

3.8.1 Electronics Manufacturing: Common Operations

Tip Sheet #1

WASTE ORIGIN: General Production Processes
Process Immersion Chemical Baths and Spray-Rinse Cabinets

WASTE TYPES: Excessive Water Consumption

WATER REDUCTION AND RECYCLING OPTIONS: *Process or Equipment Modification*

- ! Develop a **cleanliness standard** for printed circuit boards at every process stage to determine the minimum amount of water required for product quality.
- ! **Observe and record production processes** to estimate water use and pressure. Inspect tanks, enclosed cabinet chambers, pumps, pipes, spray nozzles, sumps, and photosensors for operating deficiencies.
- ! **Establish the lowest water flow rate** that produces acceptable results for parallel process lines (produce identical products using identical processes).
- ! **Monitor flow rates** of water supply lines for each process: install additional flow gauges throughout the plant to easily quantify flow-rate reductions and calculate water and cost savings.
- ! Maintain and optimize the **use of photosensors** to restrict water flow rates by:
 - ! Installing photosensors in *spray-rinse chambers* where they do not exist;
 - ! Repairing or replacing *defective photosensors*;
 - ! Performing *routine maintenance* (clean and readjust) to keep photosensors working properly.
- ! **Maintain and optimize** plumbing and other equipment used for directing water flow through the production facility:
 - ! *Eliminate hoses* that supplement supply water to spray rinses;
 - ! *Hard plumb* all water-bearing supply pipes;
 - ! *Improve water movement* in spray cabinets sumps and immersion baths to maximize water rinsing capabilities;
 - ! *Recirculate fresh water rinse* to an earlier rinsing stage using a counterflow method, or reuse it as makeup water for process bath or spray solutions.
- ! Consider **other water conservation methods** including:
 - ! *Flow restrictors* on flowing rinses;
 - ! *Counter-current* rinsing or cascade rinsing systems;
 - ! *Redesign rinsing tanks* for more efficient water use;
 - ! *Fog* rinsing;
 - ! *Reactive* rinsing;
 - ! Rinsing with *purified or softened water*;
 - ! *Dead* rinses;
 - ! *Conductivity* controllers;
 - ! *Agitation* to assure adequate rinsing and homogeneity in rinse tank;
 - ! Flow *control valves*;
 - ! *Air knives* to reduce dragout.

Sources:

Water Conservation in Printed Circuit Board Manufacturing, Vol. 11, No. 1, SOURCE Quarterly Newsletter, Minnesota Technical Assistance Program (MnTAP), University of Minnesota, Winter 1996.

EPA Sector Notebook Project: Electronic and Computer Industry, U.S. EPA, Office of Compliance, September 1995, EPA/310-R-95-001. (Also accessible via the Internet at the EPA Sector Notebook Home Page address, <http://es.inel.gov/comply/sector/index.html>).

3.8.1 Electronics Manufacturing: Common Operations

Tip Sheet #2

WASTE ORIGIN: Electroplating Operations

WASTE TYPES: Acid Fumes, Ammonia Fumes, and Volatile Organic Compounds (VOCs)

WASTE REDUCTION AND RECYCLING OPTIONS: *Process or Equipment Modification*

- ! **Modify rinsing methods** to control drag-out by:
 - ! Increasing bath *temperature*;
 - ! Decreasing *withdrawal rate* of parts from plating bath;
 - ! Increasing *drip time* over solution tanks; racking parts to avoid cupping solution within part cavities;
 - ! Drip boards;
 - ! Shaking, vibrating, or passing the parts through an *air knife*, angling drain boards between tanks;
 - ! Using *wetting agents* to decrease surface tension in tank.
- ! **Cost Savings Examples:**
 - ! Using **drip bars**.
Capital Investment: \$100/tank. Savings: \$600/year.
 - ! Using **drain boards** between tanks.
Capital Investment: \$25/tank. Savings: \$450/year.
 - ! Installing **racking**.
Capital Investment: Zero dollars. Operating Costs: Minimal. Savings: \$600/year.
 - ! Employing drag out **recovery tanks**.
Capital Investment: \$500/tank. Savings: \$4,700/year.
 - ! Increasing parts **drainage time**.
 - ! Installing an **ion exchange** system.
Savings: \$1,900/year. Capital Investment: \$78,000. Operating Costs: \$3,200/year.
 - ! Employing a **reverse osmosis** system.
Capital Investment: \$62,000. Savings: \$40,000/year.
- ! **Use water conservation methods** including:
 - ! Flow *restrictors* on flowing rinses;
 - ! *Counter-current* rinsing systems;
 - ! *Fog* or spray rinsing;
 - ! *Reactive* rinsing;
 - ! *Purified* or softened water;
 - ! *Dead* rinses;
 - ! *Conductivity* controllers;
 - ! *Agitation* to assure adequate rinsing and homogeneity in rinse tank;
 - ! Flow *control valves*.
- ! **Install atmospheric evaporator** to reduce metal concentrations.
- ! Install process (e.g., CALFRAN) to reduce pressure of vaporization water cooler

temperatures and recycle water by condensing the vapors in another container, thus **concentrating and precipitating solutes out.**

! **Use reactive rinsing and multiple drag-out baths.**

Reduce cost of treating spent process baths and rinsewaters, increase lifetime of process baths and reduce the quantity of rinsewater requiring treatment.

! Improve control of water level in rinse tanks, improve sludge separation, and enhance **recycling of supernatant** to the process by aerating the sludge.

Savings: \$2,000/year. Waste Savings/Reduction: reduced sludge generation by 32 percent.

! Install system (e.g., Low Solids Fluxer) that applies flux to printed wiring boards, leaving little residue and **eliminates the need for cleaning CFCs.**

! **Cost Savings Examples:**

! Counter flow rinsing and cascade **rinsing systems.**

Costs: \$75,000 to upgrade existing equipment and purchase new and used equipment.

Waste Savings/Reduction: reduce water use and wastewater treatment costs.

! Installing a **counter-current rinsing** operation.

Capital Investment: \$1,800-2,300. No direct costs. Savings: \$1,350/year.

Waste Savings/Reductions: reduce water use by 90-99 percent.

! Redesigning **rinse tank.**

Capital Investment: \$100. No direct costs. Savings: \$750/year.

! **Regenerate plating baths** by activated carbon filtration to remove built up organic contaminants.

Capital Investment: \$9,192. Costs: \$7,973/year. Savings: \$122,420/year.

Waste Savings/Reduction: 10,800 gallons/year. Reduce volume of plating baths disposed and requirements for virgin chemicals.

! **Install pH controller** to control the alkaline and acid concentrations in tanks.

Sources:

EPA Sector Notebook Project: Electronic and Computer Industry, U.S. EPA, Office of Compliance, September 1995, EPA/310-R-95-001. (Also accessible via the Internet at the EPA Sector Notebook Home Page address, <http://es.inel.gov/comply/sector/index.html>).