3.13.2 Printing Industry: Screen Printing

Tip Sheet #1

WASTE ORIGIN: **General Operations**
WASTE TYPES: Volatile Organic Compound (VOC) Emissions (Air and Water), Cleaning Solvents, and Solvent-based Inks

WASTE REDUCTION METHODS:

- **Proper material management** and use can reduce hazardous wastes by:
  - Keeping chemicals in ***safety cans or covered containers*** between uses minimizes chemical losses from evaporation and spills;
  - ***Separating chemical wastes*** into clearly marked, easily accessible containers for both hazardous and non-hazardous wastes;
  - Using plunger cans, squeeze bottles, or ***specialized spraying equipment*** to concentrate the area on which the chemicals are applied;
  - Using a ***pump to transfer*** cleaning and reclamation solutions from large containers to smaller containers to reduce the potential for spills;
  - Using ***manual spot application*** of chemicals rather than cleaning the entire screen, when appropriate;
  - Evaluating and experimenting with ***dilution of solutions*** that contain chemicals and water may allow chemical reduction without losing efficiency.
  - Recapturing printing ink by squeezing screen prior to washing.
- **Inventory controls** may help waste reduction by:
  - Minimizing the amount of ***chemicals available on the shop floor*** to encourage materials conservation;
  - ***Centralizing chemical storage and distribution*** can give employees incentive to use less;
  - ***Maintaining accurate records*** of chemical and material use, along with waste generation rates, helps identify and prioritize waste reduction opportunities;
  - Switching to ***non-aerosol products***, especially refillable substitutes, whenever possible;
  - Finding ***alternative screen cleaning solutions***, like traditional ink removers; consult suppliers of ink, emulsion, and haze remover solutions to identify suitable material substitutes.
- **Equipment modifications or additions** can help reduce hazardous wastes and emissions by:
  - Using operator-controlled ***adjustable sprayers*** to minimize and reduce the amount of chemical solution applied;
  - ***Controlling the overspray*** of cleaning/reclaiming solutions with a washout booth allows the capture and possible reuse of chemicals;
  - ***Separating contaminants*** from screen cleaning and reclamation effluent through distillation with a solvent still is effective in recycling and reusing hazardous chemicals;
  - ***Using a filtration/recirculation system*** to remove particulates, heavy metals, hydrocarbons, and other waste products filters cleaning solutions for reuse.

Sources:

Environmental Management and Pollution Prevention: A Guide for Screen Printers, Washington State Dept. of Ecology, September 1994, Publ. 94-137.

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Screen Printing Case Study 2: Technology Alternatives for Screen Reclamation, Draft, October 1994.

Screen Printing Case Study 3: Chemical Alternatives for Screen Reclamation, Draft, October 1994.

Screen Printing Case Study 4: Work Practice Alternatives for Screen Reclamation, Draft, December 1994, EPA/742-F-95-003.

3.13.2 Printing Industry: Screen Printing

Tip Sheet #2

WASTE ORIGIN: **Film Processing**
WASTE TYPES: Scrap Film, Processing Chemicals (Developer, Fixer, PMT Activator), and Washwater (Silver)

WASTE REDUCTION METHODS:

- **!** Reduce wastes associated with **film developer solutions** by:
  - ! Purchasing developer solutions that contain ***less than one percent hydroquinone***;
  - ! Not putting developer into used fixers when using ***chemical recovery cartridges*** (CRCs); CRCs can plug and cause dangerous pressure build up;
  - ! ***Not putting developer*** into a septic system, storm drain, dry well, or onto the ground.
  - **!** Not disposing of ***unused or past shelf-life developer*** to the sanitary sewer unless granted permission from the local sewer utility;
- **!** Reduce the discharge of **silver-contaminated fixer** by:
  - ! Attaching ***labels*** to used fixer containers that identify this hazardous waste;
  - ! Not disposing of ***unused or past shelf-life developer*** to the sanitary sewer unless granted permission from the local sewer utility;
  - ! Doing ***on-site recovery***:
    - **!** Comply with hazardous waste and sewer *discharge limits* by routinely testing fixer effluent through a lab accredited for silver analysis;
    - ! Get *approval from the local sewer authority* to discharge the remaining effluent.
- ! Reduce the **silver wastes produced by activator solutions** used for making photo mechanical transfers (PMTs) by:
  - **!** Not adding activator to used fixer; the ***high pH of the activator*** may interfere with proper silver recovery;
  - ! Not disposing of ***unused or past shelf life PMT activator*** to the sanitary sewer unless granted permission from the local sewer utility;
  - ! ***Not putting activator into*** a septic system, storm drain, dry well, or onto the ground
- **!** Reduce silver wastes from both **processed and unprocessed scrap film** by:
  - **!** ***Recycling*** accumulated scraps with participating film manufacturers, silver recovers, film product recycling, and film collection firms;
  - ! ***Not soaking scrap film*** in used fixer to remove silver; a coating of leachable fixer may make the scrap film a hazardous waste;
  - ! Asking the on-site silver recovery equipment ***supplier*** if they will take scrap film.
- **!** When using **on-site silver recovery units**, like the common electrolytic units combined with metallic replacement or chemical recovery cartridges (CRCs), properly maintain and operate CRCs by:
  - **!** Using ***two CRCs in series*** with the electrolytic recovery unit to meet hazardous waste or sewer discharge limits;
  - **!** Installing a ***sample valve*** between the two canisters to allow testing of the CRCs effectiveness;

- ***Monitoring the flow rate*** of used solutions into the CRCs for proper operation (usually between one and three gallons per hour); use a metered pump system or a restricted gravity feed system and keep flow rates at manufacturers' recommendations;
- ***Testing CRC outflow*** for compliance with silver discharge limits; keep a file with all test data to compare proper process and equipment operation.

Sources:

Environmental Management and Pollution Prevention: A Guide for Screen Printers, Washington State Dept. of Ecology, September 1994, Publ. 94-137.

Screen Printers: A Guide to Reducing Hazardous Waste and Air Emissions When Cleaning and Reclaiming Used Screens, Draft, Solid and Hazardous Waste Education Center, University of Wisconsin-Extension, March 1996.

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Screen Printing Case Study 3: Chemical Alternatives for Screen Reclamation, Draft, October 1994.

Screen Printing Case Study 4: Work Practice Alternatives for Screen Reclamation, Draft, December 1994, EPA/742-F-95-003.

3.13.2 Printing Industry: Screen Printing

Tip Sheet #3

WASTE ORIGIN: **Screen Reclamation (Screen Cleaning Chemicals)**
Ink Removal, **Emulsion (Stencil) Removal, Haze (Ghost Image or Ink Stain) Removal**

WASTE TYPES: Screen Solvent Cleaners (Acetone; Methanol, Methyl Ethyl Ketone; Toluene; 1,1,1-Trichloroethane, Xylene), Screen Degreasers, and Numerous Hazardous Volatile Organic Compounds (VOCs)

WASTE REDUCTION METHODS:

- **!** Work with vendors to **find comparable cleaning alternatives** for ink and emulsion removers:
  - **!** Avoid using ***"F-listed" solvents***, EPA-classified solvents considered hazardous wastes when used alone or when mixed with volumes of wash water;
  - ! **Suitable substitutes should have a *high flashpoint*** (greater than 140ºF) along with a low VOC content (less than 30 percent);
  - ! Determine if ***substitute cleaners, once spent***, need to be managed as hazardous waste;
  - ! ***Alternative ink remover*** that greatly reduce chemical risks include: diethylene glycol series ethers, propylene glycol series ethers, n-methyl pyrrolidone (NMP), and ethoxylated nonylphenol.
- ! **Screen management practices** can be effective in reducing hazardous wastes by:
  - **!** ***Avoiding delays in cleaning*** and reclaiming screens makes ink, emulsion, and haze easier to remove. Removing ink and emulsion immediately after printing reduces haze remover use after ink dries;
  - ! Removing ***extra ink from screens*** with a scraper or spatula before using ink remover;
  - ! Drying ***solvent-coated screens*** before washing them in water;
  - ! Not ***cleaning screens directly over a sink or drain***; use a separate solvent cleaning station that allows collection of any leftover solvent for reuse, recycling, or disposal;
  - ! ***Disposing of small or worn out screens*** to reduce chemical use, labor costs, and worker exposure, needed to clean and reclaim the screens
- ! Use a **solvent pump can** instead of pouring solvent from a jug minimizes workers' chemical exposure.
- ! **Do not mix solvent wastes**; do not store products or wastes together. Store solvents away from heat sources
- **!** Use a **haze remover** with a pH under 12.5; do not put haze remover waste in the garbage if the pH is over 12.5.
- ! **Screen degreasers** used during screen preparation and after screen reclamation should not contain chlorinated solvents; chlorinated solvent degreaser rinsate must be managed as hazardous waste.
- **!** Consider **potential alternative screen reclamation technologies** to eliminate hazardous chemical cleaners:
  - **!** ***High-pressure screen washers*** can eliminate use of ink and emulsion removers;

- ***Automatic screen washers*** can reduce solvent losses, reduce labor costs, and reduce worker exposure;
- ***Dry media blasting*** with plastics, wheat starch, ice, or carbon dioxide (dry ice);
- ***Wet media blasting*** with high pressure water, or high pressure water along with sodium bicarbonate (baking soda);
- ***Pulse light energy*** technologies using laser and flashlamp methods;
- ***Stripping methods*** including sanding, heat gun stripping, and cryogenic methods.

Sources:

Environmental Management and Pollution Prevention: A Guide for Screen Printers, Washington State Dept. of Ecology, September 1994, Publ. 94-137.

Screen Printers: A Guide to Reducing Hazardous Waste and Air Emissions When Cleaning and Reclaiming Used Screens, Draft, Solid and Hazardous Waste Education Center, University of Wisconsin-Extension, March 1996.

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Screen Printing Case Study 4: Work Practice Alternatives for Screen Reclamation, Draft, December 1994, EPA/742-F-95-003.

Fact Sheet: *Screen Printers: A Guide to Reducing Hazardous Waste and Air Emissions When Cleaning & Reclaiming Used Screens.* 425.WP.9606, 1996.

3.13.2 Printing Industry: Screen Printing

Tip Sheet #4

WASTE ORIGIN: **Screen Printing Waste Inks**

WASTE TYPES: Heavy Metals Pigments (Barium, Cadmium, Chromium, Lead, Silver, Etc.) Solvent-based Ink Liquids (Ethanol, Isopropanol, Ethylene Glycol, Xylene, Toluene, etc.), and Volatile Organic Compound (VOC) Air and Water Emissions

WASTE REDUCTION METHODS:

- **!** **Stock** only as much ink as needed for the near future.
- **!** If using **colored inks**, ask your vendor for inks that contain little or no heavy metals; ask if your vendor can reblend inks.
- ! Check **material safety data sheets** (MSDSs) to see if stocked inks contain ignitable solvents or heavy metals.
- ! **Scrape or drain cans**; make sure ink and mixing containers are empty before disposal.
- ! **Remove ink** from stir sticks using a scraper or spatula instead of solvent and shop towels; use reusable stainless steel, plastic, or wooden stir sticks.
- ! **Do not leave wooden stir sticks** sitting in cans of ink, as they can absorb additives and solvents and degrade ink quality.
- ! **Remove as much ink** as possible from adhesive tape and screens with a scraper or spatula, returning excess ink to the original or waste container.
- ! **Never put ink into** a sanitary sewer, storm drain, septic system, dry well, or onto the ground.

Sources:

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Screen Printers: A Guide to Reducing Hazardous Waste and Air Emissions When Cleaning and Reclaiming Used Screens, Draft, Solid and Hazardous Waste Education Center, University of Wisconsin-Extension, March 1996.

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Screen Printing Case Study 4: Work Practice Alternatives for Screen Reclamation, Draft, December 1994, EPA/742-F-95-003.

3.13.2 Printing Industry: Screen Printing

Tip Sheet #5

WASTE ORIGIN: **General Cleanup Operations**

WASTE TYPES: Screen Cleaning or Degreasing Solvents (Ink, Emulsion or Haze Removers), Waste Inks (Heavy Metals and Solvent-based Inks), Parts and Tools Cleaning Solvents (Mineral Spirits, Stoddard Solvent, Naphtha, Xylene), and Volatile Organic Compound (VOC) Air and Water Emissions

WASTE REDUCTION METHODS:

- **Equipment modifications or additions** may help decrease wastes and emissions by capturing chemicals on-site:
  - ***Operator-controlled adjustable sprayers*** allow close control of the amount and direction of cleaning chemical sprays;
  - ***Washout booths*** focus cleaning/reclaiming solutions in a small area and minimize solvent loss to shop air, captures chemical overspray, and allows their reuse;
  - An ***in-process solvent still*** separates contaminants from cleaning effluent through distillation for effective reuse and recycling of spent solvents;
  - ***Filtration/recirculation systems*** can remove particulates, heavy metals, hydrocarbons and other waste products from ink, emulsion and haze removers for cleaner reuse.
- **Disposable shop towels contaminated** with inks and solvents may become hazardous wastes. Check and comply with state-specific requirements.
- **Use cloth towels or wipes** which can be cleaned and reused:
  - Reduce the ***size*** of the towel or wipe for more efficient use; reduce solvent use;
  - ***Reuse*** shop towels to reduce ink remover use; reuse the final wipe rag from the previous screen as the first pass wipe on the next screen;
  - ***Squeeze excess solvent out*** of used towels; collect and reuse for initial cleanup, followed by clean solvent for final cleanup;
  - ***Do not saturate towels*** with solvents or use shop towel containers to dispose of waste ink or solvents;
  - ***Reuse or recycle cleaning solvents*** by using an explosion-proof centrifuge or gravity draining;
  - Promptly place waste shop towels in a ***separate, labeled container*** which can be covered and is fireproof; do not throw dirty towels into the dumpster;
  - Check with the local sewer district near the ***laundry service*** used to verify if the laundry is meeting local discharge limits.
- **Routinely test wash waters** for chemical content; do not dispose of waste water to sanitary sewers without knowing local discharge limits.
- **Non-empty aerosol/spray cans** containing hazardous chemicals must be disposed as hazardous waste; do not throw into the dumpster; return defective cans to the supplier.

Sources:

Environmental Management and Pollution Prevention: A Guide for Screen Printers, Washington State Dept.of Ecology, September 1994, Publ. 94-137.

Screen Printers: A Guide to Reducing Hazardous Waste and Air Emissions When Cleaning and Reclaiming Used Screens, Draft, Solid and Hazardous Waste Education Center, University of Wisconsin-Extension, March 1996.

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Screen Printing Case Study 4: Work Practice Alternatives for Screen Reclamation, Draft, December 1994, EPA/742-F-95-003.

Fact Sheet: *Management of Solvents and Wipes in the Printing Industry*, University of Wisconsin-Extension, Solid and Hazardous Waste Education Center. 425.WP.9410, 1994.