NPRI reporting guidance for facilities using chromium electroplating, chromium anodizing and reverse etching

This document provides information on NPRI reporting requirements and guidance for reporting for facilities in the chromium electroplating, chromium anodizing and reverse etching sector.

Find complete information about the NPRI reporting requirements for all substances and sectors in the Canada Gazette Notice and Guide for reporting to the NPRI

Step 1. Determine if your facility meets the NPRI reporting requirements

Reporting of hexavalent chromium

Starting with the 2018 reporting year, all facilities that are subject to the *Chromium Electroplating, Chromium Anodizing and Reverse Etching Regulations* must report to the NPRI for hexavalent chromium (and its compounds). Reporting for hexavalent chromium is required regardless of quantity and concentration of hexavalent chromium and regardless of the number of employee hours worked at the facility.

Reporting of other substances

You do NOT need to report on other substances (besides hexavalent chromium) if:

- your facility has less than 10 employees,
  and
- your facility does not do any of the activities for which reporting is required regardless of the number of employees (for example incineration or operation of stationary combustion equipment).

You MAY have to report on other substances if:

- your facility has more than 10 employees or your facility does any of the activities for which reporting is required regardless of the number of employees (for example incineration or operation of stationary combustion equipment)
  and
- your facility meets any of the substance thresholds.

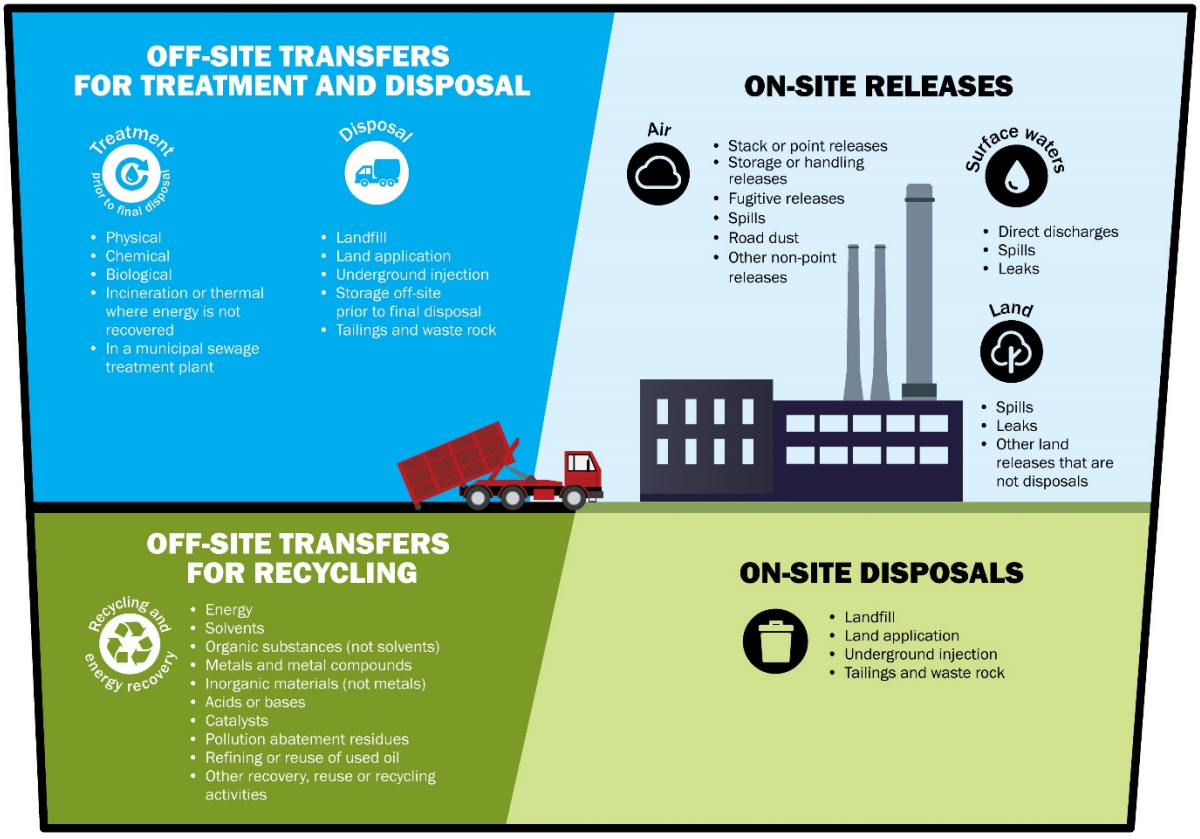
You should review the Guide for reporting to the NPRI to determine whether reporting on substances other than hexavalent chromium is required.

Step 2. Determine what you need to report

Hexavalent chromium (and its compounds) is found on Part 1b of the NPRI substance list and is assigned CAS # NA-19 for the purposes of reporting to the NPRI. Reporting for this substance is in kilograms.

Reporting to the NPRI is broken down into a number of categories:

- On-site releases: a discharge of a substance to air, water or land within the physical boundaries of the facility
- On-site disposals: disposal at the facility, such as to landfill
- Off-site disposals: materials sent to another facility for disposal, such as to landfill or storage prior to final disposal
- Off-site transfers for treatment prior to final disposal: materials sent to another facility for treatment, such as to a municipal sewage treatment plant
- Off-site transfers for recycling and energy recovery: materials sent to another facility instead of being disposed of, such as being sent back to a manufacturer, supplier or recycler for reprocessing, repackaging, resale or for credit or payment



Step 3. Determine the quantities to report

A) Collect information

If you need to report hexavalent chromium (and its compounds), you will need to collect information in order to calculate what was released, disposed of and sent for recycling from your facility. Some sources of information include:

- Material Safety Data Sheets(MSDS)
- weigh bills for recycling and disposal
- provincial permits
- manufacturer's information

B) Determine sources of releases, disposals and transfers

Some examples of hexavalent chromium releases that are likely to occur in facilities subject to the *Chromium Electroplating, Chromium Anodizing and Reverse Etching Regulations* include:

- Releases to air from the surface of the solution in tanks (chromic acid mist from chromic acid reverse etching treatment, anodizing and electroplating); this could be released via ventilation systems, exhaust vents, etc.
- Releases to surface waters (spills, leaks, discharges) of solution(s) or rinse water (releases to sewers connected to a municipal sewage treatment plant should be reported as off-site transfers for treatment and not as releases to water)
- Releases to land (spills or leaks) of solution or rinse water
- Off-site transfers for treatment or recycling of sludges or used solution
- Off-site disposal of sludges or used solution

C) Calculate the quantities to report

Annex 1 contains technical information on how to estimate emissions from the typical sources found at facilities subject to the *Chromium Electroplating, Chromium Anodizing and Reverse Etching Regulations*.

Estimates of the quantity of a substance that is released, disposed of or transferred for recycling may be based on one of the following methods:

- continuous emission monitoring systems
- predictive emission monitoring
- source testing
- mass balance
- site-specific emission factor
- published emission factor
- engineering estimates.

The online reporting system only allows one basis of estimate for each type of release, disposal and transfer. If more than one basis of estimate is used, select the basis of estimate that was used to calculate the majority of the release or transfer of the substance. Further explanation on the basis of

estimate can be provided in the comment fields found on the main pages for reporting releases, disposals and recycling in the online reporting system.

Information on releases, disposals and transfers for recycling needs to be reported if the owner/operator possesses the information or may reasonably be expected to have access to the information.

If emissions are already monitored or measured under provincial or federal legislation or a municipal bylaw, those measurements must be used to report to the NPRI. However, all releases, disposals or transfers off site for recycling must be included in threshold calculations and reported, unless otherwise specified, not just those that are measured or monitored.

An NPRI report is mandatory for any substances that meet the NPRI reporting thresholds. If emissions are not monitored or measured already, reasonable efforts must still be undertaken to gather information on releases, disposals and transfers of a substance. What is "reasonable" depends on individual circumstances, but may include additional monitoring for NPRI substances.

Step 4. Fill out and submit your report

You will need to file your report to the NPRI using Environment and Climate change Canada's Single Window system.

There is a series of online video tutorials which can help guide you through the process of setting up your account in Single Window (if this is the first year that the facility is required to report to the NPRI) and filling and submitting your report.

If you still have questions about reporting, you can contact the NPRI helpdesk for assistance.

Annex 1 – How to calculate the quantities to report

Annex 1 provides guidance on how to calculate hexavalent chromium releases and transfers from hard and decorative chromium electroplating and chromium anodizing tanks for purposes of reporting to the NPRI. If you have them, you may use site-specific methodologies in place of the guidance provided below.

This document does not discuss in detail the emissions generated in the pre-treatment steps (preparation, dipping and treatment with different chemicals, water rinsing) nor the post-treatments steps (chromate treatment, water rinsing, etc.). You must still report any releases, transfers or disposals of hexavalent chromium that result from pre/post treatment processes and other on-site activities.

Part 1 - How to determine releases to air from chromium electroplating and chromium anodizing tanks

This document describes how to estimate releases for each of the following methods used to control releases to air of hexavalent chromium from tanks:

- point source control method
- surface tension control method
    - without capture hoods
    - with capture hoods

Note: this guidance does not discuss the tank cover control method as described in the *Chromium Electroplating, Chromium Anodizing and Reverse Etching Regulations*.

1 - Releases to air from tanks using point source control method

1.1 Stack or point releases

If your facility uses the point source control method, you should use your stack testing results to estimate the annual stack or point releases of hexavalent chromium for each stack using the following equation:

$$E_{stack} = C \times Q \times A \times 3600 / 10^6$$

where:

- E_{stack} = Annual stack emission, kg/year
- C = average stack tests concentration, mg/dscm
- Q = Average stack flow, dscm/s
- A = Annual activity rate, hr/year
- 3600 = conversion factor, s/hr
- 10^6 = Conversion factor, mg/kg

If the average stack test concentration is available as total chromium only, you should assume hexavalent chromium makes up 98% of the total chromium concentration measured.

1.2 Fugitive releases

For facilities that use the point source control method, process emissions are collected from tank(s) through a local exhaust ventilation system (i.e. capture hood(s)) and directed to an emission control device, and then to the exhaust stack. The collection efficiency of the hood(s) is not 100%; you can assume a capture efficiency of 98% (TCEQ, 2007) if the hoods are well designed (follow the industrial ventilation recommended practices (ACGIH, 2016)). The remaining 2% (uncaptured) of the emissions would then be released as a fugitive emission inside the building.

A portion of these fugitive emissions could then be emitted outside the building through the general exhaust ventilation system, open doors, etc. while the remaining portion will be deposited inside the building. Based on the TCEQ guidance for chromium plating and anodizing operations using chromic acid (TCEQ, 2007), ECCC suggests assuming that 50% of the fugitive emissions will be deposited inside the building while the other 50% will be released outside.

You can use the following equation to determine the quantity of fugitive releases of hexavalent chromium:

$$E_{fug} = E_{stack} \times ((1\text{-}HCE/100) \times 0.5) / (HCE/100 \times (1\text{-}DEF/100))$$

where:

- E_{fug} = Annual fugitive emission, kg/year
- E_{stack} = Annual stack emission, kg/year
- HCE = Hood capture efficiency, %
- DEF = Efficiency of the control device, %
- 0.5 = Recommended emission capture efficiency for the building

Note: Some (or all) of the hexavalent chromium that is deposited within the building may be transferred or disposed of as detailed in section 2.3 (e.g. it may be swept up and sent for disposal). You must also include these quantities in your report, under the appropriate category.

You must apply the above emission calculations to one control device system only. If many control devices are present, you must do the calculation for each control device individually and then sum up the total releases for stacks and for fugitives.

2 - Releases to air from tanks using surface tension control method

You can use either one of the following two recommended methods to calculate hexavalent chromium releases from tanks using surface tension control method:

1. using uncontrolled emission factors (i.e. without any emission control) from AP-42 tables 12.20-1 and 12.20-2 and applying control efficiencies based on the fume suppressant supplier's information; or
2. using the AP-42 controlled emission factors (with fume suppressant) from AP-42 tables 12.20-1 and 12.20-2.

For either of these methods, you also need to consider if the electroplating and/or anodizing tanks are equipped with hoods since this affects the categories under which you need to report the releases.

2.1 Tanks using surface tension control method – use of uncontrolled emission factors

2.1.1 Tanks without capture hoods

You should report releases resulting from tanks controlled with fume suppressants as fugitive releases. While they are initially released inside the building, a portion of these fugitive emissions could then be released outside the building through the general exhaust ventilation system, open doors, etc. Based on the TCEQ guidance for chromium plating and anodizing operations using chromic acid (TCEQ, 2007), ECCC suggests assuming that 50% of the fugitive emissions will be deposited inside the building (and may need to be reported under other categories) while the other 50% will be released outside (and should be reported under "fugitive releases").

2.1.1.1 Fugitive releases from hard and decorative electroplating tanks

Use the following equation to estimate fugitive releases from hard and decorative electroplating tanks:

$$E_{fug} = A \times EF \times (1- FSCE/100) \times 0.5 / 10^6$$

where:

- E_{fug} = Annual fugitive emission, kg/year
- A = Annual electrical usage, amp-hour/year
- EF = Uncontrolled emission factor, mg/amp-hour
- FSCE = Fume suppressant control efficiency, %
- 0.5 = Recommended emission capture efficiency for the building
- 10^6 = Conversion factor, mg/kg

You can find the efficiency of the fume suppressant (FSCE) through the manufacture's literature or by contacting the manufacturer directly.

Table 1. Uncontrolled emission factors for chromium electroplating (USEPA, 1996a)

Substance	Process		EF units
Hexavalent chromium*	Hard chromium electroplating	Decorative chromium electroplating	mg/amp-hour
	7.78	2.14	

(*) AP-42 reported as chromium compounds (total chromium), which is comprised almost completely of hexavalent chromium.

2.1.1.2 Fugitive releases from anodizing tanks

Use the following equation to estimate fugitive releases from anodizing tanks:

$$E_{fug} = A \times EF \times (1- FSCE/100) \times 0.5 / 10^6$$

where:

- E_{fug} = Annual fugitive emission, kg/year
- A = Annual activity, as a tank surface area times the annual operating hours, hour-m^2/year
- EF = Uncontrolled emission factor, mg/hour-m^2
- FSCE = Fume suppressant control efficiency, %
- 0.5 = Recommended emission capture efficiency for the building
- 10^6 = Conversion factor, mg/kg

Table 2. Uncontrolled emission factors for chromium anodizing (USEPA, 1996a)

Substance	Process	EF units
Hexavalent chromium*	Chromium anodizing	mg/hour-m^2
	1394	

(*) AP-42 reported as chromium compounds (total chromium), which is comprised almost completely of hexavalent chromium.

2.1.2 Tanks with capture hoods

If the tanks controlled by a fume suppressant control method are also equipped with a local ventilation system (i.e. exhaust hood(s)), then you will need to split the emissions resulting from the tanks into fugitive and stack or point releases. Use the equations in the following sections to determine the releases from each tank. If many tanks are present, you must do the calculation for each one, and then sum each type of release (stack or point releases and fugitive releases, respectively).

You will need to account for any additional control measures (e.g. polyballs, partial covers or control devices) in the equations as appropriate.

2.1.2.1 Stack or point releases from hard and decorative electroplating tanks

Use the following equation to estimate stack or point releases from hard and decorative electroplating tanks:

$$E_{vent} = A \times EF \times (1- FSCE/100) \times HCE/100 / 10^6$$

where:

- E_{vent} = Annual vented emission, kg/year
- A = Annual electrical usage, amp-hour/year
- EF = Uncontrolled emission factor, mg/amp-hour
- FSCE = Fume suppressant control efficiency, %
- HCE = Hood capture efficiency, %
- 10^6 = Conversion factor, mg/kg

2.1.2.2 Fugitive releases from hard and decorative electroplating tanks

Use the following equation to estimate fugitive emissions from hard and decorative electroplating tanks:

$$E_{fug} = A \times EF \times (1- FSCE/100) \times (1-HCE/100) \times 0.5 / 10^6$$

where:

- E_{fug} = Annual fugitive emission, kg/year
- A = Annual electrical usage, amp-hour/year
- EF = Uncontrolled emission factor mg/amp-hour
- FSCE = Fume suppressant control efficiency, %
- HCE = Hood capture efficiency %
- 0.5 = Recommended emission capture efficiency for the building
- 10^6 = Conversion factor, mg/kg

2.1.2.3 Stack or point releases from anodizing tanks

Use the following equation to estimate stack or point releases from anodizing tanks:

$$E_{vent} = A \times EF \times (1- FSCE/100) \times HCE/100 / 10^6$$

where:

- E_{vent} = Annual vented emission, kg/year
- A = Annual activity, as a tank surface area times the annual operating hours, hour-m^2/year
- EF = Uncontrolled emission factor, mg/hour-m^2
- FSCE = Fume suppressant control efficiency, %
- HCE = Hood capture efficiency, %
- 10^6 = Conversion factor, mg/kg

2.1.2.4 Fugitive releases from anodizing tanks

Use the following equation to estimate fugitive releases from anodizing tanks:

$$E_{fug} = A \times EF \times (1- FSCE/100) \times (1-HCE/100) \times 0.5 / 10^6$$

where:

- E_{fug} = Annual fugitive emission, kg/year
- A = Annual activity, as a tank surface area times the annual operating hours, hour-m^2/year
- EF = Uncontrolled emission factor, mg/hour-m^2
- FSCE = Fume suppressant control efficiency, %
- HCE = Hood capture efficiency, %
- 0.5 = Recommended emission capture efficiency for the building
- 10^6 = Conversion factor, mg/kg

2.2 Tanks using surface tension control method – use of controlled emission factors for fume suppressants

You should report emissions from tanks controlled with fume suppressants as fugitive releases. While they are initially released inside the building, they are eventually emitted outside the building through the general exhaust ventilation system, open doors, etc. ECCC suggests assuming that 50% of the fugitive emissions will be deposited inside the building (TCEQ, 2007). If additional control measures are applied or the emissions are captured through a hood, the approach used under section 1.2.1 should be applied as appropriate.

2.2.1 Fugitive releases from hard and decorative electroplating tanks

Use the following equation to estimate fugitive releases from hard and decorative electroplating tanks:

$$E_{fug} = A \times EF \times 0.5 / 10^6$$

where:

- E_{fug} = Annual fugitive emission, kg/year
- A = Annual electrical usage, amp-hour/year
- EF = Controlled Emission Factor using fume suppressant, mg/amp-hour
- 0.5 = Recommended emission capture efficiency for the building
- 10^6 = Conversion factor, mg/kg

Table 3. Controlled emission factors for chromium electroplating with fume suppressants (USEPA, 1996b, RTI, 2012, CARB, 2015,)

Substance	Process		EF units
Hexavalent chromium*	Hard chromium electroplating(**)	Decorative chromium electroplating (***)	mg/amp-hour
	0.524	0.019	

(*) AP-42 reported as chromium compounds (total chromium), which is comprised almost completely of hexavalent chromium.
(**) Developed based on the RTI report assuming annual working hours of 8000 hours and applied median amperage of 6000 amp.
(***) Average from references 27, 28, USEPA Background Document on Electroplating, Final Report and CARB Hexavalent Chromium Emissions Testing Program.

2.2.2 Fugitive releases from anodizing tanks

Use the following equation to estimate fugitive releases from anodizing tanks:

$$E_{fug} = A \times EF \times 0.5 / 10^6$$

where:

- E_{fug} = Annual fugitive emission, kg/year
- A = Annual activity, as a tank surface area times the annual operating hours, hour-m^2/year
- EF = Controlled emission factor using fume suppressant, mg/hour-m^2
- 0.5 = Recommended emission capture efficiency for the building
- 10^6 = Conversion factor, mg/kg

Table 4. Controlled emission factor for chromium anodizing with fume suppressants (USEPA, 1996a)

Substance	Process	EF units
Hexavalent chromium*	Chromium anodizing	mg/hour-m^2
	44.61	

(*) AP-42 reported as chromium compounds (total chromium), which is comprised almost completely of hexavalent chromium.

2.3 Hard and decorative electroplating tanks using surface tension control method and equipped with capture hoods– use of the exhaust flow rate of the local exhaust ventilation system

If the tanks controlled by a fume suppressant are equipped with a local exhaust ventilation system (i.e. exhaust hood(s)), and if you have data on the exhaust flow rate, then you can calculate the emissions resulting from the tanks using the equations below. These equations were developed based on the RTI data report (RTI, 2012). As explained in the previous sections, you should split the releases into fugitive and stack or point releases.

2.3.1 Stack or point releases from hard electroplating tanks

Use the following equation to calculate the stack or point releases from hard electroplating tanks:

$$E_{vent} = 0.0062 \times Q \times A \times 3600 / 10^6$$

where:

- E_{vent} = Annual vented emission, kg/year
- 0.0062 = average stack tests concentration from RTI report, mg/dscm
- Q = Average stack flow, dscm/s
- A = Annual activity rate, hr/year
- 3600 = conversion factor, s/hr
- 10^6 = Conversion factor, mg/kg

2.3.2 Fugitive releases from hard electroplating tanks

Use the following equation to calculate the fugitive releases from hard electroplating tanks:

$$E_{fug} = E_{vent} \times (1\text{-}HCE/100) \times 0.5 / HCE/100$$

where:

- E_{fug} = Annual fugitive emission, kg/year
- E_{vent} = Annual vented emission, kg/year
- HCE = Hood capture efficiency, %
- 0.5 = Recommended emission capture efficiency for the building

2.3.3 Stack or point releases from decorative electroplating tanks

Use the following equation to calculate the stack or point releases from decorative electroplating tanks:

$$E_{vent} = 0.0042 \times Q \times A \times 3600 / 10^6$$

where:

- E_{vent} = Annual vented emission, kg/year
- 0.0042 = average stack tests concentration from RTI report, mg/dscm
- Q = Average stack flow, dscm/s
- A = Annual activity rate, hr/year
- 3600 = conversion factor, s/hr
- 10^6 = Conversion factor, mg/kg

2.3.4 Fugitive releases from decorative electroplating tanks

Use the following equation to calculate the fugitive releases from decorative electroplating tanks:

$$E_{fug} = E_{vent} \times (1\text{-}HCE/100) \times 0.5 / HCE/100$$

where:

- E_{fug} = Annual fugitive emission, kg/year
- Event = Annual vented emission, kg/year
- HCE = Hood capture efficiency, %
- 0.5 = Recommended emission capture efficiency for the building

Part 2 - How to determine other (non-air) release and transfer quantities from chromium electroplating and chromium anodizing tanks

In addition to air releases, releases and transfers may also occur to other media. Hexavalent chromium may be found in:

- mist (fugitive) deposited from the chromium electroplating and chromium anodizing tank operations
- spills of bath solution that result from drag-out
- liquid resulting from spraying operations for removing excess chromic acid from electroplated or anodized items after they are removed from tanks.

Depending on the practices in place, this hexavalent chromium may be redirected to the tanks, sent for disposal (via sewers or otherwise) or released to water bodies. You must take in account these disposals and transfers as appropriate.

Hexavalent chromium in wastewater effluents and in wastewater treatment sludge is regulated under existing municipal, provincial and territorial sewer-use bylaws and provincial/territorial hazardous waste regulations. You should use the sampling data taken in order to comply with these regulations to calculate the potential annual releases or transfers.

Releases to water bodies and transfers to municipal sewage treatment plants

Calculate the releases to water bodies and transfers to municipal sewage treatment plants using the following formula:

> Annual quantity of hexavalent chromium to report = (Annual quantity of wastewater generated) x (concentration in wastewater)
>
> Note: use the average value for the concentration in wastewater.

Transfers in aged plating wastewater and in sludge

Calculate transfers in aged plating wastewater and in sludge using the following equations:

> Quantity to be reported = (Annual amount of aged wastewater generated) x (concentration in the aged wastewater)
> Note: use the average concentration in the aged wastewater.
>
> Quantity to be reported = (Annual amount of sludge generated) x (water content in the sludge) x (concentration in water extracted)
> Note: use the average water content in the sludge and the average concentration in the extracted water

References

ACGIH (2016), Industrial Ventilation: A Manual of Recommended Practice for Design, 29th Edition, ISBN: 978-1-607260-87-5.

CARB (2015), Hexavalent Chromium Emissions Testing Program, CARB, California, USA; https://www.arb.ca.gov/toxics/chrome/etest.htm

RTI (2012), Draft – Development of revised surface tension limits for chromium electroplating and anodizing tanks controlled with wetting agent fume suppressants, Research Triangle Park, North Carolina, USA

TCEQ (2007), Calculations Guidance Package, Chromium Plating & Anodizing Operations Using Chromic Acid, Texas Commission on Environmental Quality, Austin, Texas, USA, 41 pages; https://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/emiss_calc_chrome.pdf

USEPA (1996a), Section 12-20 Electroplating, Chapter 12: Metallurgical Industry, AP 42, Fifth Edition, Volume I, EPA, USEA; https://www3.epa.gov/ttn/chief/ap42/ch12/final/c12s20.pdf

USEPA (1996b), Emission Factor Documentation for AP-42, Section 12.20 Electroplating, Background document, AP 42, Fifth Edition, Volume I, EPA, USA; https://www3.epa.gov/ttn/chief/ap42/ch12/bgdocs/b12s20.pdf