

Impacts of New SSI Standards on Mattabassett District's Operations



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Presentation Overview

- Background
- Plant Upgrade
- New Regulations
- Impact Operations
- New SSI NOx Limits



Mattabassett District Background

- Located in Cromwell
- 4 constituent communities (Berlin, Cromwell, Middletown & New Britain)
- 15 Member Volunteer Board of Directors
- Staffed 24 hours per day – every day
- Cost to treat 1000 gals of waste water is only \$1.10 one of the lowest in CT.



Nitrogen Upgrade Project

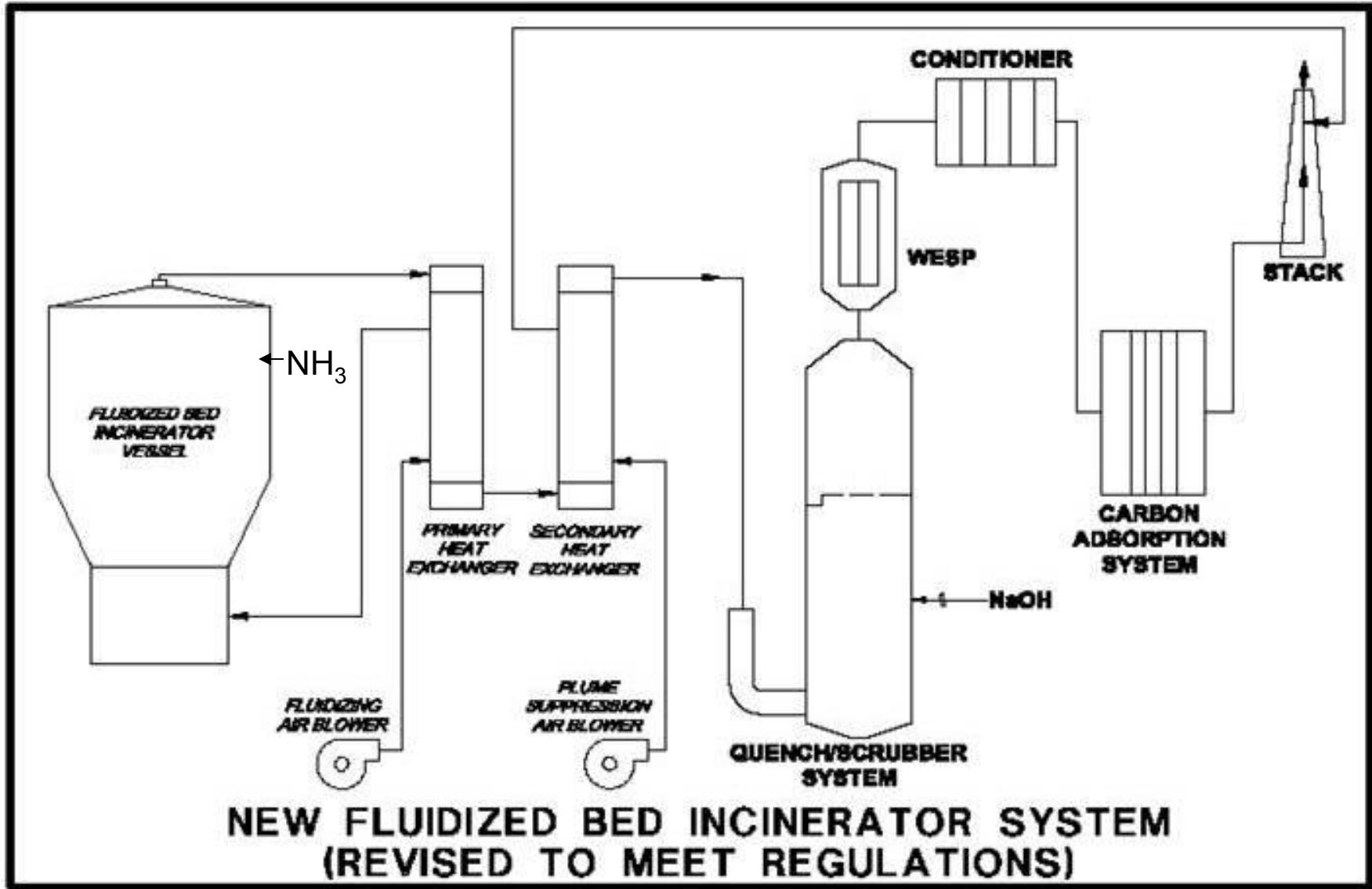
- Began May 2012 – Substantially complete July 15, 2015
- Projected Cost - \$98,000,000
- Capacity - 20 - 35 million gals/day
- Expansion to receive Middletown flows.

Mattabassett is now the 3rd largest facility in the State.

Challenges:

- FBI meeting new incinerator Quad-L NOx limits

Incinerator



New FBI System Pollution Control

- FBI bed designed for CO and NOx control
 - 6.5 second freeboard residence time
- Quench followed by multi-venturi tray scrubber
 - Removal of particulate and associated metals
 - Acid gases
- Wet Electrostatic Precipitator
 - Further reduction particulates and metals
- Carbon bed system
 - Mercury and dioxin removal

New SSI Limits (Fluidized Bed)

Criteria Pollutants	NEW SSI Limits
PM , mg/dSCM	9.6
SO _x , ppmvd	5.3
NO _x , ppmvd	30
CO, ppmvd	27
Cd, mg/dSCM	0.0011
Pb, mg/dSCM	0.00062
Hg, mg/dSCM	0.001

All at 7% Oxygen

FLUIDIZED BED INCINERATOR

Operational Issues

- NOx Emissions greatest challenge:
 - Regulatory –
 - ▷ 30 ppm limit, corrected to 7% oxygen
 - ▷ Higher O₂ equates to higher corrected NOx
 - ▷ Limits apply “at all times”
 - Process –
 - ▷ Ammonium injection provides approx. 70% reduction
 - ▷ More difficult at elevated bed temps (>1500° F)
 - ▷ Fluidizing air is constant flow (not variable)

Operational Impacts

- Requires tighter control of Process & Reactor Operation
- Management of FOG
- Dewatering Process Flexibility
- Other Factors

Tighter Control of Reactor Operation

- Maintain low bed temps (<1450° F)
- Minimize high O₂ Levels (< 10%)
- Minimize upstream equipment interruptions
- Decrease variability in sludge feed to control btu

Manage FOG Loads

- Maintain lower bed temps
 - Need lower volatile solids
- Receive FOG – Revenue Source
 - Scheduling deliveries
 - Reducing Number of deliveries

Sludge Dewatering Process

- Sludge variability
 - ▷ Feed rate
 - ▷ Dry solids concentration
 - ▷ Composition – volatiles
- “wetter” sludge burns cooler
 - ▷ Aim For 22-24% solids

Centrifuge Dewatering Process:

- Constant adjustments required
 - polymer
 - Bowl speed
 - ▷ Lower speed – wetter solids
- Operation not optimal:
 - Constant operator attention
 - Increased polymer usage
 - Decreased centrifuge recovery/capture rate

Operation Impact

- Other factors related to new SSI limits:
 - Carbon system periodic flushing requires significant downtime (1-2 weeks)
 - Ammonium Hydroxide used for NOx control
 - ▷ Chemical hazard

NOx – Can Limits be Met?

- Workout with Engineer, Incinerator Manufacturer & EPA to find Solutions:
 - Assess Ammonia Injection Requirements
 - EPA to Review Operation AC & Regulation
 - “At All Times”
 - Stack Test for NOx instead of Continuous Monitoring

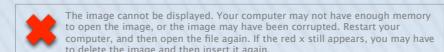


New SSI NOx Limits

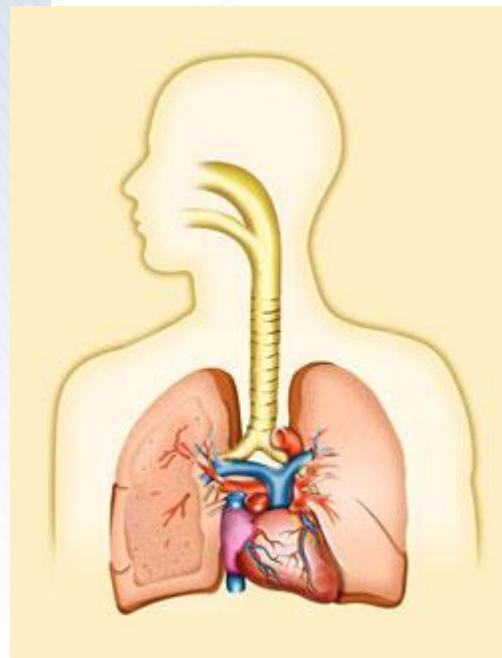
Is it Possible to Meet Them?

What is NOx?

- Nitrous Oxides
 - NO – nitric oxide **MOST COMMON FORM**
 - NO₂ – nitrogen dioxide
 - N₂O₂ – dinitrogen dioxide
 - N₂O₅ – dinitrogen pentoxide
 - N₂O – nitrous oxide
 - N₂O₄ - dinitrogen tetroxide
 - N₂O₅ – dinitrogen pentoxide



Why Control NOx ?



How is NOx Created?

- Most NOx is from human sources
- Fuel NOx
- Thermal NOx
 - Occurs at high temperatures
 - More NOx forms at higher O₂ levels



Emission Limits

FBI:

New: 30 ppm NOx at 7% O₂

Existing: 150 ppm NOx at 7% O₂

MHI:

New: 210 ppm NOx at 7% O₂

Existing: 220 ppm NOx at 7% O₂

Regulation Require...

- Emissions to be met “at all times”
 - Must meet on 24-hr avg
- CEMS: Report any time system is on
- Parameter Monitoring:
Report when burning sludge



NOx Control

- Ammonia Injection
 - Inject NH₃ in bed

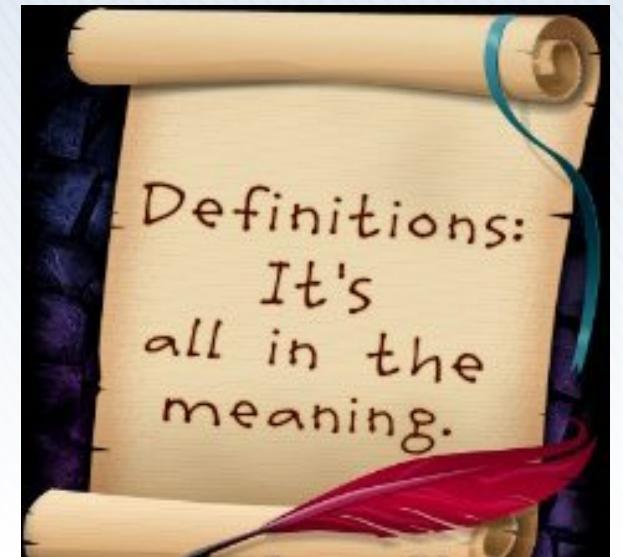


Occurs at temps of 1400 deg F to 2000 deg F

Regulation State #1:

“Periods of Startup, Normal Operations and shutdown are predictable and routine”

- Implies sludge is consistent
- Implies these 3 have same emissions
- Does not address other situations
 - Hot Standby
 - Sand addition
 - Introduction of sludge/Loss of sludge



Startup Sequence

- Aeration blower and Sludge Pump on
- Centrifuges ramped up to speed
- Introduce sludge
- Typically hours before steady state
- NOx rates are erratic
 - > 500 ppm corrected

Regulation State #2:

Use of NG or Fuel Oil during startup -
Emissions are expected to be low

But – these fuels result in higher NOx

- Final heat-up of Vessel
- Sand addition
- Hot standby



Sand Addition

- Sand addition can take 3-4 hours
- Add fuel to keep temp up
- NOx values typically cycle to >500 ppm
 - Brings daily avg to > 69 ppm corrected
 - May achieve limit for uncorrected

Regulation State #3:

Method of Calculating Daily Average

- Impact NOx more than other parameters
 - NOx is highest when O2 is high
- Calculation Uses 1- 15 min value for an hour

Example Calculation

- Shutdown in first $\frac{1}{4}$ of hour
- This hour value is 250 ppm NOx
- Rest of Day must be <20 ppm NOx
- If only use $\frac{1}{4}$ of an hour – rest of day
 - Rest of day must be less than 28.6 ppm NOx

Regulations Don't State:

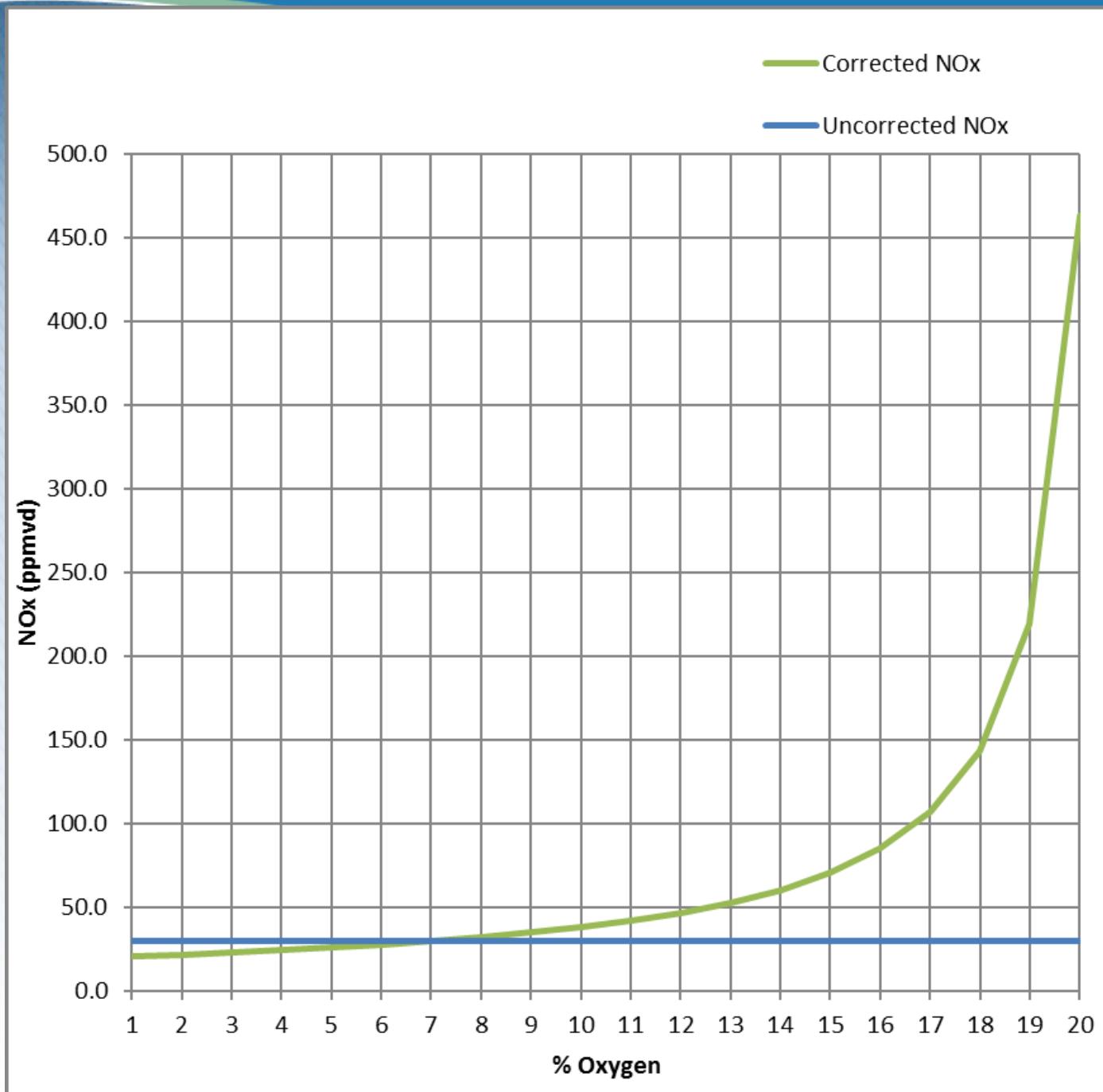
- Correct to 7% O₂ only when burning sludge

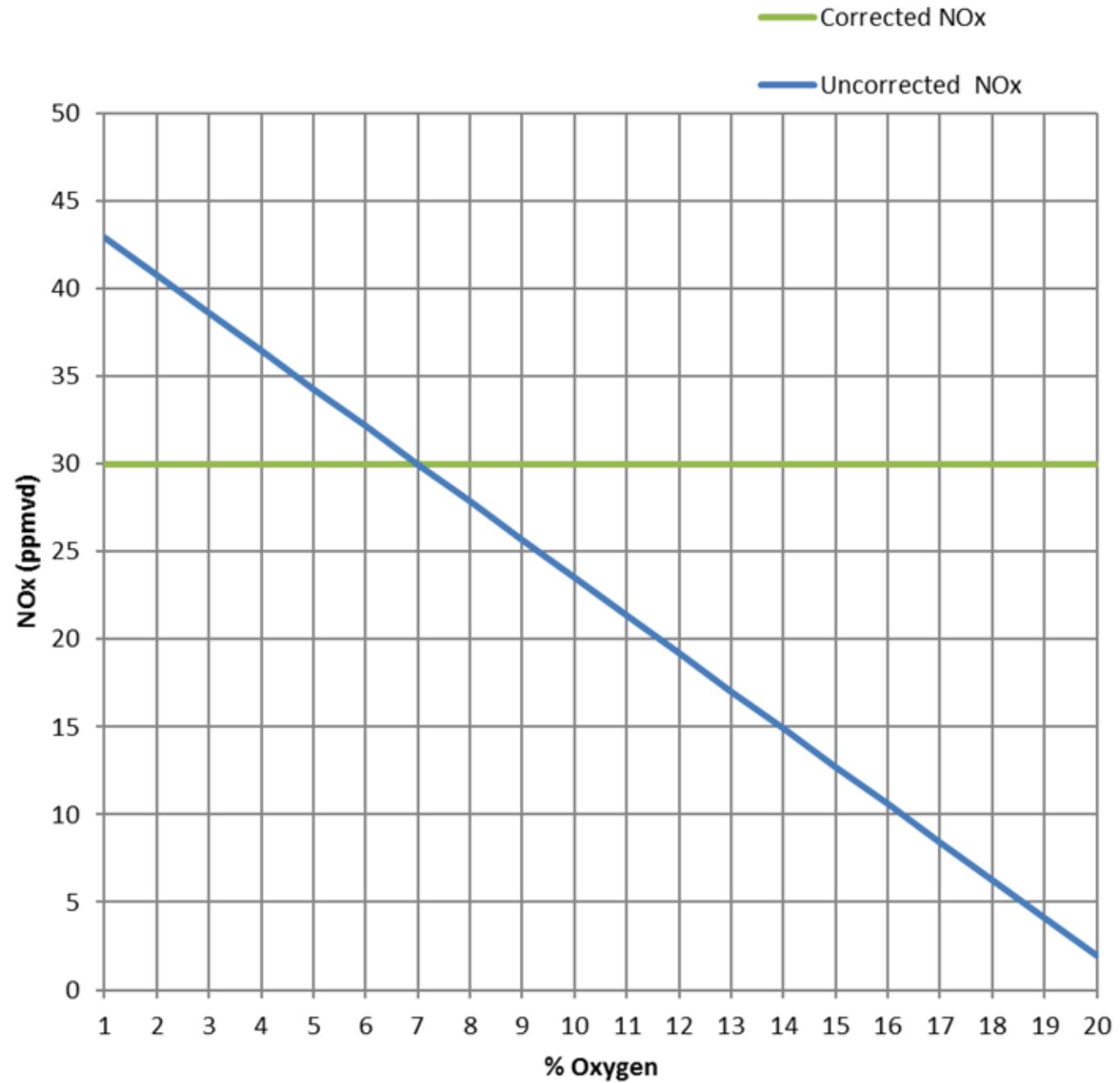
$$\text{NOx @7\% O}_2 = \text{NOx actual } (20.9 - 7) / (20.9 - \% \text{ O}_2)$$

Typical air has 50 ppb NOx

- corrected value is 139 ppm NOx







To summarize

- Emission limits cannot be consistently met during
 - Hot standby
 - Loss of sludge
 - Loss of one centrifuge
 - Sand addition
 - Startup/Shutdown of System
- Correction to 7% O₂ during startup/shutdown is unreasonable.



Questions?

