APPENDIX A

APPENDIX A

BEAUMONT FACILITY

CEMS Plan for SO_2 Emissions
Chemtrade Refinery Services
Single Absorption Sulfuric Acid Regeneration Plant with Scrubber

Principle

This CEMS Plan is the mechanism for determining compliance with all SO_2 emission limits in the Consent Decree for the Beaumont Facility. The methodology described in this CEMS Plan will provide a real-time indication of compliance with the emission limits established in the Consent Decree by determining the emission rate in terms of both pounds of SO_2 emitted per unit of time and pounds of SO_2 emitted per ton of 100% Sulfuric Acid Produced (lb/ton). The system will utilize at least three analyzers: one to measure the converter inlet SO_2 concentration, one to measure stack SO_2 concentration, and one to measure stack volumetric flow rate. From these data, the emission rate, expressed as both pounds per unit of time and lb/ton, will be directly calculated using Equations 1, 2, and 3 below.

Equation 1:

$$M_{SO_2Stack} = Q_{Stack} \cdot B \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}}$$

Equation 2:

$$P_{TonsH_2SO_4} = Q_{Stack} \cdot \left[\frac{A-B}{1-(1.5 \cdot A)}\right] \cdot \frac{98.0734\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol} \cdot 2000\ {}^{lbs}/_{Ton}}$$

Equation 3:

$$E_{lbs/ton} = \frac{M_{SO_2Stack}}{P_{TonsH_2SO_4}} = \frac{Q_{Stack} \cdot B}{Q_{Stack} \cdot \left[\frac{A-B}{1-(1.5 \cdot A)}\right]} \cdot 1306.33\ \frac{lbsSO_2}{TonAcid}$$

Where:

$P_{TonsH_2SO_4}$	= 100% Sulfuric Acid Production, tons per unit of time
M_{SO_2Stack}	= Mass SO_2 stack emission rate, lb per unit of time
Q_{Stack}	= Volumetric flow rate of stack gas, dry standard cubic feet (DSCF) per unit of time
A	= Converter inlet SO_2 concentration, fraction (dry basis)
B	= Stack SO_2 concentration, fraction (dry basis)
$E_{lbs/ton}$	= lb SO_2 per ton 100% Sulfuric Acid Produced
$98.0734\ {}^{lbs}/_{lb-mol}$	= Molecular weight of sulfuric acid
$64.058\ {}^{lbs}/_{lb-mol}$	= Molecular weight of SO_2
$1306.33\ \frac{lbsSO_2}{TonAcid}$	$= \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

$385.57 \frac{SCF}{lb-mol}$ = Volume of one lb-mole of gas at standard temperature and pressure (68°F and 14.696 psia), cubic feet

The mass emission rate equation (Equation 1) calculates the SO_2 mass emission rate by multiplying the total stack gas flow rate by the stack SO_2 concentration. The 100% Sulfuric Acid Production Rate equation (Equation 2) is based on a material balance of the contact process. The lb/ton equation (Equation 3) is the ratio of the SO_2 emission rate to the 100% Sulfuric Acid Production Rate.

The benefit of using this method is the ability to obtain information regarding the SO_2 mass emission rate, the fact that lb/ton measurements will be "weighted" based on the flow rate during each measurement, and the elimination of errors associated with measuring sulfuric acid flow and using converter inlet Reich testing.

Definitions

Terms used in this CEMS Plan that are defined in the Clean Air Act ("CAA") or in federal or state regulations promulgated pursuant to the CAA shall have the meaning assigned to them in the CAA or such regulations, unless otherwise defined in the Consent Decree. Terms used in this CEMS Plan that are defined in the Consent Decree shall have the meaning assigned to them therein.

Emissions Monitoring

- Emissions monitoring will be done using an SO_2 analyzer at the converter inlet, an SO_2 analyzer at the exit stack, and a stack flow rate analyzer. Except for any analyzer malfunctions, associated repairs, and required quality assurance or control activities (including calibration checks and required zero and span adjustments), Chemtrade will conduct monitoring during all Operating Periods and during Shutdown.

- Once every five minutes, the analyzers will measure the stack SO_2 concentration (fraction, dry basis), the converter inlet SO_2 concentration (fraction, dry basis) and the volumetric flow rate (dry standard cubic feet per minute).

- During routine calibration checks and adjustments of any analyzer, the pre-calibration level will be used to fill in any analyzer data gaps that occur pending completion of the calibration checks and adjustments.

- If any one or more than one analyzer is/are not operating for a period of 24 hours or greater, data gaps in the array involving the non-operational analyzer(s) will be filled in as follows:

  - Exit stack gas will be sampled and analyzed for SO_2 at least once per hour, during all Operating Periods. Sampling will be conducted by Reich test or other established method (*e.g.*, portable analyzer). The most recent hourly reading will be substituted for the 12 five-minute readings that would otherwise have been taken if the analyzer had been operating normally.

  - Converter inlet gas either will be sampled and analyzed for SO_2 using a Reich test or other established method, or the concentration will be estimated using engineering judgment, at least once every four hours during all Operating Periods. The most recent four-hour measurement/estimate will be substituted for the 48 five-minute readings that would otherwise have been taken if the system had been operating normally.

  - Stack volumetric flow rate will be estimated using engineering judgment.

- If any one or more than one analyzer is/are not operating for a period of less than 24 hours, one of the following must be done: (i) the requirements set forth for a 24-hour or greater period of

downtime must be used to fill in the data gaps; or (ii) the data recorded for the five minute reading immediately preceding the affected analyzer's(s') stoppage must be used to fill in the data gap.

- In order to secure data on a "dry basis," Chemtrade may either:

  (i) directly measure the moisture content using a moisture analyzer; or

  (ii) assume the moisture content is the greater of 3% or the highest measured moisture content in any Relative Accuracy Test Audit ("RATA"); or

  (iii) for saturated gas streams only, measure the stack temperature using a stack temperature sensor at the time of each SO_2 measurement and determine the moisture content using a psychrometric chart or standard text water vapor pressure correlation.

Emissions Calculations

3-Hour Rolling Average.

For purposes of calculating a 3-hour rolling average, the system will maintain an array of the 36 most recent measurements of each of the three monitored parameters. Every five minutes, the system will add the most recent readings to the array and exclude the oldest readings.

The 3-hour rolling average lb/ton SO_2 emission rate (E_{3hravg}) will be calculated using Equation 4.

Equation 4:

$$E_{3hravg} = 1306.33 \frac{lbsSO_2}{TonAcid} \cdot \frac{\sum_{i=1}^{36} Q_{Stack\,i} \cdot B_i}{\sum_{i=1}^{36} Q_{Stack\,i} \cdot \left[\frac{A_i - B_i}{1 - 1.5 \cdot A_i}\right]}$$

Where:

A_i = Converter inlet SO_2 concentration, fraction (dry basis) at measurement "*i*"

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\,i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

E_{3hravg} = 3-hour average lb SO_2 per ton 100% Sulfuric Acid Produced

Daily Mass SO_2 Emissions. The daily mass SO_2 emissions (M_{SO_2Day}) (which are based on a calendar day) will be calculated using Equation 5.

Equation 5:

$$M_{SO_2Day} = \sum_{i=1}^{n} Q_{Stack\,i} \cdot B_i \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57 \frac{SCF}{lb-mol}} \cdot 5\,\text{min}$$

Where:

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\ i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

$M_{SO_2 Day}$ = Mass emissions of SO_2 during a calendar day, lb

n = Number of measurements in a given calendar day

12-Month Rolling Sum Mass SO_2 Emissions. The 12-month rolling sum mass SO_2 emissions ($M_{SO_2 12Mo\ Sum}$) for the immediately preceding month will be calculated, by no later than the 15th day of each month, using Equation 6:

Equation 6:

$$M_{SO_2 12Mo\ Sum} = \sum_{j=1}^{d} M_{SO_2 Day\ j}$$

Where:

$M_{SO_2 Day\ j}$ = Mass emissions of SO_2 during calendar day "*j*", lb

d = Number days in the preceding 12 calendar months

$M_{SO_2 12Mo\ Sum}$ = 12-month rolling sum of SO_2 emitted into the atmosphere, lb

Rounding of Numbers resulting from Calculations

Upon completion of the calculations, the final numbers shall be rounded as follows:

E_{3hravg}: Rounded to the nearest tenth.

$M_{SO_2 12Mo\ Sum}$: Rounded to the nearest tenth of a ton (*i.e.*, 200 lb).

The number "5" shall be rounded up (*e.g.*, a short-term rate of 2.05011 shall be rounded to 2.1).

Rounding of Variables A, B, and Q_{Stack}

Rounding of the variables identified as A, B, and Q_{Stack} in the equations set forth in this CEMS Plan shall be done based on the accuracy of the measuring device as provided by the manufacturer of the device.

Compliance with Consent Decree SO_2 Limits

Short-Term SO_2 Limits

The Short-Term Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Chemtrade will be in compliance with the Short-Term SO_2 Consent Decree Limit if E_{3hravg} does not exceed 2.2 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Chemtrade contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission

rate(s) in excess of 2.2 lb/ton after the period of the Malfunction(s) end(s), Chemtrade shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

NSPS SO_2 Limits

The NSPS Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Chemtrade will be in compliance with the NSPS Limit if E_{3hravg} does not exceed 4.0 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Chemtrade contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 4.0 lb/ton after the period of the Malfunction(s) end(s), Chemtrade shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

Startup SO_2 Emission Limits

Chemtrade will be in compliance with the SO_2 emission limits during Startup if E_{3hravg} during Startup does not exceed the limits for the Beaumont Sulfuric Acid Plant set forth in Appendix H.

Mass Cap for SO_2

Chemtrade will be in compliance with the Mass Cap if the 12-month rolling sum ($M_{SO_2 12Mo\ Sum}$) is 380.0 tons (760,000 lb) of SO_2 or less.

Recordkeeping and Reporting

In addition to any requirements in the Consent Decree, Chemtrade shall maintain records of the date, time, and duration that any of the three analyzers required under this CEMS plan is not operating. In each semi-annual report required under Section IX of the Decree and in each excess emission report required by the NSPS, Chemtrade specifically shall identify all periods of analyzer downtime during the reporting period and all data during the reporting period that is "substitute" data. "Substitute" data means data that is not generated contemporaneously by an analyzer at the same time as the gas flow stack (or duct) emissions are being measured, but rather, is substituted for contemporaneous analyzer measurements consistent with the provisions of the "Emissions Monitoring" section of this CEMS Plan when an analyzer is not operating.

Retention of All CEMS Data, including Data during Startup, Shutdown, and Malfunction

Chemtrade will retain all data generated by its SO_2 analyzers and stack flow analyzer, including all data generated during Startup, Shutdown, and/or Malfunction ("SSM") of the Sulfuric Acid Plant in accordance with the requirements of Section XIII of the Consent Decree.

Analyzer Specifications

The three analyzers will meet the following specifications:

Table 1

Parameter	Location	Range
SO_2, mole fraction, dry basis	Stack	Dual range: Normal: 0 – 500 ppm SO_2 SSM: 0 – 3,600 ppm SO_2
SO_2, mole fraction, dry basis	Converter Inlet	Single range: 0 – 15 % SO_2
Volumetric flow rate, DSCFM	Stack	0 to 125% of the maximum expected volumetric flow rate

The stack SO_2 analyzer will meet all applicable requirements of 40 C.F.R. §§ 60.11, 60.13, 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

The Converter Inlet SO_2 Analyzer likewise will meet all applicable requirements of 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and 40 C.F.R. Part 60, Appendix F, Procedure 1, except as follows:

- Chemtrade will select the optimum location to obtain representative SO_2 readings. Turbulence near the blower exit and/or elevated temperatures at the converter inlet may require an analyzer measurement location that differs from the requirements of Performance Specification 2, Section 8.1.

- In lieu of annual Relative Accuracy Test Audits ("RATAs"), as described in Section 5.1.1 of Appendix F, Chemtrade will conduct quarterly cylinder gas audits (i.e., four per year) on the Converter Inlet SO_2 Analyzer.

The volumetric flow rate analyzer will meet 40 C.F.R. Part 60, Appendix B, Performance Specification 6 and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

Compliance with the NSPS: 40 C.F.R. Part 60, Subpart H

In addition to the requirements in this CEMS Plan, Chemtrade also will comply with all of the requirements of the NSPS relating to monitoring provided that, pursuant to 40 C.F.R. §60.13(i), this CEMS Plan will be an approved alternative to the following provisions of 40 C.F.R. Part 60, Subpart H:

- The requirement at 40 C.F.R. § 60.84(a) that the stack SO_2 analyzer have a span value of 1000 ppm. In lieu of this, Chemtrade will utilize the span values specified in Table 1; and

- The procedures specified at 40 C.F.R. § 60.84(b) for converting monitoring data into the units of the applicable standard. In lieu of this, Chemtrade will utilize the procedures specified in this CEMS Plan for calculating compliance with the NSPS 3-hour average limit.

APPENDIX B

APPENDIX B

SHREVEPORT FACILITY

CEMS Plan for SO_2 Emissions
Chemtrade Refinery Services
Single Absorption Sulfuric Acid Regeneration Plant with Scrubber

Principle

This CEMS Plan is the mechanism for determining compliance with all SO_2 emission limits in the Consent Decree for the Shreveport Facility. The methodology described in this CEMS Plan will provide a real-time indication of compliance with the emission limits established in the Consent Decree by determining the emission rate in terms of both pounds of SO_2 emitted per unit of time and pounds of SO_2 emitted per ton of 100% Sulfuric Acid Produced (lb/ton). The system will utilize at least three analyzers: one to measure the converter inlet SO_2 concentration, one to measure stack SO_2 concentration, and one to measure stack volumetric flow rate. From these data, the emission rate, expressed as both pounds per unit of time and lb/ton, will be directly calculated using Equations 1, 2, and 3 below.

Equation 1:

$$M_{SO_2Stack} = Q_{Stack} \cdot B \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}}$$

Equation 2:

$$P_{TonsH_2SO_4} = Q_{Stack} \cdot \left[\frac{A-B}{1-(1.5 \cdot A)}\right] \cdot \frac{98.0734\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol} \cdot 2000\ {}^{lbs}/_{Ton}}$$

Equation 3:

$$E_{lbs/ton} = \frac{M_{SO_2Stack}}{P_{TonsH_2SO_4}} = \frac{Q_{Stack} \cdot B}{Q_{Stack} \cdot \left[\frac{A-B}{1-(1.5 \cdot A)}\right]} \cdot 1306.33\ \frac{lbsSO_2}{TonAcid}$$

Where:

$P_{TonsH_2SO_4}$	= 100% Sulfuric Acid Production, tons per unit of time
M_{SO_2Stack}	= Mass SO_2 stack emission rate, lb per unit of time
Q_{Stack}	= Volumetric flow rate of stack gas, dry standard cubic feet (DSCF) per unit of time
A	= Converter inlet SO_2 concentration, fraction (dry basis)
B	= Stack SO_2 concentration, fraction (dry basis)
$E_{lbs/ton}$	= lb SO_2 per ton 100% Sulfuric Acid Produced
$98.0734\ {}^{lbs}/_{lb-mol}$	= Molecular weight of sulfuric acid
$64.058\ {}^{lbs}/_{lb-mol}$	= Molecular weight of SO_2

$$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058 \, {}^{lbs}/_{lb-mol} \cdot 2000 \, {}^{lbs}/_{ton}}{98.0734 \, {}^{lbs}/_{lb-mol}}$$

$385.57 \frac{SCF}{lb-mol}$ = Volume of one lb-mole of gas at standard temperature and pressure (68°F and 14.696 psia), cubic feet.

The mass emission rate equation (Equation 1) calculates the SO_2 mass emission rate by multiplying the total stack gas flow rate by the stack SO_2 concentration. The 100% Sulfuric Acid Production Rate equation (Equation 2) is based on a material balance of the contact process. The lb/ton equation (Equation 3) is the ratio of the SO_2 emission rate to the 100% Sulfuric Acid Production Rate.

The benefit of using this method is the ability to obtain information regarding the SO_2 mass emission rate, the fact that lb/ton measurements will be "weighted" based on the flow rate during each measurement, and the elimination of errors associated with measuring sulfuric acid flow and using converter inlet Reich testing.

Definitions

Terms used in this CEMS Plan that are defined in the Clean Air Act ("CAA") or in federal or state regulations promulgated pursuant to the CAA shall have the meaning assigned to them in the CAA or such regulations, unless otherwise defined in the Consent Decree. The terms used in this CEMS Plan that are defined in the Consent Decree shall have the meaning assigned to them therein.

Emissions Monitoring

- Emissions monitoring will be done using an SO_2 analyzer at the converter inlet, an SO_2 analyzer at the exit stack, and a stack flow rate analyzer. Except for any analyzer malfunctions, associated repairs, and required quality assurance or control activities (including calibration checks and required zero and span adjustments), Chemtrade will conduct monitoring during all Operating Periods and during Shutdown.

- Once every five minutes, the analyzers will measure the stack SO_2 concentration (fraction, dry basis), the converter inlet SO_2 concentration (fraction, dry basis) and the volumetric flow rate (dry standard cubic feet per minute).

- During routine calibration checks and adjustments of any analyzers, the pre-calibration level will be used to fill in any analyzer data gaps that occur pending completion of the calibration checks and adjustments.

- If any one or more than one analyzer is/are not operating for a period of 24 hours or greater, data gaps in the array involving the non-operational analyzer(s) will be filled in as follows:

  - Exit stack gas will be sampled and analyzed for SO_2 at least once per hour, during all Operating Periods. Sampling will be conducted by Reich test or other established method (*e.g.*, portable analyzer). The most recent hourly reading will be substituted for the 12 five-minute readings that would otherwise have been taken if the analyzer had been operating normally.

  - Converter inlet gas either will be sampled and analyzed for SO_2 using a Reich test or other established method, or the concentration will be estimated using engineering judgment, at least once every four hours during all Operating Periods. The most recent four-hour measurement/estimate will be substituted for the 48 five-minute readings that would otherwise have been taken if the system had been operating normally.

  - Stack volumetric flow rate will be estimated using engineering judgment.

- If any one or more than one analyzer is/are not operating for a period of less than 24 hours, one of the following must be done: (i) the requirements set forth for a 24-hour or greater period of downtime must be used to fill in the data gaps; or (ii) the data recorded for the five minute reading immediately preceding the affected analyzer's(s') stoppage must be used to fill in the data gap.

- In order to secure data on a "dry basis," Chemtrade may either:

  (i) directly measure the moisture content using a moisture analyzer; or

  (ii) assume the moisture content is the greater of 3% or the highest measured moisture content in any Relative Accuracy Test Audit ("RATA"); or

  (iii) for saturated gas streams only, measure the stack temperature using a stack temperature sensor at the time of each SO_2 measurement and determine the moisture content using a psychrometric chart or standard text water vapor pressure correlation.

Emissions Calculations

3-Hour Rolling Average.

For purposes of calculating a 3-hour rolling average, the system will maintain an array of the 36 most recent measurements of each of the three monitored parameters. Every five minutes, the system will add the most recent readings to the array and exclude the oldest readings.

The 3-hour rolling average lb/ton SO_2 emission rate (E_{3hravg}) will be calculated using Equation 4.

Equation 4:

$$E_{3hravg} = 1306.33 \frac{lbsSO_2}{TonAcid} \cdot \frac{\sum_{i=1}^{36} Q_{Stack\,i} \cdot B_i}{\sum_{i=1}^{36} Q_{Stack\,i} \cdot \left[\frac{A_i - B_i}{1 - 1.5 \cdot A_i}\right]}$$

Where:

A_i = Converter inlet SO_2 concentration, fraction (dry basis) at measurement "*i*"

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\,i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

E_{3hravg} = 3-hour average lb SO_2 per ton 100% Sulfuric Acid Produced

Daily Mass SO_2 Emissions. The daily mass SO_2 emissions ($M_{SO_2 Day}$) (which are based on a calendar day) will be calculated using Equation 5.

Equation 5:

$$M_{SO_2Day} = \sum_{i=1}^{n} Q_{Stack\,i} \cdot B_i \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}} \cdot 5\,\text{min}$$

Where:

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\,i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

M_{SO_2Day} = Mass emissions of SO_2 during a calendar day, lb

n = Number of measurements in a given calendar day

12-Month Rolling Sum Mass SO_2 Emissions. The 12-month rolling sum mass SO_2 emissions ($M_{SO_2 12Mo\,Sum}$) for the immediately preceding month will be calculated, by no later than the 15th day of each month, using Equation 6:

Equation 6:

$$M_{SO_2 12Mo\,Sum} = \sum_{j=1}^{d} M_{SO_2Day\,j}$$

Where:

$M_{SO_2Day\,j}$ = Mass emissions of SO_2 during calendar day "*j*", lb

d = Number days in the preceding 12 calendar months

$M_{SO_2 12Mo\,Sum}$ = 12-month rolling sum of SO_2 emitted into the atmosphere, lb

Rounding of Numbers resulting from Calculations

Upon completion of the calculations, the final numbers shall be rounded as follows:

E_{3hravg}: Rounded to the nearest tenth.

$M_{SO_2 12Mo\,Sum}$: Rounded to the nearest tenth of a ton (*i.e.*, 200 lb).

The number "5" shall be rounded up (*e.g.*, a short-term rate of 2.05011 shall be rounded to 2.1).

Rounding of Variables A, B, and Q_{Stack}

Rounding of the variables identified as A, B, and Q_{Stack} in the equations set forth in this CEMS Plan shall be done based on the accuracy of the measuring device as provided by the manufacturer of the device.

Compliance with Consent Decree SO_2 Limits

Short-Term SO_2 Limits

The Short-Term Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Chemtrade will be in compliance with the Short-Term SO_2 Consent Decree Limit if E_{3hravg} does not exceed 2.0 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Chemtrade contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 2.0 lb/ton after the period of the Malfunction(s) end(s), Chemtrade shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

NSPS SO_2 Limits

The NSPS Limit does not apply during period of Startup, Shutdown, or Malfunction. During all other Operating Periods, Chemtrade will be in compliance with the NSPS Limit if E_{3hravg} does not exceed 4 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Chemtrade contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 4.0 lb/ton after the period of the Malfunction(s) end(s), Chemtrade shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

Startup SO_2 Emission Limits

Chemtrade will be in compliance with the SO_2 emission limits during Startup if E_{3hravg} during Startup does not exceed the limits for the Shreveport Sulfuric Acid Plant set forth in Appendix H.

Mass Cap for SO_2

Chemtrade will be in compliance with the Mass Cap if the 12-month rolling sum ($M_{SO_2 12Mo\ Sum}$) is 215.0 tons (430,000 lb) of SO_2 or less.

Recordkeeping and Reporting

In addition to any requirements in the Consent Decree, Chemtrade shall maintain records of the date, time, and duration that any of the three analyzers required under this CEMS plan is not operating. In each semi-annual report required under Section IX of the Decree and in each excess emission report required by the NSPS, Chemtrade specifically shall identify all periods of analyzer downtime during the reporting period and all data during the reporting period that is "substitute" data. "Substitute" data means data that is not generated contemporaneously by an analyzer at the same time as the gas flow stack (or duct) emissions are being measured, but rather, is substituted for contemporaneous analyzer measurements consistent with the provisions of the "Emissions Monitoring" section of this CEMS Plan when an analyzer is not operating.

Retention of All CEMS Data, including Data during Startup, Shutdown, and Malfunction

Chemtrade will retain all data generated by its SO_2 analyzers and stack flow analyzer, including all data generated during Startup, Shutdown, and/or Malfunction ("SSM") of the Sulfuric Acid Plant in accordance with the requirements of Section XIII of the Consent Decree.

Analyzer Specifications

The three analyzers will meet the following specifications:

Table 1

Parameter	Location	Range
SO_2, mole fraction, dry basis	Stack	Dual range: Normal: 0 – 500 ppm SO_2 SSM: 0 – 3,600 ppm SO_2
SO_2, mole fraction, dry basis	Converter Inlet	Single range: 0 – 15 % SO_2
Volumetric flow rate, DSCFM	Stack	0 to 125% of the maximum expected volumetric flow rate

The stack SO_2 analyzer will meet all applicable requirements of 40 C.F.R. §§ 60.11, 60.13, 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

The Converter Inlet SO_2 Analyzer likewise will meet all applicable requirements of 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and 40 C.F.R. Part 60, Appendix F, Procedure 1, except as follows:

- Chemtrade will select the optimum location to obtain representative SO_2 readings. Turbulence near the blower exit and/or elevated temperatures at the converter inlet may require an analyzer measurement location that differs from the requirements of Performance Specification 2, Section 8.1.

- In lieu of annual Relative Accuracy Test Audits ("RATAs"), as described in Section 5.1.1 of Appendix F, are not necessary. In lieu of this, Chemtrade will conduct quarterly cylinder gas audits (i.e., four per year) on the Converter Inlet SO_2 Analyzer.

The volumetric flow rate analyzer will meet 40 C.F.R. Part 60, Appendix B, Performance Specification 6 and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1. .

Compliance with the NSPS: 40 C.F.R. Part 60, Subpart H

In addition to the requirements in this CEMS Plan, Chemtrade also will comply with all of the requirements of the NSPS relating to monitoring provided that, pursuant to 40 C.F.R. §60.13(i), this CEMS Plan will be an approved alternative to the following provisions of 40 C.F.R. Part 60, Subpart H:

- The requirement at 40 C.F.R. § 60.84(a) that the stack SO_2 analyzer have a span value of 1000 ppm. In lieu of this, Chemtrade will utilize the span values specified in Table 1; and

- The procedures specified at 40 C.F.R. § 60.84(b) for converting monitoring data into the units of the applicable standard. In lieu of this, Chemtrade will utilize the procedures specified in this CEMS Plan for calculating compliance with the NSPS 3-hour average limit.

APPENDIX C

APPENDIX C

TULSA FACILITY

CEMS Plan for SO_2 Emissions
Chemtrade Refinery Services
Single Absorption Sulfur Burning Plant with Scrubber

Principle

This CEMS Plan is the mechanism for determining compliance with all SO_2 emission limits in the Consent Decree for the Tulsa Facility. The methodology described in this CEMS Plan will provide a real-time indication of compliance with the emission limits established in the Consent Decree by determining the emission rate both in terms of pounds of SO_2 emitted per unit of time and pounds of SO_2 emitted per ton of 100% Sulfuric Acid Produced (lb/ton). The system will utilize at least three analyzers: one to measure stack SO_2 concentration, one to measure stack O_2 concentration, and one to measure stack volumetric flow rate. From these data, the emission rate, expressed as both pounds per unit of time and lb/ton, will be directly calculated using Equations 1, 2, and 3 below.

Equation 1:

$$M_{SO_2Stack} = Q_{Stack} \cdot B \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}}$$

Equation 2:

$$P_{TonsH_2SO_4} = Q_{Stack} \cdot 0.843 \cdot (0.209 - Y - B) \cdot \frac{98.0734\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol} \cdot 2000\ {}^{lbs}/_{Ton}}$$

Equation 3:

$$E_{lbs/ton} = \frac{M_{SO_2Stack}}{P_{TonsH_2SO_4}} = \frac{Q_{Stack} \cdot B}{Q_{Stack} \cdot 0.843 \cdot (0.209 - Y - B)} \cdot 1306.33\ \frac{lbsSO_2}{TonAcid}$$

Where:

$P_{TonsH_2SO_4}$	= 100% Sulfuric Acid Production, tons per unit of time
M_{SO_2Stack}	= Mass SO_2 stack emission rate, lb per unit of time
Q_{Stack}	= Volumetric flow rate of stack gas, dry standard cubic feet (DSCF) per unit of time
Y	= Stack O_2 concentration, fraction (dry basis)
B	= Stack SO_2 concentration, fraction (dry basis)
$E_{lbs/ton}$	= lb SO_2 per ton 100% Sulfuric Acid Produced
$98.0734\ {}^{lbs}/_{lb-mol}$	= Molecular weight of sulfuric acid
$64.058\ {}^{lbs}/_{lb-mol}$	= Molecular weight of SO_2
$1306.33\ \frac{lbsSO_2}{TonAcid}$	$= \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$
$385.57\ \frac{SCF}{lb-mol}$	= Volume of one lb-mole of gas at standard temperature and pressure (68°F and 14.696 psia), cubic feet

The mass emission rate equation (Equation 1) calculates the SO_2 mass emission rate by multiplying the total stack gas flow rate by the stack SO_2 concentration. The 100% Sulfuric Acid Production Rate equation (Equation 2) is based on a material balance of the contact process and the fact that the ratio of oxygen to nitrogen of the incoming air is fixed. The lb/ton equation (Equation 3) is the ratio of the mass SO_2 emission rate to the 100% Sulfuric Acid Production Rate.

The benefit of using this method is the ability to obtain information regarding the SO_2 mass emission rate, the fact that lb/ton measurements will be "weighted" based on the flow rate during each measurement, and the elimination of errors associated with measuring sulfuric acid flow and using converter inlet Reich testing.

Definitions

Terms used in this CEMS Plan that are defined in the Clean Air Act ("CAA") or in federal or state regulations promulgated pursuant to the CAA shall have the meaning assigned to them in the CAA or such regulations, unless otherwise defined in the Consent Decree. Terms used in this CEMS Plan that are defined in the Consent Decree shall have the meaning assigned to them therein.

Emissions Monitoring

- Emissions monitoring will be done using an O_2 analyzer at the exit stack, an SO_2 analyzer at the exit stack, and a stack flow rate analyzer. Except for any analyzer malfunctions, associated repairs, and required quality assurance or control activities (including calibration checks and required zero and span adjustments), Chemtrade will conduct monitoring during all Operating Periods and during Shutdown.

- Once every five minutes, the analyzers will measure the stack SO_2 concentration (fraction, dry basis), the stack O_2 concentration (fraction, dry basis) and the volumetric flow rate (dry standard cubic feet per minute).

- During routine calibration checks and adjustments of any analyzers, the pre-calibration level will be used to fill in any analyzer data gaps that occur pending completion of the calibration checks and adjustments.

- If any one or more than one analyzer is/are not operating for a period of 24 hours or greater, data gaps in the array involving the non-operational analyzer(s) will be filled in as follows:

  - Exit stack gas will be sampled and analyzed for SO_2 at least once per hour, during all Operating Periods. Sampling will be conducted by Reich test or other established method (*e.g.*, portable analyzer). The most recent hourly reading will be substituted for the 12 five-minute readings that would otherwise have been taken if the analyzer had been operating normally.

  - O_2 in the exit stack gas will be sampled and analyzed at least once per hour, during all Operating Periods Sampling will be conducted by Orsat test or other established method (*e.g.*, portable analyzer). The most recent hourly reading will be substituted for the 12 five-minute readings that would otherwise have been taken if the analyzer had been operating normally.

  - Stack volumetric flow rate will be estimated using engineering judgment.

- If any one or more than one analyzer is/are not operating for a period of less than 24 hours, one of the following must be done: (i) the requirements set forth for a 24-hour or greater period of downtime must be used to fill in the data gaps; or (ii) the data recorded for the five minute reading immediately preceding the affected analyzer's(s') stoppage must be used to fill in the data gap.

- In order to secure data on a "dry basis," Chemtrade may either:

  (i) directly measure the moisture content using a moisture analyzer; or

  (ii) assume the moisture content is the greater of 3% or the highest measured moisture content in any Relative Accuracy Test Audit ("RATA"); or

  (iii) for saturated gas streams only, measure the stack temperature using a stack temperature sensor at the time of each SO_2 measurement and determine the moisture content using a psychrometric chart or standard text water vapor pressure correlation.

Emissions Calculations

3-Hour Rolling Average.

For purposes of calculating a 3-hour rolling average, the system will maintain an array of the 36 most recent measurements of each of the three monitored parameters. Every five minutes, the system will add the most recent readings to the array and exclude the oldest readings.

The 3-hour rolling average lb/ton SO_2 emission rate (E_{3hravg}) will be calculated using Equation 4.

Equation 4:

$$E_{3hravg} = 1306.33 \frac{lbsSO_2}{TonAcid} \cdot \frac{\sum_{i=1}^{36} Q_{Stack\,i} \cdot B_i}{\sum_{i=1}^{36} Q_{Stack\,i} \cdot 0.843 \cdot [0.209 - Y_i - B_i]}$$

Where:

Y_i = Stack O_2 concentration, fraction (dry basis) at measurement "*i*"

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\,i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

E_{3hravg} = 3-hour average lb SO_2 per ton 100% Sulfuric Acid Produced

Daily Mass SO2 Emissions. The daily mass SO_2 emissions (M_{SO_2Day}) (which are based on a calendar day) will be calculated using Equation 5.

Equation 5:

$$M_{SO_2Day} = \sum_{i=1}^{n} Q_{Stack\,i} \cdot B_i \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}} \cdot 5\,\text{min}$$

Where:

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\ i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

M_{SO_2Day} = Mass emissions of SO_2 during a calendar day, lb

n = Number of measurements in a given calendar day

12-Month Rolling Sum Mass SO2 Emissions. The 12-month rolling sum mass SO_2 emissions ($M_{SO_2 12Mo\ Sum}$) for the immediately preceding month will be calculated, by no later than the 15th day of each month, using Equation 6:

Equation 6:

$$M_{SO_2 12Mo\ Sum} = \sum_{j=1}^{d} M_{SO_2 Day\ j}$$

Where:

$M_{SO_2Day\ j}$ = Mass emissions of SO_2 during calendar day "*j*", lb

d = Number days in the preceding 12 calendar months

$M_{SO_2 12Mo\ Sum}$ = 12-month rolling sum of SO_2 emitted into the atmosphere, lb

Rounding of Numbers resulting from Calculations

Upon completion of the calculations, the final numbers shall be rounded as follows:

E_{3hravg}: Rounded to the nearest tenth.

$M_{SO_2 12Mo\ Sum}$: Rounded to the nearest tenth of a ton (*i.e.*, 200 lb).

The number "5" shall be rounded up (*e.g.*, a short-term rate of 2.05011 shall be rounded to 2.1).

Rounding of Variables B, Q_{Stack}, and Y

Rounding of the variables identified as B, Q_{Stack}, and Y in the equations set forth in this CEMS Plan shall be done based on the accuracy of the measuring device as provided by the manufacturer of the device.

Compliance with Consent Decree SO_2 Limits

Short-Term SO_2 Limits

The Short-Term Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Chemtrade will be in compliance with the Short-Term SO_2 Consent Decree Limit if E_{3hravg} does not exceed 1.7 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Chemtrade contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 1.7 lb/ton after the period of the Malfunction(s) end(s), Chemtrade shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

NSPS SO_2 Limits

The NSPS Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Chemtrade will be in compliance with the NSPS Limit if E_{3hravg} does not exceed 4 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Chemtrade contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 4.0 lb/ton after the period of the Malfunction(s) end(s), Chemtrade shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

Startup SO_2 Emission Limits

Chemtrade will be in compliance with the SO_2 emission limits during Startup if E_{3hravg} during Startup does not exceed the limits for the Tulsa Sulfuric Acid Plant set forth in Appendix H.

Mass Cap for SO_2

Chemtrade will be in compliance with the Mass Cap if the 12-month rolling sum ($M_{SO_2 12Mo\ Sum}$) is 92.4 tons (184,800 lb) of SO_2 or less.

Recordkeeping and Reporting

In addition to any requirements in the Consent Decree, Chemtrade shall maintain records of the date, time, and duration that any of the three analyzers required under this CEMS plan is not operating. In each semi-annual report required under Section IX of the Decree and in each excess emission report required by the NSPS, Chemtrade specifically shall identify all periods of analyzer downtime during the reporting period and all data during the reporting period that is "substitute" data. "Substitute" data means data that is not generated contemporaneously by an analyzer at the same time as the gas flow stack (or duct) emissions are being measured, but rather, is substituted for contemporaneous analyzer measurements consistent with the provisions of the "Emissions Monitoring" section of this CEMS Plan when an analyzer is not operating.

Retention of All CEMS Data, including Data during Startup, Shutdown, and Malfunction

Chemtrade will retain all data generated by its SO_2 analyzer, O_2 analyzer, and stack flow analyzer, including all data generated during Startup, Shutdown, and/or Malfunction ("SSM") of the Sulfuric Acid Plant in accordance with the requirements of Section XIII of the Consent Decree.

Analyzer Specifications

The three analyzers will meet the following specifications:

Table 1

Parameter	Location	Range
SO_2, mole fraction, dry basis	Stack	Dual range: Normal: 0 – 500 ppm SO_2 SSM: 0 – 3,600 ppm SO_2
O_2, mole fraction, dry basis	Stack	Single range: 0 – 20.9 % O_2
Volumetric flow rate, DSCFM	Stack	0 to 125% of the maximum expected volumetric flow rate

The stack SO_2 analyzer will meet all applicable requirements of 40 C.F.R. §§ 60.11, 60.13, 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

The stack O_2 analyzer will meet 40 C.F.R. Part 60 Appendix B, Performance Specification 3 and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

The volumetric flow rate analyzer will meet 40 C.F.R. Part 60, Appendix B, Performance Specification 6 and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

Compliance with the NSPS: 40 C.F.R. Part 60, Subpart H

In addition to the requirements in this CEMS Plan, Chemtrade also will comply with all of the requirements of the NSPS relating to monitoring provided that, pursuant to 40 C.F.R. §60.13(i), this CEMS Plan will be an approved alternative to the following provisions of 40 C.F.R. Part 60, Subpart H:

- The requirement at 40 C.F.R. § 60.84(a) that the stack SO_2 analyzer have a span value of 1000 ppm. In lieu of this, Chemtrade will utilize the span values specified in Table 1; and
- The procedures specified at 40 C.F.R. § 60.84(b) for converting monitoring data into the units of the applicable standard. In lieu of this, Chemtrade will utilize the procedures specified in this CEMS Plan for calculating compliance with the NSPS 3-hour average limit.

APPENDIX D

APPENDIX D

RIVERTON FACILITY: RIVERTON 1 SULFURIC ACID PLANT

CEMS Plan for SO_2 Emissions
Chemtrade Refinery Services
Single Absorption Sulfur Burning Plant with Scrubber

Principle

This CEMS Plan is the mechanism for determining compliance with all SO_2 emission limits in the Consent Decree for the Riverton 1 Sulfuric Acid Plant at the Riverton Facility. The methodology described in this CEMS Plan will provide a real-time indication of compliance with the emission limits established in the Consent Decree by determining the emission rate both in terms of pounds of SO_2 emitted per unit of time and pounds of SO_2 emitted per ton of 100% Sulfuric Acid Produced (lb/ton). The system will utilize at least three analyzers: one to measure stack SO_2 concentration, one to measure stack O_2 concentration, and one to measure stack volumetric flow rate. From these data, the emission rate, expressed as both pounds per unit of time and lb/ton, will be directly calculated using Equations 1, 2, and 3 below.

Equation 1:

$$M_{SO_2Stack} = Q_{Stack} \cdot B \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}}$$

Equation 2:

$$P_{TonsH_2SO_4} = Q_{Stack} \cdot 0.843 \cdot (0.209 - Y - B) \cdot \frac{98.0734\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol} \cdot 2000\ {}^{lbs}/_{Ton}}$$

Equation 3:

$$E_{lbs/ton} = \frac{M_{SO_2Stack}}{P_{TonsH_2SO_4}} = \frac{Q_{Stack} \cdot B}{Q_{Stack} \cdot 0.843 \cdot (0.209 - Y - B)} \cdot 1306.33\ \frac{lbsSO_2}{TonAcid}$$

Where:

$P_{TonsH_2SO_4}$ = 100% Sulfuric Acid Production, tons per unit of time

M_{SO_2Stack} = Mass SO_2 stack emission rate, lb per unit of time

Q_{Stack} = Volumetric flow rate of stack gas, dry standard cubic feet (DSCF) per unit of time

Y = Stack O_2 concentration, fraction (dry basis)

B = Stack SO_2 concentration, fraction

$E_{lbs/ton}$ = lb SO_2 per ton 100% Sulfuric Acid Produced

$98.0734\ {}^{lbs}/_{lb-mol}$ = Molecular weight of sulfuric acid

$64.058\ {}^{lbs}/_{lb-mol}$ = Molecular weight of SO_2

$1306.33\ \frac{lbsSO_2}{TonAcid} = \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

$385.57\ \frac{SCF}{lb-mol}$ = Volume of one lb-mole of gas at standard temperature and pressure (68°F and 14.696 psia), cubic feet

The mass emission rate equation (Equation 1) calculates the SO_2 mass emission rate by multiplying the total stack gas flow rate by the stack SO_2 concentration. The 100% Sulfuric Acid Production Rate equation (Equation 2) is based on a material balance of the contact process and the fact that the ratio of oxygen to nitrogen of the incoming air is fixed. The lb/ton equation (Equation 3) is the ratio of the mass SO_2 emission rate to the 100% Sulfuric Acid Production Rate.

The benefit of using this method is the ability to obtain information regarding the SO_2 mass emission rate, the fact that lb/ton measurements will be "weighted" based on the flow rate during each measurement, and the elimination of errors associated with measuring sulfuric acid flow and using converter inlet Reich testing.

Definitions

Terms used in this CEMS Plan that are defined in the Clean Air Act ("CAA") or in federal or state regulations promulgated pursuant to the CAA shall have the meaning assigned to them in the CAA or such regulations, unless otherwise defined in the Consent Decree. Terms used in this CEMS Plan that are defined in the Consent Decree shall have the meaning assigned to them therein.

Emissions Monitoring

- Emissions monitoring will be done using an O_2 analyzer at the exit stack, an SO_2 analyzer at the exit stack, and a stack flow rate analyzer. Except for any analyzer malfunctions, associated repairs, and required quality assurance or control activities (including calibration checks and required zero and span adjustments), Chemtrade will conduct monitoring during all Operating Periods and during Shutdown.

- Once every five minutes, the analyzers will measure the stack SO_2 concentration (fraction, dry basis), the stack O_2 concentration (fraction, dry basis) and the volumetric flow rate (dry standard cubic feet per minute).

- During routine calibration checks and adjustments of any analyzers, the pre-calibration level will be used to fill in any analyzer data gaps that occur pending completion of the calibration checks and adjustments.

- If any one or more than one analyzer is/are not operating for a period of 24 hours or greater, data gaps in the array involving the non-operational analyzer(s) will be filled in as follows:

  - Exit stack gas will be sampled and analyzed for SO_2 at least once per hour, during all Operating Periods. Sampling will be conducted by Reich test or other established method (*e.g.*, portable analyzer). The most recent hourly reading will be substituted for the 12 five-minute readings that would otherwise have been taken if the analyzer had been operating normally.

  - O_2 in the exit stack gas will be sampled and analyzed at least once per hour, during all Operating Periods Sampling will be conducted by Orsat test or other established method (*e.g.*, portable analyzer). The most recent hourly reading will be substituted for the 12 five-minute readings that would otherwise have been taken if the analyzer had been operating normally.

  - Stack volumetric flow rate will be estimated using engineering judgment.

- If any one or more than one analyzer is/are not operating for a period of less than 24 hours, one of the following must be done: (i) the requirements set forth for a 24-hour or greater period of downtime must be used to fill in the data gaps; or (ii) the data recorded for the five minute reading immediately preceding the affected analyzer's(s') stoppage must be used to fill in the data gap.

- In order to secure data on a "dry basis," Chemtrade may either:

  (i) directly measure the moisture content using a moisture analyzer; or

  (ii) assume the moisture content is the greater of 3% or the highest measured moisture content in any Relative Accuracy Test Audit ("RATA"); or

  (iii) for saturated gas streams only, measure the stack temperature using a stack temperature sensor at the time of each SO_2 measurement and determine the moisture content using a psychrometric chart or standard text water vapor pressure correlation.

Emissions Calculations

3-Hour Rolling Average.

For purposes of calculating a 3-hour rolling average, the system will maintain an array of the 36 most recent measurements of each of the three monitored parameters. Every five minutes, the system will add the most recent readings to the array and exclude the oldest readings.

The 3-rolling hour average lb/ton SO_2 emission rate (E_{3hravg}) will be calculated using Equation 4.

Equation 4:

$$E_{3hravg} = 1306.33 \frac{lbsSO_2}{TonAcid} \cdot \frac{\sum_{i=1}^{36} Q_{Stack\,i} \cdot B_i}{\sum_{i=1}^{36} Q_{Stack\,i} \cdot 0.843 \cdot [0.209 - Y_i - B_i]}$$

Where:

Y_i = Stack O_2 concentration, fraction (dry basis) at measurement "*i*"

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\,i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

E_{3hravg} = 3-hour average lb SO_2 per ton 100% Sulfuric Acid Produced

Daily Mass SO_2 Emissions. The daily mass SO_2 emissions (M_{SO_2Day}) (which are based on a calendar day_ will be calculated using Equation 5.

Equation 5:

$$M_{SO_2Day} = \sum_{i=1}^{n} Q_{Stack\,i} \cdot B_i \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}} \cdot 5\,\text{min}$$

Where:

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\ i}$ = Stack volumetric flow rate, standard cubic feet per minute (DSCFM) at measurement "*i*"

M_{SO_2Day} = Mass emissions of SO_2 during a calendar day, lb

n = Number of measurements in a given calendar day

12-Month Rolling Sum Mass SO_2 Emissions. The 12-month rolling sum mass SO_2 emissions ($M_{SO_2 12Mo\ Sum}$) for the immediately preceding month will be calculated, by no later than the 15th day of each month, using Equation 6:

Equation 6:

$$M_{SO_2 12Mo\ Sum} = \sum_{j=1}^{d} M_{SO_2 Day\ j}$$

Where:

$M_{SO_2Day\ j}$ = Mass emissions of SO_2 during calendar day "*j*", lb

d = Number days in the preceding 12 calendar months

$M_{SO_2 12Mo\ Sum}$ = 12-month rolling sum of SO_2 emitted into the atmosphere, lb

Rounding of Numbers resulting from Calculations

Upon completion of the calculations, the final numbers shall be rounded as follows:

E_{3hravg}: Rounded to the nearest tenth.

$M_{SO_2 12Mo\ Sum}$: Rounded to the nearest tenth of a ton (*i.e.*, 200 lb).

The number "5" shall be rounded up (*e.g.*, a short-term rate of 2.05011 shall be rounded to 2.1).

Rounding of Variables B, Q_{Stack}, and Y

Rounding of the variables identified as B, Q_{Stack}, and Y in the equations set forth in this CEMS Plan shall be done based on the accuracy of the measuring device as provided by the manufacturer of the device.

Compliance with Consent Decree SO_2 Limits

Short-Term SO_2 Limits

The Short-Term Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Chemtrade will be in compliance with the Short-Term SO_2 Consent Decree Limit if E_{3hravg} does not exceed 1.9 lbs of SO_2 per ton of 100% Sulfuric Acid Produced. If Chemtrade contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 1.9 lb/ton after the period of the Malfunction(s) end(s), Chemtrade shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

NSPS SO_2 Limits

The NSPS Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Chemtrade will be in compliance with the NSPS Limit if E_{3hravg} does not exceed 4 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Chemtrade contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 4.0 lb/ton after the period of the Malfunction(s) end(s), Chemtrade shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

Startup SO_2 Emission Limits

Chemtrade will be in compliance with the SO_2 emission limits during Startup if E_{3hravg} during Startup does not exceed the limits for the Riverton 1 Sulfuric Acid Plant set forth in Appendix H.

Mass Cap for SO_2

Chemtrade will be in compliance with the Mass Cap if the 12-month rolling sum ($M_{SO_2 12Mo\ Sum}$) is 35.0 tons (70,000 lb) of SO_2 or less.

Recordkeeping and Reporting

In addition to any requirements in the Consent Decree, Chemtrade shall maintain records of the date, time, and duration that any of the three analyzers required under this CEMS plan is not operating. In each semi-annual report required under Section IX of the Decree and in each excess emission report required by the NSPS, Chemtrade specifically shall identify all periods of analyzer downtime during the reporting period and all data during the reporting period that is "substitute" data. "Substitute" data means data that is not generated contemporaneously by an analyzer at the same time as the gas flow stack (or duct) emissions are being measured, but rather, is substituted for contemporaneous analyzer measurements consistent with the provisions of the "Emissions Monitoring" section of this CEMS Plan when an analyzer is not operating.

Retention of All CEMS Data, including Data during Startup, Shutdown, and Malfunction

Chemtrade will retain all data generated by its SO_2 analyzer, O_2 analyzer, and stack flow analyzer, including all data generated during Startup, Shutdown, and/or Malfunction ("SSM") of the Sulfuric Acid Plant in accordance with the requirements of Section XIII of the Consent Decree.

Analyzer Specifications

The three analyzers will meet the following specifications:

Table 1

Parameter	Location	Range
SO_2, mole fraction, dry basis	Stack	Dual range: Normal: 0 – 500 ppm SO_2 SSM: 0 – 3,600 ppm SO_2
O_2, mole fraction, dry basis	Stack	Single range: 0 – 20.9 % O_2
Volumetric flow rate, DSCFM	Stack	0 to 125% of the maximum expected volumetric flow rate

The stack SO_2 analyzer will meet all applicable requirements of 40 C.F.R. §§ 60.11, 60.13, 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

The stack O_2 analyzer will meet 40 C.F.R. Part 60 Appendix B, Performance Specification 3 and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

The volumetric flow rate analyzer will meet 40 C.F.R. Part 60, Appendix B, Performance Specification 6 and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

Compliance with the NSPS: 40 C.F.R. Part 60, Subpart H

In addition to the requirements in this CEMS Plan, Chemtrade also will comply with all of the requirements of the NSPS relating to monitoring provided that, pursuant to 40 C.F.R. §60.13(i), this CEMS Plan will be an approved alternative to the following provisions of 40 C.F.R. Part 60, Subpart H:

- The requirement at 40 C.F.R. § 60.84(a) that the stack SO_2 analyzer have a span value of 1000 ppm. In lieu of this, Chemtrade will utilize the span values specified in Table 1; and

- The procedures specified at 40 C.F.R. § 60.84(b) for converting monitoring data into the units of the applicable standard. In lieu of this, Chemtrade will utilize the procedures specified in this CEMS Plan for calculating compliance with the NSPS 3-hour average limit.

APPENDIX E

APPENDIX E

RIVERTON FACILITY: RIVERTON 2 SULFURIC ACID PLANT

CEMS Plan for SO_2 Emissions
Chemtrade Refinery Services
Single Absorption Sulfuric Acid Regeneration Plant with Air Injection and Scrubber

Principle

This CEMS Plan is the mechanism for determining compliance with all SO_2 emission limits in the Consent Decree for the Riverton 2 Sulfuric Acid Plant at the Riverton Facility. The methodology described in this CEMS Plan will provide a real-time indication of compliance with the emission limits established in the Consent Decree by determining the emission rate in terms of both pounds of SO_2 emitted per unit of time and pounds of SO_2 emitted per ton of 100% Sulfuric Acid Produced (lb/ton). The system will utilize at least three analyzers: one to measure the converter inlet SO_2 concentration, one to measure stack SO_2 concentration, and one to measure stack volumetric flow rate. From these data, the emission rate, expressed as both pounds per unit of time and lb/ton, will be directly calculated using Equations 1, 2, and 3 below.

Equation 1:

$$M_{SO_2Stack} = Q_{Stack} \cdot B \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}}$$

Equation 2:

$$P_{TonsH_2SO_4} = Q_{Stack} \cdot \left[\frac{A - B \cdot (1+R)}{1+R-(1.5 \cdot A)}\right] \cdot \frac{98.0734\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol} \cdot 2000\ {}^{lbs}/_{Ton}}$$

Equation 3:

$$E_{lbs/ton} = \frac{M_{SO_2Stack}}{P_{TonsH_2SO_4}} = \frac{Q_{Stack} \cdot B}{Q_{Stack} \cdot \left[\frac{A - B \cdot (1+R)}{1+R-(1.5 \cdot A)}\right]} \cdot 1306.33\ \frac{lbsSO_2}{TonAcid}$$

Where:

$P_{TonsH_2SO_4}$	= 100% Sulfuric Acid Production, tons per unit of time
M_{SO_2Stack}	= Mass SO_2 stack emission rate, lb per unit of time
Q_{Stack}	= Volumetric flow rate of stack gas, dry standard cubic feet (DSCF) per unit of time
A	= Converter inlet SO_2 concentration, fraction (dry basis)
B	= Stack SO_2 concentration, fraction (dry basis)
R	= Ratio of the flow rate of gas fed into first bed of the converter to the flow rate of dilution air injected into lower beds
$E_{lbs/ton}$	= lb SO_2 per ton 100% Sulfuric Acid Produced
$98.0734\ {}^{lbs}/_{lb-mol}$	= Molecular weight of sulfuric acid
$64.058\ {}^{lbs}/_{lb-mol}$	= Molecular weight of SO_2

$$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058 \, {}^{lbs}/_{lb-mol} \cdot 2000 \, {}^{lbs}/_{ton}}{98.0734 \, {}^{lbs}/_{lb-mol}}$$

$385.57 \frac{SCF}{lb-mol}$ = Volume of one lb-mole of gas at standard temperature and pressure (68°F and 14.696 psia), cubic feet

The mass emission rate equation (Equation 1) calculates the SO_2 mass emission rate by multiplying the total stack gas flow rate by the stack SO_2 concentration. The 100% Sulfuric Acid Production Rate equation (Equation 2) is based on a material balance of the contact process. The lb/ton equation (Equation 3) is the ratio of the SO_2 emission rate to the 100% Sulfuric Acid Production Rate. Because the Riverton 2 Sulfuric Acid Plant injects air into the lower passes of its converter, the equations have been adjusted to account for this added air.

The benefit of using this method is the ability to obtain information regarding the SO_2 mass emission rate, the fact that lb/ton measurements will be "weighted" based on the flow rate during each measurement, and the elimination of errors associated with measuring sulfuric acid flow and using converter inlet Reich testing.

Definitions

Terms used in this CEMS Plan that are defined in the Clean Air Act ("CAA") or in federal or state regulations promulgated pursuant to the CAA shall have the meaning assigned to them in the CAA or such regulations, unless otherwise defined in the Consent Decree. Terms used in this CEMS Plan that are defined in the Consent Decree shall have the meaning assigned to them therein.

Emissions Monitoring

- Emissions monitoring will be done using an SO_2 analyzer at the converter inlet, an SO_2 analyzer at the exit stack, and a stack flow rate analyzer. Except for any analyzer malfunctions, associated repairs, and required quality assurance or control activities (including calibration checks and required zero and span adjustments), Chemtrade will conduct monitoring during all Operating Periods and during Shutdown.

- Once every five minutes, the analyzers will measure the stack SO_2 concentration (fraction, dry basis), the converter inlet SO_2 concentration (fraction, dry basis) and the volumetric flow rate (dry standard cubic feet per minute).

- During routine calibration checks and adjustments of any analyzers, the pre-calibration level will be used to fill in any analyzer data gaps that occur pending completion of the calibration checks and adjustments.

- If any one or more than one analyzer is/are not operating for a period of 24 hours or greater, data gaps in the array involving the non-operational analyzer(s) will be filled in as follows:

  - Exit stack gas will be sampled and analyzed for SO_2 at least once per hour, during all Operating Periods. Sampling will be conducted by Reich test or other established method (*e.g.*, portable analyzer). The most recent hourly reading will be substituted for the 12 five-minute readings that would otherwise have been taken if the analyzer had been operating normally.

  - Converter inlet gas either will be sampled and analyzed for SO_2 using a Reich test or other established method, or the concentration will be estimated using engineering judgment, at least once every four hours during all Operating Periods. The most recent four-hour measurement/estimate will be substituted for the 48 five-minute readings that would otherwise have been taken if the system had been operating normally.

- Stack volumetric flow rate will be estimated using engineering judgment.

- If any one or more than one analyzer is/are not operating for a period of less than 24 hours, one of the following must be done: (i) the requirements set forth for a 24-hour or greater period of downtime must be used to fill in the data gaps; or (ii) the data recorded for the five minute reading immediately preceding the affected analyzer's(s') stoppage must be used to fill in the data gap.

- In order to secure data on a "dry basis," Chemtrade may either:

  (i) directly measure the moisture content using a moisture analyzer; or

  (ii) assume the moisture content is the greater of 3% or the highest measured moisture content in any Relative Accuracy Test Audit ("RATA"); or

  (iii) for saturated gas streams only, measure the stack temperature using a stack temperature sensor at the time of each SO_2 measurement and determine the moisture content using a psychrometric chart or standard text water vapor pressure correlation.

Emissions Calculations

3-Hour Rolling Average.

For purposes of calculating a 3-hour rolling average, the system will maintain an array of the 36 most recent measurements of each of the three monitored parameters. Every five minutes, the system will add the most recent readings to the array and exclude the oldest readings.

The 3-hour rolling average lb/ton SO_2 emission rate (E_{3hravg}) will be calculated using Equation 4.

Equation 4:

$$E_{3hravg} = 1306.33 \frac{lbsSO_2}{TonAcid} \cdot \frac{\sum_{i=1}^{36} Q_{Stack\,i} \cdot B_i}{\sum_{i=1}^{36} Q_{Stack\,i} \cdot \left[\frac{A_i - B_i \cdot (1+R)}{1+R-1.5 \cdot A_i} \right]}$$

Where:

A_i = Converter inlet SO_2 concentration, fraction (dry basis) at measurement "i"

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "i"

$Q_{Stack\,i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "i"

R = Average of the three most recent measurements of the ratio of the flow of dilution air to the flow of process gas to the converter

$$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$$

E_{3hravg} = 3-hour average lb SO_2 per ton 100% Sulfuric Acid Produced

Daily Mass SO_2 Emissions. The daily mass SO_2 emissions ($M_{SO_2 Day}$) (which are based on a calendar day) will be calculated using Equation 5.

Equation 5:

$$M_{SO_2Day} = \sum_{i=1}^{n} Q_{Stack\,i} \cdot B_i \cdot \frac{64.058\ ^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}} \cdot 5\,\text{min}$$

Where:

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\,i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

M_{SO_2Day} = Mass emissions of SO_2 during a calendar day, lb

n = Number of measurements in a given calendar day

12-Month Rolling Sum Mass SO_2 Emissions. The 12-month rolling sum mass SO_2 emissions ($M_{SO_2 12Mo\ Sum}$) for the immediately preceding month will be calculated, by no later than the 15th day of each month, using Equation 6:

Equation 6:

$$M_{SO_2 12Mo\ Sum} = \sum_{j=1}^{d} M_{SO_2Day\,j}$$

Where:

$M_{SO_2Day\,j}$ = Mass emissions of SO_2 during calendar day "*j*", lb

d = Number days in the preceding 12 calendar months

$M_{SO_2 12Mo\ Sum}$ = 12-month rolling sum of SO_2 emitted into the atmosphere, lb

Rounding of Numbers resulting from Calculations

Upon completion of the calculations, the final numbers shall be rounded as follows:

E_{3hravg}: Rounded to the nearest tenth.

$M_{SO_2 12Mo\ Sum}$: Rounded to the nearest tenth of a ton (*i.e.*, 200 lb).

The number "5" shall be rounded up (*e.g.*, a short-term rate of 2.05011 shall be rounded to 2.1).

Rounding of Variables A, B, and Q_{Stack}

Rounding of the variables identified as A, B, and Q_{Stack} in the equations set forth in this CEMS Plan shall be done based on the accuracy of the measuring device as provided by the manufacturer of the device.

Compliance with Consent Decree SO_2 Limits

Short-Term SO_2 Limits

The Short-Term Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Chemtrade will be in compliance with the Short-Term SO_2 Consent Decree Limit if E_{3hravg} does not exceed 2.1 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Chemtrade contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 2.1 lb/ton after the period of the Malfunction(s) end(s), Chemtrade shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

NSPS SO_2 Limits

The NSPS Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Chemtrade will be in compliance with the NSPS Limit if E_{3hravg} does not exceed 4 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Chemtrade contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 4.0 lb/ton after the period of the Malfunction(s) end(s), Chemtrade shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

Startup SO_2 Emission Limits

Chemtrade will be in compliance with the SO_2 emission limits during Startup if E_{3hravg} during Startup oes not exceed the limits for the Riverton 2 Sulfuric Acid Plant set forth in Appendix H.

Mass Cap for SO_2

Chemtrade will be in compliance with the Mass Cap if the 12-month rolling sum ($M_{SO_2 12Mo\ Sum}$) is 38.0 tons (76,000 lb) of SO_2 or less during each 12-month period.

Recordkeeping and Reporting

In addition to any requirements in the Consent Decree, Chemtrade shall maintain records of the date, time, and duration that any of the three analyzers required under this CEMS plan is not operating. In each semi-annual report required under Section IX of the Decree and in each excess emission report required by the NSPS, Chemtrade specifically shall identify all periods of analyzer downtime during the reporting period and all data during the reporting period that is "substitute" data. "Substitute" data means data that is not generated contemporaneously by an analyzer at the same time as the gas flow stack (or duct) emissions are being measured, but rather, is substituted for contemporaneous analyzer measurements consistent with the provisions of the "Emissions Monitoring" section of this CEMS Plan when an analyzer is not operating.

Retention of All CEMS Data, including Data during Startup, Shutdown, and Malfunction

Chemtrade will retain all data generated by its SO_2 analyzers and stack flow analyzer, including all data generated during Startup, Shutdown, and/or Malfunction ("SSM") of the Sulfuric Acid Plant in accordance with the requirements of Section XIII of the Consent Decree.

Analyzer Specifications

The three analyzers will meet the following specifications:

Table 1

Parameter	Location	Range
SO_2, mole fraction, dry basis	Stack	Dual range: Normal: 0 – 500 ppm SO_2 SSM: 0 – 3,600 ppm SO_2
SO_2, mole fraction, dry basis	Converter Inlet	Single range: 0 – 15 % SO_2
Volumetric flow rate, DSCFM	Stack	0 to 125% of the maximum expected volumetric flow rate

The stack SO_2 analyzer will meet all applicable requirements of 40 C.F.R. §§ 60.11, 60.13, 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

The Converter Inlet SO_2 Analyzer likewise will meet all applicable requirements of 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and 40 C.F.R. Part 60, Appendix F, Procedure 1, except as follows:

- Chemtrade will select the optimum location to obtain representative SO_2 readings. Turbulence near the blower exit and/or elevated temperatures at the converter inlet may require an analyzer measurement location that differs from the requirements of Performance Specification 2, Section 8.1.

- In lieu of annual Relative Accuracy Test Audits ("RATAs"), as described in Section 5.1.1 of Appendix F, are not necessary. In lieu of this, Chemtrade will conduct quarterly cylinder gas audits (i.e., four per year) on the Converter Inlet SO_2 Analyzer.

The volumetric flow rate analyzer will meet 40 C.F.R. Part 60, Appendix B, Performance Specification 6 and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

Compliance with the NSPS: 40 C.F.R. Part 60, Subpart H

In addition to the requirements in this CEMS Plan, Chemtrade also will comply with all of the requirements of the NSPS relating to monitoring provided that, pursuant to 40 C.F.R. §60.13(i), this CEMS Plan will be an approved alternative to the following provisions of 40 C.F.R. Part 60, Subpart H:

- The requirement at 40 C.F.R. § 60.84(a) that the stack SO_2 analyzer have a span value of 1000 ppm. In lieu of this, Chemtrade will utilize the span values specified in Table 1; and

- The procedures specified at 40 C.F.R. § 60.84(b) for converting monitoring data into the units of the applicable standard. In lieu of this, Chemtrade will utilize the procedures specified in this CEMS Plan for calculating compliance with the NSPS 3-hour average limit.

APPENDIX F

APPENDIX F

CAIRO FACILITY

CEMS Plan for SO_2 Emissions
Currently Owned by Chemtrade Logistics, Inc.
Single Absorption Sulfur Burning Plant with Scrubber and Front-End Liquid SO_2 Production Plant

Principle

This CEMS Plan is the mechanism for determining compliance with all SO_2 emission limits in the Consent Decree for the Cairo Facility. The methodology described in this CEMS Plan will provide a real-time indication of compliance with the emission limits established in the Consent Decree by determining the emission rate both in terms of pounds of SO_2 emitted per unit of time and pounds of SO_2 emitted per ton of 100% Sulfuric Acid Produced (lb/ton). The system will utilize at least three analyzers: one to measure stack SO_2 concentration, one to measure stack O_2 concentration, and one to measure stack volumetric flow rate. When the front-end liquid SO_2 plant (*i.e.*, the "B" Plant) at the Cairo Facility is in operation, the short-term production rate of liquid SO_2 also will be monitored using a coriolis flow meter. From these data, the emission rate, expressed as both pounds per unit of time and lb/ton, will be directly calculated using Equations 1, 2, and 3 below.

Equation 1:

$$M_{SO_2Stack} = Q_{Stack} \cdot B \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}}$$

Equation 2:

$$P_{TonsH_2SO_4} = \frac{2}{3} \cdot \left[\frac{98.0734\ {}^{lbs}/_{lb-mol} \cdot Q_{Stack}}{385.57\ \frac{SCF}{lb-mol} \cdot 2000\ {}^{lbs}/_{Ton}} \right] \cdot \left[\frac{0.209}{0.791} \cdot (1 - Y - B) - Y - B \right] - \frac{P_{LbsSO_2Plant}}{2000\ {}^{lbs}/_{ton}}$$

Equation 3:

$$E_{lbs/ton} = \frac{M_{SO_2Stack}}{P_{TonsH_2SO_4}} = \frac{Q_{Stack} \cdot B}{Q_{Stack} \cdot \frac{2}{3} \cdot \left[\frac{0.209}{0.791} \cdot (1 - Y - B) - Y - B \right] - \left[P_{LbsSO_2Plant} \cdot \frac{385.57}{64.058} \right]} \cdot 1306.33 \frac{lbsSO_2}{TonAcid}$$

Where:

$P_{TonsH_2SO_4}$	= 100% Sulfuric Acid Production, tons per unit of time
M_{SO_2Stack}	= Mass SO_2 stack emission rate, lb per unit of time
Q_{Stack}	= Volumetric flow rate of stack gas, dry standard cubic feet (DSCF) per unit of time
P_{LbsSO_2Plant}	= Mass production rate of front-end liquid SO_2 plant (B Plant), lb per unit of time
Y	= Stack O_2 concentration, fraction (dry basis)
B	= Stack SO_2 concentration, fraction (dry basis)
$E_{lbs/ton}$	= lb SO_2 per ton 100% Sulfuric Acid Produced
$98.0734\ {}^{lbs}/_{lb-mol}$	= Molecular weight of sulfuric acid
$64.058\ {}^{lbs}/_{lb-mol}$	= Molecular weight of SO_2

$$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058 \, {}^{lbs}/_{lb-mol} \cdot 2000 \, {}^{lbs}/_{ton}}{98.0734 \, {}^{lbs}/_{lb-mol}}$$

$385.57 \frac{SCF}{lb-mol}$ = Volume of one lb-mole of gas at standard temperature and pressure (68°F and 14.696 psia), cubic feet

The mass emission rate equation (Equation 1) calculates the SO_2 mass emission rate by multiplying the total stack gas flow rate by the stack SO_2 concentration. The 100% Sulfuric Acid Production Rate equation (Equation 2) is based on a material balance of the contact process and the fact that the ratio of oxygen to nitrogen of the incoming air is fixed. The lb/ton equation (Equation 3) is the ratio of the mass SO_2 emission rate to the 100% Sulfuric Acid Production Rate.

The benefit of using this method is the ability to obtain information regarding the SO_2 mass emission rate, the fact that lb/ton measurements will be "weighted" based on the flow rate during each measurement, and the elimination of errors associated with measuring sulfuric acid flow and using converter inlet Reich testing.

Definitions

Terms used in this CEMS Plan that are defined in the Clean Air Act ("CAA") or in federal or state regulations promulgated pursuant to the CAA shall have the meaning assigned to them in the CAA or such regulations, unless otherwise defined in the Consent Decree. Terms used in this CEMS Plan that are defined in the Consent Decree shall have the meaning assigned to them therein.

Emissions Monitoring

- Emissions monitoring will be done using an O_2 analyzer at the exit stack, an SO_2 analyzer at the exit stack, and a stack flow rate analyzer. Except for any analyzer malfunctions, associated repairs, and required quality assurance or control activities (including calibration checks and required zero and span adjustments), monitoring will be conducted during all Operating Periods and during Shutdown.

- Once every five minutes, the analyzers will measure the stack SO_2 concentration (fraction, dry basis), the stack O_2 concentration (fraction, dry basis) and the volumetric flow rate (dry standard cubic feet per minute).

- During routine calibration checks and adjustments of the analyzers, the pre-calibration level will be used to fill in any analyzer data gaps that occur pending completion of the calibration checks and adjustments.

- If any one or more than one analyzer is/are not operating for a period of 24 hours or greater, data gaps in the array involving the non-operational analyzer(s) will be filled in as follows:

  - Exit stack gas will be sampled and analyzed for SO_2 at least once per hour, during all Operating Periods. Sampling will be conducted by Reich test or other established method (*e.g.*, portable analyzer). The most recent hourly reading will be substituted for the 12 five-minute readings that would otherwise have been taken if the analyzer had been operating normally.

  - O_2 in the exit stack gas will be sampled and analyzed at least once per hour, during all Operating Periods Sampling will be conducted by Orsat test or other established method (*e.g.*, portable analyzer). The most recent hourly reading will be substituted for the 12 five-minute readings that would otherwise have been taken if the analyzer had been operating normally.

  - Stack volumetric flow rate will be estimated using engineering judgment.

- B Plant production will be estimated using engineering judgment.

- If any one or more than one analyzer is/are not operating for a period of less than 24 hours, one of the following must be done: (i) the requirements set forth for a 24-hour or greater period of downtime must be used to fill in the data gaps; or (ii) the data recorded for the five minute reading immediately preceding the affected analyzer's(s') stoppage must be used to fill in the data gap.

- In order to secure data on a "dry basis," the Facility may either:

  (i) directly measure the moisture content using a moisture analyzer; or

  (ii) assume the moisture content is the greater of 3% or the highest measured moisture content in any Relative Accuracy Test Audit ("RATA"); or

  (iii) for saturated gas streams only, measure the stack temperature using a stack temperature sensor at the time of each SO_2 measurement and determine the moisture content using a psychrometric chart or standard text water vapor pressure correlation.

Emissions Calculations

3-Hour Rolling Average.

For purposes of calculating a 3-hour rolling average, the system will maintain an array of the 36 most recent measurements of each of the three monitored parameters. Every five minutes, the system will add the most recent readings to the array and exclude the oldest readings.

The 3-hour rolling average lb/ton SO_2 emission rate (E_{3hravg}) will be calculated using Equation 4.

Equation 4:

$$E_{3hravg} = 1306.33 \frac{lbsSO_2}{TonAcid} \cdot \frac{\sum_{i=1}^{36} Q_{Stack\,i} \cdot B_i}{\sum_{i=1}^{36} \left\{ \left[Q_{Stack\,i} \cdot \frac{2}{3} \cdot \left[\frac{0.209}{0.791} \cdot (1 - Y_i - B_i) - Y_i - B_i \right] \right] - \left(P_{LbsSO_2Plant\,i} \cdot \frac{385.57}{64.058} \right) \right\}}$$

Where:

Y_i = Stack O_2 concentration (dry basis), fraction at measurement "*i*"

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\,i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

$P_{LbsSO_2Plant\,i}$ = Production rate of front-end liquid SO_2 plant (B Plant), lb per minute at measurement "*i*"

$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

E_{3hravg} = 3-hour average lb SO_2 per ton 100% Sulfuric Acid Produced

365-Day Rolling Average.

For the purposes of calculating a 365-day rolling average, the system will maintain an array of all of the measurements of each of the three monitored parameters for 365 days. Every day, the system will add the readings from that day to the array and exclude the readings from the oldest day.

The 365-day rolling average lb/ton SO_2 emission rate ($E_{365-Day\ Avg}$) will be calculated using Equation 5:

$$E_{365-Day\ Avg} = 1306.33 \frac{lbsSO_2}{TonAcid} \cdot \frac{\sum_{i=1}^{n} Q_{Stack\ i} \cdot B_i}{\sum_{i=1}^{n} \left\{ \left[Q_{Stack\ i} \cdot \frac{2}{3} \cdot \left[\frac{0.209}{0.791} \cdot (1 - Y_i - B_i) - Y_i - B_i \right] \right] - \left(P_{LbsSO_2 Plant\ i} \cdot \frac{385.57}{64.058} \right) \right\}}$$

Where:

Y_i = Stack O_2 concentration (dry basis), fraction at measurement "*i*"

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\ i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

$P_{LbsSO_2 Plant\ i}$ = Production rate of front-end liquid SO_2 plant (B Plant), lb per minute at measurement "*i*"

$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

n = the number of measurements taken at 5-minute intervals over the 365-day period

$E_{365-Day\ Avg}$ = 365-day rolling average lb SO_2 per ton 100% Sulfuric Acid Produced

Rounding of Numbers resulting from Calculations

Upon completion of the calculations, the final numbers shall be rounded as follows:

E_{3hravg}: Rounded to the nearest tenth.

$E_{365-Day\ Avg}$: Rounded to the nearest hundredth.

The number "5" shall be rounded up (*e.g.*, a short-term rate of 2.05011 shall be rounded to 2.1).

Rounding of Variables B, Q_{Stack}, and Y

Rounding of the variables identified as B, Q_{Stack}, and Y in the equations set forth in this CEMS Plan shall be done based on the accuracy of the measuring device as provided by the manufacturer of the device.

Compliance with Consent Decree SO_2 Limits

Short-Term SO_2 Limit

The Short-Term Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, the Facility will be in compliance with the Short-Term SO_2 Consent Decree Limit if E_{3hravg} does not exceed 3.0 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If the Facility contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 3.0 lb/ton after the period of the Malfunction(s) end(s), the Facility shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

NSPS SO_2 Limit

The NSPS Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, the Facility will be in compliance with the NSPS Limit if E_{3hravg} does not exceed 4 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If the Facility contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 4.0 lb/ton after the period of the Malfunction(s) end(s), the Facility shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

Long-Term SO_2 Limits

The Long-Term Limit includes periods of Startup, Shutdown, and Malfunction. The Facility will be in compliance with the Long-Term SO_2 Limit if $E_{365-Day\ Avg}$ does not exceed 1.90 lb of SO_2 per ton of 100% Sulfuric Acid Produced.

Recordkeeping and Reporting

In addition to any requirements in the Consent Decree, the Facility shall maintain records of the date, time, and duration that any of the three analyzers required under this CEMS plan is not operating. In each semi-annual report required under Section IX of the Decree and in each excess emission report required by the NSPS, the Facility specifically shall identify all periods of analyzer downtime during the reporting period and all data during the reporting period that is "substitute" data. "Substitute" data means data that is not generated contemporaneously by an analyzer at the same time as the gas flow stack (or duct) emissions are being measured, but rather, is substituted for contemporaneous analyzer measurements consistent with the provisions of the "Emissions Monitoring" section of this CEMS Plan when an analyzer is not operating.

Retention of All CEMS Data, including Data during Startup, Shutdown, and Malfunction

The Facility will retain all data generated by its SO_2 analyzer, O_2 analyzer, coriolis meter and stack flow analyzer, including all data generated during Startup, Shutdown, and/or Malfunction ("SSM") of the Sulfuric Acid Plant in accordance with the requirements of Section XIII of the Consent Decree.

Analyzer Specifications

The three stack analyzers will meet the following specifications:

Table 1

Parameter	Location	Range
SO_2, mole fraction, dry basis	Stack	Dual range: Normal: 0 – 500 ppm SO_2 SSM: 0 – 3,600 ppm SO_2
O_2, mole fraction, dry basis	Stack	Single range: 0 – 20.9 % O_2
Volumetric flow rate, DSCFM	Stack	0 to 125% of the maximum expected volumetric flow rate

The stack SO_2 analyzer will meet all applicable requirements of 40 C.F.R. §§ 60.11, 60.13, 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

The stack O_2 analyzer will meet 40 C.F.R. Part 60 Appendix B, Performance Specification 3 and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

The volumetric flow rate analyzer will meet 40 C.F.R. Part 60, Appendix B, Performance Specification 6 and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

Compliance with the NSPS: 40 C.F.R. Part 60, Subpart H

In addition to the requirements in this CEMS Plan, the Facility also will comply with all of the requirements of the NSPS relating to monitoring provided that, pursuant to 40 C.F.R. §60.13(i), this CEMS Plan will be an approved alternative to the following provisions of 40 C.F.R. Part 60, Subpart H:

- The requirement at 40 C.F.R. § 60.84(a) that the stack SO_2 analyzer have a span value of 1000 ppm. In lieu of this, the Facility will utilize the span values specified in Table 1; and
- The procedures specified at 40 C.F.R. § 60.84(b) for converting monitoring data into the units of the applicable standard. In lieu of this, the Facility will utilize the procedures specified in this CEMS Plan for calculating compliance with the NSPS 3-hour average limit.

APPENDIX G

APPENDIX G

OREGON FACILITY

CEMS Plan for SO_2 Emissions
Marsulex, Inc.
Oregon A and B Double Absorption Sulfuric Acid Regeneration Plants

Principle

This CEMS Plan is the mechanism for determining compliance with all SO_2 emission limits in the Consent Decree for the Oregon A and B Sulfuric Acid Plants at the Oregon Facility. The methodology described in this CEMS Plan will provide a real-time indication of compliance with the emission limits established in the Consent Decree by determining the emission rate in terms of both pounds of SO_2 emitted per unit of time and pounds of SO_2 emitted per ton of 100% Sulfuric Acid Produced (lb/ton). The system will utilize at least three analyzers: one to measure the converter inlet SO_2 concentration, one to measure stack SO_2 concentration, and one to measure stack volumetric flow rate. From these data, the emission rate, expressed as both pounds per unit of time and lb/ton, will be directly calculated using Equations 1, 2, and 3 below.

Equation 1:

$$M_{SO_2 Stack} = Q_{Stack} \cdot B \cdot \frac{64.058\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol}}$$

Equation 2:

$$P_{TonsH_2SO_4} = Q_{Stack} \cdot \left[\frac{A-B}{1-(1.5 \cdot A)}\right] \cdot \frac{98.0734\ {}^{lbs}/_{lb-mol}}{385.57\ \frac{SCF}{lb-mol} \cdot 2000\ {}^{lbs}/_{Ton}}$$

Equation 3:

$$E_{lbs/ton} = \frac{M_{SO_2 Stack}}{P_{TonsH_2SO_4}} = \frac{Q_{Stack} \cdot B}{Q_{Stack} \cdot \left[\frac{A-B}{1-(1.5 \cdot A)}\right]} \cdot 1306.33\ \frac{lbsSO_2}{TonAcid}$$

Where:

$P_{TonsH_2SO_4}$	= 100% Sulfuric Acid Production, tons per unit of time
$M_{SO_2 Stack}$	= Mass SO_2 stack emission rate, lb per unit of time
Q_{Stack}	= Volumetric flow rate of stack gas, dry standard cubic feet (DSCF) per unit of time
A	= Converter inlet SO_2 concentration, fraction (dry basis)
B	= Stack SO_2 concentration, fraction (dry basis)
$E_{lbs/ton}$	= lb SO_2 per ton 100% Sulfuric Acid Produced
$98.0734\ {}^{lbs}/_{lb-mol}$	= Molecular weight of sulfuric acid
$64.058\ {}^{lbs}/_{lb-mol}$	= Molecular weight of SO_2
$1306.33\ \frac{lbsSO_2}{TonAcid}$	$= \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

$385.57 \frac{SCF}{lb-mol}$ = Volume of one lb-mole of gas at standard temperature and pressure (68°F and 14.696 psia), cubic feet

The mass emission rate equation (Equation 1) calculates the SO_2 mass emission rate by multiplying the total stack gas flow rate by the stack SO_2 concentration. The 100% Sulfuric Acid Production Rate equation (Equation 2) is based on a material balance of the contact process. The lb/ton equation (Equation 3) is the ratio of the SO_2 emission rate to the 100% Sulfuric Acid Production Rate.

The benefit of using this method is the ability to obtain information regarding the SO_2 mass emission rate, the fact that lb/ton measurements will be "weighted" based on the flow rate during each measurement, and the elimination of errors associated with measuring sulfuric acid flow and using converter inlet Reich testing.

Definitions

Terms used in this CEMS Plan that are defined in the Clean Air Act ("CAA") or in federal or state regulations promulgated pursuant to the CAA shall have the meaning assigned to them in the CAA or such regulations, unless otherwise defined in the Consent Decree. Terms used in this CEMS Plan that are defined in the Consent Decree shall have the meaning assigned to them therein.

Emissions Monitoring

Marsulex will undertake the following monitoring procedures separately at both the Oregon A Plant and the Oregon B Plant:

- Emissions monitoring will be done using an SO_2 analyzer at the converter inlet, an SO_2 analyzer at the exit stack, and a stack flow rate analyzer. Except for any analyzer malfunctions, associated repairs, and required quality assurance or control activities (including calibration checks and required zero and span adjustments), Marsulex will conduct monitoring during all Operating Periods and during Shutdown.

- Once every five minutes, the analyzers will measure the stack SO_2 concentration (fraction, dry basis), the converter inlet SO_2 concentration (fraction, dry basis) and the volumetric flow rate (dry standard cubic feet per minute).

- During routine calibration checks and adjustments of the any analyzers, the pre-calibration will be used to fill in any analyzer data gaps that occur pending completion of the calibration checks and adjustments.

- If any one or more than one analyzer is/are not operating for a period of 24 hours or greater, data gaps in the array involving the non-operational analyzer(s) will be filled in as follows:

  - Exit stack gas will be sampled and analyzed for SO_2 at least once per hour, during all Operating Periods. Sampling will be conducted by Reich test or other established method (*e.g.*, portable analyzer). The most recent hourly reading will be substituted for the 12 five-minute readings that would otherwise have been taken if the analyzer had been operating normally.

  - Converter inlet gas either will be sampled and analyzed for SO_2 using a Reich test or other established method, or the concentration will be estimated using engineering judgment, at least once every four hours during all Operating Periods. The most recent four-hour measurement/estimate will be substituted for the 48 five-minute readings that would otherwise have been taken if the system had been operating normally.

  - Stack volumetric flow rate will be estimated using engineering judgment.

- If any one or more than one analyzer is/are not operating for a period of less than 24 hours, one of the following must be done: (i) the requirements set forth for a 24-hour or greater period of downtime must be used to fill in the data gaps; or (ii) the data recorded for the five minute reading immediately preceding the affected analyzer's(s') stoppage must be used to fill in the data gap.

Emissions Calculations

Marsulex will make the following calculations separately at both the Oregon A Plant and the Oregon B Plant.

3-Hour Rolling Average.

For purposes of calculating a 3-hour rolling average, the system will maintain an array of the 36 most recent measurements of each of the three monitored parameters. Every five minutes, the system will add the most recent readings to the array and exclude the oldest readings.

The 3-hour rolling average lb/ton SO_2 emission rate (E_{3hravg}) will be calculated using Equation 4.

Equation 4:

$$E_{3hravg} = 1306.33 \frac{lbsSO_2}{TonAcid} \cdot \frac{\sum_{i=1}^{36} Q_{Stack\ i} \cdot B_i}{\sum_{i=1}^{36} Q_{Stack\ i} \cdot \left[\frac{A_i - B_i}{1 - 1.5 \cdot A_i} \right]}$$

Where:

A_i = Converter inlet SO_2 concentration, fraction (dry basis) at measurement "*i*"

B_i = Stack SO_2 concentration, fraction (dry basis) at measurement "*i*"

$Q_{Stack\ i}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "*i*"

$1306.33 \frac{lbsSO_2}{TonAcid} = \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

E_{3hravg} = 3-hour average lb SO_2 per ton 100% Sulfuric Acid Produced

365-Day Rolling Average.

For the purposes of calculating a 365-day rolling average, the system will maintain an array of all of the measurements of each of the three monitored parameters for 365 days. Every day, the system will add the readings from that day to the array and exclude the readings from the oldest day.

The 365-day rolling average lb/ton SO_2 emission rate ($E_{365-Day\ Avg}$) will be calculated using Equation 5.

Equation 5:

$$E_{365-Day\ Avg} = 1306.33\frac{lbsSO_2}{TonAcid} \cdot \frac{\sum_{j=1}^{n} Q_{Stack\ j} \cdot B_j}{\sum_{i=1}^{n} Q_{Stack\ j} \cdot \left[\frac{A_j - B_j}{1 - 1.5 \cdot A_j}\right]}$$

Where:

A_j = Converter inlet SO_2 concentration, fraction (dry basis) at measurement "j"

B_j = Stack SO_2 concentration, fraction (dry basis) at measurement "j"

$Q_{Stack\ j}$ = Stack volumetric flow rate, dry standard cubic feet per minute (DSCFM) at measurement "j"

$1306.33\frac{lbsSO_2}{TonAcid} = \frac{64.058\ {}^{lbs}/_{lb-mol} \cdot 2000\ {}^{lbs}/_{ton}}{98.0734\ {}^{lbs}/_{lb-mol}}$

n = the number of measurements taken at 5-minute intervals over the 365-day period

$E_{365-Day\ Avg}$ = 365-day rolling average lb SO_2 per ton 100% Sulfuric Acid Produced

Rounding of Numbers resulting from Calculations

Upon completion of the calculations, the final numbers shall be rounded as follows:

E_{3hravg}: Rounded to the nearest tenth.

$E_{365-Day\ Avg}$: Rounded to the nearest hundredth.

The number "5" shall be rounded up (*e.g.*, a short-term rate of 2.05011 shall be rounded to 2.1).

Rounding of Variables A, B, and Q_{Stack}

Rounding of the variables identified as A, B, and Q_{Stack} in the equations set forth in this CEMS Plan shall be done based on the accuracy of the measuring device as provided by the manufacturer of the device.

Compliance with Consent Decree SO_2 Limits

Short-Term SO_2 Limits

The Short-Term Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Marsulex will be in compliance with the Short-Term SO_2 Consent Decree Limit if E_{3hravg} does not exceed 3.5 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Marsulex contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 3.5 lb/ton after the period of the Malfunction(s) end(s), Marsulex shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

NSPS SO_2 Limits

The NSPS Limit does not apply during periods of Startup, Shutdown, or Malfunction. During all other Operating Periods, Marsulex will be in compliance with the NSPS Limit if E_{3hravg} does not exceed 4.0 lb of SO_2 per ton of 100% Sulfuric Acid Produced. If Marsulex contends that emissions during a Malfunction(s) resulted in a calculated 3-hour rolling average emission rate(s) in excess of 4.0 lb/ton after the period of the Malfunction(s) end(s), Marsulex shall recalculate E_{3hravg} to exclude measurements recorded during the period(s) of the claimed Malfunction(s).

Long-Term SO_2 Limits

The Long-Term Limits include periods of Startup, Shutdown, and Malfunction. Marsulex will be in compliance with the Long-Term SO_2 Limit if $E_{365-Day\ Avg}$ does not exceed the rates specified in Table 1 below:

Table 1

Plant	Limit (lb of SO_2 per ton of 100% sulfuric acid produced)
Oregon A	2.40
Oregon B	2.50

Recordkeeping and Reporting

In addition to any requirements in the Consent Decree, Marsulex shall maintain records of the date, time, and duration that any of the three analyzers required under this CEMS plan is not operating. In each semi-annual report required under Section IX of the Decree and in each excess emission report required by the NSPS, Marsulex specifically shall identify all periods of analyzer downtime during the reporting period and all data during the reporting period that is "substitute" data. "Substitute" data means data that is not generated contemporaneously by an analyzer at the same time as the gas flow stack (or duct) emissions are being measured, but rather, is substituted for contemporaneous analyzer measurements consistent with the provisions of the "Emissions Monitoring" section of this CEMS Plan when an analyzer is not operating.

Retention of All CEMS Data, including Data during Startup, Shutdown, and Malfunction

Marsulex will retain all data generated by its SO_2 analyzers and stack flow analyzer, including all data generated during Startup, Shutdown, and/or Malfunction ("SSM") of either the A Plant or the B Plant in accordance with the requirements of Section XIII of the Consent Decree.

Analyzer Specifications

The three analyzers will meet the following specifications:

Table 2

Parameter	Location	Range
SO_2, mole fraction, dry basis	Stack	Dual range: Normal: 0 – 500 ppm SO_2 SSM: 0 – 3,600 ppm SO_2
SO_2, mole fraction, dry basis	Converter Inlet	Single range: 0 – 15 % SO_2
Volumetric flow rate, DSCFM	Stack	0 to 125% of the maximum expected volumetric flow rate

The stack SO_2 analyzer will meet all applicable requirements of 40 C.F.R. §§ 60.11, 60.13, 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

The Converter Inlet SO_2 Analyzer likewise will meet all applicable requirements of 40 C.F.R. Part 60, Appendix B, Performance Specification 2, and 40 C.F.R. Part 60, Appendix F, Procedure 1, except as follows:

- Marsulex will select the optimum location to obtain representative SO_2 readings. Turbulence near the blower exit and/or elevated temperatures at the converter inlet may require an analyzer measurement location that differs from the requirements of Performance Specification 2, Section 8.1.

- In lieu of annual Relative Accuracy Test Audits ("RATAs"), as described in Section 5.1.1 of Appendix F, Marsulex will conduct quarterly cylinder gas audits (*i.e.*, four per year) on the Converter Inlet SO_2 Analyzer.

The volumetric flow rate analyzer will meet 40 C.F.R. Part 60, Appendix B, Performance Specification 6 and the Quality Assurance and Quality Control Procedures in 40 C.F.R. Part 60, Appendix F, Procedure 1.

Compliance with the NSPS: 40 C.F.R. Part 60, Subpart H

In addition to the requirements in this CEMS Plan, Marsulex also will comply with all of the requirements of the NSPS relating to monitoring provided that, pursuant to 40 C.F.R. §60.13(i), this CEMS Plan will be an approved alternative to the following provisions of 40 C.F.R. Part 60, Subpart H:

- The requirement at 40 C.F.R. § 60.84(a) that the stack SO_2 analyzer have a span value of 1000 ppm. In lieu of this, Marsulex will utilize the span values specified in Table 1; and

- The procedures specified at 40 C.F.R. § 60.84(b) for converting monitoring data into the units of the applicable standard. In lieu of this, Marsulex will utilize the procedures specified in this CEMS Plan for calculating compliance with the NSPS 3-hour average limit.

APPENDIX H

APPENDIX H

SHORT TERM EMISSION LIMITS DURING STARTUP

3-hour Time period (Hours after Startup commences)	Short-Term Sulfur Dioxide Emission Limit, lbs/ton, applicable to:				
	Beaumont	Shreveport	Riverton #1	Riverton #2	Tulsa
1st through the 3rd hour	15.00	15.00	15.00	15.00	15.00
2nd through the 4th hour	15.00	15.00	15.00	15.00	15.00
3rd through the 5th hour	15.00	15.00	15.00	15.00	15.00
4th through the 6th hour	15.00	15.00	15.00	15.00	15.00
5th through the 7th hour	15.00	15.00	15.00	15.00	15.00
6th through the 8th hour	15.00	15.00	15.00	15.00	15.00
7th through the 9th hour	15.00	15.00	15.00	15.00	15.00
8th through the 10th hour	15.00	15.00	15.00	15.00	15.00
9th through the 11th hour	15.00	15.00	15.00	15.00	15.00
10th through the 12th hour	15.00	15.00	15.00	15.00	15.00
11th through the 13th hour	15.00	15.00	15.00	15.00	15.00
12th through the 14th hour	15.00	15.00	15.00	15.00	15.00
13th through the 15th hour	12.00	12.00	12.00	12.00	12.00
14th through the 16th hour	9.00	9.00	9.00	9.00	9.00
15th through the 17th hour	6.00	6.00	6.00	6.00	6.00
16th through the 18th hour	6.00	6.00	6.00	6.00	6.00
17th through the 19th hour	6.00	6.00	6.00	6.00	6.00
18th through the 20th hour	6.00	6.00	6.00	6.00	6.00
19th through the 21st hour	6.00	6.00	6.00	6.00	6.00
20th through the 22nd hour	6.00	6.00	6.00	6.00	6.00
21st through the 23rd hour	6.00	6.00	6.00	6.00	6.00
22nd through the 24th hour	6.00	6.00	6.00	6.00	6.00
23rd through the 25th hour	4.73	4.67	4.63	4.70	4.57
24th through the 26th hour	3.47	3.33	3.27	3.40	3.13

Notes: Short-Term Limits for the 11 through 13 hour and 12 through 14 hour are weighted averages of 15.0 and 6.0 lbs/ton. Emission limits for the 23rd through 25th hour and 24th through 26th hour are weighted averages of 6.0 lbs/ton and the Short-Term Limit for each Sulfuric Acid Plant as specified in the Consent Decree. Beginning with the 3-hour period consisting of the 25th through 27th hour after Startup commences, the Short-Term Limits specified in the Consent Decree apply

APPENDIX I

APPENDIX I

Calculation of Stipulated Penalties for Violations of the Short-Term Limits, Limits During Start-up, and Long-Term Limits

I. Calculating Stipulated Penalties for Violations of the Short-Term Limits and Limits during Startup

A. Background on CEMS' Recording of SO2, 3-Hour Rolling Average Rates

The Short-Term SO2 Limits and the SO2 Limits during Startup required by the Consent Decree are based on 3-hour rolling averages. During normal operations, the analyzers required by the CEMS Plans in Appendices A-G will record readings every 5 minutes. To calculate the 3-hour rolling average SO2 rates, the system will maintain an array of 36 readings [(60 ÷ 5) x 3], and, at every five-minute interval, it will add the most recent reading to the calculation and discard the oldest reading. Thus, under normal operations, there will 36, 3-hour rolling average rates in a three hour period, and 288 3-hour rolling average rates in a 24 hour period. [1]

The example data on pages 3 – 4 illustrates how data generally will be recorded under the CEMS Plans.

B. Calculating Stipulated Penalties For Violations of the 3-Hour Rolling Average Limits

Stipulated penalties will accrue for any violation of the 3-hour rolling average limit in any non-overlapping three hour period based on how much the recorded rate is above the limit:

Percentage Over the Limit	Penalty per Violation
1 - 50%	$250
51 - 100%	$500
Over 100%	$750

Assume that the Short-Term SO2 Limit is 2.2. Using the data from pages 3- 4, stipulated penalties would accrue as follows:

(1) The first stipulated penalty that would accrue would occur at 14:00, when the 3-hour rolling average rate first exceeded the 2.2 limit. Because the recorded rate of 2.6 is between 1 - 50% above the limit, $250 would be the penalty.

(2) No stipulated penalties would accrue for the 3-hour rolling average rate exceedances that are recorded between 14:05 and 16:55 because one or more of the readings used to calculate the rolling averages in each of these five-minute intervals overlap with one or more of the readings used to calculate the rate at 14:00.

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[1] During system maintenance and/or analyzer malfunctions, there may be fewer than 36 readings in a three-hour period, but the CEMS Plans describe how to calculate the rolling, 3-hour averages under these circumstances. The use of a different method to fill in the data gaps when an analyzer is being maintained or has malfunctioned will not change the method of calculating stipulated penalties.

(3) The second stipulated penalty that would accrue would occur at 17:00 because this is the first time since 14:00 that no readings overlap with the readings that were used to calculate the rate the first time a stipulated penalty accrued at 14:00. Because the recorded rate of 3.4 is between 51 and 100% over the limit, $500 would be the appropriate penalty.

(4) No stipulated penalties would accrue for the 3-hour rolling average rates exceedances that are recorded between 17:05 and 17:15 because one or more of the readings used to calculate the rolling averages in each of these five-minute intervals overlap with one or more of the readings used to calculate the rate at 17:00.

(5) The final stipulated penalty would be $ 750 (*i.e.*, $250 + $500).

EXAMPLE DATA PURSUANT TO THE CEMS PLANS

Time	SO2 In	SO2 Stack	Stack Flow (SCFM)	SO2 Stack (SCFM)	SO3 Out Converter (SCFM)	3-Hr Rolling Average (lb/ton)	Mass (lb)
10:05	11.00%	0.0230%	40000	9.2	5258.4	--	8
10:10	11.20%	0.0230%	40000	9.2	5373.6	--	15
10:15	11.10%	0.0230%	40000	9.2	5315.9	--	23
10:20	11.20%	0.0230%	40000	9.2	5373.6	--	31
10:25	11.00%	0.0230%	40000	9.2	5258.4	--	38
10:30	11.00%	0.0230%	40000	9.2	5258.4	--	46
10:35	11.00%	0.0230%	40000	9.2	5258.4	--	53
10:40	11.00%	0.0230%	40000	9.2	5258.4	--	61
10:45	11.00%	0.0230%	40000	9.2	5258.4	--	69
10:50	11.00%	0.0230%	40000	9.2	5258.4	--	76
10:55	11.00%	0.0210%	40000	8.4	5259.4	--	83
11:00	11.00%	0.0190%	40000	7.6	5260.4	--	90
11:05	11.20%	0.0250%	35000	8.8	4701.0	--	97
11:10	11.20%	0.0250%	35000	8.8	4701.0	--	104
11:15	11.20%	0.0250%	35000	8.8	4701.0	--	112
11:20	11.20%	0.0250%	35000	8.8	4701.0	--	119
11:25	11.20%	0.0250%	35000	8.8	4701.0	--	126
11:30	11.20%	0.0250%	35000	8.8	4701.0	--	133
11:35	11.20%	0.0250%	35000	8.8	4701.0	--	141
11:40	11.20%	0.0250%	35000	8.8	4701.0	--	148
11:45	11.20%	0.0250%	35000	8.8	4701.0	--	155
11:50	11.10%	0.0250%	35000	8.8	4650.6	--	162
11:55	11.10%	0.0250%	38000	9.5	5049.2	--	170
12:00	11.10%	0.0250%	38000	9.5	5049.2	--	178
12:05	11.10%	0.0250%	38000	9.5	5049.2	--	186
12:10	11.10%	0.0250%	38000	9.5	5049.2	--	194
12:15	11.10%	0.0250%	38000	9.5	5049.2	--	202
12:20	11.10%	0.0190%	38000	7.2	5051.9	--	208
12:25	11.10%	0.0190%	38000	7.2	5051.9	--	214
12:30	11.10%	0.0190%	38000	7.2	5051.9	--	220
12:35	11.10%	0.0190%	38000	7.2	5051.9	--	226
12:40	11.10%	0.0190%	38000	7.2	5051.9	--	232
12:45	11.10%	0.0190%	38000	7.2	5051.9	--	238
12:50	11.10%	0.0190%	38000	7.2	5051.9	--	244
12:55	11.20%	0.0190%	38000	7.2	5106.7	--	250
13:00	11.20%	0.0190%	38000	7.2	5106.7	2.2	256
13:05	11.20%	0.0190%	38000	7.2	5106.7	2.2	262
13:10	11.20%	0.0190%	38000	7.2	5106.7	2.2	268
13:15	11.20%	0.0190%	41000	7.8	5509.9	2.2	274
13:20	11.20%	0.0190%	41000	7.8	5509.9	2.2	281
13:25	11.20%	0.0190%	41000	7.8	5509.9	2.2	287
13:30	11.20%	0.0190%	41000	7.8	5509.9	2.1	294
13:35	11.20%	0.0190%	41000	7.8	5509.9	2.1	300
13:40	11.20%	0.0190%	41000	7.8	5509.9	2.1	307
13:45	11.00%	0.0190%	40000	7.6	5260.4	2.1	313

13:50	11.20%	0.0190%	40000	7.6	5375.5	2.1	319
13:55	11.10%	0.0190%	40000	7.6	5317.8	2.1	326
14:00	11.00%	0.1800%	40000	72.0	5183.2	2.6	385
14:05	11.00%	0.3000%	30000	90.0	3844.3	3.1	460
14:10	11.00%	0.1000%	30000	30.0	3916.2	3.3	485
14:15	11.00%	0.1000%	28000	28.0	3655.1	3.5	508
14:20	11.00%	0.1000%	28000	28.0	3655.1	3.6	532
14:25	11.00%	0.1000%	28000	28.0	3655.1	3.8	555
14:30	11.00%	0.1000%	28000	28.0	3655.1	4.0	578
14:35	11.00%	0.0190%	28000	5.3	3682.3	4.0	583
14:40	11.00%	0.0190%	40000	7.6	5260.4	3.9	589
14:45	11.20%	0.0190%	40000	7.6	5375.5	3.9	595
14:50	11.20%	0.0190%	40000	7.6	5375.5	3.9	601
14:55	11.20%	0.0190%	40000	7.6	5375.5	3.9	608
15:00	11.20%	0.0190%	40000	7.6	5375.5	3.9	614
15:05	11.20%	0.0190%	40000	7.6	5375.5	3.8	620
15:10	11.20%	0.0190%	40000	7.6	5375.5	3.8	627
15:15	11.20%	0.0190%	40000	7.6	5375.5	3.8	633
15:20	11.20%	0.0190%	40000	7.6	5375.5	3.8	639
15:25	11.20%	0.0190%	40000	7.6	5375.5	3.8	646
15:30	11.10%	0.0190%	40000	7.6	5317.8	3.8	652
15:35	11.10%	0.0250%	40000	10.0	5314.9	3.8	660
15:40	11.10%	0.0250%	40000	10.0	5314.9	3.8	669
15:45	11.10%	0.0250%	40000	10.0	5314.9	3.8	677
15:50	11.10%	0.0190%	40000	7.6	5317.8	3.8	683
15:55	11.10%	0.0190%	40000	7.6	5317.8	3.8	690
16:00	11.10%	0.0190%	40000	7.6	5317.8	3.8	696
16:05	11.10%	0.0190%	40000	7.6	5317.8	3.8	702
16:10	11.10%	0.0190%	40000	7.6	5317.8	3.8	708
16:15	11.10%	0.0190%	40000	7.6	5317.8	3.8	715
16:20	11.10%	0.0190%	40000	7.6	5317.8	3.8	721
16:25	11.10%	0.0190%	40000	7.6	5317.8	3.8	727
16:30	11.10%	0.0190%	40000	7.6	5317.8	3.8	734
16:35	11.20%	0.0190%	40000	7.6	5375.5	3.8	740
16:40	11.20%	0.0190%	41000	7.8	5509.9	3.8	747
16:45	11.20%	0.0190%	41000	7.8	5509.9	3.8	753
16:50	11.20%	0.0190%	41000	7.8	5509.9	3.8	759
16:55	11.20%	0.0190%	41000	7.8	5509.9	3.8	766
17:00	11.20%	0.0200%	41000	8.2	5509.4	3.4	773
17:05	11.20%	0.0200%	41000	8.2	5509.4	2.7	780
17:10	11.20%	0.0200%	41000	8.2	5509.4	2.6	786
17:15	11.20%	0.0200%	41000	8.2	5509.4	2.4	793
17:20	11.20%	0.0200%	41000	8.2	5509.4	2.2	800
17:25	11.20%	0.0200%	41000	8.2	5509.4	2.1	807
17:30	11.20%	0.0200%	41000	8.2	5509.4	1.9	814
17:35	11.00%	0.0200%	41000	8.2	5391.4	1.9	820
17:40	11.00%	0.0200%	41000	8.2	5391.4	1.9	827
17:45	11.00%	0.0200%	41000	8.2	5391.4	1.9	834
17:50	11.00%	0.0200%	41000	8.2	5391.4	1.9	841

II. Calculating Stipulated Penalties for Violations of the Long-Term Limits

The Long-Term SO2 Limits required by the Consent Decree are based on 365-day rolling averages. For each day, there will be only one 365-day rolling average.

The Consent Decree provides that for each violation, per day, of the Long-Term Limit, the following stipulated penalties will apply:

Period of Noncompliance	Penalty per day
1st - 14th day	$1000
15th - 30th day	$1500
31st day and each day thereafter	$2000

If the 365-day rolling average limit is exceeded on consecutive days, then the penalties are scaled up after the 14th day and after the 30th day. Thus, for example, a violation of the Long-Term Limit for 40 consecutive days will result in $58,000 in stipulated penalties (*i.e.*, (14 x 1000) + (16 x 1500) + (10 x 2000). When the violations are not consecutive or are not consecutive for more than 14 days, then the penalties do not scale up. Thus, for example, 10 days of consecutive or non-consecutive days of violations in January; 10 days of consecutive or non-consecutive violations in March; 10 days of consecutive or non-consecutive violations in May; and 10 days of consecutive or non-consecutive violations in July will result in $40,000 in stipulated penalties (*i.e.*, 40 x 1000).

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Title 40: Protection of Environment

PART 51—REQUIREMENTS FOR PREPARATION, ADOPTION, AND SUBMITTAL OF IMPLEMENTATION PLANS
Subpart G—Control Strategy

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§ 51.117 Additional provisions for lead.

In addition to other requirements in §§51.100 through 51.116 the following requirements apply to lead. To the extent they conflict, there requirements are controlling over those of the proceeding sections.

(a) *Control strategy demonstration.* Each plan must contain a demonstration showing that the plan will attain and maintain the standard in the following areas:

(1) Areas in the vicinity of the following point sources of lead: Primary lead smelters, Secondary lead smelters, Primary copper smelters, Lead gasoline additive plants, Lead-acid storage battery manufacturing plants that produce 2,000 or more batteries per day. Any other stationary source that actually emits 25 or more tons per year of lead or lead compounds measured as elemental lead.

(2) Any other area that has lead air concentrations in excess of the national ambient air quality standard concentration for lead, measured since January 1, 1974.

(b) *Time period for demonstration of adequacy.* The demonstration of adequacy of the control strategy required under §51.112 may cover a longer period if allowed by the appropriate EPA Regional Administrator.

(c) *Special modeling provisions.* (1) For urbanized areas with measured lead concentrations in excess of 4.0 $\mu g/m^3$, quarterly mean measured since January 1, 1974, the plan must employ the modified rollback model for the demonstration of attainment as a minimum, but may use an atmospheric dispersion model if desired, consistent with requirements contained in §51.112(a). If a proportional model is used, the air quality data should be the same year as the emissions inventory required under the paragraph e.

(2) For each point source listed in §51.117(a), that plan must employ an atmospheric dispersion model for demonstration of attainment, consistent with requirements contained in §51.112(a).

(3) For each area in the vicinity of an air quality monitor that has recorded lead concentrations in excess of the lead national standard concentration, the plan must employ the modified rollback model as a minimum, but may use an atmospheric dispersion model if desired for the demonstration of attainment, consistent with requirements contained in §51.112(a).

(d) *Air quality data and projections.* (1) Each State must submit to the appropriate EPA Regional Office with the plan, but not part of the plan, all lead air quality data measured since January 1, 1974. This requirement does not apply if the data has already been submitted.

(2) The data must be submitted in accordance with the procedures and data forms specified in Chapter 3.4.0 of the "AEROS User's Manual" concerning storage and retrieval of aerometric data (SAROAD) except where the Regional Administrator waives this requirement.

(3) If additional lead air quality data are desired to determine lead air concentrations in areas suspected of exceeding the lead national ambient air quality standard, the plan may include data from any previously collected filters from particulate matter high volume samplers. In determining the lead content of the filters for control strategy demonstration purposes, a State may use, in addition to the reference method, X-ray fluorescence or any other method approved by the Regional Administrator.

(e) *Emissions data.*

(1) The point source inventory on which the summary of the baseline for lead emissions inventory is based must contain all sources that emit 0.5 or more tons of lead per year.

(2) Each State must submit lead emissions data to the appropriate EPA Regional Office with the original plan. The submission must be made with the plan, but not as part of the plan, and must include emissions data and information related to point and area source emissions. The emission data and information should include the information identified in the Hazardous and Trace Emissions System (HATREMS) point source coding forms for all point sources and the area source coding forms for all sources that are not point sources, but need not necessarily be in the format of those forms.

[41 FR 18388, May 3, 1976, as amended at 58 FR 38822, July 20, 1993; 73 FR 67057, Nov. 12, 2008]

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