Factor for Scenario #2	20.63	lb/MMscf	

N2O Emission Factor

Parameter	*Value*	*Units*	*Basis*
N2O Heat Input-Based Emission Factor	8.0E-04	kg/MMBtu, HHV	Default N2O emission factor for "Petroleum Products" from Table C-2 of Subpart C
	1.32E-03	lb/MMBtu	
Process Gas Heating Value for Scenario #1	1,222	Btu/scf	Refer to Section A-1.2.1
N2O Flow Rate-Based Emission Factor for Scenario #1	1.62	lb/MMscf	
Process Gas Heating Value for Scenario #2	3,120	Btu/scf	Refer to Section A-1.3.1
N2O Flow Rate-Based Emission Factor for Scenario #2	4.13	lb/MMscf	

I-1.6 Potential Emission Calculations for Initial Filling (Scenario #1) Based on Factors Documented

	Emission Factor			Emissions Increase for Initial Filling (Scenario #1)	
	Value	Units	Basis	(lb/hr)	(tpy)
Primary Pollutants					
CO	428	lb/MMscf	Ref. Protocol	3.08	2.28
NOX	83	lb/MMscf	Ref. Protocol	0.60	0.44
PM	33.0	lb/MMscf	Ref. Protocol	0.24	0.18
VOC	1,164	lb/MMscf	Eng. Est.	8.40	6.20
SO2	16.6	lb/MMscf	Eng. Est.	0.12	0.09
Greenhouse Gases					
CO2	173,157	lb/MMscf	MRR Eqn. Y-1a	1,249	923
CH4	8.08	lb/MMscf	MRR Table C-2	0.058	0.043
N2O	1.62	lb/MMscf	MRR Table C-2	0.012	0.009
CO2e	173,828	lb/MMscf		1,254	927
HAPS/TAPS					
Benzene	0.31	lb/MMscf	Eng. Est.	2.24E-03	1.66E-03
1,3-Butadiene	0.16	lb/MMscf	Eng. Est.	1.12E-03	8.29E-04
Total HAPS/TAPS	0.47	lb/MMscf	Eng. Est.	3.37E-03	2.49E-03

I-1.7 Potential Emission Calculations for Noncondensable Gas Venting (Scenario #2) Based on Factors Documented

	Emission Factor			Emissions Increase for Noncondensable Gas Venting (Scenario #2)	
	Value	Units	Basis	(lb/hr)	(tpy)
Primary Pollutants					
CO	1,092	lb/MMscf	Ref. Protocol	1.69	1.01E-02
NOX	212	lb/MMscf	Ref. Protocol	0.33	1.97E-03
PM	84.2	lb/MMscf	Ref. Protocol	0.130	7.80E-04
VOC	2,973	lb/MMscf	Eng. Est.	4.59	2.75E-02
SO2	16.6	lb/MMscf	Eng. Est.	0.026	1.54E-04
Greenhouse Gases					
CO2	442,426	lb/MMscf	MRR Eqn. Y-1a	683	4.10
CH4	20.63	lb/MMscf	MRR Table C-2	0.032	1.91E-04
N2O	4.13	lb/MMscf	MRR Table C-2	0.006	3.82E-05
CO2e	444,139	lb/MMscf		686	4.11
HAPS/TAPS					
Benzene	0.45	lb/MMscf	Eng. Est.	6.99E-04	4.19E-06
1,3-Butadiene	0.23	lb/MMscf	Eng. Est.	3.49E-04	2.10E-06
Total HAPS/TAPS	0.68	lb/MMscf	Eng. Est.	1.05E-03	6.29E-06

I-2. Equipment Leak Component Potential Emissions Calculations

> Documentation of the component counts and emission factors used in the potential emissions calculations for the equipment leak components is provided in this section.

I-2.1 Equipment Leak Component (ELC) Count for the Project

> The following table documents the ELCs organized by component and service type.

Component Type	Service Type	Butane Cavern Components for HF Alky Unit in WV (1S, 2-036) (#)
Valves	Light Liquid	288
Valves	Heavy Liquid	0
Valves	Gas/Vapor	74
Pump Seals	Light Liquid	0
Pump Seals	Heavy Liquid	0
Compressor Seals	Gas	0
Atmospheric Pressure Relief Valves	Gas	0
Atmospheric Pressure Relief Valves	Light Liquid	0
Atmospheric Pressure Relief Valves	Heavy Liquid	0
Connectors	All	245
Drains	Drains	0
TOTAL		**607**

I-2.2 ELC VOC Potential Emissions Calculations for WV

> The following table documents the potential VOC and HAP/TAP emissions resulting from the ELC in WV. VOC emissions are calculated based on the component count, refinery average emission factors from the EPA *Protocol for Equipment Leak Emission Estimates*, and an assumed control efficiency for implementing the NSPS Subpart VVa LDAR program required by Subpart GGGa.

Component Type	Service Type	VOC Emission Factor[1] (kg/hr/comp.)	VOC Emission Factor[1] (lb/hr/comp.)	Component Count (#)	Uncontrolled VOC Emission Rate[2] (lb/hr)	Uncontrolled VOC Emission Rate[2] (tpy)	Uncontrolled Benzene Emission Rate[2] (lb/hr)	Uncontrolled Benzene Emission Rate[2] (tpy)	Uncontrolled 1,3-Butadiene Emission Rate[2] (lb/hr)	Uncontrolled 1,3-Butadiene Emission Rate[2] (tpy)	LDAR Control Efficiency[3] (%)	Controlled VOC Emission Rate[2] (lb/hr)	Controlled VOC Emission Rate[2] (tpy)	Controlled Benzene Emission Rate[2] (lb/hr)	Controlled Benzene Emission Rate[2] (tpy)	Controlled 1,3-Butadiene Emission Rate[2] (lb/hr)	Controlled 1,3-Butadiene Emission Rate[2] (tpy)
Valves	Light Liquid	0.0109	0.0240	288	6.9	30.3	1.05E-03	4.61E-03	5.26E-04	2.30E-03	95%	0.35	1.52	5.26E-05	2.30E-04	2.63E-05	1.15E-04
Valves	Heavy Liquid	0.00023	0.00051	0	0.00	0.00	0.00	0.00	0.00	0.00	0%	0.00	0.00	0.00	0.00	0.00	0.00
Valves	Gas/Vapor	0.0268	0.0591	74	4.37	19.2	6.65E-04	2.91E-03	3.32E-04	1.46E-03	96%	0.17	0.77	2.88E-05	1.16E-04	1.33E-05	5.82E-05
Pump Seals	Light Liquid	0.114	0.251	0	0.00	0.00	0.00	0.00	0.00	0.00	88%	0.00	0.00	0.00	0.00	0.00	0.00
Pump Seals	Heavy Liquid	0.021	0.046	0	0.00	0.00	0.00	0.00	0.00	0.00	0%	0.00	0.00	0.00	0.00	0.00	0.00
Compressor Seals	Gas	0.636	1.402	0	0.00	0.00	0.00	0.00	0.00	0.00	0%	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Relief Valves	Gas	0.16	0.35	0	0.00	0.00	0.00	0.00	0.00	0.00	0%	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Relief Valves	Light Liquid	0.0109	0.0240	0	0.00	0.00	0.00	0.00	0.00	0.00	0%	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Relief Valves	Heavy Liquid	0.00023	0.00051	0	0.00	0.00	0.00	0.00	0.00	0.00	0%	0.00	0.00	0.00	0.00	0.00	0.00
Connectors	All	0.00025	0.00055	245	0.14	0.59	2.05E-05	8.99E-05	1.03E-05	4.49E-05	0%	0.14	0.59	2.05E-05	8.99E-05	1.03E-05	4.49E-05
Drains	Drains	0.0291	0.0641	0	0.00	0.00	0.00	0.00	0.00	0.00	0%	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL		-	-	**607**	**11.4**	**50.1**	**1.74E-03**	**7.61E-03**	**8.69E-04**	**3.80E-03**	-	**0.66**	**2.87**	**9.97E-05**	**4.37E-04**	**4.99E-05**	**2.18E-04**

[1] Emission factors, except for process drains, are from *Protocol for Equipment Leak Emission Estimates* (EPA-453/R-95-017), U.S. EPA, November 1995, "Table 2-2: Refinery Average Emission Factors." The emission factor for process drains is based on AP-42 Section 5.1, Table 5.1-3 (January 1995 Ed.). No emission factors for light and heavy liquid PRVs are provided in the EPA protocol, so the emission factors for light and heavy liquid valves are used for these PRVs.

[2] Annual emission rates assume the components are in service 8,760 hours per year. Benzene and 1,3-butadiene emission rates are based on the mass fraction of these compounds expected to be present in the contacting butane process stream (i.e., 152 ppmw and 76 ppmw for benzene and 1,3-butadiene, respectively).

[3] Control efficiencies for light liquid and gas/vapor valves and light liquid pumps are taken from *Protocol for Equipment Leak Emission Estimates* (EPA-453/R-95-017), U.S. EPA, November 1995, "Table G-2: Determination of LDAR Control Effectiveness at Refinery Process Units" for HON LDAR rule (40 CFR Part 63 Subpart H) being developed at the time the protocol was drafted by EPA. The leak monitoring frequencies and leak detection thresholds under HON are similar to those under NSPS Subparts VVa, so the use of the HON LDAR control credits for the selected component types is appropriate.