Proposed Amended Rule 1407

Working Group #3
January 30, 2018
Agenda

• Summary of Working Group #2
• Meeting with California Metals Coalition – December 15, 2017
• Applicability of Proposed Amended Rule 1407
• Hexavalent Chromium
• Initial Review of Two Source Tests
• Initial Concepts for Point Source Emission Limits
Summary of Working Group #2

- Discussed existing provisions under Rule 1407 and possible rule concepts for:
  - Purpose and Applicability
    - Include ferrous metal melting operations and hexavalent chromium
  - Control Approach
    - Point source controls, total enclosures, and housekeeping
  - Source Tests
    - Emission of specific toxics versus emission of particulates
    - Control efficiency versus mass emission
  - Emission Control Device Monitoring
    - Flow meter, smoke test, pressure gauge, bag leak detection system,
  - Ambient Air Monitoring
  - Exemptions
Meeting with California Metals Coalition
Meeting with California Metals Coalition

- December 15, 2017
- Attended By
  - SCAQMD
  - California Metals Coalition
  - 6 metal melting facilities
Meeting with California Metals Coalition (cont.)

• Differences between alloys, processes, furnaces, volumes
  • Varying material content depending on product and client needs
  • Volumes processed differ significantly from facility to facility
  • Melting temperature dependent on alloy
  • Vacuum melting versus air melting

• Expressed concern about a “one-size fits all” approach

• When and how is hexavalent chromium produced?
  • Not intentionally creating hexavalent chromium

• Requirement versus contaminant
  • Chromium and nickel are added to melts
  • Arsenic and cadmium are contaminants
Meeting with California Metals Coalition (cont.)

- Total Enclosures
  - May pose a health and safety issue
  - SCAQMD staff discussed this issue with Cal-OSHA
  - Staff’s approach for total enclosures is not in conflict with any Cal-OSHA requirements
  - Any requirements for total enclosures will include a provision that will allow modifications for OSHA requirements

- Source testing and ambient air monitoring
  - Source testing is expensive
  - Questions about what SCAQMD plans to do about ambient air monitoring
  - Staff responded that a separate ambient air monitoring rule is being developed – Proposed Rule 1480
    - Expected to include various types of sources and toxic air contaminants
Meeting with California Metals Coalition (cont.)

• Questions regarding why not amend Rule 1407 for non-ferrous metal melting and adopt Rule 1407.1 for ferrous metal melting?
  • Discuss in more detail in next slide

• What does SCAQMD plan to do about welding, cutting, and grinding?
  • Proposed Amended Rule 1407 may include provisions for grinding and possibly cutting
  • More discussion of welding at Rule 1407 facilities is needed

• How will SCAQMD determine thresholds?
  • Staff will be discussing possible point-source emission rates
  • Concepts for ambient or other types of thresholds or approaches for monitoring would be addressed in Proposed Rule 1480
Proposed Amended Rule 1407
Applicability
Rule 1407 and Rule 1407.1

- Stakeholders have commented to have two rules – Rule 1407 for non-ferrous metal melting and Rule 1407.1 for ferrous metal melting
- Staff believes that having one rule for both non-ferrous and ferrous metal melting will be easier for facility operators
  - Easier for operators to have all requirements in one rule versus splitting requirements in two rules
- Proposed rule can be tailored to accommodate different limits for different alloys and volumes processed
- Both non-ferrous and ferrous metal melting facilities, whether one or two rules, would have the similar requirements (housekeeping, enclosures, recordkeeping, emissions testing, etc.)
  - These requirements can also be tailored to accommodate different alloys and volumes processed
## PAR 1407 Toxic Air Contaminants

<table>
<thead>
<tr>
<th>Alloy</th>
<th>Rule 1407 Status</th>
<th>US EPA Carcinogenic Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>Current 1407</td>
<td>Carcinogenic to Humans</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Current 1407</td>
<td>Likely to be Carcinogenic to Humans</td>
</tr>
<tr>
<td>Chromium (hexavalent)</td>
<td>PAR 1407</td>
<td>Carcinogenic to Humans</td>
</tr>
<tr>
<td>Nickel</td>
<td>Current 1407</td>
<td>Carcinogenic to Humans</td>
</tr>
</tbody>
</table>
Hexavalent Chromium
# Toxicity of Hexavalent Chromium

## Exposure Pathway
- Inhalation of aerosols or particles
- Ingestion (eating and drinking)
- Skin contact

## Carcinogen
- Known human carcinogen
- Inhalation pathway (lung and nose cancers)

## Chronic Non-Cancer Health Effects
- Irritation of the nose, throat and lungs
- Allergic symptoms (wheezing, shortness of breath)
- Nasal sores and perforation of the membrane separating the nostrils

## Chronic Inhalation REL
- 0.2 (µg/m³)

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1 Health Effects of Hexavalent Chromium Fact Sheet, CalEPA’s Office of Environmental Health Hazard Assessment, November 9, 2016
Hexavalent Chromium Formation

- \( \text{Cr(s)} \xrightarrow{\text{HEAT}} \text{Cr}^{6+} + 6\text{e}^- \)
- Heat oxidizes chromium to hexavalent chromium
- Temperature of conversion
  - Trivalent chromium in chromium(III) oxide (Cr2O3) could be converted to hexavalent chromium at a temperature range of 200-300°C (392-572°F)\(^1\)
  - Initial rates of conversion increase with increased temperature

\(^1\) “Extent of oxidation of Cr(III) to Cr(VI) under various conditions pertaining to natural environment”, Journal of Hazardous Materials, February 6, 2006
Criteria for a Recommended Standard
Occupational Exposure to Hexavalent Chromium

Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health
September 2013

• Cr(VI) is formed as a by-product when metals containing metallic chromium are used, such as welding and the thermal cutting of metals; steel mills; and iron and steel foundries
  • These operations and processes use extremely high temperatures which result in the oxidation of the metallic forms of chromium to Cr(VI)
• 1994 – Meridian Research, Inc.
  • Estimated 808,177 production workers in U.S. industries with potential exposure to Cr(VI)
  • > 98% of the potentially exposed workforce was found in six industries: electroplating, welding, painting, paint and coatings production, iron and steel production, and iron and steel foundries
Criteria for a Recommended Standard
Occupational Exposure to Hexavalent Chromium
(cont.)

- 2006 – OSHA
  - Estimated that more than 558,000 U.S. workers were exposed to Cr(VI)
  - The largest number of workers potentially exposed to Cr(VI) were in the following application groups: carbon steel welding (> 141,000), stainless steel welding (> 127,000), painting (> 82,000), electroplating (> 66,000), steel mills (> 39,000), iron and steel foundries (> 30,000), and textile dyeing (> 25,000)

- 2006 – Shaw Environmental Report
  - Industry sectors with the greatest number of workers exposed above the REL and the greatest number of workers exposed to Cr(VI) include: welding, painting, electroplating, steel mills, and iron and steel foundries
Proposed Amended Rule 1407
Source Test Examples
Initial Review of Two Source Tests

• Reviewing source test data – number of source tests is limited

• Evaluated two source tests:
  • Example #1: Furnace, uncontrolled, melting aluminum
    • Multi-metals, including hexavalent chromium
  • Example #2: Furnace, controlled, melting steel
    • Chromium and hexavalent chromium

<table>
<thead>
<tr>
<th>Example</th>
<th>Control</th>
<th>Metal Melted</th>
<th>Average Processed (lbs)</th>
<th>Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example #1</td>
<td>Uncontrolled</td>
<td>Aluminum</td>
<td>56,033</td>
<td>Multi-metal, including Hexavalent Chromium</td>
</tr>
<tr>
<td>Example #2</td>
<td>Controlled</td>
<td>Steel</td>
<td>3,195</td>
<td>Chromium and Hexavalent Chromium</td>
</tr>
</tbody>
</table>
Source Test Data – Example #1

- Equipment Tested – Furnace, no control equipment
- Metal Melted – Aluminum

<table>
<thead>
<tr>
<th>Run Number</th>
<th>Amount Processed (lbs)</th>
<th>Source Test Results (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Arsenic</td>
</tr>
<tr>
<td>1</td>
<td>57,280</td>
<td>0.000348</td>
</tr>
<tr>
<td>2</td>
<td>55,320</td>
<td>0.000220</td>
</tr>
<tr>
<td>3</td>
<td>55,500</td>
<td>0.000320</td>
</tr>
</tbody>
</table>
Source Test Data – Example #2

- Equipment Tested – Furnace vented to baghouse
- Metal Melted – Steel

<table>
<thead>
<tr>
<th>Run Number</th>
<th>Amount Processed (lbs)</th>
<th>Source Test Results (lbs)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Chromium</td>
<td>Hexavalent Chromium</td>
</tr>
<tr>
<td>1</td>
<td>2,810</td>
<td>0.00013</td>
<td>0.00004</td>
</tr>
<tr>
<td>2</td>
<td>4,064</td>
<td>0.00025</td>
<td>0.00019</td>
</tr>
<tr>
<td>3</td>
<td>2,711</td>
<td>0.00068</td>
<td>0.00050</td>
</tr>
</tbody>
</table>
## Hexavalent Chromium Conversion Rates

<table>
<thead>
<tr>
<th>Source Test</th>
<th>Chromium (lbs)</th>
<th>Hexavalent Chromium (lbs)</th>
<th>Percent of Hexavalent Chromium*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example 1 (Aluminum, Uncontrolled) - Run 1</td>
<td>0.000920</td>
<td>0.000030</td>
<td>3%</td>
</tr>
<tr>
<td>Example 1 (Aluminum, Uncontrolled) - Run 2</td>
<td>0.000248</td>
<td>0.000030</td>
<td>12%</td>
</tr>
<tr>
<td>Example 1 (Aluminum, Uncontrolled) - Run 3</td>
<td>0.000296</td>
<td>0.000052</td>
<td>18%</td>
</tr>
<tr>
<td>Example 2 (Steel, Controlled) - Run 1</td>
<td>0.00013</td>
<td>0.00004</td>
<td>31%</td>
</tr>
<tr>
<td>Example 2 (Steel, Controlled) - Run 2</td>
<td>0.00025</td>
<td>0.00019</td>
<td>76%</td>
</tr>
<tr>
<td>Example 2 (Steel, Controlled) - Run 3</td>
<td>0.00068</td>
<td>0.00050</td>
<td>74%</td>
</tr>
</tbody>
</table>

* Percent of Hexavalent Chromium to Total Chromium (Hexavalent Chromium / Chromium)
Initial Observations of Two Source Tests

• Percentage of hexavalent chromium conversion was substantially lower in furnace melting aluminum as compared to furnace melting steel

• Staff is continuing to evaluate other source tests – data is very limited

• SCAQMD is planning on conducting source testing to obtain additional information
Concepts for Establishing Point-Source Emission Rate Limits

• Depending on how the emission limit is established will dictate the type of source test(s) needed:
  • PM emission limit – PM source test
  • Toxic metal particulate emission limit – Multi-metals source test PLUS a hexavalent chromium source test

• Assessing an approach that will minimize the number of source tests a facility would be required to conduct
Concept for Establishing Point Source Emission Rate Limits (cont.)

• Establish the level of point source controls that can achieve that specified risk level for:
  • Types of metals
  • Amount of metals processed

• PM source testing would verify that the control efficiency of the point source control

• Approach limits the source testing to PM for most facilities
Establishing Thresholds

• Create bins based on alloys processed and annual production
  • Bins will determine levels of housekeeping, enclosures, point source requirements, and source test frequency
  • Low chromium alloys and high chromium alloys will be in different bins
  • High annual production facilities and low annual production facilities will be in different bins

• Bins will be established based on cancer screening risk values (Table 1.1 of Permit Application Package “M” used for SCAQMD Risk Assessment Procedures)

• Facilities that produce both high and low chromium alloys would be categorized in the higher bins
Determining a Facility’s Bin

• Step 1
  • Facilities segregated by chromium content in alloys
    • Schedule A – Facilities exclusively melting low chromium alloys (alloys with chromium content ≤ 1%)
    • Schedule B – All other facilities

• Step 2
  • Determine annual production to establish bin (numbers are examples)

<table>
<thead>
<tr>
<th>Bin</th>
<th>Cancer Screening Risk</th>
<th>Schedule A (≤ 1% chromium) (tons/year)</th>
<th>Schedule B (≥ 1% chromium) (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exempt</td>
<td>&lt; 1 x 10⁻⁶</td>
<td>300</td>
<td>0.4</td>
</tr>
<tr>
<td>1</td>
<td>10 x 10⁻⁶</td>
<td>3,000</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>25 x 10⁻⁶</td>
<td>7,400</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>100 x 10⁻⁶</td>
<td>29,600</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>&gt; 100 x 10⁻⁶</td>
<td>&gt; 29,600</td>
<td>&gt; 40</td>
</tr>
</tbody>
</table>
Possible Requirements for Bins

**Bin 1**
- Housekeeping
- Recordkeeping

**Bin 2**
- Building Enclosure
- Housekeeping
- Control Efficiency of a Baghouse
- Recordkeeping
- Periodic Source Testing (PM)

**Bin 3**
- Total Enclosure
- Enhanced Housekeeping
- Control Efficiency of a HEPA Baghouse
- Recordkeeping
- Annual Source Testing (PM)

**Bin 4**
- Total Enclosure
- Enhanced Housekeeping
- Control Efficiency of a ULPA Baghouse
- Recordkeeping
- Annual Source Testing (Metals)
Determination of Bins

• Step 1 – Determined emission rate for each toxic air contaminant for low chromium alloy and high chromium alloy

• Step 2 – Correlate emission rate with cancer screening risk and toxic air contaminant that is the risk driver

• Step 3 – Calculate tons of risk driver processed to reach cancer screening risk thresholds
Possible Level for Health Risk Threshold

- Considering a cancer screening risk value of $10 \times 10^{-6}$, meteorology, and closest receptor distance
  - Table 1.1 of Permit Application Package “M” used for SCAQMD Risk Assessment Procedures

- Annual limits for worst case meteorology and closest receptor at 100 m

<table>
<thead>
<tr>
<th>Toxic Air Contaminant</th>
<th>Arsenic</th>
<th>Cadmium</th>
<th>Hexavalent Chromium</th>
<th>Nickel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Limit (lbs)</td>
<td>0.0301</td>
<td>0.234</td>
<td>0.00431</td>
<td>3.9</td>
</tr>
</tbody>
</table>

- Average distances for residents are 100 meters
- Considering 10 in a million – remaining health risk will be attributed to fugitive emissions
- These are initial concepts – seeking input
**Example #1 – Uncontrolled Aluminum Furnace (Schedule A)**

**Step 1: Determination of Average Emission Rate**

<table>
<thead>
<tr>
<th>Run Number</th>
<th>Amount Processed (lbs)</th>
<th>Amount Processed (tons)</th>
<th>Source Test Results (lbs)</th>
<th>Average Emission Rate (lb/ton processed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Arsenic</td>
<td>0.000011</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cadmium</td>
<td>0.000021</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chromium</td>
<td>0.000017</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hexavalent Chromium</td>
<td>0.000001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nickel</td>
<td>0.000001</td>
</tr>
<tr>
<td>1</td>
<td>57,280</td>
<td>28.64</td>
<td>0.000348</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>55,320</td>
<td>27.66</td>
<td>0.000220</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>55,500</td>
<td>27.75</td>
<td>0.000320</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>56,033</td>
<td>28.01</td>
<td>0.000296</td>
<td>0.000011</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.000589</td>
<td>0.000021</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.000488</td>
<td>0.000017</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.000037</td>
<td>0.000001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.000276</td>
<td>0.000001</td>
</tr>
</tbody>
</table>
Example #1

Step 2: Cancer Screening Risk Level and Determination of Risk Driver

<table>
<thead>
<tr>
<th>Toxic Air Contaminant</th>
<th>Arsenic (lbs/year)</th>
<th>Cadmium (lb/ton)</th>
<th>Chromium (lb/ton)</th>
<th>Hexavalent Chromium</th>
<th>Nickel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening Emission Levels*</td>
<td>0.0301</td>
<td>0.23</td>
<td>NA</td>
<td>0.00431</td>
<td>3.86</td>
</tr>
<tr>
<td>Emission Rate (lb/ton processed)</td>
<td>0.000011</td>
<td>0.000021</td>
<td>0.000017</td>
<td>0.000001</td>
<td>0.000001</td>
</tr>
<tr>
<td>Tons of Alloy before Screening Emission Level Exceeded**</td>
<td>2,736</td>
<td>11,142</td>
<td>NA</td>
<td>4,310</td>
<td>3,860,000</td>
</tr>
</tbody>
</table>

- Risk driver is toxic air contaminant that will exceed Screening Emission Level with least amount of metal processed

* Cancer risk at ten in a million (10 \times 10^{-6}), worst case meteorology, resident at 100 m
** Tons of Alloy = Screening Emission Level/Emission Rate
Example #1

Step 3: Calculate Tons Processed to Exceed Threshold

<table>
<thead>
<tr>
<th>Bin</th>
<th>Cancer Screen Risk</th>
<th>Tons Processed (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exempt</td>
<td>&lt; 1 x 10^{-6}</td>
<td>300</td>
</tr>
<tr>
<td>1</td>
<td>10 x 10^{-6}</td>
<td>3,000</td>
</tr>
<tr>
<td>2</td>
<td>25 x 10^{-6}</td>
<td>7,400</td>
</tr>
<tr>
<td>3</td>
<td>100 x 10^{-6}</td>
<td>29,600</td>
</tr>
<tr>
<td>4</td>
<td>&gt; 100 x 10^{-6}</td>
<td>&gt; 29,600</td>
</tr>
</tbody>
</table>
Point-Source Emission Rate Approach

- Seeking input on approach
- Expected that facilities with higher annual production and those with higher levels of chromium would be placed in higher bins (Bins 3 or 4)
  - More source tests needed to confirm
  - More examples will be provided
Schedule

- Site Visits: Ongoing
- Source Tests: TBD
- Additional Working Groups: TBD
- Public Workshop: June 2018
- Set Hearing: July 6, 2018
- Stationary Source Committee: July 20, 2018
- Public Hearing: September 7, 2018
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