10.1 CHROME PLATING (HEXAVALENT)

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Process Description

This chapter covers the permitting of chrome plating operations. Chrome plating is a finishing treatment utilizing the electrolytic deposition of chromium. These operations fall into three general categories as follows: hard (or technical) chrome plating, decorative (or bright) chrome plating, and hard chrome anodizing. Decorative chrome plating is further divided into two permit categories, hexavalent (+6 valence state) chrome based decorative plating and trivalent (+3 valence state) chrome based decorative plating. Air emissions result from these processes when byproduct hydrogen or air (air sparging is ocassionally used for mixing or cooling) leaves the bath carrying bath chemicals into the atmosphere in particulate (mist) form. Although other variants of the above chrome plating processes exist, including Porous Chrome Plating, Brush Chrome Plating and Black Chrome Plating, this chapter focuses mainly on the most prevalent plating operations, hard chrome plating, decorative chrome plating and trivalent chrome plating.

Hard chrome plating usually involves plating at high current densities for time periods measured in multiple hours to produce plating thicknesses ranging from 20 to 100 µm. Decorative chrome plating, on the other hand, is conducted at relatively lower current densities for time periods measured in minutes to produce plating thicknesses that are typically less than 1 µm, but some decorative plating operations may plate up to 10 µm.

Although both hexavalent and trivalent chrome compounds are listed on the various hazardous (toxic) materials lists, only hexavalent chrome has been identified to be a human carcinogen. Therefore, those plating operations that involve hexavalent chrome-based bath chemistry (decorative, hard chrome and hard anodizing) require a health risk screening analysis and are subject to the Statewide ATCM for chrome plating (Regulation 11, Rule 8) as well as new source review requirements (Regulation 2, Rule 2). Decorative Trivalent Chrome Plating is subject to new source review requirements (Regulation 2, Rule 2) as well as the Statewide ATCM for chrome plating (Regulation 11, Rule 8) only. No health risk screening analysis is required for trivalent chrome plating at this time.

Completeness Determination

The following District forms should be completed and fees provided for chrome plating. Use the Completeness Determination Checklist to verify completeness. Use the Data Form Guidance to ensure that the forms are completed correctly. Use the Fee Calculation Guidance to ensure that the fees are calculated accurately.

1. Form 101-B (one for facility).
2. Form G (one per source). Process code is 3070 for decorative chrome plating, 3071 for hard chrome plating, and 3079 for trivalent chrome; material code is 477; and usage unit is amp-hr. The pollutant code is 1095 for hard and decorative chrome plating and 1340 for trivalent chrome.
3. Form A (one per abatement device).
4. A Health Risk Screening is triggered, Form HRSA (one per source).
5. Fees, calculated per Regulation 3 (Schedule G1) for Sterilization Equipment (Ethylene Oxide).

Emission Calculations

Hard Chrome

In general, the emission standards of Section 93102, Subchapter 7.5, Chapter 1, Division 3, Title 17, of the California Code of Regulations: "Hexavalent Chrome Airborne Toxic Control Measure For Chrome Plating and Chromic Acid Anodizing Operations" should be used to estimate emissions from hard chrome platers. (see Section 93102(c)(1)).

With the emission factors and the project throughput (in amp-hr/year), the emissions of hexavalent chrome can be estimated:

PM10 (lbs/yr) = Cr^{VI+} = Throughput (amp-hr/yr) x Emission Factor (mg/amp-hr) x (1.0E-03 g/mg) x (2.203E-3 lb/g)

Decorative Chrome

For decorative chrome plating, emission calculations are based on source test data for decorative chrome plating operations. This information may be found in the California Air Resources Board (CARB) document "Control of Emissions from Electroplating and Anodizing Operations" December, 1988:

Decorative Chrome Plating:	0.5 mg/amp-hr
Abatement Efficiency of Mist Suppressant:	95% (factor=0.05)

With the specified emission factors and the project throughput (in amp-hr/year), the emissions of hexavalent chrome can be estimated:

PM10 (lbs/yr) = Cr^{VI+} = Throughput (amp-hr/yr) x Emission Factor (mg/amp-hr) x (1.0E-03 g/mg) x (2.203E-3 lb/g)

Trivalent Chrome

A search of Internet, the known available literature including AP-42 all indicate the emissions of trivalent chrome, if any, have not been quantified at the present time. The trivalent chrome plating bath chemistry is much more dilute than hexavalent chrome, therefore any emissions created by hydrogen gas production and entrainment would be expected to be much lower than for a similar hexavalent chrome bath. To minimize any potential emissions, the trivalent chrome chemicals include an additive that is a wetting agent, thereby reducing the surface tension and reducing emissions of plating bath solution. For the purposes of this evaluation, trivalent chrome plating bath emissions are estimated to be negligible.

It should be noted that wetting agent is included in the bath formulation to facilitate optimal bonding of the trivalent chrome metal with the substrate being plated. The reduced emissions potential is a side benefit to the desired low surface tension created by the wetting agent already included in the bath chemicals. It should also be established that the presence of any hexavalent chrome constitutes a contaminated bath, compromising the quality of the trivalent chrome plating process. For this reason, it is assumed that there is no hexavalent chrome present or emitted.

Applicable Requirements

District Rules and Regulations

The provisions of Section 93102, Subchapter 7.5, Chapter 1, Division 3, Title 17, of the California Code of Regulations: "Hexavalent Chrome Airborne Toxic Control Measure For Chrome Plating and Chromic Acid Anodizing Operations" were incorporated by reference in Regulation 11-8.

Best Available Control Technology (BACT)

The following are applicable BACT requirements for:

Chrome Plating
- Chrome Plating - Decorative Chrome

Chrome Plating - Hard Chrome
- Rectifier throughput 0 to 6,053,333 amp-hr/yr
- Rectifier throughput 6,053,333 to 151,333,333 amp-hr/yr
- Rectifier throughput >= 151,333,333 amp-hr/yr

Inform the BACT Coordinator of updates to the BACT/TBACT Workbook.

NESHAPS

A chrome plater is subject to the National Emission Standards for Chromium Emissions From Hard and Decorative Chrome Electroplating and Chromium Anodizing Tanks if it emits more than 10 tons per year of hexavalent chrome (or other hazardous air pollutant). The chrome plating ATCM has been granted equivalency with the Federal NESHAP. Hence, compliance with the ATCM is compliance with the NESHAP.

California Environmental Quality Act (CEQA)
Permit applications which are reviewed following the specific procedures, fixed standards and objective measurements set forth in this chapter (10.1) are classified as ministerial and will accordingly be exempt from CEQA review per Regulation 2-1-311.

In addition to the above-mentioned source-specific applicable requirements, other requirements may also be applicable depending on the facility, its application emissions, and its source location:

- ❑ Offsets
- ❑ Prevention of Significant Deterioration
- ❑ School Notification
- ❑ Risk Screening Analysis

Permit Conditions
Standardized conditions for chrome plating are available from the Permit Condition Guidance. Refer to the Evaluation Report Template Guidance to obtain the Microsoft Word formatted permit conditions for this source category.