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

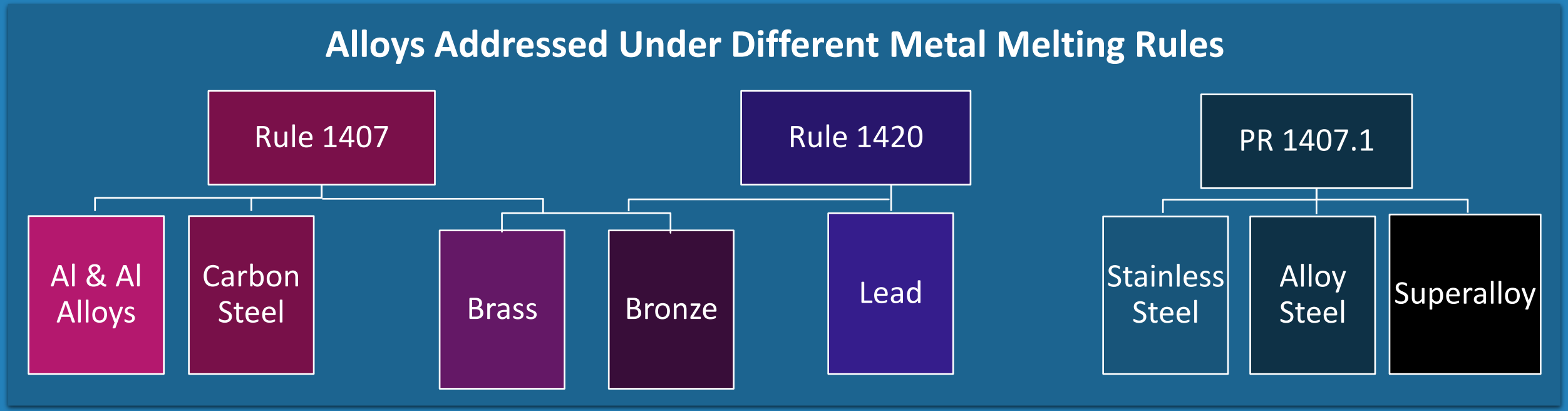
- California Metals Coalition identified three facilities that would volunteer to conduct source testing

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



Agenda

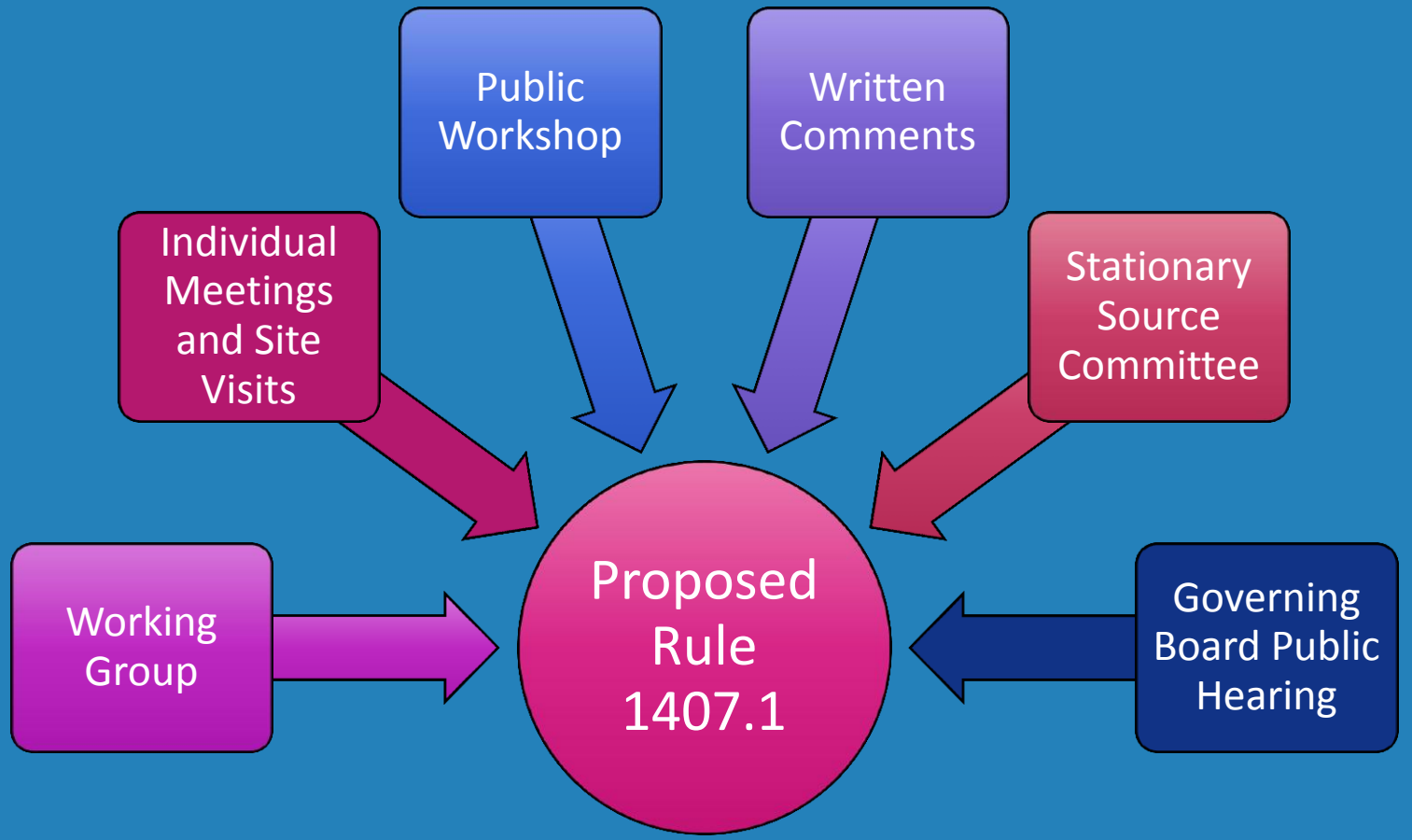
- Rule Development Process
- Source Testing Results
- General Approach

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^{6+}), 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

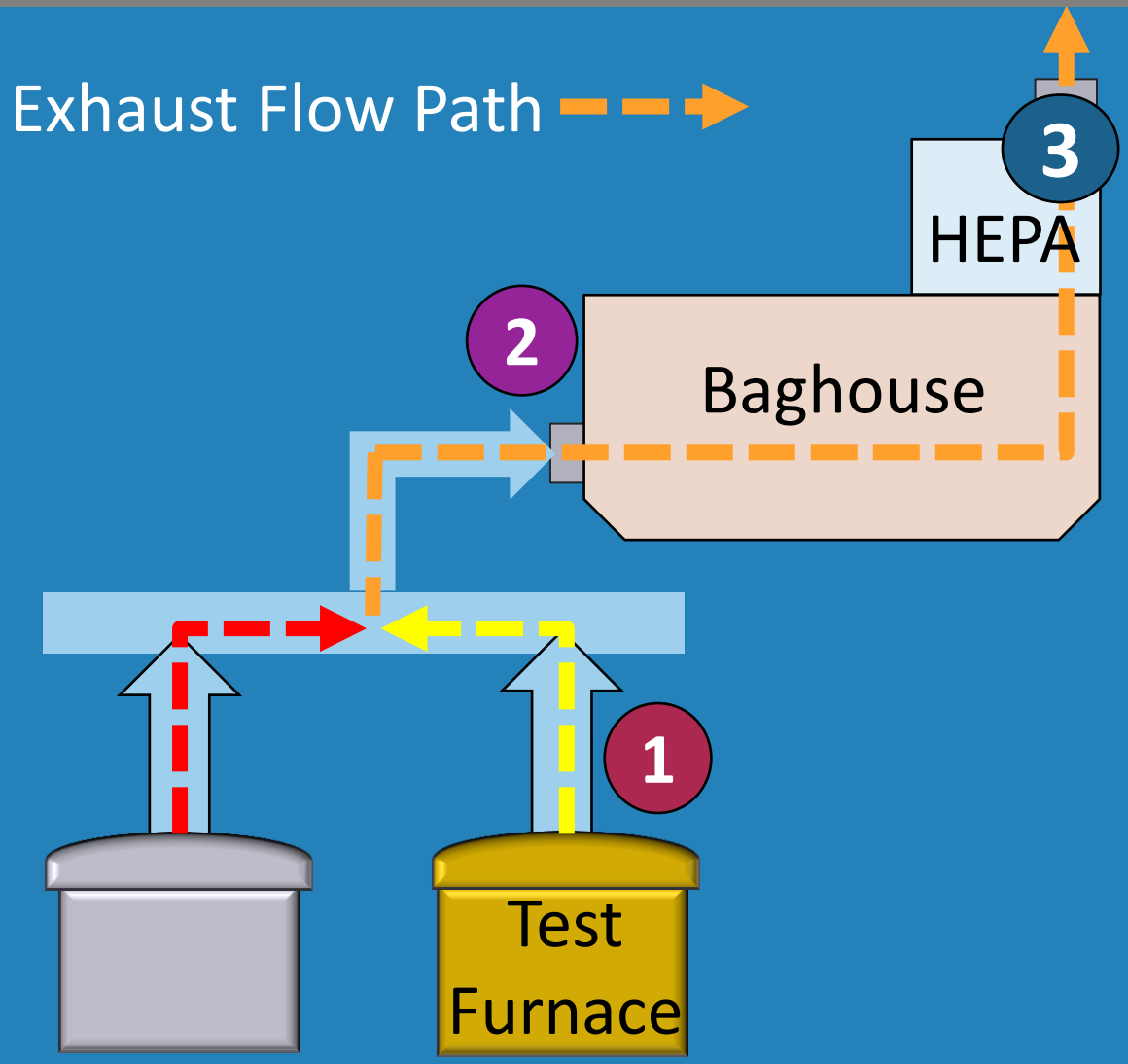
Facility B

- 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

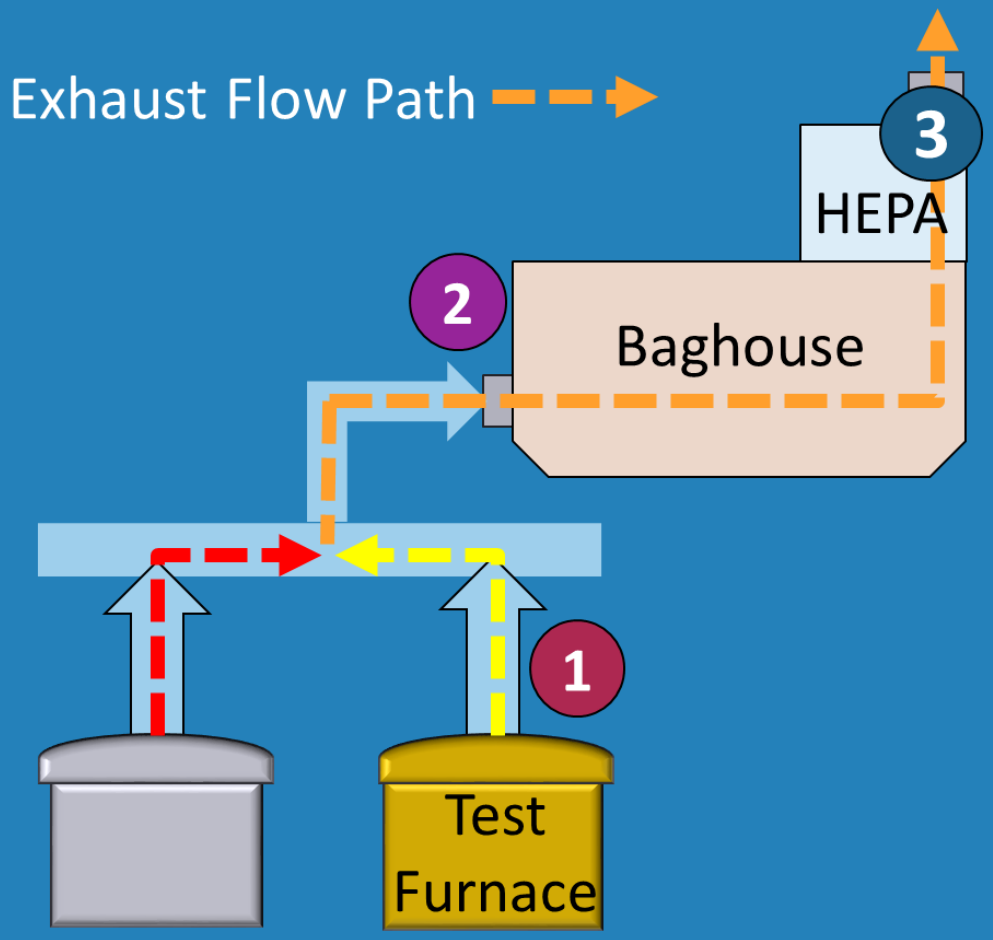
Overview of Source Testing Results

Updated Slide

- Source test results presented for:
  - Sampling of chromium (Cr), hexavalent chromium (Cr^{6+}), 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

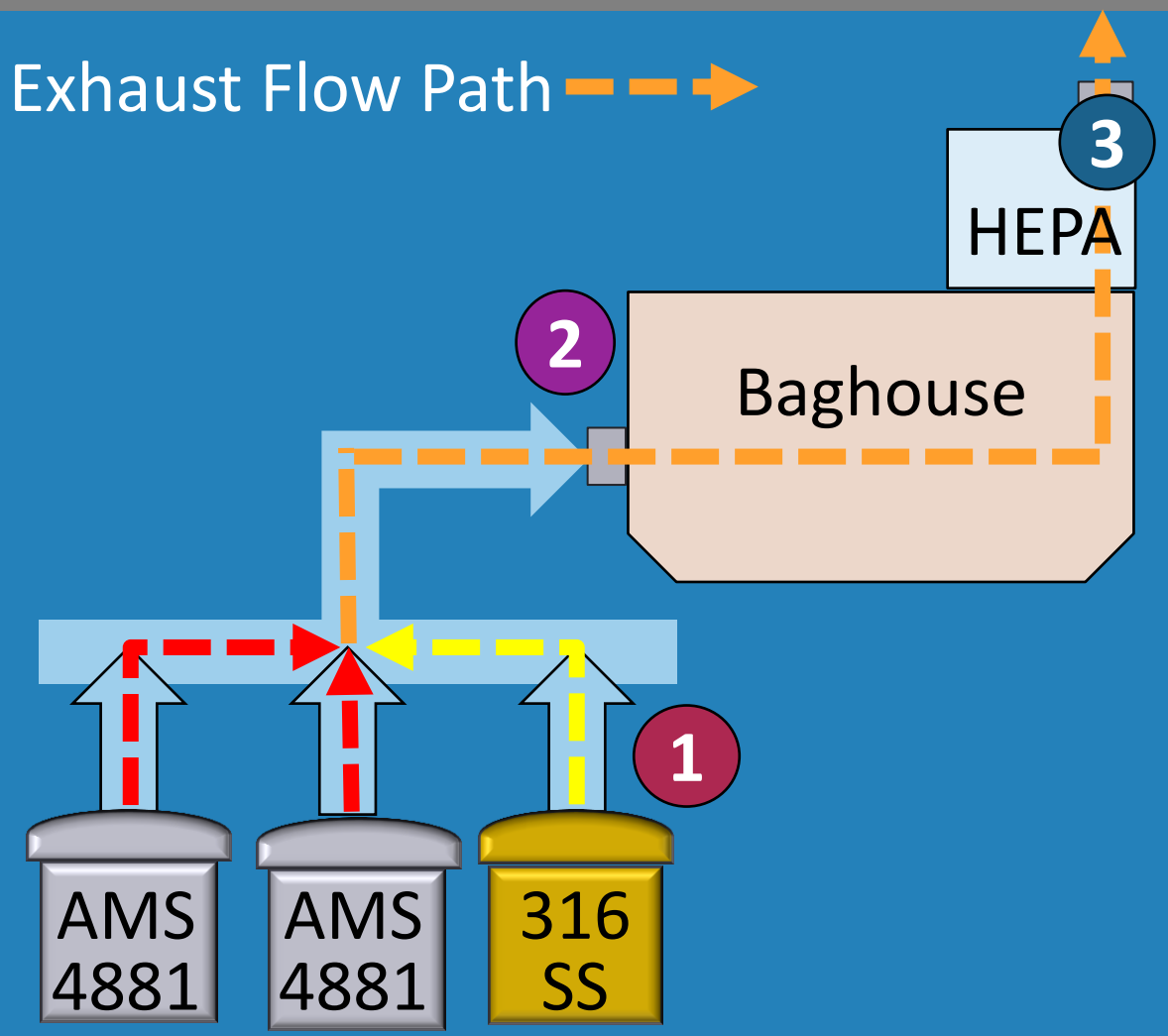
- Study design for test run was two hours – test runs are typically longer
  - Some non-detect results could have a detectable result with longer test run
- For both facilities, inlet to baghouse combines multiple furnaces
  - Emissions at "1 Furnace Exhaust" capture the emissions from Test Furnace
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



Facility A – Operating Conditions

Test Furnace	Furnace Type: 1,000 kW Electric Induction, Crucible-Type Melt Capacity: 4,500 lbs
Alloy Melted	316 Stainless Steel (316 SS) • Cr: 16 – 18% • Ni: 10 – 14% • As: Possible trace amount (<0.01%)
Melt Temperature	2,925°F
Emission Capture System	• Slot exhaust system that mounts furnace • Mobile overhead hood during metal pour process
Emission Control System	Baghouse with High-Efficiency Particulate Air (HEPA) filter • Inlet combines multiple furnaces • 2 other furnaces were operating at 2,425°F and melting AMS 4881 • AMS 4881: Cr (≤0.05%) & Ni (4 – 6%)

Facility A – Source Test Results (lb/hr)



	1	2	3
Pollutant	**Furnace Exhaust**	**Combined Inlet**	**Outlet**
Cr^{6+}	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[1] 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

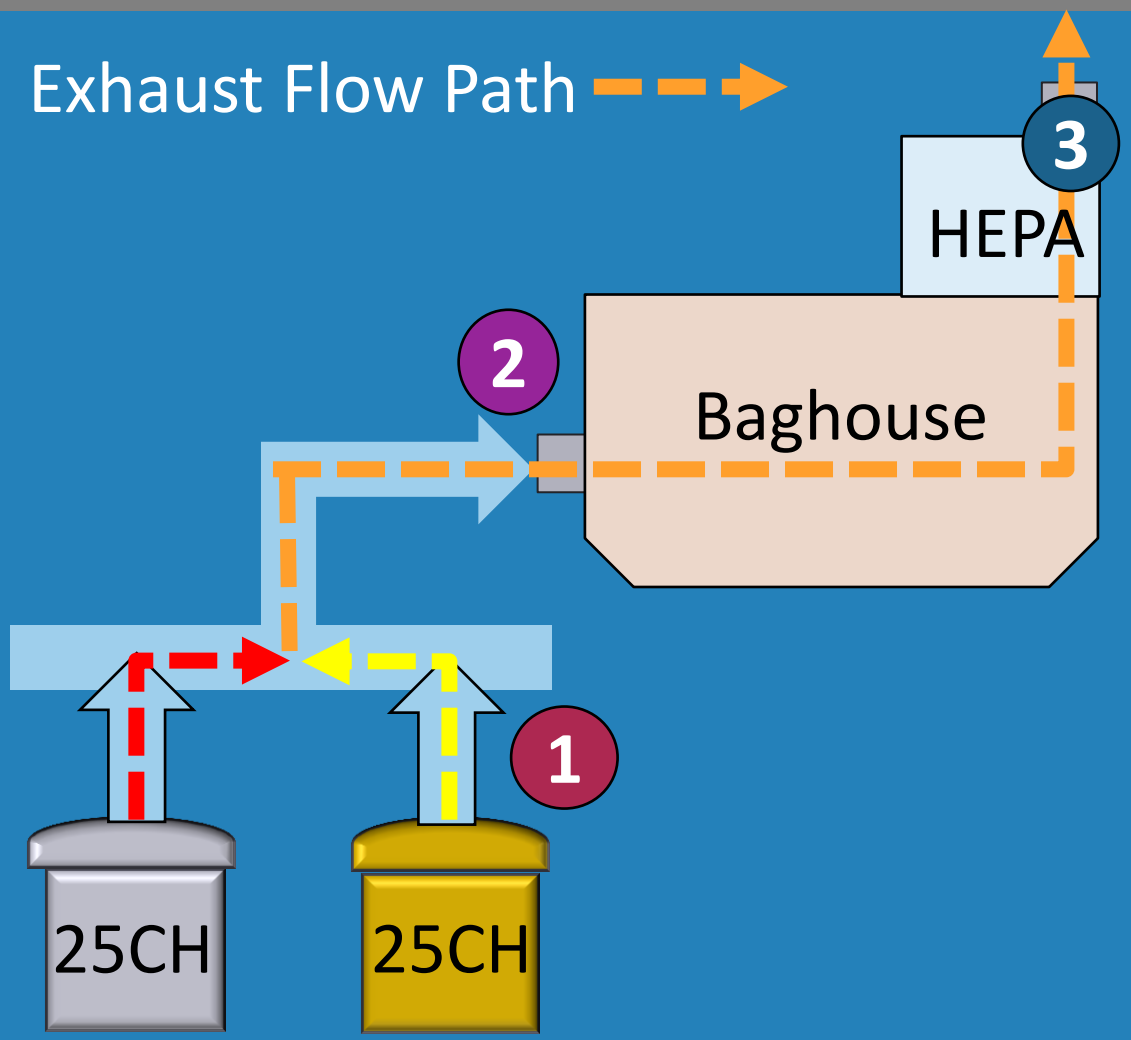
		1	2	3
Pollutant	**Screening Emissions**	**Furnace Exhaust**	**Combined Inlet**	**Outlet**
Cr^{6+}	4.00E-06	9.73E-05	1.25E-04	Non-Detect (<3.82E-06)
As	2.60E-05	Non-Detect (<6.30E-06)	Non-Detect (<5.49E-05)	Non-Detect (<6.87E-05)
Cd	2.06E-04	Non-Detect (<4.16E-06)	Non-Detect (<5.68E-05)	Non-Detect (<6.87E-05)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

[1] South Coast AQMD Permit Application Package "N", Table 1

Facility C – Operating Conditions

Furnace Tested	Furnace Type: 1,500 kW Electric Induction, Crucible-Type Melt Capacity: 6,000 lbs
Alloy Melted	25CH Chrome Iron • Cr: 23 – 30% • Ni: 2 – 3%
Melt Temperature	2,619°F
Emission Capture System	Slot exhaust system that mounts furnace
Emission Control System	Baghouse with High-Efficiency Particulate Air (HEPA) filter • Inlet combines multiple furnaces • 1 other furnace was operating at 2,619°F and melting 25CH

Facility C – Source Test Results (lb/hr)



	1	2	3
Pollutant	**Furnace Exhaust**	**Combined Inlet**	**Outlet**
Cr^{6+}	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^{6+}	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

[1] 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

Updated Slide

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

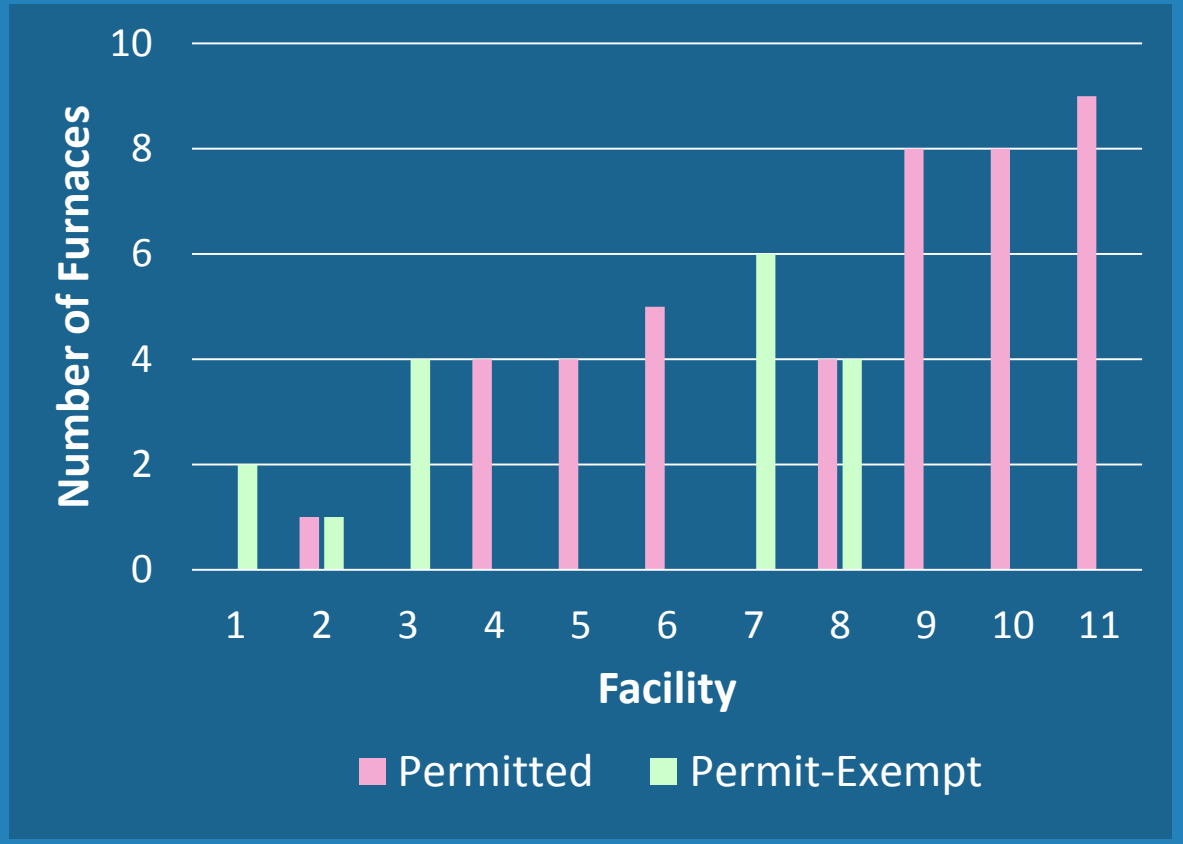
General Approach

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 ≥ 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

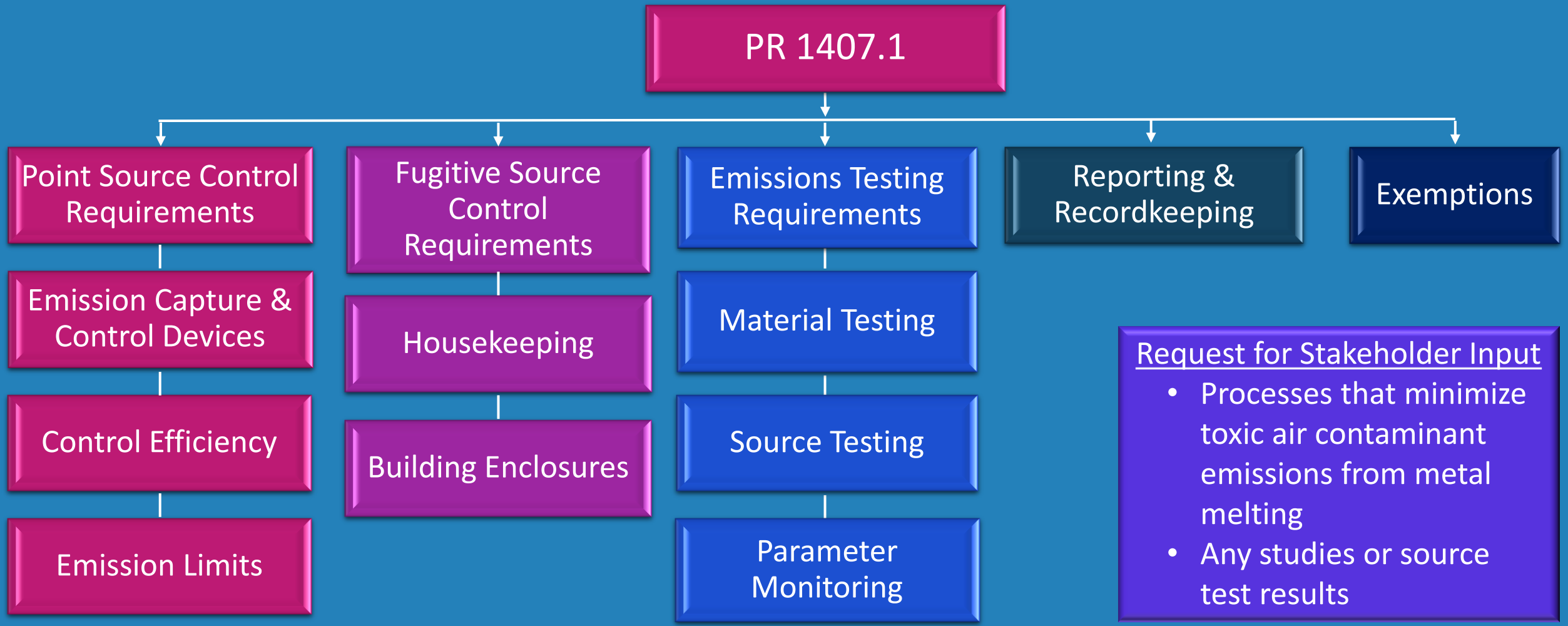


Universe of Furnaces PR 1407.1

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	• 7 vented to a baghouse • 2 contained in a building that is vented to a baghouse	0
Vacuum Induction	7	0	150 – 18,000	Stainless Steel and Superalloy	• 3 vented to one or more electrostatic precipitator • 1 vented to multiple electrostatic precipitators & a baghouse	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

Charlene Nguyen, cnguyen@aqmd.gov, (909) 396-2648

Uyen-Uyen Vo, uvo@aqmd.gov, (909) 396-2238

Michael Morris, mmorris@aqmd.gov, (909) 396-3282

General Questions

Susan Nakamura, snakamura@aqmd.gov, (909) 396-3105