



# **Proposed Rule 1407.1**

## **Control of Emissions of Toxic Air Contaminants from Chromium Alloy Melting Operations**

**Working Group Meeting #8**  
**April 8, 2020**

**Join Zoom Meeting**  
<https://scaqmd.zoom.us/j/4285162364>  
Meeting ID: 428 516 2364

**Teleconference Dial-In**  
1-669-900-6833

# Background

- Currently no source specific rule to address emissions from chromium alloys such as stainless steel, alloy steel, and superalloys
  - Chromium alloys contain toxic air contaminants which have the potential to be emitted during metal melting
  - Melting of metals containing chromium can generate hexavalent chromium
- Staff initiated rulemaking for Proposed Rule 1407.1 to address chromium alloys in metal melting operations; however, additional emissions data was needed
- In 2018, the California Metals Coalition identified three facilities that volunteered to conduct source testing
- Source testing has been completed – staff will discuss the results and is re-initiating rulemaking for Proposed Rule 1407.1

# Regulatory History of Proposed Rule (PR) 1407.1

## November 2015 – Proposed Amended Rule (PAR) 1407 Rule Development

- Initiated rule development to expand the applicability to address chromium and non-chromium metal melting operations

## April 2018 – Bifurcated Rulemaking

- PAR 1407 – Address non-chromium metal melting
- PR 1407.1 – Address chromium metal melting

## April 2018 to December 2018 – PR 1407.1 Rule Development

- Additional emissions data needed for chromium metal melting operations

## December 2018 – PR 1407.1 Source Testing

- California Metals Coalition identified three facilities that would volunteer to conduct source testing

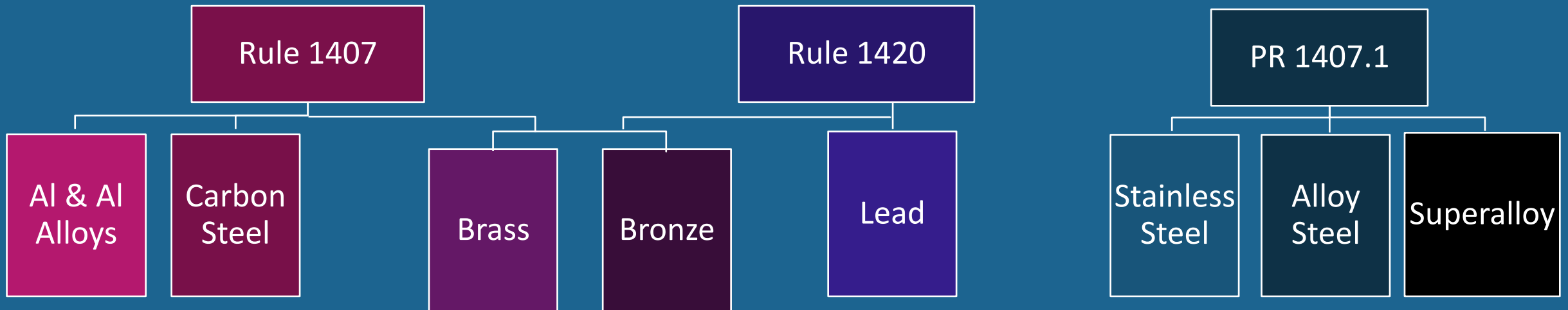
## February 2020 – Re-Initiated PR 1407.1 Rulemaking

- Source testing completed and re-initiated rulemaking

# South Coast AQMD Metal Melting Rules

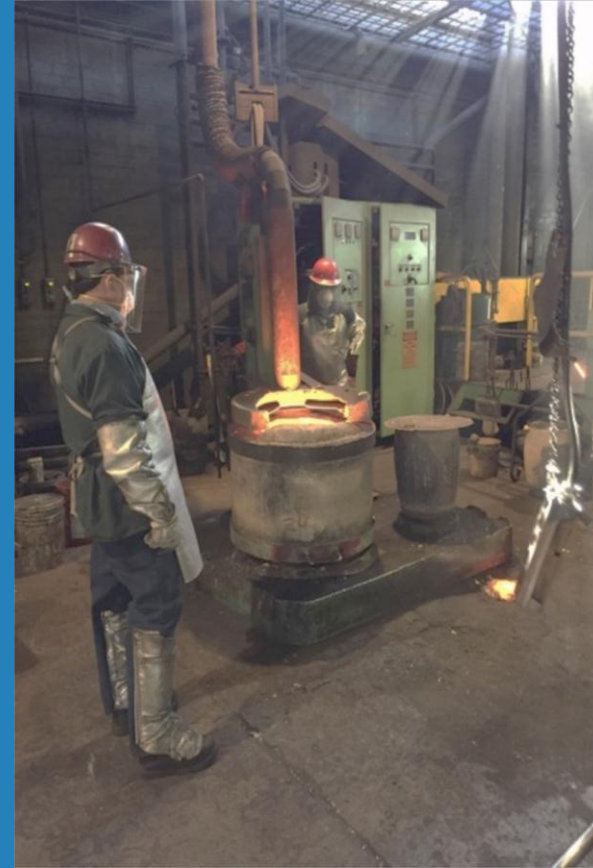
- Existing toxics rules for metal melting address variety of toxic air contaminants
  - Rule 1407: Arsenic, Cadmium, and Nickel
  - Rule 1420: Lead
- PR 1407.1 will fill a regulatory gap and address hexavalent chromium and metal melting of chromium alloys

## Alloys Addressed Under Different Metal Melting Rules



# Agenda

- Rule Development Process
- Source Testing Results
- General Approach



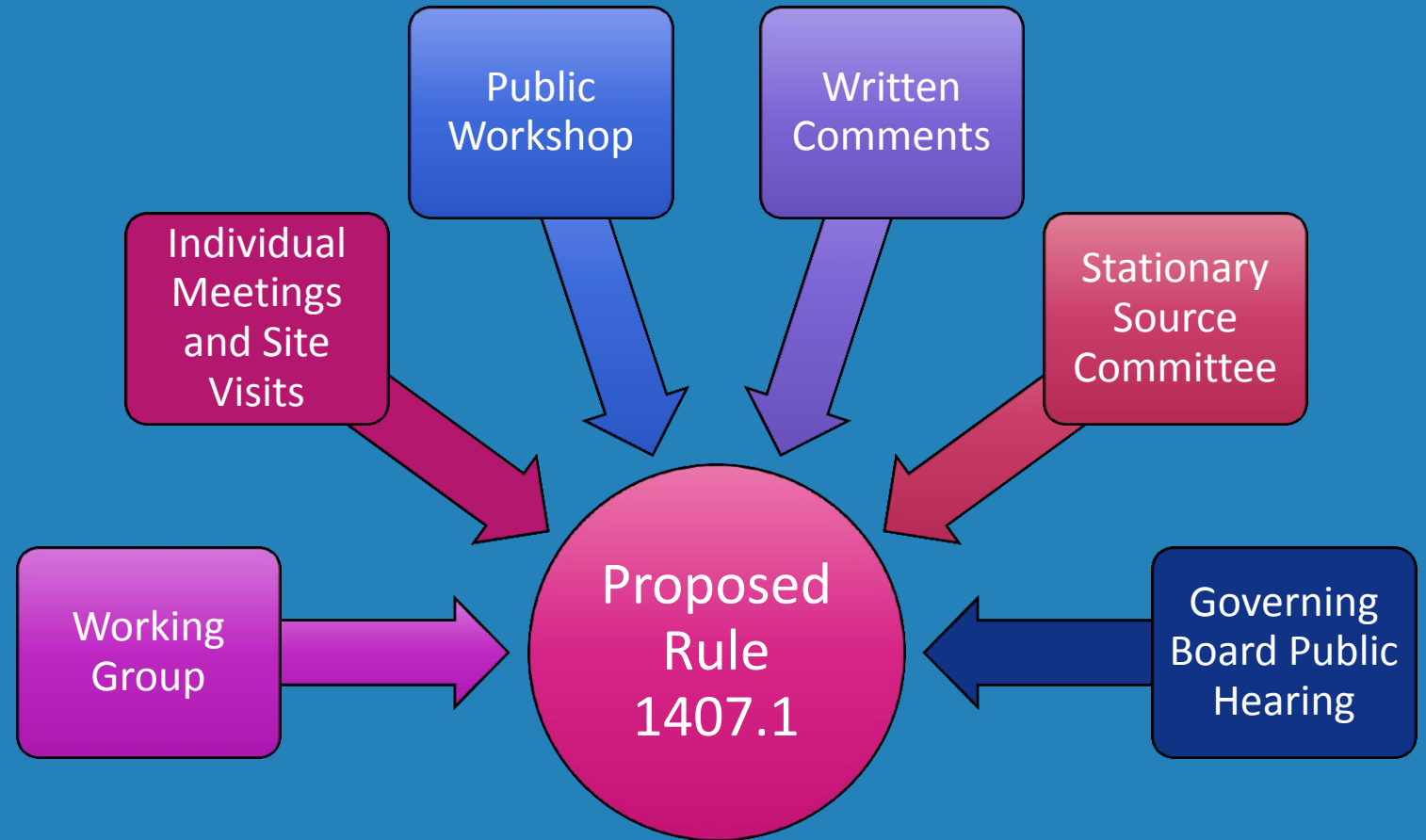
# Rule Development Process

# Overview of Rule Development Process



# Stakeholder Input

- Early input is strongly encouraged to help develop proposed rule and to address issues
- Working Group Meetings, Individual Meetings, and Site Visits allow stakeholders to dialogue directly with staff and discuss individual issues





# Source Testing Results

# Source Testing Agreement

- At November 2018 Governing Board Meeting, the California Metals Coalition presented an approach for source testing
  - Board directed staff to work with industry to finalize source testing approach
- December 2018, staff presented proposal to Stationary Source Committee
  - Three volunteer facilities, that would remain anonymous
  - Third-party consultant to conduct source testing; funded by South Coast AQMD
  - Results would be used to inform rule development
- Staff prepared a Request for Proposal (RFP) for third-party source testing company to conduct source testing
  - Staff selected third-party company and executed contract
  - Source test protocol developed by South Coast AQMD
  - Source testing began January 2019

# Overview of Source Testing

## Purpose

- Quantify toxic air contaminant emissions from chromium alloy melting
- Assess effectiveness of existing pollution control devices

## Approach

- Source test chromium alloy melting furnace and associated control device
  - Conduct source test at three facilities
  - Facilities would be anonymous

## Source Test Plan

- Quantify inlet and outlet emissions for particulate matter (PM), total chromium (Cr), hexavalent chromium (Cr<sup>6+</sup>), arsenic (As), cadmium (Cd), and nickel (Ni)

# Overview of Source Testing Facilities

## Facility A

- One furnace tested
- Alloy melted: 316 Stainless Steel
- Multiple furnaces vented to pollution control
  - Source tests included Test Furnace and other furnaces vented to pollution controls

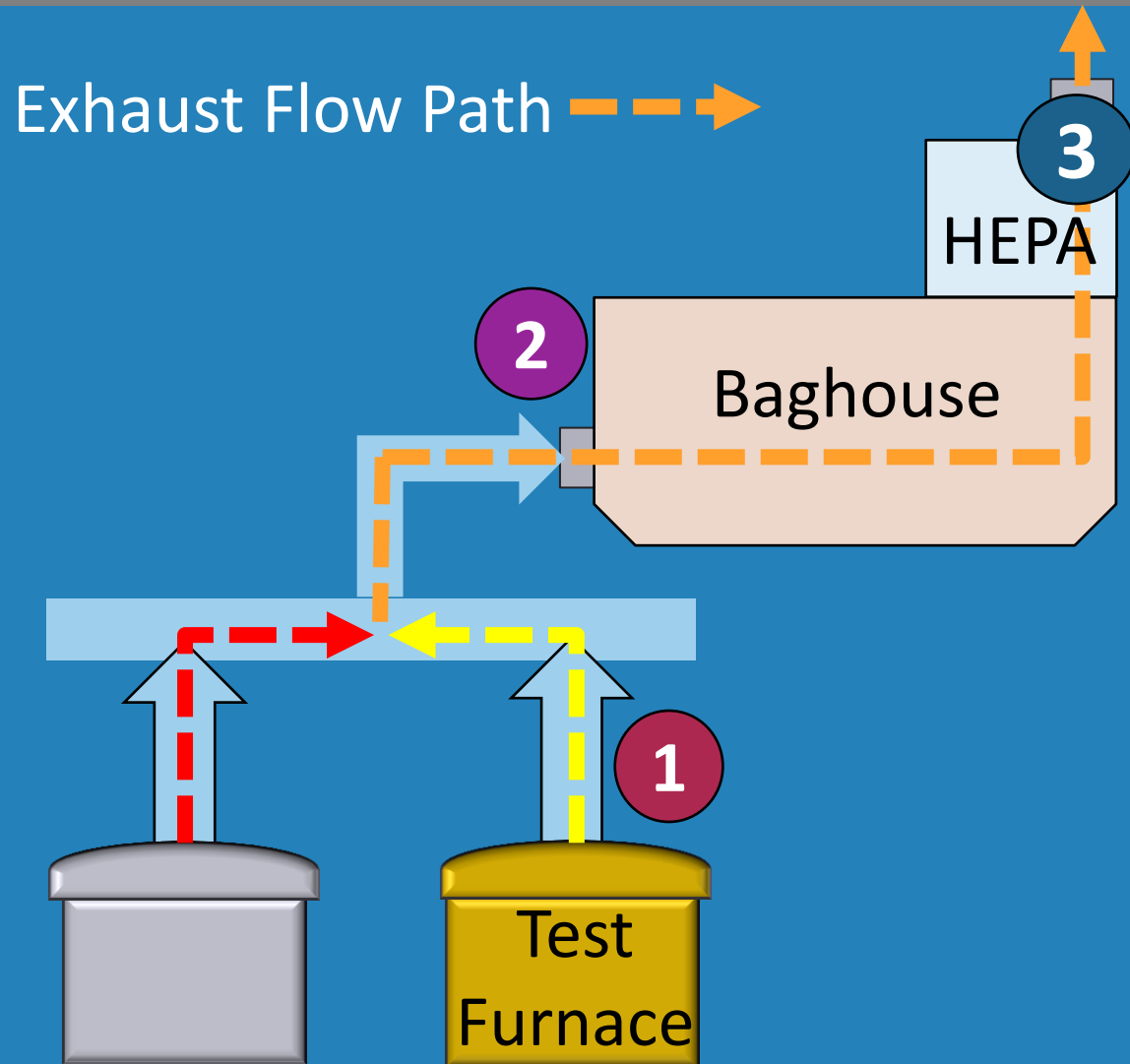
## Facility B

- Went out of business after volunteering for testing
- No source testing conducted

## Facility C

- One furnace tested
- Alloy melted: 25CH
- Multiple furnaces vented to pollution control
  - Source tests included Test Furnace and other furnaces vented to pollution controls

# Sampling Locations



- 1** Furnace Exhaust:  
Exhaust duct solely venting Test Furnace
- 2** Combined Inlet:  
Exhaust duct venting all facility furnaces, at the inlet of the baghouse with HEPA filter
- 3** Outlet:  
Exhaust stack at the outlet of the baghouse with HEPA filter

# Test Methods

South Coast AQMD  
Method 5.1

Total Particulate  
Matter

CARB  
Method 425

Total  
Chromium

Hexavalent  
Chromium

CARB  
Method 436

Arsenic

Cadmium

Nickel



\*

South Coast AQMD Methods 1 – 4  
EPA Method 5D

Flow Rates



\*

\*Photos not taken at any of the PR 1407.1 source tested facilities

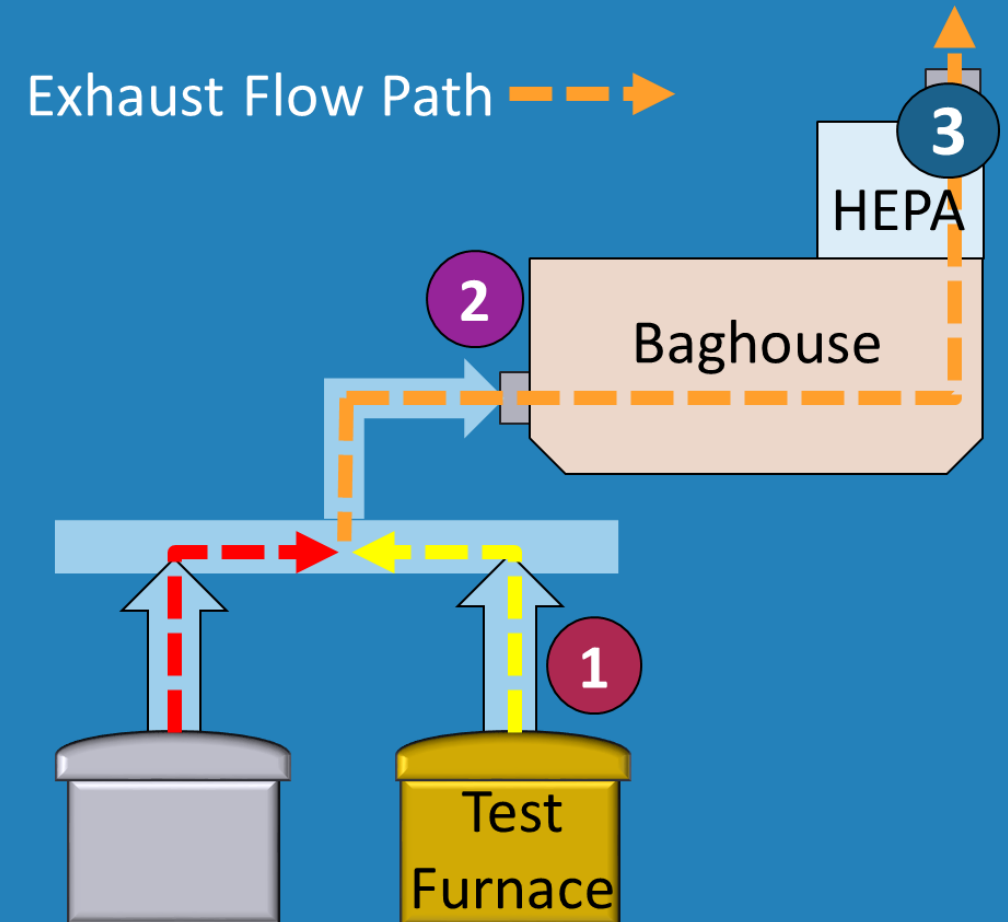
# Overview of Source Testing Results

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- Source test results presented for:
  - Sampling of chromium (Cr), hexavalent chromium (Cr<sup>6+</sup>), arsenic (As), cadmium (Cd), and nickel (Ni)
    - Three 2-hour test runs at each sampling location during metal melting
    - Emissions in pounds/hour (lb/hr)
  - Sampling of total particulate matter (PM)
    - One 2-hour test run at each sampling location during metal melting
    - Emissions in pounds/hour (lb/hr)
  - Capture and collection efficiency testing of emission capture system
- Source test results at both facilities show:
  - Formation of hexavalent chromium during metal melting process
  - Reduction of toxic air contaminants at the outlet of the baghouse with HEPA filter

# Caveats of Source Test Results

- Study design for test run was two hours
  - test runs are typically longer
  - Some non-detect results could have a detectable result with longer test run
- For both facilities, inlet to baghouse combines multiple furnaces
  - Emissions at “**1** Furnace Exhaust” capture the emissions from Test Furnace
  - Emissions at “**2** Combined Inlet” and “**3** Outlet” capture emissions from other furnaces operating in parallel with Test Furnace

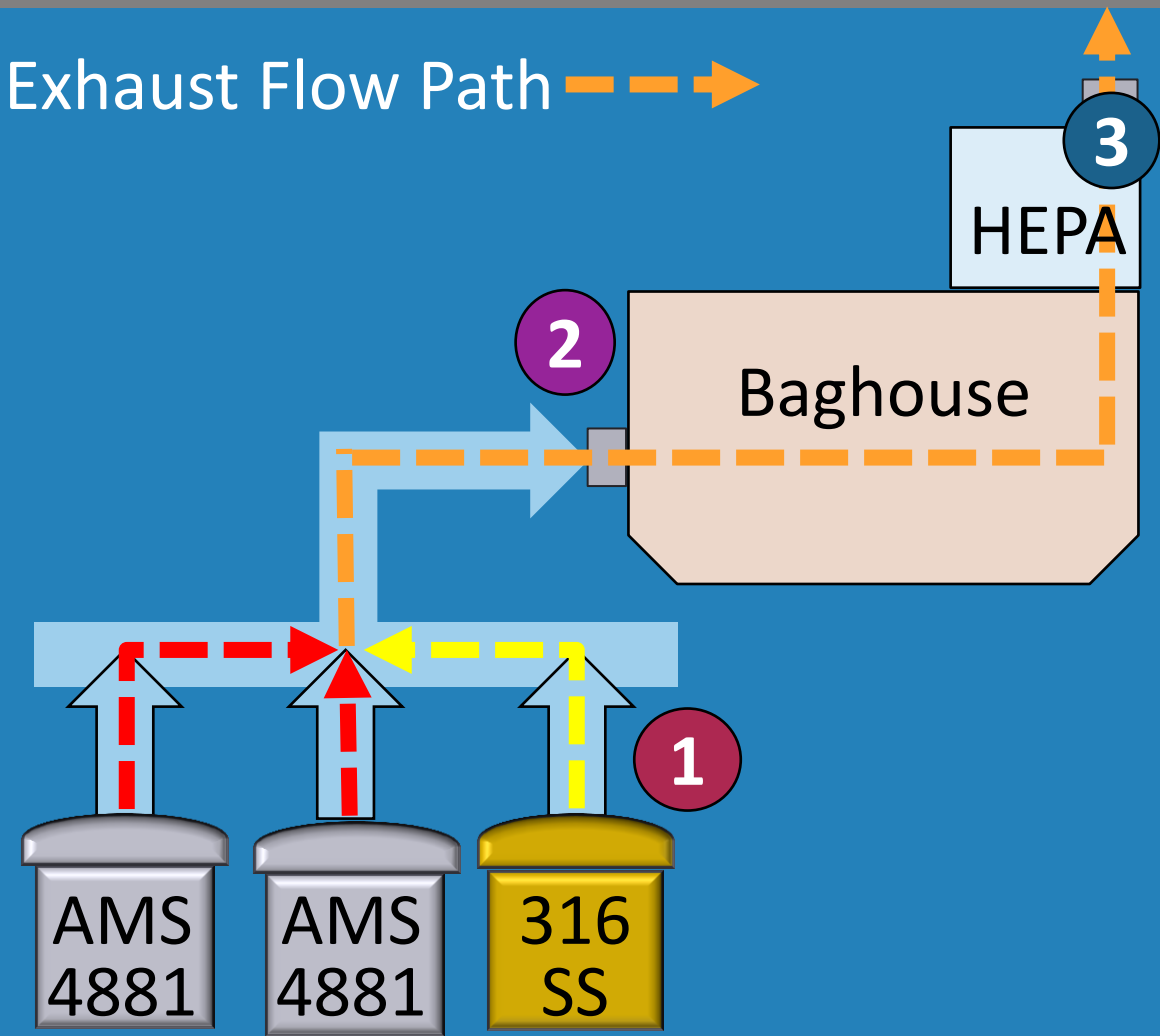




# Facility A – Operating Conditions

<b>Test Furnace</b>	Furnace Type: 1,000 kW Electric Induction, Crucible-Type Melt Capacity: 4,500 lbs
<b>Alloy Melted</b>	316 Stainless Steel (316 SS) <ul style="list-style-type: none"><li>• Cr: 16 – 18%</li><li>• Ni: 10 – 14%</li><li>• As: Possible trace amount (&lt;0.01%)</li></ul>
<b>Melt Temperature</b>	2,925°F
<b>Emission Capture System</b>	<ul style="list-style-type: none"><li>• Slot exhaust system that mounts furnace</li><li>• Mobile overhead hood during metal pour process</li></ul>
<b>Emission Control System</b>	Baghouse with High-Efficiency Particulate Air (HEPA) filter <ul style="list-style-type: none"><li>• Inlet combines multiple furnaces</li><li>• 2 other furnaces were operating at 2,425°F and melting AMS 4881<ul style="list-style-type: none"><li>• AMS 4881: Cr (<math>\leq 0.05\%</math>) &amp; Ni (4 – 6%)</li></ul></li></ul>

# Facility A – Source Test Results (lb/hr)



Pollutant	1 Furnace Exhaust	2 Combined Inlet	3 Outlet
Cr <sup>6+</sup>	9.73E-05	1.25E-04	Non-Detect (<3.82E-06)
Total Cr	7.72E-04	6.42E-04	Non-Detect (<1.43E-04)
As	Non-Detect (<6.30E-06)	Non-Detect (<5.49E-05)	Non-Detect (<6.87E-05)
Cd	Non-Detect (<4.16E-06)	Non-Detect (<5.68E-05)	Non-Detect (<6.87E-05)
Ni	2.42E-04	1.32E-03	1.62E-04
PM	0.21	0.77	0.24

# Facility A – Comparison to Screening Emissions Levels (lbs/hr)

- Source test results were compared to the South Coast AQMD Permitting Screening Emissions Levels<sup>1</sup> that represent
  - Cancer Risk of 25 in a million
  - Receptor is 100 meters from the source
  - Operating hours: 12 hours, 300 days
- Observations
  - Source test results for Hexavalent Chromium for the furnace exhaust and combined inlet are above screening emissions
  - Source test result for Hexavalent Chromium for the outlet is below screening emissions
  - Other toxic air contaminants are below screening emissions

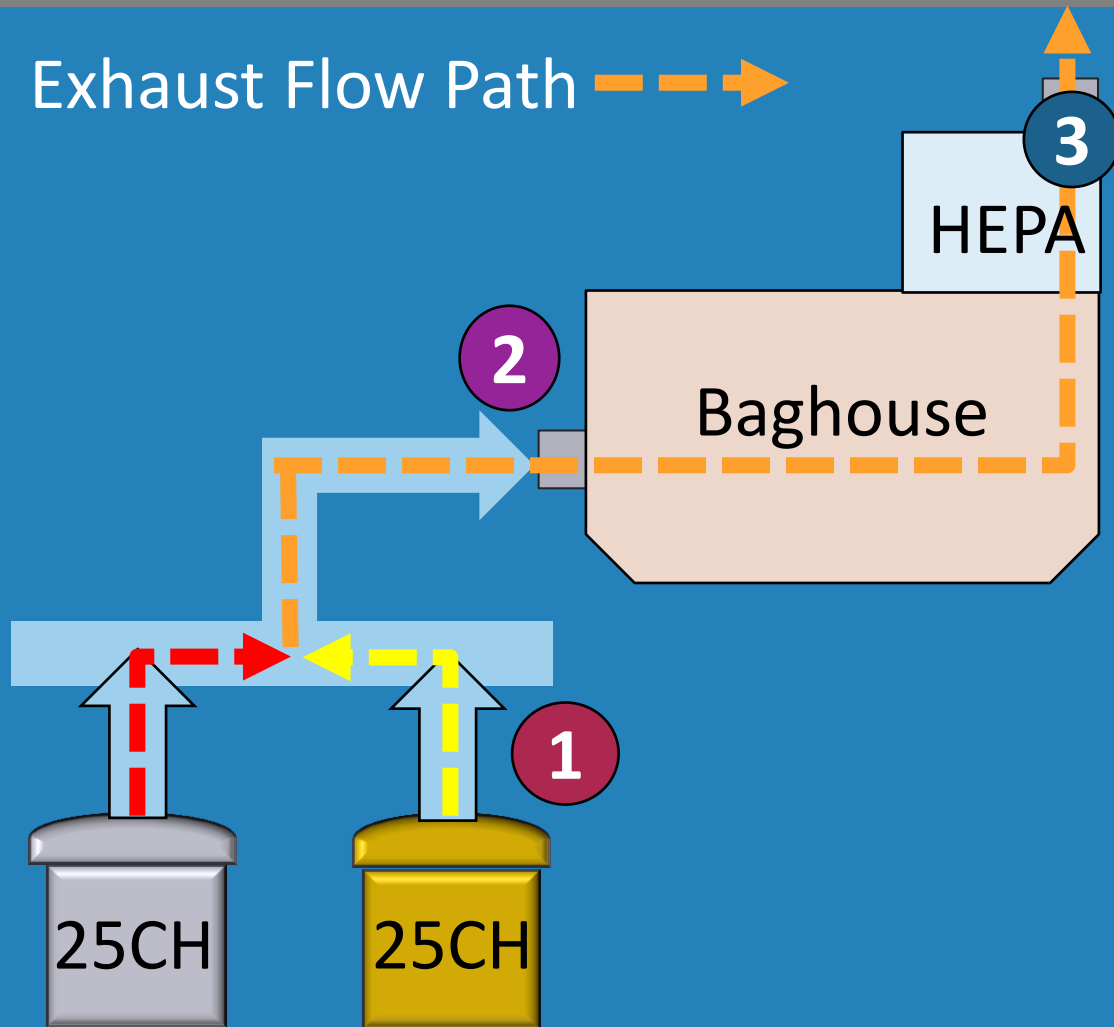
		1	2	3
Pollutant	Screening Emissions	Furnace Exhaust	Combined Inlet	Outlet
Cr <sup>6+</sup>	4.00E-06	9.73E-05	1.25E-04	Non-Detect (<3.82E-06)
As	2.60E-05	Non-Detect (<6.30E-06)	Non-Detect (<5.49E-05)	Non-Detect (<6.87E-05)
Cd	2.06E-04	Non-Detect (<4.16E-06)	Non-Detect (<5.68E-05)	Non-Detect (<6.87E-05)
Ni	3.39E-03	2.42E-04	1.32E-03	1.62E-04

<sup>1</sup> South Coast AQMD Permit Application Package “N”, Table 1

# Facility C – Operating Conditions

<b>Furnace Tested</b>	Furnace Type: 1,500 kW Electric Induction, Crucible-Type Melt Capacity: 6,000 lbs
<b>Alloy Melted</b>	25CH Chrome Iron <ul style="list-style-type: none"><li>• Cr: 23 – 30%</li><li>• Ni: 2 – 3%</li></ul>
<b>Melt Temperature</b>	2,619°F
<b>Emission Capture System</b>	Slot exhaust system that mounts furnace
<b>Emission Control System</b>	Baghouse with High-Efficiency Particulate Air (HEPA) filter <ul style="list-style-type: none"><li>• Inlet combines multiple furnaces</li><li>• 1 other furnace was operating at 2,619°F and melting 25CH</li></ul>

# Facility C – Source Test Results (lb/hr)



Pollutant	1 Furnace Exhaust	2 Combined Inlet	3 Outlet
Cr <sup>6+</sup>	2.25E-05	3.29E-05	Non-Detect (<1.72E-06)
Total Cr	2.03E-03	2.24E-03	Non-Detect (<7.43E-06)
As	1.31E-05	1.91E-05	Non-Detect (<1.26E-05)
Cd	Non-Detect (<1.51E-06)	Non-Detect (<8.20E-06)	Non-Detect (<1.26E-05)
Ni	2.33E-04	3.72E-04	1.56E-05
PM	0.270	0.625	0.136

# Facility C – Comparison to Screening Emissions Levels (lbs/hr)

- Same assumptions for screening emissions
- Observations
  - Source test results for Hexavalent Chromium for the furnace exhaust and combined inlet are above screening emissions
  - Source test result for Hexavalent Chromium for the outlet is below screening emissions
  - Other toxic air contaminants are below screening emissions

		1	2	3
Pollutant	Screening Emissions	Furnace Exhaust	Combined Inlet	Outlet
Cr <sup>6+</sup>	4.00E-6	2.25E-05	3.29E-05	Non-Detect (<1.72E-06)
As	2.60E-5	1.31E-05	1.91E-05	Non-Detect (<1.26E-05)
Cd	2.06E-04	Non-Detect (<1.51E-06)	Non-Detect (<8.20E-06)	Non-Detect (<1.26E-05)
Ni	3.39E-03	2.33E-04	3.72E-04	1.56E-05

<sup>1</sup> South Coast AQMD Permit Application Package “N”, Table 1 for screening emission levels

# Emission Collection Observations

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## Visual Observations at Facilities A & C

- Emissions not completely captured when furnace lid was opened
- Some visible emissions escaped when furnace lid was in place during
  - Charging
  - De-slagging
  - Pouring

## Considerations

- Due to some emissions not captured from charging, de-slagging, and pouring operations, source test results may be underreported
- May result in fugitive emissions

# Summary of Source Testing Results

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## Main Points

Formation of  
hexavalent  
chromium at Test  
Furnace

Hexavalent  
chromium  
continues to inlet  
of pollution  
control device

HEPA reduced  
toxic air  
contaminant  
emissions

Improvements to  
capture efficiency  
will reduce fugitive  
emissions and  
ensure more  
emissions are  
collected in  
pollution controls



# General Approach

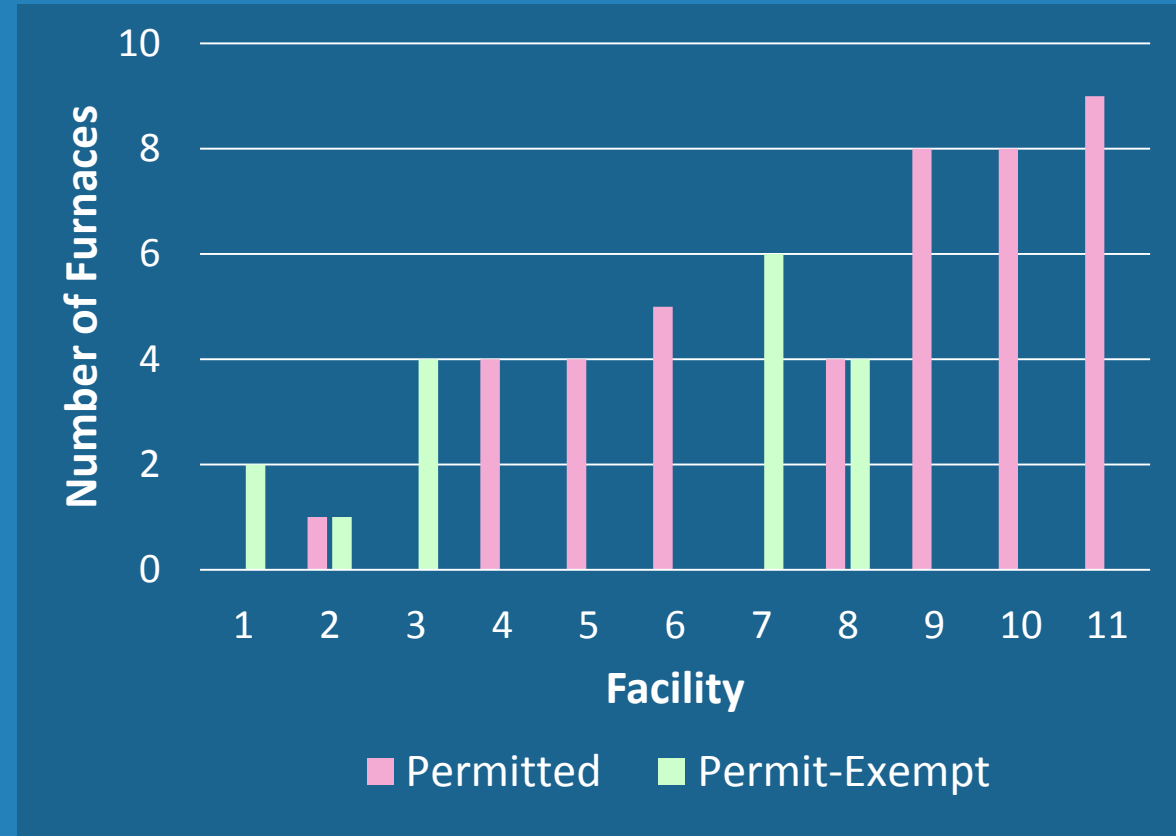
# Proposed Purpose and Applicability

- Purpose: Reduce emissions of hexavalent chromium, arsenic, cadmium, and nickel from chromium alloy melting operations
- Applicability: All melting operations of stainless steel, alloy steel, superalloy, and chromium alloy (contains  $\geq 0.5\%$  chromium)
  - Primary and secondary smelters
  - Foundries
  - Die-casters
  - Other miscellaneous melting processes
  - Grinding and cutting operations conducted at chromium metal melting facilities



# Universe of Facilities

- Identified 11 facilities that conduct chromium alloy melting operations during PAR 1407/PR 1407.1 rule development effort
  - 43 permitted furnaces
  - 17 permit-exempt furnaces
- Facility list was compiled by reviewing the South Coast AQMD database, supplemented with:
  - Internet searches
  - Industry association contacts
  - Site visits
- Staff will continue to identify additional affected facilities

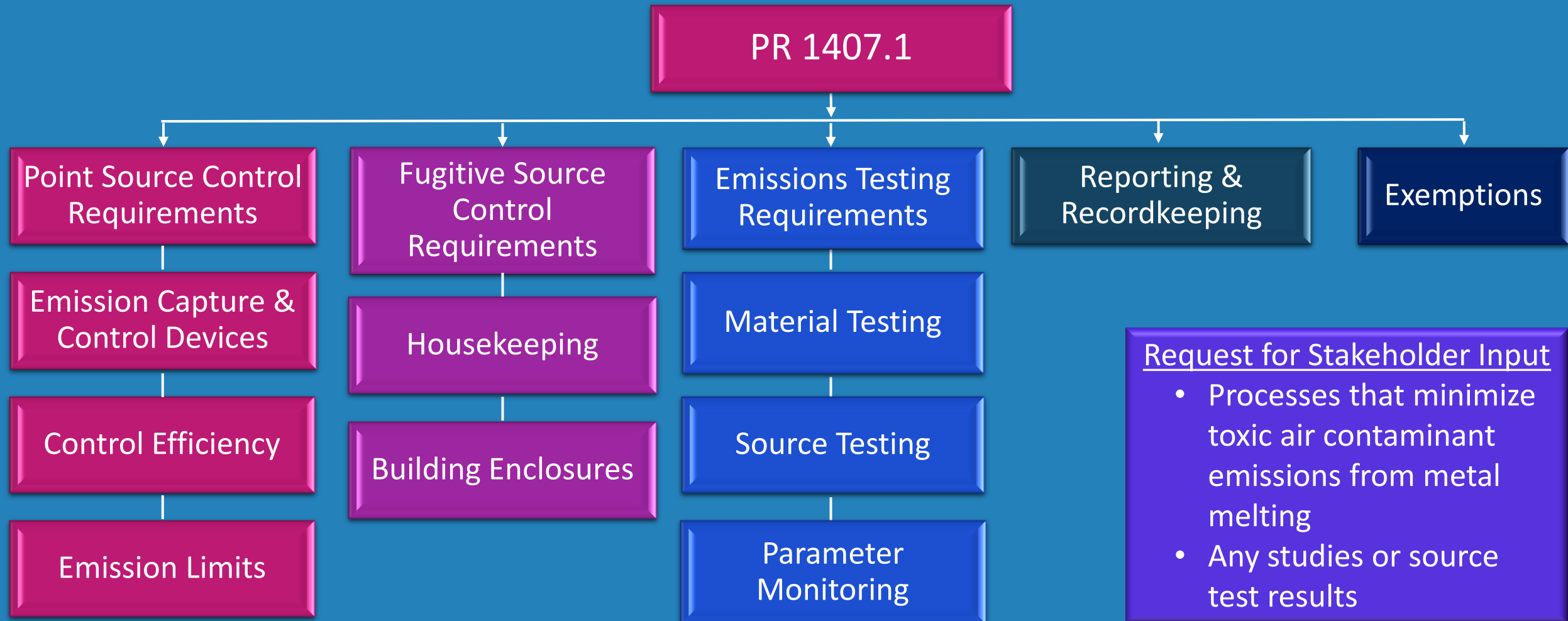


# Universe of Furnaces PR 1407.1

Furnace Type	Quantity		Size Range (lbs)	Metals/Alloys Melted	Vented to Emission Control System	
	Permitted	Permit-Exempt			Yes*	No
Tilting Crucible	23	0	300 – 6,000	Ferrous and Non-Ferrous including Stainless Steel	All vented to a baghouse	0
Crucible/Pot	4	5	500 – 4,000	Stainless Steel	1 permitted vented to a baghouse	8
Electric Induction & Resistance	9	0	220 – 6,000	Ferrous and Non-Ferrous including Stainless Steel	<ul style="list-style-type: none"> <li>7 vented to a baghouse</li> <li>2 contained in a building that is vented to a baghouse</li> </ul>	0
Vacuum Induction	7	0	150 – 18,000	Stainless Steel and Superalloy	<ul style="list-style-type: none"> <li>3 vented to one or more electrostatic precipitator</li> <li>1 vented to multiple electrostatic precipitators &amp; a baghouse</li> </ul>	3
Unknown Electric	0	12	<50 – 900	Ferrous and Non-Ferrous including Stainless Steel	0	12

\*Staff is verifying which emission control systems have HEPA

# General Overview of PR 1407.1



# Next Steps

Action	Target Dates
Additional Working Groups	TBD
Public Workshop	August 2020
Stationary Source Committee	September 18, 2020
Set Hearing	October 2, 2020
Public Hearing	November 6, 2020

# Proposed Rule 1407.1 Staff Contacts

## Rule Development

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## General Questions

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