Proposed Rule (PR) 1407.1
Control of Toxic Air Contaminant Emissions from Chromium Alloy Melting Operations

Working Group Meeting #9
July 9, 2020

Join Zoom Meeting
https://scaqmd.zoom.us/j/96042511150
Meeting ID: 960 4251 1150

Agenda

- Summary of Working Group Meeting #8
- Rule Concepts for Point Source Control Requirements
- Next Steps




Summary of Working Group Meeting #8

- Background and Overview of Rule Development Process
- Facility A and C Source Test Results
  - Will be posted on South Coast AQMD PR 1407.1 Proposed Rules Web Page
  - Summary of Results
    - Formation of hexavalent chromium during metal melting process
    - High Efficiency Particulate Air (HEPA) filter air pollution controls reduced toxic air contaminant emissions
    - Collection efficiency could be improved
- Purpose and Applicability
- Universe of Facilities and Furnaces
- Overview of Key Elements of PR 1407.1

Working Group Meeting #8 – Comments from Stakeholders

Stakeholder Comment

Will staff consider establishing process limits based on emission factors (i.e. mass emissions of hexavalent chromium per unit of chromium alloy processed)?

Staff Response

- Staff will not establish limits based on emission factors
  - Emission factors would vary depending on chromium alloy processed
- Staff prefers to establish a mass emission standard

Working Group Meeting #8 – Comments from Stakeholders

Stakeholder Comment

- Source tests were conducted on air melt furnaces, not vacuum melt furnaces
- Will staff take into consideration the difference between air and vacuum melt furnaces?

Staff Response

- Source testing was conducted to verify formation of hexavalent chromium from chromium alloy melting
- Considering having all furnaces that melt chromium alloys meet the same mass emission standard

Working Group Meeting #8 – Comments from Stakeholders

Stakeholder Comment	Staff Response
How will staff address facilities that melt small quantities of chromium alloys?	Through the rulemaking process, staff will work with the working group to address small quantity operations

Stakeholder Comment	Staff Response
What was the linear distance from the source-tested furnaces to the combined inlet of the pollution control device?	• Facility A: Approximately 70 feet • Facility C: Approximately 120 feet

General Overview of PR 1407.1

PR 1407.1

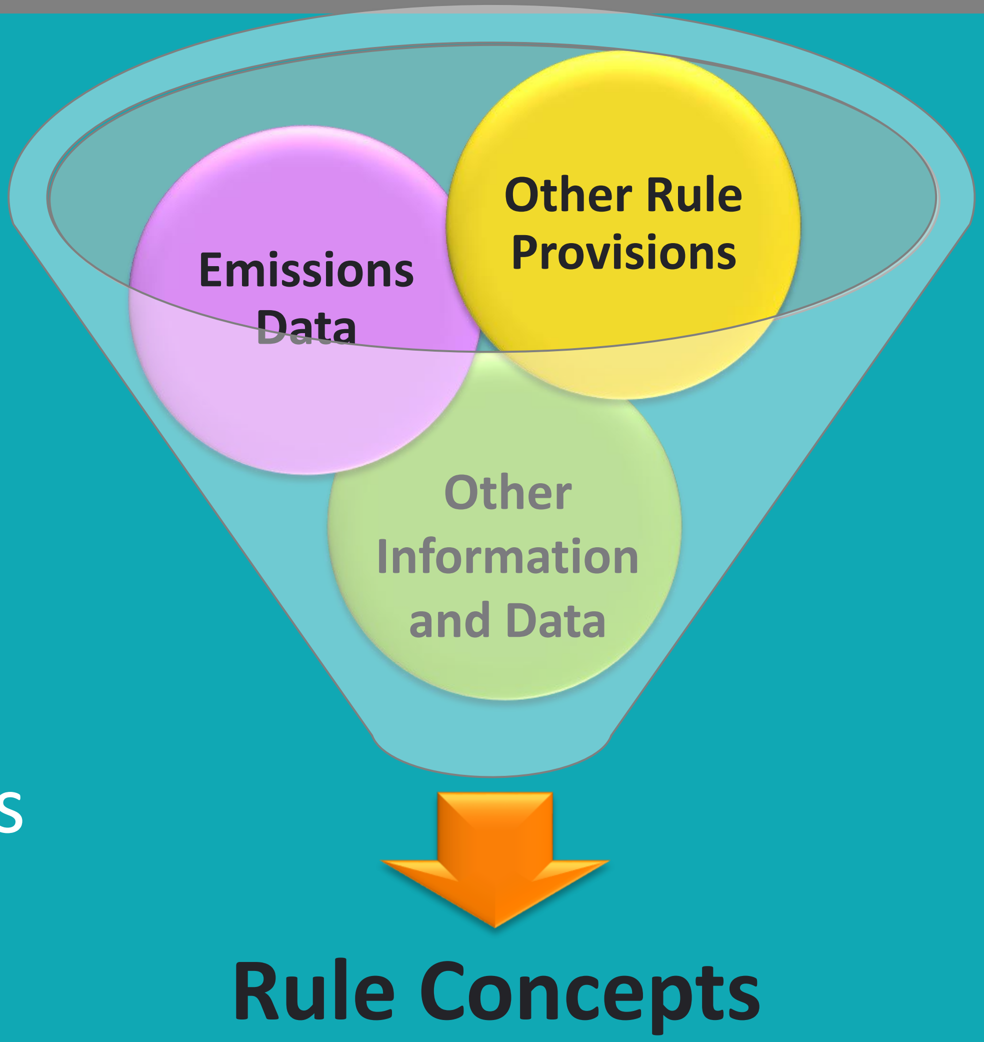
- **Point Source Control Requirements**
  - Collection Efficiency
  - Point Source Standard
- **Fugitive Emission Requirements**
  - Housekeeping
  - Building Enclosures
- **Emissions Testing Requirements**
  - Material Testing
  - Source Testing
  - Parameter Monitoring
- **Recordkeeping**
  - Raw Materials Processed
  - Emissions Testing Data
  - Housekeeping & Inspections
- **Exemptions**
  - Small Quantity
  - Rules 1420 & 1420.2

Today's Meeting

Presenting rule concepts for Point Source Control Requirements

Rule Concepts – Overview

- Rule concepts are initial thoughts for proposed provisions and take into consideration:
  - Provisions in other toxic metal rules
  - Emissions data specific to the applicable sources
  - Other information and data
- Stakeholder input on rule concepts helps shape Proposed Rule Language

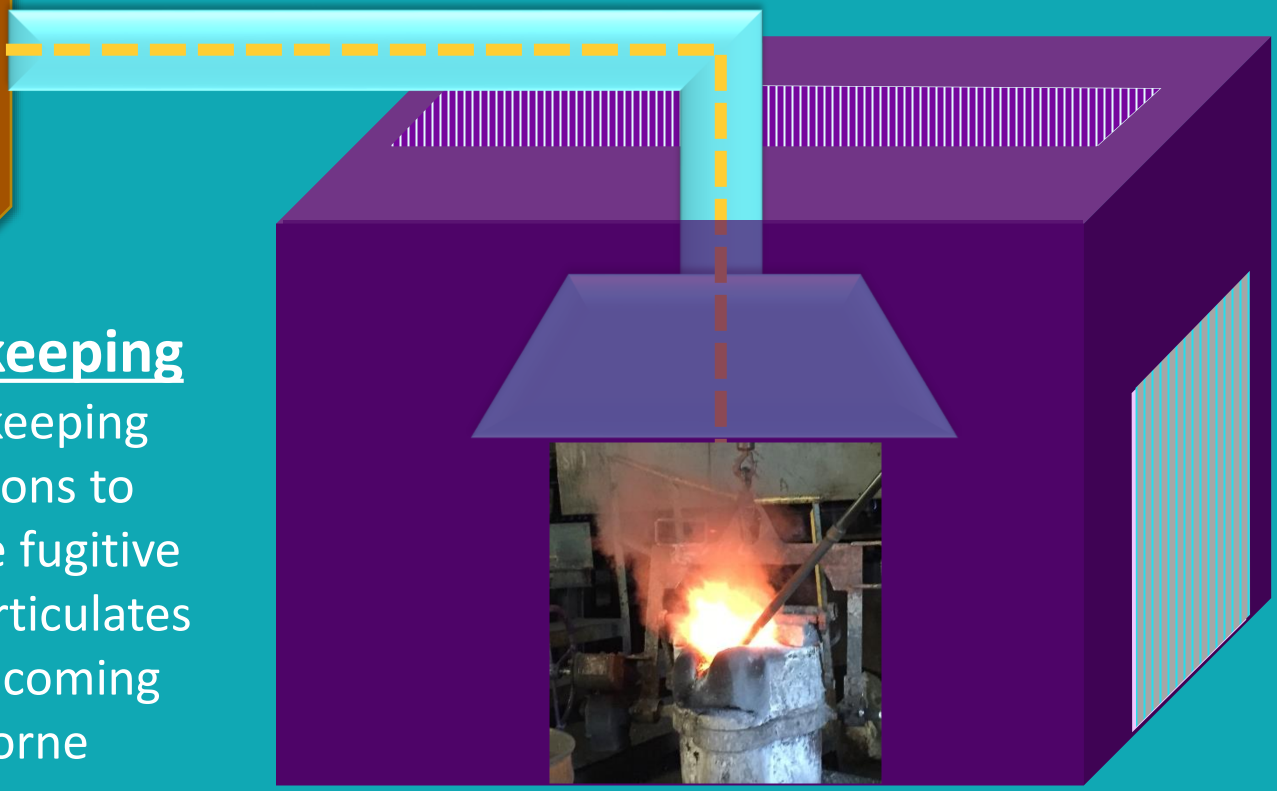


Rule Concepts for Point Source Control Requirements

Three Key Control Elements to Address Metal Toxics

Point Source Controls

Point source emission controls to reduce metal toxics at the source



Enclosures

Enclosure, with minimal openings for ingress and egress, to contain fugitive metal particulate emissions

Housekeeping

Housekeeping provisions to minimize fugitive metal particulates from becoming airborne

Toxic Air Contaminants from Chromium Alloy Melting

- Point source control requirements will be designed to address:
  - Arsenic, including gaseous arsenic
  - Cadmium
  - Hexavalent Chromium
  - Nickel

Arsenic as a Gaseous Emission

- Arsenic or arsenic trioxide can vaporize below typical furnace operating temperatures
  - Baghouse testing at a lead facility identified arsenic emissions in gaseous form*
- Gaseous arsenic is not expected to be a pollutant of concern in chromium alloy melting operations
  - Arsenic is generally a trace contaminant in chromium alloys
  - Arsenic source testing results at Facility A and Facility C are non-detect
- If melting a metal containing significant amounts of arsenic, gaseous arsenic emissions are possible and would require additional controls
  - Typical particulate control methods are not suitable for gaseous emissions

* Source Test Report 13-307 and 13-308, South Coast AQMD, October 2013
http://www.aqmd.gov/docs/default-source/exide/exide-sourcetestaug-sept.pdf?sfvrsn=2

Key Elements of Point Source Control Requirements

Collection Efficiency

Ensures the pollution control device has the appropriate design and operating parameters to collect emissions

Point Source Standard

Ensures that the pollution control devices will meet a specified standard which can be a technology, control efficiency or a mass emission limit

- Two key elements of the point source control requirements:
  - Collection efficiency
  - Point source standard
- Furnaces melting chromium alloys must meet both elements of point source control requirements

Importance of Collection Efficiency

- Proper collection efficiency ensures pollutants are directed to the pollution control device
  - Incomplete capture and insufficient air flow can result in fugitive emissions
  - Too much air flow can result in excess loading of pollution control device
  - Clogged or blocked vents or slots can reduce the collection efficiency resulting in increased fugitive emissions
- Proper collection efficiency is also dependent on external conditions
  - Cross-drafts can interfere with the collection efficiency resulting in fugitive emissions
- Collection efficiency provisions have been included in all toxic metal rules

Rule Concept for Collection Efficiency Provisions

- Recently adopted or amended metal toxic rules require that the collection efficiency of pollution controls be based on the applicable standards of the *Industrial Ventilation: A Manual of Recommended Practice for Design* published by the American Conference of Governmental Industrial Hygienists (ACGIH)
- Industrial Ventilation Manual provides recommended practices for the design and operation of:
  - Hood type and proximity
  - Capture velocity
  - Face velocity
  - Slot velocity
  - Duct velocity
  - Flow rate
  - Hood entry loss

Importance of Point Source Standards

- Point source standard establishes the standard for the air contaminant(s) released from the stack
- Ensures emissions from the source or process meet a specific standard that is health protective

Three General Approaches for Point Source Standards

Technology-Based

- Requires a specific pollution control technology (i.e. baghouse)
  - Includes requirements addressing proper operation of control technology

Control Efficiency

- Requires a minimum percent reduction from the inlet to the outlet of the pollution control device (i.e. 99% control efficiency)

Mass Emission Standard

- Limits the mass of a pollutant per unit of time at the outlet or exhaust of the stack (i.e. 0.000066 pounds of arsenic per hour)

- Approaches are not mutually exclusive
- Control efficiency can be based on a specific technology (i.e. 99% control efficiency based on a baghouse)
- Mass emission standard can be based on a specific technology, desired control efficiency

Approach for Point Source Standard

- Staff is proposing a mass emission point source standard based on industry source test results
  - Incorporates mass emission level achieved with current filtration technology – HEPA filtration
- Staff is proposing a mass emission standard for hexavalent chromium because hexavalent chromium is the risk driver
  - Approach is based on if hexavalent chromium is controlled, other metal particulate toxic air contaminants are concurrently reduced
  - Focusing on one toxic air contaminant will streamline implementation and reduce source testing costs
- To ensure approach is health protective, staff estimated the health risk for affected facilities
- Next slides will provide more detail regarding:
  - Why staff is focusing on mass emission limit for hexavalent chromium
  - Verification that the proposed hexavalent chromium point source standard will be health protective

Overview of Establishing Point Source Standard Based on Hexavalent Chromium

1. Establish that Hexavalent Chromium is the Risk Driver
2. Set an Initial Mass Emission Standard for Hexavalent Chromium Based on Source Tests
3. Verify that the Initial Mass Emission Standard for Hexavalent Chromium is Health Protective for All Affected Facilities
4. If Initial Mass Emission Standard for Hexavalent Chromium is Not Health Protective, Set Lower Emission Limit

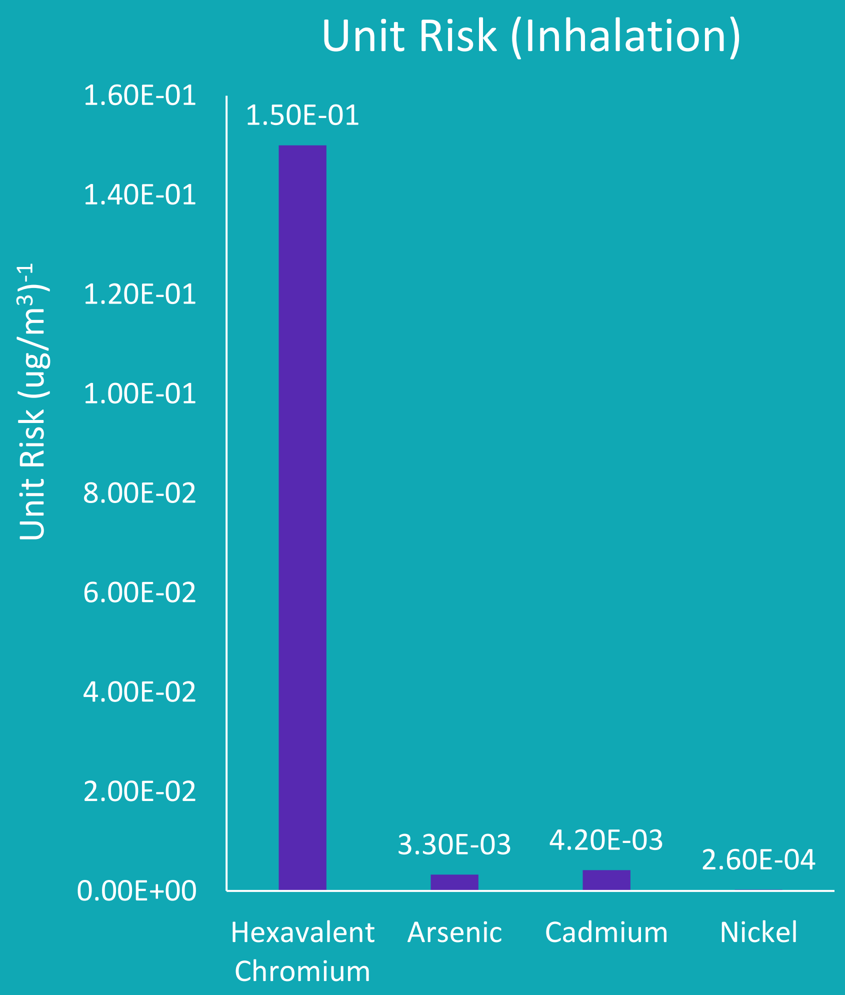
Establishing Hexavalent Chromium as the Risk Driver

- The cancer risk driver refers to the specific toxic air contaminant that dominates the estimated cancer health risk from a specific source
- Establishing a mass emission limit based on the cancer risk driver provides an overall reduction in health risk
- Mass emission limit is based on hexavalent chromium because it is the cancer risk driver when compared to arsenic, cadmium, and nickel
- Components to determine hexavalent chromium is the cancer risk driver are:
  - Cancer potency of hexavalent chromium relative to the other metal toxic air contaminants
  - Amount of each toxic air contaminant, accounting for the cancer potency

Main Components in Determining Hexavalent Chromium is the Cancer Risk Driver	
Potency of the Hexavalent Chromium Relative to the other Metal Toxic Air Contaminants	Amount of Each Toxic Air Contaminant, Accounting for the Potency

Cancer Potency of Hexavalent Chromium Relative to the Other Metal Toxic Air Contaminants

- The California Office of Environmental Human Health Assessment publishes the cancer potency of toxic air contaminants*
- Cancer potency provides the potency based on the dose and response of a specific toxic air contaminant
- Cancer potency is based on the unit risk for the various pathways (inhalation, oral, etc.)
  - All four toxic air contaminants have unit risk values for inhalation*
- Based on the inhalation unit risk:
  - Hexavalent chromium is two orders of magnitude more potent than arsenic and cadmium and three orders of magnitude more potent than nickel



* Appendix A: Hot Spots Unit Risk and Cancer Potency Values, OEHHA, May 2019
https://oehha.ca.gov/media/CPFs042909.pdf

Determining the Amount of Each Toxic Air Contaminant, Accounting for the Cancer Potency

- Although the cancer potency of hexavalent chromium is significantly higher than the arsenic, cadmium, and nickel
  - It is possible that the mass emissions of arsenic, cadmium, or nickel can be the risk driver if their mass emissions are substantially higher than hexavalent chromium
- To determine if arsenic, cadmium, or nickel are the risk driver based on mass emissions the following steps were taken:

Step 1:
Use Mass Emissions from Source Test of:
- Hexavalent Chromium
- Arsenic
- Cadmium
- Nickel

→

Step 2:
Based on Potency, Calculate Amount of Emissions Needed for a Metal Toxic Air Contaminant to be the Risk Driver

→

Step 3:
Compare Mass Emissions from the Source Test (Step 1) to Thresholds (Step 2)

If Metal Toxic Air Contaminant is Below Threshold, Hexavalent Chromium is the Risk Driver

Mass Emissions from Source Tests

Step 1:
Use Mass Emissions from Source Test for:

- Hexavalent Chromium
- Arsenic
- Cadmium
- Nickel

- The two industry source tests were used to evaluate the contribution of each toxic air contaminant

Toxic Air Contaminant	Source Test Results	
	Facility A Outlet (lb/hr)	Facility C Outlet (lb/hr)
Arsenic	Non-Detect (<6.87E-05)	Non-Detect (<1.26E-05)
Cadmium	Non-Detect (<6.87E-05)	Non-Detect (<1.26E-05)
Hexavalent Chromium	Non-Detect (<3.82E-06)	Non-Detect (<1.72E-06)
Nickel	1.62E-04	1.56E-05

Calculate Amount of Emissions Needed for Arsenic, Cadmium, or Nickel to be the Risk Driver

Step 2:
Based on Potency, Calculate Amount of Emissions Needed for a Metal Toxic Air Contaminant to be a Risk Driver

- To determine the amount of emissions needed for arsenic, cadmium, or nickel to be the risk driver
  - The cancer potency of each toxic air contaminant is compared to the cancer potency of hexavalent chromium (i.e. arsenic ratio = 0.150/0.0033)

Toxic Air Contaminant	Unit Risk $(ug/m^3)^{-1}$	Ratio of Unit Risk of Hexavalent Chromium to Toxic Air Contaminant
Hexavalent Chromium	0.15000	1
Arsenic	0.00330	45
Cadmium	0.00420	36
Nickel	0.00026	577

Arsenic emissions would need to be more than 45 times higher than hexavalent chromium emissions to be the risk driver

Compare Source Tests to Thresholds

Step 3:
Compare Mass Emissions from the Source Test (Step 1) to Thresholds (Step 2)

If Metal Toxic Air Contaminant is Below Threshold, Hexavalent Chromium is the Risk Driver

Toxic Air Contaminant	Unit Risk $(ug/m^3)^{-1}$	Ratio of Unit Risk of Hexavalent Chromium to Toxic Air Contaminant	Ratio of Emission Rate of Toxic Air Contaminant to Hexavalent Chromium	
			Facility A	Facility C
Hexavalent Chromium	0.15000	1	*	*
Arsenic	0.00330	45	18*	7*
Cadmium	0.00420	36	18*	7*
Nickel	0.00026	577	42	9

* Source test results were non-detect

- Based on the two source tests, arsenic, cadmium, and nickel emissions are well below levels that would exceed hexavalent chromium as the risk drivers
  - Source test results for hexavalent chromium, arsenic, and cadmium were non-detect, so assumed that emission rate is at the detection limit for the purpose of emission ratio calculation
- For chromium alloy melting operations, based on cancer potency and amount of toxic air contaminants, hexavalent chromium is the risk driver

Contribution of Arsenic, Cadmium, and Nickel Emissions to Overall Cancer Risk

Step 3:
Compare Mass Emissions from the Source Test (Step 1) to Thresholds (Step 2)

If Metal Toxic Air Contaminant is Below Threshold, Hexavalent Chromium is the Risk Driver

Toxic Air Contaminant	Unit Risk $(ug/m^3)^{-1}$	Ratio of Unit Risk of Hexavalent Chromium to Toxic Air Contaminant	Ratio of Emission Rate of Toxic Air Contaminant to Hexavalent Chromium (Percent of Overall Cancer Risk)	
			Facility A	Facility C
Hexavalent Chromium	0.15000	1	---	---
Arsenic	0.00330	45	*	*
Cadmium	0.00420	36	*	*
Nickel	0.00026	577	42 (6.8%)	9 (1.6%)

* Not applicable due to non-detect results

- Based on the two source tests, arsenic and cadmium would not contribute to the overall cancer risk from toxic air contaminant emissions
  - Source test results for inlet and outlet of arsenic and cadmium were trace or non-detect
- Based on the emission ratios of nickel to hexavalent chromium from the source test results, nickel would represent less than 10% of the overall cancer risk from toxic air contaminant emissions
- For chromium alloy melting operations, contribution of other toxic air contaminant emissions to overall cancer risk is minor

Overview of Initial Proposed Mass Emission Standard

- Staff proposes to set a mass emission standard for hexavalent chromium based on outlet mass emission rates achieved in practice by emission control systems that are rated to achieve a minimum filtration of 99.97% for 0.3 µm or larger particulate size
- Proposed mass emission standard is in pounds per hour (lb/hr)
- Mass emission standard will be an aggregate standard based on the sum of all outlet or exhaust stack emissions from chromium alloy melting furnaces at a facility
  - Similar approach used for Rule 1407
- Ensured a mass emission standard based on hexavalent chromium is health protective
  - Air dispersion modeling was conducted to estimate the health risk at different sensitive receptor distances
  - If possible, known information about affected facilities was used for assumptions; otherwise, conservative assumptions were used

Initial Proposed Mass Emission Standard

- Both source-tested facilities used High Efficiency Particulate Air (HEPA) controls that reduced hexavalent chromium to non-detect levels
  - HEPA is rated at 99.97% control efficiency for 0.3 µm or larger particulate size
- Based on these source test results, proposing a mass emission standard of 4.00E-06 lb/hr for hexavalent chromium

Toxic Air Contaminant	PR 1407.1 Source Test Results		Proposed Mass Emission Standard (lb/hr)
	Facility A HEPA Outlet (lb/hr)	Facility C HEPA Outlet (lb/hr)	
Hexavalent Chromium	Non-Detect (<3.82E-06)	Non-Detect (<1.72E-06)	4.00E-06

Verifying the Mass Emission Standard is Health Protective

- To ensure that a hexavalent chromium mass emission limit of 4.00E-06 lb/hr is health protective, staff converted the hourly emission rate to an annual rate of 2.34E-02 lb/yr* and estimated the cancer risk for each of the affected facilities
- Used air dispersion modeling to estimate cancer risk at the closest sensitive receptor (resident, hospital, school, or early education center)
- To verify if the annual hexavalent chromium mass emission rate of 2.34E-02 lb/yr is health protective, the following steps were taken:

Step 1: Identify Cancer Risk Threshold for Evaluating Facility Cancer Risks → Step 2: Estimate Cancer Risk for Affected Facilities → Step 3: Compare Facility Cancer Risks (Step 2) to the Cancer Risk Threshold (Step 1) → Step 4: If the Facility Cancer Risk is Above the Threshold, Adjust the Mass Emission Rate

* Proposed mass emission standard (lb/hr) converted to annual rate assuming operating schedule of 16 hours, 365 days

Cancer Risk Threshold

Step 1:
Identify Cancer
Risk Threshold for
Evaluating Facility
Cancer Risks

- Rule 1402 establishes cancer risk thresholds for facilities that are required to conduct a health risk assessment to implement the AB 2588 Hot Spots program
- Risk thresholds under Rule 1402 are designed to address facility-wide emissions at existing facilities
- There are two key cancer risk levels:
  - Action Risk Level which is a Maximum Individual Cancer Risk of 25 in-a-million
  - Notification Risk Level which is a Maximum Individual Cancer Risk of 10 in-a-million
- For PR 1407.1, staff is proposing to use the Notification Risk Level of 10 in-a-million as the cancer risk threshold
  - Using the Notification Risk Level provides greater assurance that if there are other sources of toxic emissions within the facility, facility-wide the facility will be more likely to be under the Action Risk Level of 25 in-a-million

Assumptions for Estimating the Facilities Cancer Risks

Step 2:
Estimate Cancer Risk for Affected Facilities

Likely Meteorological Conditions at Affected Facilities

- USC/Downtown Los Angeles and Long Beach Airport MET stations

Source

- Factors that characterize the source emissions
  - Exhaust stack height of 10 meters
  - Operating schedule of 16 hours (4 am – 8 pm), 365 days a year
  - Potency of hexavalent chromium

Receptor

- Distance to the nearest sensitive receptor (residential, schools, etc.) measured from the center of the exhaust stack to the fenceline of the sensitive receptor
- Assume nearest sensitive receptor in downwind direction

Estimated Cancer Risks for Affected Facilities

Step 2:
Estimate Cancer Risk for Affected Facilities

Annual Emission Rate at Initial Proposed Mass Emission Standard for Hexavalent Chromium
2.34E-02 lb/yr

Nearest Sensitive Receptor Distance* (m)		
< 50	50 – 99	≥ 100
Number of PR 1407.1 Facilities		
1	1	9
Estimated Cancer Risk (in-a-million)		
45 (at 25 m)	12 (at 60 m)	8 (at 100 m)

* Approximate distances

Comparison of Estimated Facility Cancer Risks to Threshold

Step 3: Compare Facility Cancer Risks (Step 2) to the Cancer Risk Threshold (Step1)

Nearest Sensitive Receptor Distance (m)		
< 50	50 – 99	≥ 100
Number of PR 1407.1 Facilities		
1	1	9
Estimated Cancer Risk (in-a-million)		
45 (at 25 m)	12 (at 60 m)	8 (at 100 m)
Is Estimated Cancer Risk Below 10 in-a-million Threshold?		
Above	Above	Below

- Two facilities have an estimated cancer risk above the threshold of 10 in-a-million
  - 1 facility < 50 meters
  - 1 facility between 50 and 99 meters
- Estimated cancer risk for remaining 9 facilities is below the threshold of 10 in-a-million

Adjusting Mass Emission Standard for Facilities with Estimated Cancer Risk Above Threshold

Step 4:
If the Facility Cancer Risk is Above the Threshold, Adjust the Mass Emission Rate

- For two facilities with an estimated cancer risk above the threshold, adjust the mass emission rate of hexavalent chromium to meet cancer risk of 10 in-a-million
  - Use the ratio of the initial proposed mass emission standard to estimated cancer risk to determine adjusted emission rate
    (i.e. adjusted emission rate for facility with estimated cancer risk of 12 in-a-million = (4.00E-06/12)*10)

Nearest Sensitive Receptor (m)	Estimated Cancer Risk (in-a-million) at 4.00E-06 lb/hr	Adjusted Mass Emission Rate (lb/hr) to Meet Cancer Risk Threshold of 10 in-a-million
< 50	45 (at 25 m)	8.89E-07
50 – 99	12 (at 60 m)	3.33E-06

- Establish additional mass emission standards based on adjusted mass emission rates

Proposed Mass Emission Standards – Three Limits

Proposed Mass Emission Standards for Hexavalent Chromium (lb/hr)		
Sensitive Receptor < 50 Meters	**Sensitive Receptor 50 – 99 Meters**	**Sensitive Receptor ≥ 100 Meters**
8.89E-07	3.33E-06	4.00E-06

• May need Ultra Low Particulate Air (ULPA) controls to meet emission standard
  • ULPA is rated to achieve a minimum filtration of 99.9995% for 0.12 µm or larger particulate size
  • ULPA can provide one order of magnitude additional control
	• HEPA controls should achieve emission standard
	• May need to conduct a source test with longer test run to demonstrate standard
		• Achieve emission standard using HEPA controls

Additional Considerations for Non-Ferrous Melting

- Airborne Toxic Control Measure (ATCM) for Non-Ferrous Metal Melting* has requirements for controlling arsenic and cadmium
  - Superalloys are the only non-ferrous chromium alloy applicable to PR 1407.1
- Staff is considering limiting the arsenic and cadmium content from non-ferrous chromium alloy melting furnaces
  - Same content limits prescribed in ATCM for Non-Ferrous Metal Melting and Rule 1407 to qualify for Metal or Alloy Purity Exemption
  - Alloys to contain less than 0.002% arsenic and 0.004% cadmium
  - Arsenic and cadmium are generally trace contaminants in chromium alloys, therefore arsenic and cadmium emissions are not expected to be a concern

* Airborne Toxic Control Measure for Emissions of Toxic Metals from Non-Ferrous Metal Melting, CARB, 1998
https://ww2.arb.ca.gov/sites/default/files/classic//toxics/atcm/metalm.pdf

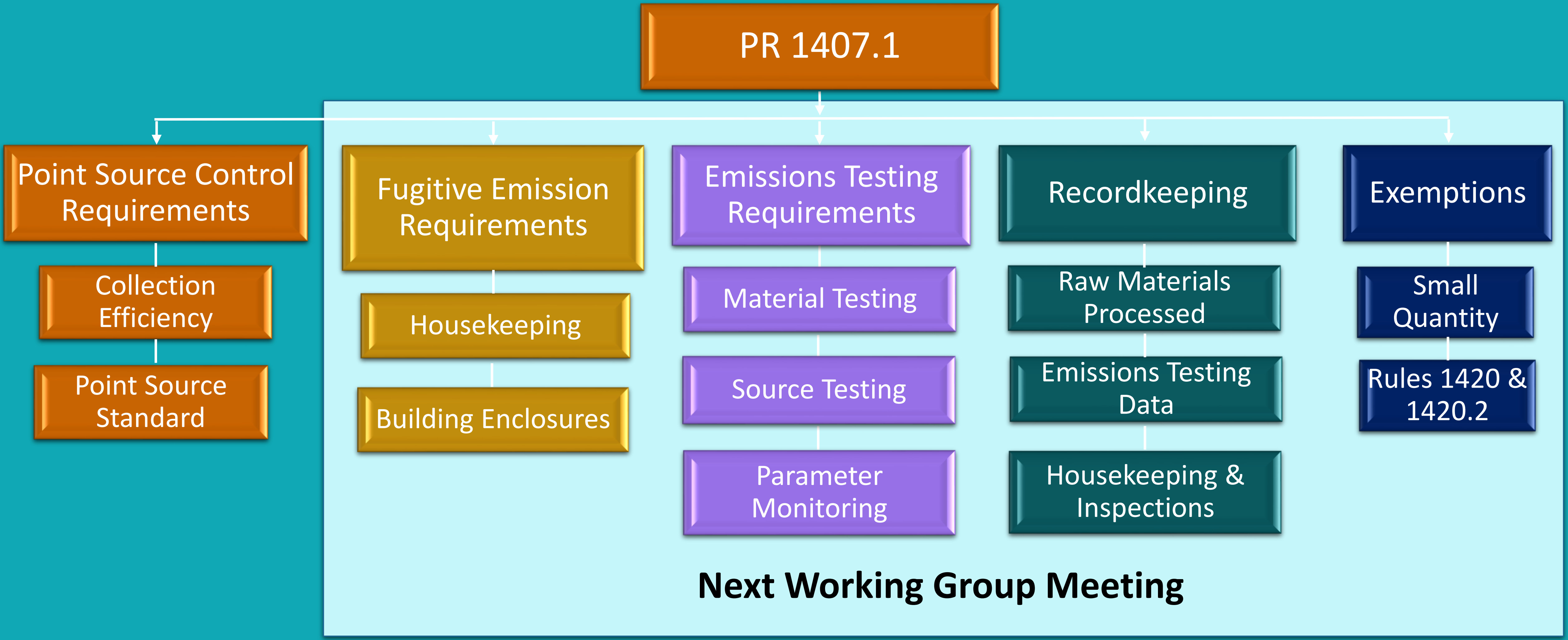
Summary of Proposed Point Source Standards

- Collection efficiency to follow recommendations set forth in the *Industrial Ventilation: A Manual of Recommended Practice for Design* (ACGIH)
- Mass emission standards for hexavalent chromium (lb/hr) based on distance to nearest sensitive receptor

Sensitive Receptor < 50 Meters (lb/hr)	Sensitive Receptor 50 – 99 Meters (lb/hr)	Sensitive Receptor ≥ 100 Meters (lb/hr)
8.89E-07	3.33E-06	4.00E-06

- Considering additional provisions necessary to ensure proper implementation of the standard for non-ferrous metal melting
  - Contents of non-ferrous metals not to exceed 0.002% for arsenic and 0.004% for cadmium

General Overview of PR 1407.1



Next Steps

Action	Target Dates
Next Working Group Meeting	Late July 2020
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

To receive e-mail notifications for Proposed Rule 1407.1, sign up at:
www.aqmd.gov/sign-up