



P2 and Metal Finishing *(An Overview)*

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Contents of Presentation

- ★ An overview of Metal Finishing and P2
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- ★ Case Study: Pollution Prevention Torcad
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The Metal Finishing Industry

- ★ 750 Metal Finishers in Canada
- ★ 450 Metal Finishers in Ontario
- ★ 250 Metal Finishers in the “Golden Horseshoe”
- ★ Canadian Metal Finishing Industry employs approximately 20,000 people and produces \$3.5 billion in annual revenue.
- ★ The Ontario Metal Finishing Industry employs approximately 15,000 people and produces \$2.5 billion in annual revenue



The Metal Finishing Industry

- ✦ Generally made up of small businesses – fewer than 10% of the firms have more than 100 employees.
- ✦ Typically, a metal finishing company is privately owned and managed by that owner.

Benefits of Electroplating

- ✦ Cost & Availability
- ✦ Decorative
- ✦ Corrosion Protection
- ✦ Alter Physical Properties
- ✦ Common Base Metals

The Generic Plating Line Configuration

- ✦ Part loading / racking
- ✦ Aqueous soak cleaner
- ✦ Electro-cleaner
- ✦ 2-stage rinse
- ✦ Spray rinse
- ✦ Acid dip
- ✦ Rinse
- ✦ Nickel Strike
- ✦ Nickel Plate
- ✦ Drag out
- ✦ 3-stage rinse
- ✦ Drag in
- ✦ Chrome Plate
- ✦ Drag out
- ✦ 3-stage rinse
- ✦ Part unloading / un racking

Environmental Challenges

- ✱ Industry is chemical-intensive
- ✱ Industry is water-intensive
- ✱ New, more stringent regulatory requirements
- ✱ Environmental monitoring requirements
- ✱ Negative Industry Image

New, more stringent regulatory requirements

- ★ New City of Toronto Sewer Use By-Law – mandatory pollution prevention planning requirement
- ★ Ontario Ministry of the Environment's new Air Monitoring & Reporting Regulation
- ★ Ontario's new proposed air models and risk assessment standards
- ★ Ontario's new Hazardous Waste Regulation
- ★ Environment Canada's Hexavalent Chromium Regulation

Pollution Prevention Solutions for Hazardous Materials Management

- ☀ preventive maintenance of floors, tanks, hoses
- ☀ control overflow from tanks
- ☀ check valves on rinse tanks for flow control
- ☀ use tanks that do not corrode (use corrosion resistant materials)
- ☀ coat floors
- ☀ spill control & leak prevention
- ☀ warning & alarm system (high level alarm)
- ☀ curbing (around tanks & filters)
- ☀ dikes and containments
- ☀ always inspect tanks (report signs of corrosion on equipment)

Pollution Prevention Solutions for Reduction in Chemical Use

- ✱ increase drag-out time
- ✱ longer drip time
- ✱ larger holes in barrels to enhance dripping
- ✱ slower movement of racks / withdrawal from tanks
- ✱ fog spray
- ✱ rack design - position of part to maximize drip
- ✱ place drain boards between tanks
- ✱ drag-out tanks (add some more tanks)
- ✱ filtrate directed back to tanks
- ✱ drag-out can be used as top up
- ✱ proper handling & storage of chemicals procedures
- ✱ try to recover metals through atmospheric/vacuum evaporation; ion exchange; UF/RO, etc.

Pollution Prevention Solutions for Reduction in Water Use

- ✱ apply flow restrictors
- ✱ spray fog rinse
- ✱ agitators in the rinse
- ✱ raised temperature in the rinse
- ✱ counter-current (counter-flow) rinsing
- ✱ multi-stage static rinsing
- ✱ separate process & non-process water
- ✱ reuse non-process water
- ✱ incorporate UF & RO systems to recycling water
- ✱ reactive rinsing / try to re-use rinse water for process ie. overflow from acid rinse can be used after alkaline rinse
- ✱ re-generate rinse water
- ✱ try to create closed-loop system where possible



P2 Case Study: Torcad Company

P2 Approach at Torcad

★ Preliminary Assessment

- ★ Familiarity of Processes/Operations/Data
- ★ Identification of Subject Pollutants/Resources

★ Detailed Assessment

- ★ Collection of Data
- ★ Quantification (mass balances)

★ Identification of P2 Options

★ Technical and Economic Feasibility

★ Preparation of P2 Plan

Preliminary Assessment

- ★ Seven Potential Operating Lines

- ★ Four Zinc Chloride Plating Lines
- ★ One Zinc Phosphate Plating Line
- ★ One Chromate Conversion Line
- ★ One Manganese Phosphate Line

- ★ Two applicable Subject Pollutants

- ★ Zinc
- ★ Chromium

- ★ One Non-Subject Pollutant (or resource)

- ★ Water

Detailed Assessment

★ Collection of Data to Perform Mass Balance

- Certificate of Approval (Air) Emission Inventory
- Laboratory analytical records of wastewater treatment system and sludge
- Production Data (total amount purchased)
- Municipal Water Records
- Product Specification Data (amount plated)

★ Mass Balance (kg/year)

- Define the Control System, e.g., 1 line or entire facility
- Input = Mass of Subject (S) Purchased
- Output = Amount of S in Product + Amount of S in Wastewater + Amount of S in Sludge

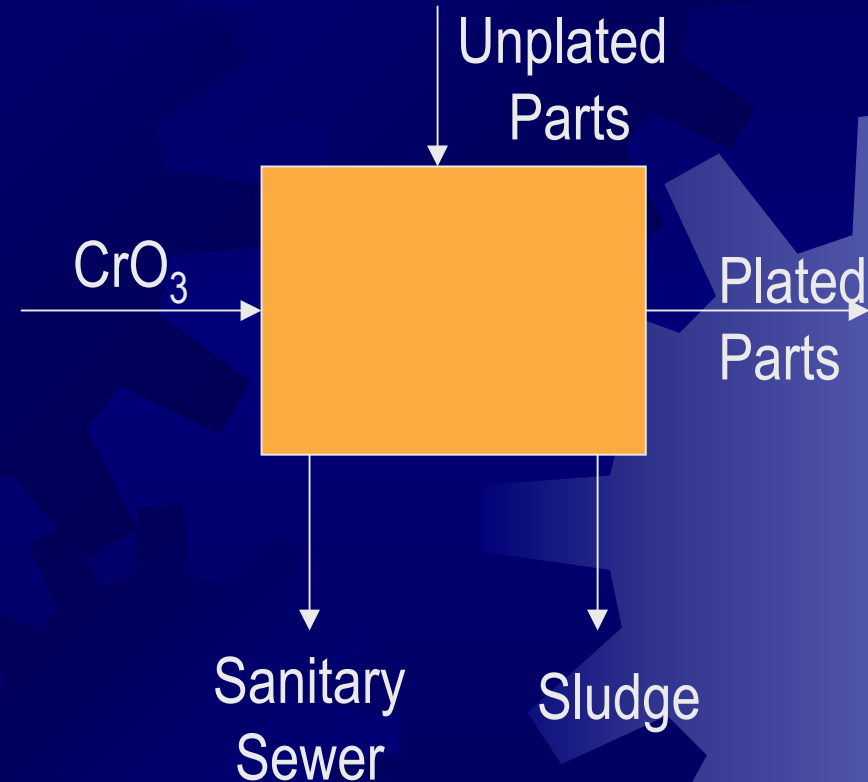
Results of Chromium Balance

★ INPUT:

- Cr(total) = 3103 kg/year

★ OUTPUT:

- Plated Parts = 508 kg/year
- Sludge = 2,556 kg/year
- Sanitary Sewer = 36 kg/year
- Total Non-Product Output = 2592 kg/year



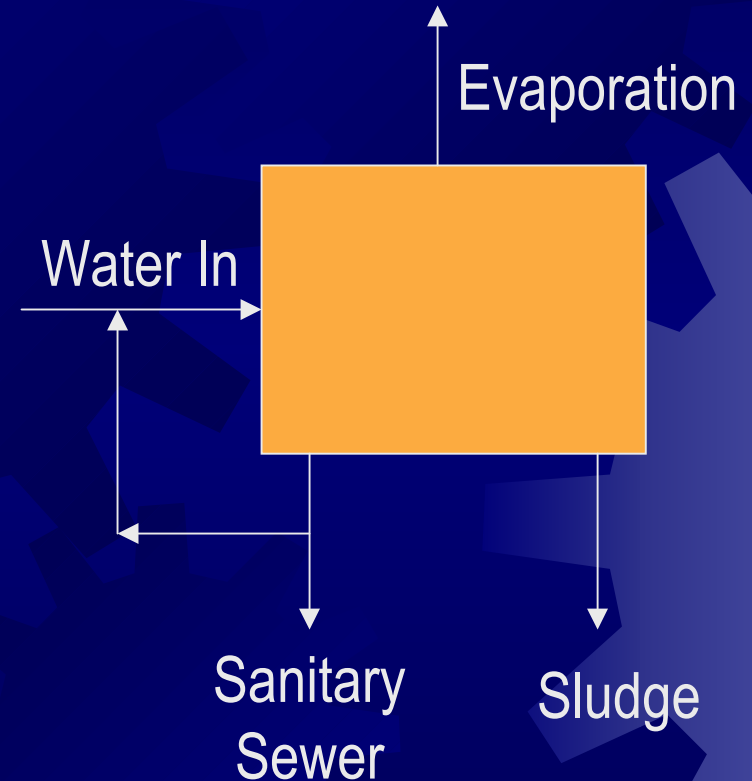
Results of Water Balance

☀ INPUT

- ☀ City Water = 260 gpm

☀ OUTPUT

- ☀ Evaporation = 30 gpm
- ☀ Sanitary Sewer = 220 gpm
- ☀ Sludge = 10 gpm



Existing P2 Practices

☀ Drag In/Drag Out Reduction

- Drip Time Optimized based on Plating Performance
- Larger drain holes in barrels
- Controlled/Slow Movement of barrels
- Bath Temperatures Increased to lower viscosity
- Drain Boards between Tanks

☀ Process Bath Maintenance

- Baths are continuously monitored for pH, metal concentrations to extend bath life
- Optimized chemical concentrations for plating thickness (not excessive to increase viscosity)
- Use of deionized water

☀ Rinse Water Minimization

- Counter-Current Flow Rinsing
- Recycling of Water

Potential P2 Opportunities

- ☀ Increase Number of Tanks (Water)
 - ☀ Increase Number of Rinse Tanks to Maximum
 - ☀ Decrease Flow rate to minimum
 - ☀ Install Evaporator to evaporate remaining small water or recover water through reverse osmosis
- ☀ Reverse Osmosis Only
- ☀ Change from Chromium (VI) Plating to Chromium (III) Plating
 - ☀ Efficiency of Plating Increased without compromising Plating Thickness

Economic Feasibility

P2 OPTION	Reverse Osmosis	Add. Rinse Tanks	Cr(VI) to Cr(III)
Capital Outlay (\$)	240,000	130,500	8,000 ¹
Operating Costs (\$/year)	19,200	0	0
Savings (\$/year)	280,600	109,500	31,430
Net Operating Cost Savings (\$/year)	261,400	109,500	31,430
Payback Period	0.9 year	1.2 year	0.3 year

Note 1 : Management costs of approval have not been included



QUESTIONS??