

# Fabricated Metal Products

## Process Description

The fabricated metal industry encompasses a wide variety of processes that machine, treat, coat, plate, paint, and clean metal parts. These processes can be broadly classified as machining, cleaning and stripping, surface treatment and plating, and painting and applying other nonmetallic coatings.

Cleaning and stripping of metal surfaces is accomplished by using one or more of the following types of cleaning media: solvents, aqueous cleaners (alkaline and acid), abrasives, ultrasonics and water. Most metal fabrication activities also involve the application of paint or some other nonmetallic coating to provide a final finish surface. Machining involves the use of various cutting tools that travel along the surface of the workpiece, shearing away the metal ahead of it to create a piece with specified dimensions. Metalworking fluids are commonly applied to the workpiece and cutting tool for cooling of materials, washing away metal shavings, protecting the work piece and giving a good final surface finish.

Metal surface treatment and plating operations include a large number of treatment processes that involve modifying the workpiece surface properties to improve corrosion or abrasion resistance, alter appearance, or otherwise enhance the utility of the product.

## Waste Streams

Waste streams of concern to sanitary sewer systems are waste rinsewater and grease-contaminated water from use of abrasives. Spent alkaline and acid cleaning solutions generally require some treatment before they can be discharged. Facilities with onsite wastewater treatment often mix primary rinsewater and alkaline and acid cleaning solutions before treatment. Waste solvents will generally be handled as a hazardous waste.

Spent bath solutions from electroplating are high in toxic heavy metals, such as cadmium and chromium, and certain electroplating baths have high concentrations of cyanide. Quench oils and vent scrubber wastes produce contaminated wastewater that may be of concern if discharged to a wastewater treatment plant. Spent electroplating and case-hardening bath solutions, ion exchange reagents, filter and wastewater treatment sludges all are likely to contain high concentrations of toxic pollutants, and are usually treated as hazardous wastes. Machining, metal-plating, and treatment activities generate waste streams from cleaning and stripping. Accidental spills are a concern when the cleanup results in a discharge of concentrated or diluted waste streams into the sewer system.

In fabricated metal products air emissions are generated primarily from the surface coating operations. Many paints contain volatile organic compounds (VOCs) that are released to the environment when sprayed from the paint applicator. In certain applications metal products' residual oils and greases are burned off in a dryer producing both VOC and particulate matter (PM) emissions.

## Pollution Prevention Opportunities

Pollution prevention techniques can be applied to reduce waste streams in five areas: metal cleaning and stripping, metal plating process solutions, metal plating rinsewater, paint application, and machining operations.

Rinsewater from metal-cleaning and metal-stripping operations can be reduced by: reducing initial input requirements, reducing makeup requirements, extending the life of rinsewater, and reusing rinsewater. Waste streams from aqueous cleaning solutions can be reduced by extending the life of solutions through reducing evaporation losses by using tank lids, frequent sludge removal, filtration, and processing of waste solutions for reuse (oil separation). Dry cleaning parts with abrasives such as sand or shot blast is an alternative to aqueous or solvent cleaning solutions.

Metal-plating process solutions tend to be high in toxic heavy metals, so efforts to reduce the amount of toxicity of waste solutions are important. Chemical conversion methods generally involve less-toxic process solutions. Also materials substitution to reduce the toxicity of process solutions may be possible. A variety of bath controls can be used to extend the life of process solutions. Bath controls include installing bath filters, using deionized water for makeup, keeping racks clean, and reducing contamination by using high-quality raw materials in anodes. Materials can be recovered through evaporation, ion exchange, reverse osmosis, chromium electro dialysis, or electrolytic recovery/electrowinning.

Opportunities for reducing metal-plating waste rinsewaters fall into three major categories:

- 1.) Drag-out reduction (reducing contamination of rinse water by process solution).
- 2.) Improvement of rinse water system design to reduce makeup or extend life of rinses (rinse tank design, multiple rinsing tanks and others).
- 3.) Reuse of contaminated rinsewater (secondary rinse as primary rinse or makeup, countercurrent rinsing, metal recovery through ion exchange or electro dialysis for the reuse of contaminated rinses, and collecting and concentrating drag-out by evaporation for reuse in the plating bath).

Techniques related to paint applications include process modifications (reducing empty container wastes, drip reduction), overspray reduction (equipment modifications, operator training), product substitution (solvent-based coatings with water-based coatings, radiation [UV] cured coatings, powder coatings), reuse of overspray, container wastes, solvent paint mixtures, and recovery (distillation, filtration).

Options related to machining operations include use of high quality metalworking fluid, optimal fluid selection for particular need, recycling of lubricants/coolants, periodic or continuous filtration of coolants, fluid concentration control, material substitution (soluble borates for soluble borate lubricants), regular sump and machine cleaning, improving equipment scheduling and establishing dedicated lines.

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### *Pollution Prevention Checklist*

- Replace oil lubricants used in cold forming operations with a hot lime bath or borax soap to reduce or eliminate the need for cleaning solvents.
- Utilize dry cutting or laser machining technologies if feasible; reduce the amount of lubricant if possible.
- Review manufacturing process to eliminate redundant cleaning of metal products. Can part degreasing be eliminated? Surface coating?
- Use stamping lubricants that remain on the part until the annealing process where they can be burned off, reducing or totally eliminating the need for cleaning solvents.
- Replace traditional solvent cleaners with low HAP/VOC, aqueous-based cleaners, ultrasonics or a combination.
- Replace solvent-borne surface coatings with water-borne or low VOC/HAP, high solids coatings.
- Convert surface coating applications to high efficiency, low VOC emitting technologies such as electrostatics, high volume low pressure (HVLP) guns or powder coating.
- Schedule production for longer product runs to reduce equipment flushing and cleaning.
- Replace solvent based cleaners with recycled high pressure water-based cleaning/phosphate systems to reduce VOC and HAPs.
- Reduce drag-out from degreasers by allowing parts to drip back into the degreaser tank. Install tank covers that automatically close during the plating operation.
- Train employees to keep all containers closed to reduce air emissions and preserve the chemical properties of the coatings and solvents (this includes all containers used to store coatings, solvents, additives, and liquid waste materials).