Proposed Rule 1407.1
Control of Emissions of Toxic Air Contaminants from Chromium Alloy Melting Operations

Working Group Meeting #5
June 6, 2018
Summary of Working Group Meeting #4 for PAR 1407 and PR 1407.1

General Approach

Initial rule concepts
- Purpose
- Applicability and Exemptions
- Information Gathering
  - Operational Information
  - Metals Composition Testing
  - Emissions Testing
    - Source Test Methodology
    - Source Testing
- Reporting
Summary of Working Group Meeting #4 (PAR 1407 and PR 1407.1)

- Summary of Working Group Meeting #3 and comments, including comments from California Metals Coalition
- Overview of rule development schedule and process, including key milestones
- Discussed new approach for PAR 1407 and PR 1407.1
  - Upon request of industry and challenges regarding the lack of emissions data for ferrous melting operations, bifurcated PAR 1407
    - PAR 1407 will address non-chromium alloy melting operations
    - PR 1407.1 will address chromium alloy melting operations
  - Discussed initial concepts for PAR 1407 and PR 1407.1
    - General approach
    - Initial concepts
    - Tentative schedules
General Approach for PR 1407.1

- Gather information to assess toxic air contaminant emissions with focus on:
  - Facility and equipment inventory
  - Processing data
  - Recordkeeping and reporting, and
  - Emissions testing

- Assess information collected
  - If warranted, initiate additional rulemaking to address toxic air contaminant emissions
Background

- Chromium alloys contain toxic air contaminants which have the potential to be emitted during metal melting operations
- A source test of a chromium alloy furnace has shown that some chromium is converted to hexavalent chromium
- Additional emissions data is needed to quantify the type and amount of toxic air contaminant emissions that occur from chromium alloy melting operations
- Emission data will be used to assess the need for requirements to address toxic air contaminant emissions

Proposed Purpose of PR 1407.1

- To gather toxic air contaminant emissions information from chromium alloy melting operations
**Initial Rule Concepts – Applicability and Exemptions**

**Background**

- Staff categorized alloys and current SCAQMD regulations
  - Aluminum, brass, bronze, and lead alloys are already regulated by SCAQMD rules
  - Super alloys are exempt from Rule 1407 due to low arsenic and cadmium content
  - Steel is not regulated by any SCAQMD rule

- Staff examined each alloy type for chromium content
  - Aluminum alloys have < 0.4% chromium
    - Aluminum 6066 is aluminum alloy with highest chromium content
  - Brass, bronze and lead alloys are not expected to contain chromium
  - Carbon steel has no minimum specifications for chromium
  - Stainless steel, alloy steel, and super alloys have ≥ 0.4% chromium
Initial Rule Concepts – Applicability and Exemptions
(continued)

Background (continued)

- Potential applicable alloys to assess
  - Stainless steel, alloy steel, and super alloys
Proposed Applicability

All operations where chromium alloys (contain ≥ 0.5% chromium) are melted

Exemptions

Equipment and structures subject to Rules 1420, 1420.1, and 1420.2

Lead series rules contain similar measures that may otherwise be overlapping
Initial Rule Concepts – Information Gathering

- Operational Information Survey
- Metals Composition Testing
- Information Gathering
- Recordkeeping
- Emissions Testing
Operational Information Survey

Background
- Stainless steel and alloy steel melting furnaces are not regulated by SCAQMD
- Super alloy furnaces regulated under Rule 1407, but are exempt
- As a result:
  - A number of furnaces may not be permitted
  - Location of metal melting operations and housekeeping are not regulated

Objective of operational information survey
- Identify types of operations and processes performed
- Collect detailed furnace information and existing pollution controls
- Obtain facility plot plan of location of equipment and processes
- Understand current housekeeping practices
Operational Informational Survey will collect

- Casting techniques or processes performed
- Finishing activities or operations performed
- For each metal melting furnace (permitted and unpermitted)
  - Furnace type (reverberatory, electric arc, electric induction, cupola, kettle, etc.)
  - Size and capacity
  - Operating temperatures (average and maximum)
  - Fuel type
    - If gas fired, include BTU rating of furnace
  - Alloy(s) melted
  - Specifications of final product(s)
  - SCAQMD permit or application number, if applicable
    - If applicable, associated control device, including the permit or application number
Operational Information Survey (continued)

- Facility Plot Plan
  - Dimensions of each building, including opening and dimensions of openings
  - Location and dimensions (height and diameter) of stacks, include weather caps or butterfly valves
  - Location of each metal melting furnace, emission collection system, and emission control device
  - Location of operations for pouring, casting, cooling, degating, cutting, blasting, sanding, and finishing (grinding, polishing, buffing)
  - Location of storage of dust-forming material
Operational Information Survey (continued)

Housekeeping

- Schedule of sweeping, washing, mopping, or vacuuming and method used for the following areas:
  - Where metal wastes are stored, disposed of, recovered, or recycled
  - Surfaces around metal melting operations and subject to vehicular or foot traffic
  - Work stations around buffing, grinding, and polishing operations
  - Parking areas

- Storage practices for metal-containing trash or debris
Metals Composition Testing

Background

- Each batch of alloy has varying content for each toxic air contaminant
- The composition of alloys may affect the emissions of these toxic air contaminants
- Collecting metals composition data will provide information on the type and amount of toxic air contaminants in alloys

Metals Composition Testing

- Test results, certificates of analyses, or other documentation to identify the content of arsenic, cadmium, chromium, hexavalent chromium, and nickel for the following materials:
  - Raw materials and final materials, per batch
  - Slag and dross, per melt
  - Baghouse catch
  - Waste
  - Other by-products
Recordkeeping

Background

- Data regarding furnace run hours and metals melted is needed to help assess emissions of toxic air contaminants

Proposed Recordkeeping Requirements

- Quarterly records for each metal melting furnace
  - Run hours
  - Melt records – quantity of raw materials processed
    - Including additives, alloys, ingots, scrap, and reruns
    - Data collected from metals composition testing
Emissions Testing

Background

- SCAQMD currently has one hexavalent chromium source test for a ferrous metal melting furnace – hexavalent chromium was detected
- SCAQMD staff offered to conduct source tests at certain facilities as part of rule development, however, facilities were either reluctant or non-responsive
- Further testing is needed to assess toxic air contaminant emissions during chromium alloy melting operations

Objective of Emissions Testing

- Obtain emissions data to assess toxic air contaminant emissions
  - Source tests for multi-metals and hexavalent chromium of chromium alloy melting furnaces will provide toxic air contaminant emissions information
Source Test Methodology

- Purpose of Testing
- Sampling Location
- Process Information
- Determination of Exhaust Flow Rate
- Hexavalent Chromium, Total Chromium Emissions (CARB Method 425)
- Multi-Metals Emissions (CARB Method 436)
- Results
Screening and Protocol Emissions Tests

- Information only, point source identification, control efficiency check, emission rate or factor determination

- Screening Emissions Tests
  - Single sampling runs with modified method
  - Lower cost, simpler, easier to identify potential sources and relative emissions
  - Results are qualitative; cannot be used for compliance or emission factor determination

- Protocol Emissions Tests
  - Three (3) run set of tests with protocol method
  - Higher cost, more complicated logistics
  - Comprehensive and statistically significant results; can be used for compliance and emission factor determination

- Results – concentration, mass emissions, emission factors
Sampling Location

Stack Diagram

Stack Cross-Section

Stack Diameter = 12 in.

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<th>Traverse Point Numbers</th>
<th>Distance from Inner Stack Wall (in.)</th>
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<tr>
<td>1, 7</td>
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<td>10.25</td>
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<td>6, 12</td>
<td>11.47</td>
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Modified Sample Probe Placement
Process Information

- Burner gas flow rate (if applicable)
- Power consumption
- Material processed
- Production rate
- Process temperatures
- Exhaust flow (if applicable)
- Exhaust capture efficiency (if applicable)
- Pressure drops across control devices (if applicable)
Exhaust Flow Rate

- **Direct Measurement**
  - Pitot tube for differential pressure
  - Thermocouple for exhaust temperature
  - Multi-point traverse across two cross-sectional diameters of duct
  - Use stack cross-sectional area, exhaust gas density and moisture content to calculate flow rate

- **Calculated from Fuel Flow and Exhaust Gas Composition**
  - Dedicated fuel gas meter
  - Exhaust gas measurement of CO$_2$ and O$_2$
  - Exhaust flow rate calculated using carbon number of fuel (corrected for ambient CO$_2$)
Particulate Matter Emissions

- SCAQMD Method 5.1, 5.2, or 5.3
- Samples extracted through probe, sample line, impinger train, filter, and sample gas meter with a vacuum pump
- First 2 impingers contain deionized water
- Probe, sample line, filter, and impinger solutions recovered following sampling
- Particulate matter determined by gravimetric methods
SCAQMD Method 5.3 – Particulate Matter
Hexavalent Chromium, Total Chromium Emissions

- California Air Resources Board Method 425 (CARB M425)
- Samples extracted through probe, sample line, impinger train, filter, and sample gas meter with a vacuum pump
- First 2 impingers contain 0.1N sodium bicarbonate or 0.1N sodium hydroxide solution
- Probe, sample line, filter, and impinger solutions recovered following sampling
- Hexavalent chromium determined by ion chromatography with a post-column reactor (IC/PCR) or colorimetric procedure (IC-C) and photometric detection
- Total chromium determined by inductively-coupled plasma mass spectrometry (ICP-MS) or graphite furnace atomic absorption (GF-AA)
CARB M425 – Hexavalent Chromium
CARB M425 – Sampling Setup
Multi-Metals Emissions

- California Air Resources Board Method 436 (CARB M436)
- Samples extracted through probe, sample line, heated filter, impinger train, and sample gas meter with a vacuum pump
- First 2 impingers contain 5 wt.% nitric acid and 10 wt.% hydrogen peroxide solution
- Probe, sample line, filter, and impinger solutions recovered following sampling
- Multi-metals determined by inductively-coupled plasma mass spectrometry (ICP-MS), direct aspiration atomic absorption spectroscopy (DAAAS), or cold vapor atomic absorption spectroscopy (CVAAS)
CARB M436 – Multi-Metals
Results

- Concentration (ng/m³, ppm)
  - Determined by screening or protocol testing
- Mass Emissions (g/hr, lb/hr, lb/year)
  - Qualitatively determined by screening testing with fuel flow and exhaust gas composition
  - Quantitatively determined by protocol testing
- Emission Factors (g/ton, lb/MMBtu)
  - Qualitatively determined by screening testing with fuel flow and exhaust gas composition
  - Quantitatively determined by protocol testing
Initial Concepts – Source Testing

Background

- Source tests for furnaces without stacks will have to be a modified protocol due to inability to test inlet and therefore will be only qualitative.
- Source tests for furnaces with stacks, following protocol, will give quantitative results.

Proposed Source Testing Requirements

- Owner or operator of chromium alloy melting operations will be required to:
  - Submit a source test protocol for approval prior to testing.
  - Conduct source testing for point sources for PM10, multi-metals, and hexavalent chromium.
  - Measure mass emissions from the furnace (inlet) and, if applicable, mass emissions from the control device (outlet).
  - Measure the temperature of gas entering the control device.
Initial Concepts – Source Testing
(continued)

- Require furnaces with existing control equipment to conduct protocol tests at inlet and outlet for concentration, mass emissions, and control efficiency
  - All furnaces with existing control equipment to be source tested
  - Alloy(s) tested should be alloy most processed in furnace tested
  - If multiple furnaces vented to single control device, then all furnaces should be operating during test (unless otherwise restricted by permit condition)
  - May be used for initial source test requirement, if further testing required

- Require furnaces without existing control equipment to conduct screening tests
  - Not all furnaces without existing control equipment will be required to be source tested
    - Only one of each type of furnace to be source tested
    - Alloy(s) tested should be alloy most processed in furnace tested
Within 90 days of rule adoption, provide the Operational Information Survey:
- Operations conducted at the facility
- Inventory of furnaces and control devices
- Facility plot plan
- Current housekeeping practices

By 1/31/2020 provide the following information:
- Processing data for individual furnaces
- Results of metal composition testing
- Results of emissions testing
## Next Steps

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<tr>
<th>Action</th>
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<tr>
<td>Working Group Meeting #6</td>
<td>July 11, 2018</td>
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<tr>
<td>Stationary Source Committee</td>
<td>July 20, 2018</td>
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<tr>
<td>Public Workshop</td>
<td>July or August 2018</td>
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<td>September 7, 2018</td>
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<td>Public Hearing</td>
<td>October 5, 2018</td>
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Contact Information

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General Questions

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