

PROPOSED AMENDED RULE 1117

EMISSIONS OF OXIDES OF NITROGEN FROM GLASS MELTING FURNACES

Working Group Meeting #1

August 1, 2019

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AGENDA

- Background
- Proposed Facilities
- BARCT Assessment
- Current Control Technology
- Areas to Address Under PAR 1117
- Next Steps

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BACKGROUND

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RECLAIM BACKGROUND

- 2016 Air Quality Management Plan
 - Adoption Resolution called for further NO_x reductions from an assessment of the RECLAIM program, including:
 - 5 ton per day NO_x reduction to be achieved no later than 2025; and
 - Transitioning RECLAIM to a command-and-control regulatory structure
- 2017 – AB 617
 - Applicable to facilities in the state greenhouse cap and trade program
 - Develop implementation schedule by 1/1/2019
 - Best Available Retrofit Control Technology (BARCT) implementation by 12/31/2023, prioritizing older, higher emitting units

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NEED FOR PAR 1117

- Two facilities need a landing rule in transition from RECLAIM to command-and-control
 - Rule 2002 provides framework for facilities transitioning out of RECLAIM
- NO_x emission limits in Rule 1117 do not represent current BARCT
 - NO_x limits achieved by both RECLAIM facilities are well below the Rule 1117 NO_x limits
- Evaluate the following elements:
 - Determine if NO_x emission limits achieved by facilities in RECLAIM are representative of BARCT
 - Convert NO_x limits from pounds of NO_x per ton of glass pulled to NO_x concentration (ppm @ 3% O₂)
 - Limitations for start-up/shutdown
 - NO_x averaging periods
 - Exemption level

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RULE 1117 BACKGROUND

- Adopted February 1982, amended January 1984
- Applicability specific to glass melting furnaces (e.g. container glass, flat glass)
- NO_x emission limit: 4 lbs NO_x/ton of glass pulled
 - Unconventional units for emission limit
 - NO_x limits usually expressed as:
 - Concentration (ppm) or
 - Process rate (lb/hr)
- All facilities subject to Rule 1117 were subsumed under RECLAIM

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RULE DEVELOPMENT PROCESS

Information Gathering – Meet with Stakeholders



Define Rule Objective and Scope



Develop Rule Concepts



Draft Proposed Rule Language

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FACILITIES SUBJECT TO PAR 1117

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PROPOSED UNIVERSE

- One container glass melting facility would be subject to Rule 1117
- One additional facility producing sodium silicate (water glass) in a similar melting process
 - Would also be subject to PAR 1117 as no command-and-control rule currently exists
- Several small craft facilities
 - Not expected to be regulated by proposed amended rule
 - Current exemption level set at furnaces producing $<15 \text{ lbs}_{\text{NO}_x}/\text{hr}$

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GLASS MELTING FACILITY (CONTAINER GLASS)

- 2 glass melting furnaces
 - (2) 68 MMBtu/hr furnaces
 - Oxy-fuel furnaces
 - Lower NO_x formation than air-fueled furnaces
 - Controlled by Tri-Mer control system
 - Installed 2016/2017
 - Controls NO_x, SO_x and PM
 - NO_x emissions: 0.11 lbs/ton of glass pulled (source test)
- Glass conveyance system
 - ~1200 small burners keep glass at elevated temperature for working properties
 - Burners are uncontrolled
- 24/7/365 operating schedule



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SODIUM SILICATE MANUFACTURING FACILITY

- Sodium silicate is a commodity used for grouting (subways, sewers), textile/lumber processing, refractory ceramics, surfactants, detergents
- Furnace operation cycles every 30 minutes
 - Higher NOx emissions during ~10 minute cycling event
- Operating schedule: Cyclic schedule
 - Based on existing product demand
 - 24/7 operating schedule while operating



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SODIUM SILICATE MANUFACTURING FACILITY EQUIPMENT DETAILS

- 1 furnace
 - Air-fueled
 - 60 MMBtu/hr
 - 2-stage combustion
 - Controlled by Tri-Mer control system (Installed 2017)
- NOx emissions:
 - 2015 – 31.5 TPY
 - 2016 – 40.0 TPY
 - 2017 – 8.8 TPY (Tri-Mer control system installed)
 - 2018 – 6.3 TPY

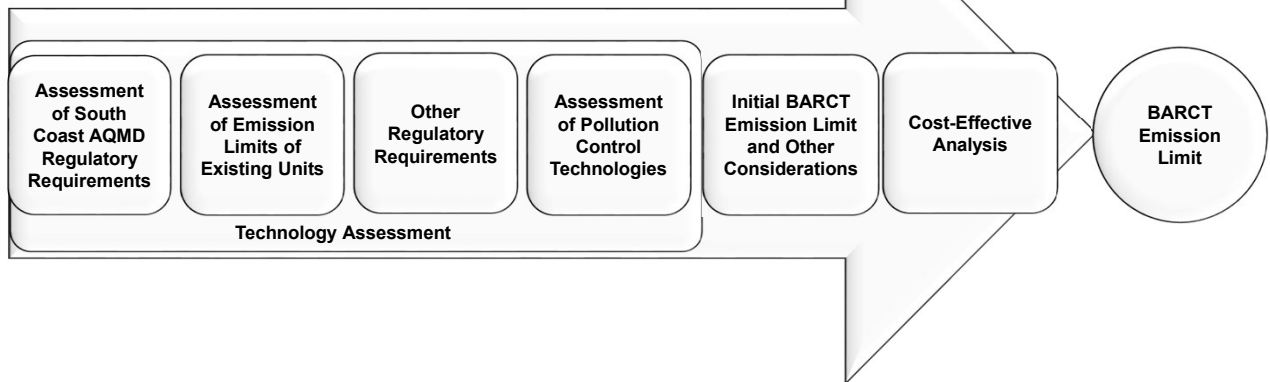
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BARCT ASSESSMENT

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BARCT ASSESSMENT

BARCT analysis conducted for each equipment category



RECLAIM EMISSION FACTORS

- RECLAIM BARCT emission factors are not necessarily permit limits
 - Used to determine future year allocations
- RECLAIM default emission factors represent a maximum reporting value for process units
 - 130 lbs_{NOx}/ MMSCF is default emission factor for external combustion equipment (natural gas-fired)
 - Lower levels can be demonstrated with source testing or manufacturer's verification
- Staff conducted a BARCT assessment in 2015 for both glass melting furnaces and sodium silicate manufacturing

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2015 RECLAIM BARCT ASSESSMENT FOR CONTAINER GLASS MELTING FURNACES

- Emission factor (lbs_{NOx}/ton of glass pulled) reduced by 70% in 2000 and a further 80% (94% overall) in 2015:
 - Rule 1117 existing limit – 4 lbs_{NOx}/ton of glass pulled
 - Ending Tier I EF (2000) – 1.2 lbs_{NOx}/ton of glass pulled *
 - Ending EF (2022) - 0.24 lbs_{NOx}/ton of glass pulled **
- Looking at other sources of information for updated emission factors

*Rule 2002, Table 1

**Rule 2002, Table 6

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COMPARISON OF CONTAINER GLASS MELTING FURNACE AND PROCESS UNIT EMISSIONS

RECLAIM Major Source (Furnace B)

- 68 MMBtu/hr
- 44 lbs/day

Emission Factor	Emissions*
0.11 lbs/ton of glass pulled	44 lbs/day

Process Unit (Glass Conveyance System)

- Uses 685 burners: Cumulative
burner ratings 15.1 MMBtu/hr
- 45 lbs/day

Emission Factor	Emissions**
130 lb/MMscf	45 lbs/day

Furnace and process unit emissions on same order of magnitude

* Based on source test, October 2017, and maximum permitted throughput

** Default RECLAIM reporting value for natural gas fired external combustion equipment, assumes 24/7/365 days operation

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COMPARISON OF CONTAINER GLASS MELTING FURNACE AND PROCESS UNIT EMISSIONS

RECLAIM Major Source (Furnace C)

- 68 MMBtu/hr
- 37 lbs/day

Emission Factor	Emissions*
0.11 lbs/ton of glass pulled	37 lbs/day

Process Unit (Glass Conveyance System)

- Uses 543 burners: Cumulative
burner ratings 11.6 MMBtu/hr
- 24 lbs/day

Emission Factor	Emissions**
130 lb/MMscf	24 lbs/day

Furnace and process unit emissions on same order of magnitude

* Based on source test, October 2017, and maximum permitted throughput

** Default RECLAIM reporting value for natural gas fired external combustion equipment, assumes 24/7/365 days operation

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2015 RECLAIM BARCT ASSESSMENT FOR SODIUM SILICATE MANUFACTURING

- Emission factor ($\text{lbs}_{\text{NO}_x}/\text{ton}$ of glass pulled) reduced by 80% in 2015:
 - Ending Tier I EF (2000) – 6.4 $\text{lbs}_{\text{NO}_x}/\text{ton}$ of glass pulled *
 - Ending EF (2022) - 1.28 $\text{lbs}_{\text{NO}_x}/\text{ton}$ of glass pulled **
- Looking at other sources of information for updated emission factors

*Rule 2002, Table 1

**Rule 2002, Table 6

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CURRENT CONTROL TECHNOLOGY

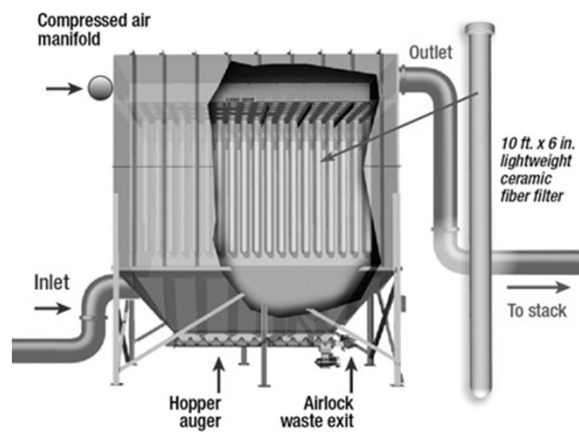
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BACKGROUND

- Both facilities potentially subject to PAR 1117 installed Tri-Mer technology (~2017)
 - UltraCat catalyst-embedded filters
 - Flue gas control from 350 to 700°F
 - Controls PM, NO_x, SO₂
 - Up to 95% NO_x control with ammonia injection
 - Over 90% SO₂ removal with dry sorbent injection
 - PM removal <0.001 gr/dscf
- Source tests demonstrate:
 - Glass melting facility
 - 0.11 lb_{NO_x}/ton of glass pulled
 - Concentration requires additional data to correct to 3% O₂
 - Sodium silicate manufacturing facility
 - NO_x concentrations: 48 ppm (raw), 74 ppm @3% O₂

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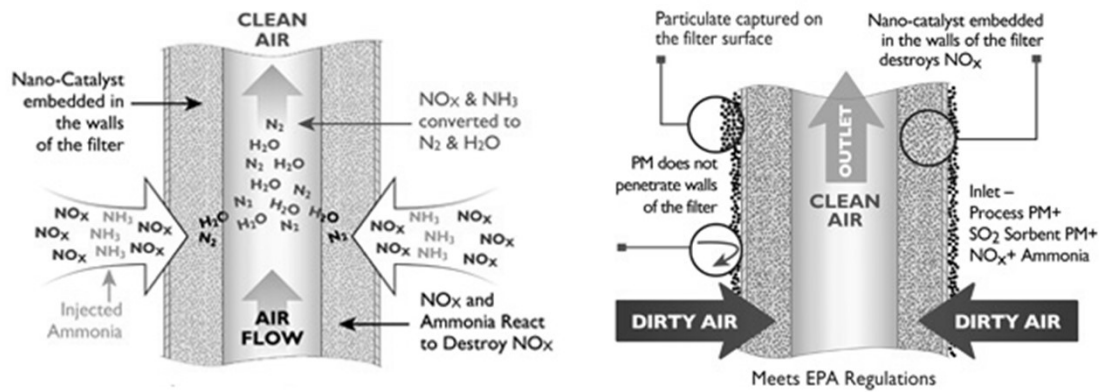
TRI-MER ULTRACAT CONTROL SYSTEM*



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*Image courtesy of Tri-Mer Corporation

CERAMIC FILTER CONTROL SYSTEM



*Image courtesy of Tri-Mer Corporation

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AREAS TO ADDRESS UNDER PAR 1117

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PAR 1117 – AREAS TO ADDRESS

- **Applicability of Rule 1117 to include sodium silicate manufacturing**
 - Rule 1117 – Emissions of Oxides of Nitrogen from Glass Melting Furnaces *and Sodium Silicate Manufacturing*
- **Continue assessment for Best Available Retrofit Control Technology (BARCT)**
 - Conduct separate BARCT assessments for glass melting and sodium silicate manufacturing
- **Consider establishing NO_x rule limits as concentrations (ppm @ 3% O₂)**
 - Current limits set as production level (lbs_{NO_x}/ton of glass pulled)
- **Consider limitations for start-up/shutdown operations**
- **Consider NO_x averaging periods**
- **Consider reducing current exemption level (furnaces producing <15 lbs_{NO_x}/hr)**

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NEXT STEPS

- Continue discussions with facilities and vendors
- Continue BARCT assessment
- Additional Working Group Meetings
- Public Workshop – September 2019 (tentative)
- Set Hearing – November 2019 (tentative)
- Public Hearing – December 2019 (tentative)

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