



Printed Circuit Board Manufacturers' Fact Sheet

Utah Department of Environmental Quality
Promoting a Healthy Environment

The printed circuit board manufacturing industry generates a variety of production wastes. Reducing waste generation can decrease future liability, ease regulatory compliance and reduce disposal costs.

Typical wastes generated include:

- Industrial wastewater and treatment residue
- Spent process baths
- Acids used for cleaning equipment
- Copper sulfate crystals

Waste Reduction

Waste reduction can reduce the amount of hazardous waste generated in the shop. Waste reduction programs benefit shops by minimizing:

- Disposal costs
- Regulatory compliance costs (record keeping, reporting, tracking, etc.)
- Operating costs
- Transportation costs
- Off-site treatment costs
- Worker safety costs

Since waste reduction methods reduce the amount of waste generated as well as the amount subject to regulation, they help shops comply with requirements and save money. Common waste reduction methods include pollution prevention (P2), recycling and resource recovery and treatment alternatives.

Start at the Top

Shop owners or managers must be committed to waste reduction and pass that commitment to employees. Employee training should be established in waste reduction, hazardous material handling and emergency response. Incentive programs encourage employees to design and use new waste reduction ideas.

Waste assessments should be completed. List the source, type and amount of hazardous waste generated, making it easier to pinpoint where waste may be reduced or eliminated.

Pollution Prevention (P2)

P2 is often the cheapest way to reduce waste . Many activities involve housekeeping changes or minor in-plant process modifications:

- Improve procedures and segregate waste
- Keep work areas clean
- Designate protected raw material and hazardous waste storage areas with spill containment. Keep areas clean and organized, and make one person responsible for maintaining them
- Label containers and cover them to prevent contact with rainfall and avoid spills
- Use a “first-in, first-out” policy for raw materials to keep them from becoming too old to use. Make one person responsible for maintaining and distributing them
- Segregate waste streams for recycling and treatment and keep non-hazardous material from becoming contaminated
- Prevent and contain spills and leaks by installing drip trays and splash guards around processing equipment
- Routinely inspect tanks and tank liners to avoid failures
- Use dry cleanup wherever possible to reduce wastewater volume

Material Substitution

- Use materials that reduce sludge generation or are that are easily recycled
- Use de-ionized water instead of tap water in process baths and/or rinsing operations to reduce sludge volume
- Use non-chelated rather the chelated process chemistries to reduce sludge volume
- Try using mild chelator if required
- Use alkaline cleaners instead of solvents for degreasing operations. These cleaners may be treated on-site and usually may be discharged to the local sewer with permit authorization

Extending Process Bath Life

- Treatment (filtration, electrolytic dummyming, etc.) of process baths can extend their useful life
- Bath replenishment extends the bath’s useful life
- Monitoring baths (using pH or conductivity meters) can determine bath replenishment need

Drag-Out Reduction

- Minimize bath concentration to the lower end of operating range
- Maximize bath operation temperatures to lower solution viscosity
- Use wetting agents which reduce solution surface tension to decrease drag-out
- Withdraw work pieces from tanks slowly, allowing maximum drainage back into process tanks
- Use air knives or spray rinses above process tanks to rinse excess solution from work piece and into process bath
- Install drainage boards between process tanks and rinse tanks to route drag-out back to the tank

- Use dedicated drag-out tanks after process baths to capture drag-out
- Install rails above process tanks to hang work piece racks for drainage prior to rinsing

Rinse Systems

- Use air agitation or work piece agitation to improve rinse efficiency
- Install multiple rinse tanks after process bath to improve rinse efficiency and reduce water consumption
- Installing flow controls can improve rinsing efficiency and reduce wastewater volume generated by rinsing operations

Equipment Cleaning

- Use a multi-stage cleaning line for work piece racks similar to a multi-stage rinse system.

Recycling and Resource Recovery

- Reuse acid rinse effluent in alkaline rinse tanks
- Treat rinse water effluent to recover process bath chemicals, allowing reuse of effluent for rinsing or neutralization prior to discharge
- Spent process baths include strong and mild etchants and alkaline photo-resist stripper. These baths can be regenerated to recycle valuable etchants
- Use treatment technology to recover metal and metal salts from process baths
- Reuse spent reagents from process baths in the wastewater treatment process
- Recycle spent solvents
- Use treatment technologies to recycle rinse waters in a closed-loop or open-loop systems

Treatment Alternatives

- Pre-treat process water to reduce natural contaminants which contribute to sludge volume
- Use treatment chemicals that reduce sludge generation (caustic soda instead of lime)
- Use sludge de-watering equipment to reduce sludge volume
- Use treatment technologies (such as ion exchange) that do not use standard precipitation /clarification methods which generate heavy metal sludge

For More Information, Contact:

Division of Solid & Hazardous Waste - (801) 538-6170

Pollution Prevention Coordinator - (801) 536-4477

Environmental Hotline - 1 (800) 458-0145

Small Business Assistance Program - (801) 536-4479