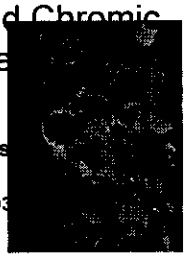
Evaluation of the Hexavalent Chromium Airborne Toxic Control Measure (ATCM) for Chrome Plating and Chromic Acid Anodizing Ope



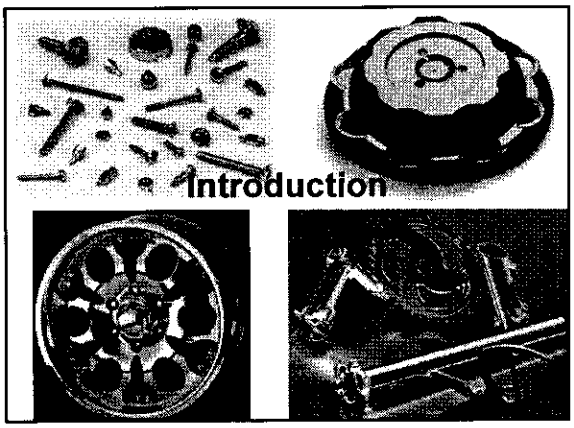
Stakeholder Workgroup Meetings
Fresno, CA - December 9, 2003
San Francisco, CA - December 10, 2003
El Monte, CA - December 11, 2003

Outline

- Introduction
- Regulatory background and activity
  - State
  - Federal
  - District
- Decorative chromium plating overview
  - Control Technology
  - Review of Emission Factors
  - Review of Available Source Test Data

Outline

- Decorative chromium plating emissions testing program
  - Overview
  - Results
    - Emission factors, Indoor levels, other parameters measured
  - Discussion
- Next steps



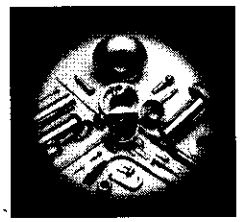
Background

- Identified by the ARB as a Toxic Air Contaminant (TAC) in 1986
- A potent human carcinogen
  - No threshold level
- Requirement for developing ATCMs
  - Reduce emissions to lowest level achievable through application of best available control technology or more effective method

Regulatory Background and Activity

- State Chrome Plating ATCM
  - Adopted in 1988
  - Amended in 1998 for equivalency with federal National Emission Standard for Hazardous Air Pollutants (NESHAP)
- Federal NESHAP
- Air Districts

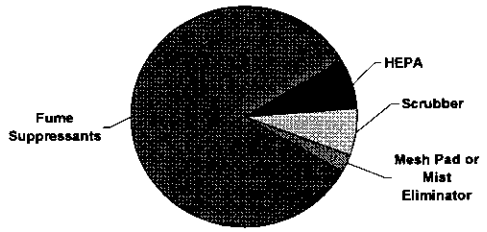
Decorative Chromium Plating Overview



Decorative Chromium Plating Standards

Method of Compliance	Requirement
Add-on air pollution control equipment, or chemical fume suppressants, or mechanical fume suppressants (i.e. polyballs)	$\leq$ 0.01 mg/dscm ($4.4\ 10^{-5}$ gr/dscf)
Chemical fume suppressants containing a wetting agent	$\leq$ 45 dynes/cm (3.1×10^{-3} lbF/ft)

Most Decorative Chromium Facilities Use Fume Suppressants



Note: Specific data for 121 operations in the State

Chemical Fume Suppressants

- Two types
  - Wetting agents that reduce surface tension
    - Fumetrol 140, Benchbrite Cr-1700 or Cr-1800, Dis Mist NP, Clepo Chrome Mist Control, Macuplex STR
  - Foam blankets
    - Fumetrol 101

Established Emission Factors

Decorative chromium plating tank controlled with fume suppressants

FEDERAL	STATE	DISTRICT
0.008 mg/A-hr	0.025 mg/A-hr	0.025 - 0.01 mg/A-hr

Available Source Test Data

- Source tests for decorative plating tanks
  - with no controls (4 tests)
    - 6.9 - 25.25 mg/amp-hr
  - with in tank controls (3 tests)
    - 0.002-0.04 mg/amp-hrs
  - with add-on controls (5 tests)
    - 0.0003 - 0.002 mg/amp-hr

Decorative Chromium Plating Emissions Testing Program

Program Overview

- To improve understanding of decorative chromium plating emissions from day to day operations
- Testing conducted by ARB staff with cooperation of air districts and industry
- Two phase testing program
  - Phase I - Ventilation system
  - Phase II - Without a ventilation system

Emissions Testing Program Phase I

Phase I - Facilities with a ventilation system

- Facilities tested
  - With in tank controls
    - fume suppressants
    - polyballs
  - With add-on controls
    - Composite mesh pad

Emissions Testing Program Phase I

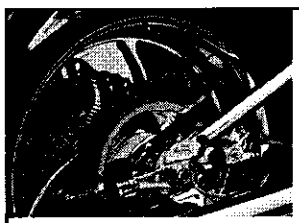
Each source test report includes

- Emission rates
  - Cr^{6+} and Cr^{total} (mg/Amp-hr)
- Indoor concentrations
  - Cr^{6+} or Cr^{total} (ng/ m^3)
- Surface tension readings
  - stalagmometer and tensiometer

Emissions Testing Program Phase I

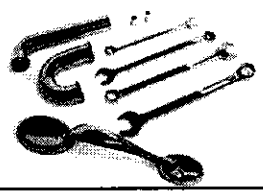
Each source test report includes (cont.)

- Other parameters measured
  - Chromic acid concentration
  - Plating tank temperature and freeboard height
  - Tank additions (chromic acid and fume suppressant)
  - Observations related to housekeeping
  - Smoke test results



Emission Testing Program Phase I

Facility Description & Results

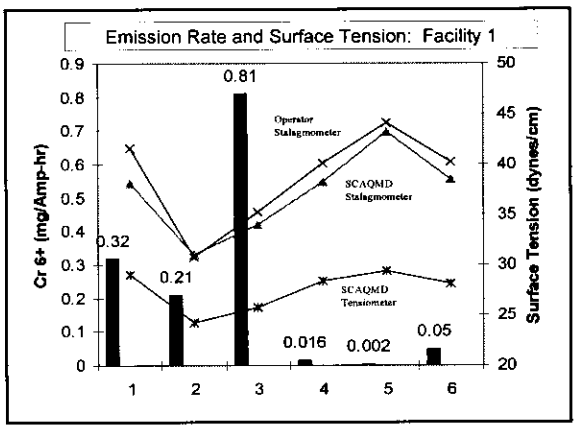


Facility 1 Description

- Test 1 & 2
  - Automated hoist line
  - Automotive parts
  - High production at high amperage
  - Efficient ventilation system
  - Average chromic acid concentration
  - Low freeboard height
  - Normal plating operation

Facility 1 Description

- Test 1 & 2
  - Facility controls
    - In tank controls
      - Benchbrite, Cr-1700 fume suppressant
    - Add-on controls:
      - Composite mesh pad and HEPA filter
  - Sampling points
    - After in tank controls
    - After composite mesh pad



Facility 1

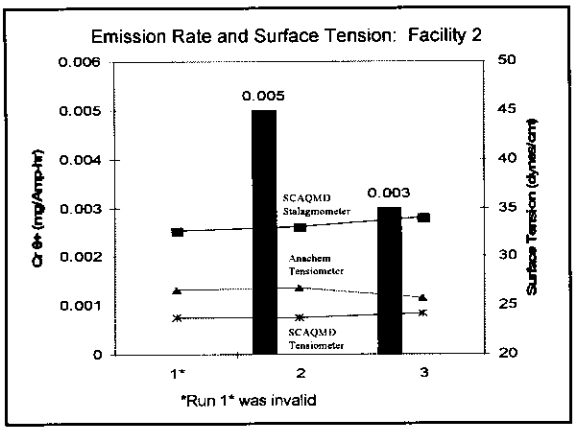
- Factors that may have affected emissions
  - Horizontal duct work
  - High ventilation rate with low freeboard
  - Wet duct
  - Shut down of the plating line

Facility 2 Description

- Test 3
  - Manual line
  - Small plumbing parts
  - Low production at low amperage
  - Efficient ventilation system
  - High chromic acid concentration, low surface tension
  - Supplemented production with dummy parts

Facility 2 Description

- Test 3
  - Facility controls
    - In tank controls
      - Atotech, Fumetrol fume suppressant
      - 100% coverage with polyballs
  - Sampling points
    - After in tank controls

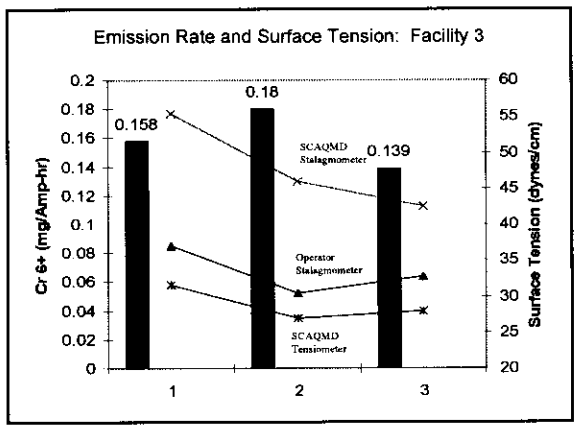


Facility 3 Description

- Test 4
  - Manual line
  - Variety of parts plated
  - Low production at low amperage
  - 60% efficient ventilation system
  - Low chromic acid concentration
  - Supplemented some production with dummy parts

Facility 3 Description

- Test 4
  - Facility controls
    - In tank controls
      - Atotech, Dis Mist NP fume suppressant
    - Add-on controls
      - Water scrubber
  - Sampling points
    - After in tank controls



Summary of Emission Rates for Fume Suppressant Controlled Tanks

	Emission Rates (mg/Amp-hr)		
Test 1	0.032	0.21	0.05
Test 2	0.81	0.016	0.002
Test 3*		0.016	0.007
Test 4*	0.26	0.30	0.23

Test 3* and Test 4* Adjusted for polyballs and ventilation system efficiency

Summary of Emission Rates for Tanks with Composite Mesh Pad

	Emission Rates (mg/Amp-hr)		
Test 2	0.002	0.003	0.002

Indoor Air Readings

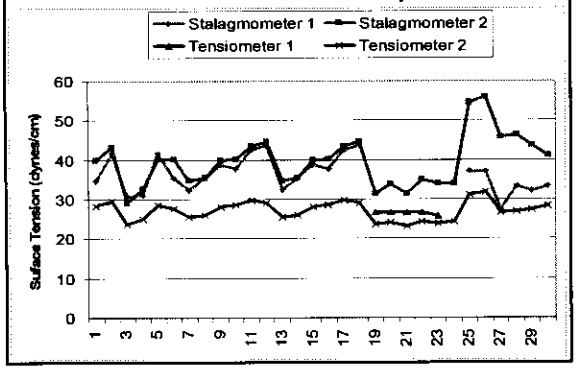
	Run 1	Run 2	Run 3
	Cr^{total} (ng/m^3)		
Test 1	131	391	
Test 2	346	285	157
	Cr^{6+} (ng/m^3)		
Test 3	220	197	106
Test 4	5.6	2.2	4.1

Summary of Other Parameters

	Test 1 & 2	Test 3*	Test 4*
Emission Rates (mg/Amp-hr)	0.235	0.012	0.265
Operator surface tension (dynes/cm)	37.1	26.4	32.7
Range of production rate (Amp-hrs/hr)	1,010 – 2,078	151 - 252	115 - 130
Tank temperature (°F)	110	111	81
Chromic acid concentration (oz/gal)	33.5	44.7	21.4
Freeboard height (inches)	3.6 / 4.7	3.9	3.2

All parameters are average values except production rate

Surface Tension Comparison

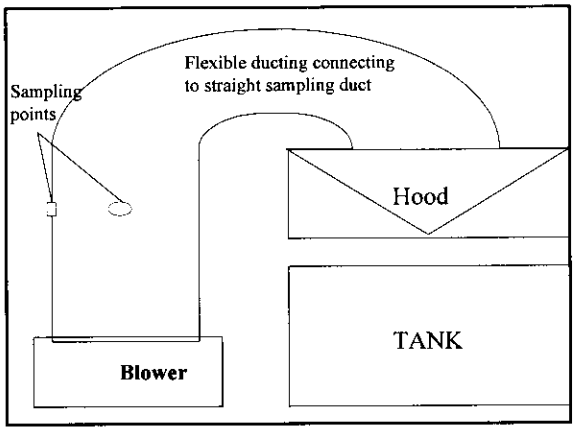


What Have We Learned From Phase I?

- Emission Rates
  - Variable for fume suppressant control
  - Consistent after add-on controls
  - Correlation between emission rates and other parameters not yet clear

Next Steps

- Phase II - Facilities with no add-on ventilation system
  - Temporary hood
  - 50 ft/min specified velocity vertically
  - Developing protocol for review
  - Testing two surface tensions
  - Facility uses a MacDermid fume suppressant



More Information

Staff Contact:
Shobna Sahni
(626) 575-7039 or
spandhoh@arb.ca.gov

Air Toxics website
http://www.arb.ca.gov/toxics/toxics.htm

Chrome Plating ATCM website
http://www.arb.ca.gov/toxics/chrome/chrome.htm

Proposed Changes for ARB Method 425 (Hexavalent & Total Chromium)

David Todd (dtodd@arb.ca.gov) 916-322-8915

Sample Collection Train

- Retain modified Method 5 (isokinetic)
- 0.1N Sodium Bicarbonate Impinger Solution
  - (change from 0.1N Sodium Hydroxide)
- No Filter
  - (change from Teflon filter after impingers)

Sample Recovery & Analysis

- 0.1N Sodium Bicarbonate recovery rinse
  - change from 0.1N Sodium Hydroxide
- Total Chromium Analysis (MLD061)
  - ICP/MS w/ 1ng/ml detection limit
  - (fm GF-AA w/ 20 mg/ml detection limit)
- Hexavalent Chromium Analysis (MLD039)
  - Ion Chromotography (IC) w/ ultraviolet (UV) detector with 1 ng/ml detection limit
  - (fm IC or manual colorimetric w/ 20 ng/ml)

Compares to ARB Ambient Cr

- Sodium Bicarbonate capture
  - Ambient: Impregnated filter
  - M-425: Impinger Solution
- Total Chromium analysis
  - Ambient & 425: SOP MLD061
- Hexavalent Chromium analysis
  - Ambient & 425: SOP MLD039

M-425 QUESTIONS?

Method 425 Contact :
David Todd, MLD
(dtodd@arb.ca.gov)
916-322-8915
or
916-327-0900 (Secretary)