POLLUTION PREVENTION

P2 Links

SURFACE FINISHING/
ELECTROPLATING ISSUE

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Broward County's Metal Finishing Partnerships

by Kay Gervasi, P2 Program Manager, Broward County DPEP

The Broward County Department of Planning and Environmental Protection (formerly the Department of Natural Resource Protection) is participating in the U.S. Environmental Protection Agency (USEPA)'s Strategic Goals Program, which is a cooperative effort developed by industry leadership to improve environmental protection and reduce economic burdens on businesses. Other partners include the Florida Department of Environmental Protection (FDEP)'s Pollution Prevention Program and the three major metal finishing trade associations: the National Association of Metal Finishers, the American Electroplaters and Surface Finishers, and the Metal Finishing Suppliers Association.

In January 1998, Broward County signed a commitment of support to be a Charter Local Government Program in the Common Sense Initiative for Metal Finishers (CSIMF). Broward County is the first local government in the nation to officially sign as a Charter Member. This project is beneficial to Broward County because it will support their vision plan by developing public/private partnerships and will recognize businesses for going beyond compliance. The partners will:

- Evaluate effectiveness of Broward's existing *Pollution Prevention - Best Management Practices for Metal Finishers* on 17 electroplating facilities
- Identify potential tools and incentives for firms to go "beyond compliance"
- Encourage firms to identify whether they are meeting the CSIMF goals and encourage them to sign up as a CSIMF partner.

Broward County and FDEP are in the process of notifying businesses of their intent to work together to provide assistance to go beyond compliance. We would like to meet to discuss each business' participation in this exciting program. Each partner feels that this new method, where business and government collaborate, is truly beneficial for us all. For more information, contact Kay Gervasi, Broward County's P2 Program Manager, at 954-519-1257.

surface finishing:

REDUCING DRAG OUT

AND

WATER USE

Drag out is the solution remaining on products, racks, and barrels as the products and their suspension systems are moved from various process baths and water rinsing operations. The residual drag out remaining on products will show up in the next tank as drag in. An electroplating operation is generally intolerant of the contamination of drag out from a previous process, hence, rinsing between processes becomes the general practice. Used rinse water then becomes a major waste stream.

A better alternative, which is environmentally and economically desirable, is to employ methods which reduce the amount of drag out remaining on the product as they are removed from a process tank. This approach will reduce the need for treatment and disposal or recovery of rinse water: if drag out can be reduced, then the use of rinse water can be reduced. Many proven practices will significantly reduce the drag out, with no compromise in product quality, process time, or electroplating functions. These practices are described briefly, below, and in more detail in the electroplating tip sheets which are being developed by the Pollution Prevention Program. If you are interested in reviewing the tip sheets and providing comments, please contact Andrew Frost at 850-488-0300, or e-mail address frost_a@dep.state.fl.us.

Barrel Design

A barrel will retain at least 10 times more drag out than most racks. However, where products consist of many small parts, there may be no other reasonable choice. Significant barrel design considerations include: a construction material that will not degrade, deteriorate, or add unwanted chemicals and metals to the process; an arrangement with as large an open surface area as possible (many big holes); and a design that can be readily cleaned to remove cumulative build-up.

Bath Chemical Concentration

Some facilities have discovered that the chemical concentration in a given process bath can be successfully operated at considerably lower concentration levels than that recommended by the manufacturer. A 25% reduction in chemical concentration will generally result in more than a 25% reduction in rinse water requirement at the following rinse stage.

Bath Temperature

An increase in bath temperature will lower its viscosity and reduce the total drag out. However, a higher temperature will increase

(Continued on page 2)

Reducing drag-out AND water use (Continued from page 1)

evaporation and energy costs.

Extended Drip Time

The rack or barrel should be suspended over the process tank from which it has been withdrawn for a significant interval. A suspension for 15 seconds may reduce drag out by as much as 50%. In general, it is strongly recommended that a minimum of 10 seconds be allowed.

Agitate Over Bath

During the time the workpiece is suspended above the tank from which it has just been removed, rotation or some form of agitation will assist drainage. A simple turning or twisting of the rack may be needed to empty recessed areas.

Spray Rinse Above Process Tank

A spray rinse installed above the process tank can be an effective method for reducing drag out. In addition, the spray water can be used to compensate for evaporative losses from the process tank and ensure that much of the drag out returns to its proper place in the process tank. Spray rinse will provide a significant reduction in drag out added to the rinse baths, resulting in a significant reduction in water usage. The spray water source must use water conditioned in the manner similar to the water used in the process bath. In the design of a top spray system, it is most desirable to confine the spray water. A high velocity spray always has a tendency to blow away. This spray will include the process bath chemicals, which are usually corrosive, hazardous, and toxic in both the liquid and vapor forms. Inadvertent release of spray into the local area may result in worker safety or compliance issues.

Drain Boards

Drain boards consist of simple flat surfaces, installed between tanks and tipped toward the process tank for drainage. They will catch all drag out drainage during movement of parts from tank to tank.

Drain Pans

In cases where the production process cannot use the rack movement system for an extended drain time, it may be desirable to install an additional tank in the process line. This tank can be used under the rack or barrel to catch and accumulate drag out. The accumulated drag out is subsequently returned to the source process tank to partially offset its losses.

Static Drag out Rinse Tank

Many facilities employ a static rinse tank to collect the drag out and provide for a reduced water usage in the subsequent rinse tanks. This tank is located immediately downstream from the process tank and just ahead of the rinse tank(s). The tank is filled with water conditioned in accordance with the water used in the process tank. There is no continuing inflow of water. The contents of this tank are used to make up the losses in the associated process tank. Some facilities have found it desirable to insert the rack into this static drag out tank both prior to and subsequent to immersion in the process bath.

Chemical Recovery and Reuse

Where drag out collection tanks are used, it is good practice to return the drag out to the tank, to compensate for normal chemical losses. This practice will reduce the waste disposal requirements of the drag out and the cost of chemicals. If the total drag out rate, spray rate, or static bath accumulation rates exceed the evaporation loss from the process tank, then it is a good practice to use an evaporator to reduce the volume of solution recovered. Evaporators range from heated open surface tanks to commercial units that employ a pump to move the solution, a blower to move the air, a heat source, an evaporation chamber in which the solution and the air can be mixed, and a mist eliminator to remove any entrained liquid from the exit air stream.

Inside information -

How to reduce water usage by 90% or more -

By Andrew Frost,
Pollution Prevention Program

In the electroplating industry, rinsing is used to remove chemical residue, applied in an earlier step. Usually this is done by dipping workpieces into a tank of water. This tank receives a steady flow of "clean" water to offset the build-up of residual chemicals. This leads to enormous water usage at facilities. Water savings are directly related to the reduction of wastewater that requires treatment or disposal.

Rinse tanks installed between chemical baths, combined with countercurrent rinsing between the rinse tanks, will reduce water usage for that step by at least 90%. For example, water is delivered to a single rinse tank at a rate of 3 gallons per minute (gpm). Installing an additional rinse tank and making sure that the water flows countercurrently from one rinse tank to the other will reduce the water flow from 3 gpm to 0.245 gpm. Installing additional tanks will further reduce the water usage. Installing multiple rinse tanks and ensuring countercurrent rinsing between them can reduce water usage from several thousand gallons per day to under a hundred gallons per day.

ELECTROPLATING ORDER SHEET
POLLUTION PREVENTION RESOURCE CENTER
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

The Pollution Prevention Program maintains an extensive library of technical information and fact sheets which are researched by our staff or obtained from technical journals, the USEPA, other state programs, and the Internet. We will be happy to provide any of the following documents, free of charge, which may assist you in your business. Please feel free to use the sheet as an order form.

CODE	TITLE
3400-005	Environmental Research Brief. Waste Minimization Assessment for a Manufacturer of Metal-Plated Display Racks.
3400-064	Environmental Research Brief: Pollution Prevention Assessment for a Metal Parts Coater.
3400-066	P2-BMPs Implementation by Metal Finishing Facilities Broward County.
3400-067	Zero Water Discharge in the Metal Plating Industry Using An Improved Ion Exchange Process.
3471-001	Pollution Prevention and Best Management Practices for KPC Southern Industries, Inc.
3471-002	Source Reduction Opportunities in the Plating Industry.
3471-003	Waste Minimization and Pollution Prevention: Self-Audit Manual. Metal Finishing.
3471-004	Feasibility Study. Recovery of Metals From Electroplating Rinses.
3471-005	The Feasibility of Ion Exchange as an Appropriate Self-Contained Waste Minimization Process for the Electroplating Industry.
3471-006	Electrolytic Recovery of Nickel From an Electroplating Process.
3471-007	Guide to Clean Technology. Alternative Metal Finishes.
3471-008	Achieving Quality Chrome Plating by Use of Agitation and Filtration.
3471-009A	Guide to Cleaner Technologies. Alternative Metal Finishes.
3471-009B	Comparing Substitutes for Cr and Cu, to Prevent Pollution.
3471-009C	Case Study - Alternatives to the Use of Chromium in Plating and Conversion Coating McClellan Air Force Base, California.
3471-009D	A Low Environmental-Risk Replacement for Chromium and Electroless Nickel.
3471-009E	Improved Corrosion Resistance Using Chromium-Free Final Rinses.
3471-009F	Vacuum Metallizing - Quality and Productivity Enhancements Through In-Line Technology.
3471-009G	Project Summary. Substituting Cadmium Cyanide Electroplating with Zinc Chloride Electroplating.
3471-009H	Comparison of Alkaline Zn - Ni & Acid Zn - Ni as a Replacement Coating for Cadmium.
3471-009I	Alternatives for Nickel in Electroplating Processes.
3471-009J	Turn to Trivalent.
3471-009K	EN for Hard Chromium.
3471-010	Decorative Plating with Trivalent Chrome.
3471-011	Diffusion Dialysis - Economical Technology for Recovery of Acids From Pickling Processes.
3471-012	Electroless Cobalt Bath-Life Extension.
3471-013	Electroplating.
3471-014	Electroplating Effluent Polishing Using Tertiary Ion Exchange: A Case Study.
3471-015	Pollution Prevention for Electroplaters and Surface Finishers.
3471-016	Toxics Use Reduction Case Study. Wastewater Treatment and Metal Recovery at the Robbins Company.
3471-017	Waste Minimization Study. The Seaboard Metal Finishing Co., Inc.
3471-018	General Electric Moves Toward Closing the Loop at Their North Carolina Facility.
3471-019	Maintenance of Electroplating and Pickling Baths - The Key for the Minimization of Waste.
3471-020	In-Tank Filtration for the Anodizing Industry.
3471-021	Methods and Technologies for Reducing the Generation of Electroplating Sludges.
3471-022	Non-Cyanide Plating Processes.
3471-023	Environmental Research Brief. Waste Minimization Assessment for a Bumper Refinishing Plant.
3471-024	Smoke-Pattern Analysis Solves Plating Problems.
3471-025	Silver Electrodeposition from Thiosulfate Solutions.
3471-026	Reduction of Cadmium Plating on Aircraft Wheels and Brakes.
3471-027	Brush and Flow Selective Sulfuric Acid Anodizing.
3471-028	Reducing Dragout in Copper and Tin/Lead Plating.
3471-029	Waste Reduction Assistance Program (WRAP) On-Site Consultation Audit Report. Electroplating Shop.
3471-030A	Source Reduction and Metal Recovery Techniques for Metal Finishers.
3471-030B	Ion Exchange in Pollution Prevention and Control Technology for Plating Operations.
3471-030C	Application of Ion Exchange Technology in Pollution Prevention.
3471-030D	Using Your Ion Exchange Wastewater Treatment Equipment.
3471-030E	Ion Exchange for Metal Recovery: A Discussion of Trade-Offs.
3471-030F	Project Summary. Cadmium and Chromium Recovery from Electroplating Rinsewaters.

3471-030G	Electrowinning in Pollution Prevention and Control Technology for Plating Operations.
3471-030H	Electrolytic Effluent Treatment for Acid or Cyanide Zinc Plating Baths.
3471-030I	Recovered Value from Electroplating Industry Waste.
3471-030J	Cadmium Compliance Achieved With Electrowinning.
3471-030K	Project Summary. Recovery of Metals from Sludge and Wastewaters.
3471-030L	Electrolytic Metal Recovery Comes of Age.
3471-030M	Reverse Osmosis in Pollution Prevention and Control Technology for Plating Operations.
3471-030N	Project Summary. Recycling Nickel Electroplating Rinse Waters by Low Temperature Evaporation and Reverse Osmosis.
3471-030O	Atmospheric Evaporators in Prevention and Control Technology for Plating Operations.
3471-030P	Vacuum Evaporators in Prevention and Control Technology for Plating Operations.
3471-030Q	The Evaporator - A Great Tool, But No Free Lunch.
3471-030R	Atmospheric Evaporative Recovery Applied to a Nickel Plating Operation.
3471-030S	Electrodialysis in Prevention and Control Technology for Plating Operations.
3471-030T	Project Summary. Evaluation of an Electrodialytic Process for Purification of Hexavalent Chromium Solutions.
3471-030U	Vendors of Metal Recovery Equipment.
3471-031A	Water Conservation for Electroplaters: Counter-Current Rinsing.
3471-031B	Water Conservation for Electroplaters: Rinse Water Reuse.
3471-031C	Water Conservation for Electroplaters: Rinse Tank Design.
3471-032	Practical Pollution Prevention Guide. Chromium Emission Reduction for Electroplaters and Anodizers.
3471-033	Project Summary. Chromate Recovery from Chromating Rinsewater in Metal-Finishing Industry.
3471-034	Chromium Electroplating Alternative Reference.
3471-035	Evaporation Process.
3471-036	Reverse Osmosis Process.
3471-037	Waste Minimization Audit Report: Case Studies of Minimization of Cyanide Waste from Electroplating Operations.
3471-038	Controlling Air Emissions from Chromium Electroplating and Anodizing Tanks.
3471-039	Recovery of Metal from Sludges and Wastewaters.
3471-040	Electroplating.
3471-041	Plating.
3471-042	Reinventing Environmental Protection, The Strategic Goals Program for Metal Finishing.
3471-043	International Waste Minimization Approaches and Policies to Metal Plating.
3471-044	Pollution Prevention Possibilities for Small and Medium Sized Industries.
3471-045	Reducing Water Pollution Control Costs in the Electroplating Industry.
3471-046	Centralized Waste Treatment Alternatives for the Electroplating Industry.
3471-047	Chromium Emission Reduction for Electroplaters and Anodizers.
3471-048	Project Summary: Chromate Recovery from Chromating Rinsewater in the Metal Finishing Industry.
3471-048	Modifying Tanks Layouts To Improve Process Efficiency.
3471-049	Reducing Rinse Water Use with Conductivity Control Systems.
3471-050	Reverse Osmosis Applications for Metal Finishing Operations.
3471-051	Innovative Cooling Systems for Head Chrome Electroplating.
3471-052	Reducing Dragout With Spray Rinses.
3471-053	New Soil-Cleaning Routes Tackle Metals.
3471-054	Pollution Prevention Technologies for Metal Finishing Operations.
3471-055	Extending Electroless Nickel Bath Life Using Electrodialysis.
3471-056	Finding An Alternative To Solvent Degreasing.
3471-057	Metal Recovery and Wastewater Reduction Using Electrowinning.
3479-001	Alternatives to Solvent-Based Coatings.
3479-002	Atwood Autodeposits for Automotive. Autodeposition System Coats Seat Assemblies and Hardware.
3479-003	Autodeposition-The Environmental Advantage.
3479-004	A Comparison of Fluoropolymer Powder Coatings.

NAME: _____

BUSINESS: _____

ADDRESS: _____

CITY/ZIP: _____ PHONE: (_____)_____

P2 Success Story: FAR-MAC Plating, Inc.

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FAR-MAC Plating, Inc., is a refurbisher of plastic and chrome bumpers in Melbourne, Florida. The Pollution Prevention Program conducted a P2 Assessment at the facility in February, 1997, and presented a number of P2 options to facility management. Subsequent to the visit, facility management began implementing some of the options. This pollution prevention success story in the making is described below.

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Chrome Bumper Refurbishing

The refurbishment process for chrome bumpers is organized into four steps. First, the mechanical deformities are corrected. Next, the original chrome finish is removed, or stripped, and the nickel base coat is reactivated to accept a subsequent plating. The bumpers are then sand blasted and polished to remove surface blemishes. Finally, a new chrome finish is electroplated onto the bumper.

Stripping Process Changes

The waste included a mineral spirits bath, a caustic soda bath, and a neutralized acid bath that were disposed of as a hazardous waste. Annual disposal costs for the combined sludge and hazardous waste were approximately $11,000.

A filtration and ion exchange process, designed by FAR-MAC, was adopted in order to reuse wastewater from both the caustic and acid rinses in the stripping process. The revised system is expected to reduce the quantity of hazardous waste generated by 19,250 pounds per year. The facility's water consumption and waste water is expected to be reduced by approximately 24,000 gallons per year. Capital equipment and installation costs were approximately $14,000.

In addition, an uninsulated heated caustic stripping tank has been replaced with a new insulated tank. It is estimated that this will save 66 percent of the unit's energy cost.

The company has also modified the rinse procedures. Previously, bumpers were rinsed over a platform with city water at normal water pressure. Now, plans are to rinse with a high-pressure top spray that is more effective and uses less water.

To further conserve energy, two of the nickel plating tanks will be replaced with new insulated tanks and a third tank will also be insulated. This insulation should result in a 50 percent energy reduction. Capital equipment and installation costs are estimated at $6,600.

Sand Blasting Process Changes

After stripping, the bumpers were sand blasted to prepare the surface for plating in an open area. This process resulted in 4,000 pounds per year of sand solid waste.

The open sand blasting station was replaced with an enclosed, recycling, glass bead blasting station. The glass beads are collected and reused. Currently, 1,000 pounds per year of glass dust waste are disposed as hazardous waste. Thus, waste from the blasting operation has been reduced by 4,000 pounds per year.

This option also protects the operator from dust. The capital equipment and installation costs were approximately $6000.

Electroplating Process Changes

Electro-clean and acid neutralization baths were previously dumped and hauled away as hazardous waste at a cost of $7500 per year. Additionally, the bath chemicals were lost and replacement was required. Both of these baths had rinse tanks associated with them that used approximately 600 gallons per hour of city water each. The used rinse water was discharged to the local wastewater treatment plant.

To extend the electro-clean bath life, FAR-MAC added a soak cleaner tank to the beginning of the plating process. This tank was installed with a filtration system to prolong the soak cleaner life.

Cleaning chemical usage has been reduced by 10,800 pounds per year. Both fresh and waste water have been reduced by 16,200 gallons per year, and 21,600 pounds per year of spent hazardous bath solution has been eliminated. Capital equipment and installation costs for these changes were approximately $4,000.

The acid rinse water for the electro-clean tank is now reused. Both fresh water and sewered wastewater have been decreased by 1.5 million gallons annually. Capital equipment and installation costs were $400.

The company has installed drip boards between all the process tanks to recover chemical drag out waste. The cost is minimal for each drip board, and since the tanks are already arranged in a line, no rearrangement will be required. The benefits of this option are conservation of process chemicals and reduction of floor contamination. Approximately 500 pounds of chemicals will be saved annually.

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Plastic Bumper Refurbishing

Most automobile bumpers are made of plastic and can be restored to their original shape by being heated to about 160 degrees. FAR-MAC was originally using an uninsulated tank without a lid for this process. A lid was installed on the facility's 900 gallon unbending tank to reduce evaporation, and the sides of the tank were insulated to reduce energy use. This initiative reduced annual propane heating gas consumption by 300,000 cubic feet per year.

f FAR-MAC has proven **beyond a doubt** that a business can save money while benefiting the environment.

f For additional information on P2 assessments, contact the FDEP Pollution Prevention Program at 850-488-0300.

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Good operating practices for GREAT results

The electroplating industry includes a variety of diverse processes and plating techniques. Initiating good operating practices in your business can prevent pollution and also improve product quality, protect worker health, and reduce costs.

A first defense in your reduction of waste generation is employee awareness. Employees who know where the waste is produced, as well as how to prevent it, and why it is important to do so, are an asset to your business. Topics for training include preventative maintenance methods, procedures for process tank additions, and procedures for handling spills and leaks.

The major sources of pollution from plating operations are process chemicals. As useable chemicals they are valuable, as waste chemicals they are costly. You can develop basic guidelines to insure optimal purchase, subsequent identification, and timely and maximal use. An effective pollution prevention program will track and record chemical purchases and usages, waste generation, production volume, and production rate. This information can be used to develop a mass balance for the process, from which you can easily analyze waste streams and identify cost effective pollution prevention opportunities.

Pollution Prevention Program engineers are developing tip sheets for the electroplating industry which may assist you in establishing employee training programs, performing materials balances, lowering water use, reducing drag out, and recovering bath chemicals. For details, contact Andrew Frost at 850-921-9231, or e-mail address frost_a@dep.state.fl.us.

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THE THIRD ANNUAL STATEWIDE POLLUTION PREVENTION CONFERENCE

The Third Annual Statewide Pollution Prevention Conference, will be held **June 9-11, 1999** at the Jacksonville Hilton and Towers Hotel at 1201 Riverplace Blvd., Jacksonville, Florida. Topics for businesses include:

- Business Success Stories
- Basic P2 and P2 Assessments
- Industrial Cleaning
- Preventative Maintenance
- Innovations in Waste Reduction
- Environmental Management Systems
- P2 Tools "Pollution Solutions"
- Simple, but Cost Effective P2 Options

Speakers from the hotel and motel, hospital, and construction industries will present business success stories. Presentations by speakers from the military, state and local government, non-profit organizations and education will address innovative technologies, low waste energy generation, and P2 in regulatory programs and enforcement.

For information on the Conference, please contact Dawn Jenkins of the University of Florida TREEO Center at 352-392-9570, ext. 127, or e-mail address djenkin@treeo.doce.ufl.edu.

Your comments or suggestions for future issues of *P2 Links* are always welcome. They may be submitted to our mailing or web site address (see return label), or electronically to *P2 Links* editor galocy_b@dep.state.fl.us.