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November 17, 2010

FedEX Express# 8684 4114 6380

Mr. David Eppler
Toxics Enforcement Section (6EN-AT)
Compliance Assurance and Enforcement Division
U.S. EPA Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Re: Response to Clean Air Act Section 114 Information Request
BP Refinery, Texas City, Texas (BP)

Mr. Eppler,

This is in response to the request for information dated September 28, 2010, received by our office on October 5, 2010. BP Products, Texas City Refinery response and supporting documentation are attached.

Should you have any further questions please contact me at 409-941-8000 or by email at mark.berlinger@bp.com.

Sincerely,

Mark J. Berlinger for
Environmental Manager
BP Products North America Inc.

KR/dr
Attachments

1. **For each day beginning on January 1, 2006, until the date of your receipt of this request, list the periods of time (date, start time, and end time) that combustible material was routed to the flares at the Texas City, Texas facility (i.e. "venting periods") designated as Refinery Flare #3 and the Ultra Cracker Flare, and any other flare to which combustible materials were routed following the Incident.**

Response:

BP Products understands that EPA's information request is limited to Refinery Flare #3 and the Ultracracker Flare as those were the only flares involved in a flaring incident in the spring of 2010. EPA confirmed to BP Products that the undefined term "Incident" refers to the spring 2010 flaring event.

On April 6, 2010 a dry gas seal on the Refinery's 100-J compressor (100-J) failed. The operator noted a disruption in the flow of seal gas to the seal and upon investigating identified a small, isolated fire on the seal face. Unit operators immediately shut down 100-J and quickly extinguished the fire. The ULC and UU4 units were shut down on April 6 in response to the seal failure and fire. These unit shutdowns resulted in the flaring of refinery process gas. Flaring from the incident only occurred at Refinery Flare #3 and the Ultracracker Flare; so this 114 request response provides information for Refinery Flare #3 and the Ultracracker Flare. As reported in STEERs report # 138052, the Ultracracker flare accounts for ~98% of the emissions for the flaring Incident.

BP Products routes combustible material to each flare daily. The flares also operate with a continuous purge stream of natural gas or fuel gas when they are in service. As required by a 2006 TCEQ Agreed Order, BP Products is currently 2/3 of the way through a program to implement flare gas recovery, and source segregation to comply with NSPS Subpart J. Refinery Flare #3, along with four other refinery flares, is scheduled to implement flare gas recovery by June, 2011 while the Ultracracker Flare will have segregated H2S streams and will only combust waste gas/fuel gas streams less then 162 ppm H2S in order to comply with NSPS J. Additionally, both Flare 3 and the ULC Flare are equipped with automated systems and controls to aid in maintaining performance such as on-line gas chromatograph analyses of ~20 components in the vent gas, and automated net heating value control to maintain the minimum BTU requirement.

The exception to when combustible materials are routed to a flare is when it is taken out of service. The two flares were out of service as follows:

- Refinery Flare #3 (Flare 3) was out of service on the following dates:
  - January 1, 2006 00:00 to March 18, 2006 14:48 (Refinery down for Hurricane Rita outage)
  - October 14, 2008 22:44 to December 13, 2008 12:20 (Flare 3 maintenance downtime)
- Ultracracker Flare (ULC Flare) is a new flare that was commissioned in February 2007, so there is no data until February 17, 2007 at 17:00
  - September 13, 2008 1:00 to September 22, 2008 14:00 (Hurricane Ike downtime)

2. **For each venting period listed in response to paragraph 1 above, provide the average heating value, in Btu/scf of the stream that was vented to each facility flare. The averaging time shall not be greater than one hour. Provide a narrative explanation and example calculations describing how you arrived at your response.**

Response:

Both Flare 3 and the ULC Flare are equipped with continuous gas chromatograph (GC) analyzers that measure most compounds in the flare gas. The composition of the stream is used to calculate the net heating value (NHV) as shown in the example calculation below.

As both flares are configured for automated NHV control. The Flare 3 NHV controller analyzes the NHV of the vent gas to the flare and adds sweet refinery fuel gas as needed to maintain a setpoint above 300 Btu/scf. Similarly, the ULC Flare NHV controller analyzes the NHV of the vent gas and adds natural gas as needed to maintain a setpoint above 300 Btu/scf. The effectiveness of the automated control can be seen in the data. The average NHV is 886 Btu/scf for Flare 3 and 712 Btu/scf for the ULC Flare. Out of 38,655 hours of operation in the time period specified in paragraph 1, only 126 hours were below 300 Btu/scf for Flare 3, which is less then 0.4%. Out of 31,831 hours of operation for the ULC Flare, only 24 hours were below 300 Btu/scf, which is less then 0.1% (Note that 10 of those hours were during the commissioning period of the ULC Flare when new streams were being added and controllers were being tuned/adjusted).

The calculated data is provided in one-hour average values for the periods in response to paragraph 1. Below is an example calculation of how net heating value (NHV_{AVG}) was calculated for both flares:

$$\mathrm{NHV}_{\text{AVG-M}} = \frac{\sum_i C_i \times MW_i \times NHV_i}{MW_{AVG}}$$

Where:
- C_i is the composition of each species (wet, mol % basis)
- MW_i is the molecular weight of each species (lb/lbmol)
- NHV_i is the net (lower) heating value of each component (BTU/lb)
- MW_{avg} is the average molecular weight of the stream calculated below

The result is a NHV_{AVG-M} in BTU/lb. The average NHV is then converted to volumetric units.

$$NHV_{AVG-VOL} = \frac{NHV_{AVG-M} \times MW_{AVG}}{STDVOL_{68F}}$$

Where:
- $STDVOL_{68F}$ is the conversion factor from standard cubic foot of gas to lbmol equal to 385.4 (scf/lbmol)
- MW_{avg} is the average molecular weight of the stream calculated below

$$\mathrm{MW}_{\text{AVG}} = \sum_i C_i \times MW_i$$

Where:
- C_i is the composition of each species (wet, mol % basis)
- MW_i is the molecular weight of each species (lb/lbmol)

The data can be found in Attachment 2 - ULC Flare Heating Values and Flare 3 Heating Values.

3. **For each venting period listed in response to paragraph 1 above, provide the average mass flow rate of all material, combustible and non-combustible, in lb/hr of the stream that was vented to each facility flare. The averaging time shall not be greater than one hour. Provide a narrative explanation and example calculations describing how you arrived at your response.**

Response:

BP Texas City does not measure the average mass flow rate of all material, combustible and non-combustible to the flare. BP Texas City measures the volumetric flow rate on both Flare 3 and the ULC Flare. Additionally, BP has GC analyzers on the flare gas streams for those flares. Using the gas composition, an average molecular weight of the stream was calculated, making some assumptions. From the mole % composition and volumetric flow of the stream, an hourly mass flow for each time period referred to in paragraph 1 was calculated for Flare 3 and the ULC Flare.

Below is an example calculation of how mass flow (F_M) was calculated for both flares:

$$F_M = \frac{F_V}{STDVOL_{68F}} \times MW_{AVG}$$

Where:
- F_V is the total volumetric flow to the flare (scf/h)
- $STDVOL_{68F}$ is the conversion factor from standard cubic foot of gas to lbmol equal to 385.4 (scf/lbmol)
- MW_{avg} is the average molecular weight of the stream calculated below

$$MW_{AVG} = \sum_i C_i \times MW_i$$

Where:
- C_i is the composition of each species (wet, mol % basis)
- MW_i is the molecular weight of each species (lb/lbmol)

The data can be found in Attachment 3 - ULC Flare Mass Flow and Flare 3 Mass Flow.

4. **For each venting period listed in response to paragraph 1 above, provide the average rate at which steam and/or air was being added to each facility flare, in lb/hr for steam and/or scf/hr for air, at all locations on the flare (i.e. the sum of seal, upper, lower, winterizing, etc) during each venting period.. The averaging time shall not be greater than one hour. Provide a narrative explanation and example calculations, if appropriate, describing how you arrived at your response**

Response:

Both Flare 3 and the ULC flare are steam assisted flares and have steam flow meters on the steam lines to the flare. The ULC Flare steam supply system provides 400 lb/h of cooling steam that is not routed through the steam flow meter but is measured by a restriction orifice. For this submission of ULC steam flow data BP Products is providing flow numbers with the 400 lb/h of cooling steam through the restriction orifice added to the steam flow measured at the flow meter.

BP Products shutdown Flare 3 for 2 months in 2008 for maintenance. As part of that maintenance BP Products replaced about 200 feet of the flare steam supply piping because it had steam leaks. Additionally, BP Products removed and repaired the steam meter and replaced the measurement orifice for the orifice flow meter. After BP Products returned the flare to service the steam flow had a step change decrease. BP Products believes that the decrease in steam flow to the flare is due to the repairs made to the leaking steam piping and/or the repairs made to the steam meter. BP Products does not believe that the steam flow indicated by the flow meter before the 2008 outage accurately reflected the steam flow at the flare tip. BP Products used engineering judgment to adjust the steam flow prior to the 2008 maintenance. The attached data table has a column for the data reported by the system and the adjusted data.

The flow meters used to measure steam for both flares are orifice plate flow meters with differential pressure (DP) flow transmitters. The orifice plate flow element contains a hole or

orifice through which steam passes. Upstream and downstream piping are required to condition the flow to provide for accurate measurement. Pressure is measured upstream and downstream from the orifice plate with the DP transmitter, which then calculates the flow rate. Steam is easily influenced by changes in temperature and pressure. Condensation can also present a problem if it occurs near the flow element. Changes in pressure can impact the flow measurement for this type of flow measurement device.

The data can be found in Attachment 4 - ULC Flare Steam Flow and Flare 3 Steam Flow.

5. **For each venting period listed in response to paragraph 1 of this section, provide the average steam-to-vent gas or air-to-vent gas ratio (lb steam/lb vent gas or scf air/lb of vent gas) during any release to each facility flare. The averaging time shall be no more than one hour. Provide a narrative explanation and example calculations, if appropriate describing how you arrived at your response.**

Response:

The data described in paragraph 4 was divided by the data described in paragraph 5 to calculate a steam-to-vent gas ratio for both Flare 3 and the ULC Flare. For Flare 3, note that for the time periods where the steam flow data is inaccurate, as described in paragraph 4, BP Products used the corrected steam value to calculate the steam-to-vent gas ratio (S/VG). See the sample calculation below.

$$\text{S/VG} = \frac{S_M}{F_M}$$

Where:
- S_M is the total steam flow to the flare, corrected as applicable (lb/h)
- F_M is the total mass flow of vent gas to the flare as calculated in paragraph 3 (lb/h)

The average steam-to-vent gas ratio over the entire period for Flare 3 is 2.0 lb/lb and for the ULC Flare is 3.3 lb/lb, which is generally consistent with the steam to vent gas ratios during the during the flaring Incident.

The data can be found in Attachment 5 - ULC Flare Steam-to-Vent Gas Ratio and Flare 3 Steam-to-Vent Gas Ratio.

6. **Provide a one-hour average of the concentration of each constituent in the vent stream during venting periods for the dates beginning one month prior to your receipt of this request, until the date of receipt of your request.**

Response:

Both Flare 3 and the ULC Flare are equipped with on-line continuous GC analyzers that analyze the composition of the flare gas. The ULC Flare has additional analysis for further speciation of some components with greater then 6 carbons (e.g. benzene, hexane, etc.), while Flare 3 analysis is not specific for carbon molecules greater then C6.

The concentration data hourly average values from the GC analyzers for each flare for each component measured to determine the composition of the stream for the month prior to the request (September 5 to October 5). As the GC analyzer is a measurement device and has some intrinsic variability, the values were normalized so that they add up to 100% for each hour (C_{NORM}). A sample calculation for this is shown below.

$$C_{NORM} = \frac{C_{GC}}{\sum_i C_{GC_i}} \times 100\%$$

Where:

-C_{GCi} is the composition of each species as measured by the GC analyzer (wet, mol % basis).

The composition data for September 5 to October 5 can be found in Attachment 6.

7. **Provide a list of the primary constituents in the vent stream released to each flare for venting periods since January 1, 2006, and an estimated range of each contsituent's concentration. Except for the period specified in paragraph 6, you need not determine the exact concentration of all compounds for each period of time, but only the most prominent compounds and an approximate range of concentration.**

Response:

Both Flare 3 and the ULC Flare are equipped with on-line continuous GC analyzers that analyze the composition of the flare gas. In November 2009, BP Products added instrumentation to the ULC Flare to speciate components with greater then 6 carbons (e.g. benzene, hexane, etc.), while Flare 3 does not have the additional analytical capabilities.

To establish a range for each component in the flare gas, the minimum and maximum normalized concentration values from GC analyzers (refer to response to paragraph 6 for a sample calculation for normalization of GC data) for each flare for each component were established for the time period from paragraph 1. Additionally, Flare 3 does have lab analysis performed semi-annually (commenced in Summer 2009) that further speciates the flare stream for benzene. The minimum and maximum benzene concentration from the lab analysis for Flare 3 is also included in the attachments.

A significant portion, over 1/3 of the total volume, of vent gas to both Flare 3 and the ULC Flare is Hydrogen and Nitrogen which are non-regulated, non-hydrocarbon streams. The average Hydrogen content of the stream to Flare 3 is 18.6% and to the ULC Flare it is 25.2%. The average Nitrogen content of the stream to Flare 3 is 25.3% and to the ULC Flare is 12.0%.

During the flaring Incident the hydrogen content of the vent gas to the ULC flare was ~80% and for Flare 3 it was ~34%.

The concentration ranges for both flares and a copy of the lab analysis reports for Flare 3 can be found in Attachment 7.

8. **For each facility flare, provide the minimum steam or air addition rate, in lb/hr for steam and/or scf/hr for air, at all locations on the flare (seal, upper and lower). To the extent that the minimum steam or air addition rate changes on a seasonal basis, state the minimum rate for each season and the time periods during which each season's minimum rate applies.**

Response:

Flare 3 has three steam lines to the flare tip, two 8" lines that reduce to 6" injection points in a lower and upper steam manifold and a 2" line that injects into the center of the flare tip. The 2" center steam flow has a minimum flow rate of 500 lb/hr and a maximum flow rate of 5,000 lb/hr. The lower steam manifold has a minimum flow requirement of 600 lb/hr and a maximum flow of 43,200 lb/hr. The upper steam manifold has a minimum flow requirement of 840 lb/hr and a maximum flow of 49,400 lb/hr. Each line is equipped with a steam control valve, and each control valve has a hole drilled in the gate to ensure proper minimum flow is maintained to the tip. All flows are accounted for in the meter as it is upstream of where the lines branch apart.

ULC Flare has two steam lines to the flare tip, an 8" line and a 3" line. The 3" line has a constant steam flow of 400 lb/h set by a flow restriction orifice (this is the un-metered flow that was added to the total steam flow rate in paragraph 4). The 8" steam line has a minimum steam flow of 400 lb/h also set by a flow restriction orifice. The remaining steam flow is adjusted via a steam controller and has a maximum flow of 94,000 lb/h according to the vendor specification sheet.

9. **Provide copies of any and all documents in your possession, custody, or control that prescribe or recommend the amount of steam or air to be added to each facility flare. Provide a copy of the entire document if within the document it states the maximum steam or air rate, minimum steam or air rate, steam or air addition rate associated with a vent scenario, general steam-to-vent gas or air-to-organic gas/vent gas ratio, or any other reference to steam addition.**

Response:

The flare vendor data and process piping and instrument diagrams were used to determine the steam flow information and can be found in Attachment 9.

See Attachment 9 - ULC Flare Specifications and Flare 3 Flare Specifications.

10. **For each facility flare, state with specificity which, if any, Federal and/or state regulations regulate/apply to each flare. If any facility flare is listed in a permit issued under Federal and/or state regulations, provide and electronic copy, preferably in a "PDF" format, of each currently effective permit.**

Response:

The Title V permit (O-01541) for the BP Texas City Refinery issued on September 19, 2007. At that time the following regulations were listed for the flares:

- Flare 3
  - State regulation 30 TAC 111 Control of Air Pollution From Visible Emissions and Particulate Matter, Subchapter A - Visible Emissions and Particulate Matter
  - State regulation 30 TAC 115 Control of Air Pollution from Volatile Organic Compounds (VOC), Subchapter B - General VOC Compound Sources
  - Federal regulation 40 CFR Part 60, Subpart A
  - Federal regulation 40 CFR Part 63, Subpart A
  - Federal regulation 40 CFR Part 63, Subpart CC
- ULC Flare
  - State regulation 30 TAC 111 Control of Air Pollution From Visible Emissions and Particulate Matter, Subchapter A - Visible Emissions and Particulate Matter
  - State regulation 30 TAC 115 Control of Air Pollution from Volatile Organic Compounds (VOC), Subchapter B - General VOC Compound Sources
  - Federal regulation 40 CFR Part 60, Subpart A
  - Federal regulation 40 CFR Part 63, Subpart A
  - Federal regulation 40 CFR Part 63, Subpart CC

On February 25, 2009, BP Products submitted a significant revision/renewal to the Texas Commission on Environmental Quality (TCEQ). The revision application is still pending approval; however, it added the following regulations to the flares:

- Flare 3
  - State regulation 30 TAC 115 Control of Air Pollution from Volatile Organic Compounds (VOC), Subchapter H - Highly Reactive VOCs
- ULC Flare
  - State regulation 30 TAC 115 Control of Air Pollution from Volatile Organic Compounds (VOC), Subchapter H - Highly Reactive VOCs

Recently BP Texas City Refinery elected to comply with the provisions of the Consolidated Air Rule (CAR) by complying with 40 CFR §§65.63(a)(1) and 65.142(b). The flares will meet the applicable requirements in §65.143 for closed vent systems; §65.147 for flares; and §65.157(a), (b), and (c) for provisions regarding flare compliance determinations; and the monitoring, recordkeeping, and reporting requirements referenced therein. Flame monitoring and compliance records will be kept as specified in §65.159(c) and (d). BP Texas City is currently revising the Title V permit O-01541 to reflect this change.

Additionally, the current revision will include updates to note compliance requirements for the BWON regulations for both Flare 3 and the ULC Flare. Both flares are required to be in compliance with 40 CFR 61.349(a)(2)(iii), which refers back to 40 CFR 60.18, 40 CFR 61.349(d), 40 CFR 61.354 in reference to the monitoring of operations, 40 CFR § 61.356 in reference to recordkeeping requirements, and 40 CFR 61.357 in reference to reporting requirements.

In addition to the Title V permit, the New Source Review (NSR) Permit No. 47256 (dated August 17, 2010) contains a list of Permit Special Conditions that the flares must comply with. Special Condition 14.A. cites 40 CFR 60.18 requirements for heating value, and flare tip velocity. It also states the right for the TCEQ Regional office to request testing per 40 CFR 60.18(f) in order to demonstrate compliance with this requirement.

Special condition 2.C. references Federal applicability for Petroleum Refineries, Subpart J per TCEQ Agreed Order Docket No. 2005-0224-AIR-E. Both Flare 3 and the ULC Flare are listed in the Agreed Order and have a compliance schedule that requires they be in compliance with NSPS Subpart J by June 2011. Refer to the attached permit for details.

The current Title V Permit O-01541 can be found in Attachment 10.
The current NSR Permit No. 47256 (issued August 17, 2010) can be found in Attachment 10.

11. For each facility flare, state whether the flare is configured to receive gases/vapors from a pressure relief device, which is a safety device used to prevent operating pressures from exceeding the maximum allowable working pressure of the process equipment. Also state whether the flare and its associated closed vent system is used as the method of compliance with any Federal leak detection and repair (LDAR) provision, including but not limited to 40 C.F.R. § 60.482-4(c) or 40 C.F.R. § 63.165(c).

Response:

Both Flare 3 and the ULC Flare are configured to receive gases/vapors from pressure relief devices. Both flares and their associated closed vent systems are used to comply with Federal leak detection and repair (LDAR) provisions.

I certify under penalty of law that I have examined and am familiar with the information in the enclosed documents, including all 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 and complete. I am aware that there are significant penalties for knowingly submitting false statements and information, including the possibility of fines or imprisonment pursuant to Section 113(c)(2) of the CAA, and 18 U.S.C. §§ 1001 and 1341.

Mark J. Berlinger
Environmental Manager
BP Products North America Inc.
Texas City Refinery

X Paula LaPorce for
Signature

11-17-10
Date signed

Attachments:

2 - Flare 3 NHV
2 - ULC Flare NHV
3 - Flare 3 Mass Flow
3 - ULC Flare Mass Flow
4 - Flare 3 Steam Flow - Corrected Data
4 - Flare 3 Steam Flow - Meter Only Data Pre TAR
4 - ULC Flare Steam Flow
5 - Flare 3 Steam to Vent Gas Ratio
5 - ULC Flare Steam to Vent Gas Ratio
6 - Flare 3 Concentration for One Month
6 - ULC Flare Concentration for One Month
7 - Flare 3 Grab Sample Results from 12-17-2009
7 - Flare 3 Grab Sample Results from 9-24-2009
7 - Flare 3 Grab Sample Results from 6-18-2010
7 - Benzene Concentration of Flare 3 from Grab Samples
7 - Range from GC Data for ULC Flare and Flare 3
9 - ULC Flare Specifications
9 - ULC Flare Operating Manual
9 - ULC Flare P&ID
9 - Flare Tip Drawing Flare 3
9 - John Zink Engineering Study 2003 for Flare 3
10 - Permit 47256 PSD 402 2010_8-17.pdf (electronic)
10 - Title V Permit 01541 Revised 11-19-07.pdf (electronic)