IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF MICHIGAN

UNITED STATES OF AMERICA, Plaintiff, v. MARATHON PETROLEUM COMPANY LP, and CATLETTSBURG REFINING, LLC, Defendants.	)	No.

CONSENT DECREE

TABLE OF CONTENTS

TABLES OF APPENDICES

TABLE 1

NUMBER	ABBREVIATION	DESCRIPTION
1.1	S-Drwgs	Drawings Illustrating Lower, Center, and Upper Steam Injection in Various Types of Flare Tips
1.2	Gen-Eq	General Equations
1.3	LFL	Calculating $NHV_{cz\text{-}limit}$ and NHV_{cz} for Steam-Assisted Flares
1.4	Malf-Pol	EPA's Policy on Excess Emissions during Malfunctions, Startup, and Shutdown
1.5	MFR-Eq	Calculating Momentum Flux Ratio
1.6	Tip-Area-Eq	Calculating the Unobstructed Cross Sectional Area of Various Types of Flare Tips
1.7	G-Drwg	Depiction of Gases Associated with Steam-Assisted Flares
1.8	Flr-Data-Rpt	Outline of Requirements for the Flare Data and Initial Monitoring Systems Report
1.9	GC-Cmpnds	List of Compounds a Gas Chromatograph must be Capable of Speciating
1.10	Tech-Specs	Equipment and Instrumentation Technical Specifications and Quality Assurance/Quality Control Requirements
1.11	WG-Map	Waste Gas Mapping: Level of Detail Needed to Show Main Headers and Process Unit Headers
1.12	DWDF-Drwgs	Representations of Discontinuous Wake Dominated Flow
1.13	Stips-Calc	Calculating the Amount of Stipulated Penalties Due for Violating Limitations on Flaring when the Stipulated Penalties are Based on Excess VOCs and SO_2 Emitted

TABLE 2

NUMBER	ABBREVIATION	DESCRIPTION
2.1	MPC-Cmplnc-Sch	Covered Flares and Applicability Dates for Certain Consent Decree Requirements
2.2	MPC_{TC}-SCF-Eq	Calculating the Total Steam Mass and Volumetric Flow Rates as Adjusted by the Steam Contribution Factor at the Texas City Main Flare
2.3	MPC_{PFTIR}-Prtcl-Otln	Outline of Protocol for Performance of Passive FTIR Testing at Robinson Flare 84-F1 (full protocol not necessary; MPC already twice has performed this type of testing)
2.4	MPC_{GRYVL}-Test-Prtcl	Flare Performance Test Plan for the GME Ground Flare Burners at the Garyville Refinery
2.5	MPC-Test-Rpt-Otln	Outline of Contents of Reports for Emissions and Flare Combustion Efficiency Testing (full outline not necessary: MPC already twice has prepared reports for emissions and combustion efficiency testing)
2.6	Mitig-Prjct	MPC's Detroit Refinery – Sludge Handling System

CONSENT DECREE

WHEREAS Plaintiff the United States of America ("United States"), on behalf of the United States Environmental Protection Agency ("EPA"), has filed a complaint against Defendants Marathon Petroleum Company LP and its wholly owned subsidiary, Catlettsburg Refining, LLC (collectively "MPC"), concurrently with the lodging of this Consent Decree, for alleged environmental violations at all of MPC's petroleum refineries, which are located in Robinson, Illinois; Catlettsburg, Kentucky; Garyville, Louisiana; Detroit, Michigan; Canton, Ohio; and Texas City, Texas ("Covered Refineries");

WHEREAS, on information and belief, the United States alleges that MPC has violated and/or continues to violate, at the Covered Refineries, the following statutory and regulatory provisions:

a. The Prevention of Significant Deterioration ("PSD") requirements found in 42 U.S.C. § 7475 and 40 C.F.R. §§ 52.21(a)(2)(iii) and 52.21(j)–52.21(r)(5);

b. The Non-Attainment New Source Review ("NNSR") requirements found in 42 U.S.C. §§ 7502(c)(5), 7503(a)–(c) and 40 C.F.R. Part 51, Appendix S, Part IV, Conditions 1–4;

c. The federally enforceable Minor New Source Review ("Minor NSR") requirements adopted and implemented by the Relevant States in their State Implementation Plans ("SIPs") pursuant to 42 U.S.C. § 7410(a)(2)(C) and 40 C.F.R. §§ 51.160–51.164;

d. The New Source Performance Standards ("NSPS") promulgated at 40 C.F.R. Part 60, Subparts A, J, VV, VVa, GGG, and GGGa, pursuant to Section 111 of the CAA, 42 U.S.C. § 7411;

e. The National Emission Standards for Hazardous Air Pollutants ("NESHAPs") promulgated at 40 C.F.R. Part 63, Subparts A, CC, and UUU, pursuant to Section 112 of the CAA, 42 U.S.C. § 7412;

f. The requirements of Title V of the CAA found at 42 U.S.C. §§ 7661a(a), 7661b(c), 7661c(a); and 40 C.F.R. §§ 70.1(b), 70.5(a) and (b), 70.6(a) and (c), and 70.7(b);

g. The portions of the Title V permits for the Covered Refineries that adopt, incorporate, or implement the provisions cited in a–e and h–i;

h. The federally enforceable SIPs for Illinois, Kentucky, Louisiana, Michigan, Ohio, and Texas that incorporate, adopt, and/or implement the federal requirements listed in a–b and d–f;

i. Additional, federally enforceable SIP regulations on a State-by-State, Refinery-by-Refinery basis; and

j. The emergency notification requirements of CERCLA, 42 U.S.C. § 9603(a), and of EPCRA, 42 U.S.C. § 11004(b).

WHEREAS MPC does not admit any liability to the United States arising out of the transactions or occurrences alleged in the Complaint;

WHEREAS, in March 2008, EPA began investigating MPC's compliance with provisions of the CAA related to flares and shortly thereafter EPA and MPC commenced negotiations that included EPA's identification of actions that MPC should take to reduce flare emissions, and MPC immediately started taking such actions at that time;

WHEREAS, since 2008, MPC has provided a unique level of resources, expertise, and assistance to EPA to develop and advance the scientific knowledge and technology for measuring emissions of volatile organic compounds ("VOCs") and hazardous air pollutants ("HAPs") from industrial flares, including but not limited to:

- Developing the protocol for and conducting the first-ever test of emissions from an operating, industrial flare using a then-new measurement technology called Passive Fourier Transfer Infrared ("PFTIR") Spectroscopy
- Implementing the PFTIR test at its Texas City refinery over a range of vent gas compositions and steam-to-vent-gas ratios to better define how to achieve 98% combustion efficiency ("CE") from operating, industrial flares
- Replicating the PFTIR test at another operating flare at the Detroit Refinery to improve the test method and accelerate technology development
- Assuring rigorous and scientifically valid data collection
- Preparing comprehensive and thorough PFTIR test reports for general distribution and use
- Assisting in generating a consensus regarding the validity of PFTIR as a method for measuring emissions from flares

- Evaluating the viability and reliability of an infrared smoke detector to maintain flare operation at the "incipient smoke point," which is the visible manifestation of the point of highest CE;

WHEREAS, since 2008, MPC has provided a unique level of cooperation to EPA to advance the understanding of the relationship between flare operating parameters and flare combustion efficiency, including but not limited to:

- Evaluating the relationship between the net heating value ("NHV") of the gas in the combustion zone of a flare and a flare's CE
- Isolating the effects of not just MPC's typical vent gas compositions on a flares' CE but also the effects of olefins such as propylene and butylene and inerts such as hydrogen and nitrogen
- Leading the development of the theoretical and practical basis for dynamically calculating the NHV of the gas in a flare's combustion zone and comparing it to the use of a static limit
- Comparing actual Total Steam-to-Vent-Gas ("S/VG") ratios to those predicted by the S/VG ratios in the American Petroleum Institute's Recommended Practice 521 to assist in the evaluation of S/VG as an appropriate metric of CE
- Evaluating the effect of wind on CE, including developing white papers regarding Momentum Flux Ratio ("MFR") and Steam Contribution Factor ("SCF");

WHEREAS MPC has represented that it incurred costs in excess of $2.4 million in undertaking the efforts described in the preceding two paragraphs;

WHEREAS EPA regards MPC's efforts as instrumental in accelerating the means of measuring VOC and HAP emissions from flares, reducing such emissions, and informing EPA's enforcement efforts;

WHEREAS MPC has agreed to install novel and unproven technology on a flare at its Robinson Refinery to determine whether such technology can reduce the minimum steam requirements of steam-assisted flares to ensure high CE at low vent gas flows;

WHEREAS, since 2008, MPC has expended more than $45 million to reduce emissions from all of its flares ("Covered Flares"), including but not limited to installing, by the end of

2011, the full suite of monitoring equipment required by Section V.A of this Consent Decree on seventeen of MPC'S twenty-two Covered Flares;

WHEREAS MPC estimates that it will spend an additional $6.5 million (for a total of $51.5 million) to further reduce emissions from the Covered Flares and also will spend an additional, undetermined sum to comply with the flaring cap in Section V.B of this Consent Decree and with 40 C.F.R. Part 60, Subparts J and Ja;

WHEREAS MPC estimates significant annual savings upon implementation of this consent decree through recovery of vent gas streams and reduced steam usage at its flares;

WHEREAS, between 2008 and the end of 2011, EPA estimates that emissions from the Covered Flares have been reduced by approximately the following amounts (in "tons per year" or "TPY"):

Pollutant	2008–2011
Volatile Organic Compounds ("VOCs")	4,720 TPY
Carbon Dioxide Equivalents ("CO_2e")	119,500 TPY
Hazardous Air Pollutants ("HAPs")	110 TPY

WHEREAS, between the beginning of 2012 and the full implementation of the controls required by this Consent Decree, MPC projects additional reductions, with total reductions approximately as follows:

Pollutant	Beginning of 2012 through Implementation	**2008 through Implementation**
VOCs	530 TPY	**5,250 TPY**
CO_2e	2200 TPY	**121,700 TPY**
HAPs	30 TPY	**140 TPY**

WHEREAS EPA estimates that, between 2008 and the end of 2011, emissions of sulfur dioxide ("SO_2"), hydrogen sulfide ("H_2S"), and carbon monoxide ("CO") from the Covered

Flares also have been reduced and that further reductions very likely will take place between the beginning of 2012 and full implementation of the controls required by this Consent Decree;

WHEREAS MPC estimates that the mitigation project required pursuant to Section VII (Mitigation Project) of this Decree will cost approximately $2.2 million;

WHEREAS MPC has installed ambient air monitors at or near the fence lines of four of its Refineries in order to better understand the impact of its operations on neighboring communities, and MPC shares the monitoring data with neighboring communities;

WHEREAS MPC has been in the vanguard of the refining industry in its willingness to propose and agree to install and maintain ambient air monitors, including having spent approximately $5.4 million on such monitors since 2008;

WHEREAS, by entering into this Consent Decree, MPC has indicated that it is committed to continuing to proactively reduce emissions from its flares;

WHEREAS this Consent Decree is intended to represent a comprehensive resolution of the claims alleged in the Complaint and the claims resolved through Section XIII (Effect of Settlement) and to ensure that when the compliance measures required by this Decree have been fully implemented, each Covered Flare will be operated and maintained to prevent a recurrence of the violations alleged in the Complaint and the violations resolved through Section XIII (Effect of Settlement);

WHEREAS the United States anticipates that the specific and comprehensive compliance measures set forth in this Consent Decree, which are subject to a reasonable timetable for implementation, will result in the cessation of the violations alleged in the Complaint and the violations resolved through Section XIII (Effect of Settlement);

WHEREAS MPC already has installed or has agreed to install through this Consent Decree Gas Chromatographs to speciate and measure the constituents of all Vent Gas directed to all Covered Flares and will utilize these Gas Chromatographs to calculate the NHV of the Vent Gas directed to the Covered Flares;

WHEREAS the response time of a Gas Chromatograph requires the use of an averaging time for the NHV of the Vent Gas that is longer than the averaging time needed for a flare that utilizes a Vent Gas Net Heating Value Analyzer/Calculator;

WHEREAS, MPC already has submitted the report required in Paragraph 16 of this Consent Decree for the Covered Flares at its Catlettsburg Refinery, all of the Covered Flares at its Detroit Refinery except the Coker Flare (which is not yet in operation), and Covered Flares 84-F1, 84-F5, and 84-F6 at its Robinson Refinery;

WHEREAS, the United States and MPC (the "Parties") recognize, and this Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith and will avoid litigation between the Parties, and that this Consent Decree is fair, reasonable, and in the public interest;

NOW, THEREFORE, before the taking of any testimony, without the adjudication or admission of any issue of fact or law except as provided in Section I, and with the consent of the Parties, IT IS HEREBY ADJUDGED, ORDERED, AND DECREED as follows:

I. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §§ 1331, 1345, and 1355; Sections 113(b) and 167 of the CAA, 42 U.S.C. §§ 7413(b) and 7477; Section 325(b) of EPCRA, 42 U.S.C. § 11045(b); Section 109(c) of CERCLA, 42 U.S.C. § 9609(c); and over the Parties. Venue lies in this District pursuant to Section 113(b) of

the CAA, 42 U.S.C. § 7413(b); Section 325(b)(3) of EPCRA, 42 U.S.C. § 11045(b)(3); Section 113(b) of CERCLA, 42 U.S.C. § 9613(b); and 28 U.S.C. §§ 1391(b) and (c) and 1395(a), because MPC resides and is located in this judicial district and some of the violations alleged in the Complaint are alleged to have occurred in this judicial district. For purposes of this Decree, or any action to enforce this Decree, MPC consents to this Court's jurisdiction over this Decree, over any action to enforce this Decree, and over MPC. MPC also consents to venue in this judicial district.

2. For purposes of this Consent Decree, MPC does not contest that the Complaint states claims upon which relief may be granted.

3. Notice of the commencement of this action has been given to Illinois, Kentucky, Louisiana, Michigan, Ohio, and Texas, under Sections 113(a)(1) and 113(b) of the CAA, 42 U.S.C. §§ 7413(a)(1) and (b).

II. APPLICABILITY

4. The obligations of this Consent Decree apply to and are binding upon the United States and upon MPC and any successors, assigns, and other entities or persons otherwise bound by law.

5. MPC shall give written notice of, and shall provide a copy of, the Consent Decree to any successors in interest at least sixty (60) days prior to the transfer of ownership or operation of any portion of the Covered Refineries. MPC shall notify the United States in accordance with the notice provisions in Section XV (Notice) of any successor in interest at least thirty days prior to any such transfer.

6. If MPC intends to request that the United States agree to a transferee's assumption of any obligations of the Consent Decree, MPC shall condition any transfer, in whole

or in part, of ownership of, operation of, or other interest (exclusive of any non-controlling, non-operational shareholder interest) in the Covered Refinery upon the transferee's written agreement to execute a modification to the Consent Decree that shall make the terms and conditions of the Consent Decree applicable to the transferee.

7. As soon as possible prior to the transfer: (i) MPC shall notify the United States of the proposed transfer and of the specific Consent Decree provisions that MPC proposes the transferee assume; (ii) MPC shall certify that the transferee is contractually bound to assume the obligations and liabilities of this Consent Decree; and (iii) the transferee shall submit to the United States a certification that the transferee has the financial and technical ability to assume the obligations and liabilities of this Consent Decree and a certification that the transferee is contractually bound to assume the obligations and liabilities of this Consent Decree.

8. After the submission to the United States of the notice and certification required by the previous Paragraph, either: (i) the United States, shall notify MPC that the United States does not agree to modify the Consent Decree to make the transferee responsible for complying with the terms and conditions of the Consent Decree; or (ii) the United States, MPC, and the transferee shall file with the Court a joint motion requesting the Court approve a modification substituting the transferee for MPC as the Defendant responsible for complying with the terms and conditions of the Consent Decree.

9. If MPC does not secure the agreement of the United States to a joint motion within a reasonable period of time, then MPC and the transferee may file, without the agreement of the United States, a motion requesting the Court to approve a modification substituting the transferee for MPC as the Defendant responsible for complying with some or all of the terms and conditions of the Consent Decree. The United States may file an opposition to the motion. The

motion to modify shall be granted unless MPC and the transferee: (i) fail to show that the transferee has the financial and technical ability to assume the obligations and liabilities of the Consent Decree; (ii) fail to show that the modification language effectively transfers the obligations and liabilities to the transferee; or (iii) the Court finds other good cause for denying the motion.

10. Except as provided in Paragraphs 5–9 and Section X (Force Majeure), MPC shall be responsible for ensuring that performance of the work contemplated under this Consent Decree is undertaken in accordance with the deadlines and requirements contained in this Consent Decree and any attachments hereto. MPC shall provide a copy of all applicable portions of this Consent Decree to all officers and employees whose duties might reasonably include compliance with any provision of this Decree. No later than the execution of any contract with a consulting or contracting firm that is retained to perform work required by this Consent Decree, MPC shall provide a copy of the applicable provisions of this Consent Decree to each such consulting or contracting firm. MPC shall condition any such contract upon performance of the work in conformity with the applicable terms of this Consent Decree. No later than thirty (30) days after the Date of Lodging of the Consent Decree, MPC also shall provide a copy of the applicable provisions of this Consent Decree to each consulting or contracting firm that MPC already has retained to perform the work required by this Consent Decree. Copies of the applicable provisions of the Consent Decree do not need to be supplied to firms who are retained to supply materials or equipment to satisfy requirements of this Consent Decree.

11. In any action to enforce this Consent Decree, MPC shall not raise as a defense the failure by any of its officers, directors, employees, agents, or contractors to take any actions necessary to comply with the provisions of this Consent Decree.

III. DEFINITIONS

12. Terms used in this Consent Decree that are defined in the CAA, EPCRA, or CERCLA, or in federal and state regulations promulgated pursuant to the CAA, EPCRA, or CERCLA, shall have the meaning assigned to them in the CAA, EPCRA, or CERCLA, or such regulations, unless otherwise provided in this Decree. Whenever the terms set forth below are used in this Consent Decree, the following definitions shall apply:

a. "Active FTIR" shall mean an Active Fourier Transform Infrared System that consists of an infrared emission source and an infrared detector and analyzes the amount of thermal (infrared) radiation absorbed by a gas, and through measurement of the absorption spectra, identifies and quantifies the path-average concentration of the organic compounds in the gas.

b. "Air-Assisted Flare" shall mean a Flare that utilizes forced air piped to a Flare tip to assist in combustion; a Flare that utilizes a Minimum Steam Reduction System is a Steam-Assisted, not an Air-Assisted, Flare.

c. "Ambient Air" or "air" shall mean that portion of the atmosphere, external to buildings, to which persons have access.

d. "Assist Air" or "Air_{asst}" shall mean all air that intentionally is introduced into an Air-Assisted Flare to assist in combustion. Assist Air does not include Ambient Air, air introduced through in a Minimum Steam Reduction System, or air entrained in Vent Gas.

e. "Automatic Control System" shall mean a system that utilizes programming logic to automate the operation of the instrumentation and systems required in Paragraphs 18–23 of this Decree so as to produce the operational results required in Paragraphs 43, 46–49.

f. “Baseload Waste Gas Flow Rate” shall mean, for a particular Covered Flare, the daily average flow rate, in scfd, to the Flare, excluding all flows during periods of Startup, Shutdown, and Malfunction. The flow rate data period that shall be used to determine Baseload Waste Gas Flow Rate is set forth in Subparagraph 30.b.ii. The Baseload Waste Gas Flow Rate shall be identified in the Initial Waste Gas Minimization Plan due under Paragraph 30 and may be updated in subsequent Waste Gas Minimization Plans due under Paragraphs 31 and 32.

g. “BTU/scf” shall mean British Thermal Unit per standard cubic feet.

h. “Calendar Quarter” shall mean a three-month period ending on March 31, June 30, September 30, or December 31.

i. “Canton Refinery” shall mean the refinery owned and operated by Marathon Petroleum Company and located at 2408 Gambrinus Ave, SW, Canton, Ohio 44706.

j. “Catlettsburg Refinery” shall mean the refinery owned and operated by Catlettsburg Refining and located at 11631 US 23 South, Catlettsburg, Kentucky, 41129.

k. “Catlettsburg Refining” shall mean Catlettsburg Refining, LLC, a wholly owned subsidiary of Marathon Petroleum Company.

l. “Center Steam” or “S_{cen}” shall mean steam piped into the center of a Flare stack or center of the lower part of the Flare tip where it mixes directly with Vent Gas without entraining air. Diagrams illustrating the meaning and location of Center, Lower, and Upper Steam are set forth in Appendix 1.1 to this Consent Decree.

m. “Center Steam Volumetric Flow Rate” or “$Q_{s\text{-}cen}$” shall mean the volumetric flow rate of Center Steam supplied to a Flare, in scfm, as either measured (if applicable) or estimated using best engineering judgment, on a 5-minute block average.

n. "Center Steam Mass Flow Rate" or "$\dot{m}_{s\text{-}cen}$" shall mean the mass flow rate of Center Steam supplied to a Flare, in pounds per hour, as either measured (if applicable) or estimated using best engineering judgment, on a 5-minute block average using Equation 2 in Appendix 1.2.

o. "Combustion Efficiency" or "*CE*" shall mean a Flare's efficiency in converting the organic carbon compounds found in Vent Gas to carbon dioxide. Combustion Efficiency shall be determined as set forth in Equation 1 in Appendix 1.2.

p. "Combustion Efficiency Multipliers" or "*CE* Multipliers" shall mean empirically derived factors that are used as multipliers of the Net Heating Value of the Vent Gas at its Lower Flammability Limit to ensure an acceptable Combustion Efficiency. The CE Multipliers are set forth in Table 2 of Appendix 1.3 of this Consent Decree.

q. "Combustion Zone" shall mean the area of the Flare flame where the combustion of Combustion Zone Gas occurs.

r. "Combustion Zone Gas" shall mean the mixture of all gases and steam found after the Flare tip. This gas includes all Vent Gas, all Pilot Gas, all Total Steam (if the Flare is Steam-Assisted), and all Assist Air (if the Flare is Air-Assisted).

s. "Consent Decree" or "Decree" shall mean this Consent Decree, including any and all appendices attached hereto.

t. "Covered Flare" shall mean each of the Flares (all of which are Steam-Assisted) set forth in Column A of Appendix 2.1 to this Consent Decree.

u. "Covered Refineries" shall mean the refineries owned and operated by MPC that have Flares that are subject to the requirements of this Consent Decree: the Canton, Catlettsburg, Detroit, Garyville, Robinson, and Texas City Refineries.

v. “Date of Lodging of this Consent Decree” or “Date of Lodging” or “DOL” shall mean the date that this Consent Decree is filed for lodging with the Clerk of the Court for the United States District Court for the Eastern District of Michigan.

w. “Date of Entry of this Consent Decree” or “Date of Entry” or “DOE” shall mean the Effective Date of this Consent Decree.

x. “Detroit Refinery” shall mean the refinery owned and operated by Marathon Petroleum Company and located at 1300 South Fort St., Detroit, Michigan 48217.

y. “Discontinuous Wake Dominated Flow” shall mean gas flow exiting a Flare tip that is identified visually by:

i. The presence of a flame that is: *(1)* immediately adjacent to the exterior of the Flare tip body; and *(2)* below the exit plane of the Flare tip; and

ii. A discontinuous flame, such that pockets of flame are detached from the portion of the flame that is immediately adjacent to the exterior of the Flare tip body.

Representations of Discontinuous Wake Dominated Flow are set forth in Appendix 1.12.

z. “Effective Date” shall have the definition set forth in Section XVI (Effective Date) of this Consent Decree.

aa. “Elevated Flare” shall mean a Flare that supports combustion at a tip that is situated at the upper end of a vertical conveyance (*e.g.*, pipe, duct); the combustion zone is elevated in order to separate the heat generated by combustion from people, equipment, or structures at grade level.

bb. “EPA” shall mean the United States Environmental Protection Agency and any of its successor departments or agencies.

cc. "Exit Velocity" shall mean the velocity ("*v*") of the Vent Gas and Center Steam as they exit the flare tip. Exit Velocity shall be calculated by adding together the Vent Gas Volumetric Flow Rate and the Center Steam Volumetric Flow Rate, based on standard conditions, and dividing by the Unobstructed Cross Sectional Area of the Flare Tip.

dd. "External Power Loss" shall mean a loss in the supply of electrical power to a Covered Refinery that is caused by events occurring outside the boundaries of a Covered Refinery, excluding power losses due to an interruptible power service agreement.

ee. "First Updated Waste Gas Minimization Plan" or "First Updated WGMP" shall mean the document submitted pursuant to Paragraph 31 as the first update to the Initial WGMP.

ff. "Flare" shall mean a combustion device that uses an uncontrolled volume of Ambient Air to burn gases.

gg. "Garyville Refinery" shall mean the refinery owned and operated by Marathon Petroleum Company and located at 4663 Airline Highway, Garyville, Louisiana 70051.

hh. "Garyville Ground Flares" shall mean the two Ground Flares located at MPC's Garyville Refinery and designated by MPC as "GME North Ground, No. 259-1401" and "GME South Ground, No. 259-1402."

ii. "Ground Flare" shall mean a Flare or array of Flare tips that supports combustion at or near grade level and uses some form of shielding or barrier to separate the heat generated by combustion from people, equipment, and structures at grade level. Ground Flares include Flares that are partially enclosed.

jj. "Initial Waste Gas Minimization Plan" or "Initial WGMP" shall mean the document submitted pursuant to Paragraph 30.

kk. "Lower Flammability Limit" or "*LFL*" shall mean the lowest volumetric concentration of a combustible gas in air that, at a given temperature and pressure, will still combust.

ll. "Lower Flammability Limit of Vent Gas" or "LFL_{vg}" shall mean the weighted average of the LFLs of each of the individual compounds in Vent Gas, weighted by their volume fraction in the Vent Gas. LFL_{vg} is represented by and shall be calculated according to Equation 1 in Appendix 1.3 of this Consent Decree.

mm. "Lower Heating Value" or "*LHV*" shall mean the theoretical total quantity of heat liberated by the complete combustion of a unit volume or weight of a fuel initially at 25 degrees Centigrade and 760 mmHg, assuming that the produced water is vaporized and all combustion products remain at, or are returned to, 25 degrees Centigrade; however, the standard for determining the volume corresponding to one mole is 20 degrees Centigrade.

nn. "Lower Steam" shall mean steam piped to an exterior annular ring near the lower part of a Flare tip, which entrains Ambient Air which flows through tubes to the Flare tip, and ultimately exits the tubes at the top of the Flare tip. Diagrams illustrating the meaning and location of Center, Lower, and Upper Steam are set forth in Appendix 1.1 to this Consent Decree.

oo. "Malfunction" shall mean any sudden, infrequent, and not reasonably preventable failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual manner. Failures that are caused in part by poor maintenance or careless operation are not Malfunctions. In any action under this Consent Decree involving this

definition, MPC shall have the burden of proving a Malfunction and, in interpreting this definition, the ten requirements for a "malfunction" set forth in Section II ("*Affirmative Defenses for Malfunctions"*) of EPA's Policy on Excess Emissions during Malfunctions, Startup, and Shutdown shall apply. This Policy is attached as Appendix 1.4.

pp. "Marathon Petroleum Company" shall mean Marathon Petroleum Company LP.

qq. "Minimum Steam Rate" or "Minimum Steam" shall mean the Total Steam Volumetric Flow Rate, in standard cubic feet per minute, or Total Steam Mass Flow Rate, in pounds per hour, recommended by the manufacturer of a Flare's tip at the time of flare tip installation, or such lower Total Steam Volumetric Flow Rate or Total Steam Mass Flow Rate as determined by the Flare tip manufacturer after Flare tip installation upon re-examination of the tip's requirements.

rr. "Minimum Steam Reduction System" or "MSRS" shall mean a system that utilizes a mixed stream of air and steam to reduce the Minimum Steam requirements of a Steam-Assisted Flare.

ss. "Minimum Steam Reduction System Air" or "Air_{MSRS}" shall mean the air intentionally introduced in an MSRS to reduce the minimum steam requirements of a Steam-Assisted Flare.

tt. "Momentum Flux Ratio" or "*MFR*" shall mean the ratio of the Vent Gas and Center Steam momentum flux to the wind momentum flux, where momentum flux is the momentum per unit area, per unit time. *MFR* characterizes the degree to which the Ambient Air affects the trajectory of the Vent Gas and Center Steam just as it exits the Flare tip. *MFR* is represented by Equation 1 in Appendix 1.5 and shall be calculated in accordance with the

equations, conversion factors, *MFR* constants, *MFR* measured variables, and *MFR* calculated variables set forth in Appendix 1.5.

uu. "MPC" shall mean the Marathon Petroleum Company and Catlettsburg Refining.

vv. "MPC's PRI Consent Decree" shall mean the Petroleum Refinery Initiative Consent Decree, as amended and revised, entered in an action styled United States, et al. v. Marathon Ashland Petroleum LLC, Civ. Act. No. 4:01-CV-40119 (S.D. Mi).

ww. "Net Heating Value" shall mean Lower Heating Value.

xx. "Net Heating Value of Combustion Zone Gas" or "NHV_{cz}" shall mean the Lower Heating Value, in BTU/scf, of the Combustion Zone Gas in a Flare. NHV_{cz} is represented by Equation 5.a or 5.b in Appendix 1.3 to this Consent Decree and shall be calculated in accordance with Equations 5–8 of Appendix 1.3. To the extent a Covered Flare is equipped with a Minimum Steam Reduction System, MPC also shall use Equations 9–13 to calculate NHV_{cz}.

yy. "Net Heating Value of Combustion Zone Gas Limit" or "$NHV_{cz\text{-}limit}$" shall mean the minimum Net Heating Value that the Combustion Zone Gas must have to ensure an acceptable Combustion Efficiency. $NHV_{cz\text{-}limit}$ shall be calculated no less than one time every 15 minutes through the use of Equation 4 in Appendix 1.3 of this Consent Decree.

zz. "Net Heating Value of Hydrogen as Adjusted" or "$NHV_{H2\text{-}adj}$" shall mean 1212 BTU/scf. $NHV_{H2\text{-}adj}$ represents an adjustment to hydrogen's actual Net Heating Value for use, consistent with Step 3 of Appendix 1.3, in the calculation of the NHV_{vg}.

aaa. "Net Heating Value of Vent Gas" or "NHV_{vg}" shall mean the Lower Heating Value, in BTU/scf, of the Vent Gas directed to a Flare. NHV_{vg} is calculated as set forth in Equation 2 of Appendix 1.3.

bbb. "Net Heating Value of Vent Gas at its Lower Flammability Limit" or "$NHV_{vg\text{-}LFL}$" shall mean the Lower Heating Value, in BTU/scf, of the Vent Gas at its LFL. $NHV_{vg\text{-}LFL}$ is represented by and shall be calculated in accordance with Equation 3 of Appendix 1.3 of this Consent Decree.

ccc. "Non-Mixing Total Steam" or "$S_{non\text{-}mix}$" shall mean the fraction of Total Steam supplied to a Flare that does not mix with the Vent Gas and therefore does not impact combustion.

ddd. "Non-Mixing Total Steam at the Texas City Main Flare" or "$S_{non\text{-}mix/TC\text{-}MF}$" shall mean the Non-Mixing Steam at the Texas City Main Flare and shall be calculated as set forth in Equation 1 in Appendix 2.2.

eee. "Passive FTIR" shall mean a Fourier Transform Infrared System that collects thermal (infrared) radiation emitted by a hot gas plume, and through the analysis of the resulting emission spectrum, identifies and quantifies the compounds producing values proportional to the path-integrated gas concentrations.

fff. "Pilot Gas" shall mean all gas introduced through the pilot tip of a Flare to maintain a flame.

ggg. "Prevention Measure" shall mean an instrument, device, piece of equipment, system, process change, physical change to process equipment, procedure, or program to minimize or eliminate flaring.

hhh. "Purge Gas" shall mean the minimum amount of gas introduced between a Flare header's water seal and the Flare tip to prevent oxygen infiltration (backflow) into the Flare tip. For a Flare with no water seal, the function of Purge Gas is performed by Sweep Gas, and therefore, by definition, such a Flare has no Purge Gas.

iii. "Reportable Flaring Incident" shall mean, for each of the following time periods, when any one of the following quantities is flared within a 24-hour period at a Covered Refinery:

From the submission of the Initial WGMP until the submission of First Updated WGMP	From the submission of the First Updated WGMP through all times thereafter
≥ 500 lb SO2	≥ 500,000 scf Waste Gas ≥ 500 lb SO2

Events that have the same root cause(s) that last more than 24 hours shall be considered a single incident. For purposes of calculating whether the triggering level of SO_2 emissions has been met, when flaring occurs at more than one Covered Flare at a Covered Refinery, the quantity of SO_2 from all Covered Flares involved shall be added together unless the root cause(s) of the flaring at the respective Covered Flares is(are) not related to each other. For purposes of calculating whether the triggering level of Waste Gas flow has been met, the following flows may be excluded: (i) the pro-rated Baseload Waste Gas Flow Rate (pro-rated on the basis of the duration of the Reportable Flaring Incident); and (ii) if MPC has instrumentation capable of measuring the volumetric flow rate of hydrogen, nitrogen, oxygen, carbon monoxide, carbon dioxide, and/or steam in the Waste Gas, the contribution of all measured flows of any of these elements/compounds. When flaring occurs at more than one Covered Flare at a Covered Refinery, the volume of non-excluded Waste Gas flow at all Covered Flares involved shall be added together unless the root cause(s) of the flaring at the respective Covered Flares is(are) not related to each other.

jjj. "Robinson Refinery" shall mean the refinery owned and operated by Marathon Petroleum Company and located at 100 South Marathon, Ave., Robinson, Illinois 62454.

kkk. “SCFD” or “scfd” shall mean standard cubic feet per day.

lll. “SCFM” or “scfm” shall mean standard cubic feet per minute.

mmm. “Shutdown” shall mean the cessation of operation for any purpose.

nnn. “Smoke Emissions” shall have the definition set forth in Section 3.5 of Method 22 of 40 C.F.R. Part 60, Appendix A. Smoke Emissions may be documented either by a person certified pursuant to Method 22 or by a video camera.

ooo. “Standard Conditions” shall mean a temperature of 68 degrees Fahrenheit and a pressure of 1 atmosphere. Unless otherwise expressly set forth in this Consent Decree or an Appendix, Standard Conditions shall apply.

ppp. “Startup” shall mean the setting in operation for any purpose.

qqq. “Steam-Assisted Flare” shall mean a Flare that utilizes steam piped to a Flare tip to assist in combustion. A Flare that utilizes a Minimum Steam Reduction System is a Steam-Assisted, not an Air-Assisted, Flare.

rrr. “Steam Contribution Factor” or “*SCF*” shall mean the percentage of Total Steam that mixes in the Combustion Zone of a Flare flame.

sss. “Steam Contribution Factor for the Texas City Main Flare” or “$SCF_{TC\text{-}MF}$” shall mean the Steam Contribution Factor at the Texas City Main Flare and shall be calculated as set forth in Equation 2 of Appendix 2.2.

ttt. “Supplemental Gas” shall mean all gas introduced to a Flare to comply with the net heating value requirements of 40 C.F.R. § 60.18(b), 40 C.F.R. § 63.11(b), and/or Paragraph 46 of this Consent Decree.

uuu. "S/VG_{mass}" or "Total-Steam-Mass-Flow-Rate-to-Vent-Gas-Mass-Flow-Rate Ratio" shall mean the ratio of the Total Steam Mass Flow Rate to the Vent Gas Mass Flow Rate.

vvv. "S/VG_{vol}" or "Total-Steam-Volumetric-Flow-Rate-to-Vent-Gas-Volumetric-Flow-Rate Ratio" shall mean the ratio of the Total Steam Volumetric Flow Rate to the Vent Gas Volumetric Flow Rate.

www. "Sweep Gas" shall mean:

i. <u>For a Flare with a Flare Gas Recovery System:</u> the minimum amount of gas introduced into a Flare header in order to: *(a)* prevent oxygen buildup, corrosion, and/or freezing in the Flare header; and *(b)* maintain a safe flow of gas through the Flare header. Sweep Gas in these Flares is introduced prior to and is intended to be recovered by the Flare Gas Recovery System;

ii. <u>For a Flare without a Flare Gas Recovery System</u>: the minimum amount of gas introduced into a Flare header in order to: *(a)* prevent oxygen buildup, corrosion, and/or freezing in the Flare header; *(b)* maintain a safe flow of gas through the Flare header, including a higher flow during hot taps; and *(c)* prevent oxygen infiltration (backflow) into the Flare tip.

xxx. "Texas City Main Flare" shall mean the Elevated Flare located at MPC's Texas City Refinery and designated by MPC as the "Main Flare, 84FL-001."

yyy. "Texas City Refinery" shall mean the refinery owned and operated by Marathon Petroleum Company located at 502 10th Street South, Texas City, Texas 77590.

zzz. "Temporary-Use Flare" shall mean a flare that receives Waste Gas that has been redirected to it from another flare for 504 hours or less on a rolling 1095-day average period.

aaaa. "Total Steam" or "*S*" shall mean the total of all steam that intentionally is introduced into a Steam-Assisted Flare to assist in combustion. Total Steam includes, but is not limited to, Lower Steam, Center Steam, and Upper Steam.

bbbb. "Total Steam Mass Flow Rate" or "$\dot{m}_s$" shall mean the mass flow rate of Total Steam supplied to a Flare, in pounds per hour as calculated on a 5-minute block average. Total Steam Mass Flow Rate shall be calculated as set forth in Equation 3 of Appendix 1.2.

cccc. "Total Steam Mass Flow Rate as Adjusted by the Steam Contribution Factor" or "$\dot{m}_{s\text{-}adj}$" shall mean the Total Steam Mass Flow Rate, in pounds per hour on a 5-minute block average, as adjusted by the Steam Contribution Factor.

dddd. "Total Steam Mass Flow Rate as Adjusted by the Steam Contribution Factor for the Texas City Main Flare" or "$\dot{m}_{s\text{-}adj/TC\text{-}MF}$" shall mean the Total Steam Mass Flow Rate, in pounds per hour on a 5-minute block average, as adjusted by the Steam Contribution Factor for the Texas City Main Flare. Total Steam Mass Flow Rate as Adjusted by the Steam Contribution Factor for the Texas City Main Flare shall be calculated as set forth in Equation 4A of Appendix 2.2.

eeee. "Total-Steam-Mass-Flow-Rate-to-Vent-Gas-Mass-Flow-Rate Ratio" or "S/VG_{mass}" shall mean the ratio of the Total Steam Mass Flow Rate to the Vent Gas Mass Flow Rate.

ffff. "Total Steam Volumetric Flow Rate" or "Q_s" shall mean the volumetric flow rate of Total Steam supplied to a Flare, in scfm as measured on a 5-minute block average.

gggg. "Total Steam Volumetric Flow Rate as Adjusted by the Steam Contribution Factor" or "$Q_{s\text{-}adj}$" shall mean the Total Steam Volumetric Flow Rate, in scfm on a 5-minute block average, as adjusted by the Steam Contribution Factor.

hhhh. "Total Steam Volumetric Flow Rate as Adjusted by the Steam Contribution Factor for the Texas City Main Flare" or "$Q_{s\text{-}adj/TC\text{-}MF}$" shall mean the Total Steam Volumetric Flow Rate, in scfm on a 5-minute block average, as adjusted by the Steam Contribution Factor for the Texas City Main Flare. Total Steam Volumetric Flow Rate as Adjusted by the Steam Contribution Factor for the Texas City Main Flare shall be calculated as set forth in Equation 4B of Appendix 2.2

iiii. "Total-Steam-Volumetric-Flow-Rate-to-Vent-Gas-Volumetric-Flow-Rate Ratio" or "S/VG_{vol}" shall mean the ratio of the Total Steam Volumetric Flow Rate to the Vent Gas Volumetric Flow Rate.

jjjj. "Unobstructed Cross Sectional Area of the Flare Tip" or "$A_{tip\text{-}unob}$" shall mean the open, unobstructed area of a Flare tip through which Vent Gas and Center Steam pass. Diagrams of four common flare types are set forth in Appendix 1.6 together with the equations for calculating the $A_{tip\text{-}unob}$ of these four types.

kkkk. "Upper Steam," sometimes called Ring Steam, shall mean steam piped to nozzles located on the exterior perimeter of the upper end of a Flare tip. Diagrams illustrating the meaning and location of Center, Lower, and Upper Steam are set forth in Appendix 1.1 to this Consent Decree.

llll. "Velocity of the Wind" or "v_{wind}" shall mean the velocity of the Ambient Air, in ft/s on a five-minute block average, measured at the Meteorological Station required pursuant to Paragraph 23 of this Consent Decree.

mmmm. "Vent Gas" shall mean the mixture of all gases found just prior to the Flare tip. This gas includes all Waste Gas, Sweep Gas, Purge Gas, and Supplemental Gas, but does not include Pilot Gas, Total Steam, or Assist Air.

nnnn. "Vent Gas Volumetric Flow Rate" or "Q_{vg}" shall mean the volumetric flow rate of Vent Gas directed to a Covered Flare, in wet scfm, on a 5-minute block average basis.

oooo. "Vent Gas Mass Flow Rate" or "$\dot{m}_{vg}$" shall mean the mass flow rate of Vent Gas directed to a Covered Flare, in pounds per hour on a 5-minute block average. Vent Gas Mass Flow Rate shall be calculated as set forth in Equation 4 of Appendix 1.2.

pppp. "Vent Gas Molecular Weight" or "MW_{vg}" shall mean the Molecular Weight, in pounds per pound-mole, of the Vent Gas, on a 5-minute block average.

qqqq. "Visible Emissions" shall mean five minutes or more of Smoke Emissions during any two consecutive hours. For purposes of this Consent Decree, Visible Emissions may be documented by either a person certified pursuant to Method 22 or by a video camera.

rrrr. "VOC" or "Volatile Organic Compounds" shall have the definition set forth in 40 C.F.R. § 51.100(s).

ssss. "VOC Vent Gas Concentration" shall mean the volumetric concentration of VOCs in the Vent Gas and shall be calculated as set forth in Equation 15 of Appendix 1.3.

tttt. "Waste Gas" shall mean the mixture of all gases from facility operations that is directed to a flare for the purpose of disposing of the gas. "Waste Gas" does not include gas introduced to a flare exclusively to make it operate safely and as intended; therefore, "Waste Gas" does not include Pilot Gas, Total Steam, Assist Air, or the minimum amount of Sweep Gas and Purge Gas that is necessary to perform the functions of Sweep Gas and Purge Gas. "Waste Gas" also does not include gas introduced to a flare to comply with regulatory requirements; therefore, "Waste Gas" does not include Supplemental Gas. Depending upon the instrumentation that measures Waste Gas, certain compounds (hydrogen, nitrogen, oxygen,

carbon dioxide, carbon monoxide, and/or water (steam)) that are directed to a Flare for the purpose of disposing of these compounds may be excluded from calculations relating to Waste Gas flow; in Part V of this Consent Decree, the circumstances in which such exclusions are permitted are specifically identified. Appendix 1.7 to this Consent Decree depicts the meaning of "Waste Gas," together with its relation to other gases associated with Flares.

IV. CIVIL PENALTY

13. By no later than 30 days after the Effective Date of this Consent Decree, MPC shall pay the sum of $460,000 as a civil penalty. MPC shall pay the civil penalty by FedWire Electronic Funds Transfer ("EFT") to the U.S. Department of Justice in accordance with written instructions to be provided to MPC, following lodging of the Consent Decree, by the Financial Litigation Unit of the U.S. Attorney's Office for the Eastern District of Michigan, 211 W. Fort St, Detroit, MI, 48226. At the time of payment, MPC shall send a copy of the EFT authorization form, the EFT transaction record, and a transmittal letter: (i) to the United States in the manner set forth in Section XV of this Decree (Notices); (ii) by email to acctsreceivable.CINWD@epa.gov; and (iii) by mail to:

EPA Cincinnati Finance Office
26 Martin Luther King Drive
Cincinnati, Ohio 45268

The transmittal letter shall state that the payment is for the civil penalty owed pursuant to the Consent Decree in United States v. Marathon Petroleum Company LP, et al., and shall reference the civil action number, USAO File Number 2011V01341, and DOJ case number 90-5-2-1-09915.

14. If any portion of the civil penalty due to the United States is not paid when due, MPC shall pay interest on the amount past due, accruing from the Effective Date through the

date of payment, at the rate specified in 28 U.S.C. § 1961. Interest payment under this Paragraph shall be in addition to any stipulated penalty due.

15. MPC shall not deduct any penalties paid under this Decree pursuant to this Section or Section IX (Stipulated Penalties) in calculating its federal income tax.

V. COMPLIANCE REQUIREMENTS

A. Instrumentation and Monitoring Systems

16. Flare Data and Monitoring Systems and Protocol Report ("Flare Data and Monitoring Systems and Protocol Report"). For the Covered Flares at the Canton, Garyville, and Texas City Refineries, the Coker Flare at the Detroit Refinery, and the Covered Flares identified as 84-F2, 84-F3, and 84-F4 at the Robinson Refinery, by no later than the dates set forth in Column B of Appendix 2.1, MPC shall submit a report, consistent with the requirements in Appendix 1.8, to EPA that includes the following:

a. The information, diagrams, and drawings specified in Paragraphs 1–8 of Appendix 1.8;

b. A detailed description of each instrument and piece of monitoring equipment, including the specific model and manufacturer, that MPC has installed or will install in compliance with Paragraphs 18–23 of this Consent Decree (Paragraph 9 of Appendix 1.8);

c. A narrative description of the monitoring methods and calculations that MPC shall use to comply with the requirements of Paragraphs 46–48 (Paragraph 10 of Appendix 1.8) and

d. The identification of the calibration gases to be used to comply with Subparagraph V.B.1 of Appendix 1.10 (Paragraph 11 of Appendix 1.8).

For any H_2S CEMS required pursuant to 40 C.F.R. Part 60, Subpart J or Subpart Ja, this report shall satisfy the notification requirements of 40 C.F.R. § 60.7(a)(5).

17. Installation and Operation of Monitoring Systems. By no later than the dates set forth in Column C of Appendix 2.1, for each Covered Flare, MPC shall have completed the

installation and commenced the operation of the instrumentation, controls, and monitoring systems set forth in Paragraphs 18–23.

18. Vent Gas Flow Monitoring System. This system shall:

a. Continuously measure and calculate the total flow, in scfm and pounds per hour, of all Vent Gas;

b. Continuously analyze pressure and temperature at each point of Vent Gas flow measurement;

c. Have dual channel measurement at each point of Vent Gas flow measurement; and

d. Have retractable or removable sensors at each point of Vent Gas flow measurement to ensure that the Vent Gas Flow Monitoring System is maintainable online.

19. Vent Gas Average Molecular Weight Analyzer. This instrument or system shall continuously analyze the average molecular weight of all Vent Gas. This analysis may be performed by an instrument that also serves as part of a Vent Gas Flow Monitoring System.

20. Total Steam Flow Monitoring System. This system shall:

a. Continuously measure and calculate the flow, in scfm and pounds per hour, of the Total Steam to the Covered Flare; and

b. Continuously analyze the pressure and temperature of steam at a representative point of steam flow measurement.

21. Steam Control Equipment. This equipment, including, as necessary, main and trim control valves and piping, shall enable MPC to control steam flow in a manner sufficient to ensure compliance with this Decree.

22. Gas Chromatograph ("GC"). This instrument shall be capable of speciating the Vent Gas constituents set forth in Appendix 1.9. For all constituents except Hydrogen Sulfide ("H_2S"), the GC shall measure the concentration on a mole percent ("mol/mol%") basis; for H_2S, the GC shall measure the concentration on a parts per million volume basis ("ppmv"). The

sample extraction point of the gas chromatograph may be located upstream of the introduction of Supplemental and/or Sweep and/or Purge Gas if the composition and flow rate of any such Supplemental and/or Sweep and/or Purge Gas is a known constant and if this constant then is used in the calculation of the volume percent of all gas constituents of the Vent Gas.

23. Meteorological Station or "Met Station" (for each Covered Refinery, not each Covered Flare). This station shall include meteorological data instruments capable of measuring wind speed. The station at each Covered Refinery shall be placed at a location where wind is representative of conditions at the elevated Covered Flare with the largest estimated volume of Waste Gas after Waste Gas minimization is complete. The Meteorological Station shall be located as high as reasonably practicable but does not have to be as high as the Covered Flare.

24. Video Camera. For the first year after MPC is required to comply with Subparagraph 47.b, MPC shall record the percentage of time that it manually overrides the Automatic Control System required in Subparagraph 43.b for the purpose of stopping Smoke Emissions that are occurring. For any Covered Flare that, for the purpose of stopping Smoke Emissions that are occurring, is operated in manual mode for 5% of the year or more, MPC shall install a Video Camera. MPC shall complete this installation by no later than the end of second year after MPC is required to comply with Subparagraph 47.b. The Video Camera shall record, in digital format, the flame of, and any Smoke Emissions from, the Covered Flare.

25. Instrumentation and Monitoring Systems: Optional Equipment for any Covered Flare. At its option, MPC may elect to install (if not already installed) and continuously measure and calculate flow, in scfm and pounds per hour, of all Pilot Gas to a Covered Flare. MPC may utilize the data generated by this system as part of the calculation of the Net Heating Value of the Combustion Zone Gas.

26. Instrumentation and Monitoring Systems: Specifications. The instrumentation and monitoring systems identified in Paragraphs 18–20 and 22–23 shall meet or exceed the specifications set forth in Appendix 1.10.

27. Instrumentation and Monitoring Systems: Recording and Averaging Times. The instrumentation and monitoring systems identified in Paragraphs 18–20 and 22–24 shall be able to produce and record data measurements and calculations for each parameter at the following time intervals.

Instrumentation and Monitoring System	Recording and Averaging Times
Vent Gas Flow; Vent Gas Average Molecular Weight; Total Steam Flow; Pilot Gas Flow (if installed)	Measure continuously and record 5 minute block averages
Gas Chromatograph	Measure no less than once every 15 minutes and record that value
Wind Speed	Measure continuously and record 5 minute block averages
Video Camera, if required	Record at a rate of no less than 4 frames per minute

Nothing in this Paragraph is intended to prohibit MPC from setting up process control logic that uses different averaging times from those in this table provided that the recording and averaging times in this table are available and used for determining compliance with this Consent Decree.

28. Instrumentation and Monitoring Systems: Operation and Maintenance. MPC shall operate each of the instruments and monitoring systems required in Paragraphs 18–20, 22–23, and, if applicable, 24, on a continuous basis except for the following periods:

a. Malfunction of an instrument;

b. Maintenance following instrument Malfunction;

c. Scheduled maintenance of an instrument in accordance with the manufacturer's recommended schedule;

d. Quality Assurance/Quality Control activities; and/or

e. When the Covered Flare that the instrument or monitoring system is associated with is not in service.

In no event, however, shall the excepted activities in Subparagraph 28.a–28.d for any instrument exceed 110 hours in any calendar quarter. The calculation of instrument downtime shall be made in accordance with 40 C.F.R. § 60.13(h)(2) and Paragraph VI of Appendix 1.10. If the excepted activities in Subparagraphs 28.a–28.d for any instrument exceed 110 hours in any calendar quarter, EPA shall be entitled to seek stipulated penalties as set forth in Subparagraph 77.e of this Consent Decree and MPC shall be entitled to assert that the period of instrumentation and monitoring system downtime was justified under the circumstances. Nothing in this Paragraph is intended to prevent MPC from claiming a *force majeure* defense to any period of instrumentation and/or monitoring system downtime. Nothing in this Paragraph supersedes or replaces the monitoring requirements, including operation, maintenance, and quality assurance/quality control requirements of 40 C.F.R. Part 60, Subparts J and Ja (including monitoring requirements in Subpart Ja that may be stayed as of the Date of Lodging of this Consent Decree but may become effective after the Date of Lodging) at such time as those requirements become applicable pursuant to Paragraphs 58 and 59. All such requirements shall apply in accordance with the terms set forth in Subparts J and Ja.

29. Taking Certain Flares Out of Service. By no later than December 31, 2012, MPC shall take the following flares out of service by physically removing piping in the Flare header or physically isolating the piping with a welded blind so as to eliminate direct piping to these flares: the Canton South Flare designated as 04-14-B-002 and the Catlettsburg Pitch Flare designated as

1-14-FS-1. To the extent that any operating permit of MPC's allows for the operation of these flares, MPC shall submit a request to the applicable state agency by no later than 6 months after taking these flares out of service, to amend the operating permit to reflect the permanent disconnection of these flares.

B. Waste Gas Minimization

30. Initial Waste Gas Minimization Plan ("Initial WGMP"). By no later than the dates set forth in Column D of Appendix 2.1, MPC shall submit to EPA an Initial Waste Gas Minimization Plan for each Covered Flare that discusses and evaluates flaring Prevention Measures both Refinery-wide and on a Flare-specific basis. The Initial WGMP shall include but not be limited to:

a. Updates. MPC shall submit updates, if and as necessary, to the information, diagrams, and drawings provided in the Flare Data and Monitoring Systems and Protocol Report required under Paragraph 16.

b. Waste Gas Characterization and Mapping. MPC shall undertake to characterize the Waste Gas being disposed of at each Covered Flare and determine its source as follows:

i. Volumetric (in scfm) and mass (in pounds) flow rate. MPC shall identify the volumetric flow of Waste Gas, in scfm on a 30-day rolling average, and the mass flow rate, in pounds per hour on a 30-day rolling average, vented to each Covered Flare at the Covered Refinery for the one-year period of time between the date in Column C of Appendix 2.1 that applies to the Covered Flare and 31 days before the submission of the Initial WGMP. To the extent that, for any particular Covered Flare, MPC has instrumentation capable of measuring the volumetric and mass flow rate of hydrogen, nitrogen, oxygen, carbon monoxide, carbon dioxide, and/or steam in the Waste Gas, MPC may break down the volumetric and mass flow as between: (i) All Waste Gas flows excluding hydrogen, nitrogen, oxygen, carbon monoxide, carbon dioxide, and/or water (steam); and (ii) hydrogen, nitrogen, oxygen,

carbon monoxide, carbon dioxide, and/or water (steam) flows in the Waste Gas. MPC may use either an engineering evaluation or measurements from monitoring or a combination to determine flow rate. In determining flow rate, flows during all periods (including but not limited to normal operations and periods of Startup, Shutdown, Malfunction, process upsets, relief valve leakages, power losses due to an interruptible power service agreement, and emergencies arising from events within the boundaries of the Covered Refinery), except those described in the next sentence, shall be included. Flows that could not be prevented through reasonable planning and are in anticipation of or caused by a natural disaster, act of war or terrorism, or External Power Loss are the only flows that shall be excluded from the calculation of flow rate. MPC shall specifically describe the date, time, and nature of the event that results in the exclusion of any flows from the calculation.

ii. Baseload Waste Gas Flow Rates. MPC shall utilize flow rate data for the one-year period of time between the date in Column C of Appendix 2.1 that applies to the Covered Flare and 31 days before the submission of the Initial WGMP to determine the Baseload Waste Gas Flow Rate, in scfd, to each Covered Flare. The Baseload Waste Gas Flow Rate shall not include flows during periods of Startup, Shutdown, and Malfunction.

iii. Identification of Constituent Gases. MPC shall use best efforts to identify the constituent gases within each Covered Flare's Waste Gas and the percentage contribution of each such constituent during baseload conditions. MPC may use either an engineering evaluation or measurements from monitoring or a combination to determine Waste Gas constituents.

iv. Waste Gas Mapping. Using instrumentation, isotopic tracing, and/or engineering calculations, MPC shall identify and estimate the flow from each process unit header (sometimes referred to as a "subheader") to the main header(s) servicing the Covered Flare. Using that information and all other available information, MPC shall complete an identification of each Waste Gas tie-in to the main header(s) and process unit header(s), as applicable, consistent with Appendix 1.11. Temporary connections to the main header(s) of a Covered Flare and/or process unit header(s) are not required to be included in the mapping.

c. Reductions previously realized. MPC shall describe the equipment, processes and procedures installed or implemented since January 2009 to reduce flaring. The

description shall specify the date of installation or implementation and the amount of reductions realized.

d. Planned reductions. MPC shall describe the equipment, processes, or procedures that MPC plans to install or implement to eliminate or reduce flaring. The description shall specify a schedule for expeditious installation and commencement of operation and a projection of the amount of reductions to be realized. Subsequent to the submission of the WGMP, MPC may revise the installation and operation dates provided that MPC does so in writing to EPA within a reasonable time of determining that such a revision(s) is(are) necessary and provides a reasonable explanation for the revised date(s). In formulating this plan, MPC specifically shall review and evaluate the results of the Waste Gas Mapping required by Subparagraph 30.b.iv.

e. Taking a Covered Flare Out of Service. MPC shall identify any Covered Flare that it intends to take out of service, including the date for completion of the decommissioning. Taking a Covered Flare "out of service" means physically removing piping in the Flare header or physically isolating the piping with a welded blind so as to eliminate direct piping to the Covered Flare.

f. Prevention Measures. MPC shall describe and evaluate all Prevention Measures, including a schedule for the expeditious implementation and commencement of operation of all Prevention Measures, to address the following:

i. Flaring that has occurred or may reasonably be expected to occur during planned maintenance activities, including Startup and Shutdown. The evaluation shall include a review of flaring that has occurred during these activities since January 2009 and shall consider the feasibility of performing these activities without flaring.

ii. Flaring that may reasonably be expected to occur due to issues of gas quantity and quality. The evaluation shall include a general audit of the existing flare gas recovery capacity of each Covered Flare, the storage capacity available for excess Waste Gases, and the scrubbing capacity available for Waste Gases including any limitations associated with scrubbing Waste Gases for use as fuel.

iii. Flaring caused by the recurrent failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual manner. The evaluation shall consider the adequacy of existing maintenance schedules and protocols for such equipment. A failure is "recurrent" if it occurs more than twice during any five year period as a result of the same cause.

31. First Updated Waste Gas Minimization Plan. By no later than the dates set forth in Column E of Appendix 2.1, MPC shall submit to EPA a First Updated WGMP which shall update for the 12-month period after the period covered by the Initial Waste Gas Minimization Plan, if and as necessary, the information required in Subparagraphs 30.a–30.f and shall also include the following:

a. Updated Waste Gas Mapping. MPC shall update the Waste Gas mapping as more information becomes available. MPC shall use this updated mapping to plan reductions;

b. Reductions Based on Root Cause Analysis. MPC shall review all of the Root Cause Analysis reports submitted under Paragraph 35 to determine if reductions in addition to the reductions achieved through any required corrective action under Paragraph 37 can be realized; and

c. Revised Schedule. To the extent that MPC proposes to extend any schedule set forth in the Initial WGMP, MPC may do so only with good cause.

32. Subsequent Updates to Waste Gas Minimization Plan. In the first semi-annual report required under Section VIII of this Decree (Reporting Requirements) that is due in July of the year that is one year after the submission of the First Updated WGMP, MPC shall submit a Second Updated WGMP. On an annual basis thereafter until termination of the Decree, MPC shall submit an updated WGMP as part of the July semi-annual report. Each update shall update,

if and as necessary, the information required in Subparagraphs 30.a–30.f, 31.a, and 31.b. To the extent that MPC proposes to extend any schedule set forth in a previous WGMP, MPC may do so only with good cause.

33. Waste Gas Minimization Plan: Implementation. By no later than the dates specified in a WGMP, MPC shall implement the actions described therein. If (i) no implementation date and/or (ii) no completion date for actions that do not require ongoing implementation (such as the installation of a piece of a equipment) is (are) set forth in the WGMP, the implementation and/or completion date shall be deemed the date of the submission of the WGMP.

34. Enforceability of WGMPs. The terms of each WGMP (including Initial, First Updated, and Subsequent Updated WGMPs) submitted under this Consent Decree are specifically enforceable.

35. Root Cause Analysis for Reportable Flaring Incident.

a. Internal Reporting and Recordkeeping. Except as provided in Paragraphs 36 and 38.a, commencing on the dates set forth in the definition of "Reportable Flaring Incident" in Section III of this Decree (Definitions), by no later than forty-five days following the end of a Reportable Flaring Incident, MPC shall conduct an investigation into the Root Cause(s) of the Incident and prepare and keep as a record an internal report that shall include, at a minimum, the following:

i. The date and time that the Reportable Flaring Incident started and ended;

ii. The volume of Waste Gas flared and an estimate of the quantity of VOCs and SO_2 that was emitted and the calculations that were used to determine that quantity;

iii.. The steps, if any, that MPC took to limit the duration of the

Reportable Flaring Incident and quantity of VOC and/or SO_2 emissions associated therewith;

iv. A detailed analysis that sets forth the root cause and all contributing causes of the Reportable Flaring Incident, to the extent determinable;

v. An analysis of the measures, if any, that are available to reduce the likelihood of a recurrence of a Reportable Flaring Incident resulting from the same root cause or contributing causes in the future. The analysis shall discuss the alternatives, if any, that are available, the probable effectiveness and the cost of the alternatives, if an alternative is eliminated based on cost. Possible design and operation and maintenance changes shall be evaluated. If MPC concludes that corrective action(s) is (are) required under Paragraph 37, the report shall include a description of the action(s) and, if not already completed, a schedule for its (their) implementation, including proposed commencement and completion dates. If MPC concludes that corrective action is not required under Paragraph 37, the report shall explain the basis for that conclusion; and

vi. To the extent that investigations of the causes and/or possible corrective actions still are underway 45 days after the Reportable Flaring Incident, a statement of the anticipated date by which a follow-up report fully conforming to the requirements of this Paragraph shall be completed.

b. Submitting Summary of Internal Flaring Incident Reports. In each semi-annual report due under Section VIII of this Decree (Reporting Requirements), MPC shall include a summary of the following items for each Reportable Flaring Incident that occurred during the six-month period that the semi-annual report covers:

i. Date;

ii. Duration;

iii. Amount of SO_2 and VOC released;

iv. Root Cause(s);

v. Corrective Action(s) completed;

vi. Corrective Action(s) still outstanding; and

vii. An analysis of any trends identified by MPC in terms of the number of Incidents, the Root Causes, or the types of Corrective Action.

36. In lieu of preparing a new report under Paragraph 35 and analyzing and implementing corrective action under Paragraph 37 for a Reportable Flaring Incident that has as its root cause the same root cause as a previously reported Reportable Flaring Incident, MPC may cross-reference and utilize the prior report and analysis when preparing the report required by Paragraph 35.

37. Corrective Action Implementation. In response to any Reportable Flaring Incident occurring after the Date of Lodging, MPC shall take, as expeditiously as practicable, such interim and/or long-term corrective actions, if any, as are consistent with good engineering practice to minimize the likelihood of a recurrence of the root cause and all contributing causes of that Reportable Flaring Incident.

38. Overlapping Requirements.

a. Root Cause Analysis and Corrective Action Requirements under MPC's PRI Consent Decree. To the extent that a Reportable Flaring Incident that is triggered solely by the SO_2 threshold in the definition of "Reportable Flaring Incident" also constitutes an Acid Gas or Hydrocarbon Flaring Incident under MPC's PRI Consent Decree, MPC shall follow the provisions of MPC's PRI Consent Decree, and not the provisions of this Decree, for addressing the incident, for as long as MPC's PRI Consent Decree is in effect.

b. Root Cause Analysis and Corrective Action Provisions of NSPS Subpart Ja. To the extent that currently stayed provisions of Subpart Ja of the New Source Performance Standards ("NSPS") that affect the applicability of requirements to undertake root

cause analyses and corrective actions, 73 Fed. Reg. 78,522, 78,539 (Dec. 22, 2008), 40 C.F.R. §§ 60.103a(b),(c), are finalized after the Date of Lodging of this Consent Decree, and to the extent that compliance with those provisions overlaps with compliance with Paragraphs 35 and 37, MPC shall comply with the requirements of the finalized Subpart Ja and also comply with each requirement in Paragraphs 35 and 37 that is not inconsistent with the requirements of a finalized Subpart Ja.

c. Flare Management Plan Provisions of NSPS Subpart Ja. To the extent that currently stayed provisions of Subpart Ja of the NSPS that affect the applicability of requirements to develop and implement flare management plans, 73 Fed. Reg. 78,522, 78,538-39 (Dec. 22, 2008), 40 C.F.R. § 60.103a(a), are finalized after the Date of Lodging of this Consent Decree, and to the extent that compliance with those provisions overlaps with compliance with Paragraphs 30–33, MPC shall comply with the requirements of the finalized Subpart Ja and also comply with each requirement in Paragraphs 30–33 that is not inconsistent with the requirements of a finalized Subpart Ja.

39. Limitations on Flaring. By no later than the dates set forth in Column I of Appendix 2.1, the following limitations on flaring shall be in effect:

Refinery (A)	No. of Covered Flares (B)	30-day Rolling Average Waste Gas Flow Limit (scfd) (C)	Refinery-Wide, 365-day Rolling Average Waste Gas Flow Limit (scfd) (D)
Canton	1	500,000	432,500
Catlettsburg	4	250,000 per Flare	1,200,000
Detroit	5	250,000 per Flare	550,000
Garyville	4	1,100,000 consolidated Waste Gas Flow to North and South Ground Flares; 1,000,000 consolidated Waste Gas Flow to North and South Elevated Flares	1,700,000
Robinson	6	500,000 consolidated Waste Gas Flow to F1, F5, and F6; 500,000 consolidated Waste Gas Flow to F2 and F3 250,000 to F4	1,000,000
Texas City	2	250,000 per Flare	417,500

Each exceedance of the 30-day rolling average limit or each exceedance of the 365-day rolling average limit shall constitute one day of violation. An exceedance of either or both of the limits shall not prohibit ongoing refinery operations.

40. Limitation on Flaring: Meaning of "Waste Gas" in Paragraph 39. For purposes of the meaning of "Waste Gas" in Paragraph 39, the following shall apply:

a. To the extent that MPC has instrumentation capable of measuring the volumetric flow rate of hydrogen, nitrogen, oxygen, carbon monoxide, carbon dioxide, and/or water (steam) in the Waste Gas, the contribution of all measured flows of any of these elements/compounds may be excluded from the Waste Gas flow rate calculation.

b. Waste Gas flows during all periods (including but not limited to normal operations and periods of Startup, Shutdown, Malfunction, process upsets, relief valve leakages, power losses due to an interruptible power service agreement, and emergencies arising from events within the boundaries of the Covered Refinery), except those described in the next sentence, shall be included. Flows that could not be prevented through reasonable planning and are in anticipation of or caused by a natural disaster, act of

war or terrorism, or External Power Loss are the only flows that may be excluded from the calculation of flow rate.

c. Except for hydrogen, nitrogen, oxygen, carbon monoxide, carbon dioxide, and/or water (steam) contributions to the flow rate that are excluded by virtue of instrumentation measuring these flows, for any flow that MPC does not include in a computation, MPC shall submit in the semi-annual report due under Paragraph 69, the following: a description of the event that resulted in the exclusion; the date(s) and duration(s) of the flows caused by the event; the estimated VOC and SO_2 emissions during the event; whether flows from the event still are anticipated to persist after the period covered by the report, and if so, for how long; and the measures taken or to be taken to prevent or minimize the flows including, for future anticipated flow, the schedule by which those measures will be implemented.

C. Flare Combustion Efficiency

41. Emission Standards and Work Practices Applicable to each Covered Flare upon the Date of Lodging. As set forth in Column F of Appendix 2.1, beginning no later than the Date of Lodging for all Covered Flares except for the Detroit Coker Flare (which is not yet in operation), and by no later than June 30, 2013, for the Detroit Coker Flare, MPC shall comply with the following requirements at each Covered Flare:

a. Operation during Emissions Venting. MPC shall operate each Covered Flare at all times when emissions may be vented to it.

b. No Visible Emissions. Except for periods of Startup, Shutdown, and/or Malfunction, MPC shall operate each Covered Flare with no Visible Emissions. Method 22 in 40 C.F.R. Part 60, Appendix A, shall be used to determine compliance with this standard. However, for purposes of this Consent Decree, Visible Emissions may be determined by either a person certified pursuant to Method 22 or a video camera.

c. Flame Presence. Except for periods of Malfunction of the Flare, MPC shall operate each Covered Flare with a flame present at all times. MPC shall monitor the

presence of the pilot flame using a thermocouple or any other equivalent device to detect the presence of the pilot flame.

d. Monitoring According to Applicable Provisions. MPC shall comply with all applicable Subparts of 40 C.F.R. Parts 60, 61, or 63 that state how a particular Covered Flare must be monitored.

e. Good Air Pollution Control Practices. At all times, including during periods of Startup, Shutdown, and/or Malfunction, MPC shall implement good air pollution control practices to minimize emissions from each Covered Flare; provided however, that MPC shall not be in violation of this requirement for any practice that this Consent Decree requires MPC to implement after the Date of Lodging for the period between the Date of Lodging and the implementation date or compliance date (whichever is applicable) for the particular practice.

42. Exit Velocity. Beginning no later than the dates set forth in Column C of Appendix 2.1, except for the Garyville Ground Flares, and except for periods of Startup, Shutdown, and/or Malfunction, MPC shall operate each Covered Flare with an Exit Velocity less than 18.3 m/sec (60 ft/sec) on a one-hour block average; provided however, that:

a. Except for the Garyville Ground Flares, for any Covered Flare that combusts Vent Gas with a Net Heating Value of greater than 1000 BTU/scf, MPC may operate the Covered Flare with an Exit Velocity equal to or greater than 18.3 m/sec (60 ft/sec) but less than 122 m/sec (400 ft/sec) on a one-hour block average;

b. Except for the Garyville Ground Flares, for any Covered Flare that has a maximum permitted Exit Velocity (V_{max}), MPC may operate the Covered Flare with an Exit Velocity less than V_{max} provided that it also operates this Flare with an Exit Velocity of less than 122 m/sec (400 ft/sec) on a one-hour block average; and

c. Except for periods of Startup, Shutdown, and/or Malfunction, MPC shall operate the Garyville Ground Flares with an Exit Velocity that shall be determined through the testing required pursuant to Paragraph 52.

V_{max} shall be calculated in accordance with 40 C.F.R. § 60.18(f)(5). The Unobstructed Cross Sectional Area of the Flare Tip shall be calculated consistent with Appendix 1.6.

43. Work Practice Standards for each Covered Flare. By no later than the dates set forth in Column G of Appendix 2.1, utilizing the instrumentation and controls required to be installed pursuant to Paragraphs 18–23, MPC shall install and operate on each Covered Flare an Automatic Control System that shall:

a. Automate the control of the Supplemental Gas flow rate to the respective Flare; and

b. Automate the control of the Total Steam Volumetric Flow Rate to the respective Flare.

44. Exception to Part of the Work Practice Standards in Subparagraph 43.b. MPC manually may override the operation of the Automatic Control System required in Subparagraph 43.b (for control of Total Steam Volumetric Flow Rate) if the exception in Paragraph 50 applies, and/or during Startup, Shutdown, or Malfunction of a process unit that feeds the Covered Flare, and/or to achieve the following:

a. Stop Smoke Emissions that are occurring;

b. Meet the Net Heating Value requirements of Paragraph 46;

c. Prevent extinguishing the Flare;

d. Protect personnel safety; and/or

e. Stop Discontinuous Wake Dominated Flow

45. Operation According to Design. By no later than the dates set forth in Column H of Appendix 2.1, MPC shall operate and maintain each Covered Flare in accordance with its design, except if, and only to the extent that, operation and maintenance of the Covered Flare in

conformance with its design conflicts with compliance with one or more of the requirements of this Consent Decree.

46. Net Heating Value Standards for each Covered Flare.

a. Net Heating Value of Vent Gas (NHV_{vg}). Beginning on the Date of Lodging and continuing until the earlier of: (i) termination of this Consent Decree; or (ii) the requirements in 40 C.F.R. §§ 60.18(c)(3)(ii) and 63.11(b)(6)(ii) related to the NHV_{vg} are modified, MPC shall operate each Covered Flare with an NHV_{vg} of greater than or equal to 300 BTU/scf, except as provided in Paragraph 50.

b. Net Heating Value of Combustion Zone Gas (NHV_{cz}).

i. By no later than the dates set forth in Column H of Appendix 2.1, and except as provided in Paragraph 50, MPC shall calculate an $NHV_{cz\text{-}limit}$ at each Covered Flare no less than every fifteen minutes. Except as provided in Paragraph 50, MPC shall operate each Covered Flare so as to ensure that the Covered Flare's NHV_{cz}, on a three-hour rolling average basis, rolled every fifteen minutes, is greater than or equal to its $NHV_{cz\text{-}limit}$ on a three-hour rolling average basis, rolled every fifteen minutes. MPC shall utilize the equations and directives set forth in Appendix 1.3, except as provided in Subparagraph 46.b.ii, to meet the requirements of this Subparagraph 46.b.i.

ii. Interim Combustion Efficiency (CE) Multipliers. Between the dates set forth in Column H of Appendix 2.1 and June 30, 2017, MPC may use the following Table of CE Multipliers instead of the CE Multipliers in Table 2 of Appendix 1.3 provided that MPC complies with the conditions in Subparagraph 46.b.iii:

Minimum Steam for Covered Flare	VOC Vent Gas Concentration	A	B*	
			Cond. X	Cond. Y
≤ 1000 lb/hr	≤ 20.0%	6.45	4.0	0.0
≤ 1000 lb/hr	>20.0%	6.85	4.0	0.0
> 1000 lb/hr	≤ 20.0%	6.45	4.0	0.0
> 1000 lb/hr	> 20.0%	6.85	4.0	0.0

*The B Multiplier used depends on the relationship of hydrogen (H_2) and propylene in the Vent Gas as follows:

Condition X: $3 \leq H_2\% \leq 8$ and Propylene% $\geq H_2\%$ (all percents are volume or mole percents)

Condition Y: Any condition not meeting the requirements for Condition X.

iii. Conditions for the Use of Interim CE Multipliers. In order to use the Interim CE Multipliers in Subparagraph 46.b.ii, MPC must comply with each of the following:

(a) By no later than December 31, 2013, MPC shall install a Minimum Steam Reduction System ("MSRS") on Covered Flare 84-F1 at the Robinson Refinery ("Robinson 84-F1").

(b) Between January 1, 2014, and June 30, 2014, in order to evaluate emissions, Combustion Efficiency, and the effectiveness of MSRS, MPC shall conduct Passive FTIR testing on Robinson 84-F1. By no later than 45 days prior to the test, MPC shall submit an Emissions and Combustion Efficiency Test Protocol in accordance with the general requirements in Appendix 2.3. The test protocol also shall describe how the testing will evaluate the effectiveness of the MSRS. MPC shall complete the testing within 30 days of commencing the test.

(c) By no later than June 30, 2014, MPC shall submit a report that complies with the requirements of Paragraph 53. The report also shall include an evaluation of the effectiveness of the MSRS.

(d) By no later than June 30, 2017, MPC shall submit a report to EPA that evaluates the feasibility and effectiveness of the use of MSRS at each Covered Flare that has a minimum steam requirement of greater than 1000 lb/hr. In that report, MPC shall identify each Covered Flare that it shall equip with MSRS, together with a schedule for installation as soon as practicable.

iv. Final CE Multipliers.

(a) For those equipped or to be equipped with MSRS. Between the dates set forth in Column H of Appendix 2.1 and the termination of the Decree, MPC shall be entitled to use, in the calculation of a Covered Flare's $NHV_{cz\text{-}limit}$, the Interim CE Multipliers set forth in Subparagraph 46.b.ii, instead of those in Table 2 of Appendix 1.3, for the Robinson 84-F1 and for each Covered Flare identified in Subparagraph 46.b.iii.*(d)*, provided that, with respect to those identified in Subparagraph 46.b.iii.*(d)*, MPC completes the installation of an MSRS in accordance with the proposed schedule.

(b) For those not scheduled to be equipped with MSRS. Between June 30, 2017, and the termination of this Decree, MPC shall be required to use, in the calculation of a Covered Flare's $NHV_{cz\text{-}limit}$, the CE Multipliers set forth in Table 2 of Appendix 1.3 for all Covered Flares that are not identified in the report due under Subparagraph 46.b.iii.*(d)* as committed to be equipped with MSRS.

47. S/VG_{mass} and S/VG_{vol} Standards (Total-Steam-Volumetric-Flow-Rate-to-Vent-Gas-Volumetric-Flow-Rate Ratio Standards)

a. Interim Period. Beginning on the Date of Lodging and continuing until the dates set forth in Column H of Appendix 2.1, and except as provided in Subparagraph 47.d and Paragraph 50, MPC shall use best efforts to operate each Covered Flare so as to minimize that Flare's S/VG_{mass} and/or S/VG_{vol}.

b. After Interim Period. By no later than the dates set forth in Column H of Appendix 2.1, and except as provided in Subparagraph 47.d and Paragraph 50, MPC shall operate each Covered Flare, except the Garyville Ground Flares, at less than or equal to either: (i) an S/VG_{mass} of 3.0 on a one-hour rolling average, rolled every five minutes; or (ii) an S/VG_{vol} of 2.7 on a one-hour rolling average, rolled every five minutes. For each Covered Flare, MPC shall record both the S/VG_{mass} and the S/VG_{vol}. MPC shall operate the Garyville Ground Flares with an S/VG_{mass} and/or an S/VG_{vol} that shall be determined through the testing required pursuant to Paragraph 52.

c. Adjustment at the Texas City Main Flare Based on Steam Contribution Factor.

i. Texas City Main Flare. For purposes of compliance with Subparagraph 47.b at the Texas City Main Flare, MPC may utilize the *Total Steam Mass Flow Rate as Corrected by the Steam Contribution Factor for the Texas City Main Flare* instead of the *Total Steam Mass Flow Rate* and the *Total Steam Volumetric Flow Rate as Corrected by the Steam Contribution Factor for the Texas*

City Main Flare instead of the *Total Steam Volumetric Flow Rate*. To calculate the *Total Steam Mass and Volumetric Flow Rates as Corrected by the Steam Contribution Factor for the Texas City Main Flare*, MPC shall utilize Equation 1 in Appendix 2.2 to first calculate the *Non-Mixing Total Steam for the Texas City Main Flare*. Thereafter, MPC shall use Equations 2–4B of Appendix 2.2 to calculate the *Total Steam Mass and Volumetric Flow Rates as Corrected by the Steam Contribution Factor for the Texas City Main Flare*.

ii. Other Covered Flares. At any time after the Date of Lodging, for any Covered Flare, MPC may submit a request to EPA for an adjustment of the *Total Steam Mass Flow Rate* and *Total Steam Volumetric Flow Rate* at that Covered Flare based on the *Steam Contribution Factor* at that Covered Flare. In any such request, MPC must demonstrate and justify the equation it proposes to use to calculate the *Non-Mixing Total Steam* at the Covered Flare that is the subject of the request.

d. Exceptions. Notwithstanding the requirements of Subparagraphs 47.a and 47.b, MPC is not subject to the emissions standards in those Subparagraphs if the exception in Paragraph 50 applies and/or in order to achieve the following:

i. Stop Smoke Emissions that are occurring;

ii. Meet the Net Heating Value requirements of Paragraph 46;

iii. Prevent extinguishing the Flare; and/or

iv. Protect personnel safety.

48. Minimum Momentum Flux Ratio (MFR) for Covered Flares, except the Garyville Ground Flares.

a. The requirements of this Paragraph have no applicability to Ground Flares; therefore, the Garyville Ground Flares are not subject to this Paragraph. All references to "Covered Flares" in this Paragraph exclude the Garyville Ground Flares.

b. By no later than the dates set forth in Column H of Appendix 2.1, for each Covered Flare, MPC shall comply with either Subparagraph 48.c.i or 48.c.ii, or, for the Detroit

Crude Flare, Subparagraph 48.d. In the first semi-annual report due after the applicable compliance date, MPC shall identify which compliance option it selects for each Covered Flare. MPC may select different alternatives for different flares. MPC subsequently may change the option it previously had selected for a Covered Flare but only after notifying EPA in a semi-annual report that it intends to make the change 30 days after submission of the report. In the report, MPC shall include the reason for changing the compliance option.

c. MFR Requirements. MFR shall be calculated in accordance with the equations, conversion factors, MFR constants, MFR measured variables, and MFR calculated variables set forth in Appendix 1.5. At each Covered Flare except the Detroit Crude Flare (which is subject to Subparagraph 48.d), MPC shall either:

i. Maintain a minimum MFR of 0.0030 on a 60-minute rolling average basis, rolled every 5 minutes; or

ii. Propose a Flare-specific MFR. MPC shall submit such a proposal to EPA for approval. In any such proposal, MPC shall demonstrate to EPA's satisfaction that at the proposed MFR, Discontinuous Wake Dominated Flow or measured Combustion Efficiency less than 98% will not occur for the Covered Flare that is the subject of the request.

d. For the Detroit Crude Flare, MPC shall maintain a minimum MFR of 0.00050 on a 60-minute rolling average basis, rolled every 5 minutes.

e. Exceptions to the Applicability of the MFR Requirements. The requirements of Subparagraphs 48.c and 48.d are not applicable in the following circumstances:

i. During any period of Vent Gas flow to the Covered Flare where there are less than 6 consecutive 5-minute averages of MFR;

ii. At any time that the wind speed at a Covered Refinery is greater than or equal to 35 mph on a 60-minute rolling average basis, rolled every 5 minutes; and/or

iii. If the exception in Paragraph 50 applies.

f. Calculation of MFR "on a 60-minute rolling average basis, rolled every 5 minutes," when there are more than 5 but less than 12 consecutive 5-minute averages of MFR. During any period of Vent Gas flow to the Covered Flare when there are more than 5 but less than 12 consecutive 5-minute averages of MFR, the MFR "on a 60-minute rolling average basis, rolled every 5 minutes" shall be calculated using the 5-minute averages that are greater than "0" during the period; the 5-minute averages when MFR is "0" because there is no Vent Gas flow shall not be used in calculating the 60-minute rolling average, rolled every 5 minutes.

49. 98% Combustion Efficiency. By no later than the dates set forth in Column H of Appendix 2.1, MPC shall operate each Covered Flare with a minimum of a 98% Combustion Efficiency at all times when Waste Gases are vented to it. To demonstrate continuous compliance with the 98% Combustion Efficiency, MPC shall operate each Covered Flare within the range of operating parameters set forth in Paragraphs 46–48.

50. Exception for Instrument Downtime. A failure to comply with the work practices or standards in Subparagraphs 43.a, 43.b, 46.a, 46.b, 47.a, 47.b, 48.c.i, 48.c.ii, or 48.d shall not constitute a violation of such work practice or standard if the noncompliance results from downtime of instruments or equipment due to the following:

a. Malfunction of an instrument, for an instrument needed to meet the requirement(s);

b. Maintenance following instrument Malfunction, for an instrument needed to meet the requirement(s);

c. Scheduled maintenance of an instrument in accordance with the manufacturer's recommended schedule, for an instrument needed to meet the requirement(s); and/or

d. Quality Assurance/Quality Control activities on an instrument needed to meet the requirement(s).

This exception shall no longer be applicable if the activities in Subparagraphs 50.a–50.d exceed 110 hours in any calendar quarter for any instrument. The calculation of instrument downtime shall be made in accordance with 40 C.F.R. § 60.13(h)(2) and Paragraph VI of Appendix 1.10.

51. Inapplicability of Paragraphs 46–49. The requirements of Paragraphs 46–49 are not applicable to any Covered Flare when the only gas or gases being vented to the Covered Flare is/are Pilot Gas and/or Purge Gas.

52. Emissions and Combustion Efficiency Testing of the Garyville Ground Flares: Requirements. By no later than September 30, 2012, MPC shall conduct testing that evaluates the emissions and Combustion Efficiency of the Garyville Ground Flares. The testing shall be conducted in accordance with the protocol set forth in Appendix 2.4. MPC shall complete the testing within 30 days of commencing the test.

53. Emissions and Combustion Efficiency Testing at the Robinson Flare 84-F1 and Garyville Ground Flares: Reporting. By no later than March 31, 2013, for the Garyville Ground Flares, and June 30, 2014, for Robinson 84-F1, MPC shall submit a report to EPA for approval that sets forth the following:

a. The detailed results of the testing done that includes minute by minute electronic data in Excel format for all measurements and process data and is not inconsistent with the requirements of Appendix 2.5;

b. A detailed description of the extent to which the operating parameters, including but not limited to Vent Gas composition, NHV_{cz}, S/VG_{mass}, and S/VG_{vol}, affect Combustion Efficiency, and, for the Garyville Ground Flares, a detailed description of how exit velocity affects Combustion Efficiency;

c. A detailed description of the range of the NHV_{cz} and S/VG_{mass} and/or S/VG_{vol} that Robinson Flare 84-F1 and the Garyville Ground Flares must be operated at, taking into consideration variability in Vent Gas flow rate, Vent Gas composition, and Vent Gas exit velocity; for the Garyville Ground Flares, a demonstration that 98% Combustion Efficiency will be achieved at maximum design exit velocity for the proposed NHV_{cz}; and

d. The proposed "A" Combustion Efficiency Multiplier for calculating the $NHV_{cz\text{-}limit}$ and the maximum S/VG_{mass} and/or S/VG_{vol} at which MPC proposes to operate Robinson Flare 84-F1 and the Garyville Ground Flares in order to achieve a Combustion Efficiency of no less than 98% on a continuous basis.

54. EPA Response to Testing Reports. EPA shall review the reports required in Paragraph 53 and establish the "A" Combustion Efficiency Multiplier for calculating the $NHV_{cz\text{-}limit}$ and the maximum S/VG_{mass} and/or S/VG_{vol} for each of these Flares. These limits will be based on the results of the testing and a consideration of emissions impacts, and will be set at a point where the limits ensure that a Combustion Efficiency of at least 98% is continuously achieved with a reasonable certainty of compliance. Disputes arising under this Paragraph shall be resolved in accordance with the dispute resolution provisions of this Decree.

55. Recordkeeping: Timing and Substance. MPC shall comply with the following recordkeeping requirements:

a. By no later than three months after the dates set forth in Column C of Appendix 2.1, MPC shall calculate and record, in accordance with the recording and averaging times required in Paragraph 27, each of the following parameters:

i. Total Steam Volumetric Flow Rate (in scfm) and Total Steam Mass Flow Rate (in lb/hr)

ii. Vent Gas Volumetric Flow Rate (in scfm) and Total Steam Mass Flow Rate (in lb/hr)

iii. S/VG_{mass} (in lb steam/lb Vent Gas)

iv. S/VG_{vol} (in scfm steam/scfm Vent Gas)

v. NHV_{vg} (in BTU/scf)

vi. NHV_{cz} (in BTU/scf)

vii. $NHV_{cz\text{-}limit}$ (in BTU/scf)

b. By no later than six months after the dates set forth in Column C of Appendix 2.1, commencing if and when the excepted activities in Subparagraphs 28.a–28.d for any instrument subject to Paragraph 28 exceed 110 hours in any calendar quarter, MPC shall record the duration of the deviation, an explanation of the cause(s) of the deviation, and a description of the corrective action(s) that MPC took.

c. By no later than the dates set forth in Column G of Appendix 2.1 for compliance with the work practice standards in Paragraph 43: (i) MPC shall record each time it manually overrides its Automatic Control System, including the date, time, duration, reason for the override, and corrective actions that MPC took; and (ii) where the reason for the override was to stop Visible Emissions that were occurring, and where MPC has been required pursuant to Paragraph 24 to install a video camera, MPC shall include a copy of the digital video record (with a time stamp) of the Covered Flare during the period of the manual override.

d. By no later than the dates required in Column F of Appendix 2.1 for compliance with the standards in Paragraph 41, and by no later than the dates required in Column H of Appendix 2.1 for compliance with the emissions standards in Paragraphs 46–49, at any time that MPC deviates from those standards, MPC shall record the duration of the deviation, an explanation of the cause(s) of the deviation, and a description of the corrective action(s) that MPC took.

D. Miscellaneous

56. Temporary-Use Flares.

a. Applicability. The provisions of this Paragraph shall apply to Temporary-Use Flares.

b. Distinction between Planned and Unplanned Outages of Covered Flares. For purposes of this Paragraph, a "planned" outage of a Covered Flare shall mean an outage that is scheduled 30 days or more in advance of the outage. An "unplanned" outage is an outage that either is scheduled less than 30 days in advance or is unscheduled.

c. 504 hours or less. For any planned or unplanned outage of a Covered Flare that MPC knows or reasonably anticipates will result in 504 hours or less of downtime on a rolling 1095-day average period, MPC shall make good faith efforts to ensure that the Temporary-Use Flare that replaces the Covered Flare complies with all of the requirements of this Consent Decree that are applicable to the Covered Flare that the Temporary-Use Flare replaces.

d. More than 504 hours.

i. Planned. For any planned outage of a Covered Flare that MPC knows or reasonably can anticipate will last 504 hours or more on a rolling 1095-day average period, MPC shall ensure that the Temporary-Use Flare complies with all of the requirements of this Consent Decree related to the Covered Flare that it replaces as of the date that the Temporary-Use Flare is placed into service.

ii. Unplanned. For any unplanned outage of a Covered Flare that, in advance of the outage, MPC cannot reasonably anticipate will last longer than 504 hours, MPC shall ensure that the Temporary-Use Flare complies with all of the requirements of this Consent Decree related to the Covered Flare that it replaces by no later than 30 days after the date that MPC knows or reasonably should have known that the outage will last 504 hours or more.

e. Recordkeeping. MPC shall keep records sufficient to document compliance with the requirements of this Paragraph any time it uses a Temporary-Use Flare.

57. Miscellaneous. Whenever this Consent Decree requires compliance within a certain number of "months" after a triggering event, the compliance obligation commences on the anniversary of the numerical date that triggers the obligation. For example, if compliance is required by no later than three months after the submission of a particular document, and if the document is submitted on March 23, 2012, the compliance obligation commences on June 23, 2012.

E. NSPS Subpart A, J, and Ja Applicability

58. NSPS Subparts A and J. As of the Date of Lodging, each Covered Flare shall continue to be an "affected facility" within the meaning of Subparts A and J of 40 C.F.R. Part 60; however, except as set forth in Subparagraph 59.a, each Covered Flare shall comply with the requirements of Subparts A and J, including all monitoring, recordkeeping, reporting, and operating requirements, by no later than the dates in Column J of Appendix 2.1.

59. NSPS Subparts A and Ja. Each Covered Flare shall be an "affected facility" within the meaning of Subparts A and Ja of 40 C.F.R. Part 60, and shall comply with the requirements of Subparts A and Ja, including all monitoring, recordkeeping, reporting, and operating requirements, by the later of: (i) the dates in Column J of Appendix 2.1; or (ii) the date(s) by which a "modified" flare (within the meaning of Subpart Ja) must comply with the requirements of Subpart Ja.

a. To the extent that the later of the two possible dates is "the dates in Column J of Appendix 2.1," then Subpart Ja, and not Subpart J, is the applicable Subpart on and after the dates in Column J of Appendix 2.1.

b. To the extent that the later of the two possible dates is "the earliest date by which a 'modified' flare (within the meaning of Subpart Ja) must comply

with the requirements of Subpart Ja," then Subpart J is applicable between the dates in Column J of Appendix 2.1 and the applicable date(s) of Subpart Ja. Thereafter, only Subpart Ja is applicable.

c. On and after the date(s) that each Covered Flare is subject to Subpart Ja, Subpart J no longer is applicable to that Covered Flare.

F. Incorporation of Consent Decree Requirements into Federally Enforceable Permits

60. Permits Needed to Meet Compliance Obligations. If any compliance obligation under this Section V requires MPC to obtain a federal, state, or local permit or approval, MPC shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals. MPC may seek relief under the provisions of Section X of this Decree (Force Majeure) for any delay in the performance of any such obligation resulting from a failure to obtain, or a delay in obtaining, any permit or approval required to fulfill such obligation, if MPC has submitted timely and complete applications and has taken all other actions necessary to obtain all such permits or approvals.

61. Permits to Ensure Survival of Consent Decree Limits and Standards after Termination of Consent Decree.

a. Prior to termination of this Consent Decree, for those states that do not have a consolidated Title V construction and operating permit program, MPC shall submit complete applications to applicable state/local agencies to incorporate the limits and standards listed in Subparagraph 61.b into non-Title V, federally enforceable permits that will survive termination of this Consent Decree. Prior to termination of this Consent Decree, for those states that have a consolidated Title V construction and operating permit program, MPC shall submit to the applicable state/local agencies, appropriate applications, amendments and/or supplements to incorporate as "applicable requirements" the limits and standards listed in Subparagraph 61.b to ensure that these limits and standards survive termination of this Consent Decree.

b. The limits and standards imposed by the following Paragraphs of this Consent Decree shall survive termination: 17–23, 24 (if required), 26–28, 39–40, 41–45, 46.b.i, 46.b.iv, 47.b–d, 48.c–f, 49–51, 55, 56.c (if applicable), 56.d (if applicable), and 58–59. At the time of submission of the documents necessary to ensure survival of the limits and standards identified in this Subparagraph, MPC may elect, at any Covered Flare, to cease recording both S/VG_{mass} and S/VG_{vol} and instead may identify the S/VG basis (*i.e.*, volume or mass) that it elects to comply with going forward and record S/VG only on that basis.

62. Modifications to Title V Operating Permits. Prior to termination of this Consent Decree, MPC shall submit complete applications to applicable state/local agencies to modify, amend, or revise the Title V permit of each Covered Refinery to incorporate the limits and standards identified in the preceding Paragraph in the Title V permits. The Parties agree that the incorporation of these emission limits and standards into Title V Permits shall be done in accordance with applicable state or local Title V rules. The Parties agree that the incorporation may be by "amendment" under 40 C.F.R. § 70.7(d) and analogous state Title V rules, where allowed by state law.

VI. EMISSION CREDIT GENERATION

63. Prohibitions.

a. Definition. "CD Emissions Reductions" shall mean any NO_x, SO_2, H_2S, PM, PM_{TOTAL}, PM_{10}, $PM_{2.5}$, VOC, or CO emissions reductions that result from any projects conducted or controls used to comply with this Consent Decree.

b. Prohibitions.

i. MPC shall neither generate nor use any CD Emissions Reductions as netting reductions, as emissions offsets, or in determining whether a project is "major" in any PSD, major non-attainment, and/or minor New Source Review permit or permit proceeding;

ii. Any CD Emissions Reductions that result from the Waste Gas minimization requirements of Paragraphs 30–37 may not be used as netting reductions, as emissions offsets, or in determining whether a project is "major" in any PSD, major non-attainment and/or minor New Source Review permit or permit proceeding even if those Reductions result in emissions lower than the allowable level under the flaring limitations in Paragraph 39.

iii. Except as provided in Subparagraph 64.b, MPC shall not apply for, obtain, trade, or sell any emission reduction credits that result from CD Emissions Reductions.

64. Outside the Scope of the Prohibition. Nothing in this Section is intended to prohibit MPC from seeking to nor prohibit an applicable state agency from denying MPC's ability to:

a. Use or generate netting reductions or emission reduction credits for refinery units that are not subject to an emission limitation pursuant to this Consent Decree;

b. Use CD Emissions Reductions for a Covered Refinery's compliance with any rules or regulations designed to address regional haze or the non-attainment status of any area (excluding PSD and Non-Attainment New Source Review rules, but including, for example, RACT rules) that apply to the Covered Refinery; provided, however, that MPC shall not be allowed to trade or sell any CD Emissions Reductions.

VII. MITIGATION PROJECT

65. By no later than September 30, 2013, MPC shall complete implementation and commence operation of the Environmental Mitigation Project described in Paragraph 66 for the purpose of reducing emissions of VOCs and benzene from the Detroit Refinery.

66. MPC shall install controls that conform to the requirements of the Benzene Waste Operations NESHAP, 40 C.F.R. Part 61, Subpart FF, on the Detroit Refinery's sludge handling facility that, as currently configured, is depicted as the "Existing System" in Appendix 2.6.

a. MPC shall undertake the following:

i. Sump Pit and Pump Adjacent to Tank 29-T12. MPC shall replace the existing sump pit and pump with hard-piping and strainers that have no openings to the atmosphere and that will enable vacuum trucks to discharge directly into Tank 29-T12.

ii. Tank 29-T12. MPC shall undertake all necessary modifications to Tank 29-T12 to make it conform to the requirements of 40 C.F.R. § 61.343 and MPC shall thereafter operate and maintain Tank 29-T12 in conformance with 40 C.F.R. § 61.343.

iii. Centrifuges 1 and 2. Centrifuges 1 and 2 each are comprised of a mix tank and a centrifuge mounted on top of a screw conveyor.

(a) Mix Tanks. MPC shall replace the existing mix tanks with new tanks that are designed, installed, operated, and maintained to conform to the requirements of 40 C.F.R. § 61.343.

(b) Centrifuges with Screw Conveyors. MPC shall undertake all necessary modifications to the centrifuges with screw conveyors to make them conform to 40 C.F.R. § 61.343 and MPC shall thereafter operate and maintain the centrifuges with screw conveyors in conformance with 40 C.F.R. § 61.343.

iv. Container(s) for Centrifuge Solids. MPC shall replace the existing uncontrolled, three-sided box that centrifuge solids currently are conveyed into with one or more containers that are designed, installed, operated and maintained in conformance with 40 C.F.R. § 61.345.

v. Frac Tank. MPC shall undertake all necessary modifications to the Frac Tank to make it conform to the requirements of 40 C.F.R. § 61.343 and MPC shall thereafter operate and maintain the Frac Tank in conformance with 40 C.F.R. § 61.343.

vi. Conveying Material between the Waste Management Units. All areas for conveyance of materials between the strainers and the Frac Tank shall be hard-piped with no openings to the atmosphere.

vii. Closed Vent System and Control Device. MPC shall eliminate emissions to the atmosphere from Tank 29-T12, the new centrifuge mixing tanks, the existing centrifuges and screw conveyors, the new container(s) that will handle centrifuged solids, and the existing frac tank by designing, installing, operating and maintaining a closed vent system in conformance with 40 C.F.R. § 61.349(a)(1). MPC shall route all vapors from this closed vent system to a control device that is designed, installed, operated, and maintained in conformance with 40 C.F.R. § 61.349(a)(2). The closed vent system and control device shall conform to all requirements of 40 C.F.R. § 61.349.

b. The modifications described in Subparagraph 66.a and labeled as "Modifications" on the second schematic of Appendix 2.6 represent MPC's design plans as of the Date of Lodging but are not the final design. If, by no later than September 30, 2013, MPC installs, on all waste management units that handle the Detroit Refinery's sludge, controls that fully conform to the requirements of the Benzene Waste Operations NESHAP, 40 C.F.R. Part 61, Subpart FF, then MPC may make changes to the modifications described herein and depicted on the second schematic in Appendix 2.6 without notifying EPA. MPC shall identify any such changes in the reports due under Paragraph 68 of this Section. MPC may not make any changes to the modifications described herein and in Appendix 2.6 that result in anything less than full control of the Detroit Refinery's sludge handling facility in conformance with the Benzene Waste Operations NESHAP, 40 C.F.R. Part 61, Subpart FF, unless such changes are consented to by the United States.

67. By signing this Consent Decree, MPC certifies that it is not required to perform or develop this Environmental Mitigation Project by any federal, state, or local law or regulation and is not required to perform or develop this Project by agreement, grant, or as injunctive relief awarded in any other action in any forum; that this Project is not one that MPC was planning or intending to construct, perform, or implement other than in settlement of the claims resolved by this Decree; and that MPC will not receive any reimbursement for any portion of the costs of this Project from any other person.

68. Environmental Mitigation Project Progress and Completion Reports. MPC shall include in each report for the Detroit Refinery required under Paragraph 69, a status update on the Environmental Mitigation Project required by this Section. In addition, the report for the Detroit Refinery required by Paragraph 69 for the period in which the Project is completed shall contain the following information:

a. A detailed description of the Project as implemented;

b. A description of any problems encountered in completing the Project and the solutions thereto;

c. A description of the environmental and public health benefits resulting from implementation of the Project (with a quantification of the benefits and an estimate of the pollutant reductions); and

d. A certification that the Project has been fully implemented pursuant to the provisions of this Decree.

VIII. REPORTING REQUIREMENTS

69. Semi-Annual Reports. On the dates and for the time periods set forth in Paragraph 72, MPC shall submit to EPA in the manner set forth in Section XV (Notices) the following information:

a. A progress report on the implementation of the requirements in Section V of this Decree (Compliance Requirements) at the Covered Refinery;

b. A description of any problems anticipated with respect to meeting the requirements of Section V at the Covered Refinery;

c. For the semi-annual report of the Detroit Refinery, a description of the status of the Mitigation Project in Section VII of this Decree (Mitigation Project);

d. Monitoring equipment/instrument downtime, override of Automatic Control System ("ASC"), and exceedances of emission standards, as described in Paragraph 70;

e. For the semi-annual report due on July 31 of each year, annual emissions data, as described in Paragraph 71;

f. Any additional matters required by any other Paragraph of this Consent Decree to be submitted in the semi-annual report; and

g. Any additional matters that MPC believes should be brought to the attention of EPA.

70. Monitoring Instrument/Equipment Downtime; Override of ACS; and Emissions Exceedances. On and after the date of applicability of any work practice or standard, MPC shall provide a summary of the following, per Covered Flare per calendar quarter (hours shall be rounded to the nearest tenth):

a. Monitoring Instrument/Equipment Downtime. The total number of hours of downtime of each monitoring instrument/equipment required pursuant to Paragraphs 18–20, 22–23, and, if applicable, 24, expressed as both an absolute number and a percentage of time the Covered Flare that the instrument/equipment monitors is available for operation;

b. Monitoring Instrument/Equipment Downtime. If the total number of hours of downtime of any monitoring instrument/equipment required pursuant to Paragraphs 18–20, 22–23, and, if applicable, 24 exceeds 110 hours in any calendar quarter, an identification of the periods of downtime by date, time, cause (including Malfunction or maintenance), and, if the cause is asserted to be a Malfunction, the corrective action taken;

c. Override of Automatic Control System. The total number of hours in which MPC overrode the ACS required in Paragraph 43, expressed both

an absolute number of hours and a percentage of time the Covered Flare was available for operation; provided however, that for any hour identified, the report shall describe either or both of the following: (i) if the reason for the override was one of the exceptions identified in Paragraph 44, a statement of which exception; or (ii) if the total number of hours in which the ACS was overrode was less than 110 hours and was caused by one or more of the exceptions identified in Paragraph 50, a statement to that effect;

d. Override of Automatic Control System. If the reason for the override was not one of the exceptions set forth in Paragraph 44 or if the total number of hours in which the ACS was overrode exceeds 110 hours in any calendar quarter, an identification of the periods of override by the date, time, duration, reason for the override, and corrective actions taken;

e. Inapplicability of Emissions Standards. The total number of hours in which the requirements of Paragraphs 46–49 were not applicable because the only gas or gases being vented was/were Pilot Gas and/or Purge Gas, expressed as both an absolute number of hours and a percentage of time the Covered Flare was available for operation; for purposes of Subparagraphs 70.f. and 70.g, all remaining hours shall be termed "Hours of Applicability";

f. Exceedances of Emissions Standards. During the Hours of Applicability, the total number of hours of exceedances of the emissions standards in Subparagraphs 46.b, 47.b, 48.c, 48.d, and 49, expressed as both an absolute number of hours and a percentage of time the Covered Flare was available for operation; provided however, that if the exceedance of these standards was less than 110 hours in the calendar quarter and was due to one or more of the exceptions set forth in Paragraph 50, the report shall so note;

g. Exceedances of Emissions Standards. During the Hours of Applicability, if the exceedance of the emissions standards in Subparagraphs 46.b, 47.b, 48.c, 48.d, or 49 was not due to one of the exceptions in Paragraph 50, or if the exceedance was due to one or more of the exceptions in Paragraph 50 but the total number of hours caused by the exceptions in Paragraph 50 was greater than 110, an identification of each averaging period that exceeded the standard, by time and date; the cause of the exceedance (including Startup, Shutdown, maintenance, or Malfunction), and if the cause is asserted to be a Malfunction, an explanation and any corrective actions taken; and

h. Flaring Limitations Exceedances.

i. For any Waste Gas flows that are excluded from the calculation of flow rate because they are asserted to be based on one or more of the excludible events identified in Subparagraph 40.b, the information required in Subparagraph 40.c;

ii. An identification of each calendar day in which the limitations on flaring set forth in Paragraph 39 were violated;

iii. The cause of the exceedance;

iv. If the cause is asserted to be a Malfunction, an explanation and any corrective actions taken;

v. A quantification of the total excess VOC and SO_2 emissions calculated pursuant to Appendix 1.13, as well as the calculations that support that quantification; and

vi. The information required in Paragraph 80.

71. Emissions Data. In the semi-annual report that is submitted on July 31 of each year, MPC shall provide, for each Covered Flare, for the prior calendar year, the amount of emissions of the following compounds (in tons per year): VOCs, SO_2, H_2S, CO_2, methane, and ethane.

72. Due Dates. The first compliance status report shall be due thirty-one days after the first full half-year after the Effective Date of this Consent Decree (*i.e.,* either: (i) January 31 of the year after the Effective Date, if the Effective Date is between January 1 and June 30 of the preceding year; or (ii) July 31 of the year after the Effective Date, if the Effective Date is between July 1 and December 31). The initial report shall cover the period between the Effective Date and the first full half year after the Effective Date (a "half year" runs between January 1 and June 30 and between July 1 and December 31). Until termination of this Decree, each subsequent report will be due on the same date in the following year and shall cover the prior two half years (*i.e.*, either January 1 to December 31 or July 1 to June 30).

73. Each report submitted under this Consent Decree shall be signed by the Covered Refinery Division Manager (or his/her designee), the person responsible for environmental management at the applicable Covered Refinery, or by a person responsible for overseeing implementation of this Consent Decree across MPC, and shall include the following certification:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

74. The reporting requirements of this Consent Decree do not relieve MPC of any reporting obligations required by the CAA or implementing regulations, or by any other federal, state, or local law, regulation, permit, or other requirement.

75. Any information provided pursuant to this Consent Decree may be used by the United States in any proceeding to enforce the provisions of this Consent Decree and as otherwise permitted by law.

IX. STIPULATED PENALTIES

76. Failure to Pay Civil Penalty. If MPC fails to pay any portion of the civil penalty required to be paid under Section IV of this Decree (Civil Penalty) when due, MPC shall pay a stipulated penalty of $ 2500 per day for each day that the payment is late. Late payment of the civil penalty and any accrued stipulated penalties shall be made in accordance with Paragraph 13.

77. Failure to Meet all Other Consent Decree Obligations. MPC shall be liable for stipulated penalties to the United States for violations of this Consent Decree as specified below

unless excused under Section IX of this Decree (Force Majeure). For those provisions where a stipulated penalty of either a fixed amount or 1.2 times the economic benefit of delayed compliance is available, the decision of which alternative to seek rests exclusively within the discretion of the United States.

Violation	**Stipulated Penalty**	
77.a. Violation of Paragraph 16. Failure to timely submit a report (¶ 16) that conforms to the requirements of that Paragraph	Period of delay or noncompliance	Penalty per day
	Days 1–30	$ 300
	Days 31–60	$ 400
	Days 61 and later	$ 500
77.b. Violation of Paragraph 30, 31, or 32. Failure to timely submit a plan (¶¶ 30, 31, or 32) that conforms to the requirements of the respective Paragraph	Period of delay or noncompliance	Penalty per day
	Days 1–30	$ 500
	Days 31–60	$ 750
	Days 61 and later	$ 1000
77.c. Violation of Paragraph 17, 18, 19, 20, 21, 22, 23, 24 (if and when required), 26, or 27. Failure to timely install the equipment and monitoring systems required by Paragraphs 18–24 in accordance with the respective, applicable technical specifications in those Paragraphs, Paragraph 27, and Appendix 1.10 (except for the requirements of Appendix 1.10 found in Subparagraphs I.g, III.e, IV, V.B, or VII.a: those are QA/QC requirements covered in Subparagraph 77.d below)	Period of delay or noncompliance, per monitoring system	Penalty per day per monitoring system
	Days 1–30	$ 750
	Days 31–60	$ 1250
	Days 61 and later	$ 2000 or an amount equal to 1.2 times the economic benefit of delayed compliance, whichever is greater
77.d. Violation of the QA/QC requirements in Appendix 1.10. Failure to comply with the QA/QC requirements in Appendix 1.10 at Subparagraphs I.g, III.e, IV, V.B, and VII.a	Violation of a:	Penalty
	Daily requirement	$ 100
	Quarterly requirement	$ 200 per day late
	Annual requirement	$ 500 per day late

77.e. Violation of Paragraph 28. After the dates in Column H of Appendix 2.1, except for 110 hours per calendar quarter, failure to operate the monitoring systems in Paragraphs 18–20, 22–23, or, if and when applicable, 24; provided however, that MPC shall not be liable for a stipulated penalty for violation of Paragraph 28 if, during the period of instrument downtime, the only gas(es) being sent to the Covered Flare in question is/are Purge Gas and/or Pilot Gas	Per monitoring system, number of hours per calendar quarter of downtime over 110 0.25–50.0 50.25–100.0 Over 100.0	Penalty per hour per monitoring system $ 250 $ 500 $ 1000
77.f. Violation of Paragraph 29. Failure to timely decommission the Canton South Flare or the Catlettsburg Pitch Flare in conformance with the requirements of Paragraph 29	Period of delay or noncompliance per Flare Days 1–30 Days 31–60 Days 61 and later	Penalty per day per Flare $ 1000 $ 2500 $ 5000
77.g. Violation of Paragraph 35. Failure to timely develop a report that conforms to the requirements in Subparagraph 35.a; or failure to keep it as an internal record; or failure to timely submit a summary of the flaring incident reports that conforms to the requirements in Subparagraph 35.b	Period of delay or noncompliance Days 1 – 30 Days 31 – 60 Days 61 and later	Penalty per day $ 800 $ 1,600 $ 3,000
77.h. Violation of Paragraph 37. Failure to complete any corrective action under Paragraph 37 in accordance with the schedule for corrective action agreed to by MPC or imposed on MPC pursuant to the dispute resolution provisions of this Decree (with any such extensions thereto as to which EPA and MPC may agree in writing)	Period of delay or noncompliance Days 1 – 30 Days 31 – 60 Days 61 and later	Penalty per day $ 1,000 $ 2,000 $ 5,000

77.i. Violation of Paragraph 39, Column C. Failure to comply with the 30-day rolling average limit on flaring	Pollutant — Penalty per day per ton SO_2 — $ 100 VOC in attainment area — $ 200 VOC in nonattainment area — $ 300 The amount of excess emissions during the event(s) which precipitate(s) the exceedance(s) of the 30-day rolling average limit is not the sole basis for calculating the stipulated penalty due. Instead, each day on which the 30-day rolling average limit is violated —which violations most likely continue even though the precipitating event and the excess emissions do not — counts as a separate day. MPC shall comply with Appendix 1.13 to calculate the stipulated penalties resulting from violating the flaring limitation in Column C of Paragraph 39.
77.j. Violation of Paragraph 39, Column D. Failure to comply with the refinery-wide 365-day rolling average limit on flaring	Pollutant — Penalty per day per ton SO_2 — $ 10 VOC in attainment area — $ 20 VOC in nonattainment area — $ 30 The amount of excess emissions during the event(s) which precipitate(s) the exceedance(s) of the 365-day rolling average limit is not the sole basis for calculating the stipulated penalty due. Instead, each day on which the 365-day rolling average limit is violated—which violations most likely continue even though the precipitating event and the excess emissions do not— counts as a separate day. MPC shall comply with Appendix 1.13 to calculate the stipulated penalties resulting from violating the flaring limitation in Column D of Paragraph 39.
77.k. Violation of Paragraph 43. Failure to timely install and operate, by the dates in Column G of Appendix 2.1, the Automatic Control System requirements of Paragraph 43	Penalty per Covered Flare per day: $500

77.l. Violation of Subparagraph 46.b. For each Covered Flare, failure to comply with the Net Heating Value in the Combustion Zone Gas ("NHV_{cz}") standard in Subparagraph 46.b.	On a per Covered Flare hours per calendar quarter in noncompliance — Penalty per hour basis, or fraction thereof per Covered Flare Hours 0.25–50.0 — $ 25 Hours 50.25–100.0 — $ 75 Hours over 100.0 — $ 150 For purposes of calculating the number of hours of noncompliance with the NHV_{cz} standard, all 15-minute periods of violation shall be added together to determine the total.
77.m. Violation of Subparagraph 47.a. Between the Date of Lodging and the compliance dates in Column H of Appendix 2.1, failure to use best efforts to minimize the S/VG ratio at each Covered Flare; provided, however, that MPC shall not be liable for a stipulated penalty for violation of Subparagraph 47.a if, at the Covered Flare in question, MPC can demonstrate that it is complying with the requirements of Subparagraph 46.b during the period of applicability of this stipulated penalty.	Penalty per Covered Flare per day or fraction thereof: $1500
77.n. Violation of Subparagraph 48.c or 48.d. Failure to comply with the applicable MFR standard	Flare Tip Size (inches) — Penalty per hour or fraction thereof 1.0–24.0 — $ 50 24.1–48.0 — $ 75 Over 48.0 — $ 175 For purposes of calculating the number of hours of noncompliance with the MFR limit, all 5-minute periods of violation shall be added together to determine the total.
77.o. Violation of Paragraph 52. Failure to timely conduct the testing set forth in Paragraph 52 in accordance with the protocol	For each flare test, period of delay or noncompliance — Penalty per day Days 1–30 — $ 250 Days 31–60 — $ 500 Days 61 and later — $1000

77.p. Violation of Paragraph 53. Failure to timely submit a test report that conforms to the requirements of Paragraph 53	For each flare test, period of delay or noncompliance — Penalty per day Days 1–30 — $ 200 Days 31–60 — $ 300 Days 61 and later — $ 400
77.q. Violation of Paragraph 55. Failure to record any information required to be recorded pursuant to Subparagraphs 55.a, b, c, or d	$100 per day
77.r. Violation of Subparagraph 56.d. Failure to ensure that a Temporary-Use Flare that falls under the conditions of Subparagraph 56.d.i or 56.d.ii complies with the requirements of those Subparagraphs	Number of days Temporary-Use Flare did not comply — Penalty per day Days 1–7 — $ 1000 Days 8–15 — $ 2500 Days 16 and later — $ 5000
77.s. Violation of Paragraph 58 or 59. Failure to comply with the H_2S emission limit at a Covered Flare after that Covered Flare is required to comply with 40 C.F.R. Part 60, Subpart J or 40 C.F.R. Part 60, Subpart Ja	On a per Covered Flare basis, hours (on a three-hour rolling average basis) per calendar quarter in noncompliance — Penalty per hour per Covered Flare Hours 1–50.0 — $ 50 Hours 51–100.0 — $ 100 Hours over 100.0 — $ 200 For purposes of calculating the number of hours of noncompliance with the H_2S limit, all one-hour periods of violation shall be added together to determine the total. The averaging period for this standard is a three-hour rolling average.

78. Waiver of Payment. The United States may, in its unreviewable discretion, reduce or waive payment of stipulated penalties otherwise due to it under this Consent Decree.

79. Demand for Stipulated Penalties (except for Stipulated Penalties Under Subparagraph 77.i or 77.j). Except for demands under Subparagraph 77.i or 77.j for violations of the flaring limitations in Paragraph 39, a written demand for the payment of stipulated penalties

will identify the particular violation(s) to which the stipulated penalty relates; the stipulated penalty amount (as can be best estimated) that the United States is demanding for each violation; the calculation method underlying the demand; and the grounds upon which the demand is based. Prior to issuing a written demand for stipulated penalties, the United States may, in its unreviewable discretion, contact MPC for informal discussion of matters that the United States believes may merit stipulated penalties.

80. Stipulated Penalties under Subparagraph 77.i. or 77.j.

a. If MPC violates any of the flaring limitations in Columns C or D of Paragraph 39, MPC shall provide in the semi-annual report due under Section VIII of this Decree (Reporting Requirements) for the period in which the violation(s) first commenced, the information required in Subparagraph 70.h. If, as of the last day that is covered by the semi-annual report:

i. The event(s) precipitating the violation(s) has(have) not ceased, MPC also shall identify any corrective measures that it took and is taking to limit the duration of the event(s) and an estimate of the expected duration of the event(s) and the violation(s);

ii. The event precipitating the violation(s) has(have) ceased but the violation(s) has(have) not ceased because of the averaging periods involved, MPC also shall provide an estimate of the expected duration of the violation(s); or

iii. Both the event precipitating the violation(s) and the violations has(have) ceased, MPC also shall provide a calculation of the amount of stipulated penalties due.

b. If Subparagraph 80.a.i or 80.a.ii applies, in the first semi-annual report in which both the event precipitating the violation(s) and the violations has(have) ceased, MPC shall provide a calculation of the amount of stipulated penalties due.

c. After receipt of a semi-annual report that provides a calculation of the amount of stipulated penalties due for violation of the flaring limitations in Columns C or D of Paragraph 39, the United States may issue a written demand for stipulated penalties. Prior to issuing a written demand, the United States may, in its unreviewable discretion, contact MPC for informal discussion of the matter.

81. Stipulated Penalties' Accrual. Stipulated penalties will begin to accrue on the day after performance is due or the day a violation occurs, whichever is applicable, and, except as provided in Paragraph 84, shall continue to accrue until performance is satisfactorily completed or the violation ceases. Stipulated penalties shall accrue simultaneously for separate violations of this Consent Decree.

82. Stipulated Penalties Payment Due Date. Stipulated penalties shall be paid no later than sixty (60) days after receipt of a written demand by the United States unless the demand is disputed through compliance with the requirements of the dispute resolution provisions of this Decree.

83. Manner of Payment of Stipulated Penalties. Stipulated penalties owing to the United States of under $10,000 shall be paid by check and made payable to "U.S. Department of Justice," referencing DOJ Number 90-5-2-1-09915 and USAO File Number 2011V01341, and delivered to the U.S. Attorney's Office in the Eastern District of Michigan, 211 W. Fort St., Suite 2100, Detroit, MI 48226. Stipulated penalties owing to the United States of $10,000 or more shall be paid in the manner set forth in Section IV of this Decree (Civil Penalty). All transmittal correspondence shall state that the payment is for stipulated penalties, shall identify the violations to which the payment relates, and shall include the same identifying information required by Paragraph 13.

84. Disputes over Stipulated Penalties. By no later than 60 days after receiving a demand for stipulated penalties, MPC may dispute liability for any or all stipulated penalties demanded by invoking the dispute resolution procedures of Section XI of this Decree (Dispute Resolution). In the event of a dispute over stipulated penalties, stipulated penalties shall not accrue commencing on the later of either: (i) the date that, during dispute resolution under Section XI, the United States and MPC agree upon; or (ii) the date that MPC files a motion with the Court under Paragraph 98; provided however, that in order for stipulated penalties to cease accruing pursuant to either (i) or (ii), MPC must place the disputed amount in an interest-bearing commercial escrow account. If the dispute thereafter is resolved in MPC's favor, the escrowed amount plus accrued interest will be returned to MPC; otherwise, the United States will be entitled to the amount determined by the Court to be due, plus interest that has accrued on such amount in the escrow account.

85. No amount of the stipulated penalties paid by MPC shall be used to reduce its federal tax obligations.

86. Subject to the provisions of Section XIII of this Decree (Effect of Settlement/Reservation of Rights), the stipulated penalties provided for in this Decree shall be in addition to any other rights, remedies, or sanctions available to the United States for a violation of this Consent Decree or applicable law. In addition to injunctive relief or stipulated penalties, the United States may seek mitigating emissions reductions equal to or greater than the excess amounts emitted if the violations result in excess emissions. MPC reserves the right to oppose the United States' request for mitigating emission reductions. MPC shall be allowed a credit, for any stipulated penalties paid, against any statutory penalties imposed for such violation.

X. FORCE MAJEURE

87. "Force Majeure," for purposes of this Consent Decree, is defined as any event beyond the control of MPC, its contractors, or any entity controlled by MPC that delays the performance of any obligation under this Consent Decree despite MPC's best efforts to fulfill the obligation. The requirement that MPC exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential Force Majeure event and best efforts to address the effects of any such event: (a) as it is occurring; and (b) after it has occurred, to prevent or minimize any resulting delay.

88. "Force Majeure" does not include MPC's financial inability to perform any obligation under this Consent Decree. Unanticipated or increased costs or expenses associated with the performance of MPC's obligations under this Consent Decree shall not constitute circumstances beyond MPC's control nor serve as the basis for an extension of time under this Section X.

89. If any event occurs or has occurred that may delay the performance of any obligation under this Consent Decree, whether or not caused by a Force Majeure event, MPC shall notify EPA in writing not later than fifteen calendar days after the time MPC first knew or should have known by the exercise of due diligence that the event might cause a delay. In the written notice, MPC shall specifically reference this Paragraph 89 of the Consent Decree and shall provide an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; MPC's rationale for attributing such delay to a Force Majeure event if it intends to assert such a claim; and a statement as to whether, in the opinion of MPC, such event may cause or

contribute to an endangerment to public health, welfare, or the environment. MPC shall be deemed to know of any circumstance of which MPC, any entity controlled by MPC, or MPC's contractors knew or should have known. MPC shall include with any notice all available documentation supporting the claim that the delay was attributable to a Force Majeure. The written notice required by this Paragraph shall be effective upon the mailing of the same by overnight mail or by certified mail, return receipt requested, to EPA in the manner set forth in Section XV of this Decree (Notices).

90. Failure by MPC to comply with the requirements in Paragraph 89 shall preclude MPC from asserting any claim of Force Majeure for the event for the period of time of such failure to comply, and for any additional delay caused by such failure.

91. If EPA agrees that the delay or anticipated delay is attributable to a Force Majeure event, the time for performance of the obligations under this Consent Decree that are affected by the Force Majeure event will be extended by EPA for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the Force Majeure event shall not, of itself, extend the time for performance of any other obligation. EPA will notify MPC in writing of the length of the extension, if any, for performance of the obligations affected by the Force Majeure event.

92. If EPA does not agree that the delay or anticipated delay has been or will be caused by a Force Majeure event, or if the EPA and MPC fail to agree on the length of the delay attributable to the Force Majeure event, EPA will notify MPC of its decision.

93. If MPC elects to invoke the dispute resolution procedures set forth in Section XI of this Decree (Dispute Resolution), it shall do so no later than 45 days after receipt of EPA's notice. In any such proceeding, MPC shall have the burden of demonstrating by a

preponderance of the evidence that the delay or anticipated delay has been or will be caused by a Force Majeure event, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were exercised to avoid and mitigate the effects of the delay, and that MPC complied with the requirements of Paragraphs 87 and 89. If MPC carries this burden, the delay at issue shall be deemed not to be a violation by MPC of the affected obligation of this Consent Decree identified to EPA and the Court.

XI. DISPUTE RESOLUTION

94. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree.

95. Informal Dispute Resolution. The first stage of dispute resolution shall consist of informal negotiations. The dispute shall be considered to have arisen when one Party sends the other Party a written Notice of Dispute. Such Notice of Dispute shall state clearly the matter in dispute. The period of informal negotiations shall not exceed 60 days after the Notice of Dispute, unless that period is modified by written agreement. If the Parties cannot resolve the dispute by informal negotiations, then the position advanced by the United States shall be considered binding unless within 45 days after the conclusion of the informal negotiation period, MPC invokes formal dispute resolution procedures set forth below.

96. Formal Dispute Resolution. MPC shall invoke formal dispute resolution procedures, within the time period provided in the preceding Paragraph, by serving on the United States a written Statement of Position regarding the matter in dispute. The Statement of Position shall include, but need not be limited to, any factual data, analysis, or opinion supporting MPC's position and any supporting documentation relied upon by MPC.

97. The United States shall serve its Statement of Position within 45 days of receipt of MPC's Statement of Position. The United States' Statement of Position shall include, but need not be limited to, any factual data, analysis, or opinion supporting that position and any supporting documentation relied upon by the United States. The United States' Statement of Position shall be binding on MPC unless MPC files a motion for judicial review of the dispute in accordance with the following Paragraph.

98. MPC may seek judicial review of the dispute by filing with the Court and serving, in accordance with Section XV of this Decree (Notices), on the United States a motion requesting judicial resolution of the dispute. The motion must be filed within 45 days of receipt of the United States' Statement of Position pursuant to the preceding Paragraph. The motion shall contain a written statement of MPC's position on the matter in dispute, including any supporting factual data, analysis, opinion, or documentation, and shall set forth the relief requested and any schedule within which the dispute must be resolved for orderly implementation of the Consent Decree.

99. The United States shall respond to MPC's motion within the time period allowed by the Local Rules of this Court for responses to dispositive motions. MPC may file a reply memorandum, to the extent permitted by the Local Rules.

100. In a formal dispute resolution proceeding under this Section, MPC shall bear the burden of demonstrating that its position complies with this Consent Decree and the CAA and that it is entitled to relief under applicable principles of law. The United States reserves the right to argue that its position is reviewable only on the administrative record and must be upheld unless arbitrary and capricious or otherwise not in accordance with law, and MPC reserves the right to argue to the contrary.

101. The invocation of dispute resolution procedures under this Section shall not, by itself, extend, postpone, or affect in any way any obligation of MPC under this Consent Decree, unless and until final resolution of the dispute so provides. Stipulated penalties with respect to the disputed matter shall accrue in accordance with Paragraph 84, but payment shall be stayed pending resolution of the dispute.

XII. INFORMATION COLLECTION AND RETENTION

102. The United States and its representatives, employees, contractors, and consultants shall have the right of entry into the Covered Refineries, at all reasonable times, upon presentation of credentials and any other documentation required by law, to:

a. monitor the progress of activities required under this Consent Decree;

b. verify any data or information submitted to the United States in accordance with the terms of this Consent Decree;

c. obtain documentary evidence, including photographs and similar data, relevant to compliance with the terms of this Consent Decree; and

d. assess MPC's compliance with this Consent Decree.

103. Except for data recorded by any video camera that may be required pursuant to Paragraph 24, until one year after termination of this Consent Decree, MPC shall retain, and shall instruct its contractors and agents to preserve, all documents, records, or other information, regardless of storage medium (*e.g.*, paper or electronic) in its or its contractors' or agents' possession or control, or that come into its or its contractors' or agents' possession or control, and that directly relate to MPC's performance of its obligations under this Consent Decree. This information-retention requirement shall apply regardless of any contrary corporate or institutional policies or procedures. At any time during this information-retention period, the United States may request copies of any documents, records, or other information required to be

maintained under this Paragraph. MPC shall retain the data recorded by any video camera required pursuant to Paragraph 24 for six months from the date of recording except that MPC shall keep any such video record until one year after termination if MPC was required to keep the record pursuant to Subparagraph 55.c.

104. Except for emissions data, MPC may assert that information required to be provided under this Section is protected as Confidential Business Information ("CBI") under 40 C.F.R. Part 2. As to any information that MPC seeks to protect as CBI, MPC shall follow the procedures set forth in 40 C.F.R. Part 2, where applicable.

105. This Consent Decree in no way limits or affects any right of entry and inspection, or any right to obtain information, held by the United States pursuant to applicable federal laws, regulations, or permits, nor does it limit or affect any duty or obligation of MPC to maintain documents, records, or other information imposed by applicable federal or state laws, regulations, or permits.

XIII. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS

106. Definitions. For purposes of this Section XIII, the following definitions apply:

a. "BTU/scf Flared Gas Requirements" shall mean the requirements found in the following regulations:

i. 40 C.F.R. § 60.18(c)(3)(ii);

ii. 40 C.F.R. § 63.11(b)(6)(ii);

iii. 40 C.F.R. §§ 60.482-10(d), 60.482-10a(d), but only to the extent that these provisions require compliance with 40 C.F.R. § 60.18(c)(3)(ii);

iv. 40 C.F.R. §§ 60.592(a), 60.592a(a), but only to the extent that these provisions: *(1)* relate to flares; and *(2)* require compliance with 40 C.F.R. § 60.18(c)(3)(ii);

v. 40 C.F.R. § 63.643(a)(1), but only to the extent that this provision requires compliance with 40 C.F.R. § 63.11(b)(6)(ii);

vi. 40 C.F.R. § 63.648(a), but only to the extent that this provision: *(1)* relates to flares; and *(2)* requires compliance with 40 C.F.R. § 60.18(c)(3)(ii); and

vii. 40 C.F.R. § 63.1566(a)(1)(i) and Table 15, but only to the extent that these provisions: *(1)* relate to flares; and *(2)* require compliance with 40 C.F.R. § 63.11(b)(6)(ii).

b. "General Flare Requirements" shall mean the requirements found in the following regulations:

i. 40 C.F.R. § 60.18(c)(1) and
40 C.F.R. § 63.11(b)(4)
(both relate to a prohibition on visible emissions);

ii. 40 C.F.R. § 60.18(c)(2) and
40 C.F.R. § 63.11(b)(5)
(both relate to flame presence);

iii. 40 C.F.R. § 60.18(c)(4) and
40 C.F.R. § 63.11(b)(7)
(both relate to exit velocity requirements for steam-assisted flares);

iv. 40 C.F.R. § 60.18(e) and
40 C.F.R. § 63.11(b)(3)
(both relate to operation during emissions venting).

c. "Good Air Pollution Control Practice Requirements" shall mean the requirements found in the following regulations:

i. 40 C.F.R. § 60.11(d);

ii. 40 C.F.R. § 63.6(e)(1)(i);

iii. 40 C.F.R. Part 63, Subpart CC, Table 6, but only to the extent that Table 6 requires compliance with 40 C.F.R. § 63.6(e)(1)(i); and

iv. 40 C.F.R. Part 63, Subpart UUU, Table 44, but only to the extent that Table 44 requires compliance with 40 C.F.R. § 63.6(e)(1).

d. "Post-Lodging Compliance Dates" shall mean any dates in this Section XIII after the Date of Lodging;

e. "PSD/NNSR Requirements" shall mean the Prevention of Significant Deterioration and Non-Attainment New Source Review requirements found in the following:

i. 42 U.S.C. § 7475;

ii. 40 C.F.R. §§ 52.21(a)(2)(iii) and 52.21(j)–52.21(r)(5);

iii. 42 U.S.C. §§ 7502(c)(5), 7503(a)–(c);

iv. 40 C.F.R. Part 51, Appendix S, Part IV, Conditions 1–4;

v. any applicable, federally enforceable state or local regulation that implements, adopts, or incorporates the federal provisions cited in Subparagraphs 106.e.i–iv; and

vi. any Title V permit requirement that implements, adopts, or incorporates the federal, or federally enforceable state, provisions cited in Subparagraphs 106.e.i–v;

f. "Requirements Related to Monitoring, Operation, and Maintenance According to Flare Design" shall mean the requirements found in the following regulations:

i. 40 C.F.R. § 60.18(d);

ii. 40 C.F.R. § 63.11(b)(1);

iii. 40 C.F.R. §§ 60.482-10(d), 60.482-10a(d), but only to the extent that these provisions require compliance with 40 C.F.R. § 60.18(d);

iv. 40 C.F.R. §§ 60.482-10(e), 60.482-10a(e), but only to the extent that these provisions relate to flares;

v. 40 C.F.R. §§ 60.592(a), 60.592a(a), but only to the extent that these provisions: *(1)* relate to flares; and *(2)* require compliance with 40 C.F.R. § 60.18(d);

vi. 40 C.F.R. § 63.643(a)(1), but only to the extent that this provision requires compliance with 40 C.F.R. § 63.11(b)(1);

vii. 40 C.F.R. § 63.648(a), but only to the extent that this provision: *(1)* relates to flares; and *(2)* requires compliance with 40 C.F.R. § 60.18(d);

viii. 40 C.F.R. § 63.1566(a)(1)(i) and Table 15 but only to the extent that this provision: *(1)* relates to flares; and *(2)* requires compliance with 40 C.F.R. § 63.11(b)(1).

g. "Stayed Subpart Ja Requirements" shall mean the following requirements of 40 C.F.R. Part 60, Subpart Ja, that are stayed pursuant to 73 F.R. 78549 (Dec. 22, 2008);

i. SO_2 and H_2S emissions limits applicable to flares (set forth in 40 C.F.R. § 60.102a(g)(1)(i) and (ii) (2010) respectively);

ii. Sulfur monitoring for flares (set forth in 40 C.F.R. § 60.107a(d) (2010)); and

iii. Flow monitoring for flares (set forth in 40 C.F.R. § 60.107a(e) (2010)).

If a final rule encompassing these Stayed Subpart Ja Requirements places them in different locations in Subpart Ja with different citations, the definition herein refers to the subject of the regulation (*e.g.*, "SO_2 emission limits applicable to flares") and not to the citation.

107. Entry of this Consent Decree shall resolve the civil claims of the United States for the violations alleged in the Complaint filed in this action through the Date of Lodging.

108. Resolution of Claims for Violating PSD/NNSR Requirements at the Covered Flares. With respect to emissions of H_2S, SO_2, VOCs, and CO, entry of this Consent Decree shall resolve the civil claims of the United States against MPC for violations of the PSD/NNSR Requirements resulting from construction or modification from the date of the pre-Lodging construction or modification through, for each Covered Flare, the date in Column J of Appendix 2.1 associated with that Covered Flare.

109. Resolution of Pre-Lodging Claims at the Covered Flares for Failing to Comply with: (a) BTU/scf Flared Gas Requirements; (b) General Flare Requirements; (c) Good Air Pollution Control Practice Requirements; (d) Requirements Related to Monitoring, Operation, and Maintenance According to Flare Design; and (e) 40 C.F.R. Part 60, Subpart J. With respect

to emissions of the following pollutants from the Covered Flares, entry of this Consent Decree shall resolve the civil claims of the United States against MPC for violations of the following requirements from the date those claims accrued through the Date of Lodging:

Pollutant(s)	**Requirement/Regulation**
VOCs and HAPs	BTU/scf Flared Gas Requirements
VOCs and HAPs	General Flare Requirements
VOCs and HAPs	Good Air Pollution Control Practice Requirements
VOCs and HAPs	Requirements Related to Monitoring, Operation, and Maintenance According to Flare Design
SO_2 and H_2S	40 C.F.R. Part 60, Subpart J

110. Resolution of Claims Continuing Post-Lodging at the Covered Flares for Failing to Comply with: (a) Requirements Related to Monitoring, Operation, and Maintenance According to Flare Design; and (b) Two Provisions of 40 C.F.R. Part 60, Subpart J.

a. Requirements Related to Monitoring, Operation, and Maintenance According to Flare Design. With respect to emissions of VOCs and HAPs from the Covered Flares, entry of this Consent Decree shall resolve the civil claims of the United States against MPC for the violations set forth in Subparagraph 110.a.i, for the time frame set forth in Subparagraph 110.a.ii:

i. Violations of Requirements Related to Monitoring, Operation, and Maintenance According to Flare Design, but only to the extent that the claims are based on MPC's use of too much steam in relation to Vent Gas flow;

ii. The resolution of liability in Subparagraph 110.a.i extends from the Date of Lodging through, for each Covered Flare, the date in Column C of Appendix 2.1 that is associated with that Covered Flare.

b. Two Provisions of 40 C.F.R. Part 60, Subpart J. With respect to emissions of SO_2, entry of this Consent Decree shall resolve the civil claims of the United States against MPC for violations of the following two provisions of 40 C.F.R. Part 60, Subpart J, from the Date of Lodging through, for each Covered Flare, the date in the following columns in Appendix 2.1 that is associated with that Covered Flare:

40 C.F.R. § 60.104(a)(1) (H_2S Emission Limit)	**40 C.F.R. § 60.105(a)(4) (H_2S Monitoring)**
Column J	Column C

111. Conditional Resolution of Claims under Stayed Subpart Ja Requirements. If EPA lifts the stay on the Stayed Subpart Ja Requirements and promulgates final regulations encompassing the Stayed Subpart Ja Requirements, then entry of this Consent Decree shall resolve the civil claims of the United States against MPC for violations of the Stayed Subpart Ja Requirements from the date that a final rule encompassing the Stayed Subpart Ja Requirements is effective through, for each Covered Flare, the date in the following columns in Appendix 2.1 that is associated with that Covered Flare:

SO_2 and H_2S Emission Limits (currently at 40 C.F.R. § 60.102a(g)(1)(i) and (ii))	**Sulfur and Flow Monitoring (currently at 40 C.F.R. §§ 60.107a(d),(e))**
Column J	Column C

112. Resolution of Title V Violations. Entry of this Consent Decree shall resolve the civil claims of the United States against MPC for the violations of Sections 502(a), 503(c), and 504(a) of the CAA, 42 U.S.C. §§ 7661a(a), 7661b(c), 7661c(a), and of 40 C.F.R. §§ 70.1(b),

70.5(a) and (b), 70.6(a) and (c), and 70.7(b), that are based upon the violations resolved by Paragraphs 108–111 for the time frames set forth in those Paragraphs.

113. Reservation of Rights: Resolution of Liability in Paragraphs 108 and 110–112 can be Rendered Void. Notwithstanding the resolution of liability in Paragraphs 108 and 110–112 for the period of time between the Date of Lodging and the Post-Lodging Compliance Dates, those resolutions of liability shall be rendered void if MPC materially fails to comply with any of the obligations and requirements of Sections V and VI of this Decree (Compliance Requirements and Emission Credit Generation). However:

a. To the extent that a material failure involves a particular Covered Refinery(ies), the resolution of liability shall be rendered void only with respect to claims involving that particular Covered Refinery(ies);

b. The resolutions of liability in Paragraphs 108 and 110–112 shall not be rendered void if MPC, as expeditiously as practicable, remedies such material failure and pays all stipulated penalties due as a result of such material failure.

114. The United States reserves all legal and equitable remedies available to enforce the provisions of this Consent Decree, except as expressly stated in Paragraphs 107–112. This Consent Decree shall not be construed to limit the rights of the United States to obtain penalties or injunctive relief under the CAA or implementing regulations, or under other federal or state laws, regulations, or permit conditions, except as expressly specified in Paragraphs 107–112. The United States further reserves all legal and equitable remedies to address any imminent and substantial endangerment to the public health or welfare or the environment arising at, or posed by, the Covered Refineries, whether related to the violations addressed in this Consent Decree or otherwise.

115. In any subsequent administrative or judicial proceeding initiated by the United States for injunctive relief, civil penalties, other appropriate relief relating to the Covered Refineries or MPC's CAA violations, MPC shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim preclusion, claim-splitting, or other defenses based upon any contention that the claims raised by the United States in the subsequent proceeding were or should have been brought in the instant case, except with respect to claims that have been specifically resolved pursuant to Paragraphs 107–112 of this Section and for which the resolution of liability has not been voided pursuant to Paragraph 113.

116. This Consent Decree is not a permit, or a modification of any permit, under any federal, state, or local laws or regulations. MPC is responsible for achieving and maintaining complete compliance with all applicable federal, state, and local laws, regulations, and permits; and MPC's compliance with this Consent Decree shall be no defense to any action commenced pursuant to any such laws, regulations, or permits, except as set forth herein. The United States does not, by its consent to the entry of this Consent Decree, warrant or aver in any manner that MPC's compliance with any aspect of this Consent Decree will result in compliance with provisions of the Act, 42 U.S.C. § 7401 *et seq.*, or with any other provisions of federal, state, or local laws, regulations, or permits.

117. This Consent Decree does not limit or affect the rights of MPC or the United States against any third parties that are not party to this Consent Decree, nor does it limit the rights of third parties that are not party to this Consent Decree against MPC, except as otherwise provided by law.

118. This Consent Decree shall not be construed to create rights in, or grant any cause of action to, any third party not party to this Consent Decree.

XIV. COSTS

119. The Parties shall bear their own costs of this action, including attorneys' fees, except that the United States shall be entitled to collect the costs (including attorneys' fees) incurred in any action necessary to enforce this Consent Decree or to collect any portion of the civil penalty or any stipulated penalties due but not paid by MPC.

XV. NOTICES

120. Unless otherwise specified herein, whenever notifications, submissions, or communications are required by this Consent Decree, they shall be made in writing and addressed to the persons set forth below. Submission by U.S. mail or courier is required and shall be sufficient to comply with the notice requirements of this Consent Decree; however, for the submission of technical information or data, MPC shall submit the data in electronic form (*e.g.*, a disk or hard drive). The email addresses listed below are to permit the submission of courtesy copies.

Notice or submission to the United States:

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
Box 7611 Ben Franklin Station
Washington, DC 20044-7611
Re: DOJ No. 90-5-2-1-09915

Notice or submission to EPA:

For All Covered Refineries:

Director, Air Enforcement Division
Office of Civil Enforcement
U.S. Environmental Protection Agency
Mail Code 2242-A
Regular Mail: 1200 Pennsylvania Ave, N.W.
Ariel Rios Building South
Room 1119
Washington, DC 20460-0001
Express Mail: Use same address but use 20004 as the zip code

and

Air and Radiation Division
EPA Region 5
77 W. Jackson Blvd. (AE-17J)
Chicago, IL 60604
Attn: Compliance Tracker

For courtesy purposes, electronic copies to:

parrish.robert@epa.gov
foley.patrick@epa.gov
dickens.brian@epa.gov

For EPA, for the Catlettsburg Refinery:

Director
Air, Pesticides and Toxics Management Division
EPA Region 4
61 Forsyth Street (4APTMD-AEEB)
Atlanta, Georgia 30303

For EPA, for the Garyville and Texas City Refineries:

Associate Director
Air, Toxics, and Inspections Coordination Branch (6 EN-A)
U.S. EPA, Region 6
1445 Ross Avenue
Dallas, Texas 75202

Notice or submission to MPC:

Environmental and Safety Manager,
Refinery Operations
Marathon Petroleum Company LP
539 S. Main St.
Findlay, OH 45840

Consent Decree Coordinator (Flare Consent Decree)
Marathon Petroleum Company LP
539 S. Main St.
Findlay, OH 45840

and

Group Counsel – Environment, Safety & Security
Marathon Petroleum Company LP
539 S. Main St.
Findlay, OH 45840

Any Party may, by written notice to the other Party, change its designated notice recipient(s) or notice address(es) provided above. Notices submitted pursuant to this Section shall be deemed submitted upon mailing, unless otherwise provided in this Consent Decree or by mutual agreement of the Parties in writing.

XVI. EFFECTIVE DATE

121. The Effective Date of this Consent Decree shall be the date upon which this Consent Decree is entered by the Court or a motion to enter the Consent Decree is granted, whichever occurs first, as recorded on the Court's docket; provided however, that MPC hereby agrees that it shall be bound to perform duties scheduled to occur prior to the Effective Date. In

the event the United States withdraws or withholds consent to this Consent Decree before entry, or the Court declines to enter this Consent Decree, then the preceding requirement to perform duties scheduled to occur before the Effective Date shall terminate.

XVII. RETENTION OF JURISDICTION

122. The Court shall retain jurisdiction over this case until termination of this Consent Decree for the purposes of resolving disputes arising under this Decree, entering orders modifying this Decree, or effectuating or enforcing compliance with the terms of this Decree.

XVIII. MODIFICATION

123. Except as provided in Paragraph 9, the terms of this Consent Decree may be modified only by a subsequent written agreement signed by the United States and MPC. Where the modification constitutes a material change to any term of this Consent Decree, it shall be effective only upon approval by the Court.

124. Except as provided in Paragraphs 5–9, any disputes concerning modification of this Decree shall be resolved pursuant to Section XI of this Decree (Dispute Resolution); provided, however, that instead of the burden of proof as provided by Paragraph 100, the Party seeking the modification bears the burden of demonstrating that it is entitled to the requested modification in accordance with Federal Rule of Civil Procedure 60(b).

XIX. TERMINATION

125. Termination: One Covered Refinery or Entire Consent Decree. If the conditions precedent to termination set forth in Paragraph 126 are satisfied, the requirements of this Consent Decree that are applicable to one Covered Refinery may be subject to termination or all of the requirements in this Consent Decree may be subject to termination.

126. Termination: Conditions Precedent. Prior to termination, MPC must have completed and satisfied all of the following requirements of this Consent Decree:

a. Payment of all civil penalties, stipulated penalties and other monetary obligations; termination as to one Covered Refinery may not be sought unless all penalties and/or monetary obligations are paid, regardless of which Covered Refinery is the subject of such monetary obligation;

b. Compliance with all provisions of Section V of this Decree (Compliance Requirements) with respect to all of the Covered Flares at the Covered Refinery(ies) that is(are) subject to the termination request;

c. Operation for at least one year in compliance with the limitations and standards set forth in Paragraphs 39, 46.b.iv, 47.b, 48.c, 48.d (for the Detroit Crude Flare), and 49 for all of the Covered Flares at the Covered Refinery(ies) that is(are) subject to the termination request;

d. For the Detroit Refinery, completion of the Mitigation Project in Section VII;

e. Application for and receipt of all non-Title V permits necessary to ensure survival of the Consent Decree limits and standards after termination of this Consent Decree (the Paragraph 61 requirement) for all of the Covered Flares at the Covered Refinery(ies) that is(are) subject to the termination request; and

f. Application for a modification or amendment to the Title V permit to incorporate the limits and standards in Paragraph 61 into the Title V permit of the Covered Refinery(ies) that is(are) subject to the termination request.

127. Termination: Procedure.

a. At such time as MPC believes that it has satisfied the conditions for termination set forth in Paragraph 126 for any one Covered Refinery or for the entire Consent Decree, MPC may submit a request for termination to the United States by certifying such compliance in accordance with the certification language in Paragraph 73. In the Request for Termination, MPC must demonstrate that it has satisfied the conditions for termination set forth

in Paragraph 126. The Request for Termination shall include all necessary supporting documentation.

b. Following receipt by the United States of MPC's Request for Termination, the Parties shall confer informally concerning the Request. If the United States agrees that the Decree may be terminated, the Parties shall submit, for the Court's approval, a joint stipulation terminating the Decree.

c. If the United States does not agree that the Consent Decree may be terminated, or if MPC does not receive a written response from the United States within 60 days of MPC's submission of the Request for Termination, MPC may invoke dispute resolution under Section XI of this Decree (Dispute Resolution).

XX. PUBLIC PARTICIPATION

128. This Consent Decree shall be lodged with the Court for a period of not less than 30 days for public notice and comment in accordance with 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if the comments regarding the Consent Decree disclose facts or considerations indicating that the Consent Decree is inappropriate, improper, or inadequate. MPC consents to entry of this Consent Decree without further notice and agrees not to withdraw from or oppose entry of this Consent Decree by the Court or to challenge any provision of the Decree unless the United States has notified MPC in writing that it no longer supports entry of the Decree.

XXI. SIGNATORIES/SERVICE

129. Each undersigned representative of MPC and the Assistant Attorney General for the Environment and Natural Resources Division of the Department of Justice (or his or her designee), certify that he or she is fully authorized to enter into the terms and conditions of this Consent Decree and to execute and legally bind the Party he or she represents to this document.

130. This Consent Decree may be signed in counterparts, and its validity shall not be challenged on that basis. MPC agrees to accept service of process by mail with respect to all matters arising under or relating to this Consent Decree and to waive the formal service requirements set forth in Rules 4 and 5 of the Federal Rules of Civil Procedure and any applicable Local Rules of this Court including, but not limited to, service of a summons.

XXII. INTEGRATION

131. This Consent Decree and its Appendices constitute the final, complete, and exclusive agreement and understanding among the Parties with respect to the settlement embodied in this Consent Decree and its Appendixes and supersede all prior agreements and understandings, whether oral or written, concerning the settlement embodied herein. No other document, except for any plans or other deliverables that are submitted pursuant to this Decree, nor any representation, inducement, agreement, understanding, or promise, constitutes any part of this Decree or the settlement it represents, and no such extrinsic document or statement of any kind shall be used in construing the terms of this Decree.

XXIII. FINAL JUDGMENT

132. Upon approval and entry of this Consent Decree by the Court, this Consent Decree shall constitute a final judgment of the Court in this action as to the United States and MPC. The Court finds that there is no just reason for delay and therefore enters this judgment as a final judgment under Fed. R. Civ. P. 54 and 58.

DATED this _____ day of _____2012.

_____
UNITED STATES DISTRICT JUDGE
EASTERN DISTRICT OF MICHIGAN

We hereby consent to the entry of the Consent Decree in the matter of United States, et al. v. Marathon Petroleum Company LP, et al., subject to public notice and comment.

FOR THE UNITED STATES OF AMERICA

_____

IGNACIA S. MORENO
Assistant Attorney General
Environment and Natural Resources Division
United States Department of Justice

_____

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By: _____

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We hereby consent to the entry of the Consent Decree in the matter of United States v. Marathon Petroleum Company LP, et al., subject to public notice and comment.

FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

_____

CYNTHIA GILES
Assistant Administrator
Office of Enforcement and Compliance Assurance
United States Environmental Protection Agency
Washington, DC

We hereby consent to the entry of the Consent Decree in the matter of United States v. Marathon Petroleum Company LP, et al., subject to public notice and comment.

FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

_____

MARY J. WILKES
Regional Counsel and Director
Office of Environmental Accountability
U.S. EPA Region 4
61 Forsyth St.
Atlanta, Georgia 30303

We hereby consent to the entry of the Consent Decree in the matter of United States v. Marathon Petroleum Company LP, et al., subject to public notice and comment.

FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 5

_____

SUSAN HEDMAN
Regional Administrator
U.S. Environmental Protection Agency
Region 5
Chicago, IL

_____

ROBERT A. KAPLAN
Regional Counsel
U.S. Environmental Protection Agency
Region 5
Chicago, IL

We hereby consent to the entry of the Consent Decree in the matter of United States v. Marathon Petroleum Company LP, et al., subject to public notice and comment.

FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6

_____

JOHN BLEVINS
Director
Compliance Assurance and Enforcement Division
EPA Region 6
Dallas, TX

We hereby consent to the entry of the Consent Decree in the matter of United States v. Marathon Petroleum Company LP, et al.

FOR MARATHON PETROLEUM COMPANY LP,
BY MPC INVESTMENT LLC, its General Partner

_____

R. D. BEDELL
Senior Vice President
Marathon Petroleum Company LP
539 South Main St.
Findlay, Ohio 45840
Phone: 419 421-2967
Fax: 419 421-4377
rdbedell@marathonpetroleum.com

We hereby consent to the entry of the Consent Decree in the matter of United States v. Marathon Petroleum Company LP, et al.

FOR CATLETTSBURG REFINING, LLC

_____

R. D. BEDELL
President of Catlettsburg Refining, LLC
Marathon Petroleum Company LP
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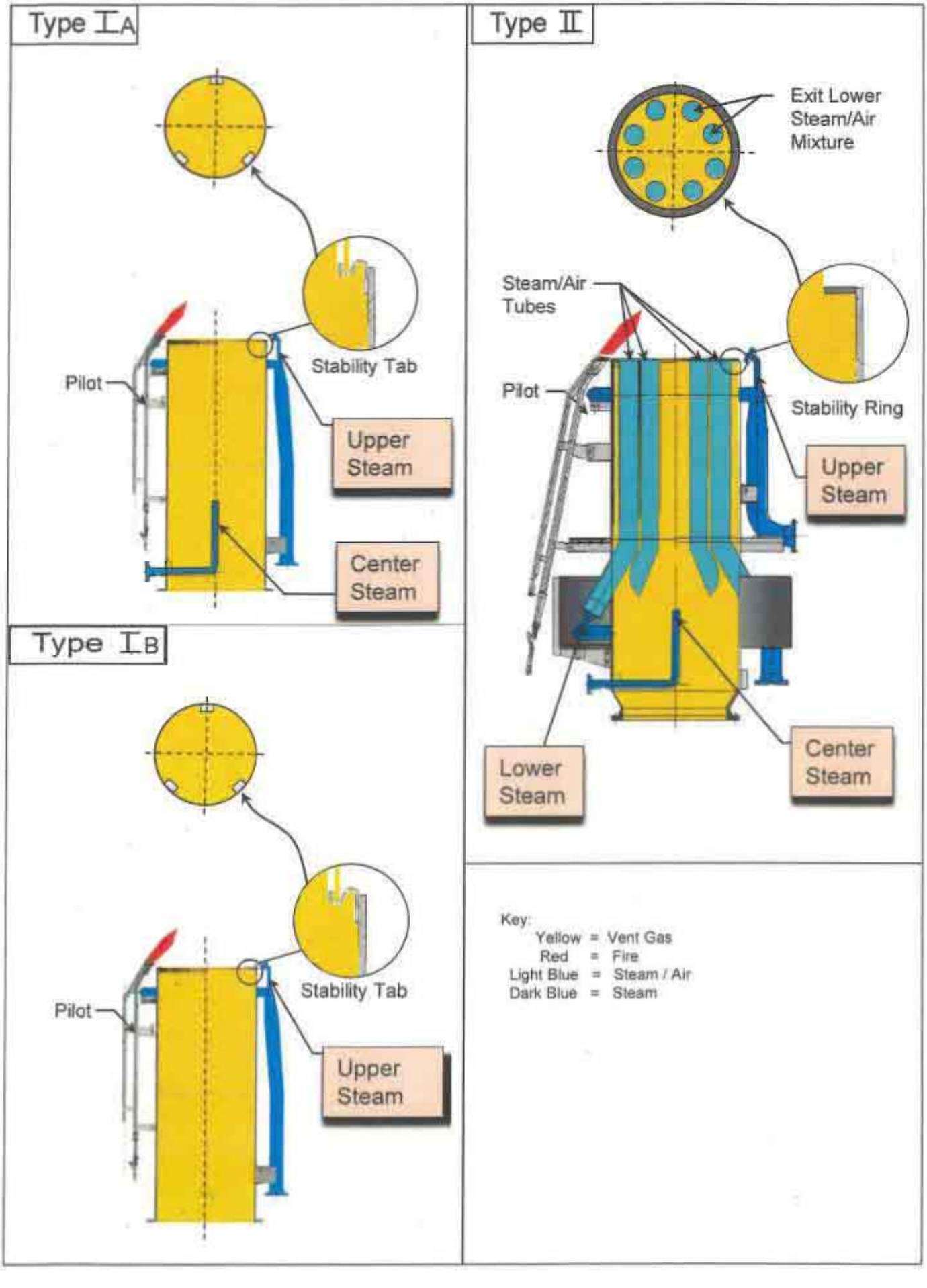
UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.1

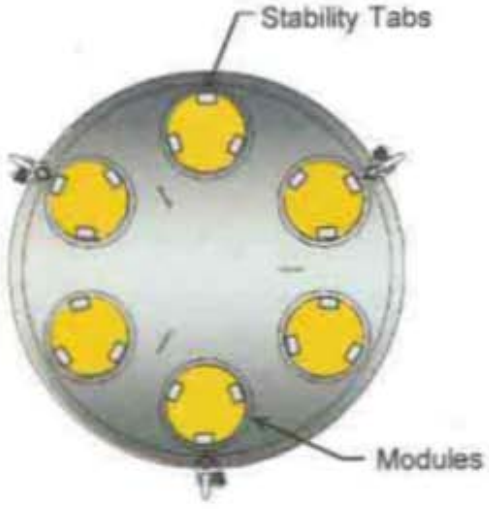
DRAWINGS ILLUSTRATING LOWER, CENTER, AND UPPER STEAM INJECTION IN VARIOUS TYPES OF FLARE TIPS

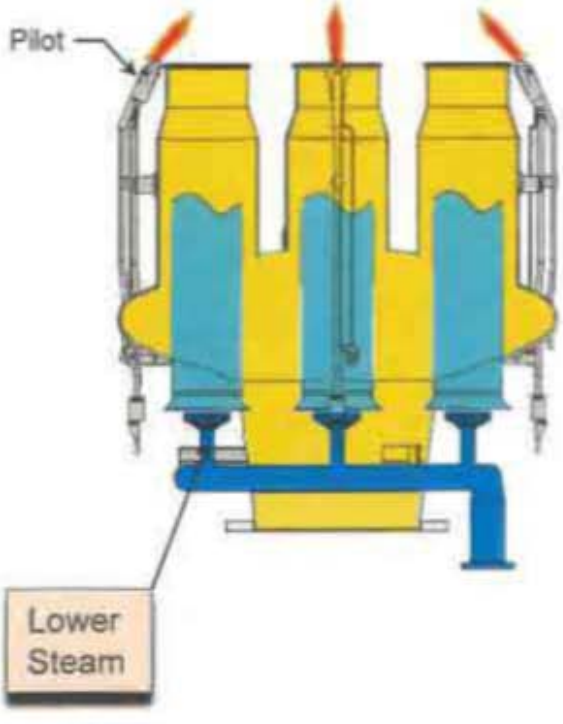
Appendix 1.1


Type IA
Pilot
Stability Tab
Upper Steam
Center Steam
Type IB
Pilot
Stability Tab
Upper Steam
Type II
Exit Lower Steam/Air Mixture
Steam/Air Tubes
Pilot
Stability Ring
Upper Steam
Lower Steam
Center Steam
Key:
Yellow = Vent Gas
Red = Fire
Light Blue = Steam / Air
Dark Blue = Steam

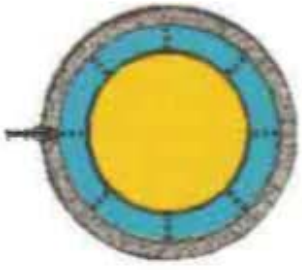
Appendix 1.1

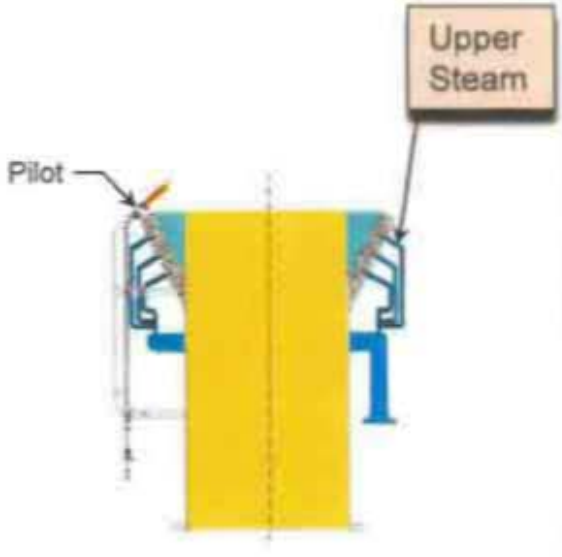
Type III





Type IV





Key:

Yellow	=	Vent Gas
Red	=	Fire
Light Blue	=	Steam / Air
Dark Blue	=	Steam

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX. 1.2

GENERAL EQUATIONS

APPENDIX 1.2

GENERAL EQUATIONS

Equation 1: ***"Combustion Efficiency" or "CE":***

$$CE = [CO_2]/([CO_2] + [CO] + [OC])$$

where:

$[CO_2]$ = Concentration in volume percent or ppm-meters of carbon dioxide in the combusted gas immediately above the Combustion Zone

$[CO]$ = Concentration in volume percent or ppm-meters of carbon monoxide in the combusted gas immediately above the Combustion Zone

$[OC]$ = Concentration in volume percent or ppm-meters of the sum of all organic carbon compounds in the combusted gas immediately above the Combustion Zone, counting each carbon molecule separately where the concentration of each individual compound is multiplied by the number of carbon atoms it contains before summing (*e.g.*, 0.1 volume percent ethane shall count as 0.2 percent OC because ethane has two carbon atoms)

For purposes of using the *CE* equation, the unit of measurement for CO_2, CO, and OC must be the same; that is, if "volume percent" is used for one compound, it must be used for all compounds. "Volume percent" cannot be used for one or more compounds and "ppm-meters" for the remainder.

Equation 2: ***"Center Steam Mass Flow Rate" or "$\dot{m}_{s\text{-}cen}$":***

$$\dot{m}_{s\text{-}cen} = Q_{s\text{-}cen} \times (18/385.5)$$

where:

$Q_{s\text{-}cen}$ = Center Steam Volumetric Flow Rate

Equation 3: ***"Total Steam Mass Flow Rate" or "$\dot{m}_s$":***

$$\dot{m}_s = Q_s \times (18/385.5)$$

where:

Q_s = Total Steam Volumetric Flow Rate

APPENDIX 1.2

Equation 4: ***"Vent Gas Mass Flow Rate"*** **or** ***"$\dot{m}_{vg}$"*:**

$\dot{m}_{vg} = Q_{vg} \times (MW_{vg}/385.5)$

where:

Q_{vg} = Vent Gas Volumetric Flow Rate

MW_{vg} = Molecular Weight, in pounds per pound-mole, of the Vent Gas, as measured by the Vent Gas Average Molecular Weight Analyzer described in Paragraph 19 of this Consent Decree

[End of Appendix 1.2]

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.3

CALCULATING $NHV_{CZ\text{-}LIMIT}$ AND NHV_{CZ} FOR STREAM-ASSISTED FLARES

APPENDIX 1.3

CALCULATING $NHV_{cz\text{-}limit}$ AND NHV_{cz} FOR STEAM-ASSISTED FLARES

All abbreviations, constants, and variables are defined in the Key on Page 6 of this Appendix.

Steps in the Calculations

Step 1: Determine the Lower Flammability Limit ("LFL") of Each Individual Vent Gas Compound

Take the LFL values of each individual Vent Gas compound from Table 1 in this Appendix.

Step 2: Calculate the LFL of the vent gas mixture

The average lower flammability limit of the vent gas is calculated by Le Chatelier's equation shown below as Equation 1. This calculation uses the weighted average of the LFLs of the individual compounds weighted by their volume fraction of the vent gas. All inerts, including nitrogen, are assumed to have an infinite lower flammability limit (e.g. $LFL_{N2} = \infty$).

$$LFL_{vg} = \frac{1}{\sum_{i=1}^{n}\left(\frac{x_i}{LFL_i}\right)} \qquad \textit{Equation 1}$$

Step 3: Determine the Net Heating Value of the Vent Gas (NHV_{vg})

If a Gas Chromatograph is used: The net heating value of the vent gas is calculated and reported from the GC at the conclusion of each analytical cycle (~10-15 minutes). Equation 2 is used by the GC to calculate the vent gas net heating value from each individual compound net heating value. Individual compound volume fractions, except for water, are measured directly by the GC. A company is not required to measure water in Vent Gas. If a company chooses to measure water, then: (i) if the water measurement is taken upstream of a knock-out drum, then water does not have to be included in the calculation of NHV_{vg}; (ii) if no knock-out drum exists or if the water measurement is taken after the knock-out drum, then the company must include water in the calculation of NHV_{vg} and adjust the concentration of the compounds measured by the GC to a wet basis. Individual compound net heating values, including water, are listed in Table 1 of this Appendix.

$$NHV_{vg} = \sum_{i=1}^{n}(x_i \cdot NHV_i) \qquad \textit{Equation 2}$$

If a Net Heating Value Analyzer/Calculator is used: Use the measured value.

NOTE: Table 1 includes two alternative values for the Net Heating Value of hydrogen: the actual NHV of hydrogen (274 BTU/scf) and an "adjusted" NHV of hydrogen (1212 BTU/scf).

APPENDIX 1.3

Companies have the option of using either in calculating NHV_{vg}; however, whichever option is selected also must be used in calculating NHV_{cz}.

Step 4: Calculate the NHV_{vg} at its LFL ($NHV_{vg\text{-}LFL}$)

Using LFL_{vg} from Equation 1 and NHV_{vg} from Equation 2, the $NHV_{vg\text{-}LFL}$ is calculated by Equation 3.

$$NHV_{vg-LFL} = NHV_{vg} \cdot LFL_{vg} \qquad \textit{Equation 3}$$

Step 5: Multiply $NHV_{vg\text{-}LFL}$ by the Combustion Efficiency Multipliers to calculate the $NHV_{cz\text{-}limit}$

The Net Heating Value of the Gases in the Combustion Zone (NHV_{cz}) of a Flare that is needed to ensure an acceptable Combustion Efficiency is determined by multiplying $NHV_{vg\text{-}LFL}$ by Combustion Efficiency Multipliers appropriate to the flare category and the volume percent of hydrogen in the Vent Gas as defined in Table 2.

The Net Heating Value of Combustion Zone Gas Limit is calculated as follows:

$$NHV_{cz-limit} = (A + B \cdot x_{propylene}) \cdot NHV_{vg-LFL} \qquad \textit{Equation 4}$$

Step 6: Calculate the Net Heating Value of the Combustion Zone Gas (NHV_{cz})

The NHV in the combustion zone (NHV_{cz}) combines the NHVs of the Vent Gas, pilot gas, and steam and is calculated by Equation 5a (based on mass flow measurement) or 5b (based on volumetric flow measurement). These two equations are equivalent for combustion zone conditions, as shown in Addendum A to this Appendix. The NHV of steam is assumed to be zero. Vent Gas flow rate ($\dot{m}_{vg}$ *or* Q_{vg}) and steam flow rate ($\dot{m}_s$ *or* Q_s) are measured by on-line flow meters. The pilot gas flow rate ($\dot{m}_{pg}$ *or* Q_{pg}) is constant for each flare and set by an orifice.

$$NHV_{cz} = \frac{\left(\frac{\dot{m}_{vg} \cdot NHV_{vg}}{MW_{vg}}\right) + \left(\frac{\dot{m}_{pg} \cdot NHV_{pg}}{MW_{pg}}\right)}{\left(\frac{\dot{m}_{vg}}{MW_{vg}}\right) + \left(\frac{\dot{m}_{pg}}{MW_{pg}}\right) + \left(\frac{\dot{m}_{s}}{MW_{H_2O}}\right) + \left(\frac{\dot{m}_{air}}{MW_{air}}\right)} \qquad \textit{Equation 5a}$$

OR

$$NHV_{cz} = \frac{(Q_{vg} * NHV_{vg}) + (Q_{pg} * NHV_{pg})}{Q_{vg} + Q_{pg} + Q_s + Q_{air}} \qquad \textit{Equation 5b}$$

APPENDIX 1.3

The values for $\dot{m}_s$, $\dot{m}_{air}$, Q_s and Q_{air} are determined as follows based on the type of flare:

Steam-Assisted Flare without a Minimum Steam Reduction System ("MSRS")

$\dot{m}_s$ *or* $Q_s = measured\ value$

$\dot{m}_{air}$ *or* $Q_{air} = 0$

Steam-Assisted Flare with MSRS

$\dot{m}_s$ *or* $Q_s = measured\ value$

$\dot{m}_{air}$ *or* $Q_{air} = result\ from\ Equation\ 13\ in\ Step\ 6a$

OR

$\dot{m}_{air}$ *or* $Q_{air} = 0$ *with vendor certification that the MSRS equipment installed on the flare is not capable (even at minimum vent gas flow) of inspirating more than twice the stoichiometric volume of air into the vent gas.*

The molecular weight of the vent gas (MW_{vg}) is calculated by the GC using Equation 6. An on-line ultrasonic flow meter may also be used to calculate MW_{vg}. Individual compound molecular weights are listed in Table 1 of this Appendix.

$$MW_{vg} = \sum_{i=1}^{n} (x_i \cdot MW_i) \qquad \textit{Equation 6}$$

The NHV of the pilot gas (NHV_{pg}) and MW of the pilot gas (MW_{pg}) are calculated using Equations 7 and 8, respectively. These calculations are similar to the vent gas calculations, except the individual compound volume fractions are that of the pilot gas and not the vent gas. Individual compound volume fractions are measured by laboratory analysis of a pilot gas sample, or may be taken from the natural gas supplier's laboratory certificate of analysis.

$$NHV_{pg} = \sum_{i=1}^{n} (pg_i \cdot NHV_i) \qquad \textit{Equation 7}$$

$$MW_{pg} = \sum_{i=1}^{n} (pg_i \cdot MW_i) \qquad \textit{Equation 8}$$

APPENDIX 1.3

Step 6a: Calculation of air mass flow rate for flares equipped with MSRS.

The complete combustion of an organic compound comprised of a combination of carbon and hydrogen atoms is shown in Equation 9:

$$C_xH_y + \left(x + \frac{y}{4}\right) O_2 \rightarrow xCO_2 + \left(\frac{y}{2}\right) H_2O \qquad \textit{Equation 9}$$

Note: x and y values for each compound are found in Table 1 of this Appendix.

Therefore, the stoichiometric oxygen molar flow rate (moles/hr) for any given combustible compound flow is defined by Equation 10a (mass basis) or Equation 10b (volumetric basis):

$$\dot{n}_{O2-stoich} = x_j \left(\frac{\dot{m}_{vg}}{MW_{vg}}\right)\left(x + \frac{y}{4}\right) \qquad \textit{Equation 10a}$$

OR

$$\dot{n}_{O2-stoich} = x_j \left(\frac{Q_{vg}}{385.5}\right)\left(x + \frac{y}{4}\right) \qquad \textit{Equation 10b}$$

The stoichiometric oxygen mass flow rate for the vent gas (lb/hr) or stoichiometric oxygen volumetric flow rate for the vent gas (scfh) is given by Equation 11a (mass basis) or 11b (volumetric basis).

$$\dot{m}_{O2-stoich-vg} = MW_{O_2} * \sum_{j=1}^{n} \dot{n}_{O2-stoich_j} \qquad \textit{Equation 11a}$$

OR

$$Q_{O2-stoich-vg} = 385.5 * \sum_{j=1}^{n} \dot{n}_{O2-stoich_j} \qquad \textit{Equation 11b}$$

The stoichiometric air mass flow rate (lb/hr) or stoichiometric air volumetric flow rate (scfh) for the vent gas is given by Equation 12a (mass basis) or Equation 12b (volumetric basis).

$$\dot{m}_{air-stoich-vg} = \frac{MW_{air}}{0.21 \cdot MW_{O_2}} * \dot{m}_{O2-stoich-vg} \qquad \textit{Equation 12a}$$

OR

$$Q_{air-stoich-vg} = \frac{Q_{O2-stoich-vg}}{0.21} \qquad \textit{Equation 12b}$$

APPENDIX 1.3

The air mass flow (lb/hour) or air volumetric flow (scfh) used in Equation 5a or 5b is given by subtracting two times the stoichiometric air from the total air provided by the MSRS. This is shown in Equation 13a and 13.b.

$$\dot{m}_{air} = \dot{m}_{air-MSRS} - (2 * \dot{m}_{air-stoich-vg}) \qquad \textit{Equation 13a}$$

OR

$$Q_{air} = Q_{air-MSRS} - (2 * Q_{air-stoich-vg}) \qquad \textit{Equation 13b}$$

The equation for $\dot{m}_{air-MSRS}$ or $Q_{air-MSRS}$ is specific to the MSRS installed and must be provided by the MSRS vendor. The factor of 2 used in Equation 13 is based on the best information available as of the Date of Lodging. If new information becomes available thereafter, the parties may modify that factor; any such modification does not constitute a material modification to the Consent Decree.

If $\dot{m}_{air} < 0$ then $\dot{m}_{air} = 0$
OR
If $Q_{air} < 0$ *then* $Q_{air} = 0$

Step 7: Ensure that during flare operation, $NHV_{cz} \geq NHV_{cz\text{-}limit}$

The flare must be operated to ensure that NHV_{cz} is equal to or above $NHV_{cz\text{-}limit}$ to ensure acceptable combustion efficiency. Equation 14 shows this relationship.

$$NHV_{cz} \geq NHV_{cz-limit} \qquad \textit{Equation 14}$$

APPENDIX 1.3

Key to the Abbreviations:

0.21 = mole fraction of oxygen in air(0.21 lb-mol O_2/lb-mol air)
385.5 = conversion from pound moles to standard cubic feet (385.5 scf/lb-mol)
A = overall combustion efficiency multiplier for NHV_{vg-LFL} (unitless)
B = propylene combustion efficiency multiplier for NHV_{vg-LFL} (unitless)
C_{vg} = concentration of VOC in the vent gas (vol %)
i = individual numbered compound from column i in Table 1 (unitless)
j = individual numbered compound from column j in Table 1 (unitless)
k = individual gaseous component of the combustion zone (unitless)
LFL_i = lower flammability limit of individual compound (vol %)
LFL_{vg} = lower flammability limit of vent gas (vol %)
$\dot{m}_{air}$ = mass flow rate of air (lb/hr)
$\dot{m}_{air-MSRS}$ = total mass flow rate of air introduced by an MSRS (lb/hr)
$\dot{m}_{air-stoich-vg}$ = stoichiometric air mass flow for the vent gas(lb/hr)
$\dot{m}_k$ = mass flow rate of individual combustion zone gas component (lb/hr)
$\dot{m}_{O2-stoich-vg}$ = stoichiometric oxygen mass flow for the vent gas (lb/hr)
$\dot{m}_{pg}$ = mass flow rate of pilot gas (lb/hr)
$\dot{m}_s$ = mass flow rate of total steam (lb/hr)
$\dot{m}_{vg}$ = mass flow rate of vent gas (lb/hr)
$\dot{n}_{O2-stoich}$ = stoichiometric oxygen molar flow for an individual compound (mol/hr)
MW_{H_2O} = molecular weight of water (18.02 lb/lb-mol)
MW_i = molecular weight of individual compound (lb/lb-mol)
MW_k = molecular weight of individual combustion zone gas component(lb/lb-mol)
MW_{O_2} = molecular weight of oxygen (32.0 lb/lb-mol)
MW_{air} = molecular weight of air (28.9 lb/lb-mol)
MW_{pg} = molecular weight of pilot gas (lb/lb-mol)
MW_{vg} = molecular weight of vent gas (lb/lb-mol)
n = list of individual compounds from Table 1 (unitless)
NHV_{cz} = net heating value of the combustion zone (BTU/scf)
NHV_i = net heating value of individual compound (BTU/scf)
NHV_{vg-LFL} = net heating value vent gas at lower flammability limit (BTU/scf)
$NHV_{cz-limit}$ = limit net heating value of the combustion zone (BTU/scf)
NHV_{pg} = net heating value of pilot gas (BTU/scf)
NHV_{vg} = net heating value of vent gas (BTU/scf)
P_{cz} = pressure of combustion zone gas (psia)
P_{std} = ambent pressure at standard condtions (14.696 psi)
pg_i = individual compound volume fraction in pilot gas (vol fraction)
$Q_{air-MSRS}$ = total volumetric flow rate of air introduced by an MSRS (scfh)
$Q_{air-stoich-vg}$ = stoichiometric air volumetric flow for the vent gas (scfh)
Q_k = individal vent gas component volumetric flow rate (scfh)
$Q_{k,acf}$ = individal vent gas component volumetric flow rate (ft^3/hr)
$Q_{O2-stoich-vg}$ = stoichiometric oxygen volumetric flow for the vent gas (scfh)
Q_{vg} = vent gas volumetric flow rate (scfh)
Q_{pg} = pilot gas volumetric flow rate (scfh)
Q_s = steam volumetric flow rate (scfh)
Q_{air} = air volumetric flow rate (scfh)
R = gas constant (10.73 $ft^3 \cdot psi/lb-mol \cdot R$)
T_{cz} = absolute temperature of combustion zone gas (°R)
T_{std} = absolute temperature at standard conditions(528°R)
x = moles of carbon per mole of C_xH_y (mol/mol)
x_i = individual compound volume fraction in the vent gas (vol fraction)
x_j = individual combustible compound volume fraction in the vent gas (vol fraction)
$x_{propylene}$ = volume fraction of propylene in the vent gas (vol fraction)
y = moles of hydrogen per mole of C_xH_y (mol/mol)

APPENDIX 1.3

Table 1
Individual Compound Properties

$i^{(1)}$	j	Compound	NHV_i (Btu/scf)	MW_i (lb/lbmol)	LFL_i (vol fraction)	C_x	H_y
1	1	Hydrogen	274 or 1212[2]	2.02	0.040	0	2
2	-	Oxygen	0	32.00	∞	n/a	n/a
3	-	Nitrogen	0	28.01	∞	n/a	n/a
4	-	CO_2	0	44.01	∞	n/a	n/a
5	-	CO	316	28.01	0.125	n/a	n/a
6	2	Methane	896	16.04	0.050	1	4
7	3	Ethane	1595	30.07	0.030	2	6
8	4	Ethylene	1477	28.05	0.027	2	4
9	5	Acetylene	1404	26.04	0.025	2	2
10	6	Propane	2281	44.10	0.021	3	8
11	7	Propylene	2150	42.08	0.024	3	6
12	8	iso-Butane	2957	58.12	0.018	4	10
13	9	n-Butane	2968	58.12	0.018	4	10
14	10	iso-Butene	2928	56.11	0.018	4	8
15	11	trans-Butene	2826	56.11	0.017	4	8
16	12	cis-Butene	2830	56.11	0.016	4	8
17	13	1,3-Butadiene	2690	54.09	0.020	4	6
18	14	Pentane+ (C_5+)	3655	72.15	0.014	5	12
19	-	Water[3]	0	18.02	∞	n/a	n/a

[1] i=all compounds, j=organic compounds and hydrogen

[2] If using an H_2-adjusted NHV_{vol} and NHV_{cor}, then use 1212 BTU/scf for hydrogen.

[3] A GC does not measure water. If water is measured by means of another instrument, the properties of water listed in this row shall be used.

Note: Benzene is not required to be speciated by the Gas Chromatograph for this refinery settlement (*see* Appendix 1.9) because benzene is present in the Vent Gas only in *de minimis* quantities. Because benzene speciation is not required, it is not listed in Table 1of this Appendix. The Vent Gas composition involved in other future settlements should be evaluated on a case-by-case basis to determine if benzene speciation should be required.

APPENDIX 1.3

Table 2
Combustion Efficiency Multipliers for Steam-Assisted Flares:
Variables Based on Minimum Steam Requirements
and VOC Concentration in the Vent Gas

Minimum Steam	VOC Vent Gas Concentration	A Multiplier	B Multiplier*	
			Condition X	Condition Y
≤ 1000 lb/hr	≤ 20.0%	6.45	4.0	0.0
≤ 1000 lb/hr	> 20.0%	6.85	4.0	0.0
> 1000 lb/hr	≤ 20.0%	7.1	4.0	0.0
> 1000 lb/hr	> 20.0%	7.4	4.0	0.0

*The B Multiplier used depends on the relationship of hydrogen and propylene in the vent gas as follows:
Condition X: $3 \leq H_2\% \leq 8$ and Propylene% $\geq H_2\%$ (all percentages are volume or mole percentages)
Condition Y: Any condition not meeting the requirements for Condition X.

Note: The specifications for Condition X are based on the best information available as of the Date of Lodging. If new information becomes available thereafter, the parties may modify these conditions; any such modification does not constitute a material modification to the Consent Decree.

The "VOC Vent Gas Concentration" shall be calculated on an annual average basis as follows:

$$C_{vg} = \sum_{j=4}^{n} x_j * 100 \qquad \textit{Equation 15}$$

Note: The summation does not include methane or ethane.

APPENDIX 1.3

Addendum A
Verification of Equation 5a and Equation 5b Equivalency

In this Appendix, all gaseous flows (i.e, vent gas, steam, pilot gas, and air) may be measured on either a mass basis (lb/hr) or a volumetric basis (scfh). Depending on which measurement methodology is used, different versions of some equations must be used. These versions are designated with an "a" or "b" (e.g. Equation 5a or 5b). In all cases, these equations are equivalent. This Addendum demonstrates the equivalence of the two methods for calculating NHVcz.

Equation 5b uses volumetric flow rates for the calculation of NHV_{cz}:

$$NHV_{cz} = \frac{(Q_{vg} * NHV_{vg}) + (Q_{pg} * NHV_{pg})}{Q_{vg} + Q_{pg} + Q_s + Q_{air}} \qquad \textit{Equation 5b}$$

The ideal gas law provides a method for determining volumetric flow rate of a specific gas, *k*, in the combustion zone at standard conditions:

$$Q_k = Q_{k,acf} * \frac{P_{cz}}{P_{std}} * \frac{T_{std}}{T_{cz}} \qquad \textit{Equation A1}$$

$$Q_{k,acf} = \frac{\dot{m}_k R T_{cz}}{MW_k P_{cz}} \qquad \textit{Equation A2}$$

$$Q_k = \frac{\dot{m}_k R T_{cz}}{MW_k P_{cz}} * \frac{P_{cz}}{P_{std}} * \frac{T_{std}}{T_{cz}} = \frac{\dot{m}_k R T_{std}}{MW_k P_{std}} \qquad \textit{Equation A3}$$

$$Q_k = \frac{\dot{m}_k * 10.73 * 528}{MW_k * 14.696} = 385.5 \frac{\dot{m}_k}{MW_k} \qquad \textit{Equation A4}$$

Substitution of this expression into Equation 5b gives NHV_{cz} in terms of mass flow:

$$NHV_{cz} = \frac{\left(385.5 \frac{\dot{m}_{vg}}{MW_{vg}} * NHV_{vg}\right) + \left(385.5 \frac{\dot{m}_{pg}}{MW_{pg}} * NHV_{pg}\right)}{385.5 \frac{\dot{m}_{vg}}{MW_{vg}} + 385.5 \frac{\dot{m}_{pg}}{MW_{pg}} + 385.5 \frac{\dot{m}_s}{MW_{H_2O}} + 385.5 \frac{\dot{m}_{air}}{MW_{air}}} \qquad \textit{Equation A5}$$

Because the combustion zone is well-mixed, each gaseous component of the combustion zone is at the same temperature and pressure. Thus, the last expression reduces to Equation 5a:

APPENDIX 1.3

$$NHV_{cz} = \frac{\left(\frac{\dot{m}_{vg} \cdot NHV_{vg}}{MW_{vg}}\right) + \left(\frac{\dot{m}_{pg} \cdot NHV_{pg}}{MW_{pg}}\right)}{\left(\frac{\dot{m}_{vg}}{MW_{vg}}\right) + \left(\frac{\dot{m}_{pg}}{MW_{pg}}\right) + \left(\frac{\dot{m}_{s}}{MW_{H_2O}}\right) + \left(\frac{\dot{m}_{air}}{MW_{air}}\right)} \qquad \textit{Equation 5a}$$

This demonstrates the equivalence of Equations 5a and 5b.

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.4

EPA'S POLICY ON EXCESS EMISSIONS DURING MALFUNCTIONS, STARTUP, AND SHUTDOWN

APPENDIX 1.4

POLICY ON EXCESS EMISSIONS DURING MALFUNCTIONS, STARTUP, AND SHUTDOWN

Introduction

This policy specifies when and in what manner state implementation plans (SIPs) may provide for defenses to violations caused by periods of excess emissions due to malfunctions,[1] startup, or shutdown. Generally, since SIPs must provide for attainment and maintenance of the national ambient air quality standards and the achievement of PSD increments, all periods of excess emissions must be considered violations. Accordingly, any provision that allows for an automatic exemption[2] for excess emissions is prohibited.

However, the imposition of a penalty for excess emissions during malfunctions caused by circumstances entirely beyond the control of the owner or operator may not be appropriate. States may, therefore, as an exercise of their inherent enforcement discretion, choose not to penalize a source that has produced excess emissions under such circumstances.

This policy provides an alternative approach to enforcement discretion for areas and pollutants where the respective contributions of individual sources to pollutant concentrations in ambient air are such that no single source or small group of sources has the potential to cause an exceedance of the NAAQS or PSD increments. Where a single source or small group of sources has the potential to cause an exceedance of the NAAQS or PSD increments, as is often the case for sulfur dioxide and lead,[3] EPA believes approaches other than enforcement discretion are not appropriate. In such cases, any excess emissions may have a significant chance of causing an exceedance or violation of the applicable standard or PSD increment.

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[1]The term excess emission means an air emission level which exceeds any applicable emission limitation. Malfunction means a sudden and unavoidable breakdown of process or control equipment.

[2]The term automatic exemption means a generally applicable provision in a SIP that would provide that if certain conditions existed during a period of excess emissions, then those exceedances would not be considered violations.

[3]This policy also does not apply for purposes of PM2.5 NAAQS. In American Trucking Association v. EPA, 175 F. 3d 1027 (D.C. Circ., 1999), the court remanded the PM2.5 NAAQS to the EPA. The Agency has not determined whether this policy is appropriate for PM2.5 NAAQS.

APPENDIX 1.4

Except where a single source or small group of sources has the potential to cause an exceedance of the NAAQS or PSD increments, states may include in their SIPs affirmative defenses[4] for excess emissions, as long as the SIP establishes limitations consistent with those set out below. If approved into a SIP, an affirmative defense would be available to sources in an enforcement action seeking penalties brought by the state, EPA, or citizens. However, a determination by the state not to take an enforcement action would not bar EPA or citizen action.[5]

In addition, in certain limited circumstances, it may be appropriate for the State to build into a source-specific or source-category-specific emission standard a provision stating that the otherwise applicable emission limitations do not apply during narrowly defined startup and shutdown periods.

I. AUTOMATIC EXEMPTIONS AND ENFORCEMENT DISCRETION

If a SIP contains a provision addressing excess emissions, it cannot be the type that provides for automatic exemptions. Automatic exemptions might aggravate ambient air quality by excusing excess emissions that cause or contribute to a violation of an ambient air quality standard. Additional grounds for disapproving a SIP that includes the automatic exemption approach are discussed in more detail at 42 Fed. Reg. 58171 (November 8, 1977) and 42 Fed. Reg. 21372 (April 27, 1977). As a result, EPA will not approve any SIP revisions that provide automatic exemptions for periods of excess emissions.

The best assurance that excess emissions will not interfere with NAAQS attainment, maintenance, or increments is to address excess emissions through enforcement discretion. This policy provides alternative means for addressing excess emissions of criteria pollutants. However, this policy does not apply where a single source or small group of sources has the potential to cause an exceedance of the NAAQS or PSD increments. Moreover,

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[4]The term affirmative defense means, in the context of an enforcement proceeding, a response or defense put forward by a defendant, regarding which the defendant has the burden of proof, and the merits of which are independently and objectively evaluated in a judicial or administrative proceeding.

[5]Because all periods of excess emissions are violations and because affirmative defense provisions may not apply in actions for injunctive relief, under no circumstances would EPA consider periods of excess emissions, even if covered by an affirmative defense, to be "federally permitted releases" under EPCRA or CERCLA.

nothing in this guidance should be construed as requiring States to include affirmative defense provisions in their SIPs.

II. AFFIRMATIVE DEFENSES FOR MALFUNCTIONS

The EPA can approve a SIP revision that creates an affirmative defense to claims for penalties in enforcement actions regarding excess emissions caused by malfunctions as long as the defense does not apply to SIP provisions that derive from federally promulgated performance standards or emission limits, such as new source performance standards (NSPS) and national emissions standards for hazardous air pollutants (NESHAPS).[6] In addition, affirmative defenses are not appropriate for areas and pollutants where a single source or small group of sources has the potential to cause an exceedance of the NAAQS or PSD increments. Furthermore, affirmative defenses to claims for injunctive relief are not allowed. To be approved, an affirmative defense provision must provide that the defendant has the burden of proof of demonstrating that:

1. The excess emissions were caused by a sudden, unavoidable breakdown of technology, beyond the control of the owner or operator;

2. The excess emissions (a) did not stem from any activity or event that could have been foreseen and avoided, or planned for, and (b) could not have been avoided by better operation and maintenance practices;

3. To the maximum extent practicable the air pollution control equipment or processes were maintained and operated in a manner consistent with good practice for minimizing emissions;

4. Repairs were made in an expeditious fashion when the operator knew or should have known that applicable emission limitations were being exceeded. Off-shift labor and overtime must have been utilized, to the extent practicable, to ensure that such repairs were made as expeditiously as practicable;

5. The amount and duration of the excess emissions (including any bypass) were minimized to the maximum extent practicable during periods of such emissions;

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[6]To the extent a State includes NSPS or NESHAPS in its SIP, the standards should not deviate from those that were federally promulgated. Because EPA set these standards taking into account technological limitations, additional exemptions would be inappropriate.

APPENDIX 1.4

6. All possible steps were taken to minimize the impact of the excess emissions on ambient air quality;

7. All emission monitoring systems were kept in operation if at all possible;

8. The owner or operator's actions in response to the excess emissions were documented by properly signed, contemporaneous operating logs, or other relevant evidence;

9. The excess emissions were not part of a recurring pattern indicative of inadequate design, operation, or maintenance; and

10. The owner or operator properly and promptly notified the appropriate regulatory authority.

The EPA interprets these criteria narrowly. Only those malfunctions that are sudden, unavoidable, and unpredictable in nature qualify for the defense. For example, a single instance of a burst pipe that meets the above criteria may qualify under an affirmative defense. The defense would not be available, however, if the facility had a history of similar failures because of improper design, improper maintenance, or poor operating practices. Furthermore, a source must have taken all available measures to compensate for and resolve the malfunction. If a facility has a baghouse fire that leads to excess emissions, the affirmative defense would be appropriate only for the period of time necessary to modify or curtail operations to come into compliance. The fire should not be used to excuse excess emissions generated during an extended period of time while the operator orders and installs new bags, and relevant SIP language must limit applicability of the affirmative defense accordingly.

III. EXCESS EMISSIONS DURING STARTUP AND SHUTDOWN

In general, startup and shutdown of process equipment are part of the normal operation of a source and should be accounted for in the planning, design, and implementation of operating procedures for the process and control equipment. Accordingly, it is reasonable to expect that careful and prudent planning and design will eliminate violations of emission limitations during such periods.

A. SOURCE CATEGORY SPECIFIC RULES FOR STARTUP AND SHUTDOWN

For some source categories, given the types of control technologies available, there may exist short periods of emissions during startup and shutdown when, despite best efforts regarding planning, design, and operating procedures, the

APPENDIX 1.4

otherwise applicable emission limitation cannot be met. Accordingly, except in the case where a single source or small group of sources has the potential to cause an exceedance of the NAAQS or PSD increments, it may be appropriate, in consultation with EPA, to create narrowly-tailored SIP revisions that take these technological limitations into account and state that the otherwise applicable emissions limitations do not apply during narrowly defined startup and shutdown periods. To be approved, these revisions should meet the following requirements:

1. The revision must be limited to specific, narrowly-defined source categories using specific control strategies (e.g., cogeneration facilities burning natural gas and using selective catalytic reduction);

2. Use of the control strategy for this source category must be technically infeasible during startup or shutdown periods;

3. The frequency and duration of operation in startup or shutdown mode must be minimized to the maximum extent practicable;

4. As part of its justification of the SIP revision, the state should analyze the potential worst-case emissions that could occur during startup and shutdown;

5. All possible steps must be taken to minimize the impact of emissions during startup and shutdown on ambient air quality;

6. At all times, the facility must be operated in a manner consistent with good practice for minimizing emissions, and the source must have used best efforts regarding planning, design, and operating procedures to meet the otherwise applicable emission limitation; and

7. The owner or operator's actions during startup and shutdown periods must be documented by properly signed, contemporaneous operating logs, or other relevant evidence.

B. GENERAL AFFIRMATIVE DEFENSE PROVISIONS RELATING TO STARTUP AND SHUTDOWN

In addition to the approach outlined in Section II(A) above, States may address the problem of excess emissions occurring during startup and shutdown periods through an enforcement discretion approach. Further, except in the case where a single source or small group of sources has the potential to cause an exceedance of the NAAQS or PSD increments, States may also adopt for their SIPs an affirmative defense approach. Using this

APPENDIX 1.4

approach, all periods of excess emissions arising during startup and shutdown must be treated as violations, and the affirmative defense provision must not be available for claims for injunctive relief. Furthermore, to be approved, such a provision must provide that the defendant has the burden of proof of demonstrating that:

1. The periods of excess emissions that occurred during startup and shutdown were short and infrequent and could not have been prevented through careful planning and design;

2. The excess emissions were not part of a recurring pattern indicative of inadequate design, operation, or maintenance;

3. If the excess emissions were caused by a bypass (an intentional diversion of control equipment), then the bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

4. At all times, the facility was operated in a manner consistent with good practice for minimizing emissions;

5. The frequency and duration of operation in startup or shutdown mode was minimized to the maximum extent practicable;

6. All possible steps were taken to minimize the impact of the excess emissions on ambient air quality;

7. All emission monitoring systems were kept in operation if at all possible;

8. The owner or operator's actions during the period of excess emissions were documented by properly signed, contemporaneous operating logs, or other relevant evidence; and

9. The owner or operator properly and promptly notified the appropriate regulatory authority.

If excess emissions occur during routine startup or shutdown periods due to a malfunction, then those instances should be treated as other malfunctions that are subject to the malfunction provisions of this policy. (Reference Part I above).

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.5

CALCULATING MOMENTUM FLUX RATIO

APPENDIX 1.5

CALCULATING MOMENTUM FLUX RATIO

Momentum Flux Ratio (MFR) is the relationship between the density (ρ) and velocity (v) of the Vent Gas plus Center Steam to the density and velocity of the wind. It is defined in Equation 1.

$$MFR = \frac{\rho_{vg+s,cent} \cdot v_{vg+s,cent}^{\ 2}}{\rho_{air} \cdot v_{air}^{\ 2}} \qquad \textit{Equation 1}$$

The numerator of the fraction is the "momentum flux" of the Vent Gas plus Center Steam and the denominator is the "momentum flux" of the air (wind). As the velocity of the wind increases, the MFR will decline for a given Vent Gas composition and flow rate.

Calculations for the density (ρ) components and velocity (v) components are discussed separately below.

Calculating Density

The general formula to calculate the density of any given component (ρ_i) at standard temperature and pressure (68 °F, 1 atm) is shown in Equation 2.

$$\rho_i = \frac{MW_i \cdot P}{R \cdot T_{abs}} = \frac{MW_i \cdot 14.696\ psi}{10.73 \frac{psi \cdot ft^3}{lbmol \cdot °R} \cdot (460°R + 68°R)} = \frac{MW_i}{385.5} \qquad \textit{Equation 2}$$

From the final form of Equation 2, the density of Ambient Air (ρ_{air}), Vent Gas (ρ_{vg}), and Center Steam ($\rho_{s,cent}$) can be calculated, shown in Equations 3, 4, and 5.

$$\rho_{air} = \frac{MW_{air}}{385.5} = \frac{28.96}{385.5} = 0.075\ \frac{lb}{ft^3} \qquad \textit{Equation 3}$$

$$\rho_{vg} = \frac{MW_{vg}}{385.5} \frac{lb}{ft^3} \qquad \textit{Equation 4}$$

$$\rho_{s,cent} = \frac{MW_{H_2O}}{385.5} = \frac{18.02}{385.5} = 0.047\ \frac{lb}{ft^3} \qquad \textit{Equation 5}$$

APPENDIX 1.5

The density of the Vent Gas plus Center Steam ($\rho_{vg+s,cent}$) is calculated by combining the mass flow rates of the Vent Gas and Center Steam and dividing by the combined volumetric flow rates of the Vent Gas and Center Steam. This is shown in Equation 6.

$$\rho_{vg+s,cent} = \frac{\dot{m}_{vg} + \dot{m}_{s,cent}}{Q_{vg} + Q_{s,cent}} = \frac{\dot{m}_{vg} + \dot{m}_{s,cent}}{\frac{\dot{m}_{vg}}{\rho_{vg}} + \frac{\dot{m}_{s,cent}}{\rho_{s,cent}}} \qquad \textit{Equation 6}$$

Calculating Velocity

The velocity of the Vent Gas plus Center Steam ($v_{vg+s,cent}$) is calculated by Equation 7.

$$v_{vg+s,cent} = \frac{Q_{vg} + Q_{s,cent}}{A_{tip-unob}} = \frac{\frac{\dot{m}_{vg}}{\rho_{vg}} + \frac{\dot{m}_{s,cent}}{\rho_{s,cent}}}{\mathrm{A}_{tip-unob}} \qquad \textit{Equation 7}$$

The wind velocity is measured directly.

Constants:

$MW_{air} = molecular\ weight\ of\ air\ \left(28.96 \frac{lb}{lbmol}\right)$

$MW_{H_2O} = molecular\ weight\ of\ water\ \left(18.02 \frac{lb}{lbmol}\right)$

$MW_i = molecular\ weight\ of\ component\ i \left(\frac{lb}{lbmol}\right)$

$P = absolute\ ambient\ pressure\ (14.73\ psia)$

$\rho_{air} = density\ of\ air\ \left(\frac{lb}{ft^3}\right) = 0.075 \frac{lb}{ft^3}$

$\rho_{s,cent} = density\ of\ Center\ Steam\ \left(\frac{lb}{ft^3}\right) = 0.047 \frac{lb}{ft^3}$

$R = gas\ constant\ \left(10.73 \frac{psi \cdot ft^3}{lbmol \cdot {}^\circ R}\right)$

$T_{abs} = absolute\ temperature\ (^\circ R) = 460^\circ R + 68^\circ R = 528\ ^\circ R$

APPENDIX 1.5

Measured variables:

$MW_{vg} = molecular\ weight\ of\ Vent\ Gas\ \left(\frac{lb}{lbmol}\right)$

$\dot{m}_{s.cent} = mass\ flow\ rate\ of\ Center\ Steam\ \left(\frac{lb}{hr}\right)$

$\dot{m}_{vg} = mass\ flow\ rate\ of\ Vent\ Gas\ \left(\frac{lb}{hr}\right)$

$Q_{s.cent} = volumetric\ flow\ rate\ of\ Center\ Steam\ (scfh)$

$Q_{vg} = volumetric\ flow\ rate\ of\ Vent\ Gas\ (scfh)$

$v_{air} = velocity\ of\ wind\ \left(\frac{ft}{hr}\right)$

Calculated variables:

$A_{tip-unob} = unobstructed\ cross-sectional\ area\ of\ flare\ tip\ (ft^2)$

$MFR = momentum\ flux\ ratio\ (unitless)$

$\rho_{vg} = density\ of\ Vent\ Gas\ \left(\frac{lb}{ft^3}\right)$

$\rho_i = density\ of\ component\ i\ \left(\frac{lb}{ft^3}\right)$

$v_{vg} = velocity\ of\ Vent\ Gas\ \left(\frac{ft}{hr}\right)$

$v_{s.cent} = velocity\ of\ Center\ Steam\ \left(\frac{ft}{hr}\right)$

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

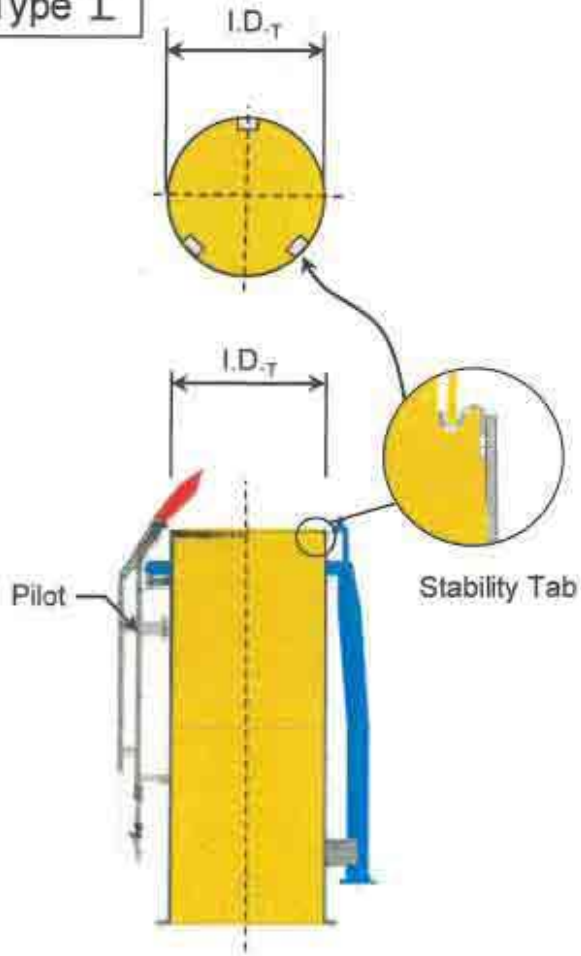
APPENDICES TO CONSENT DECREE

APPENDIX 1.6

CALCULATING THE UNOBSTRUCTED CROSS SECTIONAL AREA OF VARIOUS TYPES OF FLARE TIPS

APPENDIX 1.6

Type I



$A_{tip\text{-}unob} = \pi(I.D._T)^2/4 - (X_T * A_{ST})$

Where:

- $A_{tip\text{-}unob}$ = Unobstructed Cross Sectional Area of Flare Tip
- $I.D._T$ = Inside Diameter Flare Tip
- X_T = Number of Stability Tabs
- A_{ST} = Area of a Stability Tab

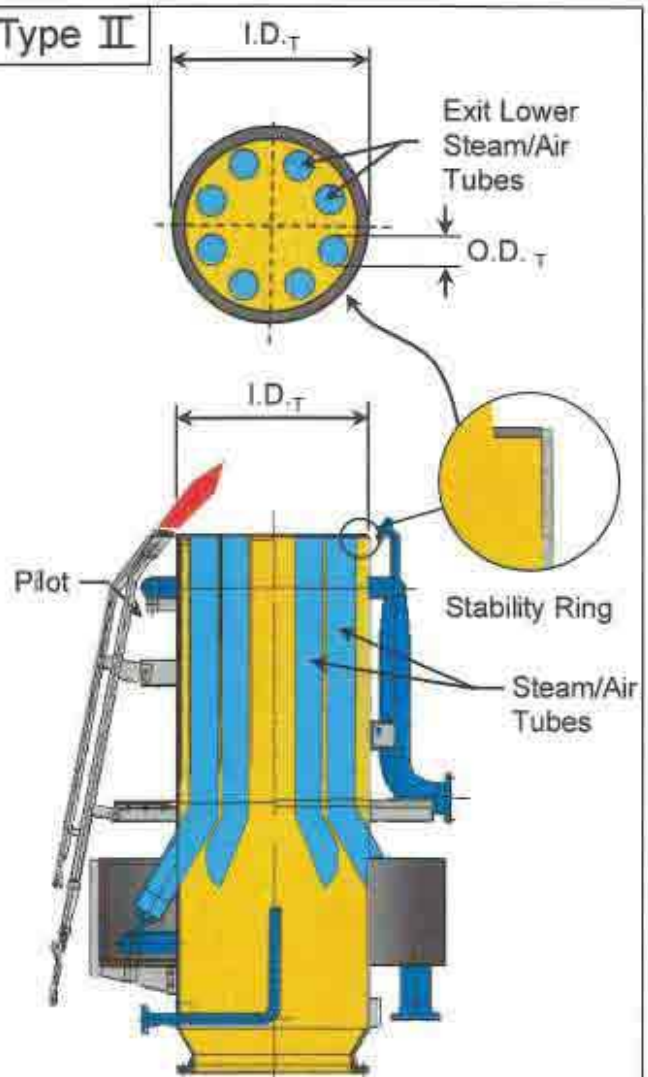
Example:

- $I.D._T$ = 41.5 inches
- X_T = 3
- A_{ST} = 3 Sq. inches

$A_{tip\text{-}unob} = \pi(41.5)^2/4 - (3 * 3)$

$A_{tip\text{-}unob}$ = 1344 Sq. inches

Type II



$A_{tip\text{-}unob} = \pi(I.D._T)^2/4 - A_{ST} - N_T * \pi * (O.D._T)^2/4$

Where:

- $A_{tip\text{-}unob}$ = Unobstructed Cross Sectional Area of Flare Tip
- $I.D._T$ = Inside Diameter Flare Tip
- A_{ST} = Area of Stability Ring
- $O.D._T$ = Outside Diameter of Steam/Air Tubes
- N_T = Number of Steam/Air Tubes

Example:

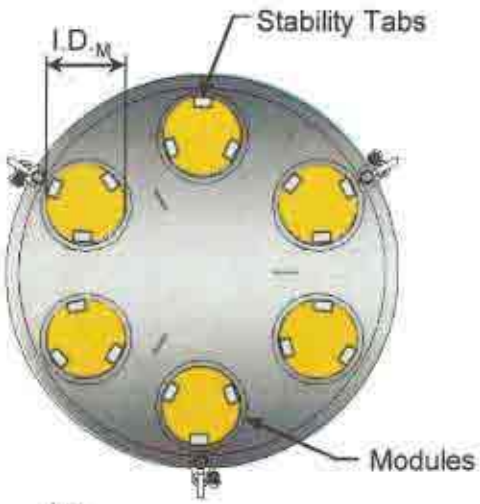
- $I.D._T$ = 47.5 inches
- A_{ST} = 100 Sq. inches
- $O.D._T$ = 6.5 inches
- N_T = 8

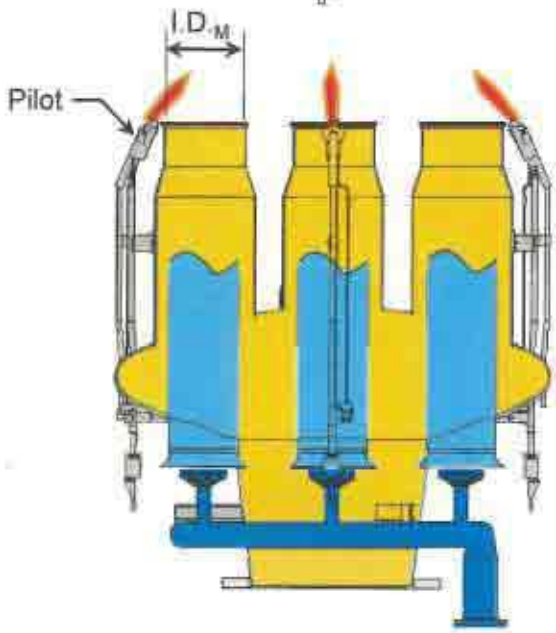
$A_{tip\text{-}unob} = \pi (47.5)^2/4 - 100 - 8 * \pi * (6.5)^2/4$

$A_{tip\text{-}unob}$ = 1322 Sq. inches

APPENDIX 1.6

Type III





$$A_{tip\text{-}unob} = N_M * (\pi * (I.D._M)^2/4 - X_T * A_{ST})$$

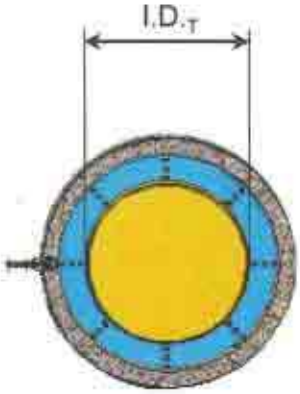
Where:
- $A_{tip\text{-}unob}$ = Unobstructed Cross Sectional Area of Flare Tip
- $I.D._M$ = Inside Diameter of One Tip Module
- N_M = Number of Modules
- X_T = Number of Stability Tabs per Module
- A_{ST} = Area of a Stability Tab

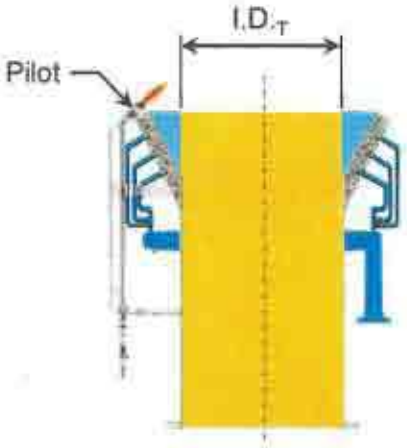
Example:
- $I.D._M$ = 17 inches
- N_M = 6 X_T = 3
- A_{ST} = 3 Sq. inches

$$A_{tip\text{-}unob} = 6 * (\pi * (17)^2/4 - 3 * 3)$$

$$A_{tip\text{-}unob} = 1308 \text{ Sq. inches}$$

Type IV





$$A_{tip\text{-}unob} = \pi (I.D._T)^2/4$$

Where:
- $A_{tip\text{-}unob}$ = Unobstructed Cross Sectional Area of Flare Tip
- $I.D._T$ = Inside Diameter of Flare Tip

Example:
- $I.D._T$ = 41.5 inches

$$A_{tip\text{-}unob} = \pi (41.5)^2/4$$

$$A_{tip\text{-}unob} = 1353 \text{ Sq. inches}$$

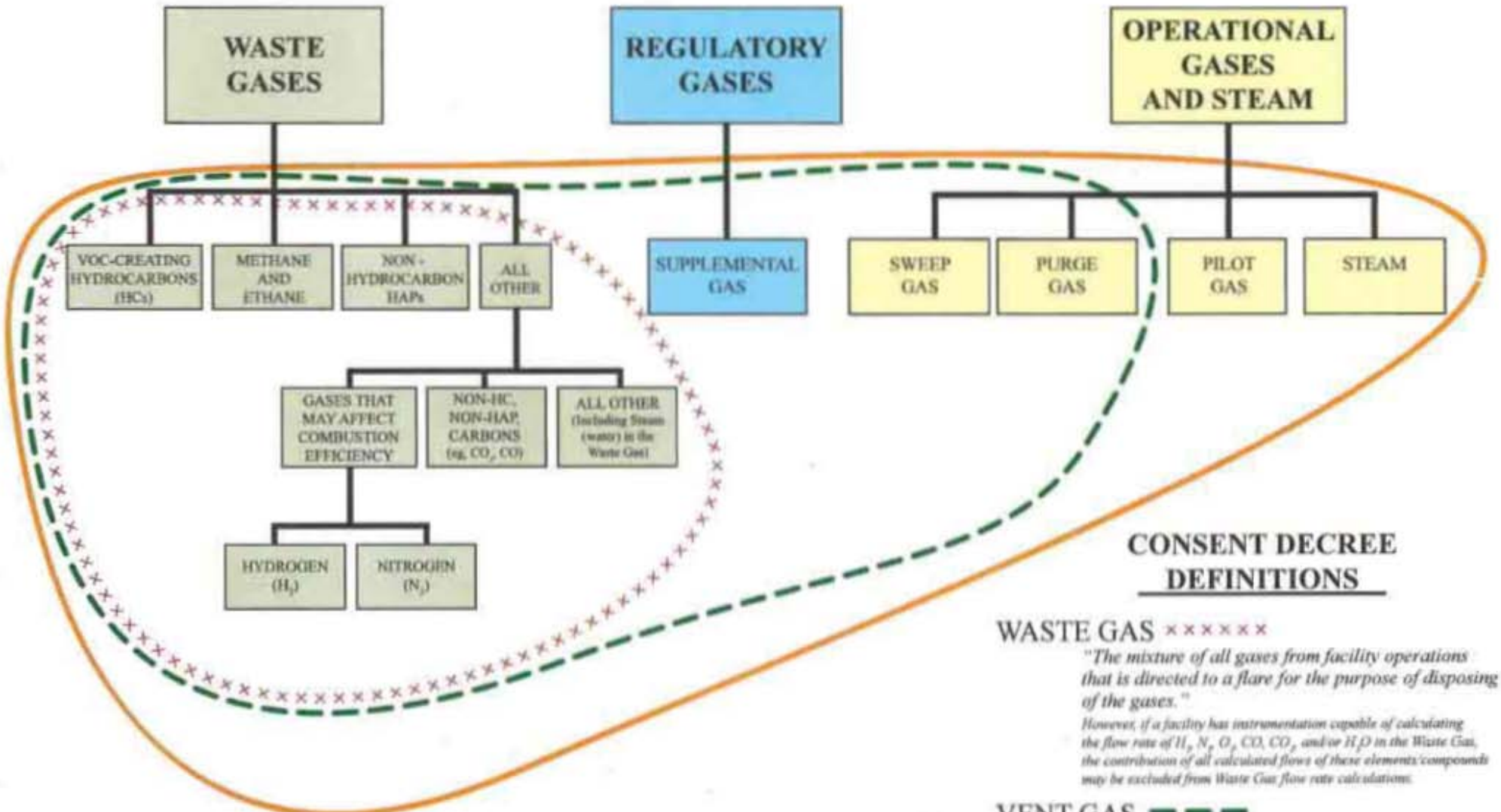
UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.7

DEPICTION OF GASES ASSOCIATED WITH STEAM-ASSISTED FLARES

DEPICTION OF GASES ASSOCIATED WITH STEAM-ASSISTED FLARES



CONSENT DECREE DEFINITIONS

WASTE GAS ××××××

"The mixture of all gases from facility operations that is directed to a flare for the purpose of disposing of the gases."

However, if a facility has instrumentation capable of calculating the flow rate of H_2, N_2, O_2, CO, CO_2, and/or H_2O in the Waste Gas, the contribution of all calculated flows of these elements/compounds may be excluded from Waste Gas flow rate calculations.

VENT GAS – – –

"The mixture of all gases found prior to the flare tip. This includes all Waste Gas, Supplemental Gas, Sweep Gas, and Purge Gas."

COMBUSTION ZONE GAS ——

"The mixture of all gases and steam found just after the flare tip. This includes all Vent Gas, Pilot Gas, and Total Steam."

APPENDIX 1.7

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.8

OUTLINE OF REQUIREMENTS FOR THE FLARE DATA AND INITIAL MONITORING SYSTEMS REPORT

APPENDIX 1.8

OUTLINE OF REQUIREMENTS FOR THE FLARE DATA AND INITIAL MONITORING SYSTEMS REPORT

1. Facility-Wide

    1.1 Facility plot plan showing the location of each flare in relation to the general plant layout

2. General Description of Flare

    2.1 Ground or elevated
    2.2 Type of assist system
    2.3 Simple or integrated (*e.g.*, sequential, staged)
    2.4 Date first installed
    2.5 History of any physical changes to the Flare
    2.6 Whether the Flare is a Temporary-Use Flare, and if so, the duration and time periods of use
    2.7 Flare Gas Recovery System ("FGRS"), if any, and date first installed

3. Flare Components: Complete description of each major component of the Flare, except the Flare Gas Recovery System (*see* Part 5), including but not limited to:

    3.1 Flare stack (for elevated flares)
    3.2 Flare tip
        3.1.2.1 Date installed
        3.1.2.2 Manufacturer
        3.1.2.3 Tip Size
        3.1.2.4 Tip Drawing
    3.3 Knockout or surge drum(s) or pot(s), including dimensions and design capacities
    3.4 Water seal(s), including dimensions and design parameters
    3.5 Flare header(s)
    3.6 Sweep Gas system
    3.7 Purge gas system
    3.8 Pilot gas system
    3.9 Supplemental gas system
    3.10 Assist system
    3.11 Ignition system

4. Simplified process diagram(s) showing the configuration of the components listed in Paragraph 3

APPENDIX 1.8

5. Existing Flare Gas Recovery System ("FGRS")

   5.1 Complete description of each major component, including but not limited to:
      5.1.1 Compressor(s), including design capacities
      5.1.2 Water seal(s), rupture disk, or similar device to divert the flow
   5.2 Maximum actual past flow on an scfm basis and the annual average flow in scfm for the five years preceding Date of Lodging
   5.3 Simplified schematic showing the FGRS
   5.4 Process Flow Diagram that adds the FGRS to the PDF(s) in Part 4

6. Flare Design Parameters

   6.1 Maximum Vent Gas Flow Rate and/or Mass Rate
   6.2 Maximum Sweep Gas Flow Rate and/or Mass Rate
   6.3 Maximum Purge Gas Flow and/or Mass Rate, if applicable
   6.4 Maximum Pilot Gas Flow and/or Mass Rate
   6.5 Maximum Supplemental Gas Flow Rate and/or Mass Rate
   6.6 If steam-assisted, Minimum Total Steam Rate, including all available information on how that Rate was derived

7. Gases Venting to Flare

   7.1. Sweep Gas
      7.1.1 Type of gas used
      7.1.2 Actual set operating flow rate (in scfm)
      7.1.3 Average lower heating value expected for each type of gas used
   7.2 Purge Gas, if applicable
      7.2.1 Type of gas used
      7.2.2 Actual set operating flow rate (in scfm)
      7.2.3 Average lower heating value expected for each type of gas used
   7.3 Pilot Gas
      7.3.1 Type of gas used
      7.3.2 Actual set operating flow rate (in scfm)
      7.3.3 Average lower heating value expected for each type of gas used
   7.4 Supplemental Gas
      7.4.1 Type of gas used
      7.4.2 Average lower heating value expected for each type of gas used
   7.5 Steam (if applicable)
      7.5.1 Drawing showing points of introduction of Lower, Center, Upper, and any other steam
   7.6 Simplified flow diagram that depicts the points of introduction of all gases, including Waste Gases, at the Flare (in this diagram, the detailed drawings of 7.5.1 may be simplified; in addition, detailed Waste Gas mapping is not required; a simple identification of the header(s) that carries(y) the Waste Gas to the Flare

and show(s) its(their) location in relation to the location of the introduction of the other gases is all that is required)

8. Existing Monitoring Systems

8.1 A brief narrative description, including manufacturer and date of installation, of all existing monitoring systems, including but not limited to:

8.1.1 Waste Gas and/or Vent Gas flow monitoring
8.1.2 Waste Gas and/or Vent Gas heat content analyzer
81.3 Sweep Gas flow monitoring
8.1.4 Purge Gas flow monitoring
8.1.5 Supplemental Gas flow monitoring
8.1.6 Steam flow monitoring
8.1.7 Waste Gas or Vent Gas molecular weight analyzer
8.1.8 Gas Chromatograph
8.1.9 Sulfur analyzer(s)
8.1.10 Video camera
8.1.11 Thermocouple

8.2 Drawing(s) showing locations of all existing monitoring systems

9. Monitoring Equipment to be Installed to Comply with Consent Decree

10. Narrative Description of the Monitoring Methods and Calculations that will be used to comply with the NHV_{CZ}, S/VG, and MFR Requirements in the Consent Decree

11. Identification of Calibration Gases to be used to comply with Appendix 1.10

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.9

LIST OF COMPOUNDS A GAS CHROMATOGRAPH MUST BE CAPABLE OF SPECIATING

APPENDIX 1.9

LIST OF COMPOUNDS A GAS CHROMATOGRAPH MUST BE CAPABLE OF SPECIATING

The Gas Chromatograph must be capable of speciating the Vent Gas into the following:

1. Hydrogen
2. Oxygen
3. Nitrogen
4. Carbon Dioxide
5. Carbon Monoxide
6. Methane
7. Ethane
8. Ethene (aka: Ethylene)
9. Acetylene
10. Propane
11. Propene (aka: Propylene)
12. 2-Methylpropane (aka: iso-Butane)
13. Butane (aka: n-Butane)
14. But-1-ene (aka: butene, alpha-butylene) and 2-methylpropene (aka: iso-butylene, iso-butene) (these two constituents will be measured on the same column and the reported result will be one value: the sum of the two constituents)
15. E-but-2-ene (aka: beta-butylene, trans-butene)
16. Z-but-2-ene (aka: beta-butylene, cis-butene)
17. 1,3 butadiene
18. Pentane plus (aka: C_5 plus) (*i.e.*, all HCs with five Cs or more)
19. Hydrogen Sulfide

Outputs from the Gas Chromatograph shall be on a mole percent basis except for Hydrogen Sulfide which will be on a parts per million basis.

MPC may submit a request to EPA for approval of changes to the list of compounds a GC at a particular Covered Refinery must measure.

Benzene is not required to be speciated by the Gas Chromatograph for this refinery settlement because benzene is present in the Vent Gas only in *de minimis* quantities. The Vent Gas composition involved in other future settlements should be evaluated on a case-by-case basis to determine if benzene speciation should be required.

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.10

EQUIPMENT AND INSTRUMENTATION TECHNICAL SPECIFICATIONS AND QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

APPENDIX 1.10

EQUIPMENT AND INSTRUMENTATION TECHICAL SPECIFICATIONS AND QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

I. VENT GAS FLOW METER

a. Velocity Range: 0.1–250 ft/sec

b. Repeatability: ± 1% of reading over the velocity range

c. Design Accuracy: ± 5% initially to 40%, 60%, and 90% of monitor full scale as certified by the manufacturer

d. Operational Accuracy: ± 20% of reading over the velocity range of 0.1–1 ft/s and ± 5% of reading over the velocity range of 1–250 ft/s

e. Installation: Applicable AGA, ANSI, API, or equivalent standard

f. Flow Rate Determination: Must be corrected to one atmosphere pressure and 68 °F

g. QA/QC: Annual calibration shall be conducted.

h. Pressure and Temperature Sensors: *See* Part IV below.

II. VENT GAS AVERAGE MOLECULAR WEIGHT ANALYZER (may be part of the Vent Gas Flow Meter)

a. Molecular Weight Range and Accuracy: 2 to 120 gr/grmol, ± 2%

III. STEAM FLOW METER

a. Repeatability: ± 1% of reading over the range of the instrument

b. Accuracy: +/- 1% from 100% to 15% of span
+/- 2% from 15% to 6% of span
+/- 3% from 6% to 4% of span

c. Installation: Applicable AGA, ANSI, API, or equivalent standard

d. Flow Rate Determination: Must be corrected to one atmosphere pressure and 68 °F

e. QA/QC: Annual calibration shall be conducted.

f. Pressure and Temperature Sensors: *See* Part IV below.

IV. VENT GAS AND STEAM FLOW METERS: PRESSURE AND TEMPERATURE SENSORS

a. Temperature monitor must be calibrated annually to ± 5%.

b. Pressure monitor must be calibrated annually to within ± 5%.

V. GAS CHROMATOGRAPH ("GC")

A. General

a. Accuracy: The gas chromatography system shall be maintained to be accurate within 5% of full scale.

b. Repeatability: ± 0.5% of full scale for full scale ranges from 2-100%;
± 1% of full scale for full scale ranges from 0.05-2%;
± 2% of full scale for full scale ranges from 50-500 ppm;
± 3% of full scale for full scale ranges from 5-50 ppm;
± 5% of full scale for full scale ranges from 0.5-5 ppm;

c. The minimum sampling frequency shall be one sample every 15 minutes.

d. The GC shall be capable of speciating all gas constituents listed in Appendix 1.9.

e. The sampling system shall be heat traced and maintained at 57°C with no cold spots. All system components shall be heated, including the probe external to the flare piping, calibration valve, sample lines, sampling loop (or sample introduction system), and GC oven.

f. Where technically feasible, the sampling location should be at least two equivalent duct diameters downstream from the nearest control device, point of pollutant generation, or other point at which a change in the pollutant concentration or emission rate occurs. The location should not be close to air in-leakages. Where technically feasible, the location should also be at least 0.5 diameters upstream from the exhaust or control device.

APPENDIX 1.10

B. Gas Chromatograph Calibration Standards

1. **Net Heating Value and Analyte Measurements**. For the Net Heating Value and Analyte measurements, the GC shall be operated and maintained in accordance with Performance Specification 9 ("PS9") of Appendix B of 40 C.F.R. Part 60 except:

   a. The daily mid-level validation procedure in Section 10.2 of PS9 shall be conducted on the Net Heating Value instead of on each analyte. The average instrument response shall not vary by more than 10 percent from the Net Heating Value of the certified calibration gas.

   b. The multi-point calibration error check procedure in Section 10.1 of PS9 shall be conducted quarterly for the limited set of analytes listed in Subparagraph V.B.1.c below. The GC must meet the calibration performance criteria in Sections 13.1 and 13.2 of PS9 for the listed analytes only, such that: (i) the average instrument response must not differ by more than 10 percent of the calibration gas value; and (ii) the precision and linearity check of each analyte listed below shall not deviate more than 5 percent from the average concentration measured.

   c. The analytes to be used are:

      i. Hydrogen
      ii. Nitrogen
      iii. Methane
      iv. Ethane
      v. Propane
      vi. Propylene

   d. The calibration gas mixtures may be set by the procedures identified in Section 7.1 of PS9 or may be within 10 percent of the concentration values listed in Table 1. The gases must be certified to ± 2 percent.

APPENDIX 1.10

Table 1: Calibration Gas Mixtures for Net Heating Value Calibrations/Validations[1]

Component	Daily Mid-Level Gas	Quarterly Low-Level Gas	Quarterly Med-Level Gas	Quarterly High-Level Gas
Hydrogen	**30**	**8**	**30**	**12**
Nitrogen	**8**	**65**	**8**	**5**
Methane	**48**	**22**	**48**	**30**
Ethane	**3**	**2**	**3**	**30**
Propane	**2**	**1**	**2**	**15**
Propylene	**8**	**1**	**8**	**5**
Ethylene	**1**	**1**	**1**	**3**
NHV (Btu/scf) Unadjusted for H2	**875**	**310**	**875**	**1273**

[1] The individual analytes are in volume percent.

2. **H_2S Measurement**. For the H_2S measurement, the GC shall be operated and maintained in accordance with Performance Specification 7 of Appendix B of 40 C.F.R. Part 60. Quality assurance procedures set forth in Appendix F of 40 C.F.R. Part 60 shall be followed. The span shall be set at 320 ppmv H_2S.

VI. Calculation of Instrument Downtime

1. For purposes of calculating the 110 hours per calendar quarter of instrument downtime allowed pursuant to Paragraphs 28 and 48, the time used for GC calibration and validation activities required by Subparagraph V.B.1 of this Appendix may be excluded.

2. Any hour that meets the requirements of 40 C.F.R. § 60.13(h)(2) shall not be counted toward instrument downtime. Specifically:

   (i) For a full operating hour (any clock hour where the flare is available for operation for 60 minutes), if there are at least four valid data points to calculate the hourly average (that is, one data point in each of the 15-minute quadrants of the hour), then there is no period of instrument downtime;

   (ii) For a partial operating hour (any clock hour with less than 60 minutes of unit operation), if there is at least one valid data point in each 15-minute quadrant of the hour in which the unit operates to calculate the hourly average, then there is no period of instrument downtime; and

(iii) For any operating hour in which required maintenance or quality-assurance activities on the instruments or monitoring systems associated with the flare are performed:

(A) If the flare is available for operation in two or more quadrants of the hour and if there are at least two valid data points separated by at least 15 minutes to calculate the hourly average, then there is no period of instrument downtime; or

(B) If the flare is available for operation in only one quadrant of the hour and if there is at least one valid data point to calculate the hourly average, then there is no period of instrument downtime.

VII. METEOROLOGIC STATION

a. Wind speed sensors must be calibrated annually to +/- 10%.

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.11

WASTE GAS MAPPING: LEVEL OF DETAIL NEEDED TO SHOW MAIN HEADERS AND PROCESS UNIT HEADERS

APPENDIX 1.11

WASTE GAS MAPPING:
LEVEL OF DETAIL NEEDED TO SHOW MAIN HEADERS AND PROCESS UNIT HEADERS

Purpose:

Waste Gas Mapping is required in order to identify the source(s) of waste gas entering each Covered Flare. Waste Gas Mapping can be done using instrumentation, isotopic tracing, acoustic monitoring, and/or engineering estimates for all sources entering a flare header (e.g. pump seal purges, sample station purges, compressor seal nitrogen purges, relief valve leakage, and other sources under normal operations). This Appendix outlines what needs to be included as the Waste Gas Mapping section within the Initial Waste Gas Minimization Plan ("Initial WGMP")

Waste Gas Mapping Criteria:

For purposes of waste gas mapping, a main header is defined as the last pipe segment prior to the flare knock out drum. Process unit headers are defined as pipes from inside the battery limits of each process unit that connect to the main header. For process unit headers that are greater than or equal to six (6) inches in diameter, flow ("Q") must be identified and quantified if it is technically feasible to do so. In addition, all sources feeding each process unit header must be identified and listed in a table, but not necessarily individually quantified. For process unit headers that are less than six (6) inches in diameter, sources must be identified, but they do not need to be quantified.

Waste Gas Mapping Submission Requirements:

For each Covered Flare, the following shall be included within the Waste Gas Mapping section of the Initial WGMP:

1. Simplified Schematic consistent with the example schematic included on the second page of this Appendix.

2. Table of all sources connected to each flare main header and process unit header consistent with the Table included on the third page of this Appendix.

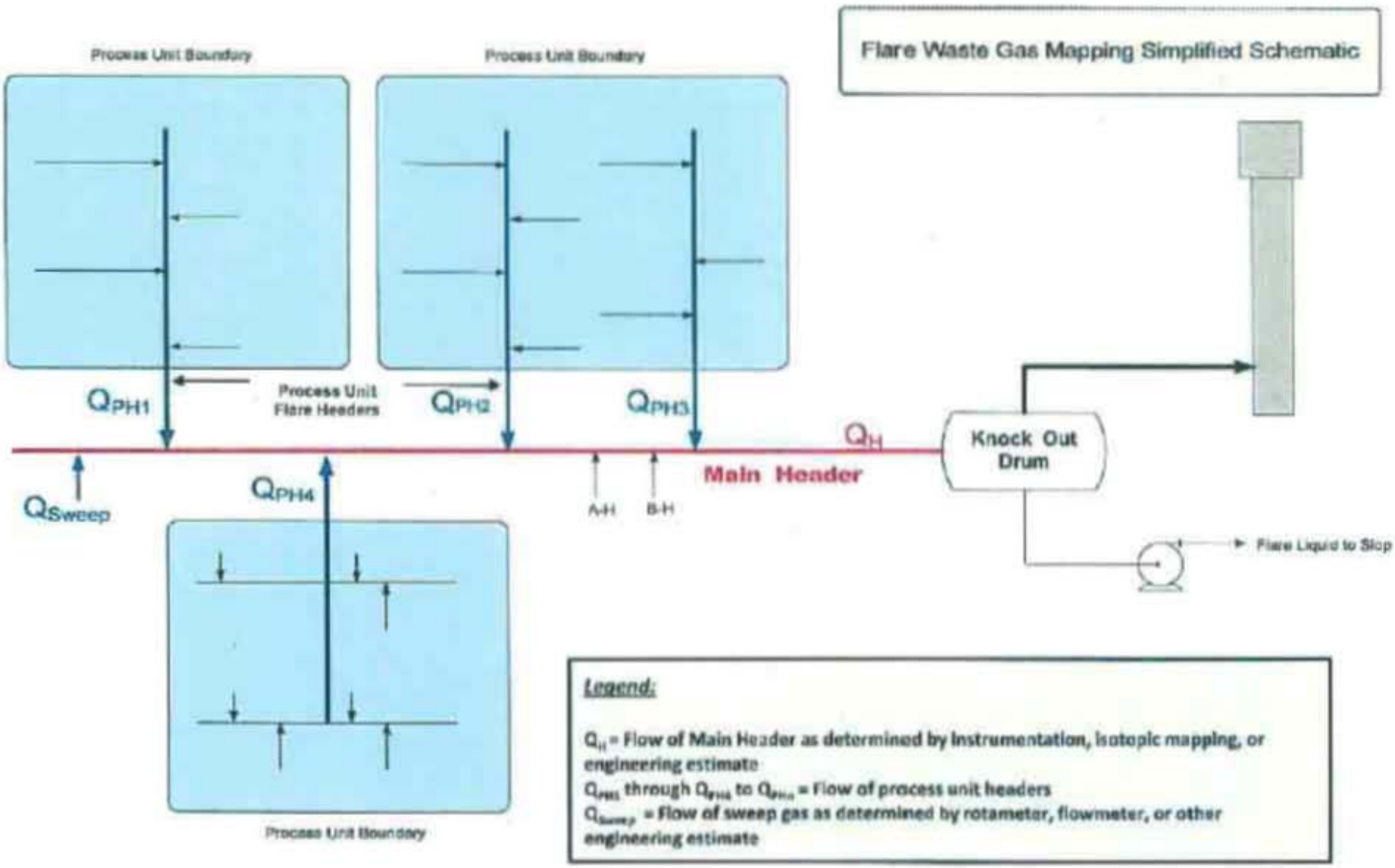

Flare Waste Gas Mapping Simplified Schematic
Process Unit Boundary
Process Unit Boundary
Q_{PH1}
Process Unit
Flare Headers
Q_{PH2}
Q_{PH3}
Q_H
Main Header
Knock Out
Drum
Q_{Sweep}
Q_{PH4}
A-H
B-H
Flare Liquid to Slop
Process Unit Boundary
Legend:
Q_H = Flow of Main Header as determined by instrumentation, isotopic mapping, or engineering estimate
Q_{PH1} through Q_{PH4} to Q_{PHn} = Flow of process unit headers
Q_{Sweep} = Flow of sweep gas as determined by rotameter, flowmeter, or other engineering estimate

Table 1: Example of Flare Source Description Table

Process Unit Header	Sources	Detailed Source Description
Q_{PH1} (Ex: FCCU Gas Con Unit)	3 PSVs	PSV-14 on 110-D-5 Gas Con Absorber PSV-12 on 110-D-1 Amine Scrubber PSV-7 on 110-F-1 Batch Caustic Vessel
	2 Pump Seal Purges	110-G-1 LPG Pump 110-G-2 Rich Amine Pump
	1 Sample Station	110-S-1 LPG
	1 PSV	PSV 17 on 112-D-1 Main Column
	1 Pressure Control Valve	PCV 21 – Emergency Wet Gas Compressor
	1 PSV	PSV-21 on Flush Oil Drum
	1 Pump Seal Purge	110-G-23 Slurry Oil Pump
Q_{PH2} (Ex: Gas Oil Treater)	Continue same as PH1	Continue same as PH1
Q_{PH3}	Continue same as PH1	Continue same as PH1
Q_{PH4}	Continue same as PH1	Continue same as PH1
A-H	1 PSVs	PSV-17 on 109-E-42 Slurry Heat Exchanger
B-H	2 Pump Seal Purges	110-G-3 Gas Oil Feed 110-G-4 Main Column Reflux

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.12

REPRESENTATIONS OF DISCONTINUOUS WAKE DOMINATED FLOW

APPENDIX 1.12

REPRESENTATIONS OF DISCONTINUOUS WAKE DOMINATED FLOW

Definition

"Discontinuous Wake Dominated Flow" shall mean gas flow exiting a Flare tip that is identified visually by:

i. The presence of a flame that is: (1) immediately adjacent to the exterior of the Flare tip body; and (2) below the exit plane of the Flare tip; and

ii. A discontinuous flame, such that pockets of flame are detached from the portion of the flame that is immediately adjacent to the exterior of the Flare tip body.

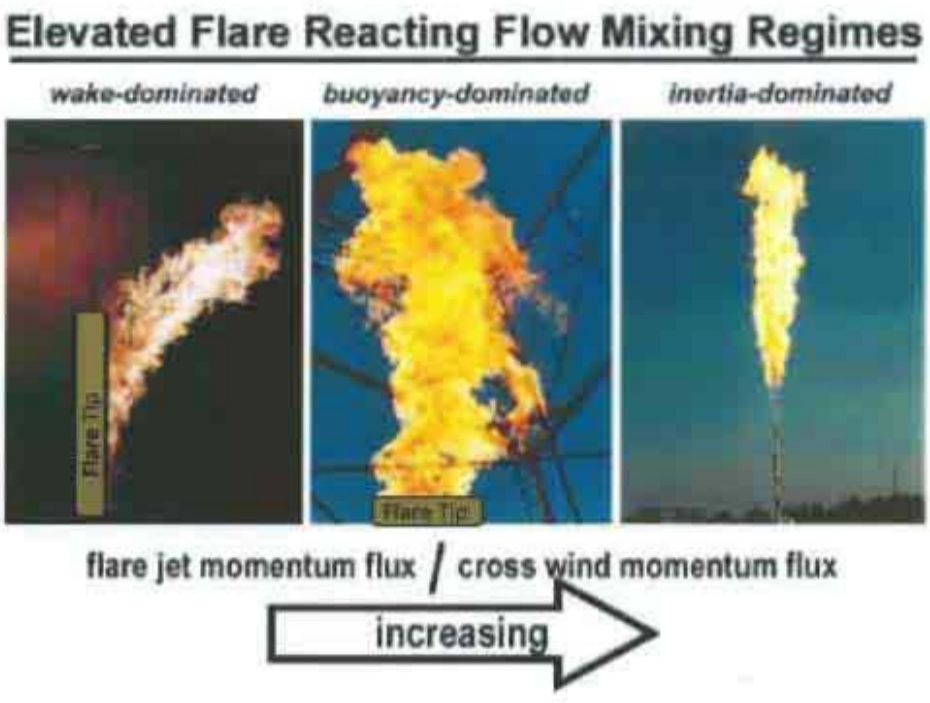
Background

The gases present just outside of the flare tip are influenced by several factors. All of these factors are present all of the time, but as process and environmental conditions change, the relative "strength" of each factor will change. The most dominant factors will dictate the flow of the Vent Gases, *i.e.*, will determine the size, shape, and direction of the flame. Some of the influences on the Vent Gases are:

- The low pressure region, or wake, that is downwind and next to the flare.
- The temperature gradient that causes the warm combustion gases to be buoyant, or rise.
- The inertia, or resistance to changes in speed and direction, of the Vent Gases as they exit the tip.

The regimes below show how a flame will appear when the most dominant influences are, respectively, the wake, the buoyancy due to temperature, and the inertia due to the gas's momentum.

APPENDIX 1.12



Images take from: Practical Implications of Prior Research on Today's Outstanding Flare Emissions Questions and a Research Program to Answer Them
James Seebold, ChevronTexaco (Retired)
Peter Gogolek, Natural Resources Canada
John Pohl, Virginia Polytechnic Institute and State University
Robert Schwartz, John Zink Company LLC

As a wake dominated flame becomes less stable, it becomes segmented, or discontinuous. The following is a representation of "Discontinuous Wake Dominated Flow." The red area is an artist's rendition of a flame.

APPENDIX 1.12

The following image represents a flame below the plane of the exit of the flare tip. However, since the flame is not discontinuous and not immediately adjacent to the tip, this image would not represent Discontinuous Wake Dominated Flow.

The following image represents a flame below the plane of the exit of the flare tip and attached to the tip. However, since the flame is not discontinuous, this image would not represent Discontinuous Wake Dominated Flow.

APPENDIX 1.12

In order for the flame to be deemed discontinuous, it should be segmented, and not merely possess small pockets of flame at the outer boundary of a single large cohesive flame. Furthermore, a discontinuous flame will normally appear thin relative to its length, and lack a single bulbous core. The following image represents a flame with a small pocket of flame only at the outer edges of the broad main flame. This would not represent a discontinuous flame, and therefore would not be Discontinuous Wake Dominated Flow.

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 1.13

CALCULATING THE AMOUNT OF STIPULATED PENALTIES DUE FOR VIOLATING LIMITATIONS OF FLARING WHEN THE STIPULATED PENALTIES ARE BASED ON EXCESS VOCS AND SO_2 EMITTED

APPENDIX 1.13

CALCULATING THE AMOUNT OF STIPULATED PENALTIES DUE FOR VIOLATING LIMITATIONS ON FLARING WHEN THE STIPULATED PENALTIES ARE BASED ON EXCESS VOCs AND SO_2 EMITTED

I. Stipulated Penalties for Violating the 30-Day Rolling Average Limit. The following equation shall be used to calculate the amount of stipulated penalties due for violating the 30-day rolling average limit on flaring:

$$\text{Penalty due} = \sum_{i=1}^{n} [\$\$_{30d,VOC} \times EE_{30d,VOC}] + [\$\$_{30d,SO2} \times EE_{30d,SO2}] \quad \textbf{(Eq. 1)}$$

Where:

n	=	Each day the 30-day rolling average limit is exceeded
$\$\$_{30d,VOC}$	=	Dollars per ton of VOC for violating the 30-day limit ($200/ton in an ozone attainment area; $300/ton in an ozone nonattainment area)
$EE_{30d,VOC}$	=	30-day average VOC emissions above the flow limit on day limit is violated; *see* Equation 3.a
$\$\$_{30d,SO2}$	=	Dollars per ton of SO_2 for violating 30-day limit ($100/ton)
$EE_{30d,SO2}$	=	30-day average SO_2 emissions above the flow limit on day limit is violated; *see* Equation 4.a

II. Stipulated Penalties for Violating the 365-day Rolling Average Limit. The following equation shall be used to calculate the amount of stipulated penalties due for violating the 365-day rolling average limit on flaring:

$$\text{Penalty due} = \sum_{i=1}^{n} [\$\$_{365d,VOC} \times EE_{365d,VOC}] + [\$\$_{365d,SO2} \times EE_{365d,SO2}] \quad \textbf{(Eq. 2)}$$

Where:

n	=	Each day the 365-day rolling average limit is exceeded
$\$\$_{365d,VOC}$	=	Dollars per ton of VOC for violating 365-day limit ($20/ton in an ozone attainment area; $30/ton in an ozone nonattainment area)
$EE_{365d,VOC}$	=	365-day average VOC emissions above the flow limit on day limit is violated; *see* Equation 3.b
$\$\$_{365d,SO2}$	=	Dollars per ton of SO_2 for violating 30 day cap ($10/ton)
$EE_{365d,SO2}$	=	365-day average SO_2 emissions above the flow limit on day limit is violated; *see* Equation 4.b

III. Calculating Average Emissions of VOCs Above the Flow Limit When Violating the 30-Day and 365-Day Rolling Average Limit

A. Violating the 30-day rolling average limit. The following equation shall be used to calculate the 30-day average VOC emissions above the flow limit for the day that the 30-day rolling average limit is violated:

$$EE_{30d,VOC} = [Q_{30d,actual} - Q_{30d,allowable}][VOC_{30d,vol\ fraction}]\ [.0026]\ [MW_{30d,VOC}]\ [.0005][1 - CE_{30d,as\ fraction}] \quad \textbf{(Eq. 3.a)}$$

Where:

$EE_{30d,VOC}$	=	30-day average VOC emissions above the flow limit on the day that the 30-day rolling average limit is violated, in tons per day
$Q_{30d,actual}$	=	Actual 30-day rolling average Waste Gas Flow Rate on the day that the 30-day rolling average limit is violated, in scfd
$Q_{30d,allowable}$	=	Allowable 30-day rolling average Waste Gas Flow Rate taken from the Consent Decree, in scfd
$VOC_{30d,vol\ fraction}$	=	30-day flow weighted rolling average VOC volume fraction in the Waste Gas on the day that the 30-day rolling average limit is violated. [NOTE: This is the VOC fraction in the Waste Gas, not the Vent Gas.] The daily flow weighted average VOC volume fraction shall be determined from an average of the hourly average VOC concentration weighted by waste gas flow. The 30-day flow weighted rolling average VOC volume fraction shall be determined from daily flow weighted CE and daily flow of waste gas.
.0026	=	1 lb-mole VOC/385.5 scf
$MW_{30d,VOC}$	=	30-day flow weighted rolling average Molecular Weight of VOCs on the day that the 30-day rolling average limit is violated, in lb/lb-mole. The daily flow weighted average molecular weight (MW) shall be determined from an average of the hourly average MW weighted by waste gas flow. The 30-day flow weighted rolling average MW shall be determined from daily flow weighted MW and daily flow of waste gas.
.0005	=	1 ton/2000 lb

$CE_{30d,as\ fraction}$ = 30-day rolling average Combustion Efficiency ("CE") determined from the NHV_{cz} of the Combustion Zone Gas as follows:

NHV_{cz} (BTU/scf)	$CE_{as\ fraction}$
$NHV_{cz} < 96$	0.0
$96 <= NHV_{cz} < 300$	$[0.12*(-95+ NHV_{cz})]/[1+0.12*(-95+ NHV_{cz})]$
$300 <= NHV_{cz} < 350$	0.98
$350 <= NHV_{cz} < 425$	0.985
$425 <= NHV_{cz} < 500$	0.9875
$500 <= NHV_{cz} < 600$	0.99
$600 <= NHV_{cz}$	0.995

Combustion Efficiency shall be determined hourly from the hourly average NHV_{cz} using the table above. The daily flow weighted average CE shall be determined from an average of the hourly average CE values weighted by waste gas flow. The 30-day flow weighted rolling average CE shall be determined from daily flow weighted CE and daily flow of waste gas.

B. **Violating the 365-day rolling average limit**. To calculate the 365-day average VOC emissions above the flow limit for the day that the 365-day rolling average limit is violated:

Substitute "365" everywhere "30" appears in Equation 3.a **(Eq. 3.b)**

[Appendix continued on next page]

APPENDIX 1.13

IV. Calculating the Average Emissions of SO_2 Above the Flow Limit when Violating the 30-Day and 365-Day Rolling Average Limit

A. Violating the 30-day rolling average limit. The following equation shall be used to calculate the 30-day average SO_2 emissions above the flow limit for the day that the 30-day rolling average limit is violated:

$$EE_{30d,SO2} = [Q_{30d,actual} - Q_{30d,allowable}] [C_{30d,H2S}/1,000,000] [8.30 \times 10^{-5}] \quad \textbf{(Eq. 4.a)}$$

Where:

$EE_{30d,SO2}$	=	30-day average SO_2 emissions above the flow limit on the day that the 30-day rolling average limit is violated, in tons per day
$Q_{30d,actual}$	=	Actual 30-day rolling average Waste Gas Flow Rate on the day that the 30-day rolling average limit is violated, in scfd
$Q_{30d,allowable}$	=	Allowable 30-day rolling average Waste Gas Flow Rate taken from the Consent Decree, in scfd
$C_{30d,H2S}$	=	30-day rolling average concentration of H_2S in Waste Gas on the day that the that the 30-day rolling average limit is violated, in ppmv
8.30×10^{-5}	=	[1 lb-mole H_2S/385.5 scf] [64 lb SO_2/lb-mole H_2S] [Ton/2000 lb]

B. Violating the 365-day rolling average limit. To calculate the 365-day average emissions of SO_2 above the flow limit for the day the 365-day rolling average limit is violated:

Substitute "365" everywhere "30" appears in Equation 4.a **(Eq. 4.b)**

[End of Appendix]

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 2.1

COVERED FLARES AND APPLICABILITY DATES FOR CERTAIN CONSENT DECREE REQUIREMENTS

APPENDIX 2.1 -- COVERED FLARES AND APPLICABILITY DATES FOR CERTAIN CONSENT DECREE REQUIREMENTS

FLARE (A)	FLARE DATA & MONITORING SYSTEMS AND PROTOCOL REPORT IN PARA.16 (B)	START-UP OF MONITORING SYSTEMS IN PARA. 17 (C)	INITIAL WASTE GAS MINIMIZATION PLAN IN PARA. 30 (D)	FIRST UPDATED WASTE GAS MINIMIZATION PLAN IN PARA. 31 (E)	REQUIREMENTS IN PARAGRAPH 41 (F)	WORK PRACTICE STANDARDS IN PARA. 43 (G)	EMISSIONS STANDARDS IN PARAGRAPHS 46-49 (H)	LIMITATIONS ON FLARING IN PARA. 39 (I)	SUBPART A, J, Ja COMPLIANCE IN PARA. 58-59 (J)
CANTON North 04-14-8-001	12.31.2012	06.30.2013	7.31.2014	7.31.2015	DOL	07.31.2013	06.30.2014	12.31.2016	12.31.2016
CATLETTSBURG New North Area 2-11-FS-2	N/A	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	06.30.2014	06.30.2016	06.30.2016
CATLETTSBURG HF Alkylation 2-11-FS-3	N/A	06.30.2013	7.31.2013	7.31.2014	DOL	07.31.2013	06.30.2014	06.30.2016	06.30.2016
CATLETTSBURG FCCU 2-11-FS-4	N/A	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	06.30.2016	06.30.2016
CATLETTSBURG Lube Petrochem 1-14-FS-3	N/A	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	06.30.2016	06.30.2016
DETROIT Crude 04FS-1	N/A	DOE + 30 days	7.31.2012	7.31.2013	DOL	DOE + 60 days	6.30.2013	06.30.2016	06.30.2016
DETROIT Unifier 07FS-1	N/A	DOE + 30 days	7.31.2012	7.31.2013	DOL	DOE + 60 days	6.30.2013	06.30.2016	06.30.2016
DETROIT Alkylation 09FS-1	N/A	DOE + 30 days	7.31.2012	7.31.2013	DOL	DOE + 60 days	6.30.2013	06.30.2016	06.30.2016
DETROIT CP 25FS-1	N/A	DOE + 30 days	7.31.2012	7.31.2013	DOL	DOE + 60 days	6.30.2013	06.30.2016	06.30.2016
DETROIT Coker 76ME801	12.31.2012	06.30.2013	7.31.2014	7.31.2015	06.30.2013	07.31.2013	06.30.2014	06.30.2016	06.30.2016
GARYVILLE North 69-74	DOE + 30 days	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	12.31.2016	12.31.2016
GARYVILLE South 83-74	DOE + 30 days	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	12.31.2016	12.31.2016
GARYVILLE GME North Ground 259-1401	DOE + 30 days	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	12.31.2016	12.31.2016
GARYVILLE GME South Ground 259-1402	DOE + 30 days	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	12.31.2016	12.31.2016
ROBINSON 84-F1	N/A	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	12.31.2016	12.31.2016
ROBINSON 84-F5	N/A	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	12.31.2016	12.31.2016
ROBINSON 84-F6	N/A	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	12.31.2016	12.31.2016
ROBINSON 84-F2	12/31/2012	06.30.2013	7.31.2014	7.31.2015	DOL	07.31.2013	06.30.2014	12.31.2016	12.31.2016
ROBINSON 84-F3	12/31/2012	06.30.2013	7.31.2014	7.31.2015	DOL	07.31.2013	06.30.2014	12.31.2016	12.31.2016
ROBINSON 84-F4	12/31/2012	06.30.2013	7.31.2014	7.31.2015	DOL	07.31.2013	06.30.2014	12.31.2016	12.31.2016
TEXAS CITY Main 84FL-001	6.30.2012	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	06.30.2016	06.30.2016
TEXAS CITY HF Alkylation 84FL-002	6.30.2012	DOE + 30 days	7.31.2013	7.31.2014	DOL	DOE + 60 days	6.30.2013	06.30.2016	06.30.2016

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 2.2

CALCULATING THE TOTAL STEAM MASS AND VOLUMETRIC FLOW RATES AS ADJUSTED BY THE STEAM CONTRIBUTION FACTOR AT THE TEXAS CITY MAIN FLARE

APPENDIX 2.2

CALCULATING THE TOTAL STEAM MASS AND VOLUMETRIC FLOW RATES AS ADJUSTED BYTHE STEAM CONTRIBUTION FACTOR FOR THE TEXAS CITY MAIN FLARE

Equation 1: ***"Non-Mixing Total Steam for Texas City Main Flare" or "$S_{non\text{-}mix/TC\text{-}MF}$":***

$$S_{non\text{-}mix/TC\text{-}MF} = -0.28 \times Ln(MFR) + 0.085$$

where:

Ln = *Natural Logarithm*

MFR = *Momentum Flux Ratio*

Equation 2: ***"Steam Contribution Factor for the Texas City Main Flare" or "$SCF_{TC\text{-}MF}$":***

$$SCF_{TC\text{-}MF} = 1 - S_{non\text{-}mix/TC\text{-}MF} \times \left(1 - \frac{\dot{m}_{s\text{-}cen}}{\dot{m}_S}\right)$$

And (by volume)

$$SCF_{TC\text{-}MF} = 1 - S_{non\text{-}mix/TC\text{-}MF} \times \left(1 - \frac{Q_{s\text{-}cen}}{Q_S}\right)$$

where:

$S_{non\text{-}mix/TC\text{-}MF}$ = *Non-Mixing Total Steam for Texas City Main Flare*

$\dot{m}_{s\text{-}cen}$ = *Center Steam Mass Flow Rate*

$Q_{s\text{-}cen}$ = *Center Steam Volumetric Flow Rate*

Equation 3: ***"Center Steam Mass Flow Rate" or "$\dot{m}_{s\text{-}cen}$":***

$$\dot{m}_{s\text{-}cen} = Q_{s\text{-}cen} \times (18/385.5)$$

Equation 4A: ***"Total Steam Mass Flow Rate as Adjusted by the Steam Contribution Factor for the Texas City Main Flare" or "$\dot{m}_{s\text{-}adj/TC\text{-}MF}$":***

$$\dot{m}_{s\text{-}adj/TC\text{-}MF} = \dot{m}_s \times SCF_{TC\text{-}MF}$$

where:

$\dot{m}_s$ = Total Steam Mass Flow Rate

$SCF_{TC\text{-}MF}$ = Steam Contribution Factor for the Texas City Main Flare

APPENDIX 2.2

Equation 4B: "Total Steam Volumetric Flow Rate as Adjusted by the Steam Contribution Factor for the Texas City Main Flare" or "$Q_{s\text{-}adj/TC\text{-}MF}$":

$$Q_{s\text{-}adj/TC\text{-}MF} = Q_s \times SCF_{TC\text{-}MF}$$

where:

Q_s = Total Steam Volumetric Flow Rate

$SCF_{TC\text{-}MF}$ = Steam Contribution Factor for the Texas City Main Flare

[End of Appendix 2.2]

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 2.3

OUTLINE OF PROTOCOL FOR PERFORMANCE OF PASSIVE FTIR TESTING AT ROBINSON FLARE 84-F1

APPENDIX 2.3

OUTLINE OF PROTOCOL FOR PERFORMANCE OF PASSIVE FTIR TESTING AT ROBINSON FLARE 84-F1

1.0 Test Objectives

2.0 Flare Performance Test
- 2.1 Overview
- 2.2 Test Descriptions
- 2.3 Test Condition Matrix

3.0 Procedure

4.0 Location

5.0 Data Collection
- 5.1 Test Run Log
- 5.2 PFTIR
- 5.3 Video

6.0 Stability of Flare

7.0 Wind Direction Impacts

Appendix A: PFTIR Operation and Calibration
- A.1 Operation
- A.2 Calibration

Appendix B: Camera Operation and Calibration
- B.1 Thermal – FLIR A320
- B.2 Visible – Axis Q1755
- B.3 Aiming Cameras

Appendix C: Visual Emissions Scale

[End of Appendix 2.3]

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 2.4

FLARE PERFORMANCE TEST PLAN FOR THE GME GROUND FLARE BURNERS AT THE GARYVILLE REFINERY

Marathon Petroleum Company, LP

Flare Performance Test Plan
for the
GME Ground Flare Burners
Garyville Refinery

Revision 0.9

January 9, 2012

Table of Contents

Introduction

Marathon Petroleum Company (MPC) has been engaged with the U.S. EPA since mid-2008 regarding enforcement initiatives on over-steaming of flares. As a result of this work, MPC has established an operating envelope to protect traditional steam-assisted elevated flares from operating less than 98% combustion efficiency. MPC will enter into a Flare Consent Decree with the United States, which covers all of MPC's flares, including the GME Ground Flares. For the Garyville Major Expansion (GME) Ground Flares, the objective of the Consent Decree will be to establish the proper over-steaming protection, as well as demonstrate that although the flares operate at higher exit velocities currently allowed by rule, they still achieve high combustion efficiency.

Garyville constructed two ground flares as part of the GME project in 2008 – 2009. The ground flares consist of multiple rows of stages, each having multiple burners per row. The first four (4) stages on each ground flare include steam-assist burners, while stages 5 and above are pressure-assist burners. The GME North Ground flare has a total of 10 stages, while the South Ground flare has a total of 8 stages. Each has an additional maintenance row. The first stage of each flare is always in service. The remaining stages are opened based upon pressure, with advanced programming logic that opens staging valves to successive stages. The steam-assisted burners are SKEC burners, and pressure-assisted burners are LRGO burners.

Figure 1: Left – SKEC Burner. Right – LRGO Burner.

The objective of the performance test is to develop an operating envelope for both the steam-assisted stages as well as examine flare performance on the pressure-assist stages at high velocity (i.e., >400 ft/sec). These style of burners perform better at higher pressure and higher velocities, and were not contemplated in early flare efficiency studies performed by CMA and EPA, which formed the basis of the exit velocity limitations in 40 CFR 60.18 and 63.11. Both the steam-assisted (SKEC) and pressure-assisted (LRGO) burners have the potential to operate with an exit velocity above the 400 ft/s limit for materials with heat content of 1,000 BTU/scf. Scenarios exist that will result in the steam-assisted burners on Stage 1 to be above the 400 ft/s velocity limit. The test will measure combustion efficiency (CE) at these higher velocities to ensure the flare continues to exhibit high CE under these conditions.

The test is planned to be conducted at the John Zink flare testing facility in Tulsa, Oklahoma. Site specific testing is not technically feasible, as the volumes of gases needed reach sonic velocity (in excess of ~1400 ft/s) on the SKEC steam-assisted and LRGO pressure-assisted burners can not be generated at the facility outside of an emergency related relief case such as a power-outage or emergency shutdown of the hydrocracker process unit.

Objective

The overall objectives of the project are as follows:

1. Demonstrate that the John Zink LRGO pressure-assisted and SKEC steam-assisted burners can achieve compliance with necessary combustion efficiency requirements at velocities greater than 400 ft/s.

2. Determine the minimum combustion zone net heating value (NHV_{CZ}) that will achieve necessary combustion efficiency requirements on the LRGO pressure-assisted burners.

3. Determine the proper steam-assisted operating envelope in terms of combustion zone net heating value (NHV_{CZ}) for the SKEC steam-assisted burners.

Test Location

MPC is proposing to conduct the test at the John Zink flare testing facility located in Tulsa, Oklahoma. In order to properly evaluate high exit velocity performance, it is necessary to operate both the SKEC and LRGO burners close to sonic velocity, or Mach 1 (~1400 ft/s for Tulsa Natural Gas). It is estimated that approximately 900 mmscfd of gas would be necessary in to order to perform the tests at the Garyville Refinery. The only scenarios that generate this volume of gas load to the GME Ground flares are emergency relief cases, such as a power outage or emergency shutdown of the hydrocracker process unit. In order to successfully conduct a burner performance test, it is necessary to withstand long periods of steady flow to the burners in a controlled fashion. Because only shutdown or malfunction events will generate the volumes of gas necessary, it is not technically feasible to conduct the test at the site.

Furthermore, the GME ground flares are open flare fields covering several acres. The GME North ground flare covers an area of more than 2 acres. The South Ground flare covers an area of 3 acres. Surrounding each flare is a 40-foot tall radiation fence. As detailed in two ground flare presentations at the recent American Flame Research Colloquium (AFRC) meeting, which took place in Houston, the air flow patterns in and around these types of flares are difficult to predict. Depending on wind speed and vent gas flow rate, burner plumes may be swirling or shifting significantly. This complicates the FTIR measurement.

The test set-up will be constructed in order to simulate the effects of having multiple burners together on a row. For each burner style tested, MPC is proposing to test a series of three similar burners on the same manifold. This will simulates the effect of multiple burners rather than the performance of a single burner.

Summary of Flare Instrumentation & Control System

John Zink Test Facility – Set Up

The flare test equipment to be used in the MPC test consists of a fuel supply system, fuel metering system, steam supply system, steam metering system, steam assisted flare tips, pressure assisted flare tips, fuel manifold, and a data acquisition system. The steam assisted flare tips are John Zink model SKEC. This tip design has a configuration for injecting steam around the perimeter of the fuel discharge. Three tips will be fired simultaneously from the same manifold. The manifold configuration allows adjustment to the spacing of these tips. The SKEC tips will have the same spacing as the SKEC tips installed at the ground flare. A single natural gas pilot is used on one of the end burners.

The pressure assisted flare tips are John Zink model LRGO. This tip design uses no assist media and achieves smokeless combustion by making efficient use of the available fuel pressure. The same manifold utilized for the SKEC burners will be used for the LRGO burners. The LRGO burners will be installed with the same spacing as Marathon LRGO burners. A single natural gas pilot will be used on one of the end burners. Note: Due to fuel limitations, only three burners will be installed on the manifold at any one time.

The John Zink data acquisition system (DAS) will automatically log the following parameters during each test at a 1 Hz sample frequency:

Parameter	Instrumentation
TNG Flow	Orifice Plate with pressure and temperature compensation
Nitrogen Flow	Orifice Plate with pressure and temperature compensation
Steam Flow	Ultrasonic flow meter w/ press. & temp. compensation
Flare Tip Fuel Pressure	Pressure Transmitter
Flare Tip Fuel Temp.	Thermocouple
Flare Tip Steam Pressure	Pressure Transmitter
Flare Tip Steam Temp.	Thermocouple
Wind Speed & Direction	Wind Monitor
Barometric Pressure	Barometric Pressure Sensor
Ambient Temperature	Temperature Element
Humidity	Weather Station

See attached P&IDs for test equipment configuration.

A gas analysis will be performed to validate fuel composition. A GC analysis service will be provided by a third-party testing company. The data from the GC analysis will be logged by the testing company's typical logging equipment and will not be included in the JZ data file.

Flare Performance Test

Flare Performance Test Philosophy & Objectives

The primary objective of the flare performance test is to demonstrate that the burners installed at the Garyville GME Ground Flares perform at a high level of combustion efficiency even at exit velocities greater than 400 ft/s. This performance test fulfills the requirements of Paragraph 36 of the Consent Decree. Passive FTIR will be utilized to measure the combustion efficiency during each test condition.

Test Procedure

Overview

A mixture of natural gas and nitrogen at various compositions and flow rates will be introduced into the flare as shown in Table 2. Six tests have been defined for this program as designated below. During each test condition the PFTIR will remotely analyze the resulting combustion gases in the flare plume to determine combustion efficiency. The result will be a defined flare operating envelope over a variety of conditions.

Test Sequencing

Each test series is conducted with a different test gas composition or flow rate. Within each test, the NHVcz or NHVvg will be varied as specified below and in Table 2. The objectives for each test are as follows:

Test SN1 Steam-assist burners. 100% Tulsa natural gas.

Objective 1: To determine the performance curve of the flare tip at the base load flow rate.

Objective 2: Establish steam baseline to compare with nitrogen dilution in Test SN2

Vent gas flow will be set at the typical base load flow rate (~4 ft/sec exit velocity). Vary steam assist. Initial test condition will be at the minimum steam rate (cooling steam rate). Subsequent test conditions will increase the steam rate to achieve successively lower NHVcz values until a combustion efficiency of <93% is measured. The steam rate which achieves <93% CE will be the final test condition of this series.

Test SN2 Steam-assist burners. 100% Tulsa natural gas/nitrogen mix

Objective: To determine if nitrogen dilution and steam dilution have the same effect on combustion efficiency.

In the velocity screening tests, both steam and nitrogen will be used to maintain a target NHVcz. This test determines whether our assumption that nitrogen and steam have equivalent effects is correct. NHVcz will be lowered by dilution with nitrogen in steps from 300 Btu/scf (minimum steam equivalent) to the point at which combustion efficiency drops below 93%. The curve from this test will be compared with the curve from SN1. There will be no replicate runs for this test.

Test VS1 Steam-assist burners. Velocity Screening Test

Objective: To identify a rough operating curve showing the 98% CE as a function of exit velocity and NHVcz.

This test will establish a rough operating region to be used for Test VS2. The test will begin at sonic velocity, 100% Tulsa natural gas (~900 Btu/scf), and no steam or nitrogen dilution (minimum steam off). NHVcz will be lowered in 100 Btu/scf increments through steam and/or nitrogen dilution until combustion efficiency (CE) drops below 98%. At this point, NHVcz will be held constant while exit velocity decreases in 100 fps increments. This will continue until CE rises above 98%. At this point, the cycle repeats – holding exit velocity constant and reducing NHVcz until the next "crossover" point then holding NHVcz constant and decreasing exit velocity. This procedure will be repeated until minimum (baseline) exit velocity is reached. At each point, the NHVcz and exit velocity will be "tuned" to dial in a more precise 98% CE point. The end result will be a series of points defining the 98% CE curve as a function of exit velocity and NHVcz. For this rough screening test, runs will be a minimum of 10 minutes in length with no replicates.

Test VS2 Steam-assist burners. Velocity Screening Test

Objective: To establish a robust operating curve showing the 98% CE as a function of exit velocity and NHVcz.

At each of the "crossover" points identified in Test VS1, full 20-minute test runs with replicates will be conducted. At several points, curve sensitivity will be determined by sampling at operating conditions slightly above and below the curve. The number of sensitivity points will be determined by how many crossover points are identified. Sensitivity points will be a minimum of 10 minutes with no replicates.

Test PA1 Pressure-assist burners. Tulsa natural gas / nitrogen mix.

Objective: To determine the minimum NHVcz that supports good combustion at sonic velocity.

Operation at maximum (sonic) velocity (~13 pounds pressure) at multiple vent gas NHVcz. Initial test condition will be 100% Tulsa natural gas (LHV = 906 Btu/scf). Subsequent test conditions will add nitrogen to the fuel to reach successively lower NHVcz values until a combustion efficiency of <93% is measured. The composition which achieves <93% CE will be the final mixture of this test series.

Test PA2 Pressure-assist burners. Tulsa natural gas / nitrogen mix.

Objective: To determine the minimum NHVcz that supports good combustion at minimum velocity.

Operation at minimum velocity (~4 pounds pressure) at multiple vent gas NHVcz. Initial test condition will be 100% Tulsa natural gas (LHV = 906 Btu/scf). Subsequent test conditions will add nitrogen to the fuel to reach successively lower NHVcz values until a combustion efficiency of <93% is measured. The composition which achieves <93% CE will be the final mixture of this test series.

A check will also be performed comparing piloted vs unpiloted burners to determine whether combustion efficiency differs significantly. Information from this test will be used to assure representative PFTIR sampling of the burner plumes.

Test Matrix

	SN1	SN2	VS1[3]	VS2[3]	PA1[4]	PA2[4]
Burner Type	SKEC	SKEC	SKEC	SKEC	LRGO	LRGO
VG Composition	100% TNG[1]	TNG[1]/N_2 mix	TNG[1]/N_2 mix	TNG[1]/N_2 mix	TNG[1]/N_2 mix	TNG[1]/N_2 mix
Fixed Parameter	Exit Velocity 4 ft/sec	Exit Velocity 4 ft/sec	N/A	N/A	Pressure ~13 lb	Pressure ~4 lb
Variable Parameter(s)	Steam Flow NHVcz	Nitrogen Flow NHVcz	Exit Velocity/ NHVcz	Exit Velocity/ NHVcz	Nitrogen flow NHVcz	Nitrogen flow NHVcz
Unit	Btu/scf	Btu/scf	ft/sec Btu/scf	ft/sec Btu/scf	Btu/scf	Btu/scf
Test Point 1	304	304	Mach 1 900 Btu/scf	1st crossover point	906	906
Test Point 2	250[3]	250[3]	See Test Description	2nd crossover point	800[3]	800[3]
Test Point 3	200[3]	200[3]	See Test Description	3rd crossover point	700[3]	700[3]
Test Point 4	150[3]	150[3]	See Test Description	4th crossover point	600[3]	600[3]
Test Point 5	100[3]	100[3]	See Test Description	5th crossover point	500[3]	500[3]
Test Point 6	50[3]	50[3]	See Test Description	6th crossover point	400[3]	400[3]

Notes:

1. Tulsa Natural Gas = 906 Btu/scf @ 68°F
2. Contingent on previous test point combustion efficiency ≥ 93%.
3. Total number of test points to be determined based on test results and may vary.
4. The combustion zone net heating value on the pressure assist burners will include the vent gas net heating value and any contribution from the pilots.

Table 2. Test Matrix

Test Procedure

Two PFTIR instruments will be used situated at 90° from the test manifold to allow for accurate plume sampling regardless of wind direction. Each instrument will be calibrated at the beginning and end of each test day.

The duration of each test run will be approximately 20 minutes (excluding time for PFTIR sky backgrounds). The PFTIR is capable of analyzing multiple spectra per minute. Therefore, 20 minutes per test condition provides ample time for a stable measurement at each test condition. Each test condition will be evaluated for data quality prior to moving to the next test. Each test condition will be replicated three times for a total test time at a specific test condition of 60 minutes. To the extent possible, replicates runs will be conducted on different days in order to capture any uncontrolled variation (e.g. wind).

A GC analysis will be performed prior to the start of the first replicate of a test condition. Once the GC analysis is complete, the test condition timer will start. Near the end of each test run another fuel composition analysis will be made to validate stable operation.

Once a test run is complete, the process conditions will be adjusted for the next test run and the procedure starts again. Each test will begin after a stable flow is achieved, the header has been purged with three volumes of gas and a GC analysis has validated fuel composition.

PFTIR data will be logged into the data acquisition system supplied by the PFTIR contractor. The reported values will constitute an average of several analytical cycles over each test period.

During each test, both vent gas and steam flow rates will be measured continuously. Determination of molecular weight of the flare gas will be provided by gas analysis.

A Long Term Stability (LTS) test will also be completed once each day under the same flare operating condition. The purpose of this test is to determine the repeatability of PFTIR measurements over an extended period. This test may also provide information on the effects of uncontrolled variables such as wind on the overall test result. Also, if possible, a relative accuracy check against a source with a CO_2/CO CEMS will be conducted prior to the start of testing.

If wind conditions allow a good view of the flare plume from both PFTIR instruments, data will be collected from both to allow a determination of method precision.

Data Collection

During the test program, the following operating parameters will be measured and reported in the test report:

Parameter	Unit	Frequency
TNG Mass Flow Rate	lb/hr	Continuous
Nitrogen Mass Flow Rate	lb/hr	Continuous
Steam Mass Flow Rate	lb/hr	Continuous
Flare Gas Pressure at Manifold	Psig	Continuous
Flare Gas Temperature at Manifold	°F	Continuous
Steam Pressure at manifold	Psig	Continuous
Steam Temperature at manifold	°F	Continuous
Meteorological Data	Various	Continuous
Flare Gas Composition (via GC)	vol %	Periodic
Flare Gas Composition (via flow meters)	vol %	Continuous
Flare Exit Velocity	fps	Continuous

Table 4. Operating Parameters Measured During Testing

In addition to the flare and steam operating parameters listed above, the following data will also be collected during the test program.

Video Record of Flare Flame

During the tests, video records will provide vital information related to the performance of the control system. Multiple video cameras will be used to record the appearances of the flare flame. Video cameras will be co-located with the IR cameras described as well as with the PFTIR. In this way, the video from the cameras will provide the same perspectives as the infrared optical devices, which will be useful in determining the control system performance as well as for any required trouble shooting. The camera located with the PFTIR will capture the view of the flare from the PFTIR perspective. All camera data will be captured and archived.

Local Weather Conditions

Weather conditions will be recorded for all tests. Weather data will be measured by facility weather stations currently existing at test facilities. Captured data will include:

- wind speed and direction
- ambient temperature
- atmospheric pressure
- humidity
- sky conditions (sunny/cloudy) by hand log

Appendix A: PFTIR Operation and Calibration

PFTIR Operation

Passive Fourier Transform Infrared (PFTIR) analysis operates on the principle of spectral analysis of thermal radiation emitted by hot gases.

In normal absorption spectroscopy, light is passed through a region containing gas to be analyzed and the transmitted light is spread out into a spectrum using an interferometer (FTIR) or a spectrometer. In this spectrum, the presence of specific compounds can be determined from the patterns of light absorbed while the compound's concentrations can be measured from the intensity of the patterns. The low energy of infrared light is absorbed my molecular species causing them to vibrate and rotate faster. Because each molecule consists of a unique structure of bound atoms, the patterns of infrared wavelengths (IR colors) absorbed by a molecule are also unique. These molecular "finger prints" are used in the infrared analysis of gases.

To monitor flares, standard absorption infrared spectroscopy could be used. However it is difficult to pass an infrared light beam through an elevated flare plume and then capture the transmission. Fortunately, a passive approach is possible. Passive means that no "active" infrared light source is used. Instead, the hot gases of the flare are the infrared source. The spectrometer is a receiver only. This approach is possible because the infrared radiation emitted by hot gases has the same patterns or fingerprints as their absorption spectrum does. Consequently, observing a flare with an infrared instrument allows for identification and quantification of species through emission spectroscopy just as absorption spectroscopy can. However, there is one main difference: the signature arising from a hot gas is proportional to the gases concentration AND to its temperature. To do emission or radiance measurements therefore, the temperature must be deduced in addition to the gas concentrations.

When a PFTIR is used as an emission monitor it is calibrated in absolute radiance units. This calibrates the output voltage of the instrument to the received power per unit area of source, per unit solid angle of observation, and per unit wavelength or wave number (watts/cm^2/steradian/wavenumber). This calibration uses a black body source. A Blackbody is an object that is perfectly absorbing throughout the infrared. If a body is perfectly absorbing, the Planck radiation law gives the power emitted by this body, when hot. This law states that the emission of a blackbody at a given absolute temperature, T, and wave number, ν, is given by:

$$N_{BB}(\nu,T) = \frac{2hc^2\nu^3}{e^{hc\nu/kT} - 1} \qquad (1)$$

Here h is Planck's constant, c the speed of light, and k Boltzmann's constant. This function looks like that shown in Figure B-1 at a temperature of 200 °C. As the

temperature rises, the peak of this function moves toward larger wave numbers (smaller wavelength) and it increases in intensity. For this reason, hotter objects will emit more in the short wavelengths or visible while cooler bodies emit in the longer wavelengths or the infrared.

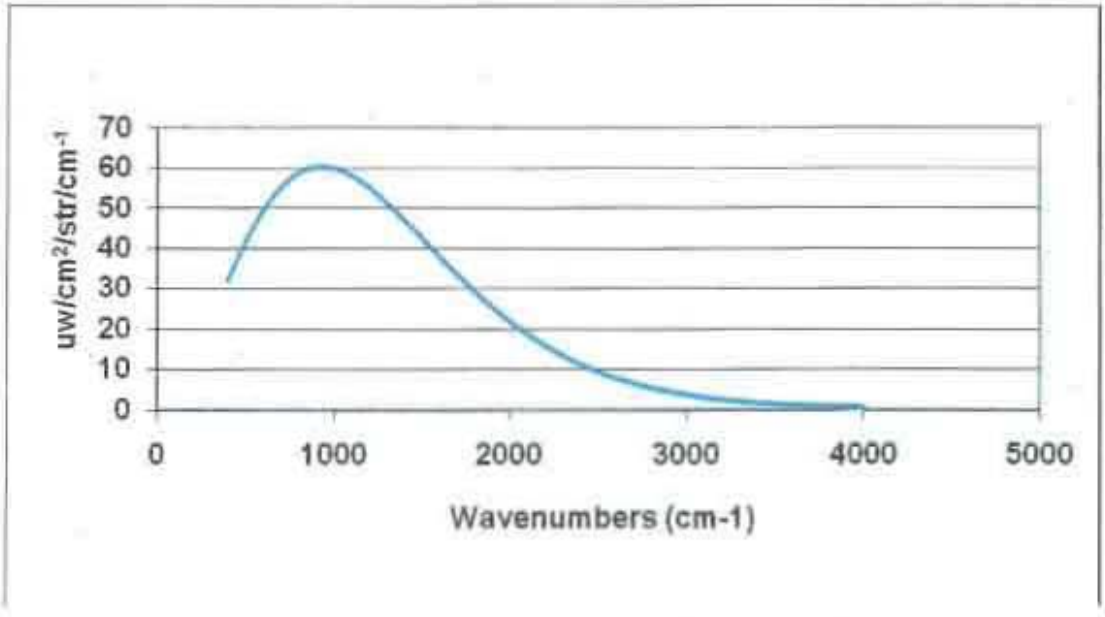


Figure B-1. Planck Function Showing the Radiation Emitted by a Blackbody at 200 °C

If a body is not "black" or totally absorbing, the energy it emits is just the Planck function times the body's absorption. For example, if the body is 50% absorbing it will emit 50% of the Planck function.

Gases have highly variable absorption with wavelength. It is in fact this variation that produces the absorption patterns that allow for their identification in the infrared. If the transmission of a gas is given by $\tau(\nu,T)$ then $[1 - \tau(\nu,T)]$ is the amount of absorption. The radiation the gas emits at temperature T is then given by:

$$N(\nu,T) = [1 - \tau(\nu,T)] * N_{bb}(\nu,T) \qquad (2)$$

For flare measurements, it is this signal that is being detected from the hot gases above the combustion zone.

However, there are also other contributions to the signal an analyzer "sees." As shown in Figure B-2, the background (typically the sky) has some emission, also defined by equation (2) that when transmitted through the plume and the intervening atmosphere is seen by the analyzer. The plume emissions transmitted through this same atmospheric

path provides the signal of interest. The intervening atmosphere itself has some emission, which is also seen by the analyzer. The total radiant signal received then consists of:

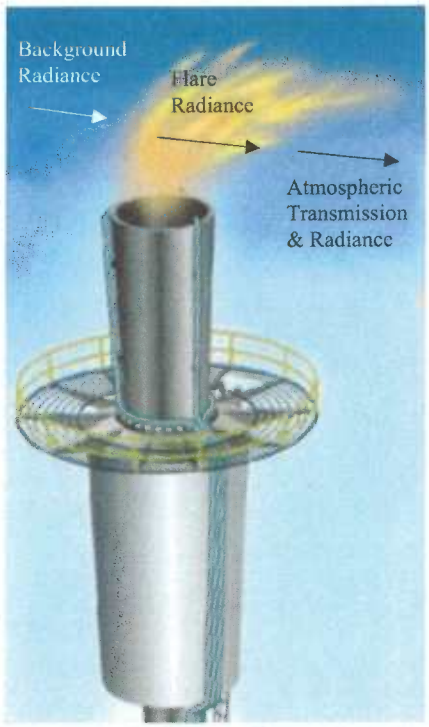


Figure B-2 Contributions to the measured flare radiance that must be accounted for.

$$N_{total} = N_{bkg} * \tau_{flr} * \tau_{atm} + N_{flr} * \tau_{atm} + N_{atm} + N_f \qquad (3)$$

In Equation (3) the arguments ν,T have been dropped for clarity and the individual terms are:

N_{total} = total radiance
N_{bkg} = background sky radiance
τ_{flr} = flare transmissivity
τ_{atm}= atmospheric transmissivity
N_{flr} = flare radiance
N_{atm}= atmospheric radiance
N_f = *radiance of the FTIR instrument itself*

The actual measurements performed by the PFTIR consist of the following:

M_{flr} = The measured plume radiance given by equation (3)
M_b = The measured background radiance taken by moving the PFTIR off the flare to monitor the sky background. This is given by

$$M_b = N_{bkg} * \tau_{atm} + N_{atm} + N_f$$

M_n = A measurement made looking at the calibration source (see below) with a cold (liquid nitrogen) emitter in place of the normal (black body)

M_{bb} = A measurement made looking at the calibration source with a commercial black body emitter in the source

τ_{atm} = Measured atmospheric path transmission

Based on these measurements Equation (3) can be rearranged to give the plume transmission as:

$$\tau_{flr} = \frac{C*(M_{flr} - M_n) - N_{BB}^{flr} * \tau_{atm}}{C*(M_b - M_n) - N_{BB}^{flr} * \tau_{atm}} \qquad (4)$$

In this equation, the superscript on the Planck function radiance (N_{BB}) denotes that this is the Planck function computed at the temperature of the flare. C is a calibration measurement made with a black body calibration source. The calibration source is a telescope identical to that of the PFTIR but with the capability of using various radiation sources. For C the radiation source is a commercial black body emitter. C then becomes the Planck function for the temperature of the black body divided by the measured radiance from the calibration source. This factor converts the FTIR voltages to radiance units and it is given by:

$$C = \frac{N_{BB}^{BB}}{(M_{bb} - M_n)} \qquad (5)$$

The measured black body radiance (M_{bb}) has the cold source measurement (M_n) subtracted to cancel emissions from the intervening air and/or the PFTIR instrument itself.

Atmospheric transmission τ_{atm} is also measured using the calibration source. In this case the black body is replaced by a standard infrared source and the measurement is made at a path length roughly equal to that of the slant-path from the PFTIR to the flare. Atmospheric transmission is then given by:

$$\tau_{atm} = \frac{M_{IR} - M_n}{I_0} \qquad (6)$$

M_{IR} is the measured signal from the calibration source using the IR source and M_n is the measured cold source as defined earlier. The only term not defined is I_0. This is the so-called synthetic background. It is frequently used in open-path FTIR measurements to convert a measured spectrum to transmission. It represents the shape of the spectrum that the PFTIR would measure if no gases were present. It can be synthesized from the (M_{IR} – M_n) measurement by doing a mathematical fit to points in the spectrum known to be free of molecular absorptions. An example is given in Figure B-3. In this Figure, the bottom plot is the measured spectrum (here a relatively clean spectrum done in the laboratory), the middle plot the points chosen for fitting, and the top plot the mathematical fit to the chosen points. The top plot is the I_o spectrum.

Figure B-3 An example of synthetic I_o generation from a measured spectrum.

With equations (5) and (6), equation (4) then contains only measured or computed terms. However, to compute the Planck function at the temperature of the flare

$$N_{BB}^{flr}$$

the flare gas temperature must be known. Fortunately, this can be measured using features in the PFTIR data itself. One convenient feature is the CO band near 2150 cm^{-1}. Figure B-4 shows this band at two different temperatures. The upper plot is at ambient temperature (300 K) and the bottom plot is at 550 K. The effect of increasing temperature is to expand the band shifting the peak position away from band center while increasing the strength of the weaker lines farther from band center. This is a sensitive function of temperature, so the shape of the band essentially measures temperature.

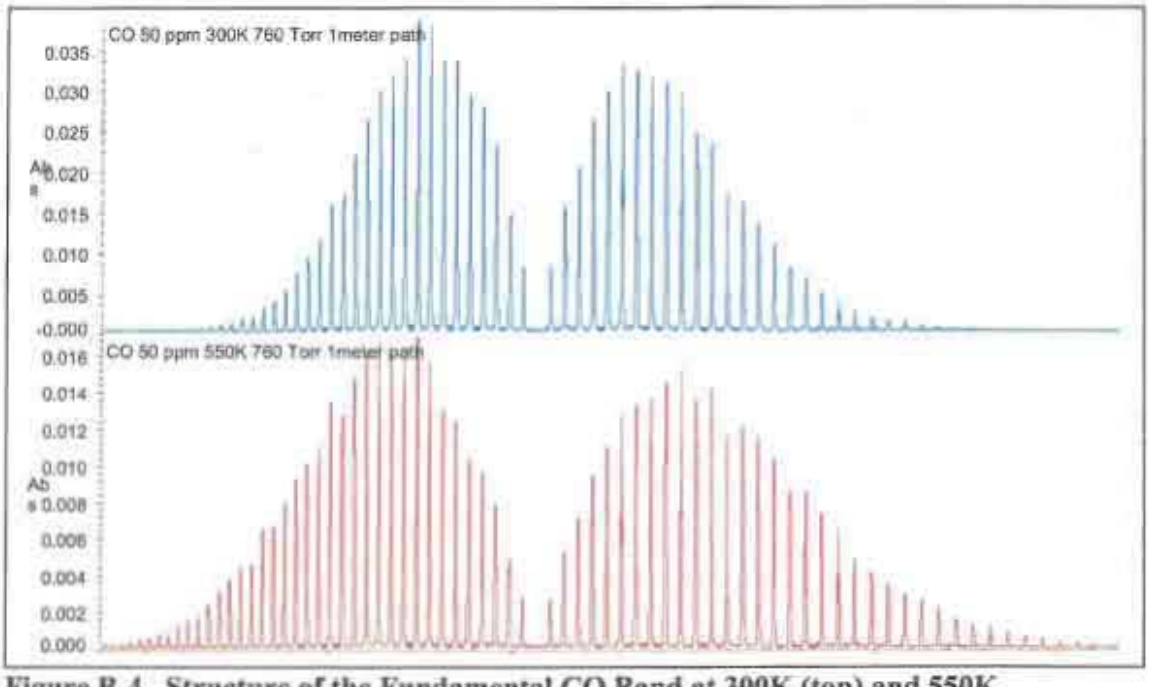


Figure B-4. Structure of the Fundamental CO Band at 300K (top) and 550K (bottom) Showing Alteration of Band Shape with Temperature

The CO lines arise (in emission) from a transition of the molecule from a higher vibration/rotation state to a lower one. The transitions are dictated by quantum mechanics. However, the intensities of the individual lines are strongly influenced by the number of molecules in the initial state available to make the transition. This "population" of the initial states is dictated by the Boltzmann distribution which is given by:

$$N_{J"} = N_0 \frac{2J"+1}{Q} \exp\left[\frac{-E"}{kT}\right] \qquad (7)$$

Here $N_{J"}$ is the number of molecules in the initial rotational state defined by the rotational quantum number J". N_0 is the total number of molecules available, E" the energy of the initial state, k Boltzmann's constant, T the absolute temperature, and Q a "partition sum." The partition sum is just the sum of the exponential term over all possible energy levels.

If the log of the measured intensity of the CO lines is plotted against the initial state energy, the plot is linear and its slope is proportional to

$$\frac{hc}{kT}$$

Where h is Planck's constant and c the speed of light. Temperature can therefore be determined by measuring the slope of the plot. An example of this process is shown in Figure B-5. In this case the temperature was 225° C and the group of lines to the left in Figure B-4 were used. These are defined as the R-branch lines of the CO band.

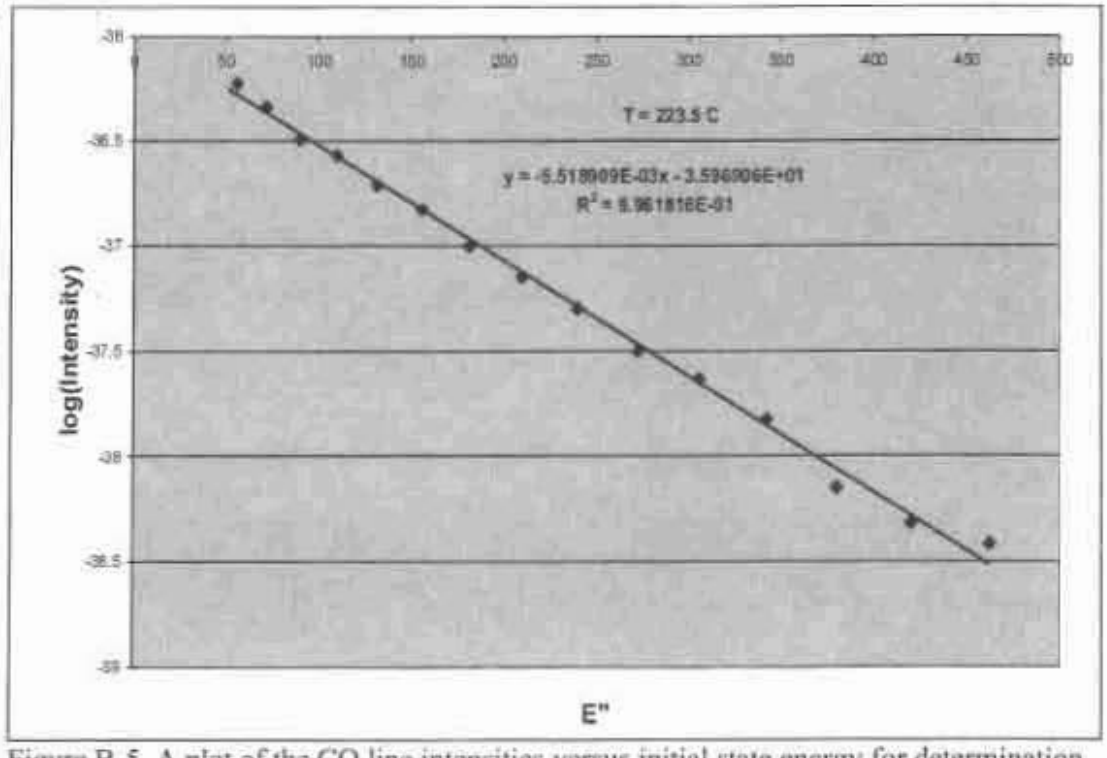


Figure B-5 A plot of the CO line intensities versus initial state energy for determination of gas temperature.

Given temperature, all terms in Equation 4 can be determined. Equation (4) represents the transmission spectrum, just as would be observed if an active FTIR were used and an IR beam propagated through the plume. As a result, the same algorithms used in normal spectroscopy can be used to analyze this transmission spectrum. As in normal absorption spectroscopy, the transmission is exponential in gas concentration. That is transmission is given by:

$$\tau_{plume} = e^{-K(\nu)*c*l} \qquad (8)$$

Where K(ν) is the absorption coefficient for the spectral line, c the gas concentration, and l the path length in the gas. Effectively K(ν) is the reference standard in the FTIR for the gas being monitored. Taking the negative log of this equation gives what is called Absorbance. That is:

$$\text{Absorbance}(\nu) = K(\nu) * c * l \qquad (9)$$

Absorbance is linear in concentration times path length and the absorbance spectrum is analyzed using standard Classical Least Squares[B-1] procedures to get the individual gas concentrations in the spectrum. To compute combustion efficiency, the concentrations of CO, CO2, and Total Hydrocarbon (THC) are used to compute:

$$Eff = \frac{[CO2]}{[CO2]+[CO]+[THC]+[soot]}$$

The remaining term, [soot], is the concentration of any soot present. If it is present at any significant concentration, it will be seen in the IR spectra as an attenuation of the signal with characteristic spectral shapes driven by particle size distribution. It is not believed that soot will be a significant issue in most well run flares but if it is present procedures can be developed to treat it.

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

APPENDICES TO CONSENT DECREE

APPENDIX 2.5

OUTLINE OF CONTENTS OF REPORTS FOR EMISSIONS AND FLARE COMBUSTION EFFICIENCY TESTING

APPENDIX 2.5

OUTLINE OF CONTENTS OF REPORTS FOR EMISSIONS AND FLARE COMBUSTION EFFICIENCY TESTING

1. Background and Summary

    1.1 Overview
    1.2 Results

2. Introduction

    2.1 Objectives of Test Program
    2.2 Testing Organization
    2.3 Flare System Components
        2.3.1 Purpose
        2.3.2 Flare Tip
        2.3.3 Flare Automatic Steam Control System
    2.4 Video Cameras
    2.5 Passive FTIR (or, if applicable, Active FTIR)
    2.6 Flare Test Program
        2.6.1 Steam Demand
        2.6.2 Test Conditions
        2.6.3 PFTIR Locations (or, if applicable, Active FTIR locations)
        2.6.4 Run Length and Replicates

3. Summary of Results

    3.1 Summary and Key Data Trends by Test Series
        3.1.1 Combustion Efficiency with Increasing Steam Rates
            3.1.2.1 Test Series A – Typical Base Load Conditions
            3.1.2.2 Test Series B – Refinery Fuel Gas
            3.1.2.3 Test Series C – Propylene Olefins

    3.2 Summary and Key Data Trends of Whole Data Set
        3.2.1 Composite of All Hydrocarbons Tested
        3.2.2 Visible Emissions and Combustion Efficiency

    3.3 Factors Influencing Test Results
        3.3.1 Run Lengths
        3.3.2 Wind Effects (only for Elevated Flares)
            3.3.2.1 Momentum Flux Ratio (only for Elevated Flares)
        3.3.3 PFTIR Aiming (if PFTIR testing was done)
        3.3.4 Overall Test Variability
            3.3.4.1 Long Term Stability
            3.3.4.2 Replicate Analysis

5.7 Long Term Stability Test
- 5.7.1 Process Conditions
- 5.7.2 Wind Conditions

6. Appendices (as necessary, modify these if the testing was done using Active FTIR)
- A.1 Calculations
- A.2 PFTIR Theory and Operation
- A.3 VOC Emissions Calculations
- A.4 Personnel Involved with Flare Performance Test
- A.5 Minute Data of Runs
- A.6 Video of Runs
- A.7 PFTIR Raw Data and Spectra
- A.8 Flare Visual Rating Data Sheets
- A.9 Gas Calibration Sheets for Field Hot Cell Checks

MPC shall modify this Outline as necessary to report the results of the testing that evaluates the emissions and Combustion Efficiency of the Garyville Ground Flares.

UNITED STATES
v.
MARATHON PETROLEUM COMPANY

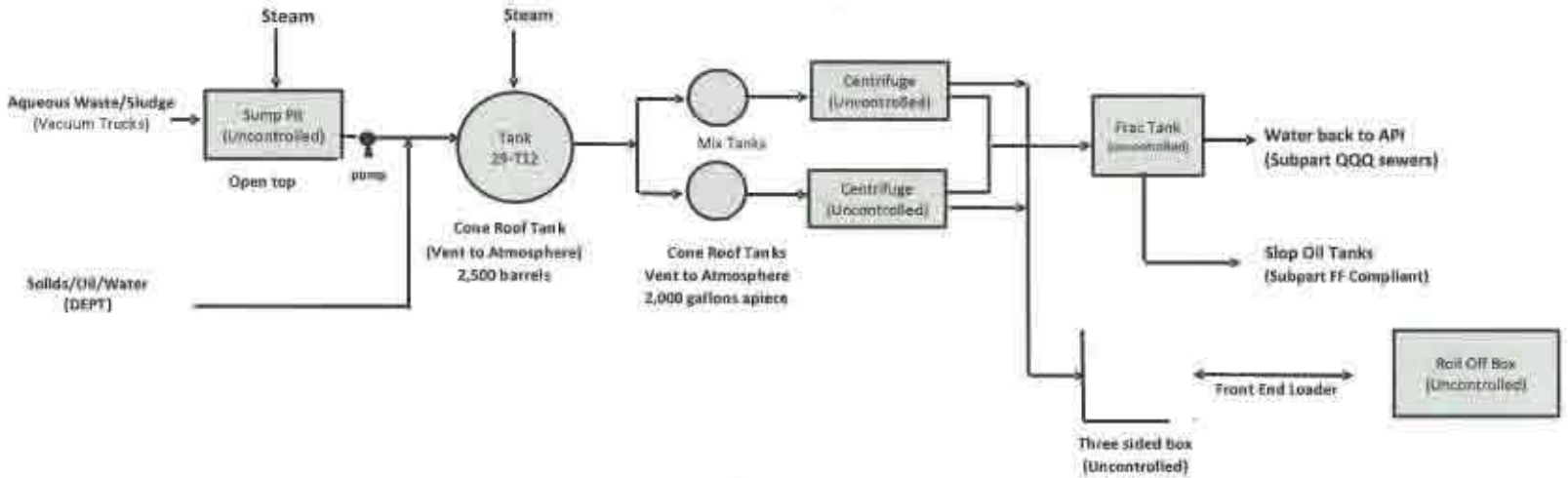
APPENDICES TO CONSENT DECREE

APPENDIX 2.6

MPC'S DETROIT REFINERY – SLUDGE HANDLING SYSTEM

Appendix 2.6
MPC's Detroit Refinery - Sludge Handling System

Existing System



Modifications