

## **PART 5            RESOURCES**

### ***Trade Waste Officers***

Metal finishing businesses have the opportunity to call on Council Trade Waste Officers for information and support about the disposal of hazardous wastes and Cleaner Production. Many businesses already have ongoing contact with Trade Waste Officers through the administration of trade waste permit or issues related to hazardous waste treatment and disposal. It is worth remembering that Trade Waste Officers can also be a valuable resource when embarking on a Cleaner Production project.

Trade Waste Officers have had considerable exposure to the metal finishing industry and may also be quite familiar with your particular site. They can provide an extra set of eyes when looking for waste minimisation opportunities and can put you in touch with suppliers of technology and consultants in the field of waste management and Cleaner Production.

They will be able to provide independent hazardous waste disposal and waste classification advice as well as assist in the co-ordination of industry-wide Cleaner Production initiatives, such as waste exchanges or joint projects.

### ***Publications***

Environmental Health Center, A Division of the National Safety Council, "Chemical Backgrounders", Washington.

EPA, 1997, National Metal Finishing, Environmental R&D Plan, Cleaner, Cheaper, Smarter, January 7, 1997

Hagler Bailly Consulting, Inc. "Pollution Prevention in Metal Finishing - Training Manual", 1995.

Howard Hughes Medical Institute and the National Academy of Sciences, "LCSS, Laboratory Chemical Safety Summaries" 1995.

ICI Chemical Fact Sheet, 1998

Kleine, J., (MacDermid) "Biological Cleaning and Activation for Electroplating", Surfers Finishing '97 Conference.

Legg K.O, Graham P, Chang P, Rastagar R, Gonzales A, Sartwell B, "The Replacement of Electroplating", Surface and Coating Technology 81 (1996) 99-105,

Magnus Francis, B., "Toxic Substances in the Environment", 1994.

MSDS, Material Safety Data Sheet, University of Utah Department of Chemistry.

OPPT Chemical Fact Sheets <http://www.epa.gov/chemfact/>

Tay J., Cleaner Production for Electroplating Industry

United States-Asia Environmental Partnership & The Civil Engineering Research Foundation, "Clean Technologies in U.S. Industries: Focus on Metal Fabrication", September, 1997

University Extension, University of California, Riverside, US EPA and Alternative Technology Division California Dept of Toxic Substances Control. "Waste Minimisation for the Metal Finishing Industry: Training Module 3." 1991

Waste Reduction Institute for Training and Applications Research (WRITAR), "Profile of the Metal Finishing Industry", Prepared for the Cleveland Advanced

Manufacturing Program under contract to the Energy Environment and Manufacturing project of the Technology Reinvestment Program, April, 1995.  
 Yau, A., Kwan Kee Electroly Dyeing Fty. Ltd; "Green Productivity in a Small Metal Coating Factory in Hong Kong", published in Green Productivity - In Pursuit of Better Quality of Life, APO World Conference on Green Productivity, 1995.

## **Internet Sites**

### General Metal Finishing Links Pages

<http://www.yarranet.swin.edu.au/yarranet/bus/pages/cpaust/welcome.htm>

The UNEP Working Group for Cleaner Production in the Metal Finishing Industry

<http://es.epa.gov/es-guide/metals/metals.htm>

Enviro\$en\$e Metal Finishing Content Guide

### Cleaner Production in the Metal Finishing Industry

<http://www.iams.org/p2irisde/metalfin.htm>

The Institute of Advanced Manufacturing Sciences (IAMS), A Pollution Prevention Resource Manual for Metal Finishers, A Competitive Advantage Manual.

<http://es.epa.gov/comply/sector/fab/fabtitle.html>

OECA Fabricated Metal Products Notebook, USEPA, Office of Enforcement and Compliance Assurance (OECA), December 14, 1995

<http://www.iti.org/ee/eem/techdemo/chromep2/index.html>

Technology Demonstration Project, Hard Chrome Pollution Prevention Demonstration Project Interim Report Industrial Technology Institute / Energy & Environment Centre, Technology Reinvestment Project, 1995.

<http://www.usaep.org/reports/metal.htm>

Clean Technology in US Industries: Focus on Metal Fabrication, USAEP, 1996.

### Case studies

<http://www.nmfrc.org/pdf/merit/merit3.htm>

Merit Partnership Pollution Prevention Project for Metal Finishers, Modifying tank layouts to improve process efficiency, 1996.

[http://www.environment.gov.au/portfolio/epg/environet/ncpd/auscase\\_studies](http://www.environment.gov.au/portfolio/epg/environet/ncpd/auscase_studies)

Cleaner Production Case study Directory

<http://www.environment.gov.au/portfolio/epg/environet/ncpd/cpdp.html>

Cleaner Production Demonstration Project

<http://www.mfe.govt.nz/cases1.htm>

New Zealand case studies

<http://www.unido.org/services/environment/envncpc/temp/casestudy>

## UNIDO Case studies

<http://c2p2.sarnia.com/hot/metal-finishing/intro.html#success-stories>

Canadian Centre for Pollution Prevention.

## Coating Technologies

<http://es.epa.gov/program/epaorgs/ord/org-rmvl.html>

Enviro\$en\$e - Guide to Cleaner Technologies Organic Coating Removal, United States Environmental Protection Agency, Office of Research and Development Washington DC.

<http://cage.rti.org/>

Research Triangle Institute CAGE Coating Alternatives Guide. Developed in cooperation with the U.S. EPA Air Pollution Prevention and Control Division (APPCD) 1996.

<http://es.epa.gov/oeca/fedfac/fflexp2/alt-metl.html>

Enviro\$en\$e - A guide to cleaner technologies and alternative metal finishes.

<http://www.ndcee.ctc.com/Core/inorg.htm>

Standard Technology Information Products: Inorganic Finishing Product Tree

## Powder Coating Information

<http://www.powdercoating.org/>

The Powder Coating Institute

## Anodising Information

<http://www.maricopa.gov/envsvc/chromp2.htm>

Maricopa County Environmental Services Department, Air Quality Program, *A guide for reducing air pollution from chromium electroplating and anodizing tanks*, Phoenix, Arizona.

<http://es.epa.gov/program/epaorgs/ord/org-coat.html>

Enviro\$en\$e - Guide To Cleaner Technologies Organic Coating Replacements, September 1994

## Metal Cleaning

<http://es.epa.gov/program/regional/trade/msfn-rpt.html>

Enviro\$en\$e - Generic Package: Report on Pollution Prevention in Mass Finishing Operations.

<http://es.epa.gov/techinfo/facts/metlprtz.html>

Enviro\$en\$e - Waste Minimization in Metal Parts Cleaning, Waste Minimization in Metal Parts Cleaning, United States Environmental Protection Agency, Office of Solid Waste.

<http://clean.rti.org/>

Research Triangle Institute, Sage - Solvent Alternatives Guide Developed in cooperation with the U.S. EPA Air Pollution Prevention and Control Division (APPCD) 1995.

## General Tip Sheets

<http://es.epa.gov/techinfo/facts/california/metal-fs.html>

Fact Sheet: *Hazardous Waste Generated by Metal Refinishing Facilities*, California Department of Health Services Toxic Substances Control Program Alternative Technology Division

<http://es.epa.gov/techinfo/facts/cheklst3.html>

Enviro\$en\$e - *Metal Finishing Pollution Prevention Opportunities Checklist*, CH2M Hill and Solid Waste Management County Sanitation Districts Of Los Angeles County.

<http://www.uwm.edu:80/Dept/besmart/Html/Business/Ec/ecmenu.htm>  
Be SMART (Save Money and Reduce Trash Program) *Electronics Manufacturing: Common Operations*

<http://www.uwm.edu:80/Dept/besmart/Html/Business/Metal/metmenu.htm>  
Metal Cleaning Tip Sheets

[http://www.umn.edu/mntap/P2/intp7-15.htm#metal finishing/plating](http://www.umn.edu/mntap/P2/intp7-15.htm#metal%20finishing/plating)  
Minnesota Technical Assistance Program (MnTAP) *Get it Plated Right*, fact sheet series.

<http://www.epa.ohio.gov/opp/fact24.html>  
Ohio EPA, *Source Reduction and Metal Recovery Techniques for Metal Finishers*, Fact Sheet #24

<http://es.epa.gov/techinfo/facts/florida/fla-fs2.html>  
Enviro\$en\$e - *Pollution Prevention for Electroplaters and Surface Finishers*, Metro-Dade County, Department of Environmental Resources Management, June 1995.

<http://www.epa.ohio.gov/opp/metalw/fact11.html>  
Ohio EPA, *Extending the Life of Metal Working Fluids*, Fact Sheet #11 March 1993

<http://www.chmr.org/ppmfi.html>  
*Pollution Prevention Strategies for the Metal Finishing Industry*, Center for Hazardous Materials Research, 1996.

<http://es.epa.gov/techinfo/facts/vdwm/va-fs16.html>  
Enviro\$en\$e - Fact Sheet: *Waste Reduction for Metal Finishers*, The Virginia Waste Minimization Program, Vol. 1 Issue 4, A Fact Sheet from the Virginia Waste Minimization Program on waste reduction for metal finishers.

#### Environment Sites

<http://es.epa.gov/techinfo/facts/vdwm/va-fs16.html>  
Environment Australia Online, Federal Department of Environment

<http://www.env.qld.gov.au/>  
Queensland Department of Environment

#### General Cleaner Production Information

<http://es.epa.gov/techinfo/facts/nc/tips.html>  
Enviro\$en\$e - *Pollution Prevention Tips: Developing and Implementing A Waste Reduction Program*, North Carolina Department of Natural Resources and Community Development.

[http://www.mmac.jcabi.gov/amp/ppp\\_2.htm](http://www.mmac.jcabi.gov/amp/ppp_2.htm)  
*Pollution Prevention Plan*, Prepared by: Environmental, Safety and Emergency Mgt. Division.

<http://es.epa.gov/new/contacts/newsltrs/unep/unep-pac.html>  
Cleaner Production at the United Nations Environment Program (UNEP)

<http://es.epa.gov/new/business/sbdc/sbdc.htm>  
Small Business Waste Reduction Guide

#### Chemical Health and Environmental Safety Information

<http://www.nsc.org/EHC/ew/chems/>  
Environment Writer *Chemical Backgrounders*, Chemical Information Environmental Health Center, A Division of the National Safety Council.

<http://www.chem.utah.edu/MSDS/msds.html>

## Material Data Safety Sheets

## **Glossary**

### *Chemical mist suppressant*

Any chemical agent that reduces or suppresses fumes or mists at the of an electroplating or anodizing bath. Another term for chemical mist suppressant is fume suppressant.

### *Chromic acid:*

The common name for chromium anhydride (CrO<sub>3</sub>).

### *Chromium anodizing.*

The electrolytic process by which an oxide layer is produced on the of a base metal for functional purposes (e.g., corrosion resistance or electrical) using a chromic acid solution.

### *Chromium electroplating or chromium anodizing tank:*

The receptacle or container in which hard or decorative chromium plating or anodizing occurs.

### *Decorative chromium electroplating:*

The process by which a thin layer of chromium, (typically 0.003 to 2.5 microns) is electrodeposited on a base metal, plastic, or undercoating to provide a bright surface with wear and tarnish resistance. This chromium process can be hexavalent or trivalent. Typical current density applied during this process ranges from 50 to 220 Amperes per square foot for total plating times ranging between 0.5 to 5 minutes.

### *Electroplating or anodizing bath:*

The electrolytic solution used as the conducting medium in which 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.

### *Hard chromium electroplating:*

A process by which a thick layer of chromium (typically 1.3 to 760 microns) is electro-deposited on a base material to provide a surface with functional properties such as wear resistance, a low coefficient of friction, hardness and corrosion resistance. Hard chromium electroplating process is performed at current densities typically ranging from 150 to 600 ampere per square foot for total plating times ranging from 20 minutes to 36 hours depending upon the desired plate thickness.

### *Hard chromium :*

The form of chromium in a valence state of +6.

**Surface tension:**

The property, due to molecular forces, which exists in the surface film of all liquids and tends to prevent liquid from spreading.

**Tank operation:**

The time in which current and/or voltage is being applied to a chromium electroplating tank or a chromium anodizing tank.

**Trivalent chromium:**

The form of chromium in a valence state of +3.

**Trivalent chromium process:**

The process 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**

A component in a chemical mist suppressant that reduces the surface tension of a liquid.

**Cleaner Production:**

The use of materials, processes, or practices that reduce or eliminate the reation of pollutants or wastes at the source

**Source Segregation:**

The act of separating process chemical effluents or wastes at each individual point of origin to facilitate materials recovery

**Sources**

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Generic Package: Report on Pollution Prevention in Mass Finishing Operations, A report published by the Rhode Island Department of Environmental Management on Pollution Prevention in Mass Finishing Operations.