



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

AUG 30 2019

REPLY TO THE ATTENTION OF

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Kristin Reynolds
Equistar Chemicals, LP
625 East U.S. Highway 36
Tuscola, Illinois 61953

Re: Administrative Order EPA-5-19-113(a)-IL-07

Dear Ms. Reynolds:

Enclosed is an executed original of the Administrative Consent Order regarding the above captioned case. If you have any questions about the Order, please contact me at (312) 886-6073.

Sincerely,

A handwritten signature in black ink, appearing to read "D. Prentice", is written over a horizontal line.

Dakota Prentice, Acting Chief
Air Enforcement and Compliance Assurance Section (MN/OH)

Enclosure

cc: Susan Prout/C-14J
Julie Armitage, Chief, Bureau of Air, Illinois EPA

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5**

In the Matter of:	)	EPA-5-19-113(a)-IL-07
	)	
Equistar Chemicals, LP	)	Proceeding Under Sections 113(a)(3)
Tuscola, IL	)	114(a)(1) of the Clean Air Act, 42 U.S.C.
	)	§§ 7413(a)(1)(3) and 7414(a)(1)
_____	)	

Administrative Consent Order

1. The Director of the Enforcement and Compliance Assurance Division, U.S. Environmental Protection Agency (EPA), Region 5, is issuing this Order to Equistar Chemicals, LP (Equistar) under Sections 113(a)(1)(3) and 114(a)(1) of the Clean Air Act (CAA), 42 U.S.C. §§ 7413(a)(1)(3) and 7414(a)(1).

Statutory and Regulatory Background

2. Section 111(b) of the CAA, 42 U.S.C. § 7411(b) requires EPA to publish a list of categories of stationary sources and, within a year after the inclusion of a category of stationary sources in the list, to publish proposed regulations establishing Federal standards of performance for new sources within the source category.

3. Under Section 111 of the CAA, 42 U.S.C. § 7411, EPA proposed General Provisions to the New Source Performance Standards (NSPS Subpart A) on August 17, 1971. *See* 36 Fed. Reg. 15704. EPA promulgated NSPS Subpart A on December 23, 1971. *See* 36 Fed. Reg. 24877. The subpart has been subsequently amended. NSPS Subpart A is codified at 40 C.F.R. §§ 60.1 – 60.19.

4. 40 C.F.R. § 60.1(a) provides that, “[e]xcept as provided in subparts B and C, the provisions of this part apply to the owner or operator of any stationary source which contains an affected facility, the construction or modification of which is commenced after the date of

publication in this part of any standard (or, if earlier, the date of publication of any proposed standard) applicable to that facility.”

5. 40 C.F.R. § 60.11(d) requires that “at all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions.”

6. Under Section 111 of the CAA, 42 U.S.C. § 7411, EPA proposed Standards of Performance for Volatile Organic Liquid (VOL) Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction or Modification Commenced after July 23, 1984 (NSPS Subpart Kb) on July 23, 1984. *See* 49 Fed. Reg. 29698. EPA promulgated NSPS Subpart Kb on April 8, 1987. *See* 52 Fed. Reg. 11420. NSPS Subpart Kb has been subsequently amended. The subpart is codified at 40 C.F.R. §§ 60.110b – 60.117b.

7. Under Section 111 of the CAA, 42 U.S.C. § 7411, EPA proposed Standards of Performance for Volatile Organic Compound (VOC) Emissions From Synthetic Organic Chemical Manufacturing Industry (SOCMI) Distillation Operations (NSPS Subpart NNN) on December 30, 1983. *See* 48 Fed. Reg. 57538. EPA promulgated NSPS Subpart NNN on June 29, 1990. *See* 55 Fed. Reg. 26931. NSPS Subpart NNN has been subsequently amended. The subpart is codified at 40 C.F.R. §§ 60.660 – 60.668.

8. 40 C.F.R. § 60.660(b) identifies the affected facility covered by NSPS Subpart NNN, which includes any distillation unit that produces ethanol, along with its associated vent gas recovery system, for which construction, modification, or reconstruction commenced after December 30, 1983.

9. 40 C.F.R. § 60.660(c)(6) provides that “[e]ach affected facility operated with a vent stream flow rate less than 0.008 [standard cubic meters per minute (scm/min)] is exempt from all provisions of this subpart except for the test method and procedure and the recordkeeping and reporting requirements in §60.664(g) and paragraphs (i), (l)(5), and (o) of §60.665.”

10. 40 C.F.R. § 60.664(a) provides that “[f]or the purpose of demonstrating compliance with §60.662, all affected facilities shall be run at full operating conditions and flow rates during any performance test.”

11. Under Section 113(a)(3) of the CAA, 42 U.S.C. § 7413(a)(3), the Administrator of EPA may issue an order requiring compliance to any person who has violated or is violating the NSPS regulations. The Administrator has delegated this authority to the Director of the Enforcement and Compliance Assurance Division.

12. The Administrator of EPA may require any person who owns or operates an emission source to make reports and provide information required by the Administrator under Section 114(a)(1) of the CAA, 42 U.S.C. § 7414(a)(1). The Administrator has delegated this authority to the Director of the Enforcement and Compliance Assurance Division.

Findings

13. Equistar owns and operates a chemical manufacturing facility at 625 East U.S. Highway 36, Tuscola, Illinois.

14. The facility previously utilized, among other control equipment, two steam-assisted flares, formerly known as the East Flare and the West Flare, to control emissions from the Alcohol Plant at the Tuscola facility.

15. The East Flare was permanently removed from service in 2016. All permits for the East Flare have been surrendered and it is no longer being operated.
16. The remaining flare, formerly called the West Flare, is now called the Process Flare.
17. Equistar installed and operates the following equipment at the Process Flare:
 - a. A flow meter to measure steam flow;
 - b. An ultrasonic flow meter to measure vent gas flow;
 - c. A gas chromatograph (GC) to determine the composition and molecular weight of vent gas; and
 - d. A FTIR analyzer to measure the molecular weight of vent gas and control Steam and Supplemental gas addition rates.
18. The facility also includes a molecular sieve dehydration unit (MSDU), which includes a distillation column that produces ethanol. The MSDU was constructed in 1998.
19. On April 2, 2003, the facility conducted a performance test demonstrating that the vent stream flow rate from the MSDU was less than 0.008 standard cubic meters per minute (scm/min). During this test, the distillation column was operating at a feed rate of approximately 63 gallons per minute (gpm).
20. From January 2009 through July 2013, Equistar at times operated its distillation column at a monthly average feed rate greater than 63 gpm.
21. Thus, this performance test was not conducted at the maximum production rate as required by 40 C.F.R. §§ 60.664(a) and 60.665(o).
22. On February 17, 2015, Equistar conducted a performance test at a feed rate of 82 gpm which demonstrated that the vent stream flow rate from the MSDU was less than 0.008 scm/min.
23. Equistar also operates an ether surge drum storage tank (Dr-1277) which is subject to NSPS Subpart Kb. Prior to being permanently removed from service, the East Flare

was used as the control device for the ether surge drum storage tank pursuant to NSPS Subpart Kb and was subject to the requirements of NSPS Subparts A and Kb.

24. The manufacturer's manual for the East Flare states that "[a] yellow or orange flame is preferred to a clear flame. A clear or blue flame will typically indicate too much steam is being applied. In addition, the operator should ensure the flame is visible at the top of the flare tip."

25. Equistar's September 20, 2013 response to EPA's August 16, 2013 Section 114 Information Request included Document 2.27.6.1 – the facility's manual for normal operation of the East and West Flares (Document 2.27.6.1). Paragraph 29 of Document 2.27.6.1 instructs operators to operate the flares in a manner inconsistent with the instructions from the manufacturer on how to properly operate the flare, resulting in Equistar operating the flare with a low heating value and a transparent flame.

26. By failing to include procedures for its operators to look for the presence of a yellow or orange flame, as recommended by the manufacturer's manual, and intermittently allowing the flame to become transparent before reducing the steam flow to the flare tip, Equistar failed to operate the East Flare, when it was in service, in a manner consistent with good engineering practices to minimize emissions, in violation of 40 C.F.R. § 60.11(d).

27. As described in Paragraphs 14 - 16, 18, and 23, Equistar owns or operates an "emission source" within the meaning of Section 114 (a)(1) of the CAA, 42 U.S.C. § 7414(a)(1). Therefore, Equistar is subject to the requirements of Section 114(a)(1).

28. On June 30, 2014, EPA issued to Equistar a Finding of Violation (FOV) for violating 40 C.F.R. §§ 60.11(d), 60.664(a), and 60.665(o).

29. On August 12, 2014, representatives of Equistar and EPA discussed the June 30, 2014 FOV.

Compliance Program

30. This Order sets forth a program of compliance that Equistar agrees it shall follow to address the violations alleged in the June 30, 2014 FOV at its facility in Tuscola, Illinois. This program consists of:

- a. Definitions provided in Paragraph 31;
- b. Operation of equipment for improved Flare monitoring and control in accordance with Paragraphs 32 and 33;
- c. Operating limitations and requirements in Paragraph 34;
- d. Reporting and recordkeeping described in Paragraphs 35 and 36; and,
- e. Title V permit modification described in Paragraph 37.

31. The following definitions shall apply to this Order:

- a. "Administrative Consent Order" or "Order" or "ACO" means this Administrative Consent Order;
- b. "Equistar" or "Facility" means the Equistar Chemicals, LP, facility located in Tuscola, Illinois and its successors and assigns;
- c. "Calendar Semi-Annual Period" means either the first six-month period (January 1 to June 30) or the second six-month period (July 1 to December 31) of any calendar year;
- d. "Combustion Zone Gas" means all gases and vapors found just after a flare tip, which includes all flare vent gas, total steam, and premix air;
- e. "East Flare" shall mean Zeeco model QFS-16 steam-assisted flare with a 16-inch diameter which was permanently decommissioned in 2016;
- f. "EPA" means the United States Environmental Protection Agency and any of its successors departments or agencies;
- g. "Net Heating Value of Vent Gas" or "NHV_{vg}" shall mean the Net Heating Value, in BTU/scf, of the Vent Gas directed to a Flare, determined in accordance with Appendix 2;
- h. "Net Heating Value in the Combustion Zone" or "NHV_{cz}" shall mean the net heating value of the combination of waste gas, steam and any supplemental gas and assist gas, but excluding the pilot gas, present at the flare tip, calculated in accordance with Appendix 2;
- i. "Pilot Gas" means gas injected at a flare tip to maintain a flame;
- j. "Process Flare" shall mean the Zeeco model HCSX-20 steam-assisted flare with a 20-in diameter, previously termed the "West Flare," or any flare which replaces it;

- k. "Purge Gas" or "Sweep Gas" means all gas introduced prior to the Flare tip to protect against oxygen buildup in the Flare header and/or to maintain a constant flow of gas through the flare and out the tip;
- l. "Standard Conditions" means a temperature of 68 degrees Fahrenheit and a pressure of 1 atmosphere. Unless otherwise expressly set forth in this Administrative Consent Order, Standard Conditions shall apply;
- m. "Supplemental Gas" means all gas introduced to raise the heating value of Vent Gas;
- n. "Vent Gas" means all gases found just prior to the flare tip. This gas includes all Waste Gas, Purge Gas, Supplemental Gas, nitrogen and hydrogen, but does not include Pilot Gas or steam; and,
- o. "Waste Gas" means all gases routed to a flare for combustion, excluding Purge Gas, Supplemental Gas, Pilot Gas and steam.

32. As of the effective date of this Order, Equistar has surrendered all permits for the East Flare, and shall not operate the East Flare.

33. At the Process Flare, Equistar has already installed and shall continue to continuously operate the equipment identified in Paragraph 17 above consistent with the requirements outlined in Appendix 1. Equistar may replace the equipment identified in Paragraph 17 above so long as the replacement equipment meets the requirements outlined in Appendix 1.

34. No later than 180 days after the effective date of this Order, Equistar shall:

- a. Whenever the Process Flare is combusting Waste Gas, directly and continuously measure and record 15-minute block averages for the following parameters:
 - i. Waste Gas flow, Supplemental Gas flow, and assist gas flow, each in scfm;
 - ii. steam flow, in lb/hr;
 - iii. molecular weight of the Vent Gas sent to each Flare;
- b. Whenever the Process Flare is combusting Waste Gas, directly and continuously calculate and record 15-minute block averages, for the following parameters:
 - i. Waste Gas flow, Supplemental Gas flow, and assist gas flow, each in lb/hr;
 - ii. NHV_{vg} , in Btu/scf; and,
 - iii. NHV_{cz} of the Combustion Zone Gas at the Process Flare, in Btu/scf;
- c. Maintain the NHV_{cz} of the Combustion Zone Gas at Process Flare at no less than 270 Btu/scf, determined on a 15-minute block period basis in accordance

- with Appendix 2, whenever the Process Flare combusts Waste Gas for at least 15 minutes; and,
- d. Adjust and control the Supplemental Gas addition rate to the Process Flare to maintain the NHV_{cz} of the Combustion Zone Gas at or above 270 Btu/scf, determined on a 15-minute block period basis.

In calculating the values required in Paragraph 34, Equistar shall use the molecular weight determined by the GC, not the FTIR analyzer.

35. Equistar shall keep records of the following for the duration of this Administrative Order, until termination:

- a. 15-minute flow rates of Vent Gas and steam to the Process Flare and the 15-minute NHV_{cz} of the Process Flare;
- b. Summary of all 15-minute NHV_{cz} values below 270 Btu/scf. This summary shall include the 15-minute period, a reason why the NHV_{cz} fell below 270 Btu/scf and any corrective action taken to mitigate the low NHV_{cz} ; and,
- c. Periods of downtime of the equipment and instrumentation used to monitor and record the NHV_{cz} of Vent Gas.

These records shall be made available to EPA upon request.

36. Equistar shall submit semiannual compliance reports pursuant to this Order as follows:

- a. Each report shall cover a Calendar Semi-Annual Period, and shall be submitted before the end of the month following the Calendar Semi-Annual Period (for example, for the January 1 – June 30 Calendar Semi-Annual Period, the report must be submitted by July 31);
- b. Each semiannual report must contain the following:
 - i. For each 15-minute period in the covered Calendar Semi-Annual Period during which the NHV_{cz} at the Process Flare was less than 270 Btu/scf:
 1. Identify the date and time of the incident, and the total duration of the incident;
 2. Identify the cause of the incident and all corrective actions taken address the incident and prevent recurrence;
 - ii. For each period in the covered Calendar Semi-Annual Period during which downtime of the equipment and instrumentation used to monitor, record and/or calculate the NHV_{cz} of the Vent Gas occurred:
 1. Identify the date and time of the downtime, and the total duration of downtime;
 2. Identify the total duration of downtime during the reporting period as a percentage of total operating time of the Process Flare; and,

3. Identify the cause of the downtime and all corrective actions taken to address the downtime and prevent recurrence.
- iii. An update on the status of the Application required by Paragraph 37, below.

37. Equistar shall apply for a federally-enforceable Title I permit or permit modification that incorporates the applicable limitations and requirements that shall continue after the effective date of this Order. In particular, the requirements found in Paragraphs 34, 35, and 36 above shall be included in the Application. All supporting documentation required for the Application shall be included. The Application shall be made in accordance with applicable State of Illinois regulations. The Application shall be submitted to the Illinois EPA no later than 6 months after the effective date of this Order, and a copy shall be provided simultaneously to EPA. Equistar shall make a good faith effort to assist the Illinois EPA in permitting these changes and subsequently incorporating these changes into a Title I permit, where appropriate. Equistar shall not retract the application once it has been submitted.

38. Equistar must send all reports required by this Order to:

Attention: Compliance Tracker (AE-18J)
R5airenforcement@epa.gov

or:

Attention: Compliance Tracker (AE-18J)
Air Enforcement and Compliance Assurance Branch
U.S. Environmental Protection Agency, Region 5
77 W. Jackson Boulevard
Chicago, Illinois 60604

General Provisions

39. This Order does not affect Equistar's responsibility to comply with other federal, state, and local laws.

40. This Order does not restrict EPA's authority to enforce the CAA and its implementing regulations.

41. Failure to comply with this Order may subject Equistar to penalties of up to \$45,268 per day for each violation under Section 113 of the CAA, 42 U.S.C. § 7413, and 40 C.F.R. Part 19.

42. The terms of this Order are binding on Equistar, its assignees and successors. Equistar must give notice of this Order to any successors in interest prior to transferring ownership and must simultaneously verify to EPA, at the above address, that it has given the notice.

43. Equistar may assert a claim of business confidentiality under 40 C.F.R. Part 2, Subpart B, for any portion of the information it submits to EPA. Information subject to a business confidentiality claim is available to the public only to the extent allowed by 40 C.F.R. Part 2, Subpart B. If Equistar fails to assert a business confidentiality claim, EPA may make all submitted information available, without further notice, to any member of the public who requests it. Emission data provided under Section 114 of the CAA, 42 U.S.C. § 7414, is not entitled to confidential treatment under 40 C.F.R. Part 2, Subpart B. "Emission data" is defined at 40 C.F.R. § 2.301.

44. This Order is not subject to the Paperwork Reduction Act, 44 U.S.C. § 3501 *et seq.*, because it seeks collection of information by an agency from specific individuals or entities as part of an administrative action or investigation. To aid in our electronic recordkeeping efforts, please furnish an electronic copy on physical media such as compact disk, flash drive or other similar item. If it is not possible to submit the information electronically, submit the response to this Order without staples; paper clips and binder clips, however, are acceptable.

45. EPA may use any information submitted under this Order in an administrative, civil judicial, or criminal action.

46. Equistar agrees to the terms of this Order. Equistar waives any remedies, claims for relief, and otherwise available rights to judicial or administrative review that it may have with respect to any issue of fact or law set forth in this Order, including any right of judicial review under Section 307(b) of the CAA, 42 U.S.C. § 7607(b).

47. This Order is effective on the date of signature by the Director of the Enforcement and Compliance Assurance Division. This Order will terminate two years from the effective date, provided that Equistar has complied with all terms of the Order throughout its duration.

Equistar Chemicals, LP

8/6/2019

Date



Andrew (AJ) Wissinger, HSE Counsel
Equistar Chemicals, LP

United States Environmental Protection Agency

8-30-19
Date

Sara Brun
for Michael D. Harris
Acting Division Director
Enforcement and Compliance Assurance Division
U.S. Environmental Protection Agency, Region 5

CERTIFICATE OF MAILING

I certify that I sent the Administrative Consent Order, EPA-5-19-113(a)-IL-07, by certified mail, return receipt requested, to:

Kristin Reynolds
Equistar Chemicals, LP
625 East U.S. Highway 36
Tuscola, Illinois 61953

I also certify that I sent a copy of the Administrative Consent Order, EPA-5-19-113(a)-IL-07, by E- mail to:

Julie Armitage
Julie.Armitage@Illinois.gov

On the 11th day of September 2019.

Kathy Jones

Kathy Jones
Program Technician
AECAB, PAS

CERTIFIED MAIL RECEIPT
NUMBER:

7019 0140 0000 0722 3734

APPENDIX 1
Equistar Chemicals, LP, Tuscola, Illinois

APPENDIX 1:

INSTRUMENTATION ACCURACY AND CALIBRATION REQUIREMENTS

The purpose of this document is to outline the accuracy and calibration requirements of the instrumentation that will be used to measure process parameters related to the Process Flare.

Waste Gas, Vent Gas, Supplemental Gas and Assist Steam flow rate monitoring systems must be able to correct for the temperature and pressure of the system and provide calculated output parameters in standard conditions (i.e., a temperature of 20 °C (68 °F) and a pressure of 1 atmosphere).

Parameter	Minimum accuracy requirements	Calibration requirements
Temperature	±1 percent over the normal range of temperature measured, expressed in degrees Celsius (C), or 2.8 degrees C, whichever is greater	Conduct calibration checks at least annually; conduct calibration checks following any period of more than 24 hours throughout which the temperature exceeded the manufacturer's specified maximum rated temperature or install a new temperature sensor. At least quarterly, visually inspect all components for integrity and all electrical connections for continuity, oxidation, and galvanic corrosion, unless there is a redundant temperature sensor.
		Record the results of each calibration check and inspection.
		Locate the temperature sensor in a position that provides a representative temperature; shield the temperature sensor system from electromagnetic interference and chemical contaminants.
Flow Rate for All Flows Other Than Flare Vent Gas	±5 percent over the normal range of flow measured or 1.9 liters per minute (0.5 gallons per minute), whichever is greater, for liquid flow	Conduct a flow sensor calibration check at least biennially (every two years); conduct a calibration check following any period of more than 24 hours throughout which the flow rate exceeded the manufacturer's specified maximum rated flow rate or install a new flow sensor.
	±5 percent over the normal range of flow measured or 280 liters per minute (10 cubic feet per minute), whichever is greater, for gas flow	At least quarterly, visually inspect all sensor components for integrity and leakage and all electrical connections for continuity, oxidation, and galvanic corrosion, unless there is a redundant flow sensor.
	±5 percent over the normal range measured for mass flow	Record the results of each calibration check and inspection. Locate the flow sensor(s) and other necessary equipment (such as straightening vanes) in a position that provides representative flow; reduce swirling flow or abnormal

APPENDIX 1
Equistar Chemicals, LP, Tuscola, Illinois

		velocity distributions due to upstream and downstream disturbances.
Flare Vent Gas Flow Rate	± 20 percent of flow rate at velocities ranging from 0.03 to 0.3 meters per second (0.1 to 1 feet per second) ± 5 percent of flow rate at velocities greater than 0.3 meters per second (1 feet per second)	Conduct a flow sensor calibration and/or validation check at least biennially (every two years); conduct a calibration and/or validation check following any period of more than 24 hours throughout which the flow rate exceeded the manufacturer's specified maximum rated flow rate or install a new flow sensor. At least quarterly, visually inspect all sensor components for integrity and leakage and all electrical connections for continuity, oxidation, and galvanic corrosion, unless there is a redundant flow sensor.
		Record the results of each calibration and validation check and inspection.
		Locate the flow sensor(s) and other necessary equipment (such as straightening vanes) in a position that provides representative flow; reduce swirling flow or abnormal velocity distributions due to upstream and downstream disturbances.
Pressure	± 5 percent over the normal operating range or 0.12 kilopascals (0.5 inches of water column), whichever is greater	Review pressure sensor readings at least once a week for straightline (unchanging) pressure and perform corrective action to ensure proper pressure sensor operation if blockage is indicated. Using an instrument recommended by the sensor's manufacturer, check gauge calibration and transducer calibration annually; conduct calibration checks following any period of more than 24 hours throughout which the pressure exceeded the manufacturer's specified maximum rated pressure or install a new pressure sensor.
		At least quarterly, visually inspect all sensor components for integrity, all electrical connections for continuity, and all mechanical connections for leakage, unless there is a redundant pressure sensor.
		Record the results of each calibration check and inspection.
		Locate the pressure sensor(s) in a position that provides a representative measurement of the pressure and minimizes or eliminates pulsating pressure, vibration, and internal and external corrosion.
Net Heating Value by Calorimeter	± 2 percent of span	Specify calibration requirements in a site specific analyzer monitoring plan. Calibration requirements should follow manufacturer's recommendations at a minimum. Temperature control (heated and/or cooled as necessary)

APPENDIX 1
Equistar Chemicals, LP, Tuscola, Illinois

		the sampling system to ensure proper year-round operation.
		Where feasible, select a sampling location at least two equivalent diameters downstream from and 0.5 equivalent diameters upstream from the nearest disturbance. Select the sampling location at least two equivalent duct diameters from the nearest control device, point of pollutant generation, air in-leakages, or other point at which a change in the pollutant concentration or emission rate occurs.
Net Heating Value by Gas Chromatograph	As specified in Performance Specification 9 of 40 CFR part 60, appendix B	Follow the procedure in Performance Specification 9 (PS9) of 40 CFR part 60, appendix B, except that: 1) Appendix 3 of this ACO shall be used for the GC calibration requirements; and, 2) the sampling line temperature must be maintained at a minimum temperature of 60°C (rather than 120°C as noted in Section 6.2 of PS9).
Hydrogen analyzer	±2 percent over the concentration measured or 0.1 volume percent, whichever is greater	Specify calibration requirements in a site specific analyzer monitoring plan. Calibration requirements should follow manufacturer's recommendations at a minimum.
		Where feasible, select the sampling location at least two equivalent duct diameters downstream from and 0.5 equivalent duct diameters upstream from the nearest disturbance. Select the sampling location at least two equivalent duct diameters from the nearest control device, point of pollutant generation, air in-leakages, or other point at which a change in the pollutant concentration occurs.

APPENDIX 2
Equistar Chemicals, LP, Tuscola, Illinois

APPENDIX 2:
CALCULATING NET HEATING VALUE OF THE COMBUSTION ZONE GAS (NHV_{cz})

All abbreviations, constants, and variables are defined in the Key on Page 5 of this Appendix.

Step 1: Determine the Net Heating Value of the Vent Gas (NHV_{vg})

Equistar shall determine the concentration of individual components in the Vent Gas or shall directly monitor the Net Heating Value of the Vent Gas (NHV_{vg}) in compliance with one of the methods specified in Step 1.a–1.d. Equistar may elect to use different monitoring methods (of the methods provided in Step 1.a–1.d) for different gaseous streams that make up the Vent Gas provided the composition or Net Heating Value of all gas streams that contribute to the Vent Gas are determined.

- a. Install, operate, calibrate, and maintain a monitoring system capable of continuously measuring (i.e., at least once every 15 minutes), calculating, and recording the individual component concentrations present in the Vent Gas; or
- b. Install, operate, and maintain a grab sampling system capable of collecting an evacuated canister sample for subsequent compositional analysis at least once every eight hours while Waste Gas is being sent to the Flare. Subsequent compositional analysis of the samples must be performed according to Method 18 of 40 CFR Part 60, Appendix A-6, ASTM D6420-99 (Reapproved 2010), ASTM D1945-03 (Reapproved 2010), ASTM D1945-14, or ASTM UOP539-12; or
- c. Install, operate, calibrate, and maintain a calorimeter capable of continuously measuring, calculating, and recording the NHV_{vg} at standard conditions. If Equistar elects this method, Equistar may, at its discretion, install, operate, calibrate, and maintain a monitoring system capable of continuously measuring, calculating, and recording the hydrogen concentration in the Vent Gas; or
- d. Direct compositional or Net Heating Value monitoring is not required for purchased (“pipeline quality”) natural gas streams. The Net Heating Value of purchased natural gas streams may be determined using annual or more frequent grab sampling at any one representative location. Alternatively, the Net Heating Value of any purchased natural gas stream can be assumed to be 920 BTU/scf with a molecular weight of 16.85 grams per gram mol (g/mol).

Equistar shall determine the Net Heating Value of the Vent Gas (NHV_{vg}) based on composition monitoring data on a 15-minute block average basis according to the following requirements. If Equistar monitors separate gas streams that combine to comprise the total vent gas flow to the Process Flare, the 15-minute block average Net Heating Value shall be determined separately for each measurement location according to the following requirements and a flow-weighted average of the gas stream Net Heating Values shall be used to determine the 15-minute block average Net Heating Value of the cumulative Vent Gas. The NHV_{vg} 15-minute block averages shall be calculated for set 15-minute time periods starting at 12 midnight to 12:15 AM, 12:15 AM to 12:30 AM and so on, concluding at 11:45 PM to midnight.

Step 1a: Equation or Output to be Used to Determine NHV_{vg} at a Measurement Location

APPENDIX 2
Equistar Chemicals, LP, Tuscola, Illinois

For any gas stream for which Equistar complies with the NHV_{cz} requirements of the Order by collecting compositional analysis data in accordance with the method set forth in Step 1.a–1.b:

Equation 1 shall be used to determine the NHV_{vg} of a specific sample by summing the Net Heating Value for each individual component by individual component volume fractions. Individual component Net Heating Values may be obtained from Table 12 to 40 C.F.R. Part 63, Subpart CC. If a component of interest is not listed in Table 12 of 40 C.F.R. Part 63, Subpart CC, the heats of combustion may be determined using any published values where the net enthalpy per mole of offgas is based on combustion at 25°C and 1 atmosphere (or constant pressure) with offgas water in the gaseous state, but the standard temperature for determining the volume corresponding to one mole of vent gas is 20°C.

$$NHV_{vg} = \sum_{i=1}^n (x_i \cdot NHV_i) \quad \text{Equation 1}$$

For any gas stream for which Equistar complies with the NHV_{cz} requirements of the Order by collecting direct Net Heating Value monitoring data in accordance with the method set forth in Step 1.c but for which a Hydrogen Concentration Monitor is not used: Use the direct output (measured value) of the monitoring system(s) (in BTU/scf) to determine the NHV_{vg} for the sample.

For any gas stream for which Equistar complies with the NHV_{cz} requirements of the Order by collecting direct Net Heating Value monitoring data in accordance with the method set forth in Step 1.c and for which a Hydrogen Concentration Monitor is also used: Equation 2 shall be used to determine the NHV_{vg} for each sample measured via the Net Heating Value monitoring system. Where hydrogen concentration data is collected, Equation 2 performs a net correction for the measured heating value of hydrogen since the theoretical Net Heating Value for hydrogen is 274 Btu/scf, but for the purposes of this Consent Decree, a Net Heating Value of 1,212 Btu/scf may be used ($1,212 - 274 = 938$ BTU/scf).

$$NHV_{vg} = NHV_{measured} + 938x_{H2} \quad \text{Equation 2}$$

Step 1b: Calculation Method to be Used in Applying Equation/Output to Determine NHV_{vg}

If Equistar complies with the NHV_{cz} requirements of the Order by using a continuous monitoring system in accordance with the method set forth in Step 1.a–1.b: Equistar may elect to determine the 15-minute block average NHV_{vg} using either the Feed-Forward Calculation Method or the Direct Calculation Method (both described below). Equistar need not elect to use the same methodology at all Process Flares with a continuous monitoring system; however, for each such Process Flare, Equistar must elect one calculation method that will apply at all times, and use that method for all continuously monitored flare vent streams associated with that Process Flare. If Equistar intends to change the calculation method that applies to the Process Flare, Equistar must notify the EPA 30 days in advance of such a change.

APPENDIX 2
Equistar Chemicals, LP, Tuscola, Illinois

Feed-Forward Calculation Method. When calculating NHV_{vg} for a specific 15-minute block:

1. Use the results from the first sample collected during an event (for periodic Vent Gas flow events) for the first 15-minute block associated with that event.
2. If the results from the first sample collected during an event (for periodic Vent Gas flow events) are not available until after the second 15-minute block starts, use the results from the first sample collected during an event for the second 15-minute block associated with that event.
3. For all other cases, use the results that are available from the most recent sample prior to the 15-minute block period for that 15-minute block period for all Vent Gas streams. For the purpose of this requirement, use the time that the results become available rather than the time the sample was collected. For example, if a sample is collected at 12:25 AM and the analysis is completed at 12:38 AM, the results are available at 12:38 AM and these results would be used to determine compliance during the 15-minute block period from 12:45 AM to 1:00 AM.

Direct Calculation Method. When calculating NHV_{vg} for a specific 15-minute block:

1. If the results from the first sample collected during an event (for periodic Vent Gas flow events) are not available until after the second 15-minute block starts, use the results from the first sample collected during an event for the first 15-minute block associated with that event.
2. For all other cases, use the arithmetic average of all NHV_{vg} measurement data results that become available during a 15-minute block to calculate the 15-minute block average for that period. For the purpose of this requirement, use the time that the results become available rather than the time the sample was collected. For example, if a sample is collected at 12:25 AM and the analysis is completed at 12:38 AM, the results are available at 12:38 AM and these results would be used to determine compliance during the 15-minute block period from 12:30 AM to 12:45 AM.

If Equistar complies with the NHV_{oz} requirements of the Order by using a grab sampling system in accordance with the method set forth in Step 1.b: Equistar shall use the analytical results from the first grab sample collected for an event for all 15-minute periods from the start of the event through the 15-minute block prior to the 15-minute block in which a subsequent grab sample is collected. Equistar shall use the results from subsequent grab sampling events for all 15-minute periods starting with the 15-minute block in which the sample was collected and ending with the 15-minute block prior to the 15-minute block in which the next grab sample is collected. For the purpose of this requirement, use the time the sample was collected rather than the time the analytical results become available.

Step 2: Determine Volumetric Flow Rates of Gas Streams

Equistar shall determine the volumetric flow rate in standard cubic feet (scf) of vent gas, along with the volumetric flow rates (in scf) of any Supplemental Gas, assist steam, and premix assist air, over a 15-minute block average basis. The 15-minute block average volumetric flow rates shall be calculated for set 15-minute time periods starting at 12 midnight to 12:15 AM, 12:15 AM to 12:30 AM and so on, concluding at 11:45 PM to midnight.

For any gas streams for which Equistar complies with Paragraph 33 by using a monitoring system that directly records volumetric flow rate: Use the direct output (measured value) of the monitoring

APPENDIX 2
Equistar Chemicals, LP, Tuscola, Illinois

system(s) (in scf), as corrected for the temperature and pressure of the system to standard conditions (i.e., a temperature of 20 °C (68 °F) and a pressure of 1 atmosphere) to then calculate the average volumetric flow rate of that gas stream for the 15-minute block period.

For Vent Gas, assist steam, or premix assist air gas streams for which Equistar complies with Paragraph 33 by using a mass flow monitor to determine volumetric flow rate: Equation 3 shall be used to determine the volumetric flow rate of Vent Gas, premix assist air, or assist steam by converting mass flow rate to volumetric flow at standard conditions (i.e., a temperature of 20 °C (68 °F) and a pressure of 1 atmosphere). Equation 3 uses the molecular weight of the gas stream as an input to the equation; therefore, if Equistar elects to use a mass flow monitor to determine volumetric flow rate of Vent Gas, Equistar must collect compositional analysis data for such Vent Gas in accordance with the method set forth in Step 1.a or 1.b. For assist steam, use a molecular weight of 18 pounds per pound-mole. For assist air, use a molecular weight of 29 pounds per pound-mole. The converted volumetric flow rates at standard conditions from Equation 3 shall then be used to calculate the average volumetric flow rate of that gas stream for the 15-minute block period.

$$Q_{vol} = \frac{Q_{mass} * 385.3}{MW_t} \quad \text{Equation 3}$$

For gas streams for which the molecular weight of the gas is known and for which Equistar complies with Paragraph 33 by using continuous pressure/temperature monitoring system(s): Use appropriate engineering calculations to determine the average volumetric flow rate of that gas stream for the 15-minute block period. For assist steam, use a molecular weight of 18 pounds per pound-mole. For assist air, use a molecular weight of 29 pounds per pound-mole. For Vent Gas, molecular weight must be determined by collecting compositional analysis data for such Vent Gas in accordance with the method set forth in Step 1.a or 1.b.

Step 3: Calculate the Net Heating Value of the Combustion Zone Gas (NHV_{cz})

If: 1) the Feed-Forward Calculation Method is used; 2) gas composition or Net Heating Value monitoring is performed in a location representative of the cumulative vent gas stream; and 3) Supplemental Gas flow additions to the flare are directly monitored: Equation 4 shall be used to determine the 15-minute block average NHV_{cz} based on the 15-minute block average vent gas, supplemental gas, and assist gas flow rates.

$$NHV_{cz} = \frac{(Q_{vg} - Q_{NG2} + Q_{NG1}) * NHV_{vg} + (Q_{NG2} - Q_{NG1}) * NHV_{NG}}{Q_{vg} + Q_s + Q_{a,premix}} \quad \text{Equation 4}$$

For the first 15-minute block period of an event, Q_{NG1} shall use the volumetric flow value for the current 15-minute block period (i.e. $Q_{NG1} = Q_{NG2}$). NHV_{NG} shall be determined using one of the following methods: 1) direct compositional or Net Heating Value monitoring of the natural gas stream in accordance with Step 1; or 2) for purchased (“pipeline quality”) natural gas streams, Equistar may elect to

APPENDIX 2
Equistar Chemicals, LP, Tuscola, Illinois

either: a) use annual or more frequent grab sampling at any one representative location; or b) assume a Net Heating Value of 920 BTU/scf and a molecular weight of 16.85 g/mol.

Otherwise: Equation 5 shall be used to determine the 15-minute block average NHV_{cz} based on the 15-minute block average vent gas and assist gas flow rates. For periods when there is no Assist Steam flow or Premix Assist Air flow, $NHV_{cz} = NHV_{vg}$.

$$NHV_{cz} = \frac{Q_{vg} * NHV_{vg}}{Q_{vg} + Q_s + Q_{a,premix}} \quad \text{Equation 5}$$

Step 4: Ensure that during flare operation, $NHV_{cz} \geq 270$ BTU/scf

The Process Flare must be operated to ensure that NHV_{cz} is equal to or above 270 BTU/scf, as determined for each 15-minute block period when Supplemental, Sweep, and/or Waste Gas is routed to the Process Flare for at least 15-minutes. Equation 6 shows this relationship.

$$NHV_{cz} \geq 270 \text{ BTU/scf} \quad \text{Equation 6}$$

APPENDIX 2
Equistar Chemicals, LP, Tuscola, Illinois

Key to the Abbreviations:

385.3 = conversion factor (scf/lb-mol)

i = individual component in Vent Gas (unitless)

MW_t = molecular weight of the gas at the flow monitoring location (lb/lb-mol)

n = number of components in Vent Gas (unitless)

NHV_{cz} = Net Heating Value of Combustion Zone Gas (BTU/scf)

NHV_i = Net Heating Value of component i according to Table 1 of this Appendix (BTU/scf)

$NHV_{measured}$ = Net Heating Value of Vent Gas stream as measured by monitoring system (BTU/scf)

NHV_{NG} = Net Heating Value of Supplemental Gas to flare during the 15 – minute block period (BTU/scf)

NHV_{vg} = Net Heating Value of Vent Gas (BTU/scf)

$Q_{a,premix}$ = cumulative vol flow of premix assist air during the 15 – minute block period (scf)

Q_{mass} = massflow rate (pounds per second)

Q_{NG1} = cumulative vol flow of Supplemental Gas to flare during previous 15 – minute block period (scf)

Q_{NG2} = cumulative vol flow of Supplemental Gas to flare during the 15 – minute block period (scf)

Q_s = cumulative vol flow of Total Steam during the 15 – minute block period (scf)

Q_{vg} = cumulative vol flow of Vent Gas during the 15 – minute block period (scf)

Q_{vol} = volumetric flow rate (scf per second)

x_i = concentration of component i in Vent Gas (vol fraction)

x_{H2} = concentration of H_2 in Vent Gas at time sample was input into NHV monitoring system (vol fraction)

APPENDIX 3
Equistar Chemicals, LP, Tuscola, Illinois

APPENDIX 3:
GC CALIBRATION STANDARDS: NET HEATING VALUE AND ANALYTE
MEASUREMENTS

For the Net Heating Value and Analyte measurements, the GC shall meet the specifications and procedures outlined in Performance Specification 9 (PS9) of Appendix B of 40 C.F.R. Part 60 except:

- 1) The initial Pretest Preparation Period or survey in Section 8.2 of PS9 is not required;
- 2) The daily mid-level calibration procedure in Section 10.2 of PS9 may be conducted using a single (rather than triplicate) injection of a surrogate daily calibration gas mixture consisting of the surrogate analytes listed in paragraph 6 below. To quantify unknown components detected in the analysis, Equistar must use the response factor for the nearest hydrocarbon in the calibration mixture that has a lower net heating value (e.g. if the analysis detects an unknown component that elutes near propane, it would be treated as ethane rather than butane). If the analysis detects unknown components that elute after n-hexane, Equistar shall use the response factor for n-hexane to quantify those unknown components. The average instrument response shall not vary by more than 10 percent from the certified calibration gas. If the difference between the analyzer response and the cylinder concentration for any target compound is greater than 10 percent, Equistar must immediately inspect the instrument making any necessary adjustments, and conduct an initial multi-point calibration as described in Section 10.1 of PS9. The facility may elect to apply the broadly applicable alternative method ALT-131 related to certified cylinder total NHV versus specific analyte calibration comparisons along with all applicable provisos contained in ALT-131. The daily mid-level calibration gas concentration ranges may be determined by the facility based upon operational history and adjusted from time to time.
- 3) The minimum frequency of the multi-point calibration error check procedure in Section 10.1 of PS9 shall be quarterly rather than monthly for the limited set of surrogate analytes listed in paragraph 6 below.
- 4) Calibrations are not required after routine maintenance or repair activities which do not have the potential to alter the sampling or analysis of the gas.
- 5) The GC must meet the calibration performance criteria in Sections 13.1 and 13.2 of PS9 for the surrogate analytes listed in Paragraph 6 of this Appendix only.
- 6) The surrogate calibration gas components to be used for the initial performance test, daily calibration, and quarterly multi-point calibration error check and performance test, at a minimum must contain:
 - i. Hydrogen;
 - ii. Methane;
 - iii. Ethane;
 - iv. Butane; and
 - v. Hexane

Additional analytes may be added to the calibration gas mixtures based upon operational requirements.