

3.8.3 Electronics Manufacturing: Printed Wiring Boards

Tip Sheet #1

WASTE ORIGINS: All Cleaning Operations (Board Preparation, Electroless Plating, Imaging, and Electroplating)

WASTE TYPES: Spent Process Baths (Etchants, Acid Solutions, Alkaline Solutions, Developing Solutions, Plating Baths, Electroless Copper Baths, Catalysts)
Air Emissions (Volatile Organic Compounds, Acid, and Ammonia Fumes)
Sludges, Rinse Waters, and Aqueous Metals)

WASTE REDUCTION AND RECYCLING OPTIONS:

! **Process or equipment modification examples:**

- ! Installing a system (e.g., Low Solids Fluxer {LSF}) which applies flux to printed wiring boards, leaving little residue, and *eliminating the need for cleaning with CFCs*.
Waste Savings/Reduction: reduce CFC emissions over 50 percent.

! **Material substitution** can reduce cleaning wastes by:

- ! *Substituting for CFC 113* used in defluxing with:
 - ! Fully aqueous system using *water soluble fluxes*;
 - ! Aqueous system using saponifiers to *remove rosin-based fluxes*;
 - ! Semi-aqueous system using **terpenes as a solvent**;
 - ! *Hydrogenated CFCs with chlorinated solvents*.
- ! *Substituting CFC 113* used in hand cleaning boards with:
 - ! Blend of *HCFC and methanol* dispensed from a trigger-grip device that limits the amount of solvent lost to the atmosphere.

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>).

3.8.3 Electronics Manufacturing: Printed Wiring Boards

Tip Sheet #2

WASTE ORIGINS: Board Preparation, Electroless Plating, Imaging, and Electroplating

WASTE TYPES: Spent Process Baths (Etchants, Acid Solutions, Alkaline Solutions, Developing Solutions, Plating Baths, Electroless Copper Baths, Catalysts)
Air Emissions (Volatile Organic Compounds, Acid Fumes, Ammonia Fumes)
Sludges, Rinse Waters, and Aqueous Metals

WASTE REDUCTION AND RECYCLING OPTIONS:

- ! **Process or equipment modifications** can reduce wastes by:
 - ! Modifying *sludge pretreatment* processes by:
 - Adding flow control valves;
 - Installing metal recovery equipment;
 - Adding deionization system;
 - ! Installing a system (e.g., CALFRAN process) to **reduce pressure of vaporization** at cooler temperatures, recycle water by condensing the vapors in another container, concentrate, and precipitate solutes.
Waste Savings/Reduction: reduce volume and quantity of aqueous waste solutions by recovering pure water.
 - ! **Alternatives to wet chemical processes** include:
 - ! *Mechanical cleaning* as an alternative to chemical methods;
 - ! *Process efficiency* improvements for applying photopolymers, printing, and developing;
 - ! *Alternative processes* for connecting the PWB layers together; and
 - ! **Alternatives to lead-based soldering** involving the use of lasers, reactive gases, or ultrasonics.
- ! **Raw material substitution** can reduce wastes by:
 - ! Substituting **semiaqueous or aqueous photoresist** for TCA and methylene chloride resists.
 - ! Substituting **no-clean fluxes**.
 - ! Substituting **aqueous clean fluxes**.
 - ! Substituting **semi-aqueous cleaning materials**.
 - ! Substituting **other solvents** for CFC 113 and TCA during board assembly.
- ! **Waste separation or preparation** can reduce wastes by:
 - ! Separating **wastewater sludge** to prepare for metal recovery.
- ! **Recycling can reduce waste by:**
 - ! **Removing and recovering lead** and tin from boards by electrolysis-chemical precipitation.

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>