July 29, 2016

Beverly D. Mckeone
WVDEP/DAQ
NSR Program Manager
601 57th Street SE
Charleston, WV 25034

RE: Permit Determination for Emergency CI RICE at Propane Cavern in Neal, West Virginia

Dear Ms. Mckeone:

Marathon Petroleum Company LP (MPC) owns and operates a propane cavern in Neal, West Virginia. The facility currently operates in accordance with West Virginia Department of Environmental Protection (WVDEP) Division for Air Quality (DAQ) Title V Operating Permit R30-09900118-2014, issued on September 16, 2014.

The propane cavern serves the Catlettsburg refinery by providing intermediate storage of excess propane produced in the Saturate Gas Plant (SGP), HF Alkylation (HF Alky) Unit, and Cumene Unit. With this permit determination submittal, MPC is requesting concurrence that an emergency compression ignition (CI) reciprocating internal combustion engine (RICE) planned to be installed as part of a fire suppression system can be installed and operated without first obtaining a pre-construction permit or other type of approval under 45 CSR 13 (R13). The diesel-driven firewater pump engine is the only source of regulated air pollutant emissions associated with the fire suppression system. The 95 hp Cummins engine (Model Number CFP5E-F10) (herein referred to as "Fire Pump Engine 2S") drives water pumps in the event of a fire emergency at the propane cavern. Refer to Table 1 below for a summary of the hourly and annual potential-to-emit (PTE) for the new firewater pump engine to be designated as "Fire Pump Engine 2S."

**Table 1. Fire Pump Engine 2S PTE Summary**

| Pollutant | Hourly Emissions (lb/hr) | Annual Emissions (tpy) |
|---|---|---|
| $NO_X$ | 0.53 | 0.13 |
| CO | 0.15 | 0.036 |
| VOC[a] | 0.013 | 3.24E-03 |
| PM | 0.018 | 4.57E-03 |
| $PM_{10}/PM_{2.5}$ | 0.021 | 5.14E-03 |
| $SO_2$ | 1.04E-03 | 2.60E-04 |
| Total HAPs | 0.54 | 6.44E-04 |

[a] Emissions of VOCs are conservatively estimated to be equivalent to emissions of non-methane hydrocarbons (NMHC).

As discussed further below, MPC believes that the firewater pump engine does not constitute a stationary source subject to the preconstruction permitting requirements in 45 CSR 13-5.1 because the diesel combustion byproduct emissions from the engine are below the following West Virginia's permitting thresholds: (i) 6 pounds per hour (lb/hr) and 10 tons per year (tpy) of any regulated air pollutant, (ii) 2 lb/hr and 5 tpy of hazardous air pollutants (HAP) on an aggregated basis; and (iii) the toxic air pollutant (TAP) emission rates listed in Table 45-13A [i.e., 1,000 pounds per year (lb/yr) benzene, 500 lb /yr 1,3 butadiene, and 1,000 lb/yr of formaldehyde]. Additionally, the engine certification and work practice standard requirements applicable to the engine under New Source Performance Standards (NSPS) for Stationary Compression Ignition Internal Combustion Engines (40 CFR 60 Subpart IIII) are not substantive requirements of an emissions control rule; thus, MPC is not required to obtain a preconstruction permit to incorporate the NSPS Subpart IIII requirements for the engine.

Potential Emissions Are Below Permitting Thresholds

Pursuant to 45 CSR 13-2.24.b, a facility is not a stationary source required to obtain a preconstruction permit if the emissions from the source are below 6 lb/hr and 10 tpy of any regulated air pollutant (as defined in 45 CSR 13-2.20). As show in Table 1, emissions of $NO_X$, CO, VOC, $PM/PM_{10}/PM_{2.5}$, and $SO_2$ are below the applicable permitting thresholds for regulated air pollutants under R13.

Pursuant to 45 CSR 13-2.24.c, a facility is not a stationary source required to obtain a preconstruction permit if the emissions from the source are below 2 lb/hr or 5 tpy of hazardous air pollutants (HAP) considered on an aggregated basis (as defined in 45 CSR 13-2.14). As show in Table 1, emissions of total HAP are below the applicable permitting thresholds for HAP under R13.

Pursuant to 45 CSR 13-2.24.d, a facility is not a stationary source required to obtain a preconstruction permit if the emissions from the source are below the amounts shown in Table 45-13A for toxic air pollutants (TAP). As show in Table 1, emissions of benzene, 1,3-butadiene, and formaldehyde (only TAPs emitted) are below the applicable permitting thresholds for TAP under R13.

Therefore, installation of the firewater pump engine will not cause an emissions increase exceeding any of the relevant R13 permitting thresholds in the stationary source definition of 45 CSR 13-2.24.

NSPS Subpart IIII Requirements Are Not Substantive Requirements

Even if a source is below the permitting thresholds, it may nevertheless be required to obtain a preconstruction permit as a stationary source that "is subject to any substantive requirement of an emission control rule promulgated by the Secretary." (45 CSR 13-2.24.a) NSPS Subpart IIII is not a substantive requirement of an emission control rule in the context of MPC's small firewater pump engine.

In order to be considered substantive, the requirements of an emissions control rule must impose emissions standards and/or control device requirements. Applicable requirements from NSPS Subpart IIII for MPC's proposed 95 hp firewater pump engine are as follows:

- Use diesel fuel that meets the requirements of 40 CFR 80.510(b) for nonroad diesel fuel (e.g., ultra-low-sulfur diesel specification) [40 CFR 60.4207(b)].
- Operate according to the requirements in 40 CFR 60.4211(f)(1) through (3) in order for the engine to be considered an emergency stationary ICE under 40 CFR 60, Subpart IIII [40 CFR 60.4211(f)]
- Comply with the following general provisions, except as permitted under 40 CFR 60.4211(g) [40 CFR 60.4211(a)]:
  - Operate and maintain the stationary CI internal combustion engine according to the manufacturer's emission-related written instructions
  - Change only those emission-related settings that are permitted by the manufacturer; and
  - Meet the requirements of 40 CFR Parts 89, 94 and/or 1068, as applicable.
- Comply with the applicable emission standards from Table 4 to 40 CFR 60, Subpart IIII based on the maximum engine power and model year of the affected fire pump engine by purchasing an engine certified to the emission standards in 40 CFR 60.4204(b), or 40 CFR 60.4205(b) or (c), as applicable, for the same model year and maximum (or in the case of fire pumps, NFPA nameplate) engine power. [40 CFR 60.4200(a)(2), 40 CFR 60.4205(c), 40 CFR 60.4206, and 40 CFR 60.4211(c)]
- If the emergency stationary CI internal combustion engine does not meet the standards applicable to non-emergency engines, install a non-resettable hour meter prior to startup of the engine [40 CFR 60.4209(a)].
- Keep records of the operation of the engine in emergency and non-emergency service that are recorded through the non-resettable hour meter if the emergency engine does not meet the standards applicable to non-emergency engines in the applicable model year. Record the time of operation of the engine and the reason the engine was in operation during that time [40 CFR 60.4214(b)].

Unlike most other NSPS regulations with applicable emissions standards and/or control requirements, MPC is not required to perform a source-specific demonstration of compliance via a performance test or engineering design analysis under NSPS Subpart IIII. Rather, MPC is deemed to be in compliance with the applicable emissions standards in NSPS Subpart IIII for the firewater pump engine simply by virtue of purchasing an engine which is certified to the applicable emission limits in Table 4 of Subpart IIII. As shown in the engine emissions data sheet included in Attachment E.2., the Fire Pump Engine 2S has $NO_X$+NMHC and PM emissions levels below the applicable emission limits in Table 4 of Subpart IIII for model year 2011 and later engines with a maximum engine power between 75 and 100 hp (i.e., $NO_X$+NMHC limit of 4.7 g/kW-hr vs. manufacturer certified emissions level of 3.494 g/kW-hr

and PM limit of 0.40 g/kW-hr vs. certified emissions level of 0.117 g/kW-hr). To support the requirement for purchasing a certified firewater pump engine operated for emergency purposes only, Subpart IIII requires a limited set of straight-forward and prescriptive work practice standards and associated periodic monitoring and recordkeeping requirements. No continuous emissions or control device/emission unit operating parameter monitoring requirements apply to firewater pump engines under Subpart IIII. Beyond the standard operating practice of operating and maintaining the engine in accordance with the manufacturer's recommended practices and emissions-related instructions and using only ultra-low sulfur diesel, the only other ongoing compliance requirement in Subpart IIII is maintaining records of operating hours for emergency and non-emergency use. This limited set of applicable requirements for firewater pump engines under Subpart IIII does not constitute a "substantive" set of requirements within the meaning of 45 CSR 13-2.24.a.

Conclusion

Installation of the proposed Fire Pump Engine 2S does not qualify as construction of a stationary source under 45 CSR 13 because the potential emissions from the engine fall below the applicable permitting thresholds and the engine is not subject to a substantive requirement of an emission control rule. Therefore, MPC requests that WVDEP respond to this permit determination request with concurrence that no R13 construction permit is required for the firewater pump engine. To further support the information provided in this letter, MPC has attached the completed Permit Determination Form and accompanying attachments (i.e., Attachment A – Area Map, Attachment B – Process Flow Diagram, Attachment C – Process Description, Attachment D – Relevant MSDS, Attachment E.1 – Emission Calculations, and Attachment E.2 – Engine Specification Sheets).

MPC plans to install the propane cavern fire suppression system as soon as possible. We greatly appreciated DEP's prompt review of the Permit Determination Form and the enclosed information. If we can assist you review in any way, please do not hesitate to contact to contact Andrew True of my staff at 606-921-6954 or adtrue@marathonpetroleum.com.

Sincerely,

Bradley J. Levi

Bradley J. Levi
Vice President

Attachment

KMT for ADT KMT MSA
adt/kmt/msa

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

# PERMIT DETERMINATION FORM (PDF)

FOR AGENCY USE ONLY: PLANT I.D. # _____

PDF # _____ PERMIT WRITER: _____

1. NAME OF APPLICANT (AS REGISTERED WITH THE WV SECRETARY OF STATE'S OFFICE):
*Marathon Petroleum Company LP*

2. NAME OF FACILITY (IF DIFFERENT FROM ABOVE):
*Neal Propane Cavern*

3. NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS) CODE:
*424710*

4A. MAILING ADDRESS:
*P.O. Box 1492*
*Catlettsburg, KY 41129*

4B. PHYSICAL ADDRESS:
*100 Big Sandy River Rd; Kenova, WV 25530*

5A. DIRECTIONS TO FACILITY (PLEASE PROVIDE **MAP** AS **ATTACHMENT A**):
*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.*

5B. NEAREST ROAD:
*Novamount Rd*

5C. NEAREST CITY OR TOWN:
*Kenova*

5D. COUNTY:
*Wayne*

5E. UTM NORTHING (KM):
*4,247.736 km*

5F. UTM EASTING (KM):
*360.688 km*

5G. UTM ZONE:
*Zone 17*

6A. INDIVIDUAL TO CONTACT IF MORE INFORMATION IS REQUIRED:
*Andrew True*

6B. TITLE:
*HES Professional*

6C. TELEPHONE:
*(606) 921-6954*

6D. FAX:
*(606) 921-3290*

6E. E-MAIL:
*adtrue@marathonpetroleum.com*

7A. DAQ PLANT I.D. NO. (FOR AN EXISTING FACILITY ONLY):
*099 – 00118*

7B. PLEASE LIST ALL CURRENT 45CSR13, 45CSR14, 45CSR19 AND/OR TITLE V (45CSR30) PERMIT NUMBERS ASSOCIATED WITH THIS PROCESS (FOR AN EXISTING FACILITY ONLY):
*Title V Permit R30–09900118–2014*

7C. IS THIS PDF BEING SUBMITTED AS THE RESULT OF AN ENFORCEMENT ACTION? IF YES, PLEASE LIST:
*NA*

8A. TYPE OF EMISSION SOURCE (CHECK ONE):
☒ NEW SOURCE ☐ ADMINISTRATIVE UPDATE
☐ MODIFICATION ☐ OTHER (PLEASE EXPLAIN IN 11B)

8B. IF ADMINISTRATIVE UPDATE, DOES DAQ HAVE THE APPLICANT'S CONSENT TO UPDATE THE EXISTING PERMIT WITH THE INFORMATION CONTAINED HEREIN?
☐ YES ☐ NO -- *NA*

9. IS *DEMOLITION* OR PHYSICAL *RENOVATION* AT AN EXISTING FACILITY INVOLVED? ☐ YES ☒ NO

10A. DATE OF ANTICIPATED INSTALLATION OR CHANGE:
*08/15/2016.*

10B. DATE OF ANTICIPATED START-UP:
*08/15/2016.*

11A. PLEASE PROVIDE A **DETAILED PROCESS FLOW DIAGRAM** SHOWING EACH PROPOSED OR MODIFIED PROCESS EMISSION POINT AS **ATTACHMENT B.**

11B. PLEASE PROVIDE A **DETAILED PROCESS DESCRIPTION** AS **ATTACHMENT C.**

12. PLEASE PROVIDE **MATERIAL SAFETY DATA SHEETS (MSDS)** FOR ALL MATERIALS PROCESSED, USED OR PRODUCED AS **ATTACHMENT D.** FOR CHEMICAL PROCESSE, PLEASE PROVIDE A MSDS FOR EACH COMPOUND EMITTED TO AIR. -- *NA*

13A. **REGULATED AIR POLLUTANT EMISSIONS:**

⇒ **FOR A NEW FACILITY,** PLEASE PROVIDE PLANT WIDE EMISSIONS BASED ON THE POTENTIAL TO EMIT (PTE) FOR THE FOLLOWING AIR POLLUTANTS INCLUDING ALL PROCESSES.

⇒ **FOR AN EXISTING FACILITY,** PLEASE PROVIDE THE PROPOSED CHANGE IN EMISSIONS BASED ON THE PTE OF ALL PROCESS CHANGES FOR THE FOLLOWING AIR POLLUTANTS.

*PTE FOR A GIVEN POLLUTANT IS TYPICALLY BEFORE AIR POLLUTION CONTROL DEVICES AND IS COLLECTED BASED ON THE MAXIMUM DESIGN CAPACITY OF PROCESS EQUIPMENT.*

| POLLUTANT | HOURLY PTE (LB/HR) | YEARLY PTE (TON/YR) (HOURLY PTE MULTIPLIED BY 8760 HR/YR)** DIVIDED BY 2000 LB/TON |
|---|---|---|
| PM | 0.018 | 4.57E-03 |
| $PM_{10}$ | 0.021 | 5.14E-03 |
| VOCs | 0.013 | 3.24E-03 |
| CO | 0.15 | 0.036 |
| $NO_x$ | 0.53 | 0.13 |
| $SO_2$ | 1.04E-03 | 2.60E-04 |
| Pb | 0 | 0 |
| HAPs (AGGREGATE AMOUNT) | 2.66E-03 | 6.64E-04 |
| TAPs (INDIVIDUALLY)* | | |
| Benzene | 6.40E-04 | 1.60E-04 |
| 1,3- Butadiene | 2.68E-05 | 6.71E-06 |
| Formaldehyde | 8.09E-04 | 2.02E-04 |
| OTHER (INDIVIDUALLY)* | See Attachment E | See Attachment E |

* ATTACH ADDITIONAL PAGES AS NEEDED

** Yearly PTE (ton/yr) = Hourly PTE multiplied by 500 hr/yr for emergency engines, divided by 2000 lb/ton

13B. PLEASE PROVIDE ALL **SUPPORTING CALCULATIONS** AS **ATTACHMENT E.**

*CALCULATE AN HOURLY AND YEARLY PTE OF EACH PROCESS EMISSION POINT (SHOWN IN YOUR DETAILED PROCESS FLOW DIAGRAM) FOR ALL AIR POLLUTANTS LISTED ABOVE INCLUDING INDIVIDUAL HAP'S (LISTED IN SECTION 112[b] OF THE 1990 CAAA), TAP'S (LISTED IN 45CSR27), AND OTHER AIR POLLUTANTS (E.G. POLLUTANTS LISTED IN TABLE 45-13A OF 45CSR13, MINERAL ACIDS PER 45CSR7, ETC.).*

14. **CERTIFICATION OF DATA**

I, Bradley J. Levi ATTEST THAT ALL THE REPRESENTATIONS CONTAINED IN THIS APPLICATION, OR APPENDED HERETO, ARE TRUE, ACCURATE, AND COMPLETE TO THE BEST OF MY KNOWLEDGE BASED ON INFORMATION AND BELIEF AFTER REASONABLE INQUIRY, AND THAT I AM A ***RESPONSIBLE OFFICIAL**** (*PRESIDENT, VICE PRESIDENT, SECRETARY OR TREASURER, GENERAL PARTNER OR SOLE PROPRIETOR*) OF THE APPLICANT.

SIGNATURE OF RESPONSIBLE OFFICIAL: Bradley J Levi

TITLE: Vice President DATE: 7 / 27 / 2016.

** THE DEFINITION OF THE PHRASE '***RESPONSIBLE OFFICIAL***' CAN BE FOUND AT 45CSR13, SECTION 2.23.

**NOTE:** PLEASE CHECK ENCLOSED ATTACHMENTS:

☒ **ATTACHMENT A** ☒ **ATTACHMENT B** ☒ **ATTACHMENT C** ☐ **ATTACHMENT D** ☒ **ATTACHMENT E**

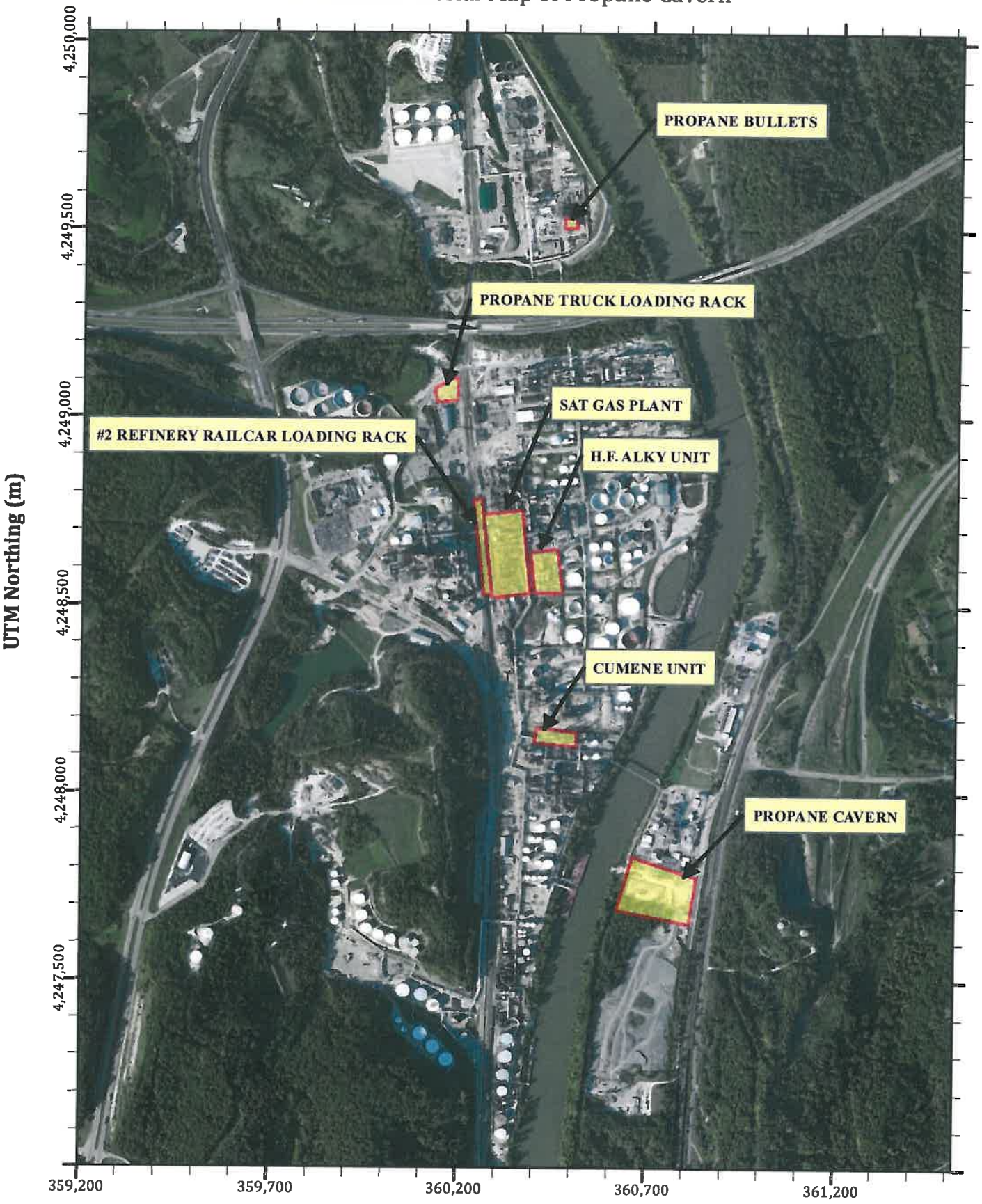
***RECORDS ON ALL CHANGES ARE REQUIRED TO BE KEPT AND MAINTAINED ON-SITE FOR TWO (2) YEARS.***

THE PERMIT DETERMINATION FORM WITH THE INSTRUCTIONS CAN BE FOUND ON DAQ'S PERMITTING SECTION WEB SITE:

***www.dep.wv.gov/daq***

# ATTACHMENT A: AREA MAP

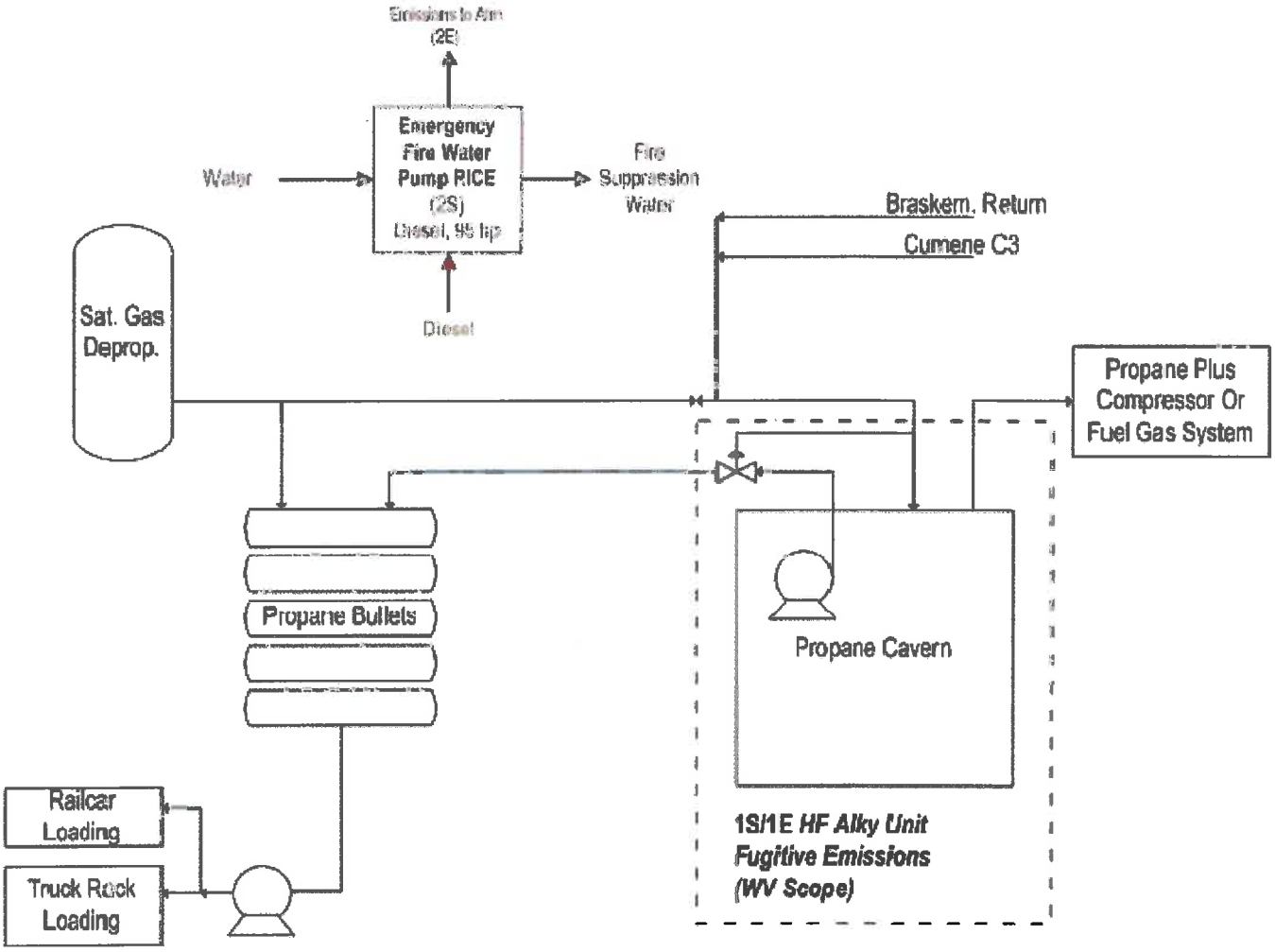
# Attachment A - Aerial Map of Propane Cavern




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

# ATTACHMENT B: PROCESS FLOW DIAGRAM

## Attachment B: Propane Cavern Process Flow Diagram



# ATTACHMENT C: PROCESS DESCRIPTION

The propane cavern serves the Catlettsburg refinery by providing intermediate storage of excess propane produced in the Saturate Gas Plant (SGP), HF Alkylation (HF Alky) Unit, and Cumene Unit. After being treated at the refinery to remove contaminants, propane is transferred as a liquid product via a pipeline traversing across the Big Sandy River and is pumped into the propane cavern. The cavern also receives propane extracted from the propylene/propane stream sold by the Catlettsburg refinery to the Braskem America, Inc. (Braskem) Kenova, West Virginia plant. Braskem separates the propane from the propane/propylene stream, uses the propylene stream in their chemical manufacturing process, and routes the separated propane stream to the cavern. On the outlet side of the system, the cavern can supply propane to the refinery's fuel gas system, but its predominant function is to supply the product propane for sale to outside customers. Propane destined for sale or use in the refinery's fuel gas system is transported back across the Big Sandy River via a separate, dedicated cavern discharge piping network. Product propane is dried, routed through carbon adsorption beds, certified for certain product specifications, and charged to a series of five (5) pressurized, bullet tanks (i.e., Tanks 862-866 listed in the refinery's Title V permit). Any off-specification product is pumped back to the cavern. From the bullet tanks, the on-specification product propane is transferred into tanker trucks or railcars for transportation to customers.

MPC is requesting authorization to install and operate an emergency compression ignition (CI) RICE (Emission Unit 2S; Emission Point 2E) as part of the installation of a fire suppression system. The 95 hp Cummins diesel-driven engine discussed in this application (Model Number CFP5E-F10) drives water pumps in the event of a fire emergency at the propane cavern. The engine specification sheets are included as Attachment E.2 to this application.

# ATTACHMENT D: MSDS

All relevant MSDS for chemical processes are to be included as Attachment D. There are no associated MSDS for the emergency fire water pump RICE installation.

# ATTACHMENT E.1: EMISSION CALCULATIONS

## Attachment E.1 - Supporting Emissions Documentation

### E-1.1 Emission Unit Nomenclature, Process Rates, and SCC Units

> Process rates for each engine used in deriving SCC based emission factors are listed below.

| Process Description | Title V EU ID | MPC ID | WVDEP Equip. ID | Manuf. Date | Install Date | Engine Rating (hp) | Hourly Fuel Rate (Mgal/hr) | Annual Operating Hours (hr/yr) | Annual Fuel Rate (Mgal/yr) | NSPS IIII Status |
|---|---|---|---|---|---|---|---|---|---|---|
| Fire Pump Engine | 2S | -- | | 2016 | 8/15/2016 | 95 | 0.0049 | 500 | 2.45 | Subject |

> The same SCC applies to all the diesel fired engines at the facility, with SCC units of thousand-gallons fuel burned

Engine SCC: 20200102
SCC Units: Mgal

### E-1.2 Documentation of Emission Factors Used from AP-42 and 40 CFR Part 98

#### E-1.21 Criteria Pollutants

> Emission factors for the primary pollutants are based on Table 3.3-1 in AP42 Chapter 3.3 for Gasoline and Diesel-Fired Industrial Engines. The default brake-specific fuel consumption in AP42 of 7000 Btu/hp-hr is used to convert from factors expressed in lb/hp-hr to factors in lb/Mgal.

**SO2**

> To take into account the lower sulfur content of the diesel fuel burned for purposes of representing potential SO2 emissions from the engines, the factor in AP42 Table 3.4-1 (Large Stationary Diesel Engines, 10/1996 edition) is used as shown below. This factor expresses SO2 as a function of sulfur content.

AP42 Emission Factor for SO2 based on sulfur content: 1.01 S lb/MMBtu (where S is the sulfur content in %)
Assumed maximum sulfur content in diesel oil: 15 ppm
Equivalent expressed in terms of percent: 0.0015 %

**SO2 Emissions Based on Sulfur Content**

| Pollutant | lb/hp-hr | lb/MMBtu | lb/Mgal |
|---|---|---|---|
| SO2 | 0.0000106 | 0.001515 | 0.2121 |

**E-1.22 HAPS**

> Emission factors for HAPs expected to be emitted are based on emission factors in AP42 Table 3.3-2 (10/96 Edition).

| | CAS # | HAP? | Emission Factor (lb/MMBtu) | Emission Factor (lb/hp-hr) | Emission Factor (lb/Mgal) | Emission Factor Basis |
|---|---|---|---|---|---|---|
| Benzene | 71-43-2 | Y | 9.33E-04 | 6.53E-06 | 1.31E-01 | AP-42 Table 3.3-2 |
| Toluene | 108-88-3 | Y | 4.09E-04 | 2.86E-06 | 5.73E-02 | AP-42 Table 3.3-2 |
| Xylenes | 1330-20-7 | Y | 2.85E-04 | 2.00E-06 | 3.99E-02 | AP-42 Table 3.3-2 |
| 1,3-Butadiene | 106-99-0 | Y | 3.91E-05 | 2.74E-07 | 5.47E-03 | AP-42 Table 3.3-2 |
| Formaldehyde | 50-00-0 | Y | 1.18E-03 | 8.26E-06 | 1.65E-01 | AP-42 Table 3.3-2 |
| Acetaldehyde | 75-07-0 | Y | 7.67E-04 | 5.37E-06 | 1.07E-01 | AP-42 Table 3.3-2 |
| Acrolein | 107-02-8 | Y | 9.25E-05 | 6.48E-07 | 1.30E-02 | AP-42 Table 3.3-2 |
| Naphthalene | 91-20-3 | Y | 8.48E-05 | 5.94E-07 | 1.19E-02 | AP-42 Table 3.3-2 |
| Acenaphthylene | 208-96-8 | Y | 5.06E-06 | 3.54E-08 | 7.08E-04 | AP-42 Table 3.3-2 |
| Acenaphthene | 83-32-9 | Y | 1.42E-06 | 9.94E-09 | 1.99E-04 | AP-42 Table 3.3-2 |
| Fluorene | 86-73-7 | Y | 2.92E-05 | 2.04E-07 | 4.09E-03 | AP-42 Table 3.3-2 |
| Phenanthrene | 85-01-8 | Y | 2.94E-05 | 2.06E-07 | 4.12E-03 | AP-42 Table 3.3-2 |
| Anthracene | 120-12-7 | Y | 1.87E-06 | 1.31E-08 | 2.62E-04 | AP-42 Table 3.3-2 |
| Fluoranthene | 206-44-0 | Y | 7.61E-06 | 5.33E-08 | 1.07E-03 | AP-42 Table 3.3-2 |
| Pyrene | 129-00-0 | Y | 4.78E-06 | 3.35E-08 | 6.69E-04 | AP-42 Table 3.3-2 |
| Benzo(a)anthracene | 56-55-3 | Y | 1.68E-06 | 1.18E-08 | 2.35E-04 | AP-42 Table 3.3-2 |
| Chrysene | 218-01-9 | Y | 3.53E-07 | 2.47E-09 | 4.94E-05 | AP-42 Table 3.3-2 |
| Benzo(b)fluoranthene | 205-99-2 | Y | 9.91E-08 | 6.94E-10 | 1.39E-05 | AP-42 Table 3.3-2 |
| Benzo(k)fluoranthene | 207-08-9 | Y | 1.55E-07 | 1.09E-09 | 2.17E-05 | AP-42 Table 3.3-2 |
| Benzo(a)pyrene | 50-32-8 | Y | 1.88E-07 | 1.32E-09 | 2.63E-05 | AP-42 Table 3.3-2 |
| Indeno (1,2,3-cd)pyrene | 193-39-5 | Y | 3.75E-07 | 2.63E-09 | 5.25E-05 | AP-42 Table 3.3-2 |
| Dibenz(a,h)anthracene | 53-70-3 | Y | 5.83E-07 | 4.08E-09 | 8.16E-05 | AP-42 Table 3.3-2 |
| Benzo(g,h,i)perylene | 191-24-2 | Y | 4.89E-07 | 3.42E-09 | 6.85E-05 | AP-42 Table 3.3-2 |
| Total HAPs | | | 3.87E-03 | 2.71E-05 | 5.42E-01 | |

**E-1.23 GHG Emission Factors**

> CO2, CH4 and N2O emissions for diesel fuel combustion are estimated using the Distillate Fuel Oil No. 2 emission factors published in 40 CFR 98, Subpart C, Tables C-1 and C-2.

Global Warming Potentials of GHGs per 40 CFR 98 Subpart A, Table A-1.

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

| | | | |
|---|---|---|---|
| CO2 Emission Factor | 73.96 | kg CO2/MMBtu | 40 CFR 98, Subpart C, Table C-1; Distillate Fuel Oil No. 2 |
| CH4 Emission Factor | 3.0E-03 | kg CH4/MMBtu | 40 CFR 98, Subpart C, Table C-2; Distillate Fuel Oil No. 2 |
| N2O Emission Factor | 6.0E-04 | kg N2O/MMBtu | 40 CFR 98, Subpart C, Table C-2; Distillate Fuel Oil No. 2 |

| Pollutant | Emission Factor (kg/MMBtu) | Equivalent Factor (lb/Mgal) |
|---|---|---|
| CO2 | 73.96 | 22,828 |
| CH4 | 3.00E-03 | 0.93 |
| N2O | 6.00E-04 | 0.19 |
| CO2e | 74.21 | 22,904 |

## E-1.3 Documentation of Emission Factors Used from NSPS Subpart IIII Limits and Engine Certificates/Manufacturer Tier 3 Data

### E-1.31 Criteria Pollutants and VOC

> Emission factor for PM2.5, NOx, and VOC based on NSPS Subpart IIII emission limits. The default brake-specific fuel consumption in AP42 of 7000 Btu/hp-hr is used to convert from factors expressed in lb/hp-hr to factors in lb/Mgal. Emission factors for NOX, NMHC, CO, and PM are based on manufacture's Tier 3 Emissions Data. Emission factors for HAPs expected to be emitted are based on emission factors in AP42 Table 3.3-2 (10/96 Edition).

| | | |
|---|---|---|
| **CO** | 0.93 g/kW-hr | Manufacturer Tier 3 Data |
| | 1.53E-03 lb/hp-hr | = 0.93 g/kW-hr * 0.0022046 lb/g / 1.341022 hp-hr/kW-hr |
| | 29.64 lb/Mgal | = 0.00153 lb/hp-hr * 19,388 hp/Mgal |
| **NOX** | 3.41 g/kW-hr | Manufacturer Tier 3 Data |
| | 5.61E-03 lb/hp-hr | = 3.41 g/kW-hr * 0.0022046 lb/g / 1.341022 hp-hr/kW-hr |
| | 108.72 lb/Mgal | = 0.00561 lb/hp-hr * 19,388 hp/Mgal |
| **VOC** | 0.083 g/kW-hr | Manufacturer Tier 3 Data (as NMHC) |
| | 1.36E-04 lb/hp-hr | = 0.083 g/kW-hr * 0.0022046 lb/g / 1.341022 hp-hr/kW-hr |
| | 2.65 lb/Mgal | = 0.00014 lb/hp-hr * 19,388 hp/Mgal |
| **PM** | 0.117 g/kW-hr | Manufacturer Tier 3 Data |
| | 1.92E-04 lb/hp-hr | = 0.117 g/kW-hr * 0.0022046 lb/g / 1.341022 hp-hr/kW-hr |
| | 3.73 lb/Mgal | = 0.00019 lb/hp-hr * 19,388 hp/Mgal |
| **PM10/PM2.5** | 0.132 g/kW-hr | Manufacturer Tier 3 PM Data (assume filt. PM only) x 0.0697 lb/MMBtu total PM / 0.0620 lb/MMBtu filt. PM from AP-42 Table 3.4-2 for uncontrolled stationary diesel engines. |
| | 2.16E-04 lb/hp-hr | = 0.132 g/kW-hr * 0.0022046 lb/g / 1.341022 hp-hr/kW-hr |
| | 4.19 lb/Mgal | = 0.00022 lb/hp-hr * 19,388 hp/Mgal |

**E-1.4 Emission Calculations Based on Factors Documented**

| Emission Unit | | Title V EU ID | MPC ID | WVDEP Equip. ID | Emission Factor (lb/Mgal) | Potential Emissions (lb/hr) | (tpy) |
|---|---|---|---|---|---|---|---|
| **Propane Cavern Fire Pump Engine** | | 2S | -- | | | | |
| CO | | | | | 29.64 | 0.15 | 0.036 |
| NOX | | | | | 108.72 | 0.53 | 0.13 |
| VOC | | | | | 2.65 | 0.013 | 3.24E-03 |
| SO2 | | | | | 0.21 | 1.04E-03 | 2.60E-04 |
| PM10/PM2.5 | | | | | 4.19 | 0.021 | 5.14E-03 |
| PM | | | | | 3.73 | 0.018 | 4.57E-03 |
| CO2 | | | | | 22,828 | 111.85 | 27.96 |
| CH4 | | | | | 0.93 | 4.54E-03 | 1.13E-03 |
| N2O | | | | | 0.19 | 9.07E-04 | 2.27E-04 |
| CO2e | | | | | 22,904 | 112.23 | 28.06 |
| Benzene | TAP/HAP | | | | 1.31E-01 | 6.40E-04 | 1.60E-04 |
| Formaldehyde | TAP/HAP | | | | 1.65E-01 | 8.09E-04 | 2.02E-04 |
| 1,3-Butadiene | TAP/HAP | | | | 5.47E-03 | 2.68E-05 | 6.71E-06 |
| Toluene | HAP | | | | 5.73E-02 | 2.81E-04 | 7.01E-05 |
| Xylenes | HAP | | | | 3.99E-02 | 1.96E-04 | 4.89E-05 |
| Acetaldehyde | HAP | | | | 1.07E-01 | 5.26E-04 | 1.32E-04 |
| Acrolein | HAP | | | | 1.30E-02 | 6.35E-05 | 1.59E-05 |
| Naphthalene | HAP | | | | 1.19E-02 | 5.82E-05 | 1.45E-05 |
| Acenaphthylene | HAP | | | | 7.08E-04 | 3.47E-06 | 8.68E-07 |
| Acenaphthene | HAP | | | | 1.99E-04 | 9.74E-07 | 2.44E-07 |
| Fluorene | HAP | | | | 4.09E-03 | 2.00E-05 | 5.01E-06 |
| Phenanthrene | HAP | | | | 4.12E-03 | 2.02E-05 | 5.04E-06 |
| Anthracene | HAP | | | | 2.62E-04 | 1.28E-06 | 3.21E-07 |
| Fluoranthene | HAP | | | | 1.07E-03 | 5.22E-06 | 1.31E-06 |
| Pyrene | HAP | | | | 6.69E-04 | 3.28E-06 | 8.20E-07 |
| Benzo(a)anthracene | HAP | | | | 2.35E-04 | 1.15E-06 | 2.88E-07 |
| Chrysene | HAP | | | | 4.94E-05 | 2.42E-07 | 6.05E-08 |
| Benzo(b)fluoranthene | HAP | | | | 1.39E-05 | 6.80E-08 | 1.70E-08 |
| Benzo(k)fluoranthene | HAP | | | | 2.17E-05 | 1.06E-07 | 2.66E-08 |
| Benzo(a)pyrene | HAP | | | | 2.63E-05 | 1.29E-07 | 3.22E-08 |
| Indeno (1,2,3-cd)pyrene | HAP | | | | 5.25E-05 | 2.57E-07 | 6.43E-08 |
| Dibenz(a,h)anthracene | HAP | | | | 8.16E-05 | 4.00E-07 | 1.00E-07 |
| Benzo(g,h,i)perylene | HAP | | | | 6.85E-05 | 3.35E-07 | 8.39E-08 |
| Total HAPs | | | | | **0.54** | **2.66E-03** | **6.64E-04** |

# ATTACHMENT E.2: ENGINE SPECIFICATION SHEETS

Fire Power

# EPA Tier 3 Emission Data
# Fire Pump NSPS Compliant

## CFP5E-F10 Fire Pump Driver

**Type: 4 Cycle; In-Line; 4 Cylinder**
**Aspiration: Turbocharged, Charge Air Cooled**

**15 PPM Diesel Fuel**

| | | Fuel Consumption | | D2 Cycle Exhaust Emissions | | | | | | | | | | Exhaust | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Grams per BHP - HR | | | | | Grams per kW - HR | | | | | Temperature | | Gas Flow | |
| RPM | BHP | Gal/Hr | L/hr | NMHC | NOx | NMHC+NOx | CO | PM | NMHC | NOx | NMHC+NOx | CO | PM | °F | °C | CFM | L/sec |
| 1470 | 84 | 4.2 | 15.9 | | | | | | | | | | | 869 | 465 | 520 | 245 |
| 1760 | 95 | 5.1 | 19.3 | | | | | | | | | | | 777 | 414 | 670 | 316 |
| 1900 | 98 | 4.9 | 18.5 | | | | | | | | | | | 761 | 405 | 711 | 336 |
| 2100 | 101 | 5.4 | 20.4 | 0.062 | 2.544 | 2.605 | 0.694 | 0.088 | 0.083 | 3.411 | 3.494 | 0.930 | 0.117 | 756 | 402 | 774 | 365 |
| 2350 | 105 | 5.8 | 22.0 | | | | | | | | | | | 786 | 419 | 862 | 407 |
| 2600 | 104 | 5.9 | 22.3 | | | | | | | | | | | 825 | 441 | 905 | 427 |
| 2700 | 95 | 5.0 | 18.9 | | | | | | | | | | | 760 | 404 | 860 | 406 |

The emissions values above are based on CARB approved calculations for converting EPA (500 ppm) fuel to CARB (15 ppm) fuel.

**300-4000 PPM Diesel Fuel**

| | | Fuel Consumption | | D2 Cycle Exhaust Emissions | | | | | | | | | | Exhaust | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Grams per BHP - HR | | | | | Grams per kW - HR | | | | | Temperature | | Gas Flow | |
| RPM | BHP | Gal/Hr | L/hr | NMHC | NOx | NMHC+NOx | CO | PM | NMHC | NOx | NMHC+NOx | CO | PM | °F | °C | CFM | L/sec |
| 1470 | 84 | 4.2 | 15.9 | | | | | | | | | | | 869 | 465 | 520 | 245 |
| 1760 | 95 | 5.1 | 19.3 | | | | | | | | | | | 777 | 414 | 670 | 316 |
| 1900 | 98 | 4.9 | 18.5 | | | | | | | | | | | 761 | 405 | 711 | 336 |
| 2100 | 101 | 5.4 | 20.4 | 0.075 | 2.759 | 2.834 | 0.694 | 0.100 | 0.1 | 3.700 | 3.800 | 0.930 | 0.134 | 756 | 402 | 774 | 365 |
| 2350 | 105 | 5.8 | 22.0 | | | | | | | | | | | 786 | 419 | 862 | 407 |
| 2600 | 104 | 5.9 | 22.3 | | | | | | | | | | | 825 | 441 | 905 | 427 |
| 2700 | 95 | 5.0 | 18.9 | | | | | | | | | | | 760 | 404 | 860 | 406 |

**QSB4.5** Base Model Manufactured by Cummins Inc.
- Using fuel rating 91487

**Reference EPA Standard Engine Family: ECEXL0275AAG**
Reference CARB Executive Order: **U-R-002-0558**

**No special options needed to meet current regulation emissions for all 50 states**

**Test Methods:**

EPA/CARB Nonroad emissions recorded per 40CFR89 (ref. ISO8178-1) and weighted at load points prescribed in Subpart E, Appendix A, for Constant Speed Engines (ref. ISO8178-4, D2).

**Diesel Fuel Specifications:**

Cetane Number: 40-48
Reference: ASTM D975 No. 2-D

**Reference Conditions:**

Air Inlet Temperature: 25°C (77°F)
Fuel Inlet Temperature: 40°C (104°F)
Barometric Pressure: 100 kPa (29.53 in Hg)
Humidity: 10.7 g/kg (75 grains $H_2O$/lb) of dry air; required for NOx correction

Restrictions: Intake Restriction set to a maximum allowable limit for clean filter; Exhaust Back Pressure set to maximum allowable limit.

**Tests conducted using alternate test methods, instrumentation, fuel or reference conditions can yield different results.**

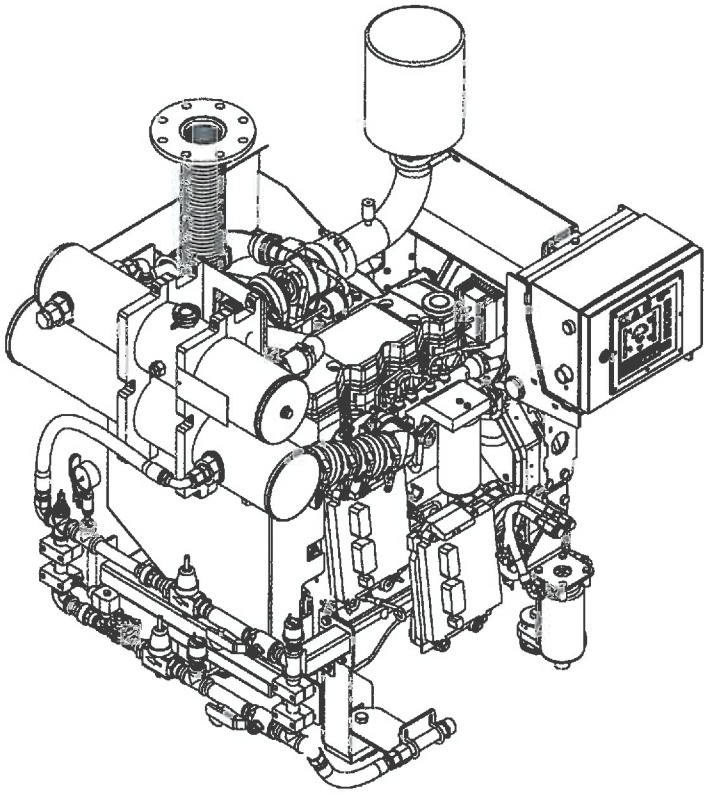
Revisions:

June 2014: Document Review & Approved.

Revision Date: June 2014

## ENGINE PERFORMANCE & CONSTRUCTION

| | | |
|---|---|---|
| Fire Power | **Engine Specification Sheet**<br>**Cummins Fire Power**<br>De Pere, WI 54115<br>http://www.cumminsfirepower.com | **Basic Engine Model**<br>**CFP5E-F10** F20, F30, F40, F50<br>Curve Number: **FR - 91601**<br>Revision Date: **June 2014** |



### Operating Speed (RPM)

| Model | 1470 | | 1760 | | 1900 | | 2100 | | 2350 | | 2600 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CFP5E-F50 | 113 | (84) | 129 | (96) | 135 | (101) | 146 | (109) | 150 | (112) | 148 | (110) |
| CFP5E-F40 | 113 | (84) | 123 | (92) | 129 | (96) | 136 | (101) | 143 | (107) | 141 | (105) |
| CFP5E-F30 | 104 | (78) | 118 | (88) | 121 | (90) | 125 | (93) | 130 | (97) | 129 | (96) |
| CFP5E-F20 | 94 | (70) | 107 | (80) | 110 | (82) | 113 | (84) | 118 | (88) | 117 | (87) |
| CFP5E-F10 | 84 | (63) | 95 | (71) | 98 | (73) | 101 | (75) | 105 | (78) | 104 | (78) |

Ratings are: **HP (kW)**

### Specifications

| | |
|---|---|
| Aspiration | Turbocharged and Charge Air Cooled |
| Rotation | Counterclockwise from flywheel end |
| Weight - lb (kg) Est | 1340 (603) |
| Displacement - $in^3$ (liter) | 272 (4.5) |
| Engine Type | 4 Cycle; In-Line, 4 Cylinder |
| Engine Series | Cummins QSB4.5 Series |
| Exhaust Emissions | EPA/CARB Tier 3 |

| Equipment | Standard | Optional |
|---|---|---|
| Air Cleaner | Disposable, Treated for High Humidity, Indoor Service | ~~Heavy-Duty, 2-stage with replaceable elements.~~ |
| Alternator | 12V-DC, 95 AMPS; With Belt Guard | ~~24V-DC, 45 AMPS; With Belt Guard~~ |
| Cooling Loop (Maximum Pressure of 350 PSI) | 3/4" diameter for Fresh Water. With alarm sensors and FM Approval. | ~~Cu-Ni Construction available for Sea-Water applicants~~ |
| Exhaust Protection | Metal Guards on Manifolds and Turbo | N/A |
| Exhaust Flex Connection | SS Flex, NPT | ~~SS Flex, 150# Flange~~ |
| Flywheel Power Take-Off | ~~Flywheel~~ | Drive Shaft System |
| Fuel Connections | Fire Resistant Flexible Supply and Return Lines | N/A |
| Fuel Injection System | Electronic, Direct Injection, High Pressure Common Rail | N/A |
| Fuel Filter | Primary and Secondary | N/A |
| Engine Heater | ~~120V-AC, 1500 Watts~~ | 240V-AC, 1500 Watts |
| Governor, Speed | Constant Speed | N/A |
| Heat Exchanger | Tube & Shell Type, 60 PSI with NPTF Connections | N/A |
| Instrument Panel | Digital, NEMA 4X, English and Metric, Tachometer, Hourmeter, Water Temperature, Oil Pressure & Two (2) Voltmeters | ~~Optional 316SS Construction, Custom gauges with expansion module~~ |
| Junction Box | Integral with Instrument Panel; For DC Wiring to Engine Controller | N/A |
| Lube Oil Cooler | Engine Water Cooled, Plate Type | N/A |
| Lube Oil Filter | Full Flow with By-Pass Valve | N/A |
| Lube Oil Pump | Gear Driven | N/A |
| Manual Start | On Instrument Panel | N/A |
| Overspeed Controls | Electronic with Reset & Test on Instrument Panel | N/A |
| Raw Water Solenoid Operation | Automatic from Engine Controller & from Emergency Local Control | N/A |
| Run-Stop Control | On Instrument Panel | N/A |
| Run Solenoid | ~~12V-DC~~ | 24V-DC |
| Starters | ~~12V-DC~~ | 24V-DC |
| Throttle Control | Adjustable Speed Control | N/A |
| Water Pump | Belt Drive with Guard | N/A |

**Marathon Petroleum Co., PO: 4100623403, Catlettsburg Cavern Facility, Enclosed Fire Pump Package, Item: 2000SEHH23456, PES Doc.: 9927106422-ENG rev 00**

| | | |
|---|---|---|
| Cummins Fire Power | **Engine Data Sheet**<br>**Cummins Fire Power**<br>De Pere, WI 54115<br>http://www.cumminsfirepower.com | Basic Engine Model<br>**CFP5E-F10, F20, F30, F40, F50** |
| | | Curve Number: **FR - 91601**<br>CPL Code: **8725** |
| Configuration Number: **D323001CX03**<br>Installation Drawing: **26105** | | Engine Family: **Industrial**<br>Revision Date: **March 2015** |

## General Engine Data

| | | |
|---|---|---|
| Type | 4 Cycle; In-Line; 4 Cylinder | |
| Aspiration | Turbocharged, Chrg Air Cooled | |
| Bore & Stroke - in. (mm) | 4.21 x 4.88 | (107 x 124) |
| Displacement - in.$^3$ (litre) | 275 | (4.5) |
| Compression Ratio | 17.2:1 | |
| Valves per Cylinder - Intake | 2 | |
| - Exhaust | 2 | |
| Maximum Allowable Bending Moment @ Rear Face of Block - lb.-ft. (N-m) | 1000 | (1356) |

## Air Induction System

| | | |
|---|---|---|
| Max. Temperature Rise Between Ambient Air and Engine Air Inlet - delta °F (delta °C) | 30 | (16.7) |
| Maximum Inlet Restriction with Dirty Filter - in. $H_2O$ (mm $H_2O$) | 25 | (635) |
| Recommended Air Cleaner Element - (Standard) Fleet Guard | AH1107 | |
| - (Heavy Duty) None | | |

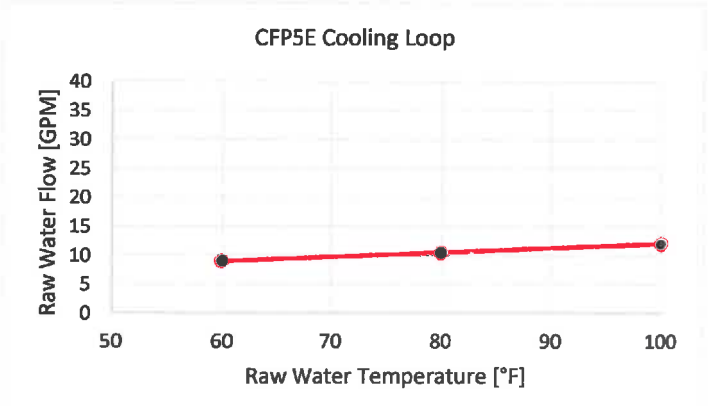
## Lubrication System

| | | |
|---|---|---|
| Oil Pressure Range at Rated - PSI (kPa) | 40-60 | (276-414) |
| Oil Capacity of Pan (High - Low) - U.S. quarts (litre) | 9.5-11.6 | (9-11) |
| Total System Capacity - U.S. Gal. (litre) | 3.2 | (12.0) |
| Recommended Lube Oil Filter Fleetguard (Cummins) | LF3970 | (3401544) |

## Cooling System

| | | |
|---|---|---|
| Raw Water Working Pressure Range at Heat Exchanger - PSI (kPa) | 60 | (413) MAX |
| Recommended Min. Water Supply Pipe Size to Heat Exchanger - in. (mm) | 0.75 | (19.05) |
| Recommended Min. Water Disch. Pipe Size From Heat Exchanger - in. (mm) | 1.00 | (25.40) |
| Coolant Water Capacity (Engine Side) - U.S. gal. (litre) | 3.5 | (13.2) |
| Standard Thermostat - Type | Modulating | |
| - Range - deg F (deg C) | 180-199 | (82-93) |
| Minimum Raw Water Flow | | |
| with Water Temperatures to 60 °F (16 °C) - U.S. GPM (litre/s) | 9 | (0.57) |
| with Water Temperatures to 80 °F (27 °C) - U.S. GPM (litre/s) | 10.5 | (0.66) |
| with Water Temperatures to 100 °F (38 °C) - U.S. GPM (litre/s) | 12 | (0.76) |

A jacket water heater is mandatory on this engine. The recommended heater wattage is 1500 down to 40 °F (4 °C).



## FM Approved and UL Listed Ratings for CFP5E-F10, F20, F30, F40, F50

| Engine Speed - RPM | 1470 | 1760 | 1900 | 2100 | 2350 | 2600 |
|---|---|---|---|---|---|---|
| CFP5E-F50 Output - BHP (kW) ..... | 113 (84) | 129 (96) | 135 (101) | 146 (109) | 150 (112) | 148 (110) |
| Ventilation Air Required - CFM (litre/sec) .... | 235 (111) | 312 (147) | 335 (158) | 366 (173) | 401 (189) | 441 (208) |
| Exhaust Gas Flow - CFM (litre/sec) ..... | 607 (287) | 718 (339) | 775 (366) | 843 (398) | 932 (440) | 979 (462) |
| Exhaust Gas Temperature - °F (°C) ..... | 923 (495) | 826 (441) | 838 (448) | 855 (457) | 895 (479) | 940 (504) |
| Heat Rejection to Coolant BTU/min. (kW) ... | 2247 (39) | 2410 (42) | 2603 (46) | 2867 (50) | 3171 (56) | 3330 (59) |
| Heat Rejection to Ambient BTU/min (kW) ... | 904 (16) | 980 (17) | 1051 (18) | 1122 (20) | 1211 (21) | 1264 (22) |
| CFP5E-F40 Output - BHP (kW) ..... | 113 (84) | 123 (92) | 129 (96) | 136 (101) | 143 (107) | 141 (105) |
| Ventilation Air Required - CFM (litre/sec) .... | 235 (111) | 308 (145) | 336 (159) | 368 (174) | 402 (190) | 442 (209) |
| Exhaust Gas Flow - CFM (litre/sec) ..... | 607 (287) | 706 (333) | 766 (362) | 840 (396) | 930 (439) | 977 (461) |
| Exhaust Gas Temperature - °F (°C) ..... | 923 (495) | 817 (436) | 822 (439) | 845 (452) | 889 (476) | 933 (501) |
| Heat Rejection to Coolant BTU/min. (kW) ... | 2247 (39) | 2343 (41) | 2507 (44) | 2775 (49) | 3129 (55) | 3285 (58) |
| Heat Rejection to Ambient BTU/min (kW) ... | 904 (16) | 951 (17) | 1019 (18) | 1088 (19) | 1174 (21) | 1226 (22) |
| CFP5E-F30 Output - BHP (kW) ..... | 104 (78) | 118 (88) | 121 (90) | 125 (93) | 130 (97) | 129 (96) |
| Ventilation Air Required - CFM (litre/sec) .... | 230 (109) | 306 (144) | 336 (159) | 369 (174) | 403 (190) | 443 (209) |
| Exhaust Gas Flow - CFM (litre/sec) ..... | 587 (277) | 700 (330) | 763 (360) | 836 (395) | 927 (438) | 973 (459) |
| Exhaust Gas Temperature - °F (°C) ..... | 909 (487) | 812 (433) | 816 (436) | 834 (446) | 883 (473) | 927 (497) |
| Heat Rejection to Coolant BTU/min. (kW) ... | 2138 (38) | 2291 (40) | 2456 (43) | 2680 (47) | 3033 (53) | 3185 (56) |
| Heat Rejection to Ambient BTU/min (kW) ... | 877 (15) | 922 (16) | 989 (17) | 1056 (19) | 1035 (18) | 1014 (18) |
| CFP5E-F20 Output - BHP (kW) ..... | 94 (70) | 107 (80) | 110 (82) | 113 (84) | 118 (88) | 117 (87) |
| Ventilation Air Required - CFM (litre/sec) .... | 222 (105) | 305 (144) | 336 (159) | 369 (174) | 403 (190) | 443 (209) |
| Exhaust Gas Flow - CFM (litre/sec) ..... | 561 (265) | 689 (325) | 754 (356) | 822 (388) | 907 (428) | 952 (450) |
| Exhaust Gas Temperature - °F (°C) ..... | 890 (477) | 800 (427) | 799 (426) | 810 (432) | 851 (455) | 894 (479) |
| Heat Rejection to Coolant BTU/min. (kW) ... | 2009 (35) | 2193 (39) | 2364 (42) | 2580 (45) | 2889 (51) | 3033 (53) |
| Heat Rejection to Ambient BTU/min (kW) ... | 851 (15) | 894 (16) | 959 (17) | 1024 (18) | 1004 (18) | 983 (17) |
| **CFP5E-F10** Output - BHP (kW) ..... | 84 (63) | 95 (71) | 98 (73) | 101 (75) | 105 (78) | 104 (78) |
| Ventilation Air Required - CFM (litre/sec) .... | 208 (98) | 295 (139) | 325 (153) | 363 (171) | 402 (190) | 442 (209) |
| Exhaust Gas Flow - CFM (litre/sec) ..... | 520 (245) | 670 (316) | 711 (336) | 774 (365) | 862 (407) | 905 (427) |
| Exhaust Gas Temperature - °F (°C) ..... | 869 (465) | 777 (414) | 761 (405) | 756 (402) | 786 (419) | 825 (441) |
| Heat Rejection to Coolant BTU/min. (kW) ... | 1833 (32) | 2100 (37) | 2167 (38) | 2367 (42) | 2656 (47) | 2789 (49) |
| Heat Rejection to Ambient BTU/min (kW) ... | 825 (14) | 868 (15) | 930 (16) | 993 (17) | 973 (17) | 954 (17) |

All Data is Subject to Change Without Notice.

**Engineering Manager:** ***Mike Dawson***
**Cummins Fire Power, De Pere, WI 54115 U.S.A.**