Small Business: Know the FACTS

Chromium Electroplating MACT

In January 1995, the U.S. Environmental Protection Agency (EPA) issued the Maximum Achievable Control Technology (or MACT) standard regulating air pollution from chromium electroplating operations. The pollutants addressed in this federal standard are hexavalent chromium as well as trivalent chromium-hazardous air pollutants known to cause harm to the lungs. Chromium electroplating and anodizing tanks are one of the largest sources of these pollutants in the United States.

How Does this Standard Affect My Chromium Electroplating Operation?

All hard or decorative chromium electroplating or chromium anodizing activities, regardless of size, are affected by this rule. There are a few exceptions:

- process tanks containing low concentrations of chromium but not used for chromium electroplating or chromium anodizing, such as rinse tanks, etching tanks, and cleaning tanks
- tanks containing a chromium solution but not used with an electrolytic process, such as chrome conversion coating tanks where no electrical current is applied
- tanks used for research and laboratory operations

Complying with this rule requires meeting each of these requirements in the following order:

1. Initial Notification
2. Emission Limits
3. Work Practice Standards
4. Initial Performance Test
5. Notification of Compliance Status
6. Ongoing Monitoring

Decorative chrome plating operations using a trivalent chromium bath are only required to comply with the Initial Notification, Notification of Compliance Status, and the Process Records requirements under Ongoing Monitoring.

1. Initial or Construction/ Reconstruction Notification

All existing chromium electroplaters should already have submitted an Initial Notification Report to the DNR. For construction or reconstruction of a tank, you must:

- file an Initial Notification before starting your project (approval of the notice is not necessary)
- notify local DNR air inspector the actual date construction began within 30 days after that date, and
- notify your local DNR air inspector of the actual startup date of the tank within 30 days after that date

The Initial Notification Report can be submitted in a cover letter to the DNR describing the project and how you plan to meet the requirements.

2. Emission Limits

You are required to reduce chromium emissions to meet the limits listed in **Table I** of Attachment 1. The emission limits are based on use of specified air pollution control techniques. However, you may use any pollution control technique, as long as it provides the same level of air pollution control or better. All compliance deadlines have passed. If you are not currently in compliance, contact your DNR Air Program compliance inspector to determine how you should come into compliance.

3. Work Practice Standards

To ensure that required pollution control and monitoring equipment is properly maintained, you must perform the Work Practice Standards listed in **Table II** in Attachment 1. This requirement begins on the date you must comply with the Emission Limits and is usually performed quarterly. In addition, you must keep records. Although none of these records need to be submitted to DNR, you must have them available at your facility for 5 years in the event of an inspection.

A. Inspection and Maintenance Records

- Checklist of appropriate Work Practice Standards and dates performed.
- Record of maintenance performed on process, air pollution control system, and monitoring equipment. Dated, handwritten descriptions and/or contractor's invoice describing the work will suffice.

B. Operation and Maintenance (O&M) Plan

- An equipment manual should suffice if it contains:
  I. description of the pollution control device and monitoring equipment you use
  II. procedures to prevent equipment or process malfunctions due to poor maintenance or other preventable conditions
  III. procedures for identifying malfunctions and for implementing corrective actions
- The records required for inspection and maintenance, identified above, should suffice for the other O&M requirements:
  I. checklist to document the operation and maintenance of your equipment
  II. list of the Work Practice Standards from **Table II** in Attachment 1 that apply to your facility
- Your O&M Plan may include all or parts of any standard operating procedure manual, vendor operation and maintenance manual, Occupational Safety and Health Administration (OSHA) plan, or other existing plans.

C. Malfunction Records

- Record of the date, duration and cause of any malfunction of the process, air pollution control device, and/or monitoring equipment. If the action taken to correct the malfunction is different than that described in your O&M Plan, you also must record the corrective action taken and revise your O&M Plan accordingly.

4. Initial Performance Test

An Initial Performance Test is required for two reasons:

1. to demonstrate that you meet the Emission Limit for your type of chromium electroplating operation, and
2. to establish values, or ranges of values, as operating parameters for your air pollution control system (necessary for Ongoing Monitoring requirements).

Exemptions:

Businesses are not required to conduct an Initial Performance Test if:

- you use a trivalent chrome (Cr+3) bath,
- you use a wetting agent and meet the emission limit, or
- you conducted a performance test after December 1991, using the EPA test methods identified below, to obtain an air operating permit.

If you meet one of these exemptions, you still must submit a Notification of Compliance Status. Existing units were required to conduct an initial performance test by deadlines that have passed. If you have not completed the test, contact your DNR Air Program compliance inspector to determine how you should come into compliance.

Test Methods:

- If you have to conduct an Initial Performance test, use EPA Test Method 306 or 306A, "Determination of Chromium Emissions from Decorative and Hard Chromium Electroplating and Anodizing Operations."
- If you do not have to conduct an Initial Performance Test because you are using a wetting agent, you must use Test Method 306B, "Surface Tension Measurement and Recordkeeping for Tanks used at Decorative Chromium Electroplating and Anodizing Facilities," to demonstrate that you meet the emission limit.

Descriptions of these test methods are available from DNR or the SBEAP along with a list of testing consultants.

A. Notice of Performance Test

Twenty days in advance of your test, send a written notice of the scheduled date and time to your local DNR Air Program compliance inspector, in case he/she wants to be present for the testing. The notice must include:

- the number and type of tank(s) to be tested,
- type of air pollution control technique chosen, and
- the date of the test.

If the scheduled test date changes, you must notify your air inspector with the new scheduled date within five calendar days of the original test date.

B. Test Plan

Before the test, you must create a test plan. It should describe the process to be tested, the conditions under which testing is to be conducted, the sampling locations, and the test method to be used.

C. Performance Test Report

During the Initial Performance Test, results must be documented so a Test Report can be written and submitted to DNR along with a Notification of Compliance Status form. The Test Report must contain:

- description of process
- description of pollution sampling locations
- description of sampling and analysis procedures
- any modifications to standard procedures
- test results
- Quality Assurance (QA) procedures and results
- documentation of calculations
- records of:
  1. operating conditions during testing
  2. preparation of standards
  3. calibration procedures
- raw data sheets for:
  1. field sampling
  2. field and laboratory analyses
- any additional information required by the given test method

Through the Initial Performance Test, you must establish operating parameters for your air pollution control system. You will use these parameters as a guide to stay in continual compliance. See **Table III** in Attachment 1 for acceptable methods to establish these parameters.

5. Notification of Compliance Status

All chromium electroplaters must submit a Notification of Compliance Status. If you are required to conduct an Initial Performance Test, the Notification and a Test Report must be submitted within 90 days of completing the Initial Performance Test. If you are not required to conduct an Initial Performance Test, you need to submit a Notification of Compliance Status within 30 days after your Emission Limit deadline.

6. Ongoing Monitoring

After your Initial Performance Test (or your Emission Limit deadline if you do not have to conduct an Initial Performance Test), you must begin monitoring each day to demonstrate that your chromium electroplating operation continues to comply with the Emission Limit. See **Table IV** in Attachment 1 for these requirements.

In addition, you must maintain the following records:

A. Monitoring Data Records

Simple chart that identifies:

- your pollution control technique
- the monitored parameter(s)
- the value of the monitored parameter(s)
- the date and time when the parameter was monitored

B. Excess Emissions Records

Records of:

- start and end times
- dates of each incident when the values of the monitored parameters exceed the value, or range of values, established during the Initial Performance Test

C. Process Records

- Record of the operating time for each chromium electroplating tank.
- If you use a fume suppressant, record the date and time of each addition of fume suppressant.
- For small, hard chromium tanks using the actual rectifier capacity to demonstrate their size, record the actual rectifier capacity expended by month and the total capacity expended for the reporting period.
- For decorative chromium tanks using a trivalent chromium bath, record the bath components purchased. A wetting agent must be clearly identified as a bath constituent. Invoices showing the bath components, quantities purchased, and date of purchase will suffice.

D. Ongoing Compliance Status Reports

If you are a major source (see definitions section below), you must submit an Ongoing Compliance Status Report to DNR every six months after you receive an air operating permit. If your facility ever exceeds the emission standard, you are required to submit this report quarterly.

However, most chromium electroplaters are area sources (see the **definitions section** below). If your facility is an area source, you must prepare a Compliance Status Report annually. Although you are not required to submit this report, you must make it available to DNR or EPA upon request for up to five years. If your facility ever exceeds the emission standard, then you must prepare this report semiannually and submit it to DNR.
For an area source, an exceedance incident occurs when both of these conditions are met:

1. the length of time of excess emissions is equal to or greater than 1% of the total operating time for the reporting period, and
2. the duration of malfunctions of the add-on air pollution control equipment and monitoring equipment is equal to or greater than 5% of the total operating time.

Reducing Frequency of Compliance Status Reporting:

The increased quarterly frequency for major sources or the semi-annual frequency for area sources can be reduced if the following three criteria are met:

1. your facility does not exceed standards for a full year,
2. you comply with all applicable record keeping and reporting requirements, and
3. you notify your air inspector of your intent to change your reporting frequency.

Definitions

An ***area source*** is a business that does not meet the ***major source*** definition.

Bath component means the trade or brand name of each component(s) in trivalent chromium plating baths. For trivalent chromium baths, the bath composition is proprietary in most cases. Therefore, the trade or brand name for each component(s) can be used; however, the actual chemical name of the wetting agent contained in that component must be identified.

Chromium anodizing is an electrolytic process by which an oxide layer is produced on the surface of a base metal for functional purposes like corrosion resistance or electrical insulation. In chromium anodizing, the part to be anodized acts as the anode in the electrical circuit and the chromic acid solution serves as the electrolyte. The chromic acid solution concentration ranges from 6.67 to 13.3 ounces per gallon (50 to 100 grams per liter).

Chromic acid is the common name for chromium anhydride (CrO3).

Composite mesh-pad (CMP) system is an add-on air pollution control device typically consisting of several mesh-pad layers. The smallest diameter fiber layer is located in the center of the pad with progressively larger diameter pads located on both sides. Emission particles collect and form large droplets that adhere to the pad's surface. These particles either drain to the bottom of the unit or are re-entrained in the gas stream and captured by large-diameter fiber layer in the back of the pad. This control devise is 99.5 percent efficient.

Decorative chromium electroplating means the process by which a thin layer of chromium is electrodeposited on a base metal, plastic, or undercoating to provide a bright surface with properties like wear and tarnish resistance. In this process, the part(s) serves as the cathode in the electrolytic cell and the solution serves as the electrolyte to create a plate thickness of 0.003 to 2.5 microns. Typical current density applied during this process ranges from 50 to 220 Amperes per square foot (540 to 2,400 Amperes per square meter) for total plating times ranging between 0.5 to 5 minutes.

Electroplating or anodizing bath means the electrolytic solution used as the conducting medium in which the flow of current is accompanied by movement of metal ions for the purposes of electroplating metal out of the solution onto a work piece or for oxidizing the base material.

A fiber-bed mist eliminator (FBME) is an add-on air pollution control device that typically is installed downstream of an existing control device. It is designed for horizontal, concurrent gas-liquid flow. The acid mist in the gas stream impacts on the FBME fibers and drains down the outer face of the bed while the cleaned gas flows up and out the top of the unit.

Foam blanket is a type of fume suppressant that generates a layer of foam across the surface of a solution when current is applied to that solution. The thickness of the blanket usually is 0.5 to 1.0 inch (1.3 to 2.5 centimeters).

Fume suppressants (FS) are chemical agents that are added directly to the bath to reduce or suppress fumes or mists at the surface. Fume suppressants include wetting agents, foam blankets and combinations of the two. Another term for fume suppressant is mist suppressant. Emission reduction efficiency is 99.5 percent.

Hard chromium electroplating is a process by which a thick layer of chromium is electrodeposited on a base material to provide a surface with functional properties like: wear resistance, a low coefficient of friction, hardness, and corrosion resistance. In this process, the part(s) serves as the cathode in the electrolytic cell and the solution serves as the electrolyte to create a plate thickness of 1.3 to 760 microns. Typical current density applied during this process ranges from 150 to 600 Amperes per square foot (1,600 to 6,500 Amperes per square meter) for total plating times ranging between 20 minutes to 36 hours.

Large equipment is a hard chromium electroplating tank or series of such tanks with a maximum potential rectifier capacity greater than or equal to 60 million ampere-hours per year.

Major source means any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit:

- 10 tons per year or more of any hazardous air pollutant; or
- 25 tons per year or more of any combination of hazardous air pollutants; or
- 100 tons per year or more of any air contaminant

Potential to emit is a measurement of your business' worst-case air pollution emissions at maximum production capacity, 24 hours per day and 365 days per year. The major source determination is based on all emission points inside the facility, not just the chromium electroplating and anodizing tanks.

Maximum potential rectifier capacity is the sum of the total installed rectifier capacities associated with all hard chromium electroplating tanks, expressed in amperes, multiplied by the maximum potential operating schedule of 8,400 hours per year (based on operating 24 hours per day, 7 days per week, 50 weeks per year) and by 70 percent tank utilization, which assumes that electrodes are energized 70 percent of the operating time. [Total installed rectifier capacity (amperes) x 8,400 hours/year x 0.7]

Operating parameter value means a minimum or maximum value established for a control device or similar subpart of a process which, if achieved by itself or in combination with one or more other operating parameter values, determines that an owner or operator is in continual compliance with the applicable emission limitation or standard.

A packed bed scrubber (PBS) is an add-on air pollution control devise consisting of a single or double packed bed that contains packing media on which chromic acid droplets impinge. The gas stream is wetted before it reaches the scrubber to enlarge the droplet size. In most cases, the packed-bed section of the scrubber is followed by a mist eliminator (see FBME) to remove any water entrained from the packed- bed section. The efficiencies of packed bed scrubbers range from 97 percent for decorative chromium electroplating and anodizing tanks to 99 percent for hard chromium electroplating tanks.

Small equipment is a hard chromium electro- plating tank or series of such tanks with a maxi- mum potential rectifier capacity of less than 60 million ampere-hours per year. Tanks can also be defined as "small" if their maximum rectifier capacity is limited to 60 million ampere-hours per year or less by an air operating permit or if a non-resettable ampere-hour meter is used on the tank and monthly records are kept to show that the actual rectifier capacity (based on the facility's actual tank utilization) is within these limits.

Stalagmometer means a device used to measure the surface tension of a solution.

Tensiometer means a device used to measure the surface tension of a solution.

Trivalent chromium process is used for electro-deposition of a thin layer of chromium onto a base material using a trivalent chromium solution instead of a chromic acid solution.

Wetting agent is a type of fume suppressant that reduces the surface tension of the bath. With this, gases escape at the surface of the solution with less "bursting" effect, forming less mist.

Attachment 1

Table I. Emission Limits		
Operations Type	**Emission Limit** *1	**Pollution Control Technique**
Hard Chrome Plating Operations		
Small, existing equipment *2	0.03 mg/dscm*3	Packed bed scrubbers
Large, existing equipment and all new equipment	0.015 mg/dscm	Composite mesh-pad system
Decorative Chrome Plating Operations		
Chromic acid equipment	0.01 mg/dscm 45 dynes/cm*4	Fume suppressants Fume suppressants containing a wetting agent
Trivalent chromium equipment	No Emission Limit	
Chrome Anodizing Operations		
All equipment	0.01 mg/dscm 45 dynes/cm	Fume suppressants Fume suppressants containing a wetting agent

*1 Emission Limits apply during tank operation.

*2 Sources are small if they are less than the Maximum Cumulative Potential Rectifier Capacity (MCPRC) of 60 million amp-hour/year.

*3 A limit expressed in mg/dscm is the concentration of chromium in milligrams (mg) per dry standard cubic meter (dscm) of exhaust air. The established method of measuring this is described in EPA's Test Methods 306 or 306A, "Determination of Chromium Emissions from Decorative and Hard Chromium Electroplating and Anodizing Operations."

*4 A limit expressed in dynes/cm is a measurement of surface tension. The established method of measuring this is described in EPA's Test Method 306B, "Surface Tension Measurement and Recordkeeping for Tanks used at Decorative Chromium Electroplating and Anodizing Facilities."

Table II. Work Practice Standards		
Equipment	**Work Practice Standard**	**Frequency**
Pollution Control Technique		
Composite mesh-pad system	Visually inspect device to ensure there is proper drainage, no chromic acid build up on the pads, and no evidence of chemical attack on the structural integrity of the device.	Quarterly
	Visually inspect back portion of the mesh pad closest to the fan to ensure there is no breakthrough of chromic acid mist.	Quarterly
	Visibly inspect ductwork from tank or tanks to the control device to ensure there are no leaks.	Quarterly
	Perform washdown of the composite mesh-pads in accordance with manufacturers recommendations.	Per manufacturer
Packed-bed scrubber	Visually inspect device to ensure proper drainage, no chromic acid build up on the placed beds, and no evidence of chemical attack on the structural integrity of the device.	Quarterly
	Visually inspect back portion of the chevron blade mist eliminator to ensure that it is dry and there is no breakthrough of chromic acid mist.	Quarterly
	Visually inspect ductwork from tank or tanks to the control device to ensure there are no leaks.	Quarterly
	Add fresh makeup water to the top of the packed bed.	Whenever makeup is added
Packed-bed scrubber/ Composite mesh-pad system	Same as composite-mesh pad system.	
Fiber-bed mist eliminator[*5]	Visually inspect fiber-bed unit and prefiltering device to ensure there is proper drainage, no chromic acid buildup in the units, and no evidence of chemical attack on the structural integrity of the devices.	Quarterly
	Visually inspect ductwork from tank or tanks to the control device to ensure there are no leaks.	Quarterly
	Perform washdown of fiber elements in accordance with manufacturers recommendations.	Per manufacturer
Other air pollution control device(s)	To be proposed by the business for approval.	
Monitoring Equipment		
Pitot tube	Backflush with water, or remove from the duct and rinse with fresh water. Replace in the duct and rotate 180 [m]to ensure same zero reading is obtained. Check pitot tube ends for damage. Replace pitot tube if cracked or fatigued.	Quarterly
Stalagmometer	Follow manufacturer recommendations.	

*5 Work Practice Standards for the pollution control device installed upstream of the fiber-bed mist eliminator do not apply as long as the Work Practice Standards for the fiber-bed unit are followed.

TABLE III. Methods Used to Establish Operating Parameter Values for Air Pollution Control Systems

Air Pollution Control Systems*6	Monitored Parameter	Acceptable Operating Parameter Values
Composite mesh pad system Packed-bed scrubber Fiber-bed mist eliminator	Pressure drop	1. Range of values from multiple performance tests, or 2. +/- 1 inch of water column about the average of three test runs measured during performance testing
Packed-bed scrubber	Velocity pressure	1. Range of values from multiple performance tests, or 2. +/- 10% about the average of three test runs measured during performance testing
Wetting agent	Surface tension	1. Use 45 dynes/cm, or 2. Maximum surface tension measured during performance testing
Foam blanket Fume suppressant	Foam blanket thickness	1. Use 1 inch foam blanket thickness, or 2. Minimum foam blanket thickness measured during performance testing

*6 If you use a control system not specified here, such as a fiber-bed mist eliminator, contact your DNR air inspector for assistance in determining the appropriate operating parameters.

TABLE IV. Ongoing Monitoring Requirements

Pollution Control Technique	Monitored Parameter	Frequency
Composite mesh-pad system	Pressure drop across system	Daily
Packed-bed scrubber	Pressure drop across system, and Velocity pressure at system inlet	Daily
Composite mesh-pad system/ Packed-bed scrubber	Pressure drop across the mesh-pad system	Daily
Fiber-bed mist eliminator	Pressure drop across the mist eliminator, and Pressure drop across the control devise located upstream of the fiber bed	Daily
Wetting agent, or Wetting agent/foam blanket fume suppressants	Surface tension of bath	Every 4 hours*7,8
Foam blanket fume suppressants	Foam blanket thickness	Hourly*8,9
Fume suppressant/ Add-on control devise	As identified above	

*7 If there are no exceedances of the maximum surface tension after 40 hours of operation, then the monitoring frequency can be decreased to every 8 hours. If there are no exceedances for the next 40 hours, then the frequency can be decreased to every 40 hours. If an exceedance occurs, than the initial monitoring schedule of every 4 hours must be resumed.
*8 The initial schedule of every 4 hours must be resumed for every new tank solution.
*9 If there are no exceedances of the minimum foam blanket thickness after 40 hours of operation, then the monitoring frequency can be decreased to every 4 hours. If there are no exceedances for the next 40 hours, then the frequency can be decreased to every 8 hours. If an exceedance occurs, then the initial monitoring schedule of every hour must be resumed.