MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

Periodic Monitoring Guidance

Contents

Periodic Monitoring Guidance 1

Section 1.0: Procedure for Evaluating Periodic Monitoring Submittals with Renewable Operating Permit Applications 2

Section 2.0: Pollutant-Specific Periodic Monitoring Guidance 5

Section 3.0: Emission Unit-Specific Periodic Monitoring Examples 7

3.1: Periodic Monitoring for Industrial Boilers 7

3.1a: Sample Monitoring Plan for a Coal-Fired Boiler 9

3.2: Periodic Monitoring for Coating and Printing Operations 11

Section 4.0: Parametric Monitoring Examples for Control Equipment 14

4.1: Carbon Adsorption Systems 14

4.2: Condensers (Contact) 16

4.3: Condensers (Noncontact) 18

4.4: Cyclones and Multiclones 19

4.5: Electrostatic Precipitators 20

4.6: Fabric Filter Baghouses 22

4.7: Flares 24

4.8: Catalytic Oxidizers 25

4.9: Thermal Oxidizers 26

4.10: Packed Tower Scrubbers 27

4.11: Scrubbers (Other) 30

4.12: Settling Chambers 32

Section 1.0: Procedure for Evaluating Periodic Monitoring Submittals with Renewable Operating Permit Applications

BACKGROUND

Rule 213(3) requires that each renewable operating permit shall contain testing, monitoring, recordkeeping, reporting, and compliance evaluation activities that are sufficient for making a compliance determination for all emission limitations and standards. These conditions are referred to as **Periodic Monitoring Requirements.**

Periodic monitoring requirements are especially important because Rule 213(3)(c)(i) requires semi-annual reports certifying compliance with all emission limitations and standards and a description of any deviations from the permit requirements during the reporting cycle. These reports will require certification by the responsible official for the facility.

Many applicable requirements (NSPS, Part 6 Rules, Part 61 NESHAPs, Part 63 NESHAP-MACT Rules, etc.) specify testing, monitoring, or recordkeeping for verifying compliance with emission limits. If the applicable requirement already contains a protocol for determining compliance with its emission limitations, no additional requirements will be necessary to satisfy Rule 213(3)(a) or (b).

Some applicable requirements do not specify a method of verifying compliance with emission limitations. In these cases, Rule 213(3)(a)(ii) requires the use of periodic monitoring sufficient to yield reliable data from the relevant time period that are representative of the stationary source's compliance with the emission limitations or standards.

The purpose of this document is to set forth a flexible procedure that AQD staff may use to determine the reasonableness and adequacy of proposed periodic monitoring plans in renewable operating permit applications. This document will describe some of the various approaches which may be used to determine compliance with an emission limitation and describe general aspects which must be present in a periodic monitoring proposal. It will also provide guidance for parametric monitoring protocols for several types of control equipment, as well as discussion of acceptable periodic monitoring plans for coating lines and industrial boilers. Unusual or complicated situations may be referred to supervisory staff or, if necessary, to the ROP Central Unit for individual consideration.

PROCEDURE

Periodic monitoring must be proposed for all emission limitations, including generally applicable emission limits, such as Rule 301. However, each emission limitation does not need its own exclusive monitoring system. A more logical and practical solution is to have a single periodic monitoring system for each emission unit or, where applicable, flexible grouping.

If existing monitoring is specified as the Basis for Compliance for an applicable requirement, enough additional information must be included to show that the monitoring system is adequate. If the existing monitoring system satisfies testing, recordkeeping, monitoring, or reporting requirements that were specified as part of the underlying applicable requirement, Rule 213(3)a and b are satisfied and no further deliberation is necessary.

If monitoring was not previously required by a permit to install, consent order, or other applicable requirement, the reviewer must decide if the proposed periodic monitoring is sufficient for determining compliance with the emission limitation.

These general approaches may be used for verifying compliance with emission limitations:

1. **Direct measurement of emitted pollutants**. This can be accomplished by a continuous emissions monitoring system (CEMS), intermittent stack testing as approved by the reviewer, or careful recordkeeping of material throughput and likely resultant emissions. Many emission limits are based on units or reporting periods (i.e. lb./1,000 lb. exhaust gas and lb./hr.) that are fashioned for direct measurement. Adequate monitoring for these types of requirements could consist of a CEMS or intermittent stack testing. Recent stack test results (if any exist) could be cited and a schedule provided for further testing. Stack testing should be required every 5 years at a minimum, unless the emissions are below significant thresholds. A special condition allowing stack testing at the request of the AQD is permissible for emission units with insignificant emissions. Furthermore, AQD has the authority to require testing pursuant to R 336.2001 as specified in general conditions No. 13 – 15 of the ROP shell document. If compliance history or other extenuating circumstances (like netting out of PSD) are issues, stack testing may be scheduled annually, once during each permit renewal cycle (every five years), or upon AQD request, depending upon the reviewer's assessment of the situation. If technical assistance regarding direct emission measurement is needed, district staff should contact the Technical Programs Unit.

2. **Parametric monitoring in conjunction with a Malfunction Abatement Plan (MAP)**. An acceptable parametric monitoring protocol must consist of daily (or other representative period as determined by the reviewer) monitoring of operating parameters in conjunction with a MAP. In this type of monitoring program, an excursion from the recommended operating parameter range would not constitute a deviation; however, failure to immediately implement the approved MAP in the event of an excursion from the approved range of operating parameters would be a deviation of the renewable operating permit condition.

   A MAP, at a minimum, must include the following information:

   - Identification of the individual or position responsible for inspecting and maintaining the device.
   - A description of the items or conditions that will be inspected, including a schedule.
   - Corrective actions that will be implemented if the inspection indicates a malfunction.
   - Time schedules for taking corrective actions for common problems which may occur.
   - Identification and quantification of replacement parts maintained on site for quick replacement

3. **Other method which has previously been approved by the department**, such as an alternative emissions quantification protocol for the Emissions Trading Program.

A MAP is recommended for all facilities, regardless of the type of periodic monitoring that is used.

When evaluating a periodic monitoring proposal, the reviewer must ask several questions*:*

- Is the pollutant being measured directly? [Approach 1]
- Has a relationship been established between the monitored parameter and compliance with the emission limitation? [Approach 2]
- Will the monitoring method yield “representative data”, i.e. do the sampling frequency and averaging times correlate with the emission limits?
- Do situations exist at the site which merit more stringent monitoring for determining compliance? Examples of these situations include unstable processes, a history of compliance problems, normal operation in close proximity to the maximum emission limit, or compliance with very stringent emission limits in order to “net out” of federal PSD regulations.
- Will the monitoring method yield enough information to make a compliance determination for all emission limitations?

Incorporation of Periodic Monitoring Proposals into the ROP Application Forms*:*

Periodic monitoring which are also the “Basis for Compliance” for an applicable requirement can be included with the ROP Initial or Renewal application forms under Site Requirement Information: *“Does the source have any required plans such as a malfunction abatement plan, fugitive dust plan, operation/maintenance plan, startup/shutdown plans or any other monitoring plan?”* or under AI-001: Additional Information near the end of each form. However, many applicable requirements will have a “Basis for Compliance” based on current data and a separate periodic monitoring proposal to ensure compliance in the future. If more periodic monitoring information is requested during the technical review, it may be submitted under AI-001: Additional Information.

After the periodic monitoring proposal has been determined to be adequate, the reviewer should incorporate the monitoring requirements into the ROP shell document. Whenever possible, periodic monitoring requirements should be incorporated into the Emission Unit or Flexible Group tables in Sections IV. Design / Equipment Parameter(s), V. Testing / Sampling and VI. Monitoring / Recordkeeping. If the requirement cannot be abbreviated in the table, it should be included in its entirety in Appendices 3-5.

Section 2.0: Pollutant-Specific Periodic Monitoring Guidance

This section provides examples of periodic monitoring protocols which may be used to ensure compliance with criteria pollutant emission limitations. It is not intended to show all acceptable options for determining compliance. The most adequate and reasonable periodic monitoring for a given facility must be determined on a case-by-case basis.

Periodic Monitoring for Particulate Matter (PM) Emissions and Opacity

An acceptable parametric monitoring protocol for PM-emitting processes and related control devices would be:

- Establish a range of operating parameters which indicates control equipment is operating properly. This range should be based upon manufacturer's recommendations, conditions during previous stack testing, and/or operator's experience. See **Section 4.0** for equipment-specific parametric monitoring guidance.

- Conduct daily, weekly, or other acceptable time period as determined by the permit reviewer, visual emission observations during peak normal operating conditions.

- Check operating parameters (pressure differential gauge, liquid flow indicator, etc.).

- Perform routine maintenance.

- If equipment is within established operating parameter range, document operating conditions and any maintenance which was performed.

- If equipment is not operating within established parameter ranges, implement preventative maintenance plan immediately. This includes manufacturer's recommended routine maintenance measures as well as trouble-shooting activities to be undertaken in the event of a malfunction. Document the excursion and corrective actions taken. Submit any necessary reports required by Rule 213(3)c or Rule 912.

- Stack testing performed upon request by AQD, if operating data persistently indicates that the equipment is not functioning properly.

Other acceptable PM and opacity monitoring could include instrumental continuous opacity monitoring systems (COMS) or daily "Method 9" opacity readings by a certified reader along with parametric monitoring of the control equipment.

Sulfur Dioxide Monitoring

Acceptable periodic monitoring proposals for sulfur dioxide emission limitations may include:

- Fuel sampling which correlates to the emission limit. Monitoring and recordkeeping of the fuel sulfur content as well as material usage can provide a reliable quantification of emissions. To verify the monitoring information, the permittee must be required to keep all supplier fuel analysis data for each shipment on file for at least five years and made available to AQD upon request. Refer to **Section 2.01** for specific guidance for industrial boilers.

- Use of fuels with specifications that guarantee a maximum sulfur content which complies with the applicable emission limit. For example, ultra low sulfur diesel (ULSD) cannot exceed a maximum sulfur content of 15 ppm sulfur (0.0015% sulfur by weight). The permittee must maintain sufficient documentation, i.e. purchasing records, usage records, etc., to show that compliant fuels were used. The information must be kept on file for at least five years and made available to AQD upon request.

- Parametric monitoring. If a relationship between an operating parameter for the equipment and sulfur dioxide emissions is established, a parametric monitoring protocol can be implemented.

- Instrumental monitoring for sulfur dioxide using SO_2 CEMS.

VOC Monitoring:

Acceptable periodic monitoring proposals for VOC emission limitations may include:

- Parametric monitoring, including material usage records and control device operating parameters. Refer to the **Particulate and Opacity Periodic Monitoring** portion of this section and **Section 3.0** for the recommended content of a parametric monitoring protocol.

- Instrumental monitoring using VOC CEMS, including a photo-ionization detector (PID) or flame ionization detector (FID). The information yielded by the CEMS must be sufficient for making a compliance determination with all emission limits. Proper instrumental maintenance and calibration must also be assured.

HAP Monitoring:

Because no reliable continuous instrumental monitoring system exists for exhaust streams with multiple hazardous air pollutants (HAPs), verification of compliance must be established almost exclusively through recordkeeping. Detailed material usage records, including the percentage of each HAP, must be maintained for a period of at least five years and made available to the AQD upon request. In cases where a single constituent or a constant mix is present, instrumental monitoring may be feasible. Refer to **Section 3.2** for further guidance.

Section 3.0: Emission Unit-Specific Periodic Monitoring Examples

3.1: Periodic Monitoring for Industrial Boilers

Discussion

Industrial boilers present a unique challenge when developing a periodic monitoring protocol. Unlike most emission units, boilers often have multiple emission limits for particulate, opacity, sulfur dioxide, oxides of nitrogen, and carbon monoxide. These emission limits may be found in a permit to install, NSPS Subparts D, Da, Db, and Dc, or in Rules 301, 331, 401, or 402.

A variety of monitoring options are available for industrial boilers. Choosing an acceptable monitoring program depends on several factors: fuel type, control equipment, capacity, age, etc.

Depending upon the capacity and the age of the boiler, it may be subject to **40 CFR 60 Subpart D, Subpart Da, Subpart Db, or Subpart Dc**. All these federal regulations have extensive monitoring requirements that satisfy Rule 213(3) a and b.

The use of external control equipment for industrial boilers is almost exclusively limited to coal-fired equipment. Several types of control equipment may be present at an industrial coal-fired boiler including cyclones/multiclones, electrostatic precipitators (ESPs), fabric filter baghouses, and scrubbers. Internal controls include low-NOx burners, exhaust gas recirculation, and damper control.

Procedure for Review

Step 1. Determine if the boiler is subject to a federal New Source Performance Standard.

- Subpart D: fossil-fuels, >250 MMBTU/hr. capacity, constructed after 8/17/1971
- Subpart Da: fossil-fuels, >250 MMBTU/hr. capacity, constructed after 9/18/1978
- Subpart Db: > 100 MMBTU/hr. capacity, constructed after 6/19/1984
- Subpart Dc: > 10 MMBTU/hr. but <100 MMBTU/hr. capacity, constructed after 6/9/1989.

If the boiler is subject to Subpart D, Da, Db, or Dc, refer to 40 CFR Part 60 for the monitoring protocol. No additional monitoring requirements will be necessary to satisfy Rule 213 a or b.

Step 2. Determine if a continuous emissions monitoring system (CEMS) is present. Instrumental monitoring technologies exist for opacity, sulfur dioxide, and NOx. If data from an existing CEMS can be used to verify compliance with an emission limit, it must be incorporated into the periodic monitoring plan. Most boilers will have instrumental oxygen (O_2) or carbon dioxide (CO_2) monitoring. Data from this monitor will indicate if the boiler is firing properly. Although CEMS (Opacity, SO2, NOx, etc.) is not considered parametric monitoring, the O_2 and CO_2 monitors may be used for predicting performance of the boiler and may be incorporated into a parametric monitoring plan.

Step 3. Evaluate the proposed method of emission calculations from fuel usage data. At a minimum, fuel usage, sulfur content, and emission calculation data must be provided. The proposed calculation method must coincide with the current emissions inventory method, a method described in the AP-42, or other more site-specific data such as stack testing information. Also, a condition must be included in the ROP requiring fuel usage / purchase inventory data, supplier's fuel analyses, and any other facility fuel sampling information to be kept on file for the duration of the ROP (5 years).

Step 4. If control equipment is utilized, a preventative maintenance plan must be incorporated into a parametric monitoring protocol. See **Section 4.0** for guidance for reviewing a parametric monitoring protocol. If the parametric monitoring data indicates the equipment is functioning properly, the control efficiency can be applied to the emissions calculations.

3.1a: Sample Monitoring Plan for a Coal-Fired Boiler

Example:

Emission Unit: Coal fired boiler Constructed 1965. Modified 1980.
50 MMBTU/hr. capacity
Controlled by a fabric filter baghouse.
Excess O_2 Monitor for boiler.
Static pressure differential indicator for baghouse.
Permit to Install issued for 1980 modification including emission limits for PM, SO_2, NOx, and CO.

Step 1. The boiler is not subject to any of the NSPS standards, so a monitoring protocol must be proposed by the facility.

Step 2. The only CEMS present on this boiler is O_2 monitoring. A range of operating values indicative of good performance must be proposed by the facility. In this case, the facility supplied data to show that an excess O_2 percentage of 4 - 9% indicates the boiler is firing properly. The reviewer would then include a condition in the permit stating that if the monitored excess oxygen is not within the 4 - 9% range for greater than 15 minutes, the operator must document the excursion, the reason (i.e. startup, shutdown, malfunction, fuel change, etc.), and any corrective action or preventative maintenance which was initiated.

Step 3. The company proposed the following recordkeeping format:

Day	Coal Tons	%Sulfur	PM Tons	SO_2 Tons	NOx Tons	CO Tons
1						
2						
....						

Calculations: Emissions = Coal Usage x E.I. Emission factors
Baghouse control efficiency to be multiplied for PM
%S will be multiplied for SO_2

This method is acceptable, because it uses the Emissions Inventory method for quantification.

Step 4

Because an external control device (fabric filter baghouse) is present, the company proposes a parametric monitoring protocol:

- Daily visual emissions survey. *Note: if the boiler routinely operates at or near its opacity limit, the reviewer may wish to require opacity readings by a certified "US EPA Method 9" reader.*
- Check operating parameters and provide routine maintenance. Manufacturer's data for this baghouse suggests a pressure drop of 1.5 - 5.5 inches of water is typical for a properly functioning baghouse of this type.
- If equipment is not operating within the established range, implement a preventative maintenance plan and document excursion.
- If an excursion has occurred, submit reports as required by Rule 213(3)c or Rule 912.

After consulting the parametric monitoring guidance for fabric filter baghouses in Section 4.6, the reviewer determines this plan is acceptable. A condition is added requiring stack testing every 5 years, or for units with emissions below significance, testing upon request by AQD for situations where monitoring data indicates an emission limit may be exceeded.

The reviewer would then include the entire periodic monitoring plan in the applicable portions of Section VI. Monitoring / Recordkeeping and Appendices 3-5 of the ROP shell document.

3.2: Periodic Monitoring for Coating and Printing Operations

Discussion

The basis for nearly all emission calculations from coating and printing processes is recordkeeping of both the material usage and VOC content of the material. Only in rare cases can instrumental monitors be used to directly measure and quantify stack emissions. It is also rare that instrumentation can be installed to measure the material usage rate.

In most cases, companies and the regulatory agency must rely on manual or semi-manual tracking of material usage. This can be a combination of purchase records, inventory checks, storeroom check out procedures, usage records at the point of application, and waste records. These records typically must be recorded into a database or spreadsheet whereby calculations are made.

It is possible in very automated, high-volume coating or printing operations that material usage can be metered using instrumentation that can either be transferred, manually or electronically, to a database or spreadsheet.

For emission units without control equipment, emissions are calculated by multiplying the amount of material used by the VOC content of the material.

For emission units with control equipment, emissions are calculated by multiplying the amount of material used by the VOC content of the material and then by the control equipment capture efficiency and removal efficiency.

VOC content may be taken from the coating manufacturer’s formulation information and corrected to account for any thinners, reducers, catalysts, etc., which have been added. Periodic sampling and lab analysis, using EPA Recommended Test Method 24, determining VOC content of the coatings, as applied, may be used to add an additional degree of accuracy to the parametric monitoring protocol.

Stack measurement of emissions is only practical when there is a single volatile constituent. Volatile organic compound (VOC) measurement equipment is usually a flame ionization detector or a photoionization detector that measures the number of carbons and relates it to a VOC concentration. These methods have varying response factors depending on the chemicals. If more than one chemical is present, a different response will occur for each chemical, thus yielding an inaccurate reading.

Acceptable Minimum Monitoring Options for VOC Emissions

Uncontrolled Operations

1. Recordkeeping
    a. Operations that have applicable requirements that are based on Part 6, Part 7, Part 18 or Part 19 rules:
        i. RACT, BACT, or LAER compliance calculations.
    b. Other operations with VOCs and/or HAPs.

    i. Usage records of coatings, inks, reducers, catalysts, or other material.
    ii. Calculations to determine total VOC, individual HAP, and total HAPs.
  c. For both A & B above.
    i. Records of periodic emission monitoring information, where appropriate, as detailed in Rule 213(3)b.

2. Reporting to District
   a. Submit certified report at least every 6 months as detailed in Rule 213(3)c.
   b. Submit certified report for emission exceedances according to Rule 912 promptly and/or monthly as detailed in Rule 213(3)c.
   c. Any other frequency required by an applicable rule or NSR condition.

3. Instrumental Monitoring
   a. Optional coating or ink volume metering system.
   b. Optional flame ionization detector or a photoionization detector for coatings or inks with a single volatile constituent.

Controlled Operations

1. Recordkeeping.
   a. Operations that have applicable requirements based on Part 6, Part 7, Part 18 or Part 19 rules.
      i. RACT, BACT, or LAER compliance calculations, taking into account capture and control efficiencies.
   b. Other operations with VOCs and/or HAPs.
      i. Usage records of coatings, inks, reducers, catalysts, and any other volatile materials.
      ii. Calculations to determine total uncontrolled and controlled VOC, individual HAP, and total HAPs, taking into account capture and control efficiencies.
      iii. Records of periodic emission information, where appropriate, as detailed in Rule 213(3)b.
   c. For both A & B above.
      i. Records of periodic emission or parametric monitoring information, where appropriate, as detailed in Rule 213(3)b.

2. Reporting to District.
   a. VOCs and/or HAPs.
      i. Optional coating or ink volume metering system.
      ii. Optional flame ionization detector or a photoionization detector for coatings or inks with a single volatile constituent.
      iii. Parametric monitoring of controls, required for but not limited to the following:

A. **Thermal Oxidizer** – Combustion chamber temperature or Temperature of the outlet gas.

B. **Condenser** - Temperature of the outlet gas.

C. **Scrubber** - Differential pressure, liquid flow

D. **Activated Carbon Bed** - Flame ionization detector or a photoionization detector to indicate carbon breakthrough

Section 4.0: Parametric Monitoring Examples for Control Equipment

4.1: Carbon Adsorption Systems

APPLICABILITY

Control Technology: Carbon Adsorption System

Pollutant: VOC

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: VOC concentration

Monitoring Devices: Flame ionization detector (FID), Photoionization detector (PID).

Location on Control Equipment: Adsorber outlet duct or stack.

Rationale for Monitoring Approach: Increasing outlet VOC concentration indicates breakthrough of VOCs through the adsorbent bed. Measurement of the actual concentration of individual compounds in a multi-species mix is not feasible due to the varying response factors of different compounds.

Frequency of Measurement: Hourly if manual, or preferably recorded continuously on chart or data acquisition system.

Corrective Action Trigger: High concentration as determined during baseline emission test and by analysis of historical breakthrough curves.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Time since last regeneration.

Monitoring Devices: Timers etc.

Location on Control Equipment: Control panel.

Rationale for Monitoring Approach: Too long a time interval between regenerations may indicate breakthrough.

Frequency of Measurement: Each cycle recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Time periods as determined during baseline emission test or other historical data.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

4.2: Condensers (Contact)

APPLICABILITY

Control Technology: Condenser (contact)

Pollutant: VOC

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Coolant (water) flow.

Monitoring Devices: Flow Meter device such as float type or differential pressure sensor type.

Location on Control Equipment: Inlet of unit.

Rationale for Monitoring Approach: Proper liquid flow is essential to supply enough coolant to condense the VOC vapor loading. A decrease in flow indicates that some vapors may be passing through uncontrolled.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Lower range as determined by baseline measurements during stack test, manufacturer recommendation, or other historical operating periods.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Coolant / condensate temperature.

Monitoring Devices: Thermocouple, other temperature sensor / gauge.

Location on Control Equipment: Discharge of coolant / condensate mix.

Rationale for Monitoring Approach: An adequately low temperature must be supplied in the inlet coolant such that the coolant / condensate temperature remains below the design level. High temperature in the discharge indicates that some vapors are not condensed and may be passing through uncontrolled.

Frequency of Measurement: Once during each shift manually or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Upper range as determined by baseline measurements during stack test or other historical operating periods, theoretical critical temperature based on the worst case chemical in the vapor mix.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer’s recommendations.

4.3: Condensers (Noncontact)

APPLICABILITY

Control Technology: Condenser (Non Contact Shell and Tube)

Pollutant: VOC

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Temperature of exit gas.

Monitoring Devices: Thermocouple, other temperature sensor / gauge.

Location on Control Equipment: At exit gas header.

Rationale for Monitoring Approach: An adequately cooled liquid must be provided on the inside of the tubes to cool the inlet vapors to the liquid phase. If the exit (controlled) gases are too warm, it is likely that either the coolant temperature is too high, or there is a buildup on the tubes preventing proper heat exchange. This results in uncondensed vapors remaining in the stream.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Upper range as determined by baseline measurements during stack test or other historical operating periods, or the theoretical critical temperature based on the worst case chemical in the vapor mix..

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer’s recommendations.

4.4: Cyclones and Multiclones

APPLICABILITY

Control Technology: Cyclone, Multiclone

Pollutant: Particulate Matter

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Pressure drop across unit.

Monitoring Devices: Differential pressure gauges/switches, Manometers.

Location on Control Equipment: Taps at inlet and outlet of single cyclone or entire multiclone unit.

Rationale for Monitoring Approach: In general, too low of pressure drop will result in low collection efficiency. Too high of pressure drop will cause too much turbulence, therefore a low collection efficiency due to re-entrainment of particles. Increase in pressure drop indicates plugging of inlet or outlet openings, or a buildup of material on cyclone walls. A decrease in pressure drop indicates a short circuiting of the flow due to a hole in the vortex finder.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendation or other historical operating periods.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer’s recommendations.

4.5: Electrostatic Precipitators

APPLICABILITY

Control Technology: Electrostatic Precipitator

Pollutant: Particulate Matter

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Voltage, current.

Monitoring Devices: Voltmeters, ammeters, etc.

Location on Control Equipment: Each transformer / rectifier set.

Rationale for Monitoring Approach: Increases and decreases in voltage and current over time (drift) can be indicative of various problems such as air leakage, dust buildup, or electrical component deterioration, all affecting control efficiency.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendation, or other historical operating periods.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer’s recommendations.

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Spark rate

Monitoring Devices: Spark rate meter.

Location on Control Equipment: Each section

Rationale for Monitoring Approach: An increase in spark rate may indicate that the voltage is too high or that the electrodes or plates are misaligned. If the spark rate is too high, the electric field will constantly collapse, resulting in lower removal efficiency. A lowered spark rate indicates less voltage is available to charge particles, and therefore, also indicates a lower removal efficiency.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendation, or other historical operating periods.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

4.6: Fabric Filter Baghouses

APPLICABILITY

Control Technology: Fabric Filter (Baghouse)

Pollutant: Particulate

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Pressure drop across the baghouse.

Monitoring Devices: Differential pressure gauges/switches, Manometers.

Location on Control Equipment: Taps at inlet and outlet of each compartment and/or entire unit.

Rationale for Monitoring Approach: Decrease in pressure drop indicates holes in the bags, or other bag deterioration. Increase in pressure drop indicates bag blinding.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendations, or other historical operating periods.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Opacity.

Monitoring Devices: Opacity meter/monitor or visible emissions observation or triboelectric detector.

Location on Control Equipment: Instrumentation in straight run of stack. or breaching.

Rationale for Monitoring Approach: An increase in opacity indicates process changes, baghouse leaks, or otherwise deteriorated filters. Also, a leak detected by the triboelectric sensor may indicate increased opacity.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: An upper range as determined by baseline measurements during stack test, other historical operating periods, or as a worst case - the opacity standard in the rules.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

4.7: Flares

APPLICABILITY

Control Technology: Flare

Pollutant: VOC

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Presence of flame.

Monitoring Devices: Thermocouple, flame out detector, or visual observations.

Location on Control Equipment: Flare tip.

Rationale for Monitoring Approach: Presence of flame indicates that flare is operating. Severe and sudden drop in temperature indicates loss of flame.

Frequency of Measurement: One visual observation during each shift manually, or preferably, temperature recorded continuously on chart or data acquisition system, with a low temperature alarm.

Corrective Action Trigger: Low temperature as determined by baseline measurements during stack test or other historical operating periods. Immediately, if there is a visual flame out condition.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

4.8: Catalytic Oxidizers

APPLICABILITY

Control Technology: Catalytic Oxidizer

Pollutant: VOC, CO

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Temperature

Monitoring Devices: Thermocouple, other temperature sensor / gauge.

Location on Control Equipment: Ahead of the catalyst, outlet, after the catalyst.

Rationale for Monitoring Approach: A minimum temperature is required to fully combust the contaminant, with the assumption that the unit is designed with adequate turbulence ahead of the catalyst and adequate catalyst contact time. A low temperature ahead of the catalyst indicates the reaction may not initiate. Low temperature after the catalyst indicates that a reaction was not initiated, therefore there was incomplete combustion of the contaminant and some level of uncontrolled emissions. There should be an increase in temperature across the catalyst.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Lower range as determined by baseline measurements during stack test or other historical operating periods, or the theoretical critical low temperature based on the worst case chemical in the vapor mix.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations

4.9: Thermal Oxidizers

APPLICABILITY

Control Technology: Thermal Oxidizer

Pollutant: VOC, CO

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Temperature.

Monitoring Devices: Thermocouple, other temperature sensor / gauge.

Location on Control Equipment: At or near the combustion chamber outlet.

Rationale for Monitoring Approach: A minimum temperature is required to fully combust the contaminant, with the assumption that the unit is designed with adequate turbulence and residence time. A low temperature indicates incomplete combustion of the contaminant, thus some level of uncontrolled emissions.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Lower range as determined by baseline measurements during stack test or other historical operating periods, or the theoretical critical temperature based on the worst case chemical in the vapor mix.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

4.10: Packed Tower Scrubbers

APPLICABILITY

Control Technology: Packed Tower Scrubber

Pollutant: acid gases or caustic gases

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Differential pressure.

Monitoring Devices: Differential pressure gauges/switches, Manometers.

Location on Control Equipment: Taps at inlet and outlet of unit.

Rationale for Monitoring Approach: Increase in pressure drop indicates plugging of packing material. Decrease in pressure drop indicates channeling through the packing material, or a decrease in water flow.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendation, or other historical operating periods.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Liquid (water) flow.

Monitoring Devices: Flow Meter device such as float type or differential pressure sensor type, or sight gauge.

Location on Control Equipment: In the recirculating line and the fresh water makeup line. A sight gauge or open discharge may be desirable on the sump bleed line**.**

Rationale for Monitoring Approach: Proper liquid flow is essential for the droplet to make contact with the gas molecule. Decreased flow will likely result in less gas dissolved or neutralized. Increase in flow may flood the unit rendering it inoperable. A visual check on the flow from the sump shows that there will not be a chemical buildup in the system.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendation, or other historical operating periods.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: pH of scrubbing solution.

Monitoring Devices: pH meter.

Location on Control Equipment: In the sump prior to the recirculating line leading to the scrubber.

Rationale for Monitoring Approach: Proper pH must be maintained in the scrubbing liquid if acid gases or caustic gas are being treated. If neutralization is to occur a constant addition of chemical to the sump is needed. Either a decrease or increase in pH of the solution moving towards the pH of the pollutant will likely result in less neutralization.

Frequency of Measurement: Once during each shift manually, or recorded continuously on a chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendation, or other historical operating data.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Temperature of scrubbing solution.

Monitoring Devices: Thermal couple, temperature gauge.

Location on Control Equipment: Liquid outlet or sump.

Rationale for Monitoring Approach: Temperature may affect the absorption capacity of gases.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendation, or other historical operating data.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

4.11: Scrubbers (Other)

APPLICABILITY

Control Technology: Venturi Scrubber, Mesh Pad or Wet Filter Scrubber, Sieve Tray Scrubber

Pollutant: Particulate Matter

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Differential pressure.

Monitoring Devices: Differential pressure gauges/switches, Manometers.

Location on Control Equipment: Taps at inlet and outlet of unit.

Rationale for Monitoring Approach: Increase in pressure drop indicates plugging of venturi throat, mesh pad or mist eliminator, or tray perforation. Decrease in pressure drop indicates channeling through a failed area of the pad or sieve, or a decrease in water flow into the unit.

Frequency of Measurement: Once during each shift manually, or recorded continuously on a chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendation, or other historical operating data.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Liquid (water) flow.

Monitoring Devices: Flow Meter device such as float type or differential pressure sensor type, or sight gauge.

Location on Control Equipment: In the recirculating line and the fresh water makeup line. Where flow is split to a venturi and a spray tower, separate meters may be needed. A sight gauge or open discharge may be desirable on the sump bleed line.

Rationale for Monitoring Approach: Proper liquid flow is essential for the droplet to impact and intercept the particle. Decreased flow will likely result in less particle collection. Increase in flow may flood the unit rendering it inoperable. A visual check on the flow from the sump shows that solids are being bled off. Decreased flow indicates a solids overloading in the system.

Frequency of Measurement: Once during each shift manually, or recorded continuously on chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendation, or other historical operating periods.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer's recommendations.

4.12: Settling Chambers

APPLICABILITY

Control Technology: Settling Chamber

Pollutant: Particulate Matter

MONITORING PROGRAM DESCRIPTION

Monitored Parameter: Pressure drop across chamber.

Monitoring Devices: Differential pressure gauges/switches, Manometers.

Location on Control Equipment: Taps at inlet and outlet of chamber.

Rationale for Monitoring Approach: In general, too low of pressure drop will result in low collection efficiency. Too high of pressure drop will cause too much turbulence, therefore a low collection efficiency due to re-entrainment of particles. Increase in pressure drop indicates plugging of inlet or outlet openings, or a buildup of material on the chamber or baffle walls. A decrease in pressure drop indicates a short circuiting of the flow due to a hole in the baffle(s).

Frequency of Measurement: Once during each shift manually, or recorded continuously on a chart or data acquisition system.

Corrective Action Trigger: Upper and lower ranges as determined by baseline measurements during stack test, manufacturer recommendation or other historical operating data.

Corrective Action Period: A reasonable time to inspect and isolate the problem is typically 1 to 24 hours from discovery. A reasonable time period to develop and implement a solution is typically 1 to 7 days, depending on severity.

QA/QC Procedures: Calibrate, maintain, and operate instrumentation according to the manufacturer’s recommendations.