TECHNICAL SUPPORT DOCUMENT

FOR

Amendments to COMAR 26.11.08 – Control of Incinerators

September 25, 2019

PREPARED BY:
MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard
Baltimore Maryland 21230

Table of Contents

I. PURPOSE OF REGULATORY ACTION

The purpose of this action is to amend nitrogen oxide (NOx) reasonable available control technology (RACT) requirements under COMAR 26.11.08.10 for Large municipal waste combustors (MWCs). In order to satisfy the Environmental Protection Agency's (EPA) updated startup, shutdown and malfunction (SSM) policy (80 Fed. Reg. 33840), NOx emission limits shall be extended to cover periods when a Large MWC is solely combusting fossil fuel as a means to warm-up the furnace and other critical components prior to municipal solid waste being fed to the combustor. Additional amendments are being made to clarify how the 24-hour block average emission rates and 30-day rolling average emission rates are to be calculated.

The NOx RACT requirements pertaining to Large MWCs will be submitted to the U.S. Environmental Protection Agency (EPA) for approval as part of Maryland's SIP.

II. FACTS FOR PROPOSAL

A. Background

On December 6, 2018, the Maryland Department of the Environment (MDE) adopted updates to NOx RACT for Large MWCs with a capacity greater than 250 tons per day. New regulation COMAR 26.11.08.10 requires that Maryland's two Large MWCs shall meet specific NOx 24-hour block average emission rates by May 1, 2019 and NOx 30-day rolling average emission rates by May 1, 2020, except during periods of startup and shutdown.

During periods of startup and shutdown, additional ambient air is introduced into the furnace making concentration-based emission limits not practical during these times. The excess ambient air makes it technically infeasible for MWCs to comply with the emission rates due to the "7 percent oxygen correction factor" that is required to be applied to the NOx 24-hour block rates. Therefore, an equivalent mass-based emission limit is required during startup and shutdown. In addition to the mass-based emission limit, the NOx 24-hour block average emission rate will apply for the 24-hour period after startup is completed and before shutdown commences, as applicable.

EPA informed MDE that since the definition of "startup" excludes warm-up periods, the regulations present a period of time when no NOx emission limits are in place. As is the case with startup and shutdown, warm-up periods require excess ambient air to be introduced into the furnace making concentration-based emission limits not practical. Therefore, an equivalent mass-based emission limit will be required during warm-up periods.

Large MWCs operate solely on natural gas during warm-up periods. Input to natural gas burners and corresponding furnace temperatures are increased gradually to ensure safe operations and integrity of incinerator components. Warm-up periods may run from 3 hours to 16 hours depending upon a number of variables, such as ambient temperatures, duration of unit shutdown, furnace temperature, etc. The warm-up period ends when start-up begins, which entails municipal solid waste being fed to the combustor. By definition, under COMAR 26.11.08 periods of startup and shutdown are limited to 3 hours in duration.

B. Sources Affected and Location

There are two large MWCs in Maryland, Wheelabrator Baltimore, L.P. (Wheelabrator), and Montgomery County Resource Recovery Facility (MCRRF).

C. Requirements

Warm-up Period

This action establishes warm-up period NOx RACT emission limitations and related requirements for large MWCs with a capacity greater than 250 tons per day. The amendments to COMAR 26.11.08.10 will require that as of January 1, 2020, Maryland's two Large MWCs shall meet mass-based emission limits during warm-up periods. During periods of warm-up the Montgomery County Resource Recovery Facility shall meet a facility wide NOx emission limit of 202 lbs/hr timed average mass loading averaged over the hours operated in warm-up period and the Wheelabrator Baltimore, Inc. facility shall meet a unit specific NOx emission limit of 84 lbs/hr timed average mass loading averaged over the hours operated in warm-up period.

The startup, shutdown and warm-up period mass emission limits are based upon the 24-hour block average NOx RACT rates applicable to each Large MWC (incorporating the NOx 24-hour block average emission rates of COMAR 26.11.08.10B into the calculation) and provide equivalent stringency to the concentration limits that apply at all other times. Mass based emission calculations are derived utilizing 40 CFR 60.1460 (Concentration correction to 7 percent oxygen) or 40 CFR 60.45 (Conversion procedures to convert CEM data into applicable standards). EPA Method 19 may also be utilized to determine NOx emission rates based upon oxygen concentrations. Facility average flue gas flow rates are also utilized in the calculations. The calculation methodology for the mass emission limits is based upon the Prevention of Significant Deterioration (PSD) Approval for each affected facility.

The NOx RACT amendments further specify that Large MWCs shall minimize NOx emissions during warm-up periods by operating and optimizing the use of all installed pollution control technology and combustion controls consistent with the technological limitations, manufacturers' specifications, good engineering and maintenance practices, and good air pollution control practices for minimizing emissions (as defined in 40 CFR §60.11(d)) for such equipment and the unit at all times the unit is in operation. These requirements are currently in place for normal operations and periods of startup and shutdown. Quarterly reporting requirements which demonstrate compliance with the NOx RACT emission rates and NOx mass loading emission limits are amended to include warm-up periods. The reports shall now include flagging of periods of warm-up and exceedance of warm-up period emission rates.

NOx Emission Rate Calculations
The existing definition for "30-day rolling average emission rate" under COMAR 26.11.08.01 inadvertently required the summation of the total hourly ppmv NOx in a 30-day

period and then dividing by 30 days to determine the 30-day rolling average emission rate. The proposed amendment now clarifies that the 30-day rolling average emission rate is to be calculated by summing the total hourly ppmv of NOx averages for the 30-day period and then dividing by the total number of hourly averages in the 30 day period. Total hourly ppmv NOx averages are to exclude periods of warm-up, startup and shutdown.

The following scenarios demonstrate the applicable NOx emission limits for Large MWCs:

- For any operating day that does not include a warm-up, startup or shut down event, each operating unit of a Large MWC must meet the applicable NOx emission limits of COMAR 26.11.08.10B, corrected to 7% oxygen, for the 24-hour block average that occurs from midnight to midnight.
  [COMAR 26.11.08.10B]

- For any operating day which includes a warm-up event, the following emission limit must be met:

  i. A NOx mass loading emission limitation of either COMAR 26.11.08.10D(5) or (6), respectively, shall be met during the hours of the warm-up period. For example, if Unit 1 begins to warm-up at 5 pm on a Friday, then from 5 pm that Friday until startup is commenced (i.e. the unit begins the continuous burning of municipal solid waste), the facility or unit, respectively, will need to meet the NOx mass loading emission limit averaged over the hours the unit was performing the warm-up. **[COMAR 26.11.08.10D (5) and (6)]**

- For any operating day which includes a startup event, the following emission limits must be met:

  i. The facility wide NOx mass loading emission limit of COMAR 26.11.08.10D(1) or (2), respectively, over a 24-hr period beginning when startup commences. For example, if Unit 1 starts up at 5 pm on a Friday, then from 5 pm that Friday to 5 pm the following Saturday the facility will need to meet the 24-hour mass loading emission limit.
  [COMAR 26.11.08.10D (1) or (2)]

  ii. The unit that commenced startup will also need to meet the respective 24-hr block average emission limit of COMAR 26.11.08.10B, corrected to 7% oxygen, beginning after the 3-hr startup period ends. For example, if Unit 1 starts up at 5 pm on a Friday, then from 8 pm on that Friday to 8 pm the following Saturday the unit will need to meet their respective NOx 24-hour block average emission rate, corrected to 7% oxygen.
  [COMAR 26.11.08.10D(3)]

  iii. The NOx 24-hour block average emission rate of COMAR 26.11.08.10B shall begin to be calculated anew at midnight following initiation of a startup event.
  [COMAR 26.11.08.10B]

- For any operating day which includes a shutdown event, the following emission limits must be met:
    i. The facility wide NOx mass loading emission limit of COMAR 26.11.08.10D(1) or (2), respectively, over a 24-hr period prior to the end of shutdown. For example, if Unit 1 commences shutdown at 2 pm on a Friday, then by definition shutdown is complete at 5 pm on that Friday. Accordingly, the facility must meet the 24-hour mass loading emission limit for the time period covering 5 pm that Friday to 5 pm the prior Thursday.
    [COMAR 26.11.08.10 D (2)]

    ii. The unit that shutdown will also need to meet the respective 24-hr block average emission limit of COMAR 26.11.08.10B, corrected to 7% oxygen, prior to the commencement of shutdown. For example, if Unit 1 commences shutdown at 2 pm on a Friday, then the unit must meet the 24-hr block average emission limit, corrected to 7% oxygen limit, for the time period covering 2 pm on that Friday to 2 pm the prior Thursday.
    [COMAR 26.11.08.10D(4)]

    iii. The NOx 24-hour block average emission rate of COMAR 26.11.08.10B shall be calculated up to and including the previous midnight prior to a shutdown event.
    [COMAR 26.11.08.10B]

- Excluding periods of warm-up, startup or shut down, each operating unit of a Large MWC must meet the applicable NOx emission limits of COMAR 26.11.08.10C, corrected to 7% oxygen, for the 30-day rolling average.
  [COMAR 26.11.08.10C]

This process ensures that during all hours of operation there is an applicable NOx emission standard in place, as is required by EPA's 2015 SSM policy.

D. Projected Emission Reductions

There are no expected NOx emission reductions for Large MWCs from these amendments.

E. Estimate of Economic Impact

Economic Impact on Affected Sources, the Department, other State Agencies, Local Government, other Industries or Trade Groups, the Public

There are no expected economic impacts for Large MWCs. There will be no impact on the Department or other state agencies or local government as a result of this action.

Economic Impact on Small Businesses

The proposed action has minimal or no economic impact on small businesses.

III. COMPARISON TO FEDERAL STANDARDS

This regulatory action proposes NOx RACT standards for Large MWCs during warm-up periods. There is no equivalent federal RACT standard for Large MWCs. Maryland's existing NOx RACT for Large MWCs is based upon 40 CFR 60, Subpart Ea - Standards of Performance for Municipal Waste Combustors for Which Construction Is Commenced After December 20, 1989 and On or Before September 20, 1994, 40 CFR 60, Subpart Eb - New Source Performance Standards for Large Municipal Waste Combustors constructed after September 20, 1994 and 40 CFR 60,Subpart Cb - Emission Guidelines and Compliance Times for Large Municipal Waste Combustors constructed on or before September 20, 1994.

IV. PROPOSED REGULATIONS

DRAFT 9-25-2019
DOWNLOAD 12-11-2018

Title 26 DEPARTMENT OF THE ENVIRONMENT

Subtitle 11 AIR QUALITY

Chapter 08 Control of Incinerators

Authority: Environment Article, §§1-101, 1-404, 2-101—2-103, 2-301—2-303, 2-406, 10-102, and 10-103, Annotated Code of Maryland

.01 Definitions.

A. (text unchanged)

B. Terms Defined.

(1) — (60) (text unchanged)

(61) "30-day rolling average emission rate" means a value of NO_x emissions in ppmv, corrected to 7 percent oxygen, calculated by:

(a) Summing the total hourly ppmv of NO_x *averages* emitted from the unit during the current operating day and *all hourly* NO_x *ppmv averages for* the previous 29 operating days, excluding periods of *warm-up*, startup and shutdown; and

(b) Dividing the total hourly ppmv of NO_x emitted from the unit during the 30 operating days summed in §B(61)(a) of this regulation by **[**30**]** *the total number of hourly averages in the 30 day period*.

(62) "24-hour block average emission rate" means a value of NO_x emissions in ppmv, corrected to 7 percent oxygen, calculated by:

(a) Summing the hourly average ppmv of NO_x emitted from the unit during 24 hours between midnight of one day and ending the following midnight, excluding periods of *warm-up*, startup and shutdown; and

(b) Dividing the total sum of hourly NO_x ppmv values emitted during 24 hours between midnight of one day and ending the following midnight by 24*, excluding periods of warm-up, startup and shutdown*.

(63) "Warm-up period" means a period of time that:

(a) Commences when a unit at a Large MWC is combusting fossil fuel or other non-municipal solid waste fuel, and no municipal solid waste is being fed to the combustor; and

(b) Ends for a unit at a Large MWC when municipal solid waste is being fed to the combustor.

[(63)] *(64)* "Wet scrubber" means an add-on air pollution control device that utilizes an alkaline scrubbing liquor to collect particulate matter (including nonvaporous metals and condensed organics) or to absorb and neutralize acid gases, or both.

.02 — .09 (text unchanged)

.10 NO_x Requirements for Large Municipal Waste Combustors.

A. The owner and operator of a Large MWC shall minimize NO_x emissions by operating and optimizing the use of all installed pollution control technology and combustion controls consistent with the technological limitations, manufacturers' specifications, good engineering and maintenance practices, and good air pollution control practices for minimizing emissions (as defined in 40 CFR §60.11(d)) for such equipment and the unit at all times the unit is in operation, including periods of startup, **[**and **]**shutdown, *and warm-up*.

B. As of May 1, 2019, the owner or operator of a Large MWC shall meet the following applicable NO_x emission rates, except for periods of startup, **[**and **]**shutdown, *and warm-up*:

(text unchanged)

C. As of May 1, 2020, the owner or operator of a Large MWC shall meet the requirements of §B of this regulation and the following applicable NO_x emission rates, except for periods of startup, **[**and **]**shutdown, *and warm-up*:

(text unchanged)

D. Startup, [and]Shutdown*, and Warm-Up* NO_x Emission Limitations.

(1) — (4) (text unchanged)

(5) As of January 1, 2020, a facility-wide NO_x *emission limit of 202 lbs/hr timed average mass loading over the warm-up period shall apply for the Montgomery County Resource Recovery Facility.*

(6) As of January 1, 2020, a unit-specific NO_x *emission limit of 84 lbs/hr timed average mass loading over the warm-up period shall apply for Wheelabrator Baltimore Inc.*

E. Additional NO_x Emission Control Requirements.

(1) — (2) (text unchanged)

(3) Not later than January 1, 2020, based upon the results of the feasibility analysis as required under §E(1) of this regulation, the owner or operator of Wheelabrator Baltimore Inc. shall propose and submit a NO_x 24-hour block average emission rate, NO_x 30-day rolling average emission rate, and NOx mass loading emission limitation for periods of startup, shutdown, **[**and**]** malfunction, *and warm-up*.

F. (text unchanged)

G. Not later than 45 days after the effective date of this regulation, the owner or operator of a Large MWC shall submit a plan to the Department and EPA for approval that demonstrates how the Large MWC will operate installed pollution control technology and combustion controls to meet the requirements of §A of this regulation. The plan shall summarize the data that will be collected to demonstrate compliance with §A of this regulation. The plan shall cover all modes of operation, including but not limited to normal operations, startup, **[**and **]**shutdown, *and warm-up*.

H. Beginning July 1, 2019, the owner or operator of a Large MWC shall submit a quarterly report to the Department containing:

(1) (text unchanged)

(2) Data, information, and calculations, including NO_x continuous emission monitoring data and stack flow data, which demonstrate compliance with the startup, **[**and **]**shutdown, *and warm-up* mass NO_x emission limits as required in §D of this regulation;

(3) Flagging of periods of startup, **[**and **]**shutdown, *and warm-up* and exceedances of emission rates;

(4) (text unchanged)

(5) Documented actions taken during periods of startup **[**and **]**shutdown, *and warm-up* in signed, contemporaneous operating logs.

I. — K. (text unchanged)

L. Compliance with the NO_x Mass Loading Emission Limitation for the Montgomery County Resource Recovery Facility.

(1) — (2) (text unchanged)

(3) Compliance with the NOx mass loading emission limitations for warm-up periods in §D(5) of this regulation shall be demonstrated by calculating the average of all hourly average NOx emission concentrations during the warm-up period from continuous emission monitoring systems.

(4) The calculations in §L(3) of this regulation shall utilize stack flow rates derived from flow monitors, for all the hours during the warm-up period.

M. Compliance with the NO_x Mass Loading Emission Limitation for the Wheelabrator Baltimore Inc.

(1) — (2) (text unchanged)

(3) Compliance with the NOx mass loading emission limitations for warm-up periods in §D(6) of this regulation shall be demonstrated by calculating the average of all hourly average NOx emission concentrations during the warm-up period from continuous emission monitoring systems.

(4) The calculations in §M(3) of this regulation shall utilize the applicable Prevention of Significant Deterioration calculation methodology, for all the hours during the warm-up period.

Appendix A – Air Quality Control Advisory Council

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NOx RACT for Municipal Waste Combustors (MWCs)

AQCAC Meeting – June 17, 2019

Topics Covered

- Municipal Waste Combustors (MWCs) in Maryland
  - MWC overview
  - Purpose of NO_x RACT amendments
- MDE NO_x RACT amendments
  - NO_x 30-day rolling average calculation
  - Warm-up period mass limits
- Baltimore City Clean Air Act
- Timeline

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MD NOx RACT for Large MWCs

- New MWC NO_x RACT and SIP strengthening requirements adopted on December 6, 2018
- There are two large MWCs in Maryland;
  - Wheelabrator Baltimore, Inc. and
  - Montgomery County Resource Recovery Facility (MCRRF)
- Established NO_x 24-hour block average and NO_x 30-day rolling average emission rates
- Facility-wide mass NO_x emission limits during periods of startup and shutdown
- Feasibility analysis for additional NO_x controls for Wheelabrator Baltimore

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Daily and Longer Term Limits

- .10B and C – NOx emission rates
- 24-hour block average rates effective May 1, 2019
- 30-day rolling average rates effective May 1, 2020
  - Allows time to ensure more stringent, long-term rates can be met on a consistent basis

Unit	24 Hour Block Average Rate	30 Day Rolling Average Rate
Wheelabrator	150 ppmv	145 ppmv
MCRRF	140 ppmv	105 ppmv

ppmv = parts per million volume

PROPOSED MWC NOX RACT AMENDMENTS

NOx 30-day Rolling Average

- Existing definition inadvertently required the summation of the total hourly ppmv NO_x in a 30-day period and then dividing by 30 days
- Amendment clarifies that the calculation should sum the total hourly ppmv of NO_x averages for the 30-day period and then dividing by the total number of hourly averages in the 30-day period
- Clarifies that total hourly ppmv NO_x averages are to exclude periods of startup, shutdown and warm-up

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Warm-up Period Mass Limits

- To satisfy EPA's SSM policy, NO_x emission limits shall be extended to cover periods when a Large MWC is solely combusting fossil fuel as a means to warm-up the furnace and other critical components prior to municipal solid waste being fed to the combustor

- As the current definition of "startup" excludes warm-up periods, the regulations present a period of time when no NO_x emission limits are in place
  - 26.11.08.01B(60)(c) "Startup" for a Large MWC commences when the unit begins the continuous burning of municipal solid waste and continues for a period of time not to exceed 3 hours, but does not include any warm-up period when the particular unit is combusting fossil fuel or other non-municipal solid waste fuel, and no municipal solid waste is being fed to the combustor.

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Warm-up Period Mass Limits

- The warm-up period mass emission limits are based upon the 24-hour block average NOx RACT rates applicable to each Large MWC (incorporating the NOx 24-hour block average emission rates of COMAR 26.11.08.10B into the calculation) and provide equivalent stringency to the concentration limits that apply at all other times

- During periods of warm-up:
  - the Montgomery County Resource Recovery Facility shall meet a facility wide NOx emission limit of 202 lbs/hr timed average mass loading averaged over the hours operated in warm-up mode
  - the Wheelabrator Baltimore, Inc. facility shall meet a facility wide NOx emission limit of 252 lbs/hr timed average mass loading averaged over the hours operated in warm-up mode.

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Timeline

- AQCAC
  - June 17, 2019
- Regulation Adoption
  - NPA – September 2019
  - Public Hearing – October 2019
  - NFA – November 2019
- Effective Date
  - December 2019

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BALTIMORE CITY'S
CLEAN AIR ACT

Baltimore City Clean Air Act

- The CAA establishes requirements for Wheelabrator Baltimore and the Hospital Medical Waste Incinerator at Curtis Bay
- Requires operation of CEMs for dioxins, furans, carbon dioxide, carbon monoxide, hydrochloric acid, hydrofluoric acid, nitrogen oxides, sulfur dioxides, particulate matter, volatile organic compounds, polycyclic aromatic hydrocarbons, arsenic, cadmium, chromium, lead, manganese, mercury, nickel, selenium, and zinc

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Baltimore City Clean Air Act

- Each facility is to meet the following emission limits:

Pollutant	Emission Limit
Mercury	15 µg/DSCM (micrograms per dry standard cubic meter)
Sulfur Dioxide	18 ppmvd (parts per million dry volume)
Dioxins/Furans	2.6 NG/DCSM (nanograms per dry standard cubic meter)
Nitrogen Oxides (NOx)	45 ppmvd – 24 hour block average 40 ppmvd – 12 month rolling average

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Discussion

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Appendix B – EPA Startup, Shutdown, and Malfunction criteria

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MWC NOx RACT Mass Loading Limits during Periods of Startup and Shutdown

September 25, 2019

Purpose

On June 12, 2015, the Environmental Protection Agency (EPA) published an updated startup, shutdown and malfunction (SSM) policy in the Federal Register, 80 Fed. Reg. 33840. The SSM Policy, in part, provides guidance to states for development of alternative emission limitations during SSM events. There are seven criteria that the guidance recommends states consider when setting an alternative emission limitation. The purpose of this document is to address those seven specific criteria as appropriate considerations for developing emission limitations in NOx RACT SIP provisions that apply during startup and shutdown for large municipal waste combustors (Large MWCs).

Section XI.D. of the SSM Policy provides recommendations for the development of alternative emission limitations applicable during startup and shutdown. *See* 80 Fed. Reg. at 33980. A state can develop special, alternative emission limitations that apply during startup or shutdown if the source cannot meet the otherwise applicable emission limitation in a State Implementation Plan (SIP). SIP provisions may include alternative emission limitations for startup and shutdown as part of a continuously applicable emission limitation when properly developed and otherwise consistent with Clean Air Act (CAA) requirements.

The EPA recommends that, in order to be approvable (*i.e.,* meet CAA requirements), alternative requirements applicable to the source during startup and shutdown should be narrowly tailored and take into account considerations such as the technological limitations of the specific source category and the control technology that is feasible during startup and shutdown.

EPA's Current Startup, Shutdown, Malfunction (SSM) Policy

EPA has revised prior guidance provided in the CFR with respect to startup, shutdown and malfunctions. Alternative emission limitations may be developed for startup, shutdown or other normal modes of operation, but no longer may be applied during periods of malfunction.

EPA's current SSM Policy states: "EPA is reiterating and clarifying its prior guidance concerning how states may elect to replace existing exemptions for excess emissions during SSM events with properly developed alternative emission limitations that apply to the affected sources during startup, shutdown or other normal modes of source operation (*i.e.,* that apply to excess emissions during those normal modes of operation as opposed to during malfunctions)." 80 Fed. Reg. at 33845.

"The EPA recognizes that…some sources may need to take steps to control emissions better so as to comply with emission limitations continuously, as required by the CAA, or to increase durability of components and monitoring systems to detect and manage malfunctions promptly." 80 Fed. Reg. at 33849.

EPA's SSM policy provides that in the event of a malfunction which causes excess emissions, consideration for enforcement discretion should be exercised, provided reasonable care to avoid malfunctions and good operating practices are being followed by the source operator: "The EPA emphasizes that the absence of an affirmative defense provision in a SIP, whether as a freestanding generally applicable provision or as a specific component of a particular emission limitation, does not mean that all exceedances of SIP emission limitations will automatically be subject to enforcement or automatically be subject to imposition of particular remedies. Pursuant to the CAA, all parties with authority to bring an enforcement action to enforce SIP provisions (*i.e.,* the state, the EPA or any parties who qualify under the citizen suit provision of section 304) have enforcement discretion that they may exercise as they deem appropriate in any given circumstances. For example, if the event that causes excess emissions is an actual malfunction that occurred despite reasonable care by the source operator to avoid malfunctions, then each of these parties may decide that no enforcement action is warranted." 80 Fed. Reg. at 33852.

Seven Criteria for Startup, Shutdown Events

The EPA identifies the following seven specific criteria as appropriate considerations for developing emission limitations in SIP provisions that apply during startup and shutdown (80 Fed. Reg. at 33912):

(1) The revision is limited to specific, narrowly defined source categories using specific control strategies (*e.g.,* cogeneration facilities burning natural gas and using selective catalytic reduction);
(2) Use of the control strategy for this source category is technically infeasible during startup or shutdown periods;

MWC NOx RACT Mass Loading Limits during Periods of Startup and Shutdown

(3) The alternative emission limitation requires that the frequency and duration of operation in startup or shutdown mode are minimized to the greatest extent practicable;
(4) As part of its justification of the SIP revision, the state analyzes the potential worst-case emissions that could occur during startup and shutdown based on the applicable alternative emission limitation;
(5) The alternative emission limitation requires that all possible steps are taken to minimize the impact of emissions during startup and shutdown on ambient air quality;
(6) The alternative emission limitation requires that, at all times, the facility is operated in a manner consistent with good practice for minimizing emissions and the source uses best efforts regarding planning, design, and operating procedures; and
(7) The alternative emission limitation requires that the owner or operator's actions during startup and shutdown periods are documented by properly signed, contemporaneous operating logs or other relevant evidence.

The Department addressed these seven criteria for emission limitations that apply during startup and shutdown for Large MWCs in the following ways:

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

Under COMAR 26.11.08.10D, the Department provides for alternative facility-wide, mass loading NOx emission limits averaged over a 24-hour period for startup and shutdown. Mass loading NOx emission limits shall also apply during warm-up periods when the unit is combusting fossil fuel and no municipal solid waste is being fed to the combustor. These alternative limits only apply to Large MWCs that have a capacity greater than 250 tons per day. Specifically, these alternative Startup/Shutdown/Warm-up limits apply to the Montgomery County Resource Recovery Facility (MCRRF) and Wheelabrator Baltimore, Inc. (Wheelabrator).

MCRRF and Wheelabrator utilize selective non-catalytic reduction (SNCR) for control of NOx emissions. Therefore, MDE's alternative NOx emission limitations are limited to apply to Large MWCs that have a capacity greater than 250 tons per day and use SNCR for control of NOx emissions.

(2) Use of the control strategy for this source category is technically infeasible during startup or shutdown periods

MWC NOx RACT Mass Loading Limits during Periods of Startup and Shutdown

COMAR 26.11.08.10B and .10C require updated NOx RACT limits for Large MWCs. In part, the regulations set NOx 24-hour block average and 30-day rolling average emission rates to be met at all times except for periods of warm-up, startup and shutdown. The 24-hour block average and 30-day rolling average emission rates are steady state (normal operation mode) emission limits in parts per million by volume (ppmv), which is a measure of concentration. This concentration measurement is calculated as mass of NOx emitted / volumetric gas flow rate from the stack.

The 24-hour block average and 30-day rolling average emission rates for Large MWCs are defined as a value of NO_x emissions in ppmv, corrected to 7 percent oxygen. Therefore, the 24-hour block average and 30-day rolling average emission rates are mathematically adjusted so that the volumetric gas flow rate from the stack is corrected to 7 percent oxygen.

Concentration-based emission limits are not practical during warm-up, startup and shutdown because it is technically infeasible for Large MWCs to comply with the emission rates due to the "7 percent oxygen correction factor" that is required to be applied to the NOx 24-hour block average and 30-day rolling average emission rates. During periods of warm-up, startup and shutdown, the volumetric gas flow rate from the stack is transient, as adjustments are made to the amount of air introduced into the furnace. The mathematical oxygen correction would result in an artificially high NOx "concentration reading", even though the amount (mass) of actual NOx emissions would remain unchanged during warm-up, startup or shutdown. Therefore, it is necessary to set alternative NOx emission limits based on mass of NOx emitted during periods of warm-up, startup and shutdown (transient periods).

(3) The alternative emission limitation requires that the frequency and duration of operation in startup or shutdown mode are minimized to the greatest extent practicable

COMAR 26.11.08.01B(60)(c) defines "Startup" for a Large MWC as commencing when the unit begins the continuous burning of municipal solid waste and continuing for a period of time not to exceed three hours; but does not include any warm-up period when the particular unit is combusting fossil fuel or other non-municipal solid waste fuel, and no municipal solid waste is being fed to the combustor.

Continuous burning begins once municipal solid waste is fed to the combustor. Once municipal solid waste is being fed to the combustor, the MWC operates continuously until a shutdown is initiated.

MWC NOx RACT Mass Loading Limits during Periods of Startup and Shutdown

COMAR 26.11.08.01B(54)(e) defines “Shutdown” for the MCRRF as commencing thirty minutes after the chute to the loading hopper of the combustion train is closed and ending no later than three hours thereafter.

COMAR 26.11.08.01B(54)(f) defines “Shutdown” for the Wheelabrator facility as commencing thirty minutes after municipal solid waste feed to the loading hopper has ceased and ending no later than three hours thereafter.

By definition the duration of startup and shutdown procedures for a Large MWC are not to exceed three hours per occurrence, which minimizes the duration of the startup or shutdown to the greatest extent practicable. The alternative 24-hour mass emission limits established by COMAR 26.11.08.10D, apply during these times.

COMAR 26.11.08.01B(63) defines “Warm-up period” as a period of time that commences when a unit at a Large MWC is combusting fossil fuel or other non-municipal solid waste fuel, and no municipal solid waste is being fed to the combustor. Warm-up period for a Large MWC ends for a unit when municipal solid waste is being fed to the combustor. Facility-wide (Montgomery County Resource Recovery Facility) or unit-specific (Wheelabrator Baltimore, Inc.) mass loading NOx emission limits apply during periods of warm-up.

(4) As part of its justification of the SIP revision, the state analyzes the potential worst-case emissions that could occur during startup and shutdown based on the applicable alternative emission limitation

Under COMAR 26.11.08.10D, facility-wide, mass loading NOx emission limits are averaged over a 24-hour period to determine the NOx load to the ambient atmosphere on days where there is a startup or shutdown event. Mass loading NOx emission limits shall also apply during warm-up periods when the unit is combusting fossil fuel and no municipal solid waste is being fed to the combustor. The mass loading limits include emissions during the warm-up, startup or shutdown. In addition, on days where the unit experiences startup or shutdown, the concentration-based 24-hour block average emission rate in COMAR 26.11.08.10B will also apply for the 24-hour period after startup or the 24-hour period before shutdown, as applicable.

Mass NOx emission limits take into account the design flue gas flow rate and represent the worst case actual NOx emissions that could occur during periods of warm-up, startup and shutdown. These mass NOx emission limits, applicable to each Large MWC, provide equivalent stringency to the concentration limits that apply at all other times. The 24-hour block average NOx emissions rates of COMAR 26.11.08.10B are part of the calculation used to derive the mass NOx emission limits of COMAR 26.11.08.10D. Mass emission limit calculations are derived utilizing 40 CFR 60.58b(h)(2) of subpart Eb (Concentration correction to 7 percent oxygen) or 40 CFR 60.45 (Conversion procedures to convert CEM data into applicable standards). EPA Method 19 may also be utilized to determine NOx emission rates based upon oxygen concentrations. Facility average flue gas flow rates are also utilized into the calculations. The calculation methodology for the mass emission limits is based upon the existing Prevention of Significant Deterioration (PSD) Approval for each affected facility. Mass based emission calculations for each affected Large MWC are detailed below.

Wheelabrator Baltimore, Inc.

Mass based emission calculations for Wheelabrator utilize the facility average flue gas flow (106,336 dscf/min) and O2 (10.7%) values from the facility's 2017 stack test and the 150 ppmv NOx 24-hour block average emission rate from COMAR 26.11.08.10B.

150 ppm7% x (20.9-10.7)/13.9) x 1.194E-7 x 106,336 dscf/min x 60 min/hour x 3 boilers
= 252 lbs/hour

EPA Method 19-NOx ppm to lbs/dscf Conversion Factor:
1.194 E-7 = 46 lbs/lb-mole /385.3 dscf lb-mole/1,000,000

Montgomery County Resource Recovery Facility

Mass based emission calculations for Montgomery County Resource Recovery Facility utilize the facility average flue gas flow (91,204 dscf/min) and O2 (8.1%) values as provided by the facility based upon their Prevention of Significant Deterioration (PSD) Approval and the 140 ppmv NOx 24-hour block average emission rate from COMAR 26.11.08.10B.

$$\frac{46.01\ (lb/lb\text{-}mol) * (20.9-8.1)/(20.9-7.0) * 140.00 (ppmdv) * 91{,}204\ (dscfm) * (1800/2250) * 60 (m/h) * 3\ \text{Boiler Units}}{3.853E+08\ (ft3/lb\text{-}mol)}$$

= 202 lbs/hr

In addition, during periods of warm-up the Montgomery County Resource Recovery Facility shall meet a facility wide NOx emission limit of 202 lbs/hr timed average mass loading averaged over the hours operated in warm-up period and the Wheelabrator Baltimore, Inc. facility shall meet a unit specific NOx emission limit of 84 lbs/hr timed average mass loading averaged over the hours operated in warm-up period.

(5) The alternative emission limitation requires that all possible steps are taken to minimize the impact of emissions during startup and shutdown on ambient air quality

The specific steps that each affected facility takes to operate and minimize the impact of emissions during warm-up, startup and shutdown are listed in Operating Procedures for Large MWCs, as provided by the facility.

Additionally, under COMAR 26.11.08.10A and G, the Large MWCs are subject to the following provisions. These provisions will apply at all times, including periods of warm-up, startup and shutdown, and will minimize the impact of emissions on ambient air quality:

A. The owner and operator of a Large MWC shall minimize NOx emissions by operating and optimizing the use of all installed pollution control technology and combustion controls consistent with the technological limitations, manufacturers' specifications, good engineering and maintenance practices, and good air pollution control practices for minimizing emissions (as defined in 40 CFR §60.11(d)) for such equipment and the unit at all times the unit is in operation, including periods of startup, shutdown, and warm-up.

G. Not later than 45 days after the effective date of this Regulation, the owner or operator of a Large MWC shall submit a plan to the Department and EPA for approval that demonstrates how the Large MWC will operate installed pollution control technology and combustion controls to meet the requirements of §A of this Regulation. The plan shall summarize the data that will be collected to demonstrate compliance with §A of this Regulation. The plan shall cover all modes of operation, including but not limited to normal operations, startup, shutdown, and warm-up.

Compliance for Large MWCs will be dependent upon the facilities operating their units as specified in the approved plans during all modes of operation, including but not limited to normal operations, warm-up, startup, and shutdown.

(6) The alternative emission limitation requires that, at all times, the facility is operated in a manner consistent with good practice for minimizing emissions and the source uses best efforts regarding planning, design, and operating procedures

Under COMAR 26.11.08.10A and G, Large MWCs are subject to the following provisions. These provisions will apply at all times, including periods of warm-up, startup and shutdown, and will minimize the impact of emissions on ambient air quality:

Under COMAR 26.11.08.10A, the following provision applies:

A. The owner and operator of a Large MWC shall minimize NO_x emissions by operating and optimizing the use of all installed pollution control technology and combustion controls consistent with the technological limitations, manufacturers' specifications, good engineering and maintenance practices, and good air pollution control practices for minimizing emissions (as defined in 40 CFR §60.11(d)) for such equipment and the unit at all times the unit is in operation, including periods of startup, shutdown, and warm-up.

Under COMAR 26.11.08.10G, the following provision applies:

G. Not later than 45 days after the effective date of this regulation, the owner or operator of a Large MWC shall submit a plan to the Department and EPA for approval that demonstrates how the Large MWC will operate installed pollution control technology and combustion controls to meet the requirements of §A of this Regulation. The plan shall summarize the data that will be collected to demonstrate compliance with §A of this Regulation. The plan shall cover all modes of operation, including but not limited to normal operations, startup, shutdown, and warm-up.

Compliance for Large MWCs will be dependent upon the facilities operating their units as specified in the approved plans during all modes of operation, including but not limited to normal operations, warm-up, startup, and shutdown. The MWC facility will provide quarterly reports detailing that the emission limitations have been met.

(7) The alternative emission limitation requires that the owner or operator's actions during startup and shutdown periods are documented by properly signed, contemporaneous operating logs or other relevant evidence

Under COMAR 26.11.08.10H, the following provisions apply:

MWC NOx RACT Mass Loading Limits during Periods of Startup and Shutdown

Beginning July 1, 2019, the owner or operator of a Large MWC shall submit a quarterly report to the Department containing:
(1) Data, information, and calculations which demonstrate compliance with the NOx 24-hour block average emission rate as required in §B of this Regulation;
(2) Data, information, and calculations, including NOx continuous emission monitoring data and stack flow data, which demonstrate compliance with the startup, shutdown, and warm-up mass NOx emission limits as required in §D of this Regulation;
(3) Flagging of periods of startup, shutdown, and warm-up and exceedances of emission rates;
(4) NOx continuous emission monitoring data and total urea flow rate to the boiler averaged over a 1-hour period, in a Microsoft Excel format; and
(5) Documented actions taken during periods of startup and shutdown in signed, contemporaneous operating logs.

Under COMAR 26.11.08.10I, the following provision applies:

Beginning July 1, 2020, the quarterly report to be submitted pursuant to §H of this Regulation shall also include data, information, and calculations which demonstrate compliance with the NOx 30-day rolling average emission rate as required in §C of this Regulation.

Under COMAR 26.11.08.10L, the following provision applies:

L. Compliance with the NOx mass loading emission limitation for periods of startup and shutdown in §D(1) of this Regulation shall be demonstrated by calculating the 24-hr average of all hourly average NOx emission concentrations from continuous emission monitoring systems, utilizing stack flow rates derived from flow monitors, for all the hours during the 3-hour startup or shutdown period and the remaining 21 hours of the 24-hour period.

Compliance with the NOx mass loading emission limitations for warm-up periods in §D(5) of this regulation shall be demonstrated by calculating the average of all hourly average NOx emission concentrations during the warm-up period from continuous emission monitoring systems, utilizing stack flow rates derived from flow monitors, for all the hours during the warm-up period.

Under COMAR 26.11.08.10M, the Department is proposing the following provision:

M. Compliance with the NOx mass loading emission limitation for periods of startup and shutdown in §D(2) of this Regulation shall be demonstrated by calculating the 24-hr average of all hourly average NOx emission concentrations from continuous emission monitoring systems, utilizing the applicable Prevention of Significant Deterioration calculation methodology, for all the hours during the 3-hour startup or shutdown period and the remaining 21 hours of the 24-hour period.

Compliance with the NOx mass loading emission limitations for warm-up periods in §D(6) of this regulation shall be demonstrated by calculating the average of all hourly average NOx emission concentrations during the warm-up period from continuous emission monitoring systems, utilizing the applicable Prevention of Significant Deterioration calculation methodology, for all the hours during the warm-up period.

Maryland Department of the Environment

MWC NOx RACT Mass Loading Limits during Periods of Startup and Shutdown

Operating Procedures for Large MWCs

WHEELABRATOR BALITMORE NOX RACT COMPLIANCE PLAN

Revision 0

DATE: JANUARY 22, 2019

1) **Introduction**

This NOx RACT compliance plan has been developed to meet the NOx RACT requirements for Large Municipal Waste Combustors (MWC) under COMAR 26.11.08.10 that became effective December 6, 2018. The plan provides information and procedures that demonstrate how Wheelabrator Baltimore will operate the installed NOx and combustion controls and what data will be collected to ensure compliance with the NOx emission limits under this regulation. The plan addresses all modes of operation including normal operations, startup, and shutdown. In general, the NOx emission limits under COMAR 26.11.08.10 will be achieved by operating and optimizing NOx emission and combustion controls consistent with the technological limitations, manufacturers' specifications, good engineering and maintenance practices, and good air pollution control practices for minimizing emissions (as defined in 40 CFR §60.11(d)). NOx emissions will be continuously monitored using the existing MDE approved continuous emission monitoring systems (CEMS) operated and maintained in accordance with COMAR 26.11.01.11.

2) **NOx RACT Emission Limits**

A summary of NOx RACT limits is as follows:

Normal Operation NOx Limits - During normal operation the NOx limit applicable to each MWC is 150 ppm at 7%O_2 /24-hour daily block average. By May 1, 2020 each MWC unit will comply with an additional NOx limit of 145 ppm 7%O_2/30 day rolling average. Both these limits do not apply during startups and shutdowns however, emissions during malfunctions are included in the averages.

Note: The Subpart Cb 24 hour block average limit of 205 ppm7%O_2 still applies and does not include startups shutdowns or malfunctions. In addition the facility PSD limit of 298 lbs/hour/8 hour block average continues to apply.

Facility Startup and Shutdown Limit - During MWC unit startups and shutdowns, the facility will comply with the facility wide NO_x emission limit of 252 lbs/hour averaged over a 24-hour period including emissions from the MWC unit startup and shutdown period. Startup and shutdown periods are limited to 3 hour in duration. In addition:

- The 150 ppm/24 hour daily (midnight to midnight) and 145 ppm 30 day rolling average limits do not apply to the MWC unit that had started up or been shut down during that 24 hour period.
- For the MWC unit that went through a startup, the 150 ppm/24-hour average limit applies for the next contiguous 24-hour period after startup is completed. Example: If startup completed at 06:00, the contiguous 24 hour period after startup completed is 07:00 to 06:00 the next day.
- For a MWC unit that went through a shutdown, the 150 ppm 24-hour average limit applies for the 24-hour contiguous period prior to the commencement of shutdown. Example: if shutdown was started at 20:00 the prior 24 contiguous period is the 19:00 hour (last normal operating hour) before shutdown initiated back to 20:00 the previous day.

Note: Prior to a scheduled shutdown, NOx data will be reviewed to ensure the NOx average for the 24 contiguous hours prior to commencing the shutdown is below the 150 ppm limit. If not, the shutdown should not commence until the prior 24 hour average is below the limit.

Determining Compliance During MWC Unit Startup and Shutdown Periods-Compliance with the 252 lbs/hour facility NO_x limit during startup and shutdown of any MWC unit is demonstrated by calculating the 24-hour average of all hourly NO_x emissions rates (lbs/hour) utilizing the Prevention of Significant Deterioration (PSD) calculation methodology. Hourly emissions rates include hours during the 3-hour startup or shutdown period and the remaining 21 hours of the 24-hour period the MWC unit was operating prior to shut down or after startup.

Note: It is understood the RACT regulation will be revised in the future to include the periods when only natural gas is being fired prior to startup (continuous burning) and during a shutdown. The emissions from natural gas only firing periods will be included in determining compliance with the 252 lbs/hour facility limit during startup and shutdown periods.

3) Definitions

The following definitions apply for purposes of demonstrating compliance with NOx RACT limits:

Startup -Start up begins with the continuous burning of municipal solid waste (MSW) and continues for a period of time not to exceed 3 hours, but does not include any warm-up period when the particular unit is combusting natural gas or other non-municipal solid waste fuel, and no MSW is being fed to the combustor.

Continuous Burning - Continuous burning is the continuous, semi-continuous, or batch feeding of MSW for purposes of waste disposal, energy production, or providing heat to the combustion system in preparation for waste disposal or energy production and begins when MSW is fed to the combustor. (Start of ram feeders to push MSW from the feed hopper to the first grate zone)

Shutdown - Shutdown commences 30 minutes after MSW to the loading hopper has ceased and ends no later than 3 hours thereafter.

30 Day Rolling Average - The 30-day rolling average emission rate is calculated by summing the total hourly ppm7%O_2 NOx concentrations for the current operating day and the previous 29 operating days, excluding periods of startup and shutdown; and dividing the total hourly ppm7%O_2 value by the number of hours in the 30 day rolling average.

4) NOx Control Description

NOx emissions are controlled using a combination of good combustion practice (staged combustion) and a selective non-catalytic reduction (SNCR) NOx control system supplied by Wheelabrator Air Pollution Control under a licensing agreement with Nalco Fuel Tech (Fuel Tech). The Fuel Tech system uses a 50% by weight urea solution as the NOx reducing agent. Dilution water is added to the urea solution as a carrier to ensure urea is widely distributed in the furnace in the proper temperature zone. When injected in the optimum temperature range urea decomposes to the reducing agent ammonia which reacts with NOx (as NO) forming nitrogen (N_2) and water (H_2O).

Fuel Tech SNCR System Description:

The Fuel Tech SNCR system consists of four different modules:

- Heated insulated storage tank (1)
- Recirculation Module (1)
- Metering Modules (3)
- Distribution Modules (6)

Recirculation Module (RM) - The RM continuously recirculates the urea solution from the insulated storage tank to three Metering Modules located on the 5th floor and back to the storage tank. The RM is equipped with an electric inline heater to maintain urea solution at a temperature greater than 95°F. Insulated heat traced lines from the RM to and from the Metering Modules to storage tank maintain urea solution at the required temperature. The RM has redundant pumps to maintain the recirculation flow to Metering Modules should a pump fail or need maintenance.

Metering Modules (MM) - There is a dedicated MM for each MWC/boiler train located near each boiler on the 5th floor. The MM controls the flow of urea and dilution water and is where urea and dilution water are mixed and pumped to the Distribution Modules. Urea flow is automatically modulated by the continuous NOx signal from the CEMS to maintain the required NOx set point. Dilution water is used as the urea carrier. Dilution water flow rate is determined by furnace temperature, number of injectors in service, urea utilization rate and other factors to insure adequate mixing and dispersion of urea into furnace in the optimum temperature range. More dilution water makes larger droplets that will carry further into the furnace before evaporating and releasing the ammonia. Additionally if the furnace temperature is too hot larger droplets carry to a cooler furnace region where it takes longer for water to evaporate preventing premature release of ammonia and subsequent high temperature oxidation of ammonia to NOx. A pair of dedicated pumps (2 for urea and 2 for dilution water) provide redundancy to ensure urea and dilution water flow is maintained in the case of a pump failure. A Programmable Logic Controller (PLC) on each MM control the urea and dilution water pumps and monitor urea and dilution water flow rates. The PLCs are connected to the control room Distributed Control System (DCS) so plant operators have full control of each metering module. The urea flow rate signals are also sent to the CEM DAS for recording and MDE reporting purposes.

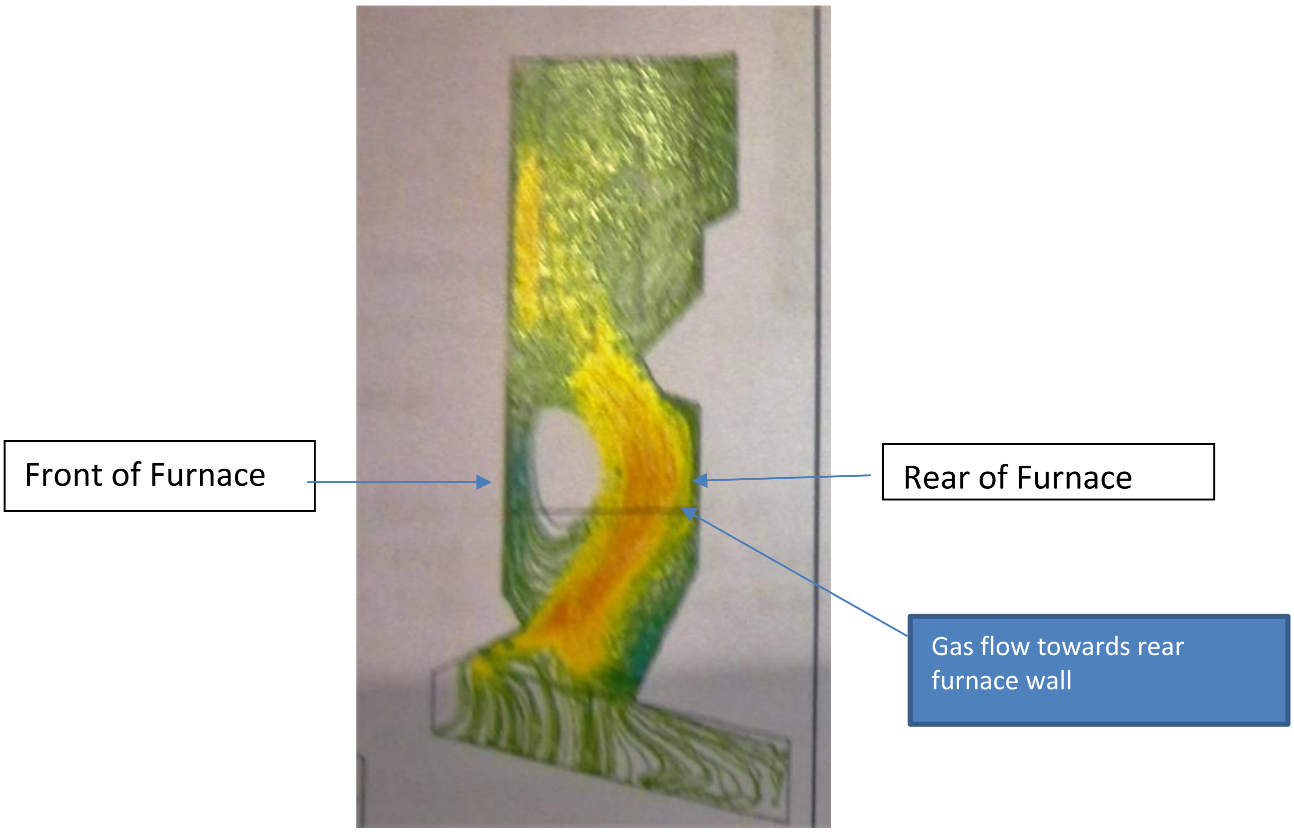
Distribution Panels or Modules (DM) - DMs control the flow of the urea/water mixture to the individual injectors located in the furnace walls of each MWC/boiler. There are 2 DMs for each MWC unit and each DM controls the urea/dilution water mixture flow and atomizing air flow to 4 injectors. Urea/dilution water flow and atomizing air rates can be separately controlled to each injector to ensure optimum spray pattern and furnace coverage is maintained. Varying atomizing air pressure will change the urea/dilution water droplet size. If the furnace it too hot, less atomizing air makes larger droplets that will carry into higher cooler furnace elevations before releasing the ammonia preventing high temperature oxidation of ammonia to NOx. Additionally, total flow of urea/dilution water mixture to each injector is controlled by flow meters through individual flow meters. In general, urea/dilution water flow is divided equally to all injectors in service. Nominal atomizing air and urea/dilution water pressures for injectors are as follows: atomizing air pressure 40-55 psig and urea/dilution water pressure 75 to 76 psig.

SNCR System Performance Factors:
Temperature is critical for SNCR performance since NOx is only reduced effectively within a narrow range of 1800°F to 2100°F. Equally important, the urea causes ammonia slip emissions if injected at temperatures below 1600°F and forms more NOx than it reduces at temperatures above 2400°F as mentioned previously. Furnace temperature profiles may change with boiler load, fuel composition and degree of furnace fouling or slagging, but NOx control can be maintained by making combustion control and/or SNCR system to ensure NOx limits are achieved. SNCR system optimization takes three factors into consideration:

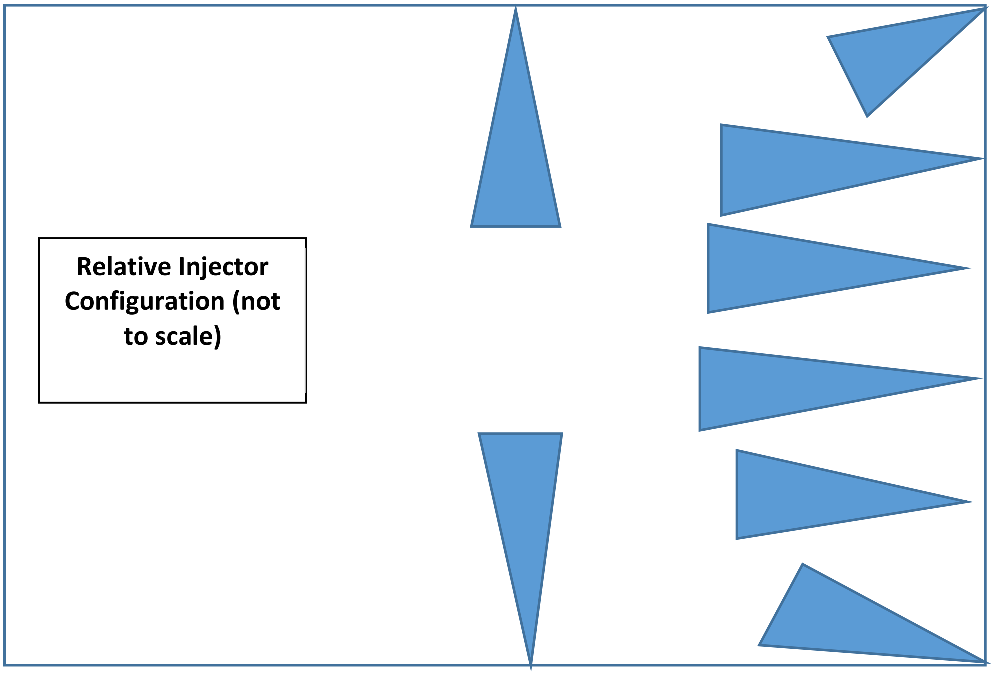
- Temperature: Injecting the urea reagent in the optimum SNCR operating range of 1800-2100 °F.
- Mixing: Maximizing furnace spatial overage within optimum temperature range to insure maximum contact between the urea/ammonia and NOx.
- Time: Providing enough residence time at the optimal temperature range after urea/flue gas mixing to achieve reaction-evaporation of carrier water, decomposition of urea to ammonia and ammonia/NOx reducing reaction.

Based on SNCR optimization testing conducted during development of the limit, it was found that urea injectors are best located on the 4th floor elevation as this elevation was within the middle of optimum SNCR temperature range. Furthermore, the most effective injector locations were determined to be on the side walls toward the rear of the furnace, rear furnace corner ports and on the furnace rear wall as was predicted with the CFD modeling conducted for the design of the front wall water wall platens as shown below. As more operational experience is gained during long term performance achieving the 150 ppm limit and subsequent 145 ppm limit, modifications to the basic injector configurations and locations may be made.

Furnace Gas Flow Pattern



Relative Injector Locations



The final SNCR system modification for optimizing the SNCR system was the installation of larger injectors (3/4 inch OD) equipped that can be equipped with variable geometry tips to provide different spray angles and patterns in the furnace. The larger injectors required rolling furnace tube walls at the desired locations to accommodate the wider injector body. The larger injectors allow for higher water flow (up to 1.4 gpm/injector verses 0.75 gpm for small injectors) that can be put through the injector providing for larger droplet size when need for better penetration of urea into the furnace to improve dispersion/mixing and/or for carrying urea to cooler furnace regions should the furnace temperature increase. The injector tip angles can also be changed to spray up or down as well as produce a wider or narrower spray to help track furnace temperature changes and keep urea injection close to the optimum temperature range, and to optimize furnace coverage.

5) **Combustion Control for Minimizing NOx Emissions**

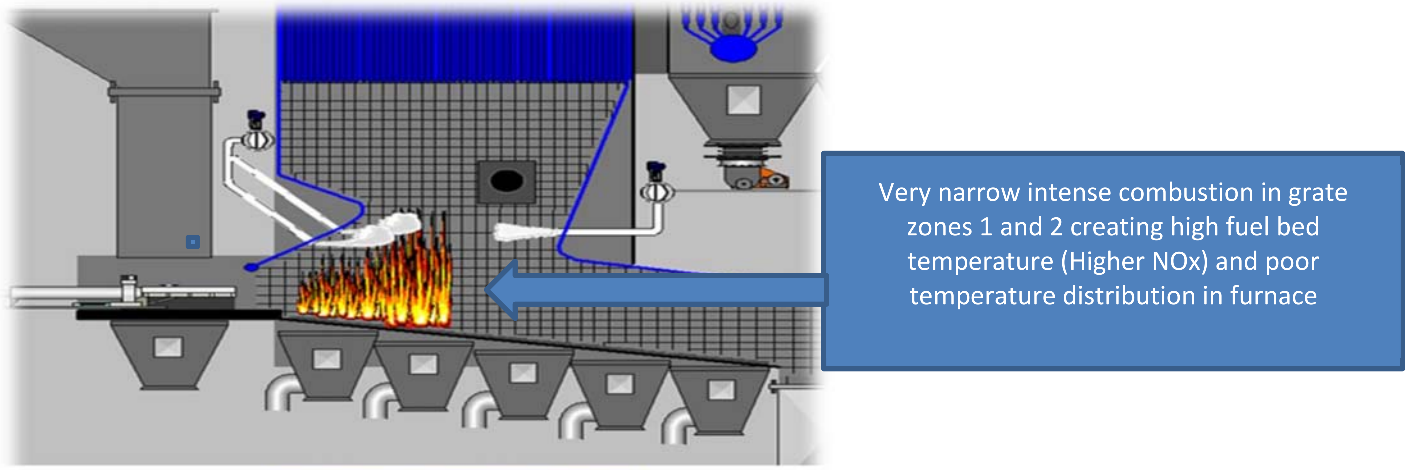
NOx Formation - NOx formation in MWS combustion is primarily attributed to two (2) mechanisms: 1) Thermal NOx and 2) Fuel NOx. Thermal NOx is formed at relatively high temperatures (> 2400°F) by oxidation of nitrogen (N_2) in the combustion. Fuel NOx is formed at relatively lower temperatures (below 2,000°F) by the oxidation of nitrogen contained in the MSW. Local temperatures and O_2 concentrations in the primary combustion zone (on the grates) significantly influence the conversion of fuel bound nitrogen. At low excess air (O_2 levels) and low temperatures, fuel hydrogen and carbon oxidation is favored over fuel nitrogen oxidation to NOx while and preventing thermal NOx formation. Maintaining low excess air levels and lower temperature on the grates in the primary combustion zone is accomplished by low excess air-staged combustion as explained below.

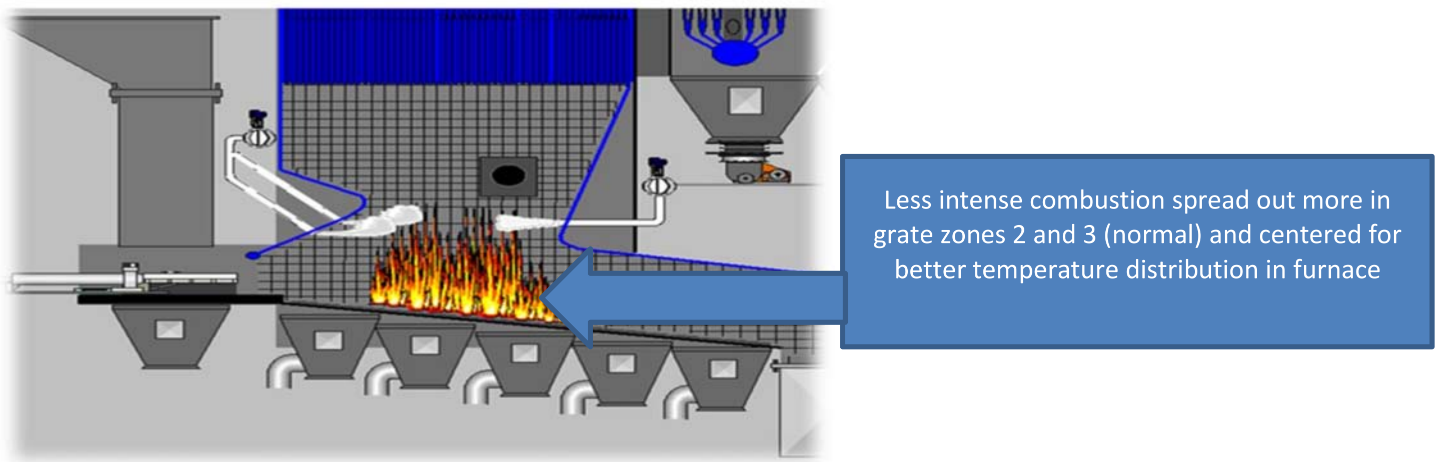
Combustion Controls to Minimize NOx Formation - The furnace and combustion system on the MWC units are designed for low excess air-stage combustion. In staged combustion, combustion air is staged or split approximately 60%/40% between primary under grate combustion air and secondary combustion air above the grates respectively. Staging combustion air maintains a low excess air level on the combustion grates reducing grate MSW combustion intensity and keeping local fuel bed temperature lower to minimize fuel

NOx formation and local hotspots that could make Thermal NOx. The high velocity secondary combustion air above the grates completes combustion by ensuring good mixing of secondary air with good turbulence to minimizing CO and ensuring complete combustion of unburned volatile gases and carbon released from the MSW fuel on the combustion grates. The Boiler Master is the primary combustion controller and automatically varies MSW feed rate (ram feeder) and primary combustion air flow rate to maintain the steam set point. Secondary air is also automatically varied to maintain the proper primary to secondary air ratio or split. Maintaining proper secondary air levels is also key to help maintain middle furnace temperatures within optimum range at the SNCR injector location.

Primary Combustion Grate Zones - The combustion grate is divided into five (5) separate independently controlled grate zones. Primary air supply and grate zone speed (determines how fast MSW fuel is pushed through the furnace) is controlled independently to maintain the desired low O2 levels and fuel bed combustion level/intensity or temperature in each grate zone while ensuring MSW is completely combusted and ash burnout complete before ash is discharged at rear of furnace. Maintaining low excess air levels and low fuel bed combustion temperatures in each grate zone minimize NOx formation as well as helps ensure more even temperature distribution in the furnace at the SNCR injector location as the figures below illustrate.

Operator Control - As in all automated control systems, operators are watching combustion control parameters and visually looking at the fires on combustion grates via cameras. Operators will make adjustments as necessary to various controls if fuel conditions changes (wet fuel for instance) to maintain good combustion conditions.





6) **Maintaining Compliance with NOx RACT Limits during Normal Operation**

General - Primary SNCR system control is automatically performed by PLCs located on the SNCR system Metering Modules. These PLCs receive continuous NOx signals (ppm7%O2) from the CEMs and automatically adjust urea flow rate to maintain the required NOx control set point. As mentioned the PLCs are connected to the Distributed Control System that allow the plant operator to make changes to combustion and SNCR system operations during abnormal or upset conditions. NOx control set points, urea flows and dilution water flows can be adjusted directly by the plant operator. SNCR system information including NOx levels, urea flow rates, and dilution water flow rated are displayed on the control room screens for each MWC unit. The CEM system data acquisition display screen is also in the control room providing the plant operator real time information on NOx limit compliance status of each unit.

Response to Upset Conditions - During combustion upsets or abnormal variations in steam flow, the SNCR control may be put in manual to allow operators to adjust urea feed rate manually to prevent over feed conditions that could lead to excess ammonia slip. The system would remain in manual until normal combustion conditions are restored. Dilution water flow to the injectors can also be varied by the plant operator in response to high urea feed rates and increasing NOx concentrations above set point. Such conditions are usually the result of hotter combustion conditions in the furnace when higher BTU fuel is temporarily encountered. The high temperature actually causes oxidation of the urea to NOx contributing to higher NOx emissions despite an increase in urea flow. Increasing dilution water flow to injectors allows urea to be carried into a cooler section of the furnace preventing oxidation and allowing urea to react and reduce NOx concentrations.

<u>NO_X Control Settings</u> - The NO_X automatic control set point will be maintained at 145 ppm on all three boilers, unless short term adjustments are required to control an upset condition. At the beginning of each shift the Plant Operator ensures that automatic control set points on all three SNCR systems are at the required set point.

<u>Metering Module and Distribution Module Operations:</u>

- Six (6) to eight (8) urea injectors or lances per boiler will be in service during full load MWC/boiler operation to ensure good urea distribution consistent with each boiler's operating conditions.

- Metering Module dilution water flows will normally be set in the range of 6-12 GPM, respectively. Pressure and water flows to each boiler will vary based on boiler operating conditions including boiler load (steam flow), fuel BTU or heating value, and degree of furnace fouling, which influences the optimum SNCR temperature zone in the furnace. Periodic review of optimized SNCR system condition for each MWC/boiler SNCR will be conducted based on evaluation of urea usage over time.

- Distribution Module atomizing air and combined urea and dilution water flow pressures to each injector will be maintained nominally at 40-55 psig and 50-75 psig, respectively. These pressures will vary depending on combustion conditions and ongoing optimization efforts to minimize urea usage and avoid excessive ammonia slip conditions.

- The Metering Modules and Distribution Modules will be inspected once per shift for proper operation by the assistant plant operator (APO).

- The duplex strainers to each Metering Module will be swapped and cleaned once per week by the weekend dayshift APO as a preventative measure to ensure adequate dilution water/chemical flow is maintained to Distribution Modules and injectors.

- Metering Modules and piping to all Distribution Modules will be flushed with dilute acid (safe acid) once per week by the dayshift APO to ensure ability to maintain full urea/dilution water flow rates to injectors.

- The SNCR system dilution water softener will be inspected for proper operation once per shift by the APO. This includes replenishing salt in the brine tank. Proper softening of dilution water is required to prevent scaling and plugging of piping supplying urea/water mix to Distribution Modules and prevent fouling of injectors.

- The urea flow meters on metering modules are calibrated ("draw down test") once per week by the nightshift APO to verify accuracy of urea flow rates. Maintaining accuracy of urea flow rates is necessary for evaluating SNCR system performance as the overall goal is to achieve limits with minimum amount of urea to ensure potential for ammonia slip formation is minimized.

- The Recirculation Module will be inspected every shift by the Utility Operator (UO) to ensure pumps are in good condition, the inline heater is operational, and that the urea solution is being maintained at proper temperature (> 95°F).

Response to Invalid CEM Data Periods - CEM downtime for maintenance (preventative and emergency) or sudden CEM malfunction such as sample pump failure will interrupt the NOx control signal to the SNCR metering module disrupting automatic NOx control and resulting in invalid CEM data being recorded by the CEM data acquisition system (DAS). During CEM downtime/invalid data periods the SNCR system is placed in manual control and urea flow will be maintained at the flow rate from most recent hour in which valid CEM data was captured and NOx emission were below the limit. The SNCR system will be placed back in automatic control when CEM is returned to service. For planned CEM downtime for preventive maintenance and quality assurance activities (quarterly audits), the plant operator maintains communication with the CEM service contractor and/or E&I technician working on the CEM to place SNCR in manual in advance of planned activity and to return SNCR system to automatic control following completion.

NO_X Upset Conditions and Corrective Actions - Most of the time the automatic controls should maintain hourly NOx concentrations below the limit with minimal operator intervention. However, any time a single hourly average NO_X emissions exceeds 150 ppm in the current 24-hour compliance period will be considered an upset condition requiring the plant operator to immediately investigate and take corrective action to ensure the 24-hour block average and 30 day rolling average limits are achieved. Corrective actions may include but not be limited to the following:

- If SNCR control response appears slow and not responding to increase urea flow rate as NOx emission continue to increase, the SNCR control will be put into manual and urea flow rate manually increased until NOx levels drop below 150 ppm for the next hourly average.

- If urea flow rate cannot be increased it then the following actions will be taken:
    - Metering module water strainer inspected and swapped and cleaned.
    - If urea flow is not restored the recirculation module will be checked for proper flow to metering modules and RM pressure adjusted or strainer cleaned as needed to restore full flow to metering modules.
    - If strainer is cleaned and urea recirculation flow rate remains low, then second recirculation pump will be put into operation to restore flow to metering modules.

- If urea feed is increased and NOx continues to increase this is indicative of increase in furnace temperature at injector location. Dilution water flow should be increased incrementally until NOx begins to drop. Once NOx drops and is steady below limit, the dilution water can be gradually returned to previous flow rate provided NOx levels remain steady.

7) Startup and Shutdown Procedures

During startups the furnace is preheated to initial temperature required for start of MSW combustion using the auxiliary natural gas burners. With the exception of the SNCR system, preheating the furnace and boiler allows emission control systems to be put into service prior to continuous MSW combustion. The SNCR system is put in service approximately 15 - 45 minutes after the start of continuous MSW combustion or whenever MSW combustion has been properly established across the first three main combustion zones. This allows furnace temperature at the SNCR injection location to be established across as much of the furnace cross sectional area as possible to ensure there is sufficient heat to evaporate dilution water and release the ammonia from urea for reaction with NOx. Waiting for higher more optimum furnace temperature conditions serves to minimize excessive ammonia slip from being released and causing visible stack plume episodes and reduces potential for impingement of unevaporated urea/dilution water mixture on furnace water wall platens or superheater.

During shutdowns emission controls remain in service until continuous refuse combustion is completed. Auxiliary gas burners will be fired as needed to maintain furnace temperature until MSW combustion is completed and only ash remains on the grates. A summary of startup and shutdown procedures is provided below.

Startup Procedure

1. Auxiliary gas burner is lit to begin preheating of furnace and boiler. Auxiliary burner firing rate is ramped up gradually in accordance with boiler startup curve to ensure slow heating and expansion of furnace and boiler components.
2. After furnace/boiler have reached warmup temperature, the ram feeder and combustion grates are turned off in advance of dropping MSW into the feed hopper.
3. Crane Operator will begin feeding MSW into feed hopper to establish air seal on boiler.
4. When the feed hopper is full and furnace air seal established, the furnace pressure will drop rapidly and the ID fan is place in automatic control with a set point of -0.25 inches H_2O to maintain proper furnace draft.
5. The Secondary Air Fan (SAF) is then started with fan damper at -5%.
6. The SAF header pressure is placed into automatic control at 14 inches H_2O. *Note: When ID Fan control is in automatic, boiler temperature and pressure are maintained by changing SAF header pressure and or gas burner set point.*
7. Carbon system and SDA are placed into service.
8. Ram feeders and grates are started, MSW is pushed from the feed hopper onto 1st grate zone and continuous MSW combustion will start. This will begin the 3 hour startup period.
9. Ram feeder and grates speeds are adjusted as needed to establish good combustion across the first 3 grate zones and SNCR system is placed into service.
10. Steam flow set point is gradually increased until full load set point achieved. Grate speeds and combustion air settings are adjusted as needed to maintain steady combustion. Auxiliary gas burner will be shut off when combustion has stabilized. In general, shutting off of auxiliary burner marks end of the startup period.

Shutdown Procedure

1. MSW feed to hopper is stopped. 30 minutes after MSW feeding stops is when the 3 hour shutdown period begins. Hopper will be just about empty after 30 minutes.
2. Steam flow set point is gradually reduced while grate and combustion air settings are adjusted to maintain good combustion. When feed hopper is empty the furnace air seal is lost and combustion begins to rapidly decrease. As the remaining MSW is combusted, the primary combustion air to each grate zone is shut off and grate speed is increased to 100%.
3. SNCR system will be shut off when all MSW has been combusted on the first grate zone nearest the feed hopper. As in the case of startup, furnace temperatures at this point will be not be sufficiently high or uniform enough in the furnace and this will minimize potential for excessive ammonia slip.
4. Shutdown will be considered complete (continuous combustion has stopped) when there are no visible fires on grate zones 1-3. Carbon feed system and SDA system will be shutdown at this point.

8) **CEMs Data Collection to Ensure Compliance with NOx Limit**

NOx emissions are continuously monitored using the existing MDE approved continuous emission monitoring systems (CEMS) operated and maintained in accordance with COMAR 26.11.01.11. An Ecochem Cemtrac3 data acquisition system (DAS) provides full data recording, calculation and reporting capabilities and will be used to produce all required MDE reports. In addition, a DAS screen in the control room provides operators up to the minute information on NOx emissions and running 24 hour and 30 day rolling averages relative to compliance with limit. Example report formats are provided on the following pages.

Daily NOx RACT Compliance Summary Report

Start 00:00 17-Jan-2019
End 23:00 17-Jan-2019

	Unit 1 Outlet	Unit 1 Outlet	Unit 1 Outlet	Unit 2 Outlet	Unit 2 Outlet	Unit 2 Outlet	Unit 3 Outlet	Unit 3 Outlet	Unit 3 Outlet
	STMFLW_1	UreaFlow_1	NOXRPT_1	STMFLW_2	UreaFlow_2	NOXRPT_2	STMFLW_3	UreaFlow_3	NOXRPT_3
	K#/Hr	GPH	ppm 7% O2	K#/Hr	GPH	ppm 7% O2	K#/Hr	GPH	ppm 7% O2
00:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
01:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
02:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
03:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
04:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
05:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
06:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
07:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
08:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
09:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
10:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
11:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
12:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
13:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
14:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
15:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
16:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
17:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
18:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
19:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
20:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
21:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
22:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
23:00 17-Jan-2019	192	9.5	145	191	10.5	146	192	14.1	148
Valid Avg	192	9.5	145	191	10.5	146	192	14.1	148
Valid Max	192	9.5	145	191	10.5	146	192	14.1	148
Valid Min	192	9.5	145	191	10.5	146	192	14.1	148
Valid Count	24	24	24	24	24	24	24	24	24

Monthly NOx RACT Summary Report

Start	0:00 11/1/2019
End	23:59 11/30/2019

	Unit 1 Outlet STMFLW_1 K#/Hr	Unit 1 Outlet UreaFlow_1 GPH	Unit 1 Outlet NOXRPT_1 ppm 7% O2	Unit 2 Outlet STMFLW_2 K#/Hr	Unit 2 Outlet UreaFlow_1 GPH	Unit 2 Outlet NOXRPT_2 ppm 7% O2	Unit 3 Outlet STMFLW_3 K#/Hr	Unit 3 Outlet UreaFlow_1 GPH	Unit 3 Outlet NOXRPT_3 ppm 7% O2
00:00 01-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 02-Nov-2019	191	8.5	146	191	10.6	147	192	14.1	147
00:00 03-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 04-Nov-2019	191	8.5	146	191	10.6	147	192	14.1	147
00:00 05-Nov-2019	191	8.5	146	191	10.6	147	192	14.1	147
00:00 06-Nov-2019	191	8.5	146	191	10.6	147	192	14.1	147
00:00 07-Nov-2019	191	8.5	146	191	10.6	147	192	14.1	147
00:00 08-Nov-2019	191	8.5	146	191	10.6	147	192	14.1	147
00:00 09-Nov-2019	Shutdown	Shutdown	Shutdown	191	10.6	147	192	14.1	147
00:00 10-Nov-2019	Offline	Offline	Offline	191	10.6	147	192	14.1	147
00:00 11-Nov-2019	Offline	Offline	Offline	191	10.6	147	192	14.1	147
00:00 12-Nov-2019	Offline	Offline	Offline	191	10.6	147	192	14.1	147
00:00 13-Nov-2019	Startup	Startup	Startup	191	10.6	147	192	14.1	147
00:00 14-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 15-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 16-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 17-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 18-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 19-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 20-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 21-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 22-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 23-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 24-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 25-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 26-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 27-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 28-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 29-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
00:00 30-Nov-2019	192	8.5	146	191	10.6	147	192	14.1	147
		8.5							
Valid Avg	192	8.5	146	191	10.6	147	192	14.1	147
Valid Max	192	8.5	146	191	10.6	147	192	14.1	147
Valid Min	191	8.5	146	191	10.6	147	192	14.1	147
Online Days	27	27	27	30	30	30	30	30	30

NOx RACT Startup Summary Report

Startup Begin																
00:00 17-Jan-2019																
End	**Facility**	Unit 1 Outlet					Unit 2 Outlet					Unit 3 Outlet				
23:00 17-Jan-2019	**NOx**	STMFLW_1	UreaFlow1	NOXPPM_1	STKFLOW1	NOxLBS_1	STMFLW_2	UreaFlow2	NOXPPM_2	STKFLOW2	NOxLBS_2	STMFLW_3	UreaFlow3	NOXPPM_3	STKFLOW3	NOxLBS_3
	LBS/HR	K#/Hr	GPH	ppmd	DSCFM	LBS/HR	K#/Hr	GPH	ppmd	DSCFM	LBS/HR	K#/Hr	GPH	ppmd	DSCFM	LBS/HR
00:00 17-Jan-2019	159.6	25	0	40	13385	3.8	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
01:00 17-Jan-2019	169.5	45	2	80	24094	13.8	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
02:00 17-Jan-2019	183.1	75	5	95	40156	27.3	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
03:00 17-Jan-2019	221.3	150	8	114	80313	65.6	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
04:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
05:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
06:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
07:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
08:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
09:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
10:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
11:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
12:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
13:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
14:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
15:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
16:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
17:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
18:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
19:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
20:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
21:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
22:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
23:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
Average	**230.3**															

NOx RACT Shutdown Summary Report

Startup Begin																
00:00 17-Jan-2019																
End	Facility	Unit 1 Outlet					Unit 2 Outlet					Unit 3 Outlet				
23:00 17-Jan-2019	NOx	STMFLW_1	UreaFlow1	NOXPPM_1	STKFLOW1	NOxLBS_1	STMFLW_2	UreaFlow2	NOXPPM_2	STKFLOW2	NOxLBS_2	STMFLW_3	UreaFlow3	NOXPPM_3	STKFLOW3	NOxLBS_3
	LBS/HR	K#/Hr	GPH	ppmd	DSCFM	LBS/HR	K#/Hr	GPH	ppmd	DSCFM	LBS/HR	K#/Hr	GPH	ppmd	DSCFM	LBS/HR
00:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
01:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
02:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
03:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
04:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
05:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
06:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
07:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
08:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
09:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
10:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
11:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
12:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
13:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
14:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
15:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
16:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
17:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
18:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
19:00 17-Jan-2019	239.7	192	9.5	114	102800	84.0	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
20:00 17-Jan-2019	222.0	192	8	90	102800	66.3	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
21:00 17-Jan-2019	175.9	75	5	70	40156	20.1	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
22:00 17-Jan-2019	163.5	45	2	45	24094	7.8	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
23:00 17-Jan-2019	157.6	25	0	20	13385	1.9	191	10.5	115	95516	78.7	192	14.1	112	96016	77.0
Average	**229.7**															

30 Day-NOx RACT Summary Report

Start	11/1/2020								
End	11/30/2020								
	Unit 1 Outlet	Unit 1 Outlet	Unit 1 Outlet	Unit 2 Outlet	Unit 2 Outlet	Unit 2 Outlet	Unit 3 Outlet	Unit 3 Outlet	Unit 3 Outlet
	STMFLW_1	UreaFlow_1	NOXRPT_1	STMFLW_2	UreaFlow_1	NOXRPT_2	STMFLW_3	UreaFlow_1	NOXRPT_3
	K#/Hr	GPH	ppm 7% O2	K#/Hr	GPH	ppm 7% O2	K#/Hr	GPH	ppm 7% O2
11/1/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/2/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/3/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/4/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/5/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/6/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/7/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/8/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/9/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/10/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/11/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/12/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/13/2019	191	8.5	143	191	10.6	141	192	14.1	140
11/14/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/15/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/16/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/17/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/18/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/19/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/20/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/21/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/22/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/23/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/24/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/25/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/26/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/27/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/28/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/29/2019	192	8.5	143	191	10.6	141	192	14.1	140
11/30/2019	192	8.5	143	191	10.6	141	192	14.1	140
		8.5							
Valid Avg	192	8.5	143	191	10.6	141	192	14.1	140
Valid Max	192	8.5	143	191	10.6	141	192	14.1	140
Valid Min	191	8.5	143	191	10.6	141	192	14.1	140
Online Days	30	30	30	30	30	30	30	30	30

COVANTA
ENERGY
for a cleaner world

Covanta Montgomery, Inc.
21204 Martinsburg Rd
Dickerson, MD 20842
Tel 301 916 3031
Fax 301 349 5309

January 17, 2019

Mr. Randy Mosier, Division Chief
Air Quality Regulations Division
Maryland Department of the Environment
Air Quality Planning Program
1800 Washington Boulevard, Suite 715
Baltimore, MD 21230-1720

SUBJECT: **Montgomery County Resource Recovery Facility**
NOx RACT – Plan to Operate

Dear Mr. Mosier:

On behalf of the Northeast Maryland Waste Disposal Agency and in accordance with COMAR 26.11.08.10.G, NOx Requirements for Large Municipal Waste Combustors, enclosed is the Plan to Operate for the Montgomery County Resource Recovery Facility, operated by Covanta. The Plan outlines how the Facility will be operated to maintain compliance with this regulation.

If you have any questions regarding this submittal, please do not hesitate to contact me 301-691-9008.

Sincerely,

Eli Golfer
Environmental Specialist

cc: David Blackmore
Joe Walsh
Steve Sprague
Ray Liou
Chris Skaggs
John Schott
Joe LaDana

NOx RACT - Plan to Operate

COMAR 26.11.08.10.G - NOx Requirements for Large Municipal Waste Combustors plan to operate to meet new NOx limits.

The Montgomery County Resource Recovery Facility (MCRRF) is a large municipal waste combustor facility operated by Covanta Montgomery Inc., on behalf of the Northeast Maryland Waste Disposal Authority (NMWDA) and the Montgomery County Department of Environmental Protection, Division of Solid Waste Services. The SIC code for the MCRRF is 4953 (refuse systems). The MCRRF consists of three independent combustion trains that have a total nominal design capacity of 1,800 tons/day with an average heating value of 5,500 Btu/lb of waste combusted. The thermal output from the facility is used to generate up to 63 megawatts of renewable energy for distribution to the electrical grid.

In October 2009, the MCRRF implemented an upgrade to the Selective Non-Catalytic Reduction (SNCR) for Nitrogen Oxides (NOx) emission control called Low NOx or LN™. This upgrade reduced NOx emissions to levels below the existing federal and Maryland standards. The system involves the redirection of a portion of the secondary or overfire air to a higher elevation in the furnace. This allows for completion of the combustion process while minimizing NOx formation through temperature control. In addition to the combustion air modifications, the system also included the replacement of anhydrous ammonia with aqueous ammonia. This project reduced NOx concentration at the stack while simultaneously reducing reagent use. Continued use of LN™, in combination with the SNCR system, will allow the MCRRF to meet the NOx emission limits contained within the current permit approvals as well the new limits under COMAR 26.11.08.10 as further outlined below.

Currently the MCRRF operates pursuant to the following permit approvals:

1) Title V Operating Permit / PSD Permit
    a. Daily NOx concentration limit: 180 ppm, 24-hour average
    b. NOx mass limit during Startup/Shutdown/Malfunction: 260 lb/hr, 24-hour average.

    c. NOx RACT Requirement (COMAR 26.11.08.10)
        i. Emission Limits beginning May 1, 2019

NOx (Oxides of Nitrogen)	Emission Standard for a Large MWC
24-hour Block Average Emission Rate	140 ppmv
Startup/Shutdown emission limit timed average mass loading over a 24-hour period	202 lbs/hr

        ii. Beginning May 1, 2020

NOx (Oxides of Nitrogen)	Emission Standard for a Large MWC
30-day rolling average emission rate	105 ppmv

To continue operating in compliance with the NOx RACT requirements under COMAR 26.11.08.10, the MCRRF will adhere to its Environmental Compliance Operating Manual (ECOM) procedures for the following:

2) ECOM Section 4 – MWC Unit Startup, Shutdown, and Malfunction Procedures

   These procedures cover the startup and shutdown of the boilers and its auxiliaries as well as all associated air pollution control equipment. The procedures for responding to malfunctions during normal operations are also identified.

   i. 4.1 MWC Startup Procedures
   ii. 4.2 MWC Unit Shutdown Procedures
   iii. 4.3 MWC Unit Malfunction Procedures

3) ECOM Section 7.2 Response to Elevated Nitrogen Oxides (NOx)

   In the event that NO_x emissions are above the permit limit, immediate action must be taken to reduce emissions to ensure compliance. If NO_x levels cannot be reduced to permitted levels in one hour, the Chief Engineer, or if not available, the Facility Manager or Maintenance Supervisor must be notified. Unit load must be reduced, or the unit removed from service, as necessary to prevent exceeding the permit limit for NO_x emissions. In addition to increasing the delivery rate of ammonia to the NO_x control system, auxiliary gas burners may be used for short term control.

4) ECOM Section 11 – Procedures for Monitoring MWC Unit Emissions

   Written quality control procedures for the gas and opacity CEMS are required under federal regulation 40 CFR Part 60, Appendix F, Procedure 1: "Quality Assurance Requirements for Gaseous Continuous Emission Monitoring Systems (CEM) Used for Compliance Determination."

   i. 11.3 Continuous Emission Monitoring System (CEMS)
   ii. 11.4.5 Acquisition/Control System

5) Procedures for maintaining the NOx analyzers including daily calibrations, quarterly cylinder gas audits, and annual relative accuracy testing audits are performing in accordance with *40CFR appendix B to Part 60 – Performance Specification 2 – Specifications and Test Procedures for SO2 and NOx Continuous Emissions Monitoring Systems in Station Sources.*

6) ECOM Section 12 - Reporting and Recordkeeping

This section describes and illustrates the calculations used to determine NO_x emissions and Gas and Opacity CEM accuracy.

i. 12.1.1.1 Calculations
    1. 24-hour NOx concentration of 140 ppm
    2. Rolling 30-day average NOx concentration of 105 ppm
    3. NOx mass emission during startup and shutdown of 202 lbs/hr

ii. 12.1.1.2 Reporting Requirements
    1. NOx RACT reporting requirements will become Section H of the Quarterly Operations and Maintenance (O&M) Report that is submitted to MDE [30 days] after the completion of each calendar quarter. This section will include the following:
        a. Data, information, and calculations which demonstrated compliance with the NOx 24-hour block average.
        b. Data, information, and calculations, including NOx CEMS data and stack flow data which demonstrate compliance with startup and shutdown mass NOx emission limits.
        c. Flagging of periods of startup and shutdown and exceedances of emission rates.
        d. Documented actions taken during periods of startup and shutdown in signed, contemporaneous logs.