Proposed Rule (PR) 1147.2

NOx Reductions from Metal Processing Equipment

Working Group Meeting #4
February 26, 2020

Call-in Number / Passcode
1-866-705-2554 / 356426

Updated Presentation

Agenda

- Working Group Meeting #3
  - Summary
  - Comments from Stakeholders
- BARCT Analysis
  - Initial BARCT Emission Limits by Class and Category

Working Group Meeting #3

Summary of Working Group Meeting #3

- Process Temperatures, Furnace Types, and NOx Source Tests
- NOx Formation Pathways
- Continuation of BARCT Analysis
  - Technology Assessment
  - Establishing Proposed BARCT Emission Limit

Working Group Meeting #3: Comments from Stakeholders

Stakeholder Comment	Staff Response
BARCT determination needs to further separate categories beyond metal melting and metal heating	For this working group meeting, staff conducted BARCT analysis by furnace type and temperature to establish Initial NOx BARCT Emission Limits
Requested more information on ultra-low source test results	For this working group meeting, staff prepared a handout with additional information from all source tests with results ≤ 30 ppm @ 3% O_2

Working Group Meeting #3: Comments from Stakeholders *(cont.)*

Stakeholder Comment	Staff Response
Staff should obtain emission guarantees beyond vendors' product literature	Staff has been communicating with burner manufacturers and will continue to gather information
Requested staff perform a cumulative economic analysis for all South Coast AQMD metals industry rules over the past 5 years and add how PR 1174.2 will add to the overall economic impact	PR 1147.2 compliance schedule will take into account all South Coast AQMD rules that are affecting the same facilities

Working Group Meeting #3: Comments from Stakeholders *(cont.)*

Stakeholder Comment	Staff Response
Will facilities that recently replaced their burners to comply with Rule 1147 be required to replace their burners again?	▪ If a lower emission limit is proposed, staff will take into account burner age and stranded assets in the implementation approach ▪ Staff will consider various implementation approaches such as a replacement after 15 years ▪ BARCT analyses are conducted periodically and emission limits are updated accordingly

Working Group Meeting #3: Comments from Stakeholders *(cont.)*

Stakeholder Comment	Staff Response

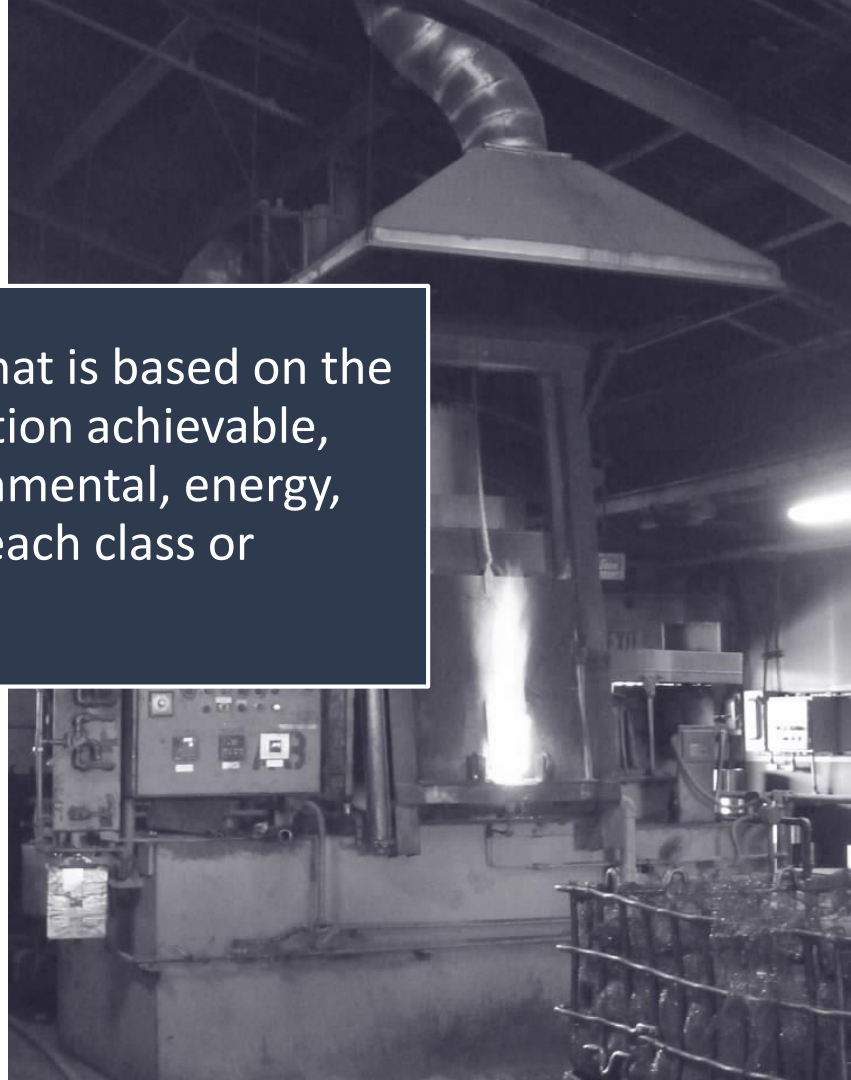
SCR may not be applicable to forging and heat treating operations	▪ Staff is evaluating the applicability of SCR
	▪ Considerations include
	  ▪ Technical feasibility
	  ▪ Evaluation of existing heat treating units using SCR
	  ▪ Issues that may be unique to the application of SCR for metal melting and heating furnaces
	  ▪ Cost-effectiveness

Initial BARCT Emission Limits

BARCT

California H&SC §40406 defines BARCT as:

"…an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source."



- Includes a technology assessment and cost-effectiveness analysis
- Applicable to equipment retrofits and replacement

Overview

- Staff presented Initial BARCT Emission Limits at Working Group Meeting #3 for two categories
  - Metal melting
  - Metal heating
- Stakeholders suggested to separate categories beyond metal melting and metal heating
- Today's Working Group Meeting will include Initial BARCT Emission Limits for more specific categories

Summary of NOx Concentrations for Pollution Control Technologies (Working Group Meeting #3)

Ultra-Low NOx Burners (ULNB) – 30 ppm

- One vendor has guaranteed 30 ppm NOx emission for a variety of temperatures
- One vendor has literature stating ability to meet 30 ppm within certain operating parameters
- These vendors represent at least 60% of the burners currently used

Selective Catalytic Reduction (SCR) – 15 ppm

- Working Group Meeting #3 determined NOx concentration of 11 ppm for furnaces with SCR
- Revising NOx concentration to 15 ppm based on emissions data from metal re-heat furnace with SCR

Approach for Establishing the Initial BARCT Emission Limit

- Proposed Initial BARCT Emission Limit will be the lowest NOx concentration based on the BARCT technology assessment
- All NOx concentrations are reported as corrected to 3% O_2 on a dry basis

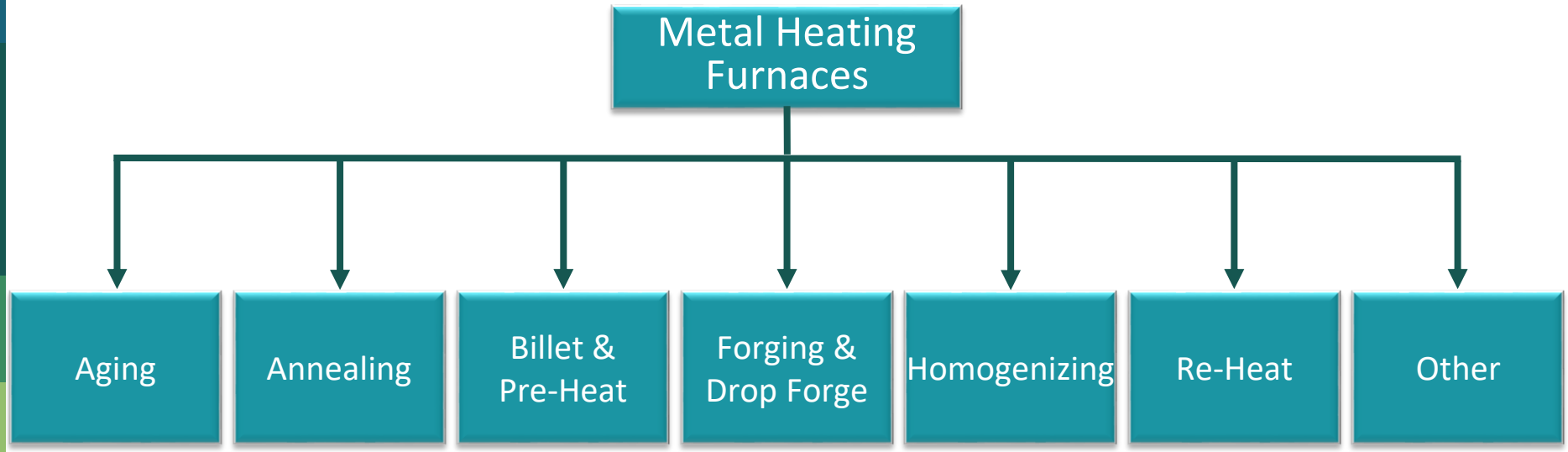
Process Temperature

- For both metal melting and metal heating furnaces, identified low and high process temperatures during Working Group Meeting #3
  - Units with no temperature data were assigned to the low or high temperature group based upon the majority of units in that category

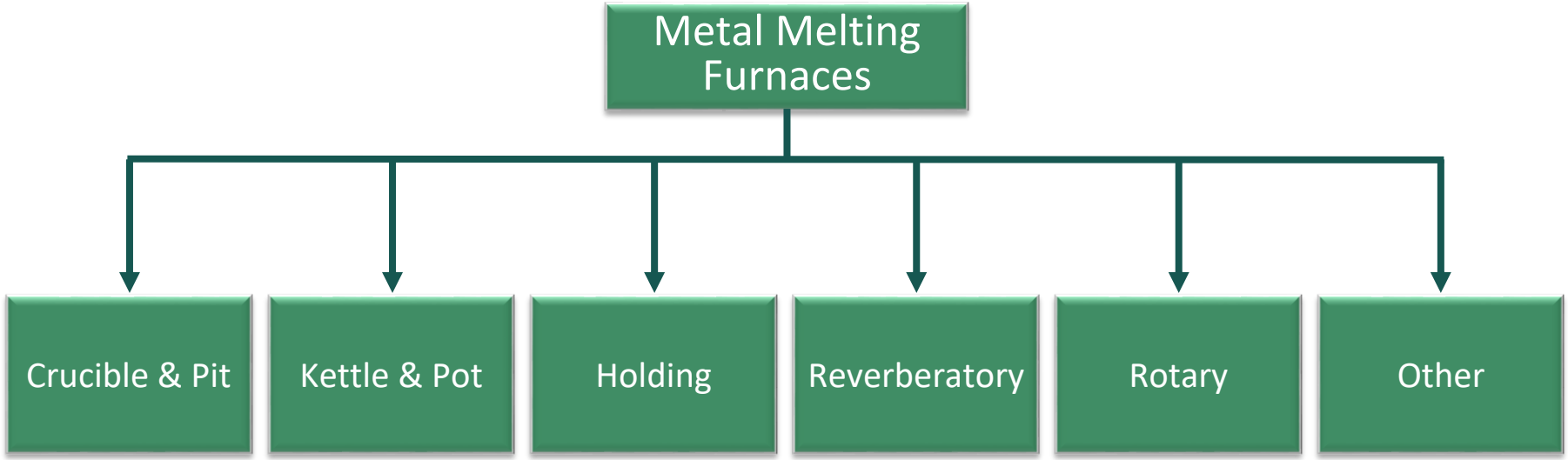
Metal Melting Furnaces	Metal Heating Furnaces
Low Temperature ≤ 1,230 °F	Low Temperature ≤ 1,500 °F
High Temperature > 1,230 °F	High Temperature > 1,500 °F

Note: Rule 1147 uses 1,200 °F to establish low and high temperature cutoffs for both metal melting and metal heating furnaces

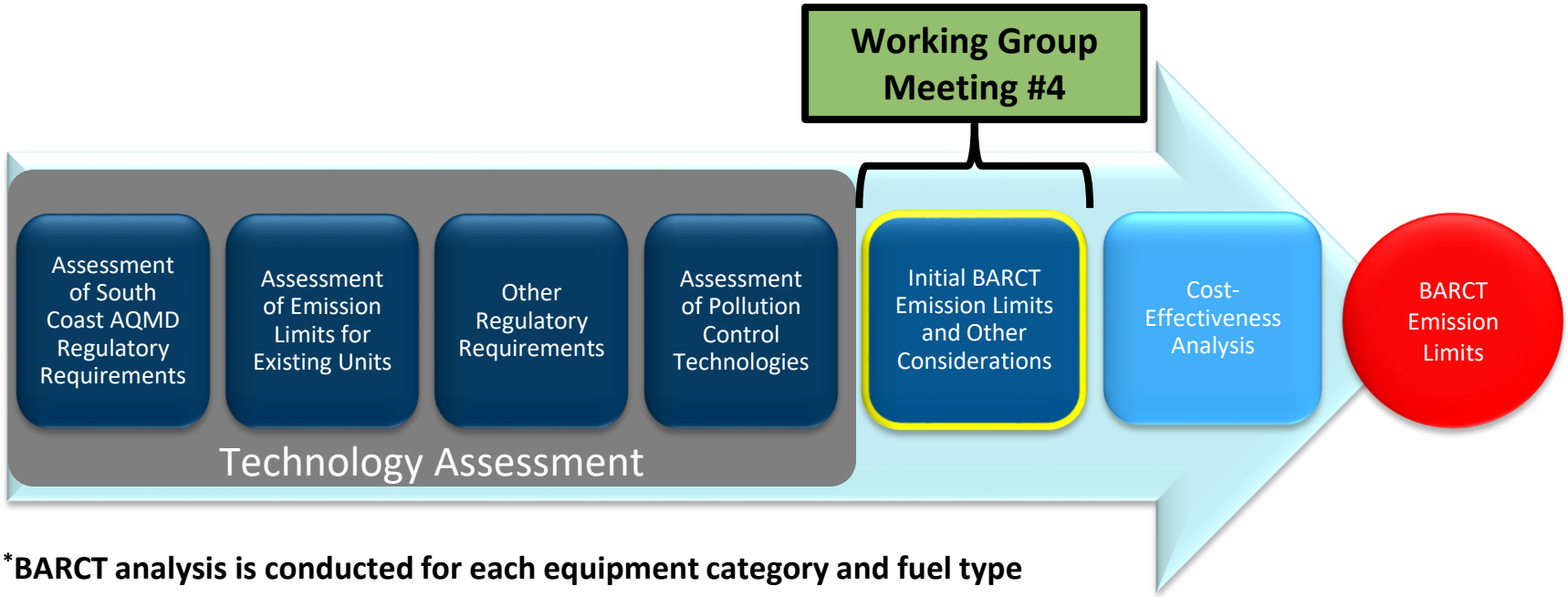
Metal Heating Furnace Categories



Metal Melting Furnace Categories



BARCT Analysis

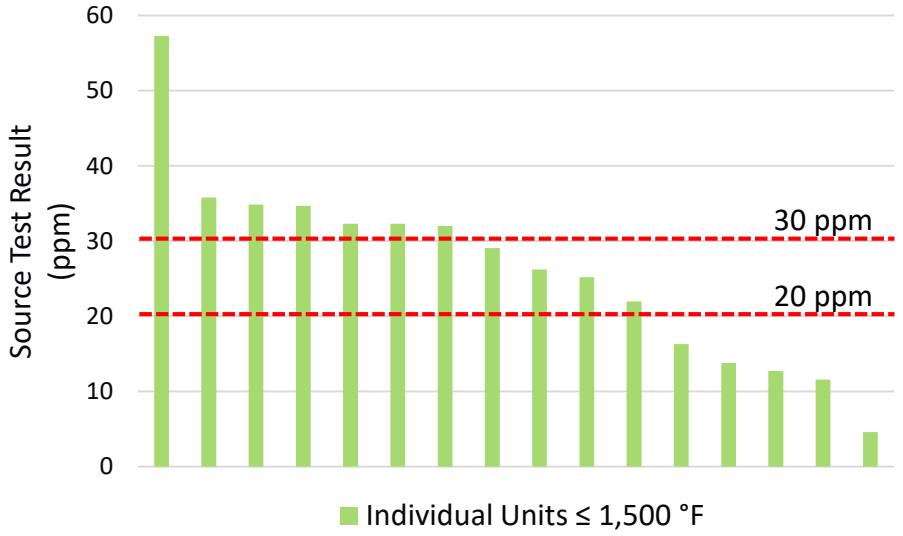


*BARCT analysis is conducted for each equipment category and fuel type

Metal Heating Furnaces

Aging Furnaces – Source Test Data

- Aging furnaces
  - Total units: 26
  - Units with source tests: 16
- ≤ 1,500 °F
  - Total units: 26
  - Units with source tests
    - 16 units: 5 – 57 ppm
    - 5 units: ≤ 20 ppm
  - 1 unit permitted at 30 ppm with no source test
- > 1,500 °F
  - No high temperature units



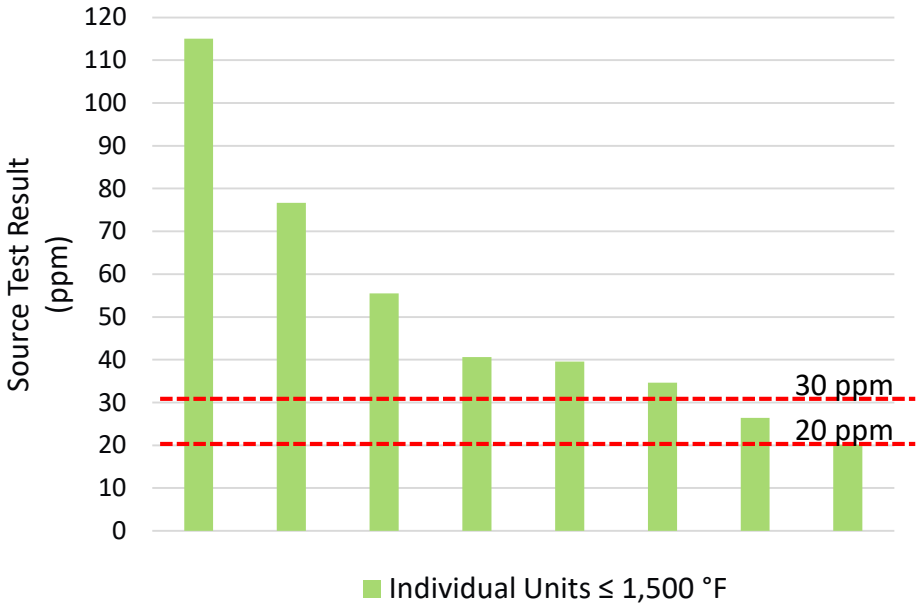
Aging Furnaces – Initial BARCT Emission Limit

Aging

Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,500 °F (26 units)	60 ppm	5 – 57 ppm (5 units ≤ 20 ppm)	60 ppm	30 ppm (via ULNB)	20 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Annealing Furnaces – Source Test Data

- Annealing furnaces
  - Total units: 31
  - Units with source tests: 8
- ≤ 1,500 °F
  - Total units: 27
  - Units with source tests
    - 8 units: 20.1 – 115 ppm
    - 2 units : ≤ 30 ppm
- > 1,500 °F
  - Total units: 4
  - Units with source tests
    - 0 units



Annealing Furnaces – Initial BARCT Emission Limit

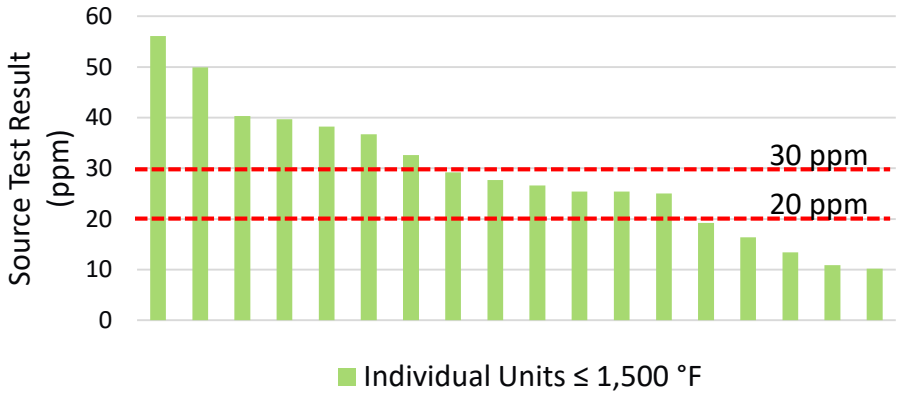
Annealing

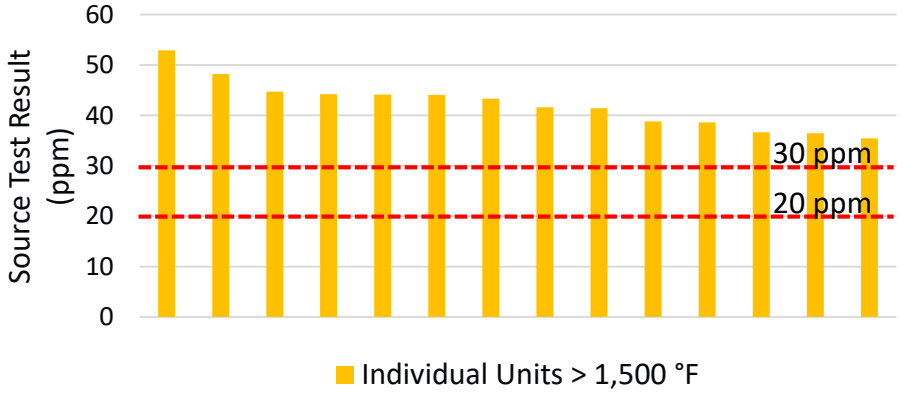
Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,500 °F (27 units)	60 ppm	20.1 – 115 ppm (2 units ≤ 30 ppm)	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	
> 1,500 °F (4 units)	60 ppm	0 source tests	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Billet and Pre-Heat Furnaces – Source Test Data

Billet & Pre-Heat

- Billet and pre-heat furnaces
  - Total units: 57
  - Units with source tests: 32
- ≤ 1,500 °F
  - Total units: 39
  - Units with source tests
    - 18 units: 10 – 56 ppm
    - 5 units: ≤ 20 ppm
  - 9 units permitted at 30 ppm with no source test
- > 1,500 °F
  - Total units: 18
  - Units with source tests
    - 14 units: 35 – 53 ppm





Billet and Pre-Heat Furnaces – Initial BARCT Emission Limit

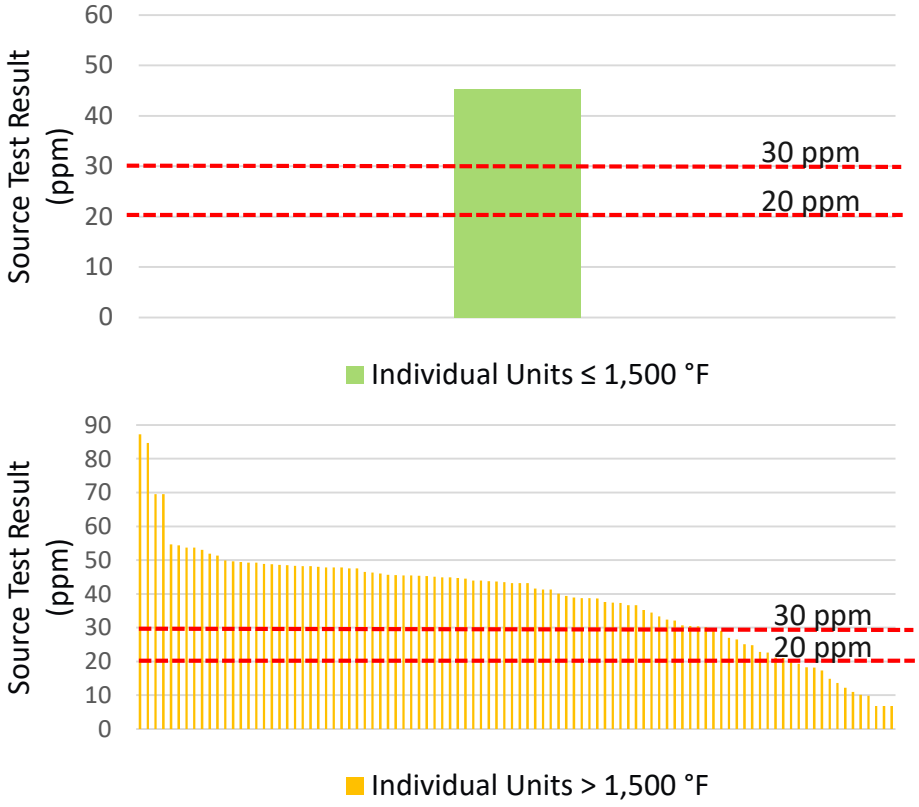
Billet & Pre-Heat

Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,500 °F (39 units)	60 ppm	10 – 56 ppm (5 units ≤ 20 ppm)	60 ppm	30 ppm (via ULNB)	20 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	
> 1,500 °F (18 units)	60 ppm	35 – 53 ppm	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Forging and Drop Forge Furnaces – Source Test Data

Forging & Drop Forge

- Forging and drop forge furnaces
  - Total units: 170
  - Units with source tests: 99
- ≤ 1,500 °F
  - Total units: 3
  - Units with source tests
    - 1 unit: 45 ppm
- > 1,500 °F
  - Total units: 167
  - Units with source tests:
    - 98 units: 7 – 87 ppm
    - 13 units: ≤ 20 ppm



Forging and Drop Forge Furnaces – Initial BARCT Emission Limit

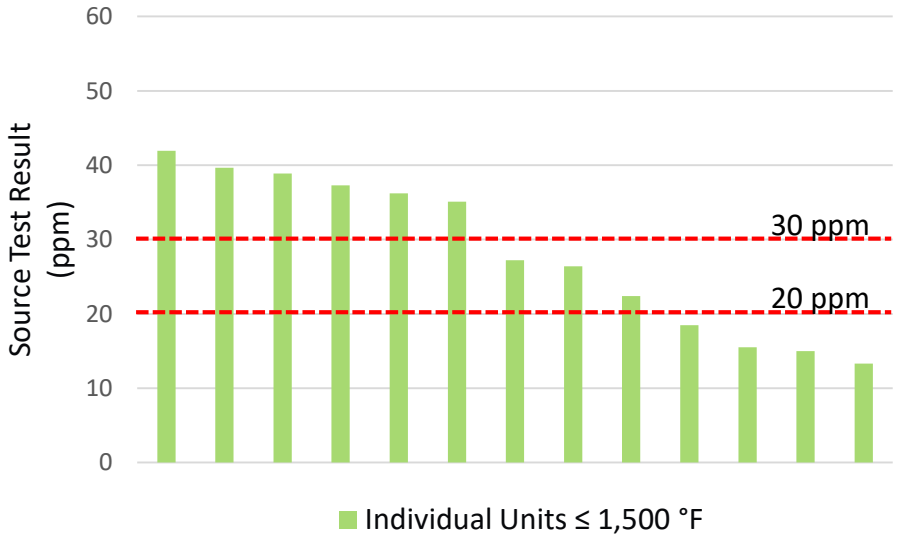
Forging & Drop Forge

Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,500 °F (3 units)	60 ppm	45 ppm	60 ppm	30 ppm (via ULNB)	20 ppm* (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	
> 1,500 °F (167 units)	60 ppm	7 – 87 ppm (13 units ≤ 20 ppm)	60 ppm	20 ppm (via ULNB)	20 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

* Recommending 20 ppm since 20 ppm can be achieved for higher temperature units

Homogenizing Furnaces – Source Test Data

- Homogenizing furnaces
  - Total units: 14
  - Units with source tests: 13
- ≤ 1,500 °F
  - Total units: 14
  - Units with source tests
    - 13 units: 13 – 42 ppm
    - 4 units: ≤ 20 ppm
- > 1,500 °F
  - No high temperature units



Homogenizing Furnaces – Initial BARCT Emission Limit

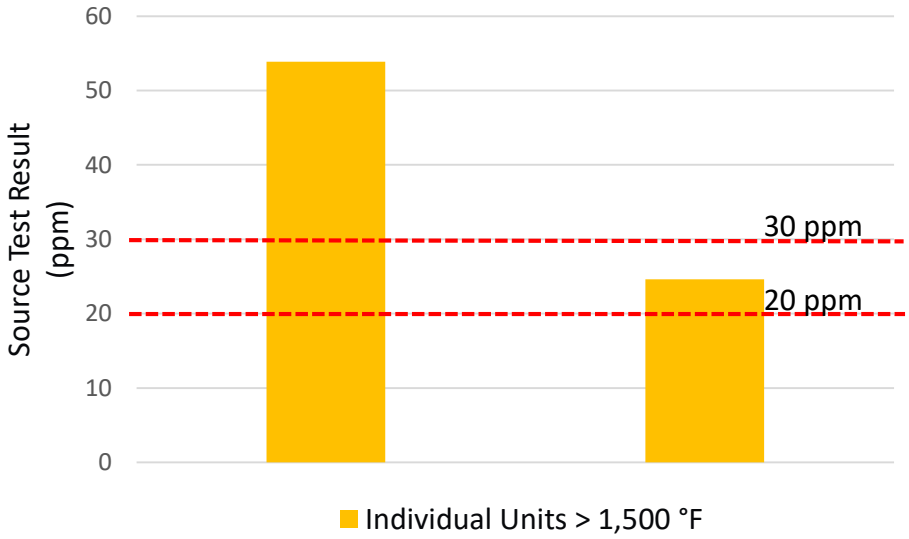
Homogenizing

Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,500 °F (14 units)	60 ppm	13 – 42 ppm (4 units ≤ 20 ppm)	60 ppm	30 ppm (via ULNB)	20 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Re-Heat Furnaces – Source Test Data

Re-Heat

- Re-heat furnaces
  - Total units: 3
  - Units with source tests: 2
- ≤ 1,500 °F
  - No low temperature units
- > 1,500 °F
  - Total units: 3
  - Units with source tests
    - 2 units: 25 – 54 ppm
    - 1 unit: ≤ 30 ppm



Re-Heat Furnaces – Initial BARCT Emission Limit

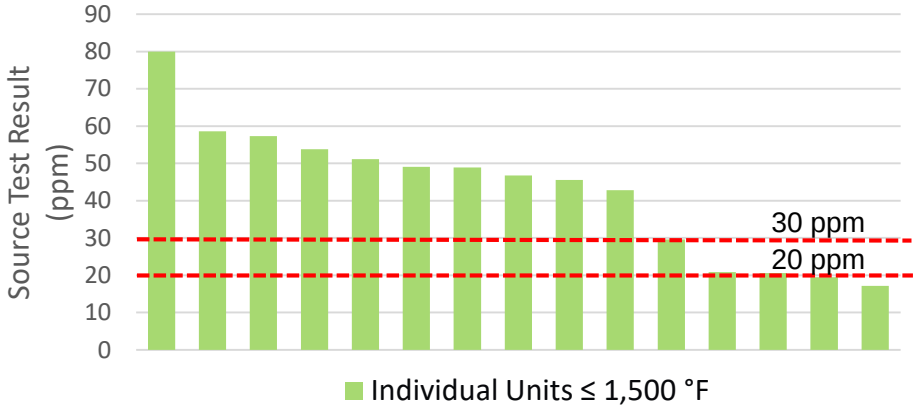
Re-Heat

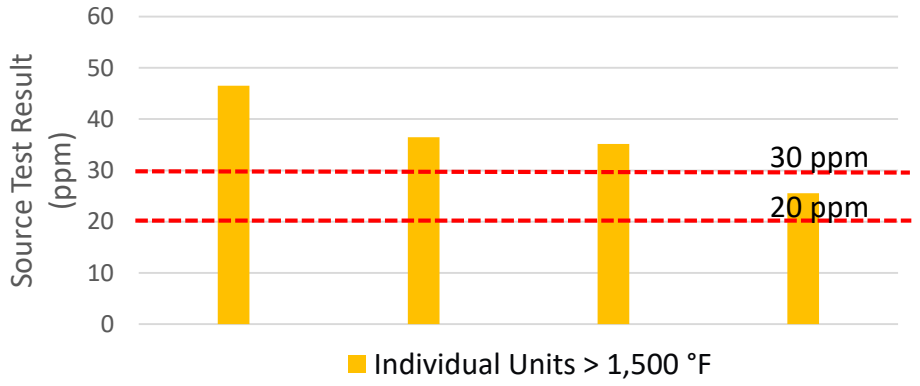
Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
> 1,500 °F (3 units)	60 ppm	25 – 54 ppm (1 unit ≤ 30 ppm)	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Other Furnaces – Source Test Data

Other

- Other furnaces
  - Total units: 88
  - Units with source tests: 19
- ≤ 1,500 °F
  - Total units: 55
  - Units with source tests
    - 15 units: 17 – 80 ppm
    - 2 units: ≤ 20 ppm
- > 1,500 °F
  - Total units: 33
  - Units with source tests
    - 4 units: 26 – 47 ppm
    - 1 unit: ≤ 30 ppm





Other Furnaces – Initial BARCT Emission Limit

Other

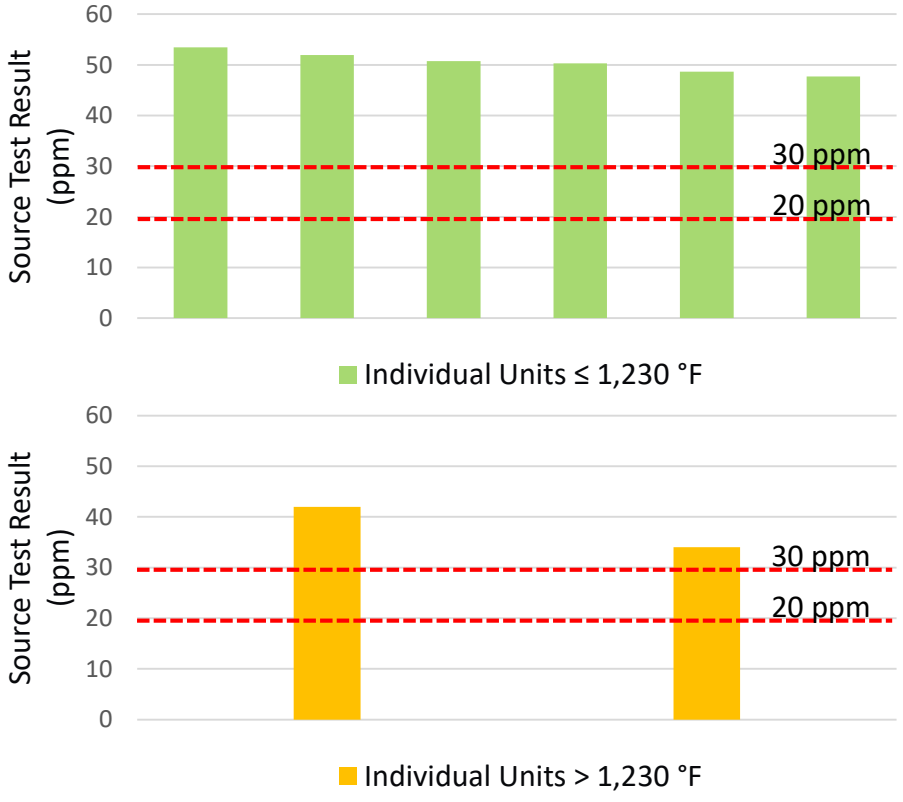
Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,500 °F (55 units)	60 ppm	17 – 80 ppm (2 units ≤ 20 ppm)	60 ppm	30 ppm (via ULNB)	20 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	
>1,500 °F (33 units)	60 ppm	26 – 47 ppm (1 unit ≤ 30 ppm)	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Metal Melting Furnaces

Crucible and Pit Furnaces – Source Test Data

Crucible & Pit

- Crucible and pit furnaces
  - Total units: 36
  - Units with source tests: 8
- ≤ 1,230 °F
  - Total units: 29
  - Units with source tests
    - 6 units: 48 – 53 ppm
- > 1,230 °F
  - Total units: 7
  - Units with source tests
    - 2 units: 34 – 42 ppm



Crucible and Pit Furnaces – Initial BARCT Emission Limit

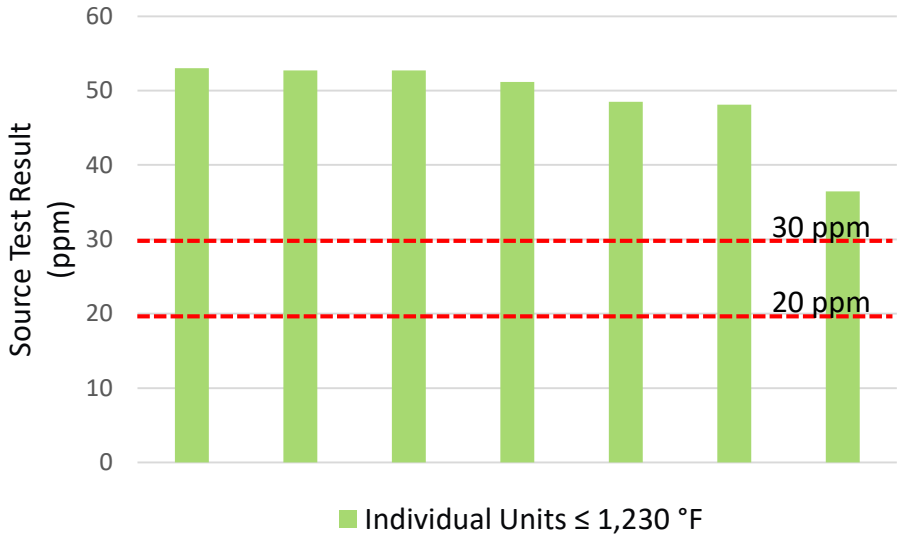
Crucible & Pit

Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,230 °F (29 units)	60 ppm	48 – 53 ppm	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on initial BARCT emission limit
				15 ppm (via SCR)	15 ppm (via SCR)	
> 1,230 °F (7 units)	60 ppm	34 – 42 ppm	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on initial BARCT emission limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Kettle and Pot Furnaces – Source Test Data

Kettle & Pot

- Kettle and pot furnaces
  - Total units: 88
  - Units with source tests: 7
- ≤ 1,230 °F
  - Total Units: 88
  - Units with source tests
    - 7 units: 36 – 53 ppm
  - 1 unit permitted at 30 ppm with no source test
- > 1,230 °F
  - No high temperature units



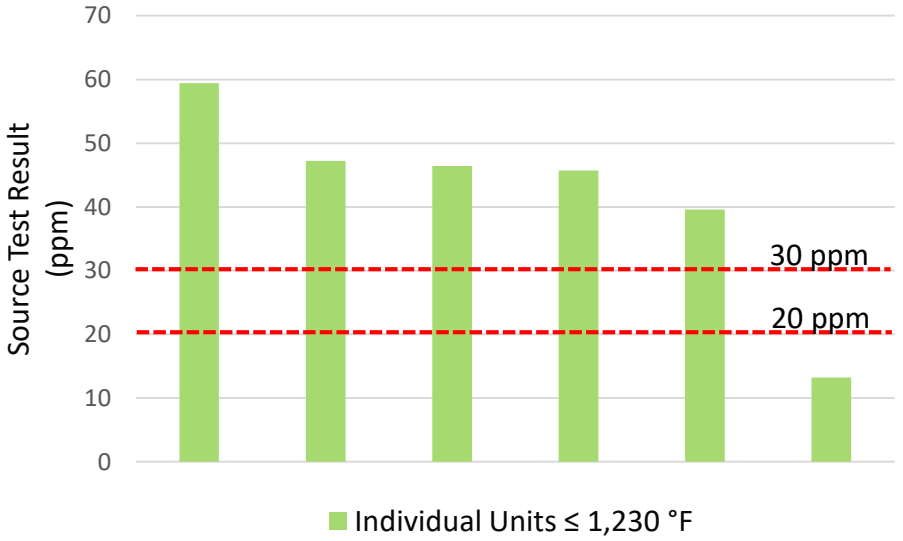
Kettle and Pot Furnaces – Initial BARCT Emission Limit

Kettle & Pot

Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,230 °F (88 units)	60 ppm	36 – 53 ppm	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Holding Furnaces – Source Test Data

- Holding furnaces
  - Total units: 10
  - Units with source tests: 6
- ≤ 1,230 °F
  - Total units: 10
  - Units with source tests
    - 6 units: 13 – 59 ppm
- > 1,230 °F
  - No high temperature units



Holding Furnaces – Initial BARCT Emission Limit

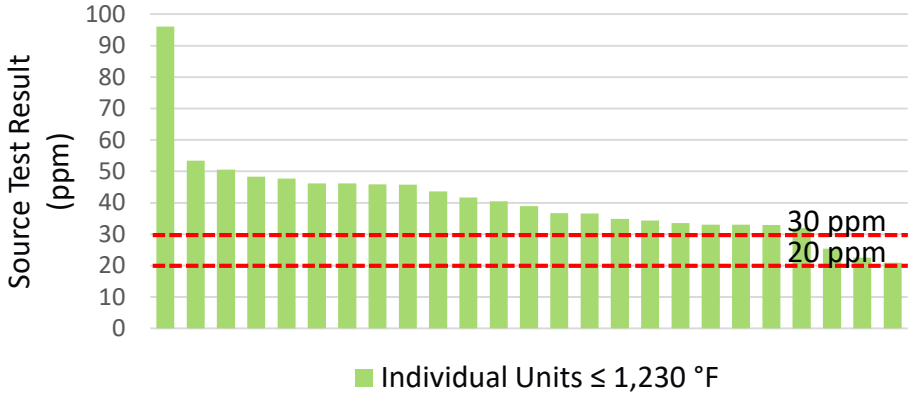
Holding

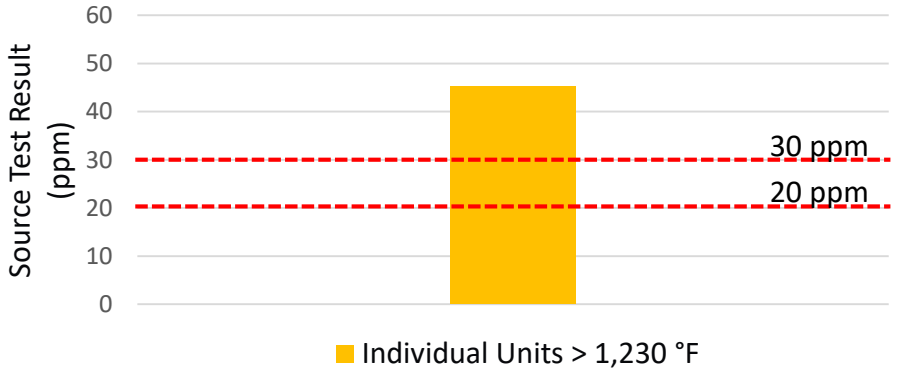
Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,230 °F (10 units)	60 ppm	13 – 59 ppm (1 unit ≤ 20 ppm)	60 ppm	30 ppm (via ULNB)	20-30 ppm* (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

* Staff is looking at data for source tested units

Reverberatory Furnaces – Source Test Data

- Reverberatory furnaces
  - Total units: 54
  - Units with source tests: 25
- ≤ 1,230 °F
  - Total units: 50
  - Units with source tests
    - 25 units: 21 – 96 ppm
    - 3 unit: ≤ 30 ppm
- > 1,230 °F
  - Total units: 4
  - Units with source tests
    - 1 unit: 45 ppm





Reverberatory Furnaces – Initial BARCT Emission Limit

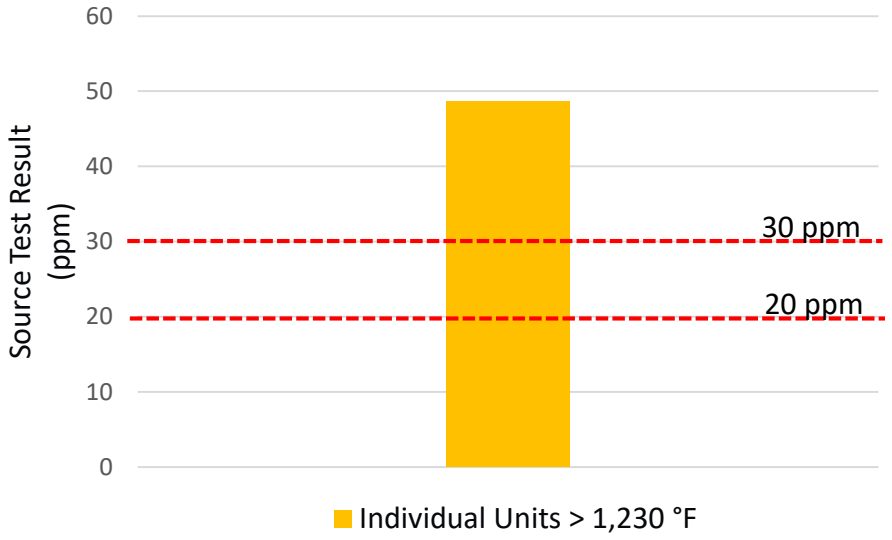
Reverberatory

Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,230 °F (50 units)	60 ppm	21 – 96 ppm (3 units ≤ 30 ppm)	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	
> 1,230 °F (4 units)	60 ppm	45 ppm	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Rotary Furnaces – Source Test Data

Rotary

- Rotary furnaces
  - Total units: 4
  - Units with source tests: 1
- ≤ 1,230 °F
  - No low temperature units
- > 1,230 °F
  - Total units: 4
  - Units with source tests
    - 1 unit: 49 ppm



Rotary Furnaces – Initial BARCT Emission Limit

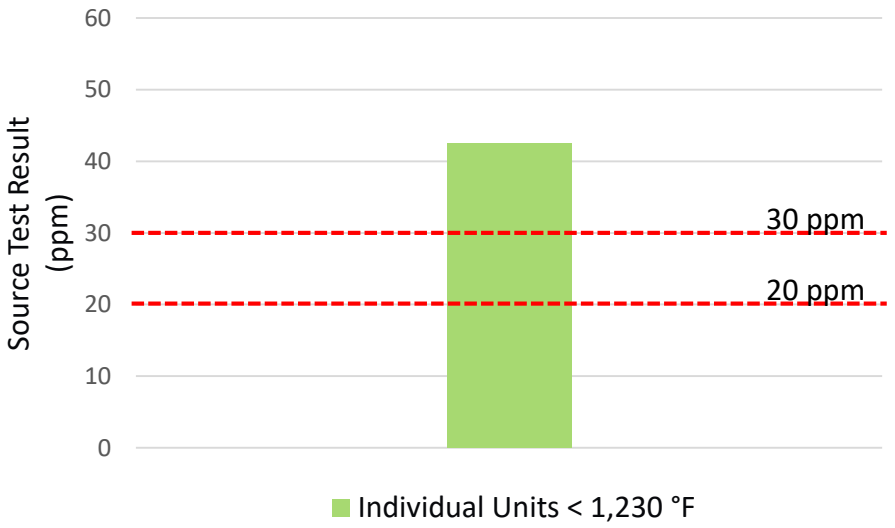
Rotary

Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
> 1,230 °F (4 units)	60 ppm	49 ppm	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Other Furnaces – Source Test Data

Other

- Other furnaces
  - Total units: 11
  - Units with source tests: 1
- ≤ 1,230 °F
  - Total units: 11
  - Units with source tests
    - 1 unit: 43 ppm
- > 1,230 °F
  - No high temperature units



Other Furnaces – Initial BARCT Emission Limit

Other

Temp.	South Coast AQMD Regulatory Requirements	Existing Units (Source Testing)	Other Regulatory Requirements	Assessment of Pollution Controls	Initial BARCT Emission Limit	Proposed BARCT Emission Limit
≤ 1,230 °F (11 units)	60 ppm	43 ppm	60 ppm	30 ppm (via ULNB)	30 ppm (via ULNB)	Need to conduct cost-effectiveness on Initial BARCT NOx limit
				15 ppm (via SCR)	15 ppm (via SCR)	

Initial BARCT Emission Limit Summary for Metal Heating Furnaces

Temp.	Aging	Annealing	Billet & Pre-Heat	Forging & Drop Forge	Homog-enizing	Re-Heat	Other
≤ 1,500 °F	20 ppm (via UNLB)	30 ppm (via UNLB)	20 ppm (via UNLB)	20 ppm (via UNLB)	20 ppm (via UNLB)	No Units	20 ppm (via UNLB)
	15 ppm (via SCR)	15 ppm (via SCR)	15 ppm (via SCR)	15 ppm (via SCR)	15 ppm (via SCR)	No Units	15 ppm (via SCR)
> 1,500 °F	No Units	30 ppm (via UNLB)	30 ppm (via UNLB)	20 ppm (via UNLB)	No Units	30 ppm (via UNLB)	30 ppm (via UNLB)
	No Units	15 ppm (via SCR)	15 ppm (via SCR)	15 ppm (via SCR)	No Units	15 ppm (via SCR)	15 ppm (via SCR)

Initial BARCT Emission Limit Summary for Metal Melting Furnaces

Temp.	Crucible & Pit	Kettle & Pot	Holding	Reverb-eratory	Rotary	Other
≤ 1,230 °F	30 ppm (via UNLB)	30 ppm (via UNLB)	20-30 ppm (via UNLB)	30 ppm (via UNLB)	No Units	30 ppm (via UNLB)
	15 ppm (via SCR)	15 ppm (via SCR)	15 ppm (via SCR)	15 ppm (via SCR)	No Units	15 ppm (via SCR)
> 1,230 °F	30 ppm (via UNLB)	No Units	No Units	30 ppm (via UNLB)	30 ppm (via UNLB)	No Units
	15 ppm (via SCR)	No Units	No Units	15 ppm (via SCR)	15 ppm (via SCR)	No Units

Next Steps

Rule Development Activity	Tentative Schedule
Next Working Group Meeting	March 2019
Public Workshop	May 2020
Set Hearing	June 2020
Public Hearing	August 2020

Contacts

PR 1147.2	PAR 1147	RECLAIM Questions	General Questions
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