GREEN AND PROFITABLE PRINTING

NATIONAL SATELLITE VIDEOCONFERENCE

COURSE NOTEBOOK

Content developed by the University of Wisconsin-Extension, Solid & Hazardous Waste Education Center
in collaboration with the Graphic Arts Technical Foundation
on behalf of the
Printers' National Environmental Assistance Center

UW-EXTENSION
COOPERATIVE EXTENSION

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Green and Profitable Printing

Acknowledgements

Development of this national videoconference has been made possible by the financial support from the following sources:

- A grant to the Printers' National Environmental Assistance Center from
  - — EPA Office of Enforcement and Compliance Assurance
  - — EPA Pollution Prevention Policy Staff, Office of the Administrator
- Additional labor contributed by the University of Wisconsin-Extension's
  - — Cooperative Distance Education Unit
  - — Solid & Hazardous Waste Education Center (SHWEC)
- A grant to SHWEC from the Great Lakes Protection Fund for the production of the Green and Profitable Printing Video Series, excerpted for this videoconference.
- Registration fees from State, City, and International Sponsoring Partners. We gratefully recognize the partnership of the following sponsors in making this videoconference possible:

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National and Regional Co-Sponsors

The development, promotion and delivery of this program nationally was made possible through the collaborative efforts of the following organizations:

Council of Great Lakes Governors
Graphic Arts Technical Foundation
Illinois Hazardous Waste Research and Information Center
National Pollution Prevention Roundtable
Printing Industries of America
Printers National Environmental Assistance Center
University of Wisconsin-Extension
U.S. Environmental Protection Agency

We would also like to thank all those organizations who generously allowed us to reprint portions of their manuals, factsheets, or other documentation for use in this packet.

Agfa Center for Education
Agfa Division of Bayer, Inc.
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Graphics Arts Technical Foundation (GATF)
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Iowa Waste Reduction Center
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Cedar Falls, IA 50614-0185
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Minnesota Office of Environmental Assistance
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Printing Industry of Ohio
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400 Market Street, 14th floor
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Silver Coalition/Association of Metropolitan Sewerage Agencies
c/o National Association of Photographic Manufacturers (NAPM)
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Harrison, NY 10528-1612
(914) 698-7603

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(423) 974-2171

US Environmental Protection Agency
Office of Pollution Prevention, Pesticides and Toxics
401 M Street SW
Washington, DC 20009
(202) 260-1821

Green and Profitable Printing

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TELEPHONE NUMBERS TO USE DURING THE PROGRAM
Live Question and Answer Period: 1-800-221-1036
Fax Number: 1-414-297-7536

Green and Profitable Printing

Program Goals and Agenda

Goals

1. Overview key environmental issues affecting smaller lithographic printers.
2. Discuss effective compliance strategies for smaller shops.
3. Examine practical opportunities to lower costs and liabilities by reducing waste at the source.
4. Examine the importance of process control in reducing wastes while improving quality.
5. Identify resources for additional information and assistance.

Agenda

Time Activity (Times shown are Central Daylight Saving)

Test Pattern and On-Site Activity

9:30 Satellite Program Begins

Welcome and Introductory Remarks
Carol Browner, EPA Administrator (invited)
Wayne Pferdehirt, Solid & Hazardous Waste Education Center, University of Wisconsin
Jim Peck, Program Moderator

Green & Profitable Through Process Control

Overview of Key Compliance Issues for Small Litho Shops
Gary Jones, Graphic Arts Technical Foundation (GATF),
Developing an effective compliance strategy for your shop,
air emissions, wastewater, hazardous wastes

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Green and Profitable Printing

Agenda (continued)

10:15 Live Question & Answer Session

Panelists: Gary Jones, GATF; Dale Kalina, R.R. Donnelley; Stig Bolgen, Printing Industries of New England (PINE); and David Salman, EPA

Practical Waste Reduction Strategies
Video excerpts, introduced by Wayne Pferdehirt

Waste Prevention During Prepress—Silver recovery, prepress process control and electronic imaging.

Reducing Wastes During Production—Reducing make ready wastes, understanding and controlling press chemistry, reducing ink wastes, reducing alcohol in fountain solutions

Reducing Wastes During Cleanup—Solvent selection and use; management of shop towels, ink wastes and paper wastes.

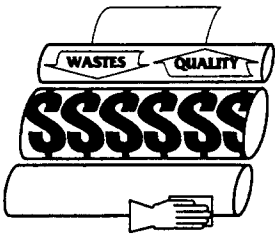
11:10 Question and Answer Session

Panelists: Jeff Adrian, John Roberts Co.; Beth Swedberg, General Litho Services; Rick Quann, Craftsmen Clubs and On-Q Video; Gary Jones; and Wayne Pferdehirt

Getting Help: Where You Can Get Follow-Up Compliance Assistance Information

11:30 End of National Satellite Broadcast; Program Evaluation

Please complete evaluations and return to your site facilitator



Green and Profitable Printing

Biographical Sketches of Presenters and Panelists

Jim Peck, Moderator, is an Emmy-Award winning talk show host and news anchor.

Jeffrey Adrian is Environmental Director with the John Roberts Co., winner of the Minnesota Governor's Award for Excellence in Pollution Prevention. Adrian and the John Roberts Co. are participating in the Environmental Protection Agency's Environmental Leadership Pilot Program to develop new concepts in environmental leadership.
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Stig Bolgen is Director of Environmental and Government Affairs for Printing Industries of New England, a trade association representing over 500 printing facilities. Bolgen has worked with manufacturers on environmental and regulatory issues for the past nine years.
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Gary Jones is Manager of Environmental Information for the Graphic Arts Technical Foundation (GATF), where he analyzes environmental, health, and safety regulations for the printing industry. Jones authors the "Environmental Alert" column in GATFWORLD, the Graphic Arts Technical Foundation's publication. He is the author of several publications addressing regulatory concerns and compliance for the printing industry.
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Dale Kalina is Director of Corporate Environmental Affairs of RR Donnelley and Sons Co., where he is involved in environmental issues facing the printing industry. Kalina is Director of the Environmental Conservation Board of the Graphic Communications Industries, the Great Printers Project and the Environmental Protection Agency's Common Sense Initiative. He is the author of 18 scientific papers and has been awarded two patents.
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Green and Profitable Printing

Wayne Pferdehirt is a waste reduction and management specialist with the University of Wisconsin Solid & Hazardous Waste Education Center and a co-director with the Printers' National Environmental Assistance Center. Pferdehirt assists printers and other businesses seeking to reduce hazardous wastes and toxic air and water emissions.
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Richard Quann, President of ON-Q Video Productions/Share A Trainer of Milwaukee, is a trainer for the graphic communications industry. Quann has over 30 years of experience as an instructor, lithographer, and manager. He has conducted seminars for a variety of graphic communications organizations.
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David Salman is an environmental engineer in the Environmental Protection Agency's Office of Air Quality Planning and Standards. Salman, who has been with the EPA since 1978, has developed federal air pollution control regulations and guidance for many coatings industries. He is currently lead engineer in the development of hazardous air pollution standards for the printing industry.
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Beth Swedberg is an operations manager with General Litho Services. She has 17 years of experience in graphic arts. Swedberg is a member of the Printing Industry of Minnesota Environmental and Safety Task Force, and she will serve on the Minnesota Great Printers Project in 1996-97.
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Green and Profitable Printing

II. SPEAKERS NOTES

Green and Profitable through Process Control

Excerpted from the Green and Profitable Printing video training series, produced by the University of Wisconsin, Solid & Hazardous Waste Education Center

Waste Prevention Makes Dollars and Sense

- Reduces production costs
- Increases profits
- Reduces environmental risk and liability
- Protects the environment
- Improves image in the community
- Makes the workplace safer and cleaner
- Responds to needs of customers, increasing market share

Preventing Waste is Better than Simply Managing It

Progressive printers are increasingly using *prevention* strategies to focus on *up-front management and control* of printing processes, rather than simply dealing with the costs and liabilities of wastes after they are created.

Notes

What is Waste?

"If it doesn't produce value, it's waste." – *Henry Ford*

Process Control ...

... comes down to knowing and documenting what each piece of equipment needs to consistently turn out high-quality printing.

Eliminating Quality Defects Helps Prevent Wastes

- Finished products that do not meet customer specifications are the most expensive wastes
- At that point you have already invested :
  - labor
  - press time
  - materials
- *Getting it right the first time* is the key to increasing efficiency and profitability

Notes

Process Control Makes Dollars and Sense

"What it really boils down to is money savings. ...the less amount of waste you generate means the less amount of money you have to pay to dispose of your waste. So the money you save on waste disposal goes right to your company's bottom line."

Scott Schuler
Printing Industries of Minnesota

Moving from Symptoms to the Source

"... there's a natural evolution ... we get creative in our ways to recycle and then we start to think in terms of reducing the material in the first place, or eliminating it altogether. ... the beauty of a pollution prevention plan is it's good for the bottom line if you can move ... to reducing at the source."

Beth Swedberg
General Litho Services

Develop a Good Picture of Your Types, Quantities, and Costs of Wastes

- Reveals opportunities for improvement
- Helps you prioritize actions
- Helps you assess benefits of possible changes
- Helps You Get Biggest Bang for Buck

Notes

Notes

Build on Success

"The important thing is to pick a target, pick one item you're going to work on and achieve success for that. ... once you've done that ... you've got a powerful motivator ... Start at one end, you're not going to do it all at once, and work forward from there."

Jeff Adrian
John Roberts Co.

Process Control:

Reduces Costs,

Improves Quality

... and Reduces Wastes along the Way

ENVIRONMENTAL COMPLIANCE

Gary Jones
Manager, GATF Office of
Environmental Information

GATF MISSION: ***"To serve the graphic communications community as the major resource for technical information and services through research and education."***

Environmental Compliance

Basic Principals:

- All Environmental Regulatory Programs Apply To Printers.
- All Environmental Regulations Have Thresholds Which Mandate Action or Dictate Requirements.
- Compliance Begins With Lowest Governmental Agency's Requirements.

Legislation/Regulations Affecting Printers

- Clean Air Act.
- Clean Water Act.
- Resource Conservation and Recovery Act.
- Emergency Planning and Community RTK Act
- Comprehensive Environmental Response, Compensation, and Liability Act.
- Safe Drinking Water Act.
- Toxic Substances Control Act.

Environmental Compliance Management Program

- Definition - A System of Policies, Procedures, and Documentation to Ensure:
  - Compliance with Applicable Regulations.
  - Detection and Correction of Procedural Breakdowns.
  - Detection and Correction of Potential Violations.
  - Continuous Improvement - e.g. ISO 14000.

Good information is your responsibility

The Printer Is.....

***Legally Liable** For <u>All</u> Information Provided To An Environmental Agency.*

Demonstrating Compliance: DOCUMENTATION

It is not enough to do the right thing.

It is sometimes necessary to <u>prove</u> that you have done the right thing...

or at least prove that you have done all that could have been <u>reasonably expected</u> of an individual in your situation.

A Rule of Thumb...

If It's Not In Writing.....

It Does Not Exist!

Air Pollution Control

Basic Principals:

I. Permit Requirements
II. Control Requirements

Air Pollutants Emitted by Printers

- Volatile Organic Compounds
- Hazardous Air Pollutants
- Nitrogen Oxides
- Sulfur Oxides
- Particulates-Solid and Condensable Organic
- Odors

VOC/Air Toxic Emission Inventory

- Film and Imagesetting Chemistry.
- Proofing Processor Chemistry.
- Ink Oils or Ink Solvents.
- Fountain Solution Additives.
- Cleaning Solutions - Press, Parts, & Misc.
- Overprint Coatings or Varnishes.

Other Emissions Inventories

NOx/SOx Emission Inventory:

- Boilers, Heaters, Furnaces, Dryers, Control Devices & Other Fuel Combustion Sources.

Particulate Emission Inventory:

- Fuel Combustion Sources.
- Paper Dust/Cyclones.
- Uncontrolled Ink Oil Emissions.

Air Pollution Control Permits

- System Designed To Identify and Inventory Sources of Air Pollution.
- Legally Binding Document Granting Permission To Operate An Air Pollution Source.
- Imposes Control, Monitoring, Recordkeeping, & Reporting Requirements.

Permit Requirements Depend Upon:

- Location - Attainment Vs. Nonattainment
- Pollutant - VOC, HAP, NOx, Particulate
- Emission Rate - Lb/Hr, Lb/Day, TPY

Types of Air Permits

- Construction/Installation
- Operating - State and Federal
  - Title V
  - FESOP or Synthetic Minor
- Registration For Smaller Sources

Water Pollution Control

Basic Principals:

I. Discharges of Process Wastewater.
- Limits, Permits, Testing, and Surveys.

II. Discharges of Stormwater.
- Permit and Testing.

Wastewater Discharge Requirements

- Contact Local POTW For Discharge Limits, Permit, and Testing Requirements.
- Direct Discharges To Waterways Require National Pollutant Discharge Elimination System (NPDES) Permit.
- Industrial Discharges to Septic System Usually Prohibited. Those Which Are Allowable Require NPDES Permit.

Typical Sewer Code Limits

Parameter	Typical	Normal Range
Temperature	150°F	120 to 160°F
pH	5.5 to 9.5	4.5 to 12
SS	350 ppm	200 to 1,000 ppm
BOD45	300 ppm	200 to 1,200 ppm
COD	500 ppm	400 to 2,500 ppm
Cl Demand	30 ppm	10 to 40 ppm
Cyanide	2.0 ppm	0 to 10 ppm
Phenols	0.1 ppm	0.002 to 20 ppm

Typical Sewer Code Limits (cont'd)

Heavy Metal	Typical	Normal Range
Cadmium	0.5 ppm	0.002 to 20 ppm
Chromium	5.0 ppm	0.02 to 25 ppm
Chromium (VI)	0.5 ppm	0.1 to 10 ppm
Copper	3.0 ppm	0.1 to 10 ppm
Iron	20 ppm	3 to 100 ppm
Lead	0.1 ppm	0.05 to 5 ppm
Mercury	0.0005 ppm	0 to 5 ppm
Nickel	5 ppm	0.1 to 12.0 ppm
Silver	2 ppm	0.025 to 20 ppm
Zinc	5 ppm	0.25 to 25 ppm

Basic Principals of Waste Disposal

I. Hazardous Waste Identification.
II. Determination of Generator Status.
III. Storage and Labeling Requirements.
IV. Shipping/Transportation Requirements.
V. Disposal Requirements and Liability.

What Are Hazardous Wastes?

Characteristic Wastes:

- Ignitability (D001) - Flashpoint < 140°F.
- Corrosivity (D002) - 2.0 < pH > 12.5.
- Reactive (D003) - Unstable, Shock Sensitive, Gives Off Gas.
- TCLP Toxicity (D004-D043) - Leach Haz. Chemicals To Groundwater.

What Are Hazardous Wastes?

Listed Hazardous Wastes:

- "F" - Certain Chlorinated and Organic Solvents (F001-F005)
- "P" - Extremely Hazardous Wastes (P106 - Sodium Cyanide)
- "K" - Specific Sources (K002 PbCr Pigment Manufact Wastewater)
- "U" - Toxic Wastes (U220 - Toluene)

TCLP Concentration Levels

Constituent	Regulatory Level
Benzene	0.5 ppm
Carbon Tetrachoride	0.5 ppm
Chloroform	6.0 ppm
Cresols	200.0 ppm
MEK	200.0 ppm
Pyridine	5.0 ppm
Trichloroethylene	0.5 ppm
Vinyl Chloride	0.2 ppm

TCLP Concentration Levels

Constituent	Regulatory Level
Arsenic	5.0 ppm
Barium	100.0 ppm
Cadmium	1.0 ppm
Chromium	5.0 ppm
Lead	5.0 ppm
Mercury	0.2 ppm
Selenium	1.0 ppm
Silver	5.0 ppm

Hazardous Waste Determination

- Must Be Waste - Abandoned Discarded Material Unsuitable For Use Without Treatment or Recycling.
- Test Wastes Using Approved Methods.
- Apply Knowledge - Label, MSDS, Process Knowledge.

Counting Hazardous Waste

- All "Listed" and "Characteristic" Wastes That Are:
  - Accumulated On-Site For Any Time Period.
  - Packaged and Transported Off-Site.
  - Placed In a Regulated On-Site Treatment or Disposal Unit.

... more ...

Counting Hazardous Waste (cont'd)

- All "Listed" and "Characteristic" Wastes That Are:
  - Still Bottoms or Sludges Removed From Storage Tanks.
  - Contaminated Soil or Spilled Chemistry.
  - Any Material Mixed With a Listed Waste.
  - Unused Inventory - Usually One Year Old.

... more ...

Counting Hazardous Waste (cont'd)

- **Don't** Count Waste That:
  - Is Continuously Reclaimed On-Site In a Closed Piped System.
  - Is Sewer Effluent From a Neutralization Unit.
  - Is Discharged Directly To a Publically Owned Treatment Works.
  - Has Already Been Counted Once During a Calendar Month, Treated or Reclaimed, and Used Again.

... more ...

Counting Hazardous Waste (cont'd)

- **Don't** Count Waste That:
  - Is Used Oil Sent Offsite For Recycling and Not Mixed With Listed Hazardous Waste.
  - Has Been Left in Containers Emptied Through Conventional Means. Triple Rinse Containers from Acutely Hazardous Materials.
  - Is Left As Residue in Bottom of Product Storage Tank.
  - Is Under Contract Reclamation For SQGs.

Categories Of Waste Generators

- Exempt Small Quantity Generator:
  - Less Than 100 kg (220 lbs.) and 1 kg (2.2 lbs.) of Acute Per Month.
- Small Quantity Generator:
  - Between 100 kg (220 lbs.) and 1,000 kg (2,200 lbs.) and Less Than 1 kg (2.2 lbs.) Acute/Month
- Large Quantity Generator:
  - Greater Than 1,000 kg (2,200 lbs.) and 1 kg (2.2 lbs.) Acute Per Month.

Hazardous Waste Generator Requirements

Exempt Small Quantity Generator:
(not applicable in all states)

- Determine Amount Generated.
- Label and Store Wastes According To Regs.
- Ensure Wastes Are Properly Disposed.
- Not Require Manifest and Can Use Own Vehicle To Transport Waste.
- Can Participate In Local Collection Pgm.

Hazardous Waste Generator Requirements

Exempt Small Quantity Generator:

- Do Not Accumulate More Than 1,000 kg (2,200 lbs.).
- Uncontrollable Spill Reporting to Local, State, and NRC (800/424-8802).

Hazardous Waste Generator Requirements

Small Quantity Generator:

- Determine Amount Generated.
- Obtain EPA Identification Number - Site Specific.
- Collect, Label, and Store Wastes According to Requirements.
- Perform Weekly Inspections of Storage Area and Maintain Log or Other Record.

... more ...

Hazardous Waste Generator Requirements

Small Quantity Generator (cont'd):

- Do Not Exceed Storage Limits of 6,000 kg (13,200 lbs.) In Any 180 Day Period. A 270 Day Period is Allowed for Shipments Traveling Over 200 Miles.
- Use Uniform Hazardous Waste Manifest For Off-Site Shipments.
- File Exception Report Within 60 Days.

... more ...

Hazardous Waste Generator Requirements

Small Quantity Generator (cont'd):

- Appoint Emergency Coordinator.
- Contact Local Emergency Resp Authorities.
- Post:
  - Name/Number of Emergency Coordinator and Fire Department.
  - Location of Fire Extinguisher, Spill Control Material, and Fire Alarms.

... more ...

Hazardous Waste Generator Requirements

Small Quantity Generator (cont'd):

- Provide General Awareness Training On Proper Waste Handling and Emergency Response.
- Develop Informal Waste Minimization Plan
- Uncontrolled Spill Reporting to Local, State, and NRC (800/424-8802).
- Maintain Records.

Notes

Green and Profitable Printing:
- During Pre-Press
- At Press
- During Cleanup

Excerpted from the Green and Profitable Printing video training series, produced by the University of Wisconsin, Solid & Hazardous Waste Education Center

SHWEC

Waste Prevention during Pre-Press

Reducing Waste from Pre-Press Operations

- Manage photographic supplies to prevent spoilage or date expiration
- Use replenishers to extend the lives of developers and fixers
- Use non-hazardous platemaking systems
- Minimize VOC content in platemaking chemistries
- Avoid chrome-bearing cleaners for film and plate processing equipment
- Use and monitor silver recovery equipment
- Electronic imaging reduces photochemical wastes

Properly Install and Monitor Silver Recovery Equipment

- Know your municipality's wastewater discharge limits
- Select recovery equipment type and size appropriate for your operation and discharge limits
- Check performance of recovery equipment at least weekly
- Check recommendations in Code of Management Practices for Silver Dischargers, from National Association of Photographic Manufacturers

Pre-Press Process Control Improves Quality and Reduces Wastes

- Build your job within press capabilities
- Monitor film and plate making exposures and development
- Check all films and plates for errors
- Regularly clean film and plate processors
- Date and properly store all materials
- Change color-viewing lights periodically
- Periodically calibrate all pre-press electronic systems and measuring tools

Reducing Wastes During Production

Notes

Reducing Wastes During Production

- Reducing Makeready Wastes
- Understanding and Controlling Press Chemistry
- Reducing Alcohol in Fountain Solutions
- Reducing Ink Wastes

Practical Waste Reduction in the Pressroom

- Preventive maintenance of pressroom equipment
- Reducing makeready wastes
- Reducing alcohol in fountain solutions
- Reducing ink wastes

Establishing and Maintaining Process Control Saves You $$

- Prevents problems
- Saves time
- Reduces labor
- Increases efficiency of material use

Notes

Practical, Cost-Effective Preventive Maintenance

Develop and follow a checklist for basic press maintenance:

- ☑ *What* should be done
- ☑ *When* it should be done
- ☑ *When* it *is* done
- ☑ *Who* did it

Typical Items for Basic Press Maintenance Checklist

- ✓ Clean dampening fountains
- ✓ Check all dampening rollers and systems
- ✓ Check all roller durometer readings
- ✓ Deep clean and recondition rollers regularly
- ✓ Remove and replace bad rollers as needed
- ✓ Clean and maintain all press cylinders

... more ...

Typical Items for Press Maintenance Checklist (cont'd)

- ✓ Measure and maintain correct gap settings between rollers
- ✓ Keep presses lubricated on daily, weekly, or monthly basis, as required
- ✓ Keep press and related equipment clean and free of hazards
- ✓ Clean and oil vacuum system
- ✓ Perform other press maintenance as recommended by manufacturer

Notes

Notes

Reducing Makeready Wastes

- Keep dampening system clean
- Maintain accurate plate-to-press registration
- Do your press set-up by the numbers
- Document the press used and all press settings on the job jacket
- Check impression pressure
- Adjust ink fountain and water fountain settings
- Choose compatible ink and paper

The Magic of Lithographic Printing Boils Down to Basic Chemistry

- Non-image area of plate attracts water and repels ink
- Image area of plate accepts ink, repelling water
- Many print quality problems can be traced to improper ink-water balance
- Improper ink-water balance will cause wasted material and labor

Key Characteristics of Fountain Solution (cont'd)

- pH
  - indicates relative acidity (<7) or alkalinity (>7)
  - most fountain solutions are acidic, but alkaline and neutral are also used
  - pH typically measured with pH pen
  - test strips can be used, but less accurate

... more ...

Key Characteristics of Fountain Solution (cont'd)

- Conductivity
  - indicates ability of solution to pass electrical current
  - rises as additives or impurities increase in fountain solution
  - measure with conductivity meter or pen

Mixing Fountain Solution

- Measure concentrate and additives carefully
- Measure pH
- Measure conductivity
- Match pH and conductivity to meet supplier recommendations for plate, paper and ink used for job

Monitor and Control Fountain Solution Quality

- Measure pH and conductivity at least daily
- During a run, pH can either increase or decrease, depending on acidity or alkalinity of paper
- Contaminants will increase conductivity

Notes

Monitor and Control Quality of Makeup Water

- Inconsistent water quality can affect fountain solution and press performance
- Water needs to have consistent, acceptable pH and conductivity
- May need to treat incoming water
  - water softening
  - deionization
  - reverse osmosis
- Before investing in treatment, test treated samples on your presses

Alcohol in Fountain Solutions

- Isopropyl alcohol (IPA) is used as a wetting agent
- Allows a broader "operating window" at press
- IPA is regulated as a volatile organic compound (VOC)
  - VOCs lead to creation of ground level ozone
- IPA is flammable

Alcohol Substitution Benefits

- Richer, brighter colors
- No replenisher needed
- Improved dot quality and reduced dot gain
- Cost savings
- Reduced shop odors
- Reduced fire risk
- Less fountain solution required

Notes

Keys to Effective Process Control

- **Understand the conditions** that affect quality
- **Define the acceptable ranges**
- **Control the printing process** to stay within defined limits

Tips for Making the No/Low Alcohol Conversion

- Provide good training for operators
- May need to pretreat water to assure consistent quality

... more ...

Tips for Making the No/Low Alcohol Conversion (cont'd)

- Possible press adjustments
  - Metering roller durometer should be 18-22, rather than 25-30
  - Decrease nip between chrome roller and dampening form roller
  - Higher roller speed may be necessary
  - Increase nip between chrome roller and metering roller
  - Skewing the metering roller works best for some presses and fountain solutions

Notes

Achieving Success in Conversion to No/Low Alcohol

- Use teamwork to develop and implement gameplan
- Assure success by briefing and training all press operators
- Work through successful conversion of one press
- Transfer and adapt lessons to other presses

Reducing the Costs of Paper Waste

- Reuse waste paper
  - internally
  - for secondary products (e.g., scratch pads)
- Recycle paper that cannot be reduced or reused
- Know your marketplace choices:
  - Markets: Processors, recycling centers and local waste haulers
  - Categories of waste paper: Evaluate tradeoffs of increased sorting to increase value of waste paper

Reducing Ink Costs and Wastes

- Increase accuracy of ink estimating techniques
- Increase use of existing ink inventory
- Improve ink handling techniques
- Minimize purchase of inks requiring management as hazardous wastes

Notes

Improving Ink Handling Techniques

- Remove any foreign or dried material from surface
- Cover surface with wax paper or plastic wrap
- Properly seal and date ink cans
- Seal can lip with coating of grease or oil
- Record date on can before storing

Managing Ink Inventory to Reduce Wastes

- Keep good records of all existing stock to enable recall and reuse
- Use first in, first out rule
- Consider mixing small quantities of needed PMS colors from existing, partially used cans of inks
  - Readily available software can show how to use existing stock to mix required colors

... more ...

Managing Ink Inventory to Reduce Wastes (cont'd)

- Use existing stock whenever possible for in-house jobs
- For jobs where exact color is not critical, offer customer reduced price for use of leftover ink colors.
- Reblend leftovers into "house black"
- If quantities are sufficiently large, consider sending to ink recycler for reprocessing

Notes

Improving Production Quality while Reducing Wastes

- It all starts with preventive maintenance
- Standard setup procedures reduce makeready wastes
- Understand and control the process to reduce production costs
  - proper ink and water balance
  - fountain solution pH and conductivity
- Better control at press enables alcohol reduction

Reducing Wastes at Press

- Preventive maintenance
- Reducing makeready wastes through process control
- Understand and control press chemistry
- Reduce alcohol in fountain solution
- Increasing revenues from paper recycling
- Reducing and managing ink wastes

Reducing Wastes During Cleanup

Notes

Notes

Reducing Wastes during Cleanup

- Smart solvent selection and use
- Prudent management of solvent wastes
- Responsible management of towels and wipes
- Reduction and management of ink wastes

Reduce Solvent Washups by Planning Ahead

- Group jobs with similar ink colors
- Run from light colors to dark
- When possible, designate some presses to run certain colors
- If schedules allow, run certain colors on given days

Liabilities from Wastes Can Hurt in a Big Way

"The other thing, too, that most companies kind of think won't happen to them and consequently they don't pay much attention to it, is the possibility of getting involved in a Superfund cleanup site ... Their share of that cleanup could put them out of business..."

Scott Schuler
Printing Industries of Minnesota

Some Fundamental Principles of Responsible Waste Management

- Know the Law
  - Understand regulations that affect your operations
  - Ignorance can hurt you, and is a poor defense
- Segregating wastes by type increase your ability to recycle and reduce costs

<... more ...>

Some Fundamental Principles of Responsible Waste Management (cont'd)

- Manage wastes in a manner that minimizes your liabilities
  - Just following the law can still expose you to liabilities
  - carefully weigh and minimize risks
  - choose reputable haulers
  - establish paper trail documenting responsible management of waste products
  - consider fuel blending, rather than landfilling, of nonhazardous ink and solvent wastes

Separation of Wastes Is Essential for Reducing Costs

- Keeping different wastes separated increases potential for recycling/reuse
- If a hazardous waste is mixed with a non-hazardous waste, the entire mixture must be managed as hazardous waste
- Failure to follow this rule can cost you big bucks.
- Example of poor management: mixing leftover inks and ink skins with spent hazardous solvent, causing entire mixture to be classified as hazardous waste.

Notes

Reducing Cleaning Solvent Waste

- Use the least amount necessary to do the job
- Use pump cans or squirt bottles to reduce the amount of cleaner used
- Usually better to dampen rag rather than apply solvent directly to blanket
- Store used towels and wipes in safety containers with tight-fitting lids

Choose the Right Cleaners for Your Shop

- Identify all cleaning applications in the shop
- Use the mildest effective cleaner for each task
- Use aggressive, quick-evaporating solvents only for tasks requiring their use
- Standardize types of cleaners and cleaning procedures
- Separate different types of used solvents to maximize reuse/recycling possibilities

Questions to Ask when Evaluating Alternative Cleaners

- Will the cleaner product work satisfactorily in my shop?
  - Remember, ink choice influences cleaner choice
- What will be necessary for proper storage and disposal of cleaning products?
- What risk does the use of the cleaners pose to employees?

Notes

Evaluate New Cleaners' Impacts Prior to Purchase

- Ask for and review a Material Safety Data Sheet (MSDS)
- To reduce air emissions:
  - Select solvents with low volatile organic chemical (VOC) content
  - Opt for lower vapor pressure solvents

... more ...

Evaluate New Cleaners' Impacts Prior to Purchase (cont'd)

- To reduce hazardous wastes:
  - Favor cleaners with high flashpoints (above 140 F)
  - Minimize purchases of cleaners with hazardous constituents
  - Used solvents may still be hazardous wastes if residues removed by solvent are hazardous
- Require suppliers to take back unused portions of sample cleaners

New Cleaners May Require New Operating Procedures

Since most newer cleaning solvents require different cleanup procedures than traditional, quick flash solvents, be sure to provide press operators with thorough instructions on recommended techniques.

Notes

Notes

Build on Success

"Once people were comfortable with work practices and they were assured that the system would work, it became much easier to use a low-volatility, low vapor pressure solvent blend."

Jeff Adrian
John Roberts Co.

Managing Solvent Waste and Shop Towels or Wipes

- For launderable towels:
  - Wring, drain or centrifuge shop towels to recover solvent prior to laundering
  - Use recovered solvent for dirtiest cleaning operations (e.g., press parts washer)
- For disposable wipes:
  - Dispose at a properly permitted incineration facility

Case Study: John Roberts Co.

- Situation
  - Problem with solvents at towel vendor's laundry
  - Laundry asked major customers and PIM for help in developing effective solutions
  - Roberts was using highly volatile Type Wash for all solvent cleaning
- John Roberts' Response
  - Examine solvents used and applications
  - Involve press operators, trade association and solvent supplier in assessing problem and identifying solutions

Case Study: John Roberts Co.

- Found Replacement Solvent
  - Replaced Type Wash with less volatile solvent for majority of cleaning applications
  - $1800/year savings in solvent purchases
- Reduced Amount of Solvent Used
- Recovered Solvent for Reuse
  - Installed explosion-proof centrifuge to spin rags
    - » recovering 3.5 gal per 220 wipes
    - » reused in parts washers to clean press ink trays
    - » Saving $34,000/year on $15,000 investment
- Employee Involvement and Training was the Key

Waste Prevention is Good Business

"We found that we could use some of that recovered solvent in our parts washers, for washing ink trays. The cost of the centrifuge was $15,000, but we saved $34,000 in the first year alone."

Jeff Adrian
John Roberts Co.

Managing Waste Inks

- Scrape and crush empty ink cans
- Re-blend leftover inks from previously opened cans to match requested PMS colors
- Reblend or recycle uncontaminated ink from fountains into black ink
- Reduce environmental risk by sending ink waste to properly permitted incineration facility rather than to landfill

Notes

Notes

Case Study: General Litho Services

- Situation
  - Previously purchased inks pre-mixed to job specs
  - Had accumulated over $700 waste ink, some requiring haz waste disposal

Case Study: General Litho Services

- Solution
  - Decided to mix own inks for small jobs
  - Used inexpensive computer program to mix required colors from existing stock
  - Select colors from existing excess stock whenever possible
  - Generated color-specific table to increase accuracy of ink estimates

Moving beyond Management of Wastes

"There's just that natural evolution to recycle, reuse, and it moves you naturally upstream to reducing or eliminating altogether."

Beth Swedberg
General Litho Services

Green and Profitable ... It Makes Dollars and Sense

"What it really boils down to is money savings. ...the less amount of waste you generate means the less amount of money you have to pay to dispose of your waste."

Scott Schuler
Printing Industries of Minnesota

Start Today

"The important thing is to pick a target, pick one item you're going to work on and achieve success for that. ... once you've done that ... you've got a powerful motivator ... Start at one end, you're not going to do it all at once, and work forward from there."

Jeff Adrian
John Roberts Co.

Notes

Order Form

Green and Profitable Printing Video Training Series

The second hour of today's videoconference used excerpts from a series of four professionally produced video modules that can be ordered from the University of Wisconsin Extension. The modules explore practical waste reduction strategies for small and medium lithographic printers. They have been designed to be used in a wide variety of training situations, including workshops, in-plant training and as program content for trade association meetings.

The videos and their contents are summarized below:

Module 1: Introduces series and examines the critical link between process control and the dual benefits of improved print quality and reduced waste. Approx. running time 23 min.

Module 2: Discusses specific methods to reduce wastes and related costs through prepress process control, silver recovery, inventory management, housekeeping and job planning. Approx. running time 27 min.

Module 3: Presents waste reduction opportunities through: preventive maintenance; improved process control during makeready and production, elimination of alcohol in fountain solutions; better ink estimating and usage practices; and improved recycling of paper wastes. Approx. running time 39 min.

Module 4: Explores waste and emissions prevention during cleanup including: selection and use of blanket and roller cleaners; management of cleanup towels and wipes; and management of ink wastes. Approx. running time 31 min.

Under funding from the Great Lakes Protection Fund, a free set of the tapes will be provided to the following types of organizations in the eight U.S. Great Lake states and Ontario: printing trade associations; pollution prevention technical assistance agencies; and state/provincial regulatory agencies.

Other organizations can use this form to order tapes and an accompanying set of course notes. The fee for this four module series and accompanying viewer notes is $35, prepaid.

Please send me _____ sets of the Green and Profitable Printing video training tapes and notes at $35 each.

Total enclosed: $ _____

Name _____

Organization _____

Address _____

City _____ State ___ Zip _____

Send form and check payable to University of Wisconsin-Extension to:

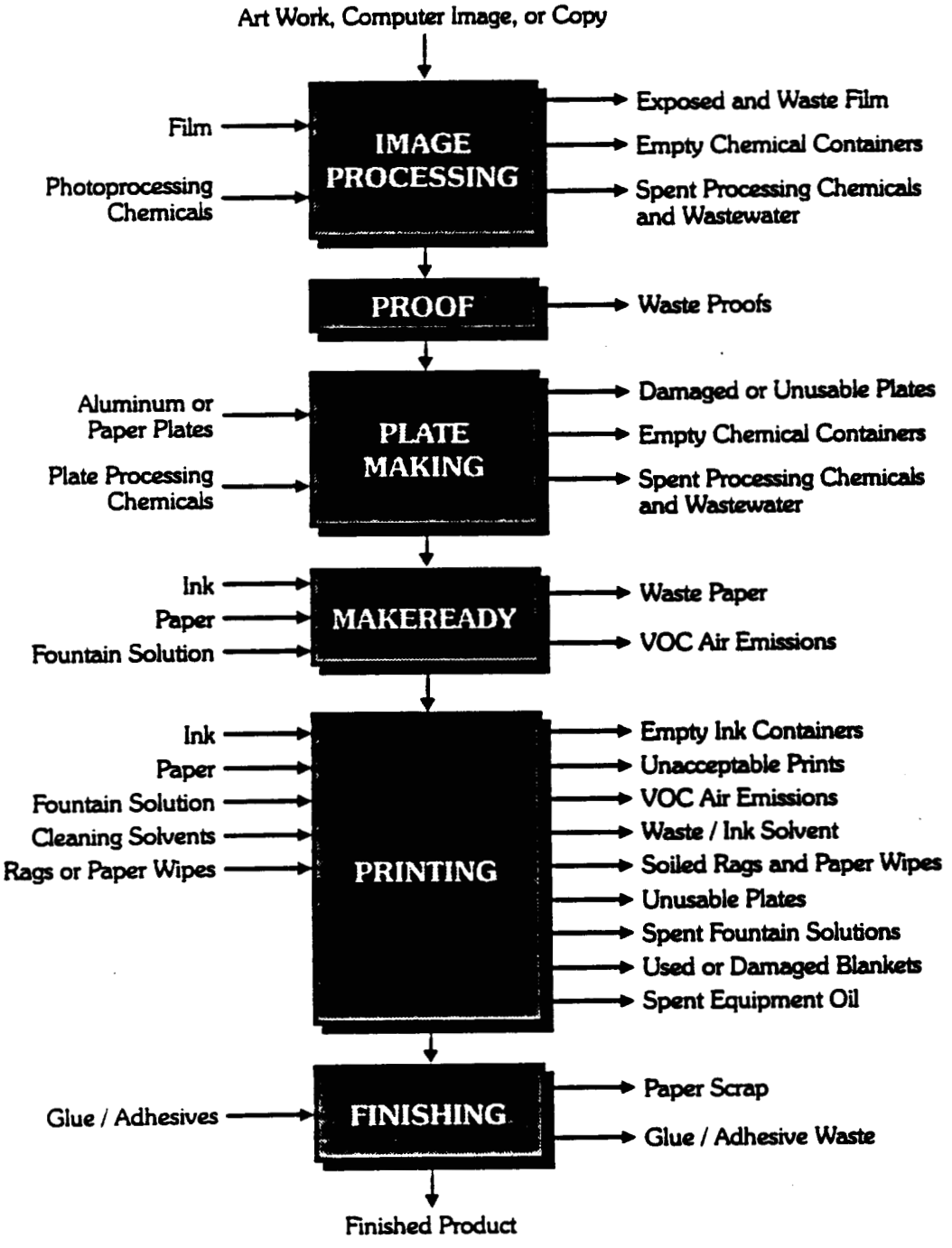
Marilyn McDole
University of Wisconsin-Extension
Solid & Hazardous Waste Education Center
610 Langdon Street, Room 529
Madison WI 53703
(608)262-0910

Green and
Profitable Printing

III. SUPPLEMENTAL MATERIALS:

A. Regulatory Compliance

Figure 1. Lithographic Printing Process Flow Diagram



This figure is reprinted with permission from the "Waste Reduction Manual for Lithographic and Screen Printers," prepared by the Printing Industry Association of the South and the University of Tennessee, August 1994.

Environmental Compliance Checklist for Printers

Prepared by Gary Jones, Graphic Arts Technical Foundation (GATF)
Revised 4/18/96

A. Air

[ ] Annually prepare detailed facility wide emissions inventory which includes emissions of Volatile Organic Compounds (VOCs), Hazardous Air Pollutants (HAPs) Nitrogen Oxides (NOx), Sulfur Oxides (SOx) , Carbon Monoxide (CO) and Particulate Matter (e.g., paper dust or uncontrolled ink oil emissions). Emissions should be determined for both actual and potential emissions. Sources of emissions include film and plate processors, some proofing systems, printing presses, bindery lines, cyclones, bailers, boilers, dryers, furnaces, and other fuel combustion equipment. Emission determinations can be based on either test data or mass balance incorporating appropriate engineering estimates and emission factors.

[ ] Determine thresholds for registration, construction/installation and operating permits for existing operations which could be equipment specific (e.g., press, control device, or boiler) or facility-wide. Many state/local permitting programs are now focusing on facility permits and not per equipment permits. The thresholds for registration and permits depend upon the current attainment/nonattainment classification of the area, specific regulations being enforced by the appropriate government agency, and the amount or rate of air pollutants being emitted. Contact state/local agency to obtain a copy of permit and air pollution control requirements.

[ ] Obtain appropriate permit(s) for existing operation. Keep copies of all permit application packages and emission determinations.

[ ] Determine permit thresholds for installation of new equipment to existing operations. New equipment could include presses, coaters, emission control devices, boilers, cyclones, evaporators, distillation units, and some proofing and bindery equipment. The thresholds for new equipment and processes depend upon the current attainment/nonattainment classification of the area, specific regulations being enforced by the appropriate government agency, and the amount/rate of air pollutants being emitted. Contact state/local agency to obtain a copy of permit and air pollution control requirements.

[ ] Obtain appropriate permit(s) for existing operation. Keep copies of all permit application packages and emission determinations.

[ ] Determine thresholds for modifications to existing equipment that would require a permit amendment. Modifications to existing equipment includes changes in materials used (e.g., inks, dampening solutions, coatings, cleaning solvents, and other chemistries), increase in operating speeds, or material application rates. Keep copies of all correspondence and subsequent permit amendments. Modification do not need to lead to an increase in emissions especially if an existing permit dictates the use of specific equipment, throughput rates, materials or chemicals. All emission increases need to closely examined.

[ ] Determine thresholds for exemption. Some equipment/facilities may be exempt from registration and permit requirements. Exemption level is dependent upon attainment/nonattainment classification of area, date of installation, and rate/amount of emissions. All exemption determinations need to be documented.

[ ] Establish a system to track all permits and ensure that permit renewals are filed in a timely manner.

[ ] Document all actions taken to reduce or eliminate emissions. Reductions could be generated by changing process materials (e.g., use of isopropanol substitutes) or shutting down equipment. Typically, all creditable emission reductions must have occurred after 1990. Some states have specific forms to file for emission reduction credits. These credits can be used internally to net emission increases or sold to another company requiring offsets for emission increases.

[ ] Establish appropriate recordkeeping and monitoring system. The system should be designed to allow for the demonstration of compliance with permit conditions and detection of potential violations. Permit conditions or regulations may require records of materials use, hours of operation, pollution control logs, temperatures of combustion or fountain solution, routine tests, etc. Depending upon the specific permit condition, it may be appropriate to periodically sample and test incoming materials, emissions, and control devices.

[ ] File semi-annual emission reports and annual certification. Some permits, especially Title V, require facilities to submit reports and certification of compliance.

[ ] File annual emission statements. Emission statements can be required of sources/facilities even if they are exempt from permitting. Thresholds for emission statements vary according to specific state/local agency and attainment/nonattainment classification. Some states require emission statements from facilities with emissions greater than 3 tons per year. Many states require them from facilities with emissions greater than 10 tons per year.

[ ] If necessary, develop and implement (when required) an emission reduction plan. Emission reduction plans typically address emissions of VOCs and NOx during excessive day(s) of ozone formation. Depending upon severity of ozone formation, actions taken could be minor (e.g., delaying certain non -critical operations, car pooling, keeping chemical containers closed) or major which would involve production curtailment.

[ ] Keep records of any phone conversation, correspondence, testing, and calculations; and send all correspondence to any agency by return registered mail.

B. Water Discharges

[ ] Inventory all sources of wastewater discharges.

[ ] Determine fate of all sink drains, floor drains, processor and equipment drains and sewage lines. Direct discharges of wastewater are prohibited, unless permitted (see NPDES requirements below).

[ ] Maintain copy of sewer connect permit or notification and other correspondence.

[ ] Annually determine total wastewater flow in gallons. The amount resulting from industrial water use should be either measured or estimated. Sources of information for estimating total flow include records indicating the volume of water purchased, other water purchased with process chemistry like water-based coatings, water-based inks, film and fountain solution concentrates, and any water pumped from wells. If necessary, gallons per month and day may also have to be determined.

[ ] Contact local publicly owned treatment works (POTW) or sewer authority for permission to discharge process wastewater effluent and for permitting requirements and obtain a copy of the sewer code.

[ ] Most POTWs require silver recovery and may have specific limitations for certain chemicals, heavy metals, and physical characteristics (e.g., Copper, Ammonia, pH, COD, and BOD) contained in wastewater effluent. Contact POTW to determine specific limits.

[ ] Establish a system to track all permits and ensure that permit renewals are filed in a timely manner.

[ ] Some states/local POTWs require employees who operate and maintain any pretreatment equipment to be trained and certified as wastewater treatment operator. Contact local POTW/state agency to determine requirements.

[ ] Conduct testing of wastewater discharges. Permits and/or sewer code may require periodic discharge testing and monitoring reports of effluents. Contact local POTW to determine requirements.

[ ] When conducting wastewater sampling, especially during compliance determination testing, take a sample of incoming water to use as baseline. The preferred sampling protocol is a multiple-hour (ideally, 24-hour) composite sample versus a grab sample.

[ ] Establish policies and procedures to prevent inadvertent release of prohibited materials. EPA ban on discharging of oil/grease, materials that could create a fire or explosion, and chemicals that could produce toxic vapors and fumes. Many POTWs allow a small amount of oil/grease discharge, usually in the 50- to 100-ppm range. Some ignitables, especially those that contain less than 25% alcohol, could also be exempt from the discharge ban.

[ ] Permanently block all open floor drains in the facility or if floor drain is necessary, provide drain covers. In the event of a spill, open floor drains provide a means to allow spilled chemicals to be discharged directly to the POTW and depending upon the material spilled, in a concentrated form. Alternately, a raised pipe or other device could be provided to prevent spilled chemistry from being released through the open floor drain. The alternate approach cannot present a tripping hazard.

[ ] Provide secondary containment for all processors or equipment using chemistry to help contain spills and prevent them from spreading. The secondary containment should be capable of holding at least 110% of the volume of the contents of a single chemical container or processor. If more than one container or processor is included in the containment area, then the secondary containment must be capable of holding 150% of the volume of the largest primary container or 10% of the aggregate volume of all primary containers, whichever is greater.

[ ] Assemble and locate appropriate spill response and neutralization materials in prepress area. Materials include a wide variety of absorbents, two or three mops, mop bucket with wringer, several squeegees, several push brooms, traffic tape, spill sign, small shovel, clean container with lid for receiving spilled materials and contaminated cleanup material, weak acids (for developer), alkali material (for fix), containers, and personal protective equipment (e.g., rubber gloves, goggles, aprons, shoe covers, and general purpose respirators).

[ ] Discharges of more than 33 lbs./month of hazardous waste, especially listed ones, or any acute wastes mixed with domestic sewage requires written notification to local EPA office, state waste agency, and POTW.

[ ] Significant dischargers (those discharging more than 25,000 gallons/day) and occasionally smaller dischargers may be required to submit biannual effluent testing data and develop plans to respond to accidental spills and discharges. Contact local POTW to determine requirements.

[ ] File annual industrial wastewater discharge survey. Some local POTWs require annual reporting of industrial effluents. Some surveys can be extensive.

[ ] Install and maintain backflow prevention system. Some water authorities require backflow prevention devices on each piece of process equipment connected to incoming water supply. Some water authorities require annual testing and registration of all backflow preventors.

[ ] ***National Pollutant Discharge Elimination System (NPDES) permit:***

[ ] Obtain permit for discharges of industrial and sanitary wastewater effluent, non-contact cooling water, and boiler blowdown water to navigable waterways (e.g., streams, creeks, lakes, rivers, etc.).

[ ] Obtain NPDES stormwater discharge permit for any rain or snow melt runoff exposed to industrial activity (e.g., contaminated with chemicals) and discharged to navigable waterways. NPDES permits can be either group, individual, or general. Printers constructing shelters over sources of contamination (e.g., dumpsters) or bringing materials inside can exempt themselves from this regulation.

[ ] If stormwater discharge permit is required, determine pollutant monitoring, sampling and testing requirements. Keep copies of all testing results.

[ ] If stormwater discharge permit is required, develop and implement pollution prevention plan designed to minimize or eliminate sources of pollution.

[ ] Contaminated stormwater discharges to municipal systems require notification to the municipality. Printers constructing shelters over sources of contamination (e.g., dumpsters) or bringing materials inside can exempt themselves from this regulation.

[ ] Establish tracking system to ensure permit renewals are filed in a timely manner.

[ ] ***Septic system:***

[ ] Ensure that all septic systems are installed in accordance with state/local requirements. Permits for installation may be necessary.

[ ] Conduct annual inspection of septic system to ensure it is operating properly. Some state/local agencies require annual inspections by qualified engineers.

[ ] Prohibit discharges of industrial wastewater effluent into septic system. In some instances, states will allow discharges of certain industrial wastes into septic systems, but discharger will typically be required to obtain a NPDES permit.

[ ] If a septic system had been previously used and/or removed, keep copies of all sampling and test results indicating contamination with industrial effluents. If remediation actions were taken, copies of all pertinent records and test results must be maintained.

[ ] ***Drinking water:***

[ ] Make sure that lead-free solder for pipes and drinking water fountains is used.

[ ] Use lead-free drinking fountains that have not been cited/recalled for lead-lined cooling tanks.

[ ] Water being supplied from wells for drinking may have to be periodically tested for presence of contaminants. This testing is usually mandatory for plants with more than 25 employees.

C. Hazardous Waste

[ ] Determine if hazardous waste is generated. A waste is any material that has been abandoned or discarded that is unsuitable for use without treatment or recycling. The U.S. Environmental Protection Agency (USEPA) has established a protocol of using process knowledge, chemical identification, or testing (flashpoint, pH, Toxicity Characteristic Leaching Procedure, etc.) to determine classification of wastes. USEPA also provides for many exceptions, while some state agencies do not observe the same exemptions. For example, in some states, silver-laden fixer must be counted as a hazardous waste, while USEPA exempts it. In addition, some states regulate other materials like used oil as hazardous wastes. Please check with your state agency to see if they regulate materials USEPA does not.

[ ] Ignitable Wastes

[ ] A liquid that has a flashpoint below 60°C or 140°F. Aqueous solutions containing less than 24% alcohol by volume are not included in this definition.

[ ] A non-liquid capable of spontaneous and sustained combustion under normal conditions.

[ ] An ignitable compressed gas as defined by DOT.

[ ] An oxidizer as defined by DOT.

[ ] Corrosive Wastes

[ ] An aqueous material with a pH less than 2.0 or greater than 12.5.

[ ] A liquid that corrodes steel at a rate greater than one-forth inch per year at a temperature of 55°C or 130°F.

[ ] Reactive Wastes

[ ] Normally unstable and reacts violently without detonating.

[ ] Reacts violently with water.

[ ] Forms an explosive mixture with water.

[ ] Generates toxic gases, vapor, or fumes when mixed with water.

[ ] Contains cyanide or sulfide and generates toxic gas vapors or fumes at a pH between 2 and 12.5.

[ ] Toxic Wastes

[ ] Requires testing by Toxicity Characteristic Leaching Procedure (TCLP) for 25 organic chemicals, 8 metals, and 6 pesticides and sets threshold levels above which the waste would be classified as hazardous.

[ ] Listed Wastes

[ ] Waste contains or is completely composed of chemicals from four separate lists of hazardous wastes. Some "F" listed wastes must contain chemicals on the list that exceed at least 10% of the original mixture.

[ ] Determine generator status (e.g., exempt, small, or large), which is dependent upon the amount of hazardous waste generated per month. Some states do not recognize distinctions between exempt and small and between small and large quantity generators, thus requiring either exempt quantity generators to observe small-quantity generator requirements and small-quantity generators to observe large-quantity requirements.

[ ] *Exempt* quantity generators are those generating less than 220 pounds/month of hazardous waste and less than 2.2 pounds/month of acute waste.

[ ] *Small* quantity generators are those facilities who generate between 220 and 2,200 pounds/month of hazardous waste and less than 2.2 pounds/month of acute waste.

[ ] *Large* generates over 2,200 pounds/month of hazardous waste and/or more than 2.2 pounds/month of acute waste.

[ ] Wastes to count toward generator status (Note: This list is not all inclusive.):

[ ] All listed and characteristic wastes that are accumulated on-site for any time period.

[ ] All listed and characteristic wastes that are packaged and transported off-site.

[ ] Placed in a regulated on-site treatment or disposal unit.

[ ] Still bottoms or slugs removed from storage tanks.

[ ] Contaminated soil or spilled chemistry.

[ ] Any material mixed with a listed hazardous waste.

[ ] Unused inventory that has not been used within one year.

[ ] Wastes <u>not</u> to count toward generator status (Note: This list is not all inclusive.):

[ ] Sewer discharges sent directly to a POTW, as long as POTW grants permission.

[ ] Sewer discharges from a neutralization (pH) unit.

[ ] Wastes continuously reclaimed on-site in a closed pipe system.

[ ] Any material already counted once during a calendar month, treated or reclaimed, and used again.

[ ] Used oil sent off-site for disposal or recycling and not mixed with listed hazardous waste and contains less than 1,000 ppm total halogens. Chlorofluorocarbon-bearing compressor oils are exempt, if not mixed with other oils and recycled or reclaimed. Oils burned either on-site or off-site for energy recovery that contain more than 2 ppm cadmium, 10 ppm chromium, 100 ppm lead, or 5 ppm arsenic must be burned in specially equipped furnaces, boilers, or incinerators with scrubbers.

[ ] Any material left in containers emptied through conventional means. If a container is less than 110 gallons, then one inch or 3% by weight of the total capacity is allowed in the container for it to be considered empty. For example, 55-Gallon drums are allowed one inch of material remaining in it for them to be considered empty. A five pound ink can would be allowed to have about one-eighth of an inch of ink in it to be considered empty. Containers greater than 100 gallons are allowed either one inch or 0.3% by weight of the total capacity. Containers with acute wastes must be tripled rinsed.

[ ] For reusable shop towels contaminated with hazardous waste (e.g., some solvents and inks), states may require written contract with laundry facility; laundry uses own trucks to pick up and deliver shop towels; shop towels not saturated with solvent and pass paint filter test (under these conditions, shop towels being washed and returned *should be* exempt from regulation). Some states regulate all reusable and disposable solvent-laden shop towels (regardless of amount) as hazardous and require manifests, while other states have established management practices to exempt them from being classified as hazardous. It is important to minimize the amount of excess solvent placed on the shop towels to help launderers meet their wastewater discharge limits. Obtain copy of state interpretation of solvent-laden reusable cleaning shop towels.

[ ] Some states classify waste and used oil, recovered silver and silver-bearing wastes, fluorescent and high-intensity lights (mercury content), PCBs, ethylene glycol (anti-freeze) and uncontaminated lithographic ink as hazardous.

[ ] Fluorescent lights properly disposed. Some states regulate them as hazardous because of the mercury content.

[ ] Batteries and recalled pesticides classified as universal wastes and can be taken to local collection center without manifest.

[ ] *Exempt Quantity Generator Requirements*:

  [ ] Determine amount of hazardous waste generated per month.

  [ ] Label and store wastes according to requirements (see below).

  [ ] Ensure wastes are properly disposed at licensed treatment, storage, and disposal facility.

  [ ] Can use own vehicle to transport waste to disposal facility.

  [ ] Can participate in local neighborhood hazardous waste collection program.

  [ ] Total hazardous waste accumulation not to exceed 2,200 pounds.

  [ ] Spills or accidental releases of listed materials above reportable quantities requires notification to national response center (800/424-8802), state, and local governmental agencies. Obtain proper telephone numbers for appropriate agency.

[ ] *Small Quantity Generator Requirements*:

[ ] Determine amount of hazardous waste generated per month.

[ ] Collect, label and store wastes according to requirements (see below).

[ ] Obtain facility identification number for off-site shipment of hazardous waste to a treatment or recycling facility. Number is specific to location and is not transferable.

[ ] Change in type or volume of hazardous waste stream requires notification of state agency by refiling the notification of hazardous waste activity form.

[ ] Manifests for all shipments of hazardous wastes with all proper EPA code(s), land ban notification. Some states allow for contractual reclamation or recycling that does not require a manifest (e.g., solvent reclamation or reusable rags).

[ ] Generator must keep copies of manifests for at least three years and land ban forms for five years. Some states require twenty year retention for manifests. Permanent manifest storage for Superfund purposes is strongly suggested.

[ ] Exception report for missing manifest must be filed within 60 days of shipment.

[ ] Complete annual or biennial report. Some states require small quantity generators to file reports on waste generation and minimization activities.

[ ] Total hazardous waste accumulation not to exceed 13,200 pounds in any 180 day period. A 270 day storage period is allowed if waste shipment to disposal facility is over 200 miles. Some states do not recognize the federal time limits and impose tighter limits.

[ ] Confirm treatment method and treatment facility location, existence of liability insurance, financial status, regulatory status (permits), and historical regulatory compliance record for every treatment facility receiving waste and also the transporter (if a separate company).

[ ] Appoint an emergency coordinator either on-site or available 24 hours per day.

[ ] Contact local emergency response authorities and coordinate any response actions for facility. Information should be provided on waste storage, sprinkler system, utility cut-offs, and water main, etc. (See contingency plan for large quantity generators below.)

[ ] Post name and number of emergency coordinator and fire department at strategic locations like phones and front door.

[ ] Post location of fire extinguishers, spill control equipment, and fire alarms at strategic locations.

[ ] Provide general awareness training on proper waste handling and emergency response to all employees involved in hazardous waste management activities.

[ ] Develop informal waste minimization plan.

[ ] Spills or accidental releases of listed materials above reportable quantities requires notification to national response center (800/424-8802), state, and local governmental agencies. Obtain and keep on hand proper telephone numbers for appropriate agency.

[ ] Some states require generators to develop and implement pollution prevention and waste minimization plans.

[ ] *Large Quantity Generator Requirements*:

[ ] Determine amount of hazardous waste generated per month.

[ ] Collect, label and store wastes according to requirements (see below).

[ ] Obtain facility identification number for off-site shipment of hazardous waste to a treatment or recycling facility. Number is specific to location and is not transferable.

[ ] Change in type or volume of hazardous waste stream requires notification of state agency by refiling the notification of hazardous waste activity form.

[ ] Manifests for all shipments of hazardous wastes with all proper EPA code(s), land ban notification. Some states allow for contractual reclamation or recycling that does not require a manifest (e.g., solvent reclamation or reusable shop towels).

[ ] Generator must keep copies of manifests for at least three years and land ban forms for five years. Some states require twenty year retention for manifests. Permanent manifest storage for Superfund purposes is strongly suggested.

[ ] Investigation of missing manifest must begin within 35 days of shipment and exception report for missing manifest must be filed within 45 days of shipment.

[ ] Complete and submit biennial report. Some states require more frequent reporting.

[ ] Total hazardous waste accumulation not to exceed 13,200 pounds in any 90 day period.

[ ] Confirm treatment method and treatment facility location, existence of liability insurance, financial status, regulatory status (permits), and historical regulatory compliance record for every treatment facility receiving waste and also the transporter (if a separate company).

[ ] Appoint an emergency coordinator either on-site or available 24 hours per day.

[ ] Post name and number of emergency coordinator and fire department at strategic locations like phones and front door.

[ ] Post location of fire extinguishers, spill control equipment, and fire alarms at strategic locations.

[ ] Develop and implement a formal emergency procedure and contingency plan. Plan needs to be shared with local emergency response authorities.

[ ] *Minimum Elements of Contingency plan for responding to an emergency:*

[ ] Facility description including review of activities, map and review of existing response plan.

[ ] Activity review should include description of materials processed, waste generated, and copies of appropriate MSDSs.

[ ] Facility map should be 7.5" USGS with facility name and ID number indicating property boundaries, storage tanks, location of surface drainage courses and potentially exposed surface and groundwater.

[ ] Facility plot plan should indicate boundaries, manufacturing areas, raw material and product storage areas, waste handling and storage areas, drains, pipes, and outfalls, secure and open access areas, and entrance and exit routes.

[ ] Brief incident history including spill description and cleanup measures.

[ ] Facility personnel action responses including organizational structure of chain of command.

[ ] List names, addresses, and phone numbers of emergency coordinators; designate primary emergency coordinator and list others in order of responsibility.

[ ] Spill and leak prevention measures including planning for emergencies, employee training, inspection and monitoring program, and preventive measures like housekeeping, material compatibility considerations, and security.

[ ] Countermeasure plan details describing measures to be taken facility personnel and outside contractors, list of emergency equipment available for response, internal and external communication and alarm system, and evacuation plan for facility personnel.

[ ] Contingency plan amended with dates.

[ ] Copies of plan submitted to police, fire department, hospital, and local emergency response teams.

[ ] At least one emergency coordinator is on facility premises at all times or on call.

[ ] Some states require emergency response capabilities for containment/clean that require training under OSHA spill control regulation.

[ ] Develop and implement formal employee training program. Training records must be kept as long as a person is employed, and for three years after leaving the company. Employee's job descriptions must include hazardous waste handling responsibilities.

[ ] *Minimum Elements of Employee Training Program:*

[ ] Training program consisting of classroom or on-the-job training (OJT) covering hazardous waste identification, storage, labeling, and shipping requirements, handling procedures, and emergency response actions.

[ ] Training directed by person trained in hazardous waste management procedures.

[ ] Training completed within six months of employment or assignment.

[ ] Annual training review.

[ ] *Training records:*

[ ] Job title and name of employee.

[ ] Job description.

[ ] Amount and type of initial and continuing training to be given each person filling position.

[ ] Documentation of training as job experience given to and completed by personnel.

[ ] Records kept until closure or three years after termination of employment.

[ ] Develop and implement formal waste minimization plan.

[ ] *Minimum Elements of a Waste Minimization Program:*

[ ] Development of written policy setting explicit waste reduction goals.

[ ] Designation of waste minimization coordinator.

[ ] Development and implementation of employee appropriate training and recognition of accomplishments.

[ ] Characterization of waste generation and management by developing and maintaining a waste accounting system to track waste generation dates, types, and amounts. Attempt to determine true costs associated with waste generation and cleanup including regulatory oversight, recordkeeping, reporting, loss of potential production, costs of materials in waste stream, transportation and disposal costs, employee exposure and health care, and potential future liability.

[ ] Conduct periodic waste minimization assessments by identifying opportunities at all points in the production process where materials can be prevented from becoming a waste. Opportunities should be analyzed based on true cost of waste management.

[ ] Explore technology transfer opportunities. Sources of information include internal and external sources like other companies, trade associations, consultants, and federal or state funded programs.

[ ] Implement most promising options are identified by assessment process evaluations.

[ ] Conduct periodic review of program for effectiveness and feedback for potential improvement.

[ ] Spills or accidental releases of listed materials above reportable quantities requires notification to national response center (800/424-8802), state, and local governmental agencies. Obtain and keep on hand proper telephone numbers for appropriate agency.

[ ] *Storage and Labeling Requirements*:

[ ] Satellite storage areas:

[ ] Total volume limited to 55 gallons.

[ ] Wastes must be stored in compatible containers.

[ ] Must be under visual control of operator and at or near equipment.

[ ] Multiple containers usually allowed, number depends on type of waste and size of business.

[ ] Containers must be labeled "Hazardous Waste" and marked with accumulation date when first amount of waste is placed into the container.

[ ] Containers must be closed unless filling or draining, spring closed funnel tops permitted.

[ ] Filled drums need to be moved to storage/disposal staging area within 72 hours of being filled. If moved to storage area, they need to be relabeled for accumulation time limit.

[ ] There is no federal storage time limit, but some states have a time limit of one year or less, while others do not allow satellite accumulation.

[ ] *Storage and Staging Areas:*

[ ] All drums or other containers need to be labeled "Hazardous Wastes" with accumulation date and contents [can use classification code (e.g., D001)].

[ ] All wastes must be kept in closed containers unless they are being drained or filled.

[ ] Wastes need to be stored on impervious surface like sealed concrete or similar material.

[ ] Storage areas must have adequate aisle space (at least 3 ft.) for inspections and reading labels.

[ ] Drums need to be properly maintained and not leaking or rusted.

[ ] Conduct weekly drum storage area inspections and daily inspections for tank storage. Maintain log of inspection results indicating any corrective action.

[ ] Storage area needs to be equipped with or have immediate access to a communication system (e.g., phone, alarm, or two-way radio), fire extinguisher, water (e.g., sprinkler system), spill cleanup materials, and first-aid materials (e.g., eyewash).

[ ] Permits for recycling/recovery hazardous waste (e.g., silver recovery, distillation units). Many states require generators of all sizes to obtain permits for these activities. Check with state/local agency for requirements.

[ ] Unused chemicals not stored for more than one year. They are considered waste and must be properly disposed.

D. Non-hazardous Waste

[ ] Some states have adopted mandatory recycling programs for business and require annual/biannual reporting on program effectiveness.

[ ] Some states have adopted Residual Waste regulations governing the proper disposal of non-hazardous industrial wastes (e.g., uncontaminated lithographic inks, films, and chemical containers). These wastes must go to an approved treatment/landfill facility, the generator has to complete a biennial report, perform chemical analysis, and develop a source reduction plan.

[ ] Confirm treatment method and treatment facility location, existence of liability insurance, financial status, regulatory status (permits), and historical regulatory compliance record for every treatment facility receiving waste and also the transporter (if a separate company).

E. Emergency Planning and Community Right-to-Know

[ ] Obtain copy of USEPA's consolidated list of chemicals (800/535-0202).

[ ] Procedure for notifying federal, state, and local authorities in case hazardous substances are accidentally released above reportable quantity amounts. Depending on type of material, quantity, location and duration, and receiving media, notification should be immediate but no longer than 24 hrs. May require written follow-up report detailing spill and remediation activities.

[ ] Submission of copies of Material Safety Data Sheets (MSDSs) or list of substances to local authorities, state authorities, and fire department for substances *stored* above threshold levels—usually 500 lbs. for extremely hazardous substances and 10,000 lbs. for any substance(s) requiring an MSDS. Some states and local governments have lower threshold levels and also require submission of MSDSs to hospitals.

[ ] Submission of Tier I/Tier II forms by March 1 for chemicals stored in excess of threshold levels during previous calendar year. (See previous item for threshold quantities.) Some states and local governments have lower threshold levels.

[ ] Submission of Form R, Toxic Chemical Release Inventory Reporting Form by July 1 for each chemical on a specific list of chemicals used in excess of the threshold levels (25,000 lbs. for manufactured or processed chemicals [components of inks] or 10,000 lbs. for otherwise used chemicals [solvents]) during the previous calendar year. New Form R requires pollution prevention activity reporting.

[ ] Consider using approved alternate reporting option for Section 313 (e.g., Form R). Under this option a Form R need not be submitted, only an annual certification is needed. Applies to reporting year 1995 and chemical being reported must be used in quantities less than 1 million pounds and have a combined reportable threshold of 500 pounds (i.e., released, treated, or disposed).

F. Storage Tanks

[ ] Submit registration form for all chemical underground storage tanks (USTs) greater than 110 gallons storing listed hazardous chemicals or petroleum products except for heating oil tanks. Some states do regulate heating oil tanks with the size for regulation varying. Some states regulate all chemical tanks.

[ ] New petroleum USTs must be equipped with leak detection devices, corrosion protection, and spill/overfill prevention measures. New chemical USTs must also have secondary containment.

[ ] Existing petroleum and chemical USTs must be retrofitted with leak detection by 1993 depending upon the age of the tank. Corrosion and spill/overfill prevention measures are required by 1998. Existing chemical USTs must be retrofitted with secondary containment systems by 1998.

[ ] Aboveground tanks located outside the plant must have a spill containment system including dikes. Some states regulate aboveground storage tanks with regard to registration, spill control programs, and other corrosion requirements.

[ ] Aboveground tanks located inside the plant (tote tanks) may also require a spill containment system, registration, and spill control programs. Contact state for requirements.

[ ] Tank removal, especially of USTs, requires written notification, state supervision, possible testing for contamination, and remediation.

[ ] Demonstrate financial assurance of at least $1 million for cleanup costs and third-party claims resulting from leaks and spills from USTs.

[ ] Maintain records of testing, maintenance, spills, and cleanup activities.

G. Spill Prevention Control and Countermeasures Plan

[ ] Storage total of more than 1,320 gallons in aboveground tanks or single tanks exceeding 660 gallons or UST with more than 42,000 gallons of petroleum or petroleum-derived products (e.g., inks, lubrication oil, gasoline, diesel fuel, and possibly some solvents) that when accidentally released can contaminate navigable waters of the United States and adjoining shorelines requires development of contingency and cleanup plan. Plan must be updated and certified by professional engineer every three years.

[ ] Spills of materials require notification of federal, state, and local authorities.

H. Polychlorinated Biphenyls

[ ] Some states regulate polychlorinated biphenyls (PCBs) and PCB-contaminated material as hazardous wastes (e.g., ballasts from fluorescent lights, dielectric fluid from transformers, soil, and power -stabilizing rectifiers).

[ ] PCBs or PCB-contaminated material must be shipped with a special manifest, or if considered hazardous, then with a state manifest form.

[ ] 480-volt or greater transformers containing more than 500 parts per million PCB located near a commercial building and located in a network must be removed or reclassified by draining and refilling by October 1, 1990. Transformers less than 480 volts can be used, but they must be protected and disposed properly.

[ ] Transformers containing less than 500 ppm and greater than 50 ppm PCB can be used, but they must be disposed properly.

[ ] Transformers containing less than 50 ppm are exempt from federal regulation.

[ ] Presence of PCB can be determined by records, manufacturer's data, or testing.

[ ] PCB-containing transformers need to be inspected quarterly and prominently identified for firefighters.

[ ] Fires involving PCB transformers need to reported to the national response center (800/424-8802), state, and local emergency response personnel. The phone numbers should also be included in the contingency plan.

[ ] Maintain records of inspections, manifests, service, marking, and maintenance of PCB areas on the proper forms.

[ ] A one-year time limit is imposed requiring the disposal of PCB-contaminated materials removed from service.

I. Asbestos

[ ] Renovation or demolition of more than 260 linear feet, 160 square feet, or 35 cubic feet of asbestos-containing material requires EPA/state approval.

[ ] Removal of more than 80 linear feet or 15 cubic feet requires the presence of a trained person on site to monitor activities and employee exposure. Make sure that the contractor has the proper credentials and has not been cited for violations.

[ ] Suggest institution of asbestos operation and maintenance program including regular inspections.

[ ] Some banks and lending institutions require that all asbestos be removed from commercial buildings prior to granting loans for property acquisition or expansion.

[ ] See new OSHA regulations on employee training and exposure control requirements.

J. Department of Transportation Employee Training

[ ] Training required for employees and supervisors involved in driving, loading, unloading, or handling hazardous materials. Training is specific to job function and should include:

  [ ] General awareness of regulations.

  [ ] Shipping paper preparation.

  [ ] Recognition and identification of hazardous materials.

[ ] Proper handling and safety procedures

[ ] Procedures for accident prevention and emergency response including specific protection measures like personal protective equipment.

[ ] DOT allows OSHA hazard communication standard, hazardous waste response (Hazwoper), and USEPA Resource Conservation and Recovery Act (see hazardous waste generator requirements).

K. Ozone Depleting Substances

[ ] All products manufactured with or containing a Class I substance (chloroflurocarbons, halons, carbon tetrachloride, or 1,1,1-trichloroethane) after May 15, 1993 must be labeled. All products manufactured with or containing a Class II substance (hydrochloroflurocarbons) after January 1, 2015 must be labeled. All containers used to transport or store a Class I or II substance must also be labeled. Labeling requirements are specified by regulation.

[ ] No venting of refrigerants from commercial refrigeration equipment, air conditioners, and vehicle air conditioners. Refrigerants must be recovered and recycled by certified technician.

[ ] Certifications obtained for technicians who will work on refrigeration equipment.

[ ] Equipment used to recover and recycle refrigerants must be certified.

[ ] Used refrigeration equipment cannot be discarded without first removing refrigerant.

[ ] Consider retrofitting existing equipment for new refrigerants.

Bayer

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Agfa has a long-standing commitment to developing environmentally responsible products and systems. Agfa also believes in bringing value added services to our customers.

To demonstrate Agfa's ecology commitment,The Environmental Awareness and Solutions Manual is being offered FREE to the National Environmental Compliance Assistance Center's May 96 Teleconference participants.

This Environmental Awareness and Solutions Manual is designed to make you aware of your business' environmental impact and to help you select solution(s) that work within your local compliance regulations.

To assist our customers with waste management and compliance management Agfa offers The Planet Agfa Program. This program helps you proactively run your business with less environmental impact as it focuses on minimizing waste at the source. Environmental training and support material is also part of The Planet Agfa Program. Agfa is a leading manufacturer that produces and markets its own electronic, photographic, offset and ecology products. All of Agfa's products are supported with technical hands-on training from the Agfa Center for Education.

This year The Agfa Center for Education (A.C.E.) has a new 14,000 square foot technical training lab in Teterboro NJ. The Agfa Center for Education offers hands-on interactive training, designed to provide you with the knowledge and the skills needed today and in the future.

For more information on ecology training or to receive an Agfa Center for Education training catalog call 800-540-AGFA x3959
For more information on Planet Agfa solutions designed for the needs of our film, plate and proofing customers call 800-227-2780 x7671.

Rita J. Witherly
Agfa Center for Education

Due to space limitations, this packet contains only portions of Agfa's full "Environmental Awareness and Solutions" Manual.

AGFA

The Environmental Awareness and Solutions Manual

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Special thanks to:
Susan Johnson
Joanie Hornidge

Agfa Center for Education is a leading resource of hands-on training in the graphic arts industry. It encompasses a variety of programs designed to meet the needs of Agfa personnel, customers and dealers, and offers traditional, electronic and integrated production environments to educate the printing industry via hands-on lab and classroom instruction.

Whether you would like the opportunity to evaluate new products and technologies, improve current production, learn how ecology affects your business, or attain better color application, sales or presentation skills, Agfa Center for Education (ACE) presents these programs and more. ACE offers the graphic arts industry current specialized training, a value-added service from Agfa.

An Agfa Center for Education catalogue can be obtained by calling 1-800-540-AGFA, ext. 3959.

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INTRODUCTION

In the years to come, the 1990s will probably be remembered as "the decade of awareness." There is no better evidence of this than the fact that environmental awareness has risen to a prominent position in the agendas of many businesses. Painters, service bureaus and other operations are no exception.

There are two main driving forces behind this awareness: public pressure and the resulting government legislation and regulations. Although public pressure is somewhat less organized than the government actions, it leads to the legislation and regulations with which compliance is mandatory. The public can also force changes by creating demand for more environmentally responsible products through preferential purchasing and boycotts.

Because the printing process involves the use of chemicals, virtually every environmental regulation applies. This manual will focus principally on the prepress environmental concerns that are affected by these regulations: the sources, causes and solutions for emissions, effluents and solid waste.

For example, film and plate processing generate a significant amount of liquid waste discharges and solid waste (used packaging and film/paper). The waste also contains VOCs, which are being scrutinized by the various environmental agencies. By-products from the prepress area must be properly disposed of according to federal, state and local regulations which can vary greatly depending upon your section of the country.

THE AGFA ENVIRONMENTAL COMMITMENT

As the regulatory pressure has increased, the graphic arts community has responded by acknowledging its environmental protection responsibilities. Agfa readily endorses developing and providing environmentally responsible products and seminars. In fact, Agfa has been involved in ecological concerns for over 20 years — and has invested a considerable amount of resources in the research and development of comprehensive, economical solutions that benefit both customers and the environment.

Agfa's corporate strategy it is to be a partner with our customers in ecology and environmental compliance issues. One of the most important elements of this strategy is the range of ecological equipment and systems being offered by Agfa. These solutions allow for a substantial reduction of various wastes and wastewater, while simultaneously protecting the environment and its various interdependent ecosystems.

Agfa has integrated its strategy with the "3 Rs":

- **Reduce** — the type and amount of waste generated by your business.
- **Reuse** — as much of your process materials as possible.
- **Recycle** — the contents and packaging of your materials back rather than disposing of them.

Agfa's overall goal in producing this manual and course is to demonstrate how to apply the "3 Rs" to your particular operation. The earlier these issues can be addressed in the process — by reducing or pretreating them — the less it will cost to dispose of them in both the short and long term because you are responsible for the hazardous process wastes "from cradle to grave."

WHAT YOU WILL LEARN FROM THIS MANUAL

Upon completion of this manual and training course, you will be able to:

- Understand where effluents, emissions and solid waste are generated in the production cycle.
- Obtain a general understanding of federal, state and local regulation of wastewater discharges, air pollution emissions and solid waste. Also covered is pollution prevention, Community Right-to-Know and some Occupational Safety and Health Administration (OSHA) requirements.

- Understand the need to evaluate process by-products with respect to compliance with these regulations.
- Determine if any actions are necessary to achieve compliance.
- Evaluate if pretreatment of by-products is necessary for compliance.
- Understand concepts, terms and acronyms specific to environmental issues.
- Locate the various Ecological support groups (e.g., Agfa technical managers, GATF and other local industry trade groups) in your region.

BACKGROUND

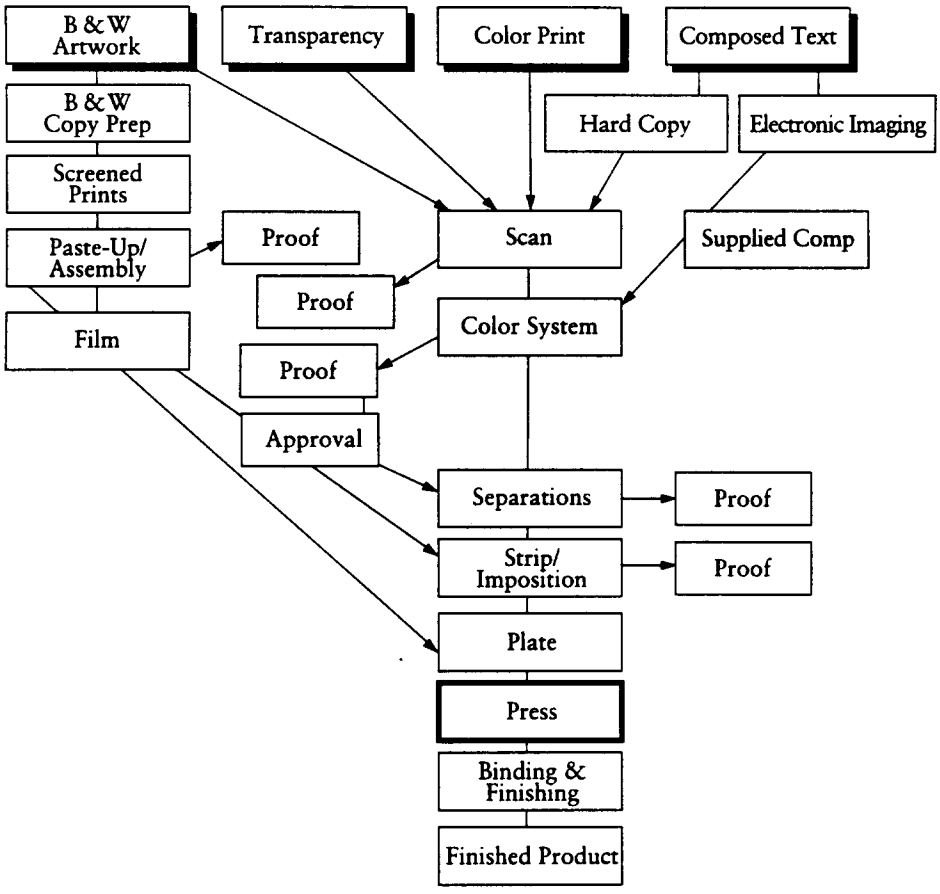
Up until the late 1960's and early 1970's, economic growth and prosperity in America often took precedence over environmental concerns. It was acceptable for industrial and urban waste to be indiscriminately poured into waterways and dumped in landfills and for air pollutants to cloud our skies. Public pressure and the resulting stricter environmental regulations and monitoring have changed all that. Now waste disposal practices that were once economical and convenient could cost your business heavily in fines and litigation.

In response to the environmental crisis, the Environmental Protection Agency was created in 1970. Over the next decade and a half, Congress passed a series of far-reaching laws that prompted needed changes in the way the nation conducts its business. Slowly, a process was built to ensure that environmental considerations are incorporated into the decision-making of government and industry.

Many of the new regulations for environmental protection are increasingly focusing on small businesses, such as the graphic arts industry. Air, water and waste pollution control requirements are influencing the way that businesses are introducing and using new technology. This technology is reflected in not only more efficient prepress equipment, but also materials and chemistries that help reduce the by-products of existing processes.

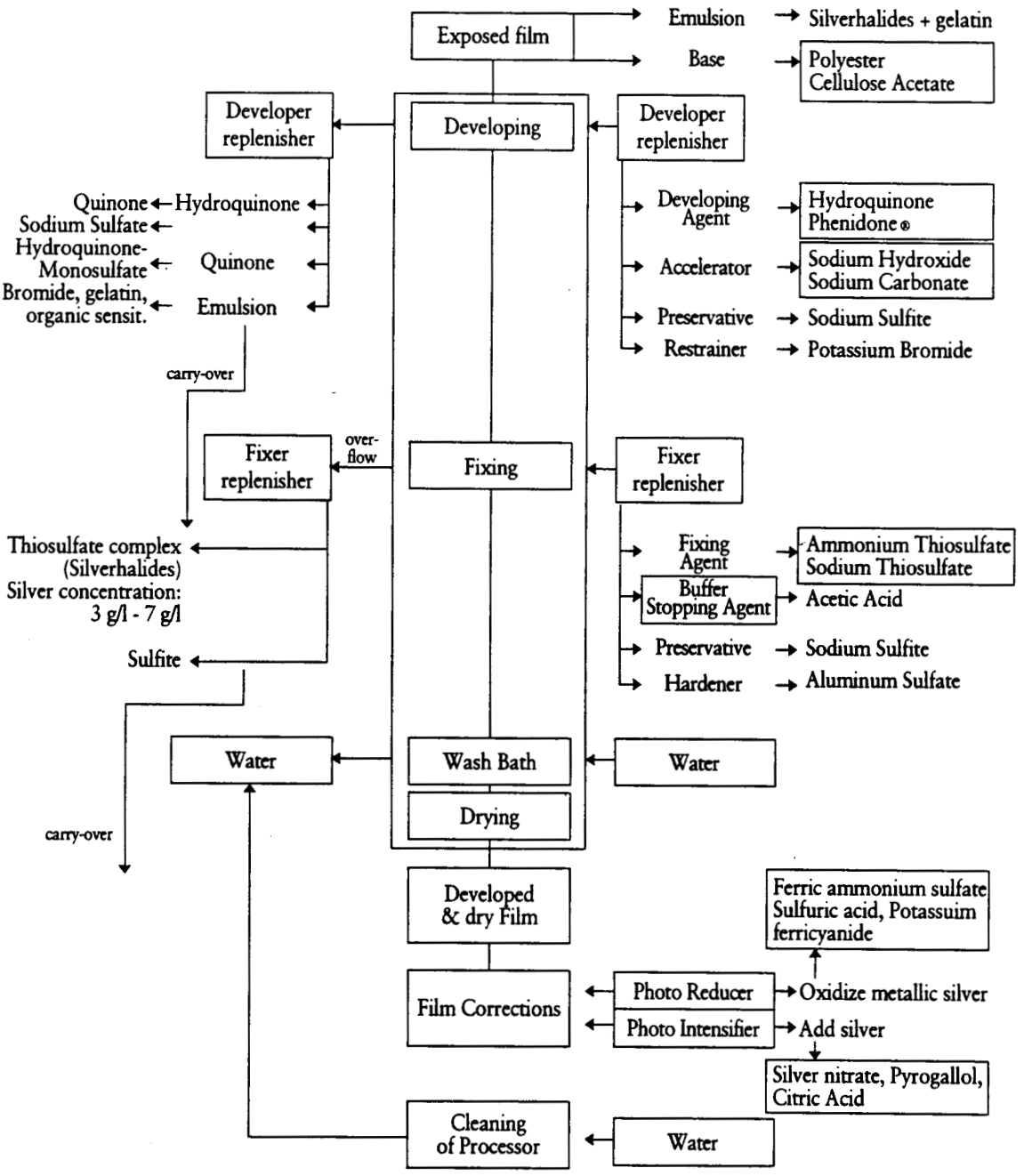
THE PRODUCTION CYCLE

To understand the effects of regulations on the prepress process, a brief review of the printing and publishing production cycle is necessary.



FILM PROCESS WASTES AND BY-PRODUCTS

The following chart shows some of the waste generated from film and paper processing.



PREPRESS CHEMISTRY

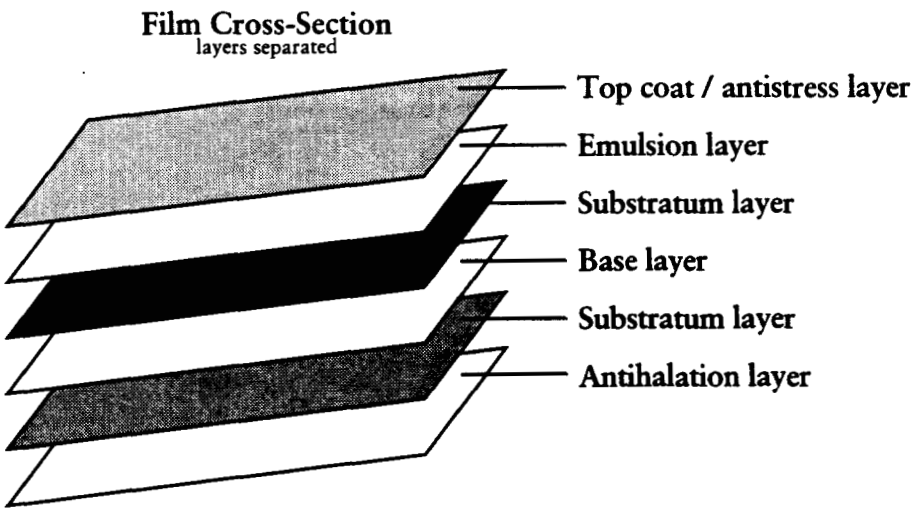
In order to determine the best solutions for a particular environmental challenge, the first item to address is the cause. By identifying and isolating these "causes" and their resulting "effects," the most effective and economical environmental decisions can be selected.

An example of just one step in the prepress area that produces regulated by-products is photo processing. A review of the chemistry of film development will provide the appropriate background and allow for a better understanding of effluents and other sources which create the prepress waste stream.

Photography in the prepress area involves image conversion for platemaking. Most photography is accomplished with polyester films or papers that are coated with an emulsion that contains compounds of silver. These materials are exposed to light that has been either reflected from copy or passed through imaged film — positive or negative. Following exposure, the film or paper is developed, fixed, washed and dried.

PHOTOGRAPHIC EMULSION

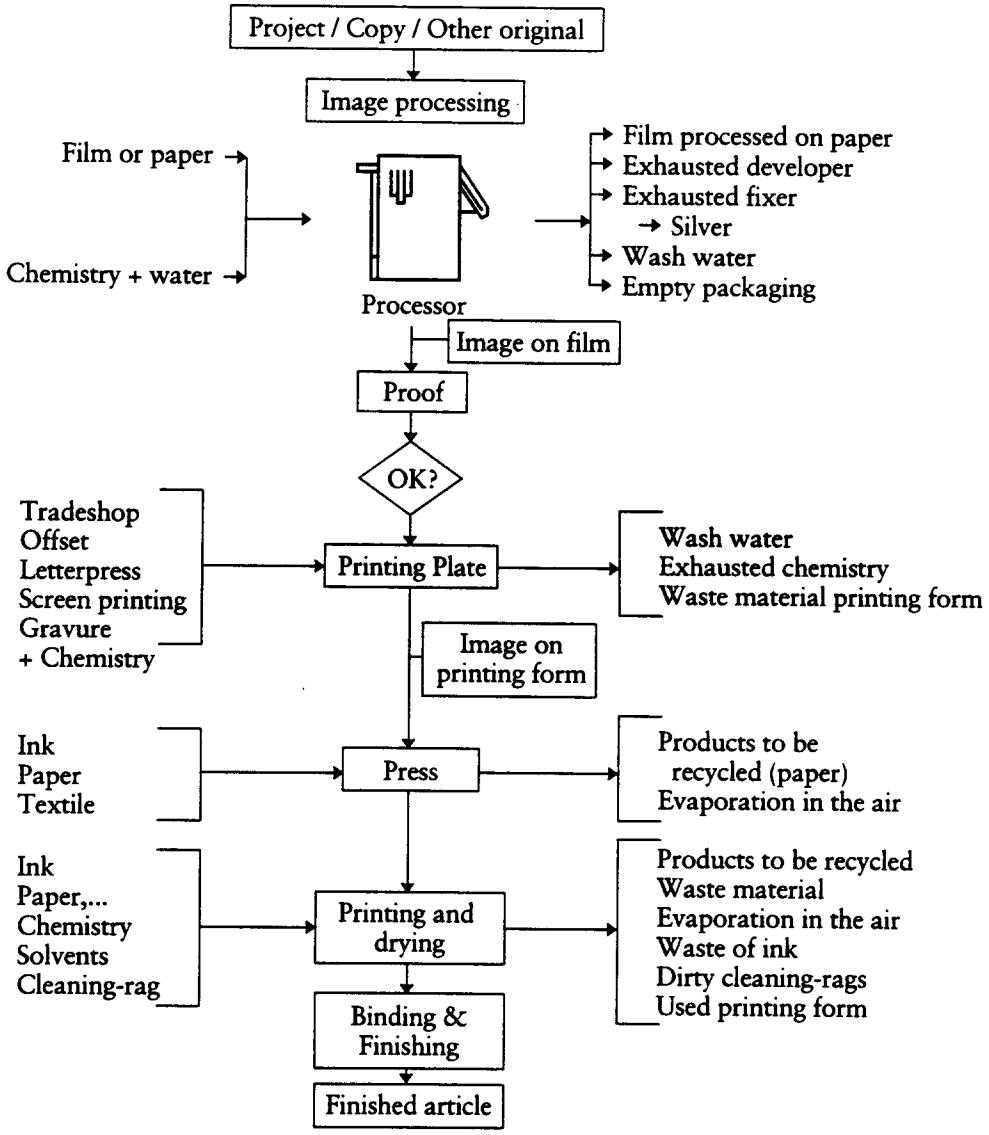
As indicated in the diagram below, the photographic emulsion is made from a silver halide suspended in a gelatin on a substrate of either polyester film, paper or plate.



During exposure of classical photographic materials, the image information is recorded in silver halide crystals as an invisible latent image. Processing steps convert the latent image into a permanent viable image. Development converts the exposed latent image into a visible image. Fixing removes the undeveloped silver halide crystals from the film.

This final permanent image is used in the reproduction steps and ultimately results in the printed piece. When film, paper or plates are developed, a chemical reaction takes place. The above examples represent only a few of the kinds of chemical changes that occur during the film development process, which is necessary to complete the printing process.

After exposure, the film is first immersed in a developer. (See the diagram below.) This converts the silver halide in the photographic emulsion to metallic silver.



The developer is composed of many different chemicals, each with a specific function. Some of these chemicals are consumed by processing film, as well as by oxidation or contact of the liquid with the air. This causes a chemical reaction that creates exhausted developer.

Unused developers typically could contain benzine derivatives. These include pyrogallol, Hydroquinone, catechol, p-phenylene diamine, paminophenol, Metol®, amidol and pyramidol. The two most common developing agents are hydroquinone and Phenidone®.

In general, the developer solution also contains an accelerator, preservative and restrainer. The accelerator is an alkaline material — such as sodium hydroxide, sodium carbonate or sodium tetraborate (borax) — which increases the activity of the developer by neutralizing the acid formed during the development process. This means the pH of the bath is greater than 7 and typically around 10. (In the pH scale, 7 is neutral; those less than 7 indicate acidity, while those larger than 7 indicate alkalinity.) The preservative, typically sodium sulfite, reduces oxidation damage to the developing agent. The restrainer, potassium bromide, reduces the formation of the "fog" on the images.

The replenishment system pulls a proportion of new chemistry into the bath and removes an equal amount of old chemistry. This makes sure the developer in the processor has all the necessary components at the proper strength to produce optimum image quality. The following chart lists common developer ingredients for your reference.

• Major constituents

Constituent	Function	Products most frequently used
Developing agent	To reduce exposed AgX into silver (latent) image	Hydroquinone, Phenidone®
Alkali	To speed up development reaction	Highly alkaline: hydroxides Reasonably alkaline: carbonates Moderately alkaline: sulfites, bicarbonates
Preservative	To inhibit oxidation of developing agent	Sodium sulfite
Inhibitors	To check the speed of development, creating enhanced selectivity and anti-fog reaction	Potassium bromide

Other additives: water softening agents, solvents, lubricants, anti-fog agents,...

The following list represents the typical composition of black & white developing baths:

Always present:

- Developing substances, e.g., Hydroquinone, Phenidone®
- Activator and buffer, e.g., carbonate, borate
- Antioxidant: Sulfite
- Water softener

Sometimes present:

- Glycol
- Antifogging agent, e.g., bromide

Present after use:

- Sulfate (oxidized sulfite)
- Bromide or chloride (from the film)
- Traces of gelatin
- Traces of metallic silver

In the second step of the development process, the unexposed and undeveloped silver halide crystals must be removed from the film emulsion so that it may be handled in light without causing a change to the image. The fixer accomplishes this function, as well as stopping the development reaction.

The principal fixer chemical usually involves one of the following: sodium thiosulfate (hypo) or ammonium thiosulfate. These chemicals convert the silver halides from the photographic emulsion to soluble complexes. By removing the unexposed silver from the emulsion, you preserve the original image. This prevents it from turning to metallic silver which would make the image in the emulsion black. Fixer ingredients are summarized in the following table.

- **Fixing removes unexposed undeveloped silver from the emulsion**
  Two stages: - make the silver soluble
  - remove the unexposed silver from the emulsion

- **Major constituents**

Constituent	Function	Products most frequently used
Fixing salt	To dissolve AgX*	Sodium thiosulfate Ammonium thiosulfate
Acid + buffer	To neutralize developer	Acetic acid + sodium acetate
Preservative	To stop the oxidation of fixing salt	Sodium sulfite
Hardening agent of gel	To counter the swelling	Aluminum sulfate

- **Replenishment: with the fixer itself**

*** AgX is the chemical abbreviation for Silver Halide**
Ag = Silver
X = Halide - Bromine, Chlorine, Iodide

The fixing solution is kept at a low pH (acidic) via acetic acid. It must neutralize the alkalinity of any developing solution remaining on the film, thus immediately stopping the developing action.

Aluminum sulfate, which prevents excess swelling of the photo emulsion gelatin, is not stable in a neutral or alkaline solution. Unless the pH is kept low, aluminum hydroxide will form and will interfere in the fixing process.

Boric acid is added to buffer the fixing solution and limit pH changes. This helps prevent precipitation of aluminum compounds. For this reason, the fixer has an acidic pH — typically around 4.5.

The following represents the common constituents of all black & white fixing baths:

Always present:

- Fixing salt, e.g., ammonium thiosulfate
- Antioxidant: sulfite
- Buffer: Acetic acid or citric acid

Sometimes present:

- Hardener: Aluminum sulfate
- Borate

After use:

- Silver thiosulfate complexes
- Bromide or chloride ions
- Carried-over developer

In this second step, a hazardous waste is created — "*silver laden fix*" — because it contains more than 5 ppm silver (EPA's definition of hazardous waste). Each time film or paper is immersed in the fixing bath, a small amount of silver enters the bath from the photographic emulsion. After a negative or positive is fixed, some of the fixing bath chemicals remain in the gelatin emulsion layer. One of the chemicals present is hypo. If it is not removed from the emulsion, it can react with the silver to form yellowish-brown silver sulfide. This compound impairs the quality of the image and causes fading or the discoloration of the nonimage areas.

The third step of the process is the wash bath which washes any residue left by the developer or fixer from the substrate. The rinsing water is composed of 98% pure water plus carried-over fix with traces of gelatin. For every square meter of film processed, 20 to 100 ml. of fixing bath is carried over along with typically up to 200 ppm of silver. The concentration of silver per liter of wastewater depends on the flow of finishing water, the positive/negative work, the size of the film, the squeegee rollers on the processor, processor speed, production flow, absorption characteristics and other factors. The waste generated from the processing of black & white photographic material include:

- Small amounts of vapors, moist air-heat.
- Developed film and paper comprised of support material, e.g., PET, cellulose triacetate or paper (>90%), gelatin layer (6 to 10%) and metallic silver (0.3 to 3%).
- Exhausted developing bath (the amount of waste developer can be reduced by the use of an optimized replenishment rate).
- Exhausted fixing bath (see above).
- Rinsing water (see above).
- Empty packaging from chemical containers composed of polyethylene (PE). It does not contain chlorinated hydrocarbons or heavy metals, such as silver. Other packaging material includes slip sheets, corrugated and other boxes and "packing" peanuts — all of which can be recycled.
- Silver in the form of Silver Thiosulfate in the fix and wash water.

U.S. ENVIRONMENTAL AND SAFETY REGULATION OVERVIEW

Virtually every business is faced with environmental regulations that limit the release of materials into the air, water and land. The number of new laws and regulations are increasing and the requirements are becoming more stringent.

Since these laws and regulations affect us both personally and professionally, they must be incorporated into the management of business on a daily basis. The demands on business are complex and the reporting and record-keeping requirements can be confusing. Direct responsibility for making sure the business is operating within compliance of water, air and hazardous waste regulations falls on the owner. Otherwise, violations can result in stiff fines and sanctions.

Because the overall set of environmental regulations are undergoing constant revision and expansion, it will be quite difficult to present all of the applicable requirements. The example we will be focusing on is black & white processing in relation to other types of processing (e.g., proofing or plates). Once this basic process is understood, it is an easy transition to other types of processing used.

To help in understanding some of the concepts and terms presented, a glossary of terms is provided. In addition, a checklist of regulatory concerns is also available.

The following information addresses the general federal requirements, along with some state and local regulations that are important. It is imperative that you also familiarize yourself with the state/local requirements for your area because they can be more stringent — and easily enforced — than the federal requirements. For example, a number of states have regulations that are actually more extensive than their federal counterparts. California, New York (Suffolk County) and parts of Florida — along with a number of other areas around the U.S. — have exceptionally stringent and enforced regulations.

The basic areas of environmental regulations fall into the following categories:

WATER:

- Discharges to a Publicly Owned Treatment Works (POTW) Sewer Authority
- Discharges to a septic system
- Discharges to a body of water
- Storm water discharges

AIR:

- Direct sources of air pollutants
- Indirect or fugitive sources of air pollutants
- Permits and control requirements

SOLID WASTE:

- Hazardous waste and its disposal
- Nonhazardous industrial waste and its disposal
- Municipal waste and its disposal
- Waste minimization and recycling

EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW:

- Emergency release notification
- Inventory reporting
- Release reporting

POLLUTION PREVENTION:

- Pollution Prevention Act
- State activities
- Voluntary activities

SAFETY AND HEALTH REGULATIONS:

- Occupational Safety and Health Administration (OSHA) and its requirements for the work place

The free silver ion is an effective bactericide, which can seriously impair biological systems. On July 1, 1976, interim federal guidelines were issued for point source discharges in the photoprocessing industry (40 CFR 459). These apply to processors which discharge wastewaters directly into a surface water such as a stream or lake. These guidelines established limits of 0.03 pounds of silver per day per 1000 square feet of film or paper processed and a 30 consecutive-day average of 0.015 pounds/day per 1000 square feet. However, most processors discharge into municipal sewer systems. Approximately half of the municipal sewer codes in the nation contain limits on silver discharge. Most of these limits range from 0.05 to 5.0 mg/l. (ppm). Some municipalities have prohibited the discharge of photoprocessing effluents into their sewage systems.

The impact of silver in processing wastes is controversial. However, a number of published studies indicate that there is no real threat to aquatic systems. These studies are supported by the silver coalition (composed of the major film manufacturers, e.g., Agfa, DuPont, Kodak). Although, delisting of silver is being studied by some federal authorities, some local authorities regard it as a hazardous waste. In those locations, silver-containing materials must be manifested and shipped as a hazardous waste if they contain more than 5 mg/l. of silver as measured by the EPA-specific leaching test, increasing the cost for offsite reclamation.

Silver-bearing solid wastes include scrap film and photographic paper. Other solid wastes are film cartridges, cassettes and canisters, as well as containers for photographic chemicals.

RECYCLING AND RESOURCE RECOVERY

Silver Recovery

Metallic silver trades as a commodity in units of Troy ounces (one Troy ounce equals 31.10 grams). In recent years the price range has typically been $4 to $6 per Troy ounce, although during the speculative fever of 1980, the price reached $50 per Troy ounce, before the market collapsed. Thus, if the market price were $6 per ounce and an effluent contained 31 mg/l. silver, the potential recovery value of silver would be 0.6 cents per liter or nearly 2.4 cents per gallon of effluent. Since silver recovered from photoprocessing requires further processing, reclaimers will offer somewhat less than market price for the recovered silver.

Major sources of recoverable silver are photo processing solutions, spent rinse water and scrap film paper. The silver in these materials may exist as insoluble silver halide, soluble silver thiosulfate complex, silver ion or elemental silver depending on the type of process and the stage in the process where the silver is being recovered.

As much as 80 percent of the total silver processed for black & white positives and almost 100 percent of the silver processed in color work will end up in the fixer or bleach-fix solution. Silver is also present in the rinse water following the fixer or bleach-fix due to carry-over. The amount of silver in rinse water is only a small fraction of that in the fixer or bleach-fix solutions, but can be economically recovered when high volumes of rinse water are used. A variety of equipment types and sizes are available for silver recovery.

Silver Recovery from Fixer Solution

The most common methods of silver recovery from the fixer and bleach-fix processing solutions are metal replacement, electrolytic recovery and chemical precipitation. Ion exchange and reverse osmosis are other methods that can also be used. However, these are suitable only for dilute silver solutions such as wash water from a primary silver recovery unit. Some facilities use primary silver recovery unit, which removes the bulk of silver, in combination with a "tailing" unit to treat the relatively low silver concentration effluents.

Metallic Replacement

Metallic replacement occurs when an active solid metal, such as iron, contacts a solution containing dissolved ions of a less active metal, such as silver. The more active metal, iron, goes into the solution as an ion, being replaced by an atom of the less active metal, silver, in the solid matrix. The dissolved silver, which is present in the form of a thiosulfate complex, reacts with solid metal.

Silver ions will displace many of the common metals from their solid state. Because of its economy and convenience, iron in the form of steel would be used most often.

Comparison of Silver Recovery Methods

Method	Advantages	Disadvantages
Metallic Replacement	Simplest operation Low investment Low operating cost High iron content of effluent	Proper flow rate is required Silver recovered as sludge High silver concentration in effluent unless two units are in series Can only handle low volume of silver Channeling can occur
Electrolytic Recovery	Recovers silver as pure metal High silver recovery High silver concentration in effluent	Potential for sulfide formation if electric charge is too high which is why a sensor device is required
Precipitation	Can attain 0.1 mg Ag+/l. Low investment	Complex operation Silver recovered as sludge treated solution cannot be reused Potential H2S release
Reverse Osmosis	Also recovers other chemicals Purified water is recyclable	Concentration requires further processing High investment High operating costs
Ion Exchange	Can attain 0.1 mg Ag+/l. Good for very low Ag limits only for dilute effluent	Complex operation High investment
Evaporation	Minimum aqueous effluent Water conversation	High energy requirement Organic contaminant buildup Potential air emissions

Metallic Exchange

Used as a "tailing unit," this is an enclosed container that is designed to handle less than 3-5 ppm of silver. It is attached to the overflow base before the silver-bearing chemicals go into the sewer line. The silver solution flows through the container which is filled with a steel wool cartridge. A metallic exchange occurs where an ion of iron in the steel wool is exchanged for an ion of silver.

The drawback of this unit is that the chemicals can start to "channel" directly through the steel wool to the end of the container rather than flow throughout it. This limits the surface area with which the silver/iron exchange can occur along with ability of the unit to remove silver from the effluent so the unit becomes ineffective. This "channeling" does not occur with the stainless steel mesh version of this unit, but both units are designed for small quantities of silver removal. Also, with both units, fixer is not recycled after the silver is removed so there is no chemistry savings. In both types of units, cartridges must be replaced regularly and be disposed of by a licensed waste hauler or sold to a silver reclaimer.

It is also recommended that bleach from film processing not be treated in the system. Bleach has a tendency to destroy the iron mesh and dissolve silver, causing the system to pass silver.

Electrolytic Recovery

An electrolytic unit can be used for a primary recovery system for the waste stream and can be either batch for large quantities or continuous for average use. This silver recovery method applies a direct current across two electrodes in a silver bearing solution. Silver deposits on the cathode. Sulfite and thiosulfate are oxidized at the anode:

$H_2O + SO_3^{-2} \rightarrow SO_4^{-2} + 2e^- + 2h^+$ (Anode)

$SO_3^{-2} + S_2O_3^{-2} \rightarrow S_3O_6^{-2} + 2e^-$ (Anode)

$Ag^+ + e^- \rightarrow AgO$ (Cathode)

Approximately 1 gram of sodium sulfite is oxidized for each gram of silver deposited. Considerable agitation and large plating surface areas can achieve good plating efficiency and silver up to 90-98 percent pure. Lower silver purity levels usually result from tailing unit applications because of the lower silver concentration in the effluent solution. The cathodes are removed periodically and silver metal is stripped off. An elec-

trolytic system should recover about 98 percent of the recoverable silver. But it is only effective in recovering silver in solutions with a silver concentration above 300 ppm, whereas metallic replacement works at all concentrations.

Care must be taken to control the current density in the cell because high density can cause "sulfiding." Sulfiding is the decomposition of thiosulfate into sulfide at the cathode, which contaminates the deposited silver and reduces recovery efficiency. The higher the silver concentration, the higher the current density can be without sulfiding. Therefore, as the silver is plated out of solution, the current density must be reduced. Cream-colored silver is what you want to see on the cathode. Too much electricity makes the silver dark gray and burns the fix. Too little electricity applied to the fixer bath causes the silver to be a light gray color and this means that all the silver is not being plated out.

Batch Electrolytic Recovery

In batch recovery, overflow fixer and bleach-fix from one or more process lines is collected in a tank. When sufficient volume is reached, the waste solution is pumped to an electrolytic cell for silver removal and/or chemical replenished to reuse.

Recirculating Electrolytic recovery

Silver can also be removed from an in-use fixer solution at approximately the same rate it is added by film processing, using a continuously recirculating system. The recovery cell is connected "in-line" as part of the recirculating system. This continuous removal technique has the particular advantage of maintaining a relatively low silver concentration in the fixer processing solution, which minimizes the amount of silver carried out into the wash tank. The silver concentration in the fixer can be maintained in the range of .5-1.0 g/L without forming sulfide.

A recirculating silver recovery unit receives a small continuous stream of fixer from an in-use process tank, removes the silver, then returns the desilvered fixer to the processor. Once installed, the unit is fully automatic, turning itself on by sensing the amount of silver and the silver is then harvested when the unit is full.

Desilvered fixer solution can be reused, whether from an "in-line" continuous system or from batch. This requires adequate monitoring and process control to maintain composition and protect quality. Parameters (pH, silver and sulfate concentrations) should be monitored to maintain the physical and chemical properties of the fixer solution. This reuse of the fixer substantially reduces the fixer chemistry used.

Chemical Precipitation

Chemical precipitation is the oldest and cheapest method for recovery of silver. It is widely used by manufacturers of photographic supplies but usually not by processors. The two primary disadvantages are that extremely toxic hydrogen sulfide gas (H2S) can be evolved and that the resulting sludge may have to be managed as hazardous waste. A third disadvantage is that recovery of silver from the sludge is more difficult than with other methods. One such method is known as TMT.

Silver Recovery From Rinse Water

Even with an efficient fixer solution silver recovery system and an effective squeegee on the fixer tank, up to 10 percent of recoverable silver is lost by carry-over into the rinse tank. The silver concentration in the spent rinse water is typically in the range of 1 to 50 mg/l., too low for economical recovery with electrolytic methods. Some processors use metallic replacement to meet municipal sewer effluent
limits, an ion exchange system is more efficient.

Two methods are currently being used for effective recovery of silver from rinse water: resin ion exchange and reverse osmosis (RO). Processors equipped with low-flow wash tanks are well suited to silver recovery with metallic replacement, which also reduces water consumption.

Ion Exchange

Ion exchange is the reversible exchange of ions between a solid resin and the wash water. A variety of weak and strong anionic resins are effective in silver recovery. Using chloride as the mobile ion, the following represents the reactions:

(Resin)-Cl + AgS2O3 ->	(Resin)-AgS2O3 + Cl-
(in solution)	(in solution)

The silver-thiosulfate complex has a high affinity for the resin, making it difficult to reclaim the silver and regenerate the resin. Other problems include plugging of the resin by suspended matter,

such as gelatin, but these have also been solved by improved equipment design and operational procedures. Some ion exchange units produce effluents with silver concentrations less than 0.1 ppm at the point source.

This unit is designed to remove silver from the wash water via resin cartridges. It is attached to the wash tank of the processor. The most effective ion exchange units have a special pump that pushes the water inside and circulates it through a micron filter to remove sediment and then through resin filters. As the wash water passes through the resin filters, an ion of silver is exchanged for an ion of resin.

This type of unit also has a chemical additive that stops the growth of algae so you never have to clean out the wash tank again. It reduces silver in the bath to less than 1 mg/l. This means that the water can be recycled back into the unit which can add up to substantial savings.

Reverse Osmosis

In reverse osmosis (RO) techniques, the wastewater stream flows under pressure over the surface of a selectively permeable membrane. Water molecules pass through the membrane and other constituents are left behind. The extent of separation is determined by membrane surface chemistry and pore size, fluid pressure and wastewater characteristics. The RO unit has one inlet to receive the waste stream and two discharge outlets. Purified water exits from one outlet and concentrated wastewater exits from the other. This process reportedly can recover 90 percent of the silver thiosulfate. Silver can be recovered from the resulting concentrate by conventional silver recovery methods.

Water Conservation

Water conservation is especially important in certain parts of the United States where either fresh water is in short supply, or local regulations severely limit or prohibit discharge of photoprocessing effluents to the sewer system. Some operators simply shut off the rinse water except when film is moving through the processor. However, certain processors require a continuous water flow to maintain temperature control. Many locales have established concentration-based limits on aqueous effluents. Check the local requirements to be sure that reducing water without proportionately reducing all other contaminants will not violate the concentration limit.

Rinse Water Recycling

To maintain product quality, many processing operations use continuous rinse water flows. The result is rinse water waste streams usually are the highest volumes of waste from processors. This effluent consists primarily of water with low concentrations of chemicals from the carry-over of the processing solutions. More importantly, silver carry-over exists in the wash water from the fixer tank. Commercial rinse water recycling systems are available for processing operations. Spent rinse water can be treated to restore purity and recycled for rinsing. A small portion of incoming clean water is added to the recycled water stream and an equivalent overflow goes to the sewer drain after the fixer wash. A single recycling system can serve several processor units.

Distillation Systems

Another option in managing liquid waste effluent solutions is evaporation, in which the wastewaters are collected and heated to evaporate all liquids. This is often done under vacuum to reduce the boiling temperature. The resulting sludge is collected in filter bags, which can be sent to a silver reclaimer for recovery. Evaporation can accommodate operations that do not have access to sewer connections or wastewater discharge. If the water vapor is condensed and recycled, instead of being vented to the atmosphere, this can be considered a source reduction technique. The advantage of this approach is that it achieves "zero" water discharge. Virtually all of the silver in the waste solutions is captured with the solids. There are several disadvantages, however. One is that volatile organics in the waste solution may be evaporated as well, creating an air pollution problem (one evaporation unit has a charcoal air filter to capture these organics). A second disadvantage is that any organics which condense with the water will be recycled also, causing a potential buildup of their concentrations in the process. The sludge left also needs to be hauled as a hazardous waste. Finally, a third disadvantage, the cost of energy to evaporate water is likely to be high.

POTENTIAL TO EMIT VOC (FORMULAS FOR CALCULATIONS)

Formulas are one method to determine emissions. You must check with state and federal agencies to make sure this formula is acceptable.

It is strongly suggested that you consult with an environmental agency consultant who has extensive knowledge in the printing industry when incorporating formulas, as this area is very difficult to determine.

Ink Emissions

Ink Emissions = Lbs of Ink Used x VOC % x Emission Factor

To determine how many pounds of ink are used, subtract pounds discarded from pounds purchased. For flexo and gravure operations, add the amount of dilution solvent to the amount of ink purchased. The VOC % is found on the MSDS for the ink or from Method 24/24A test results. Method 24A is only for publication gravure inks. The VOC % must include any additional dilution solvent added (e.g., some flexo and gravure inks).

Emission factors vary with the process. For sheet fed and nonheatset web, the factor is 0.05. For heatset web the emission factor is 0.60b-0.80, and flexography and rotogravure have a factor of 0.93-0.98.

Cleaning Solvent Emissions

Cleaning Emissions = Volume Used x Density x VOC % x Emission Factor

When calculating emissions from cleaning solvents, the figure for volume used should not include any exempt chemicals (e.g., methylene chloride or 1,1,1 trichloroethane). If they are present in the solvent, their volume needs to be subtracted.

To find the density of the solvent, multiply its specific gravity by 8.33 lbs/gal. Alternatively, use the VOC % in lbs/gal. from the MSDS. The emission factor for cleaning solvents used with shop towels is 50%. The emission factor for heatset presses with automatic blanket washes is 40%. The amount released would be further reduced if an add-on control device is present.

Dampening Solution Emissions

Dampening Solution Emissions = Volume of Additive Used x Density x VOC %

The volume of the additive used is found by multiplying the total amount of dampening solution discarded by the percentage of additive in the mixture and subtracting this quantity from the amount of additive that was purchased.

To find the density of the solvent, multiply its specific gravity by 8.33 lbs/gal. Use the VOC % in lbs/gal. from the MSDS. For heatset presses, 90% of the alcohol substitute and 50% of isopropyl alcohol is captured by the device. The amount reduced would be further reduced by the efficiency of the oxidative control device (if equipped).

Coating Emissions

Infrared or Water-Based Coating Emissions = Volume Used x VOC %

UV/EB coatings should not have any VOC emissions. For conventional varnishes, see ink emission factor for non-heatset web.

Miscellaneous

Emissions = Volume Used x Density x VOC %

Emission Rate Potential

ERP = Total all VOC emissions x 8,760 hours/year

Actual and Potential Emissions

The actual emission rate is determined by summing all VOC emissions and dividing by the actual hours of operation. The annual emission rate potential is then determined by multiplying the actual emission rate by 8,760 hours/year.

Sources

a. Draft CTG for Offset Lithography, Nov 1993
b. AP-42 Compilation of Air Pollutant Emission Factors (EPA/450/4-79-014)
c. Kansas and Missouri Printing RACT Rule; Texas Air Control Board Emission Factors
d. June 1993 ACT for Offset Lithography

Waste Stream

The major hazardous waste streams of the lithographic printing process consist of platemaking and photographic liquid wastes that are discharged to the publicly owned treatment works (POTW) through wastewater. These wastes, once pretreated and if accepted by your local sewer district, do not need to be manifested or included in the quantity of hazardous wastes generated from your facility. According to the EPA, any liquid waste that contains more than 5 ppm of silver is considered a hazardous waste. Even if you have your fixer hauled away and desilver it, you don't need to count it in your generator status and the transportation costs are less as it is no longer considered a hazardous waste. Unpermitted discharges into septic tanks, drain fields or navigable waters not accepted by the local POTW must be collected, counted, manifested and sent to an approved disposal site.

Most facilities treat the photographic waste stream to recover silver for both economic and environmental reasons. Platemaking wastes normally require no pretreatment prior to discharge to a POTW. If these wastes cannot be discharged into a POTW or are not accepted by a POTW, they must be collected, counted, manifested (if hazardous) and sent to an approved disposal site.

The equipment cleaning waste stream consists of additional material. Discarded dirty shop towels can be classified as hazardous and require either incineration or disposal in an approved landfill. If a facility employs a professional laundry and the towels are picked up, unsaturated, laundered and returned to the printer, no manifest is usually required nor does the weight need to be included in waste generation inventory.

Most waste lithographic inks are not considered hazardous waste, except in California and Massachusetts, but their disposal can cause problems. Most of these can be legally discarded with normal trash except in Pennsylvania where it has to be disposed in an approved landfill. Because local landfills are becoming more restrictive, many refuse haulers are reluctant to take waste ink. Printers are finding it difficult to dispose of nonhazardous ink properly. It is generally recommended that the unused ink and containers, where possible, are recycled back to the manufacturer.

Techniques of Waste Minimization

The following items highlight good operating practices that could reduce waste:

1. Waste stream segregation
2. Personnel practices
   a. Management initiatives
   b. Employee training
3. Procedural measures
   a. Documentation
   b. Material handling and storage
   c. Material inventory control
   d. Scheduling
4. Loss prevention practices
   a. Spill protection
   b. Preventative maintenance
   c. Emergency preparedness

Today, there are many methods and technologies used to reduce waste in lithographic printing.

Trash

Even excluding spoiled paper, trash represents a major waste stream in the lithographic industry. Other trash includes used photographic film, empty containers, packages and outdated materials. The most effective waste reduction measures follow:

- **Recycle empty containers:** Most ink containers are scraped free of ink and discarded in the trash. Since the degree of cleanliness depends on the operator, the amount of discarded ink varies widely. Larger operations could purchase ink in recyclable bulk containers, so the container can be refilled instead of thrown away. The use of bulk containers also cuts down on the amount of cleaning required since the surface area of the container per unit volume of ink stored is reduced.
- **Recycle used photographic film and paper:** A current practice in the industry is to send used and/or spoiled film to professional recyclers for silver recovery. However, this option might not be practical for small-scale producers nor available to facilities located far away from recyclers.
- **Electronic imaging and laser platemaking:** Since all text and photos are edited on a workstation terminal, the need for photographing, editing and reshooting is reduced. In addition,

color separations can be produced electronically, which eliminates many of the photoprocessing steps currently needed.

- **Install web break detectors:** Provide an electronic system that detects web breaks in a noncontact fashion that will neither smear ink nor crease the web, thereby reducing waste from these sources.
- **Monitor press performance.**
- **Institute better operating practices:** Photosensitive film and paper storage areas should be designed for economical and efficient use. Some shops waste up to one-fourth of these materials due to improper storage.

Wastewater

Wastewater comes from two main sources: image processing (including plate developing) and the platemaking process. Other wastewater sources are cleanup operations and spent fountain solutions. Since these wastes are produced by many different processes, which require different minimization procedures, each operation is discussed separately.

Image Processing (and plate developing)

Great strides have been made in pollution abatement by the photographic printing industry. The waste reduction methods are as follows:

- **Recover silver and recycle spent chemicals:** Basically, photoprocessing chemicals consist of developer, fixer and rinse water.

Keeping the individual process baths as uncontaminated as possible is a prerequisite to the successful recycling of these chemicals. Silver is a component in most photographic films and paper and is present in the wastewaters produced. Economical methods for recovering silver are available and include metallic replacement, chemical precipitation and electrolytic recovery. A number of companies market equipment that will suit the needs of even the smallest printing shop. Technologies for reusing fixer are available.

- **Use squeegees to reduce chemical carryover:** Squeegees in nonautomated processing systems can reduce chemical carryover, typically by 50 percent when transferring film and paper from one process bath to the next. Minimizing chemical contamination of process baths facilitates recycling and enhances the lifetime of the process baths.
- **Institute better operating practice:** Taking care to accurately add and monitor chemical replenishment of process baths will reduce chemical waste.

To retain the potency of oxidizable process baths, reduce their exposure to air. Store chemicals in closed plastic containers and use floating lids to bring the liquid level to the brim each time liquid is used. This way, the amount of oxygen that reaches the chemical reduced and the chemical's usefulness is extended.

- **Wastewater from platemaking:** Consider using water-based development chemistries in lieu of solvent-based ones.

HAZARDOUS WASTE DEFINITION

The first step in determining if a material is a hazardous waste is to determine if it is a "solid waste." The regulatory definition of a solid waste is complex. In essence, a solid waste is defined in the RCRA as "any garbage, refuse sludge and other discarded materials including solid, liquid, semisolid or contained gaseous material resulting from industrial operations." This does not include domestic sewage or permitted water discharges (covered under the Clean Water Act) or certain recycled or reclaimed wastes. However, any material that is stored in inventory over one year can be classified as a solid waste.

Once a material is determined to be a solid waste, it must then be classified as hazardous or nonhazardous. According to RCRA, a hazardous waste is defined as: "a solid waste or combination of solid wastes which, because of its quantity, concentration of physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious irreversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of or otherwise managed."

A more simplified definition is a material (solid, liquid or contained gaseous) that you no longer use and, when disposed of, could cause injury/death or damage/pollute land, air or water.

A waste is classified by USEPA as a hazardous waste in one of two ways:

(1) It is either specifically listed as hazardous waste (see chapter addendum)

or

(2) It exhibits any of the specified characteristics determined by the EPA to be hazardous.

The list of specific hazardous wastes are subdivided into four separate lists by the EPA — see chapter addendum. The EPA lists them in 4 sections as F, P, K and U:

- F-listed wastes are those from nonspecific sources and include solvents that can be found in printing. These solvents include methylene chloride, xylene and acetone. In order for a waste to qualify as an F-listed waste, at least 10% of its original mixture must have been composed of one or more of the F-listed chemicals, except for those classified as F003 where it has to be 100% of that chemical.
- K-listed wastes are those from specific sources, like ink manufacturing,

  Printers generally do not generate any K-listed wastes.
- U-listed wastes are those materials that are unused, discarded or off-spec commercial products.
- P-listed wastes are those which are acutely hazardous and that are unused, discarded or off-spec commercial products. Cyanides are a good example of these wastes.

A complete list of the federal-listed hazardous wastes is provided in the chapter addendum. In addition, some states have added specific chemicals to the list of existing hazardous wastes. Common materials include waste oil and silver bearing wastes.

Characteristic hazardous wastes are those materials that exhibit a certain characteristic and they're assigned a D code. A hazardous waste is defined as characteristic if it exhibits any of the following qualities:

- **Ignitable** — Has a flashpoint less than 140°F (D001).
- **Corrosive** — Has a pH of 2 or less or 12.5 or greater (D002).
- **Reactive** — Is unstable or undergoes rapid and violent reactions (D003).
- **Toxicity Characteristic Leaching Procedure (TCLP)** — Contains certain heavy metals and organic chemicals in excess of specified levels (D003-D004). Most photochemicals are regulated under D011.

The Toxicity Characteristic Leaching Procedure for toxic hazardous waste became effective in March 1991 and is the new test for determining the presence and concentration of chemicals considered hazardous. The TCLP test is designed to simulate the potentially acidic conditions found in a landfill. The test will predict the leachability of a material or constituents of a material.

The TCLP is used to test for 39 organic chemicals, pesticides and heavy metals. If these materials are present above a certain concentration, then

the waste is deemed hazardous (all Agfa's films pass the TCLP test). The complete list of TCLP materials and their concentration is provided in chapter addendum.

This new change in the TCLP test method means that many wastes that previously were not covered could now be subject to federal hazardous waste regulations. The concern for graphic arts businesses is that some nonhazardous waste streams — such as spent desilvered photographic solutions and some waste inks — may be reclassified as hazardous wastes. Check with the manufacturer of these materials to determine TCLP parameters on the products, prior to disposal.

HAZARDOUS WASTE DETERMINATION

Once the definition of solid waste and hazardous waste is understood, it must be applied to the waste streams generated by your process. The first step would be to compile a list of all wastes generated in the business and the original ingredients involved in creating those wastes (which can be obtained from MSDS sheets).

The second step involves making a decision: To test each waste stream or "apply knowledge." In determining the status of a particular waste, not every single waste stream needs to be tested. The generator is allowed to "apply knowledge" of the contents of the waste to determine if it is hazardous or not. For example, a used solvent which has a flashpoint of less than 140°F will automatically be considered a hazardous waste when it is spent or spilled and subsequently cleaned up. Some proofing chemistries could also have flashpoints less than 140°F.

"Applying knowledge" can also be used for the listed hazardous wastes. Any waste that is a listed chemical automatically becomes a listed waste under that code. For F-listed wastes, except F003, the original mixture must have contained at least 10% of the listed chemical. Otherwise, it would not be a listed hazardous waste. Remember, it could still be hazardous because it exhibits a single characteristic.

To assist you in applying knowledge, the material safety data sheet (MSDS) can provide a significant amount of information. MSDSs will provide a list of OSHA hazardous chemicals (not USEPA hazardous chemicals) and a flashpoint determination. Other sources of information about the waste can include manufacturers' product information and labels. MSDS sheets are available from the manufacturer or your local dealer.

Since not all waste streams are represented by an MSDS for the original unused product — because of some type of reaction or natural blending when the product is used — testing by a certified laboratory may be necessary. For example, a used film or ink/cleaning solution waste stream might require testing for silver, flashpoint and barium content, respectively. However, before these tests are conducted, contact the manufacturer to determine if it has already been performed.

Another important provision is the "mixture and derived from" rule. This rule simply states that any nonhazardous waste that is mixed with any amount of a listed hazardous waste automatically becomes a listed hazardous waste. This provision is designed to prevent the dilution of hazardous wastes to escape proper treatment and disposal. The "derived from" aspect of this rule is applied to sludges and other materials remaining from a recycling/reclamation operation. The sludges would carry the same listed designation as the original waste, until such time as the remaining material would undergo treatment changing its form. However, desilvered processing solutions that have been evaporated to reduce volume can contain more than 5 ppm total silver.

One common waste stream that has been exempted by some states from the mixture rule is reusable shop towels. A strict interpretation of the mixture rule would classify reusable shop towels contaminated with listed chemicals as listed hazardous wastes. However, several states — namely Pennsylvania, New Jersey, New York, Massachusetts, Minnesota and Michigan — have set out management standards for this type of waste stream that (if followed) exempts them from being classified as hazardous. These standards all require that the towels be able to pass the paint filter test, which is a gravity test to determine how much liquid can be drained out of a waste. In essence, the towels must not be saturated with solvent. Management practices such as hand wringing, centrifuging, distillation or drying in which the vapors are captured and gravity draining, should suffice. Evaporation is not permitted. A written contract with the launderer and other minor requirements are common to these standards. Check with your particular state agency to determine your business requirements.

Two very important exemptions to the definition of a hazardous waste is the domestic sewage exclusion and the empty container rule. The domestic exclusion allows for hazardous wastes mixed with normal sewage that is discharged to a POTW not to be classified as hazardous waste. Before taking advantage of this exclusion, the prepress business needs to contact the POTW and receive permission to discharge the particular waste. Two common waste streams that fit this exemption are photoprocessing and proofing chemistries.

However, any printer who discharges more than 33 pounds of hazardous waste per month to the POTW must notify the POTW and the state authorities. Any printer who discharges more than 25,000 gallons of wastewater per month must also notify the POTW and the state, perform biannual testing and develop a written spill prevention plan.

The container rule simply states that containers that contained materials that would be classified as hazardous (when they are spent) do not have to be completely empty. Containers, such as 55-gallon drums, can have up to one inch of material remaining in them and still be classified as "RCRA empty." For containers less than 55 gallons in capacity, up to 3% of the dry volume weight can be allowed to remain. For acutely hazardous materials (P-listed wastes), the container must be triple-rinsed before it can be considered "RCRA empty."

Since state agencies can be more stringent than USEPA, the definition of hazardous waste can vary among the states and give rise to confusion. For example, in Kentucky and Virginia, fixer that contains more than 5 ppm silver being sent to a silver recovery unit and then to a POTW is classified as hazardous and must be counted toward a company's generator status, even though USEPA does not consider this waste hazardous. It is important that you also learn the existing state definitions of hazardous waste and how they differ from those of USEPA. Check with your state hazardous waste department or the EPA.

The following is a list of some wastes found in the printing industry that could be classified as hazardous:

- Waste from cleaning printing presses like some waste ink, cleaning solutions and fountain solution containing more than 5% IPA
- Wash water from cleaning ink printing equipment
- Plating and etching waste from platemaking
- Spent photoprocessing chemistries/water not sent to a POTW
- Waste solvents and waste lubricating oil
- Spent or waste cyanide solutions or sludges
- Acid and alkali wastes
- Waste solvent-based inks and some paste inks (depending upon the state)
- Some recovered or recycled wastes
- Containers, unless properly drained or triple-rinsed

DETERMINATION OF GENERATOR STATUS

Once a determinaton has been made that a material is a hazardous waste, the generator of the material, your prepress operation, becomes subject to specific requirements detailed below. Virtually every printer must comply with the hazardous waste regulations in some manner. The specific regulatory requirements are dependent upon the type, volume (converted to weight) and storage time of hazardous waste generated per month. The regulation divides generators into the following three groups:

1) **Conditionally exempt small-quantity generators:** Companies that produce less than 100 kilograms (220 pounds) of hazardous waste per month. There is no time limit for storage, but there is a weight limit of **1,000 kilograms** (2,200 pounds).
2) **Small-quantity generators (SQGs):** Companies that produce 100 kilograms (220 pounds) or more, but less than 1000 kilograms (2,200 pounds) per month and less than 2.2 pounds of acutely hazardous waste per month. Storage of hazardous waste is limited to 180 days (or 270 days for storage of up to 6,000 kg, if the waste must be shipped over 200 miles for disposal or treatment).
3) **Large-quantity generators (LQGs):** Those companies that produce 1000 kilograms (2,200 pounds) or more per month and more than 2.2 pounds of acutely hazardous waste per month. Storage of hazardous waste is limited to 90 days.

If the amount limit is exceeded in any area, the generator is automatically reclassified up to the next higher status. For LQGs, this would mean they would be classified as a treatment, storage and disposal facility. This status has many detailed requirements, including permits, environmental impact statements, spill prevention plans, employee training and closure plans.

Since state regulations are generally stricter than those of the federal government, the above generator status thresholds can vary. For example, the state of California does not recognize the small quantity status and has only two categories. It is important to contact the state/local agency to determine the differences from the federal definitions and your state requirements for each quantity generator.

HAZARDOUS WASTE STORAGE REQUIREMENTS

USEPA has set very specific requirements for the storage and transportation of hazardous waste. Wastes stored on site must be kept in appropriate and compatible containers. These containers must be stored in a secure area and kept closed at all times — unless being filled or emptied. They need to be properly labeled with generator name, address, contents, identification number and date of accumulation (which should be documented when the first drop is placed into it).

The area for storage must be equipped with fire suppression equipment, phone or alarm system, spill containment equipment or secondary containment, personal protection equipment, eyewash station and even an emergency shower. Multiple containers must be segregated according to compatibility and have adequate space between them for weekly inspection. All containers must be inspected weekly for leaks and spills and a log of this activity needs to be maintained. Some states, like New Jersey, require daily inspections of wastes for all large quantity generators. The storage area must be properly identified with a warning sign(s). Ignitables with flashpoints less than 100°F must be grounded and more than 120 gallons should be stored in a special solvent storage room.

The only exception to the time limit for storage given above is for satellite storage. This is defined as temporary storage at or near the point of generation.

A generator is allowed to accumulate waste at or near the point of generation. This type of storage is limited to 55 gallons with no time limit. Once the drum is full, it must be moved within 72 hours, relabeled and shipped before the above time limits. Usually, only one drum per waste stream is permitted at the point of generation. Some states (like New York) limit the time of satellite storage to no more than one year.

HAZARDOUS WASTE TRANSPORTATION REQUIREMENTS

For SQGs and LQGs, any hazardous waste shipped off-site for disposal must be accompanied by a round-trip manifest and land ban forms. The generator must obtain a USEPA identification number to include on the manifest. The number is site-specific; multiple locations must have their own number. The number is to be placed on the manifest along with the number of the transportation company and, eventually, the disposal site. If the return copy of the manifest is not received within 45 days for a LQG or 60 days for a SQG, the generator must notify the state it has not been received.

Identification numbers are obtained by completing a "notification of hazardous waste activity" form and submitting it to the state. After this number has been obtained, the generator should notify the state in writing of any changes to the type, nature and amount of wastes generated.

Exempt-quantity generators do not have to obtain a USEPA identification number or manifest their shipments. They are required to ensure that the wastes are being disposed by an approved treatment/disposal facility. For all practical purposes, virtually no reputable transportation or treatment/disposal facility will accept any hazardous waste without a manifest or generator identification number. However, because of a new USEPA rule, exempt-quantity generators can now take their wastes to a community hazardous waste collection center or program, as long as the state approves. Check your local requirements.

Many states that are operating their own hazardous waste programs require additional information on the manifest or require the state's version of the uniform Hazardous Waste Manifest. It is necessary to check with the local hazardous waste agency to attain the exact

requirements in your area. Also, the manifest must be accompanied by a land ban notification form.

All hazardous wastes must be treated prior to their being placed into a landfill. The specified treatment techniques call for incineration, neutralization, solidification/stabilization or a combination of those methods. This rule covers such materials as solvent-contaminated disposable wipers, sludges from solvent and ink recovery operations, concentrated acids and bases, some waste adhesives and other heavy-metal bearing solid materials.

Containers for shipping hazardous waste must be approved and labeled in accordance with the Department of Transportation (DOT). The key feature to the DOT requirements is the performance-oriented packaging requirements, in accordance with international standards. Instead of specifying size, construction material, thickness and coatings of the containers, the new regulations require containers to pass "drop, leak and stackability" tests.

Since you, as the generator, own your hazardous waste forever, it is prudent to investigate the company that transports and treats/disposes of the waste. See chapter addendum on selecting a quality waste transportation or treatment/disposal company; all manifests need to be kept for at least three years. Land Ban Manifestation forms need to be kept for at least five years. Some states, like Pennsylvania, require generators to keep manifests and land ban forms for twenty years. Check your local/state authorities to determine the requirements in your area.

CONTINGENCY PLANS, TRAINING and REPORTING REQUIREMENTS

As reviewed above, all generators are required to report the accidental releases of hazardous materials above their respective reportable quantity thresholds. All LQGs and some SQGs (depending upon the state) must complete biannual hazardous waste generation activity reports. Some states, (such as Pennsylvania) require a quarterly report from all LQGs.

All LQGs must also establish a contingency plan that describes the personnel or firms who will respond to an emergency release or spill, emergency response procedures, evacuation plan and an inventory of available emergency response equipment and its capabilities. The contingency plan must be submitted to all state and local authorities who may be called upon in the event of a release. SQGs are not required to have a written program, but they must identify an emergency response coordinator. (Each state's requirements may vary, so check your local regulations.)

In addition, all LQGs must develop and implement an annual training program for their employees proper container management, proper use of personal protective equipment and spill response and proper cleanup procedures. Records of training should also be maintained.

OSHA and DOT impose additional training requirements on all types of generators. OSHA requires formal spill response training for any personnel involved in cleaning up any spill that can not be handled by personnel in the immediate area. DOT is now requiring training for any personnel, including supervisory staff, involved in the packaging of hazardous materials for off-site shipment. They must be trained in DOT's new container regulations, new United Nations chemical/waste designations and shipping papers requirements (completion date was October 1993).

WASTE MINIMIZATION

A little known fact is that every time a generator "signs off" on a manifest, he/she is certifying that they have a hazardous waste minimization program in place. LQGs must have a formal written program with documentation. SQGs are not required to have a formal program, but they should be prepared to prove they are performing some type of waste minimization or have explored all potential practices. The chapter addendum contains some tips on waste minimization practices that can be used by printers and other graphic arts businesses.

Air Pollution Permits - A Brief Review

By: Gary A. Jones, Manager, Environmental, Health and Safety Affairs*
Rick Hartwig, Environmental, Health and Safety Specialist*

Printers, both large and small, need to be aware of the new air pollution permitting requirements that are being imposed across the country. The printing industry along with other small business oriented industries are being targeted by the Environmental Protection Agency (EPA), and state/local air pollution control agencies because printers emit volatile organic compounds (VOCs).

VOC emissions are tightly controlled because they lead to the formation of ozone in the lower atmosphere. Ozone is a reactive form of oxygen and is a component of smog. EPA has established acceptable levels of ozone that can be present in the lower atmosphere and those areas exceeding it are considered non-attainment. Non-attainment areas are further classified as to the severity of the ozone problem and can be marginal, moderate, serious, severe, or extreme.

Air pollution control requirements are broken into two separate, but related requirements. The first involves permit requirements and the second is the imposition of control requirements. Permits serve several roles. They provide an inventory of air pollution sources. States and local agencies use these inventories in their planning process for either the further reduction of air pollution or maintenance of current air quality. Any control requirements designed to reduce the emissions of certain pollutants are always incorporated into a facilities permit. The last and most important function of permits is that they provide a facility with the legal basis for operation.

Permits can take several forms. Some state and local agencies require a permit-to-construct before any new facility can be built or more inportantly, before a new piece of equipment like a printing press can be installed. Most state/local agencies that have these types of permits will generally allow a facility to accept delivery of a new press, but will not allow it to be assembled without the proper permits. The state and local agencies with the permit-to-construct will also require a permit-to-operate as well, and in some cases the construction permit can also serve as the operating permit. State and local agencies without a permit-to-construct program will still have a permit-to-operate program.

Permits-to-operate look very similar to permits-to-construct and will contain all applicable and enforceable control requirements. They may also contain recordkeeping and reporting requirements. Operating permits will have a definitive period of effectiveness. Some permits require an annual renewal, but more permits are being written with a five-year life term.

Besides the construction/operating permit systems described above, some states and local agencies have a registration permit system. Typically, these types of permits are less complex and do not require the facility to provide a significant amount of detail in the application forms.

Because of the 1990 Clean Air Act Amendments, another type of operating permit was created. These permits are called Title V permits and are a five-year federally enforceable operating permit. It will specify all control requirements, emission limits, recordkeeping, compliance reporting, compliance certification, and monitoring requirements. Title V permits will be administered by the state and local agencies and only apply to certain types of facilities, but will be reviewed by EPA.

Title V permits are not like any permitting program advanced in the past. It requires a detailed analysis of a facility's emission sources and must address the future utilization of the equipment and materials. It can not be relegated to the "engineering" department because it requires input from the operating, sales and marketing, and administrative departments. Current and future strategic business decisions have to be made within the context of the Title V permitting process.

The need to obtain an air pollution control permit depends on the threshold that has been set by the state and local air pollution control agency. The thresholds can be based on several different parameters. Some state and local agencies use actual emission rate/amount while others use potential emissions rate/amount. Some agencies use actual material consumption rates to determine if permits are required.

The permitting thresholds can vary quite dramatically. For example, in New York City, all printers regardless of their emission rate are required to have a permit. The Illinois EPA requires a permit for any printer who uses more than 750 gallons per year of VOCs, while Indiana's threshold for permitting is 25 tons/year potential VOC emissions. Printers in Indiana with emissions less than 25 tons/year potential are required to register their business with the state.

The Title V permit uses a facility's annual potential amount to determine applicability and apply to both VOC and hazardous air pollutant (HAP) emissions. HAPs are a list of 189 individual chemicals and chemical categories. The most common chemicals on this list used by lithographers is glycol ethers which can be found in alcohol substitutes and cleaning solutions. The threshold for permitting is 10 tons/year for a single chemical/category and 25 tons/year for all HAP chemicals/categories. These thresholds are universal in that they apply across the entire country.

The Title V thresholds for VOC emissions are dependent upon the geographical location and severity of the non-attainment problem. The only extreme area is Los Angeles, Ca and the threshold is 10 tons/year. Severe areas like Chicago, IL, Philadelphia, Pa, and New York City area have thresholds of 25 tons/year. Serious areas like Atlanta, GA have thresholds of 50 tons/year. Moderate and Marginal areas like Pittsburgh, Pa, have thresholds of 100 tons/year.

"Potential to emit" is defined as the greatest amount of emissions that could be released from a piece of equipment based on its maximum design capacity or maximum production. Potential to emit determinations must also assume the equipment will run 24 hours/day 365 days/year or 8,760 hours/year. There are at least three different ways to calculate potential emissions from a printing press.

The worst case scenario is to assume 100% coverage on all cylinders at maximum press speed for 8,760 hours/year. In a study performed on a printer using water-based flexography and letterpress to manufacturer corrugated boxes, their 5 ton/year actual emissions climbed to 4,000 tons by assuming the worst case scenario. While this method is not realistic, some state agencies insist that printers use this method. The method preferred by industry would be to take the actual hourly emission rate and multiply it by 8,760 hours/year. In the same study performed on the corrugated manufacturer, the potential emissions using this approach would be 20 tons/year. EPA has not issued a policy dictating any approach.

In addition to determining the appropriate threshold, the printer must also determine their VOC/HAP emission levels. This is accomplished by first deriving material use information. The materials include, but not are limited to inks, fountain solutions, fountain solution additives, coatings, cleaning solutions, and other miscellaneous use chemicals. Material use is defined as the amount purchased minus the amount discarded. The amount released is determined by multiplying the amount used by the VOC content and if appropriate, an emission factor. An emission factor is the number used to reflect the actual release of materials. For example, a 5% emission factor is applied to all sheetfed offset lithographic inks. Studies conducted by the printing industry have shown that 95% of all ink oil is retained by the substrate.

Every printer, whether operating a large or small facility, must know and understand the air pollution permit regulations applicable to their facility. Knowing and complying with these regulations are crucial for printers because it allows them to legally operate their businesses under the current

regulatory requirements. Even if a printers does not have to permit their business, it is equally important to know and prove that they are not subject to the regulation. This aspect of the printers business needs to be actively managed just like other important aspects of the business. In the long run, an active approach benefits the printer rather than the alternative of ignoring them, where it will ultimately become an enforcement action and a business liability.

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WHAT IS A HAZARDOUS WASTE?

By: Gary A. Jones, Manager, Environmental, Health and Safety Affairs*

A waste is any solid, liquid, or contained gaseous material that is no longer used, and is either recycled, thrown away, or stored until sufficient quantities are accumulated for treatment or disposal. As a result of conducting its business, a company may generate wastes that can cause serious problems if not handled and disposed of carefully. Such wastes could: cause injury or death; or damage or pollute land, air, or water. Such wastes are considered hazardous, and are currently regulated by both federal and state public health and environmental safety laws.

A waste is classified as a hazardous waste in one of two ways: (1) it is specifically listed as a hazardous waste in EPA regulations, or (2) it exhibits any of the characteristics specified by EPA regulations as hazardous.

- (1) **Listed wastes.** A waste is considered hazardous is it appears on any one of the four lists of hazardous wastes contained in the RCRA regulations. Such wastes have been classified as hazardous because they either exhibit one of the characteristics described below, or contain any of a number of toxic constituents that have been shown to be harmful to health and/or the environment. EPA regulations specifically list over 400 hazardous wastes, including wastes derived from manufacturing processes and discarded commercial chemical products.

- (2) **Characteristic wastes.** Even is a waste does not appear on one of the EPA lists, it is considered hazardous is it has one or more of the following characteristics:

  - It is easily combustible or flammable (a flash point of 140° or less). This is called an **ignitable** waste. Examples are blanket washes, roller washes and other solvents. Ignitable wastes which are not "EPA Listed Wastes," carry the EPA hazardous waste number, D001.

  - It dissolves metals, other materials, or burns the skin. This is called a **corrosive** waste. Examples are ferric chloride-based plate developing waste rust removers, waste acid or alkaline cleaning fluids, and waste battery acid. Corrosive wastes carry the EPA hazardous waste number, D002.

  - It is unstable or undergoes rapid or violent chemical reaction with water or other materials. This is called a **reactive** waste. Examples are cyanide plating wastes, waste bleaches, and other waste oxidizers. Reactive wastes carry the EPA hazardous waste number, D003.

  - A waste sample is tested and shows TCLP (toxicity characteristic leaching procedure) toxicity. Wastes are **TCLP toxic** if an extract from the waste is tested and found to contain high concentrations of heavy metals (such as barium, silver, chromium or lead), certain organic

chemicals, or specific pesticides that could be released into the ground water.

It is the printer's responsibility to determine whether the wastes generated at the facility are hazardous. EPA allows for two approaches to determine if a waste is hazardous. EPA allows the generator to "apply knowledge" or test using a variety of test methods.

Applying knowledge of the physical characteristics of a chemical or material and how it is used in a given process is the most cost effective method of hazardous waste determination. The most direct way of determining a material's physical characteristics would be to examine the material safety data sheet (MSDS) provided by the manufacturer. If a material is chemically unchanged (e.g., blanket or roller wash), the MSDS would be representative of that material as a waste. For example, is the flashpoint of the chemical 140° F or less? If so, the chemical is ignitable and gets a designation of D001. Does the chemical have a pH less than or equal to 2.0, or greater than or equal to 12.5? If so, it is corrosive and gets a designation of D002.

The MSDS can also be used to compare the ingredients to the list of chemicals to either the list of "listed" hazardous wastes or if the material as a waste would exhibit a characteristic.

If you need assistance, call one of the sources of information listed below:

- Your state hazardous waste management agency.
- Your EPA regional office.
- The RCRA/Superfund Hotline -- 1-800-424-9346 (In Washington, DC: 202-382-3000).
- EPA's Small Business Ombudsman Hotline 1-800-368-5888 (In Washington, DC: 703-557-1938).
- Graphic Arts Technical Foundation (412-621-6941).
- Your local PIA Affiliate Office.
- Your PIA Government Affairs Department (703-519-8115)
- The Environmental Conservation Board of the Graphic Arts Industry (703-648-3218)

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Characteristics of *Hazardous Waste*

Characteristic	Criteria of Characteristic Waste	Possible Printing-Related Sources
Characteristic of Ignitability EPA Waste Code "D001"	• A liquid (except solutions containing less than 25% alcohol) that has a flash point below 140°F (60°C)[1]; or • A non-liquid capable of spontaneous and sustained combustion under normal conditions; or, • An ignitable compressed gas (as defined by DOT); or • An oxidizer (as defined by DOT)	Chemical products such as blanket and roller washes, cleanup solvents, isopropyl alcohol, and inks. Shop towels being thrown out for disposal.
Characteristic of Corrosivity EPA Waste Code"D002"	• An aqueous material with a pH less than 2.0 or greater than or equal to 12.5; or • A liquid that corrodes steel at a rate greater than 1/4" per year at a temperature of 130°F (55°C)	Plate and film processing chemicals, particularly etching chemicals. Acids, waste battery acid and alkaline cleaners, depending on their pH.
Characteristic of Reactivity EPA Waste Code "D003"	• Normally unstable and reacts violents without detonating; or • Reacts violently or forms an explosive mixture with water; or • Generates toxic gases, vapor or fumes when mixed with water; or • Contains cyanide or sulfide and generates toxic gas vapors or fumes at a pH between 2 and 12.5.	Waste bleaches and oxidizers.
Characteristic of Toxicity EPA Waste Code "D004" - "D043"	• Contains specific toxic contaminants above threshold levels; • Waste must be tested[2] using specific test method(s); • List of some common printing contaminants and threshold levels are provided on the following pages.	Waste fixer, plate processing chemicals, cleanup solvents.

Notes:

1. For solvents, check the MSDS. Normally the product's flash point will be provided as "Physical Data".
2. Testing is normally done by an outside laboratory or through a disposal company.

Federal Environmental Regulations
Potentially Affecting the Commercial Printing Industry

The following tables and information are drawn from the EPA publication "Federal Environmental Regulations Potentially Affecting the Commercial Printing Industry" (EPA744B-93-003), prepared by the Design for the Environment Program for the Office of Pollution Prevention and Toxics, US Environmental Protection Agency, Washington, D.C., October 1993. The full report is available from the EPA. Tables are numbered as in the full report.

EXHIBIT 6. Chemicals used in the printing industry that are listed as Hazardous Air Pollutants (HAPs) in the Clean Air Act Amendments

HAZARDOUS AIR POLLUTANTS		
Benzene	Formaldehyde	Methylene chloride
Cadium compounds	Glycol ethers	Perchloroethylene
Carbon tectrachloride	Hexane	Polycyclic organic matter
Chromium compounds	Hydrochloic acid	Propylene oxice
Cumene	Isophorone	Toluene
Dibutylphthalate	Lead compounds	2,4-Toluene diisocyanate
Diethanolamine	Methanol	1,1,2-Trichloroethane
Ethyl benzene	Methyl ethly ketone	Vinyl chloride
Ethylene glycol	Methyl isobutyl ketone	Xylenes

EXHIBIT 9. Examples of Listed Wastes (U-series) found in the printing industry

WASTE CODE	NAME/DESCRIPTION	WASTE CODE	NAME/DESCRIPTION
U002	Acetone	U226	Methyl chloroform
U019	Benzene	U080	Methylene chloride
U211	Carbon tetrachloride	U159	Methyl ethyl ketone (MEK)
U055	Cumene	U161	Methyl isobutyl ketone
U056	Cyclohexane	U210	Tetrachloroethylene
U069	Dibutyl phthalate		(perchloroethylene)
U112	Ethyl acetate	U220	Toluene
U359	Ethanol, 2-ethoxy	U223	Toluene diisocyanate
U359	Ethylene glycol monoethyl ether	U228	Trichloroethylene
U122	Formaldehyde	U043	Vinyl chloride
U154	Methanol	U239	Xylene

EXHIBIT 8. Examples of Listed Wastes (F-series) found in the printing industry

WASTE CODE	NAME OR DESCRIPTION OF WASTE
F001	The following spent halogenated solvents used in degreasing: Tectracholorethylend, tricholorethylene, methyl chloide, 1,1,1-trichloroethane, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of 10% or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.
F002	The following spent halogenated solvents used in degreasing: Tectracholorethylend, tricholorethylene, methyl chloide, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane, and 1,1,2-trichloroethane; all spent solvent mixtures/blends containing, before use, a total of 10% or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F001, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.
F003	The following spent non-halogenated sovents: Xylene, acetone, ethyl acetate, ethyl benzene, ethly ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/bends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and a total of 10% or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.
F005	The following spent non-halogenated solvents: Toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of 10% or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

EXHIBIT 11. EPA Toxic Characteristic Contaminants that may be found in printing waste

WASTE CODE	CONTAMINANT	WASTE CODE	CONTAMINANT
D005	Barium	D011	Silver
D007	Chromium	D040	Trichloroethylene
D019	Carbon tetrachloride	D043	Vinyl chloride
D035	Methyl ethyl ketone		

APPX B. Clean Water Act: Reportable Quantities (RQ) of hazardous substances that may apply in the printing industry

HAZARDOUS SUBSTANCE	RQ (in pounds)
Benzene	10
Carbon tetrachloride	10
Chloroform	10
Cyclohexane	1,000
Ethylbenzene	1,000
Formaldehyde	100
Hydrochloric acid	5,000
Propylene oxide	100
Styrene	1,000
Toluene	1,000
Xylene (mixed)	1,000

APPX D. CERCLA: Reportable Quantities (RQ) for some chemicals that may apply in the printing industry

CHEMICAL	RQ (in pounds)	CHEMICAL	RQ (in pounds)
Acetone	5,000	Methyl chloroform	1,000
Ammonia	100	Methylene chloride	1,000
Benzene	10	Methanol	5,000
Cadmium and compounds	1	Methyl ethyl ketone	5,000
Carbon tetrachloride	10	Methyl isobutyl ketone	5,000
Chloroform	10	Perchloroethylene	100
Chromium and compounds	1	Phosphoric acid	5,000
Cumene	5,000	Propylene oxide	100
Cyclohexane	1,000	Sulfuric acid	1,000
Dibutyl phthalate	10	Toluene	1,000
Ethanol, 2-ethoxy	1,000	Toluene diisocyanate	100
Ethyl acetate	5,000	1,1,1-trichloroethane	1,000
Ethylbenzene	1,000	1,1,2-trichloroethane	100
Formaldehyde	100	Trichloroethylene	100
Hydrochloric acid	5,000	Vinyl chloride	1
Isophorone	5,000	Xylene (mixed)	1,000
Lead and compounds	1		

APPX E. Threshold planning and Reportable Quantities (RQ) for some EPCRA-designated extremely hazardous chemicals used in the printing industry

CHEMICAL NAME	RQ (in pounds)	THRESHOLD PLANNING (in pounds)
Ammonia	100	500
Formaldehyde	100	500
Hydraquinone	1	500/10,000*
Propylene oxide	100	10,000
Sulfuric acid	1,000	1,000
Toluene 2,4-diisocyanate	100	500

* Revised threshold planning quantity based on new or re-evaluated toxicity data.

APPX F. Chemicals used in the printing industry that are listed in the Toxic Release Inventory (TRI)

TOXIC CHEMICALS		
Acetone	Ethylene glycol	Methyl isobutyl ketone
Ammonia	Ethylene oxide	Phosphoric acid
Barium	Formaldehyde	Silver
Cadmium	Freon 113	Sulfuric acid
Chromium	Hydrochloric acid	Tetrachloroethylene
Copper*	Hydroquinone	Toluene
Cumene	Lead	Trichloroethylene
Cyclohexane	Methanol	1,1,1-Trichloroethane
Methylene chloride	Methyl ethyl ketone	Xylene
Ethylbenzene		

* Copper phthalocyanine pigments delisted in May 1991.

Code of Management Practice for Silver Dischargers

Recommendations on Technology, Equipment and Management Practices for Controlling Silver Discharges from Facilities that Process Photographic Materials

Silver Coalition/Association of Metropolitan Sewerage Agencies (AMSA)

September, 1995

This information is reprinted in part with permission from the "Code of Management Practices for Silver Dischargers," prepared by the Silver Coalition/Association of Metropolitan Sewerage Agencies (AMSA), September 1995.

The following chart outlines some of the major advantages and limitations for each of the silver recovery and management systems listed in Part 4.

Comparison of Silver Recovery and Management Systems

System	Advantages	Limitations
Chemical Recovery Cartridges (CRCs)	Can be used for all silver-rich solutions Little maintenance Low capital costs Can achieve 99% when 2 CRCs used in series	Requires metered flow for consistency Must be replaced on schedule Tendency to channel causes silver concentration fluctuations High smelting & refining costs Cannot determine amount of silver recovered until refined. pH dependent Cannot reuse treated solutions in photo process
Electrolytic (terminal)	High silver quality flake Low refining costs Can determine silver recovered Capital costs moderate Can achieve 90% recovery	Cannot achieve 5 mg/l with electrolytic alone. Can sulfide if not properly maintained pH dependent Not suitable for low-silver solutions
Electrolytic (in-line)	High silver quality flake Can reduce silver concentration in wash waters Allows fixer replenishment rate reductions Reduces chemical usage & mixing labor	Used for fixers only Can sulfide and damage fixer if not properly maintained Not suitable for low-silver solutions
Precipitation	Can achieve consistent recovery over 99% Little operator maintenance Moderate capital costs	Smelting cost higher than electrolytic Requires ongoing additives Operation costs vary from moderate to high
Evaporation/ Distillation	Reduces wastes up to 90% Virtually zero overflow of silver	Moderate to high capital costs Sludges are messy to handle
Ion Exchange	Efficient way of recovering silver from dilute photoprocessing solutions and wash waters Recovery efficiency 98-99.5% range.	Capital costs vary significantly Biological growth problems May require the use of hazardous chemicals Works best on dilute solutions such as washwater
Reverse Osmosis	Efficient way of recovering silver from dilute photoprocessing solutions and wash waters No water treatment chemicals required Reduces effluent volume significantly	Capital costs vary significantly Size of equipment needed to obtain sufficient flow Frequent maintenance of membrane and pumps Works best on dilute solutions such as washwater Large installations can be noisy

Appendix B

Parameters Affecting Silver Concentration in Wash Water	
Number and Configuration of Wash Tanks	
Number of Tanks	Generally the more tanks the lower the silver concentration.
Counter-Current Flow	Concentrates the silver in the tank adjacent to the silver-rich solutions
Low-Flow Washes	Reduces the amount of silver in the wash water.
In Line Water System	Recirculation reduces the amount of water used and increases the silver concentration in process wash water
Type of Processor	
Leader Belt	Silver-rich solutions can transport on the belt to wash waters.
Roller Transport	Most common processor type. Rollers can squeeze photographic media before transport to the wash water reducing carry-over.
Rack and Tank	Older technology does not allow for physical squeegee thus carry-over of silver-rich solutions into wash water is high.
Squeegees	
Squeeze Roller	Photographic media passes between two soft rollers in close proximity. Effectively removes surface chemicals on both sides of the photographic media.
Single Blade	Physical pressure of blade removes surface liquid.
Delta Blade	Similar to single blade but can be rotated to increase efficiency life.
Air Knife	Uses a concentrated force of air to remove chemicals from surface.
Imaging Media & Type	
Type of Media	X-ray film has more silver per square unit than graphic arts film. In turn graphic arts film has more silver per square unit than consumer color film. Generally, the more silver in the product, the more silver in the process wash water.
Exposure Percentage	In negative B&W media, the more exposure, the less silver in the process wash water. In positive B&W media, the more exposure, the more silver in process wash water.
Surface	A matte or rippled media surface will retain more chemicals which can be transferred to wash water than a glossy or smooth surfaced media.
Quantity and Size	If product size is not matched to processor sensors over or under replenishment can occur causing fluctuations of silver-rich carry-over to wash water. Mismatched product to equipment can also cause an increase in wash water usage.
Silver Recovery	
Terminal	Has no effect on silver concentration in process wash water.
In-Line	Can reduce silver concentration in process wash water by lowering concentration in preceding fix tank.
Chemistry	
Low Replenishment	Generally causes higher silver concentrations in process wash water.
Over Replenishment	Generally causes lower silver concentrations in process wash water.
Regeneration	Marginally increases silver concentration in process wash water.

facility would be required to operate and maintain a silver recovery or management system capable of removing at least 90% of the silver rich solutions before discharge to the sewer.

A high volume X-ray diagnostic area, which may include several processors and produce on average more than 20 GPD of silver-rich solution and uses more than 10,000 GPD of process wash water, would have the same requirements as a large photographic processing facility. This area would be required to operate and maintain a silver recovery or management system capable of removing at least 99% of the silver rich solutions before discharge to the sewer.

Staff at each photographic processing facility would be responsible for monitoring the silver removal efficiencies. The type of monitoring and required documentation would be specified by the POTW or Control Authority.

3.1 Recommendations for On-Site Silver Recovery and Management at Small Size Photographic Processing Facilities

Small photographic processing facilities that produce on average less than 2 GPD of silver-rich processing solution and use less than 1,000 GPD of process wash water must use one of the following equipment options capable of recovering or managing at least 90% of the silver. The options are listed in order of increasing cost:

- One or two CRCs with manufacturer specified flow control *
- One electrolytic unit **
- One precipitation unit
- One evaporation or distillation unit
- Alternative technology providing at least 90% recovery or management

*Very small photographic processing facilities that generate less than 0.5 GPD of silver-rich processing, require only one recovery cartridge. A second recovery cartridge used in these circumstances would oxidize and channel by the time the first cartridge was exhausted, resulting in higher waste and added costs with no additional silver recovery. For all other processing facilities it is strongly recommended to use two CRCs in series to reduce the potential of silver breakthrough.

** It is strongly recommended that an additional CRC be used after electrolytic recovery to ensure consistent recovery.

from accidental release to the POTW.

- The facility must have a spill plan to ensure spills of silver-rich solutions are not accidentally released to the POTW. (see part 5.6 for more spill information)

Analytical and record keeping requirements for facilities using a batch operation for silver recovery:

- The silver concentration of each batch must be checked before and after the recovery or management system to ensure proper system operation.

- The test can be performed with silver test papers, an analytical test kit or a lab analysis. This test will identify problems or failures with the recovery/management system:

- Test results must be recorded in a silver recovery log.

Analytical and record keeping requirements for facilities using a continuous operation for silver recovery and management.

- The silver concentrations in the influent and effluent must be checked weekly.

- The test can be performed using silver test papers, an analytical test kit or a lab analysis. This test will identify problems or failures with the recovery system.

- Test results must be recorded in a silver recovery log.

3.1.2 Verification

For the purpose of verifying at least 90% recovery, all facilities must have a silver analysis done on the influent and effluent to the recovery system at least every six months by an analytical laboratory acceptable to the POTW. The facility must retain the analytical records for a period of time acceptable to the POTW.

3.2 Recommendations for On-Site Silver Recovery and Management at Medium Size Photographic Processing Facilities

For medium size photographic processing facilities that produce on average less than 20 GPD of silver-rich processing solution and use less than 10,000 GPD of process wash water, one of the following equipment options capable of recovering or managing at least 95% of the silver must be used. The options are listed in order of increasing cost:

- Two or more CRCs with manufacturer specified flow control
- One electrolytic unit plus one CRC with manufacturer specified flow control

- One precipitation unit
- One electrolytic unit plus one precipitation unit
- One evaporation or distillation unit
- Alternative technology providing at least 95% recovery or management

3.2.1 Operating Procedures

The following procedures should be used in medium sized photographic processing facilities.

- Processing and holding tanks for silver-rich solutions and the silver recovery or management system must be maintained in a manner that protects the material from accidental release to the POTW.

- The facility must have a spill plan to ensure spills of silver-rich solutions are not accidentally released to the POTW. (See part 5.4 for more spill information.)

Analytical and record keeping requirements for facilities using batch operations for silver recovery:

- The primary unit must be checked before and after each batch with silver test papers, an analytical test kit, or a lab analysis to ensure proper operation.

- The effluent from the secondary unit must also be checked with silver test papers, an analytical test kit, or a lab analysis before discharge to the sewer. This will identify any problems or failures with the recovery or management system.

- Test results must be recorded in a silver recovery log.

For facilities using continuous operations for silver recovery:

- The silver concentration in the influent and effluent of the primary unit must be tested weekly with silver test papers, an analytical test kit, or a lab analysis to ensure it is operating properly.

- The effluent from the secondary unit must also be tested weekly with silver test papers, an analytical test kit, or a lab analysis before discharge to the sewer.

- Test results must be recorded in a silver recovery log.

3.2.2 Verification

When using an in-line electrolytic unit, the silver concentration in the processing

tank must be tested weekly to ensure proper operation of the unit. The test can be performed with silver test papers, an analytical test kit or a lab analysis. This information must be recorded in a silver recovery log.

All facilities must have a silver analysis done on the influent and effluent of the recovery system at least every three months by an analytical laboratory acceptable to the POTW. The facility must retain the analytical records for a period of time acceptable to the POTW.

3.3 Recommendations for On-Site Silver Recovery and Management at Large Size Photographic Processing Facilities

For large photographic processing facilities that produce on average more than 20 GPD of silver-rich processing solution and use more than 10,000 GPD of process wash water, one of the following equipment options capable of recovering or managing at least 99% of the silver must be used. The options are listed in order of increasing cost:

- Electrolytic unit plus two or more CRCs with manufacturer specified flow control
- Electrolytic unit plus a precipitation unit
- Evaporation or distillation unit
- Alternative technology providing at least 99% recovery or management

3.3.1 Operating Procedures

The following procedures should be used in large photographic processing facilities:

- Processing and holding tanks for silver-rich solutions and the silver recovery or management system must be maintained in a manner that protects the material from accidental release to the POTW.

- The facility must have a spill plan to ensure spills of silver-rich solutions are not accidentally released to the POTW. (See 5.3 for more spill information.)

- In-line electrolytic desilvering units should be used in processes where possible.

- Squeegees or air knives and low-flow washes should be used on processors where possible.

- Conservation of wash water should be encouraged where possible.

Appendix B.1

Costs and Revenues for Silver Recovery Operations at a 2000 mg/L Level

	Volume Silver Rich Solutions GPD[1]				
	1	5	10	25	100
Silver/day (troy oz)	.25	1.2	2.4	6.1	24.3
Silver/year (troy oz)[2]	75	360	720	1830	7300
Equipment Capital ($)	125	2500	5000	9000	18000
Equipment Cost/year ($)[3]	25	500	1000	1800	3600
Operating Cost/year ($)	175	450	900	1800	3600
Refining Costs/year ($)[4]	150	235	475	775	3100
Annual Costs ($)	350	1185	2375	4375	10300
Annual Revenue ($)[5]	365	1825	3650	9130	36510
Net Return ($)	10	640	1275	4755	26210

[1] Volume of silver rich solution (fix, bleach-fix, washless stabilizer and low flow wash).

[2] Amount of silver assuming 2000 mg/l (31.1 troy oz/kg) with operations 6 days/week and 50 weeks/year.

[3] Capital equipment costs amortized over 5 years. System uses CRCs for volumes under 5 GPD and electrolytic plus CRCs for higher volumes.

[4] Assumes a smelting and refining charge of $0.50/troy oz with volumes less than 1000 troy oz and $0.25/troy oz with volumes greater than 1000 troy oz for electrolytic flake. Smelting and refining charges for CRCs are calculated at $2.00/troy oz less than 1000 troy oz and at $1.00/troy oz at volumes greater than 1000 troy oz.

[5] Assumes a selling price of $5.00/tr oz.

Appendix B.2

Costs and Revenues for Silver Recovery Operations at a 5000 mg/L Level

	Volume Silver Rich Solutions GPD[1]				
	1	5	10	25	100
Silver/day (troy oz)	0.6	3	6	15	60
Silver/year (troy oz)[2]	180	900	1800	4500	18000
Equipment Capital ($)	250	3000	6000	10000	20000
Equipment Cost/year ($)[3]	50	600	1200	2000	4000
Operating Cost/year ($)	200	500	1000	2000	4000
Refining Costs/year ($)[4]	360	585	765	1912	5850
Annual Costs ($)	610	1685	2965	5912	13850
Annual Revenue ($)[5]	900	4500	9000	22500	90000
Net Return ($)	290	2815	6035	16588	76150

[1] Volume of silver rich solution (fix, bleach-fix, washless stabilizer and low flow wash).

[2] Amount of silver assuming 5000 mg/l (31.1 troy oz) with operations 6 days/week and 50 weeks/year.

[3] Capital equipment costs amortized over 5 years. System uses CRCs for volumes under 5 GPD and electrolytic plus CRCs for higher volumes.

[4] Assumes a smelting and refining charge of $0.50/troy oz with volumes less than 1000 troy oz and $0.25/troy oz with volumes greater than 1000 troy oz for electrolytic flake. Smelting and refining charges for CRCs are calculated at $2.00/troy oz less than 1000 troy oz and at $1.00/troy oz at volumes greater than 1000 troy oz.

[5] Assumes a selling price of $5.00/tr oz.

Appendix C

Estimated Process Volumes in Gallons Per Day (GPD)

Facility Type (Size)	Silver Rich Solution	Low Silver Solution
Dental Office—Small*	0.1	10
Dental Office—Medium*	0.2	20
Dental Office—Large*	0.4	40
Hospital—Small	20	2600
Hospital—Medium	40	5200
Hospital—Large	80	10400
Medical Professional—Small	0.2	100
Medical Professional—Medium	1.0	500
Medical Professional—Large	5	1000
Microfilm—Small	0.1	15
Microfilm—Medium	0.3	75
Microfilm—Large	50	3750
Printer/Graphic Art—Small	1	225
Printer/Graphic Art—Medium	2	450
Printer/Graphic Art—Large	20	4500
Minilab:—Washless—All sizes	2.3	21
Minilab:—Washwater—All sizes	1.0	100
Photofinisher/Professional—Small	10	1300
Photofinisher/Professional—Medium	100	13000
Photofinisher/Professional—Large	260	32500
Motion Picture—Small	25	1000
Motion Picture—Medium	50	2000
Motion Picture—Large	2000	80000
Police Dept.—Small	0.2	7000
Police Dept.—Medium	0.4	7000
Police Dept.—Large	2	16000
School—Small	1	25
School—Medium	5	50
School—Large	10	125

• This volume does not include waste water from dental chairs which would contain silver.

Green and
Profitable Printing

III. SUPPLEMENTAL MATERIALS:

B. Fact Sheets

Solid and Hazardous Waste Education Center
Waste Education Series

Cooperative Extension • University of Wisconsin—Extension

425.WP.9408

Waste Reduction Opportunities for Printers

Wastes and emissions from your printing facility can cause environmental compliance headaches and unnecessary drain on your operation's profits. Eliminating the sources of hazardous waste and hazardous air and wastewater contamination can often reduce costs and simplify environmental compliance. Prevention of waste, rather than after-the-fact treatment of wastes, attacks the problem at the source.

This fact sheet serves as a checklist to help you review potential sources of hazardous waste, solid waste, air emissions, and wastewater contaminants in your printing operations. Strategies for reducing these wastes at the source are also reviewed.

Potential Sources of Printers' Waste

The following wastes may be classified as hazardous depending on the actual composition (see WI-DNR Small Quantity Generator's Guide for information on how to determine whether a waste must be categorized and handled as hazardous). When reviewing material safety data sheets (MSDS) to identify potential sources of hazardous wastes, remember to also consider potential contaminants, such as inks, metals and other chemicals, that a solution can pick up during production processes.

Hazardous Wastes

- ***Photographic Wastes***
  photo developer, photo fixer, intensifiers, reducers, systems cleaner, scrap litho film.
- ***Spent Solvents***
  carbon tetrachloride, ethanol, isopropanol, ethyl benzene, 1,1,1-trichloroethane, methylene chloride, trichloroethylene.
- ***Waste Inks with Solvents or Heavy Metals***
  inks and empty containers.
- ***Cleaning Rags***
  if contaminated with solvents or residues that are classified as hazardous waste.
- ***Strong Acid or Alkaline Wastes***
  ammonium hydroxide, hydrochloric acid, nitric acid, phosphoric acid, sodium hydroxide, sulfuric acid, chromic acid.
- ***Spent Plating Wastes***
  spent etch baths, spent plating solutions and sludges, and cleaning baths.
- ***Ink Sludge Containing Heavy Metals***
  ink sludges with chromium, lead or cadmium.
- ***Used containers***
  containing hazardous residues of solvents, inks or adhesives.
- ***Miscellaneous***
  refrigeration tank filters
  used oil from vehicles or compressors.

Types of Printing Wastes

- ***Hazardous Wastes***
  - photographic wastes
  - spent solvents
  - waste inks
  - solvent-laden cleaning rags
  - strong acid/alkaline wastes
  - spent plating waste
  - ink sludge
  - used containers with hazardous residues
- ***VOC's***
  - inks
  - fountain solutions
  - adhesives
  - cleanup solvents
- ***Toxic Waste Emissions***
  - rinse from photodeveloping process
  - any hazardous waste released down drain
- ***Non-Hazardous Solid Wastes***
  - waste substrate
  - non-hazardous waste inks
  - rags and wipes without solvents or residues
  - empty cartons, wrappers, and roll cores

Note: For additional information about waste reduction in the printing industry, contact SHWEC Pollution Prevention Specialists at **608/262-0385.**

Collaborating UW Institutions: UW—Green Bay, UW—Madison, UW—Stevens Point

Volatile Organic Compound (VOC) Air Emissions

- ***Inks***
  xylenes, ketones, alcohols, aliphatics
- ***Adhesives***
  binding, labels
- ***Fountain Solutions***
  isopropyl alcohol, VOC substitutes for IPA.
- ***Cleanup***
  toluene, naptha, kerosene, methanol, chlorinated solvents

Toxic Wastewater Emissions

- ***Photo Developing***
  rinse from photo developing processes.
- ***Liquid Hazardous Waste***
  when released down drain.

Non-Hazardous Solid Wastes

- ***Waste Substrate***
  paper, plastic, foil, textiles and metals from trimmings, rejects, and excess quantities.
- ***Rags and Wipes***
  without solvents or hazardous residues.
- ***Empty Packaging***
  including cartons, wrappers and roll cores.
- ***Non-Hazardous Waste Inks***
  inks and empty containers.

Waste and Emission Reduction Opportunities for Printers

Good Housekeeping

- Cover all solvents.
- Limit solvent use by using pumps or squeeze bottles, rather than pails, to wet cleanup cloths.
- Keep hazardous wastes segregated from non-hazardous and each other.
- Do not allow personal stockpiles of hazardous materials (e.g., cleanup solvents).

Waste Accounting

- Collect accurate data on wastes and emissions to identify key reduction opportunities.
- Establish accountability for waste generation and provide incentives for reduction.
- Provide feedback on waste reduction performance to employees.

Inventory

- Order and manage to minimize date expiration of materials.
- Centralize responsibility for storing and distributing solvents.
- Use returnable containers.
- Use returnable plastic or wood pallets.

Key Process Improvements for Source Reduction

- ***Improve accountability for waste generation and incentives for reduction***
- ***Improve control over inventory and the printing processes***
- ***Substitute less hazardous materials***
- ***Reducte and reuse solvents***
- ***Extend lives of plating and developing baths***
- ***Recycle inks, developers, and films***
- ***Educate customers***

- Require that all potentially hazardous samples be pre-approved and vendor must accept unused portion.

Photochemicals

- Extend lives of photo and film developing baths by adding replenishers and regenerators.
- Reclaim and recycle silver from wastewater.
- Use countercurrent rinsing.
- Keep sensitive process baths covered.
- Increase use of electronic imaging.
- Recycle photographic film and paper.

Platemaking

- Use countercurrent rinsing.
- Reduce drag-in of contaminants. Reduce drag-out of solution by adding dripboards and extending drip time.
- Use non-hazardous developers and finishers.
- Increase use of direct-to-plate technologies that allow preparation of plates from computer images without intermediate steps.

Alternative Materials

- Use inks that reduce VOC emissions: e.g., vegetable-based; water-based; ultraviolet; and electron beam drying.
- For jobs still using inks with heavy metals, find alternatives.
- Eliminate or reduce alcohol in fountain solution.
- Consider using waterless offset printing.
- Use non-hazardous, low- or no-VOC solution to clean equipment.

Printing Process

- Use standard sequence on process colors to minimize color changes for presses.
- Improve quality control to reduce rejects.
- Improve accuracy of counting methods, reducing excess quantities printed to accommodate inaccuracy.
- Use web break detector and automatic splicer.
- Properly store ink to prevent skin from forming.
- Use refrigerative cooling to reduce evaporative losses of fountain solution.
- Run similar jobs simultaneously to reduce cleanup.
- Reuse waste paper or collect for recycling.
- Use scrap paper for press setup runs.

Cleanup

- Use automatic blanket washes.
- Wring or centrifuge used cloths to recover solvent and reuse solvent in parts washer or for additional press cleaning.
- Avoid soaking cloths in solvent; use plunger or squeeze bottle to dampen cloth.
- Use parts washing equipment to wash press trays.
- Use cleanup solution with lower VOC content and lower vapor pressure.

Waste Reduction Opportunities

Good Housekeeping

Waste Accounting

Inventory

Photochemicals

Platemaking

Alternative Materials

Printing

Cleanup

Waste Ink

Finishing

- Clean ink fountains only when changing color; use spray skin overnight.
- Provide marked, accessible containers for segregated collection of used solvents.

Waste Inks

- Consider reusing as house colors.
- Carefully label and store special-order colors for future reuse.
- Mix to make black ink for internal or external use.
- Recycle after processing.
- Donate for reuse by printing schools or others.

Finishing

- Use water-based adhesives.
- Minimize coatings that hinder recycling.

Researched and written by Wayne Pferdehirt, P.E., Pollution Prevention Specialist, with assistance from Kristin Andersen, Pollution Prevention Intern. 8/94

Educate Customers

- Customer choices and specifications affect environmental impacts of a printing process. It is important that customers receive the right information and pricing signals to encourage purchasing decisions that reduce environmental impacts.

❖ For More Information, Contact Your County Extension Agent or SHWEC ❖

County Extension Information

SHWEC Offices

UW—Green Bay
University of Wisconsin
Environmental Science 317
2420 Nicolet Drive
Green Bay, WI 54311
414/465-2707
FAX 414/465-2143

UW—Madison
610 Langdon Street, Rm. 529
Madison, WI 53703
608/262-0385
FAX 608/262-6250

UW—Stevens Point
College of Natural Resources
University of Wisconsin
Stevens Point, WI 54481
715/346-2793
FAX 715/346-3624

Solid and Hazardous Waste Education Center
Waste Education Series
Cooperative Extension • University of Wisconsin-Extension

OPPORTUNITIES FOR PRINTERS TO REDUCE IMAGE PROCESSING COSTS BY MINIMIZING WASTE AND RECOVERING SILVER

425.WP.9604

PURPOSE & OVERVIEW

This fact sheet describes how litho-printers can take actions that will help them to recycle silver and at the same time generate less wastes during image processing. These wastes typically include film, developer, fixer, and wash waters, all of which can be harmful to the environment. Some developer solutions contain hydroquinone, which can make them a hazardous waste. Film, fixer and wash waters can contain silver, a regulated metal. This fact sheet describes how to manage these wastes in an environmentally sound manner, and emphasizes the importance of recovering silver from both business and environmental standpoints. A list of companies that manufacture silver recovery equipment and/or provide on-site recovery assistance is also included.

DEVELOPER SOLUTION

Developer solution consists of a developing agent and other chemicals such as accelerators, preservatives and restrainers. Hydroquinone, a benzene derivative and extremely hazardous material, is often used as the developing agent. If unused developer is disposed it has to be managed as a hazardous waste because of the hydroquinone content. On the other hand, the hydroquinone is exhausted while film is being developed; therefore, used developer can typically be safely discharged to the local wastewater treatment plant with permission of the plant. Neutralization before discharge may be necessary. The following tips will help you reduce developer solution waste:

- Keep developer solutions covered when possible to prevent oxidation and reduce emissions.
- Use a squeegee to wipe excess liquid from photographic film to minimize carryover of developer (be careful not to damage film).
- Ask your chemical supplier about how to use replenishers to regenerate developer solutions. As the developing reaction takes place, the developing agent is consumed, but developer solution can be replenished to extend its life.

SILVER-CONTAINING WASTES

Waste fixer and washwaters, along with film can contain silver. If the silver is present in leachable concentrations of 5 ppm or more, these wastes can be classified as hazardous. Five ppm is also a common wastewater discharge limit for silver, but local wastewater treatment plants have the option of setting the discharge limit for their facility much lower. If a printer is permitted/authorized to discharge fixer solution and wash water to a wastewater treatment plant, it is important to know the discharge limit for silver and what silver recovery options exist for meeting the discharge limit. Never discharge silver-bearing wastewater to a septic system. Besides being illegal, this could cause serious contamination and create an expensive cleanup responsibility for your company.

SILVER RECOVERY OPTIONS

Recovering silver from image processing wastes helps recover the costs associated with image processing, as well as helps achieve compliance with discharge limits. Silver recovery also conserves silver resources. The primary silver recovery options used by printers include electrolytic recovery, ion-exchange, and chemical recovery. Chemical precipitation, although less common, is another option to consider. To confirm that a selected silver recovery option is achieving the required discharge limits, it is important to test the effluent being discharged from the print shop. Test papers or test-kits should be used weekly. Once each 6 months, a sample should be pulled from the shop's effluent and analyzed by an environmental analytical laboratory to confirm that discharge limits are being met.[1]

Electrolytic Recovery Units In electrolytic recovery units, a direct current is applied across two electrodes, which causes positively charged silver to become "plated" onto negatively charged electrodes. Electrolytic recovery is most effective on silver-rich solutions, such as fixer solution. It is recommended that at least one chemical recovery cartridge/canister (CRC) be used in-line following electrolytic recovery to ensure consistent recovery. Electrolytic recovery can also be used to recirculate fixer, thus minimizing the amount of waste fixer generated; if recirculated, pH levels should be adjusted and any additional replenishment conducted.

Ion-Exchange This method relies on positively charged resins in various shapes (e.g. beads) attracting and holding negatively charged silver thiosulfates. The beads are typically sent to a silver refiner or reclaimer where the resin is smelted to recover the silver. Ion exchange is best used to recover silver from dilute solutions such as image processing wash waters.

Chemical Recovery Cartridge (CRC) This method of silver recovery is also known as metallic replacement. Cartridges/canisters filled with steel wool or iron particles are used to trap silver when spent fixer is pumped through the unit. Fixer solution should not be recirculated through CRCs because this method is less effective as the solution becomes dilute. To most effectively operate a CRC unit, do the following:

- Ensure that the flow of fixer through the canisters is slow enough for recovery of silver and that the pH is maintained between 7 and 8.
- Use two canisters in series. If you generate less than 0.5 gallons of fixer per day, only one canister is needed. A second canister with such low flows could oxidize and channel by the time the first canister is exhausted.
- Install clear tubing and sample ports between canisters. Monitor the effluent weekly. Brown solution indicates that the first canister should be replaced. Monitoring can also be conducted using silver-estimating test papers or a chemical test kit.
- Track and log fixer usage to be able to predict the effective life of each canister.
- Keep a log of any measurements taken as evidence that discharge limits are being met.
- When changing out canisters, remove the first one and put the second canister in position 1. Fill a new canister with water before installing it in position 2 to prevent the steel wool from prematurely dissolving.
- Flush free silver from canisters with clean water before sending them off-site. Treat the rinse water by discharging it through the CRC unit.

[1]A list of Environmental Analytical Labs is available from SHWEC (608/262-0385), ask for resource 430.DL.9312A.

Chemical Precipitation. Silver-rich solutions, such as fixer can be discharged to a vessel to which a prescribed amount of chemical precipitant is added. The silver will settle out. After the clear liquid is removed, the silver sludge is filtered and sent to a silver refiner.

WASTE MANAGEMENT ALTERNATIVES & POLLUTION PREVENTION OPPORTUNITIES

Silver-containing wastes may be classified as hazardous and need to be managed safely. Reducing and preventing the generation of these wastes can decrease the cost of disposal, and can offset the cost of treatment through the sale of recovered silver. See **Table 1** for a description of the silver-containing wastes generated by image processing, and a description of appropriate waste management alternatives and pollution prevention opportunities associated with each.

Table 1: Image Processing Wastes - Management Alternatives and Pollution Prevention

Photo processing Waste	Waste Management Alternatives	Pollution Prevention Opportunities
Fixer stops the chemical reaction initiated by the developer. A small print shop generates approximately 1 or 2 gallons of waste fixer each day. Undeveloped silver is removed from the film and goes into suspension in the fixer. Used fixer can contain as much as 8000 ppm of silver.	Use an electrolytic recovery unit, chemical recovery cartridges (CRCs) or chemical precipitation to remove silver from fixer solution. Silver needs to be removed before the fixer is disposed or discharged to a wastewater treatment plant.	To reduce the amount of fixer waste generated: • Keep the pH of the fixing bath between 4.1 and 5.5 by adding acetic acid as necessary. • Replenish the strength of the fixer by adding ammonium thiosulfate, when necessary. • Use an acid stop bath prior to the fixing bath to help keep the pH of the fixer low by preventing developer carryover. • Keep fixer covered when not being used to prevent oxidation and minimize emissions.
Wash baths remove developer and fixer residues from the film. Silver can be carried from the fixer solution into a wash bath; concentrations can reach as high as 200 ppm. A small print shop generates approximately 100 to 400 gallons of image processing wash water each day.	Use ion-exchange to recover silver from wash waters. Wash water should not be discharged to a wastewater treatment plant unless it meets the discharge limits for silver.	To reduce the amount of wash water generated: • Replace parallel wash systems with counter current wash systems* (but be aware that an increase in the concentration of silver in the washwater will result, making effective recovery even more important). • Improve the efficiency of the wash bath by: keeping the water warm (80°F); adding ammonia to keep the pH above 4.9; and adding "washing aids" (salts). • If an ion-exchange system is used, recirculate the effluent from the unit.
Film scraps also have silver on them. When film is soaked in fixer a coating of leachable fixer remains on the film, which can make the film a hazardous waste. You may be required to perform a TCLP (toxicity) test prior to disposal.	Recycle film. If film cannot be recycled it often can be disposed as nonhazardous, because commercial and professional films/papers usually pass a TCLP test. If in doubt, test before discarding.	Consider using silver-free film such as diazo, vesicular, photopolymer, electrostatic, or selenium-based. Consider using a "direct-to-plate" or computer-to-plate system. Consider implementing digital proofing technologies.

* In counter current wash systems, rinse water is used in the initial film wash and fresh water is introduced only at the final rinse stage.

One alternative to recovering silver with an on-site process is to ship your silver containing solutions off-site to a silver recovery company. Generally, if you ship wastes off-site you need to contract with a hauler that has a DNR hazardous waste transportation license and follows all DOT hazardous materials transport regulations[2].

SILVER RECOVERY COMPANIES

Besides helping you meet discharge limits, recovering silver makes economic sense. The following companies will help you recover the value in the silver trapped in your image processing wastes.

Equipment Manufacturers	
Academy Corp., (IL):	1-800-321-6685
ADS Environmental, (CA):	714/738-4941
CPAC, Inc., (NY):	716/382-3223
ECS, (RI):	401/942-1822
Silver Solutions, (MS):	601/746-7470
Jaynor, Inc., (VA):	703/256-2122
Metafix, Inc., Montreal, Quebec:	1-800-638-2349

On-site Silver Recovery Assistance Providers	
Century Refinery (Mn):	612/985-9995
D&M Recycling (WI):	608/783-3030
Environmental Silver (WI):	414/422-9311
Hy-Ho Silver (WI):	608/221-1375
Maguire & Strickland (MN):	800/486-2858
National Recovery (WI):	715/425-9005
North America Micro (WI):	414/863-6911
USI Env. Reclamation (WI):	414/334-3000

Additional film and silver recyclers are listed in the Wisconsin Recycling Markets Directory. The Directory can be obtained from the DNR by calling (608) 267-7566; ask for it by name. Your telephone directory yellow-pages are also a good source of information about silver recyclers in your immediate area.

SUMMARY

Opportunities for pollution prevention in image processing should be investigated as a means of meeting hazardous waste regulations and wastewater treatment plant discharge limits. Recovery of silver also makes good economic sense. There are a number of companies that will help printers recover and recycle silver.

Resources:

Washington State Dept. of Ecology: Environmental Management and Pollution Prevention - A Guide for Lithographic Printers (09/94) Publ. 94-139

Environmental Awareness & Solutions Guide - AGFA PP2-06-0084-CM (10/93)

Code of Management Practice for Silver Dischargers - The Silver Council and Association of Metropolitan Sewerage Agencies (AMSA), 09/95.

EnviroPrint: A Self-Help Guide to Environmentally Sound Printing Operations - Printing Industries of Ohio (PIO), 1995.

Fact Sheet developed by Dan Boehm, Graduate Assistant, under the supervision of Wayne Pferdehirt, Waste Management and Reduction Specialist. Peer Review by Tom Purcell, The Silver Council. **(04/96)**

FOR MORE INFORMATION

Contact your County Extension Agent, or one of the SHWEC Offices listed below:

UW-Green Bay	UW-Madison	UW-Stevens Point	UW-Stout
414/465-2707	608/262-0385	715/346-2793	715/232-5031

[2]See the DNR's Small Quantity Generator Guide (Publ. SW-071 93REV avail. from DNR at 608/267-9523) for a full discussion of hazardous waste generation and transportation requirements.

Solid and Hazardous Waste Education Center

Waste Education Series

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425.WP.9508

LITHOGRAPHIC INK WASTES: *How to Reduce, Reuse, and Recycle ink waste*

PURPOSE

This fact sheet discusses several ink management techniques that increase the opportunities to prevent, reuse, and recycle waste ink. A list of ink recycling service providers is also included.

Ink waste costs the printer for disposal, but also represents a less than optimum use of purchased raw materials. In the extremely competitive world of commercial printing, reducing ink wastes and their costs just makes good business sense.

MANAGING INK WASTE

Reduce ink waste and you reduce your ink disposal costs.

Most lithographic inks are not classified as hazardous wastes under state and federal regulations. The exception is if an ink contains pigments with heavy metals (for example, cadmium, lead or chromium), or if the ink is mixed with solvents classified as hazardous wastes.[1] Proper disposal of ink wastes can be expensive, but is necessary to meet regulatory compliance requirements, and at least as importantly, to minimize liabilities faced by a printer. To be landfilled, waste ink must be in a non-liquid state or otherwise stabilized.

[1] See the DNR's Small Quantity Generator Guide (Publ SW-071 93REV, avail. from DNR at 608/267-9523) for a full discussion of hazardous waste identification and management requirements.

Many printers dispose of their inks by sending them to a fuel-blending service, which combines and forwards these and other wastes for burning at industrial boilers or kilns. Burning the inks reduces the potential exposure to litigation and cleanup costs to which a printer could otherwise be exposed if a landfill is used and it experiences groundwater contamination problems.

Ink disposal can be expensive and result in environmental liability.

Whether waste inks are burned or landfilled, costs can be reduced by minimizing the generation of ink wastes and internally re-using inks whenever possible. Recycling services can sometimes be used to reclaim remaining waste inks, although presently these services are more practical for web press operations, especially those with larger amounts of waste inks. Whether ink can be reused or recycled is dependent upon the quality of the ink waste that is generated. Waste ink can typically be classified in one of the following two categories:

Uncontaminated, excess ink -- this category includes ink that has not been used in the press fountain. Although it can be recycled, reuse of this ink is usually a more cost-effective means of managing it.

Contaminated, combined ink -- this ink has been used in the press fountain and is commonly contaminated with paper fibers, solvents, or other colors of ink. For these inks to be recycled, they typically must be filtered, reconditioned and reblended. The remainder of this fact sheet addresses strategies for reducing ink wastes, internally reusing inks whenever possible, and using recycling services for remaining inks when use of these services is technically and economically practical.

REDUCING THE VOLUME OF WASTE INK GENERATED

Reuse uncontaminated excess ink and recycle contaminated combined ink.

There are many practical ways for sheetfed and web lithographic printers to reduce the volume of waste ink generated:

- Help press operators to accurately estimate the amount of ink needed for each job through training in ink estimating techniques. Keep accurate records of the quantity of ink that is used for specific jobs, particularly for repeat customers' jobs or re-orders.
- Use a standard ink sequence - from light to dark ink.
- Monitor your ink inventory and use existing stock according to the "first in - first out" strategy. Test any out-of-date ink for useability before you consider it waste ink.
- Carefully label, log, and store special-order colors for future use rather than dumping them into waste ink drums.

Estimate ink needs accurately and manage your ink inventory wisely to reduce the overall volume of waste ink generated.

- Donate product ink that you no longer use to schools, or give the ink to other printers, rather than pay for disposal.
- Use an automatic ink leveller to maintain the desired ink level in the fountain.
- Dedicate presses to specific colors or special inks to decrease the number of cleanings required for each press.

INK MANAGEMENT TECHNIQUES FOR BETTER REUSE AND RECYCLING OPPORTUNITIES

To maximize the opportunities for ink reuse and recycling:

Keep ink that has been separated by color and type, free from contaminants, in order to maximize opportunities for ink reuse and recycling.

- Do not mix different colors of ink.
- Keep different types of ink separate.
- Store excess ink in properly sealed and labelled containers. Place plastic or waxed paper on top of sheetfed ink, or spray the ink with an anti-skinning agent, or cover the ink with an oil consistent with printing inks to prevent oxidation.
- Do not dip knives deeply into sheetfed inks. Removing the ink evenly from the top surface of the ink can reduces the surface area of the ink exposed to oxidation.
- Transfer used ink back to the original containers and prevent drying by keeping the ink containers sealed.
- Clearly mark the containers used to collect waste ink and prevent contamination with solvents and trash (e.g., floor sweepings, cigarette butts, etc.).
- Don't treat excess ink as waste. Instead, manage it like a manufacturing by-product that should be re-introduced, as much as possible, back into the manufacturing system.

REUSING EXCESS INK

Excess ink results from overestimating ink usage at the press or at the time of ink purchase. Whenever possible, return unopened cans of excess ink to the supplier. Reusing excess ink in one of the manners described below can reduce both your virgin ink purchasing costs and your waste ink disposal costs:

- Mix excess ink, including black and/or colored inks, on-site to produce black ink. Many printers like the quality of the black ink produced from mixing colored inks, because the colored inks are of such a high quality.
- Mix excess ink with virgin ink of the same color, provided that the excess ink is contaminant-free.
- Use a computer software program, such as "The MixMaster" to keep track of ink in your inventory and to produce recipes for needed PMS colors from excess ink in stock.

Computer programs for PCs can be used to develop recipes for mixing required colors from existing inventory. Relatively inexpensive software is available from printing supply companies.

RECYCLING WASTE INK

Ink recyclers take waste inks, and reprocess them, along with necessary additives to make new ink. Opportunities for recycling web inks are growing, but are currently very limited for sheetfed inks. Consider the following advantages to recycling waste ink:

- The cost of fuel-blending or landfilling the ink can be avoided. Typically the cost is $100 to $400 per 55-gallon drum.
- Liability associated with ink disposal is minimized.
- The recycled ink meets new ink specifications and is available to you at a savings compared to new ink prices.
- Business with environmentally sensitive customers may increase, if they are aware that you recycle.

Typically, ink recycling service providers filter the ink to remove impurities, mix the ink with oil or otherwise adjust its physical characteristics, and then blend the ink with new ink to ensure that product specifications are being satisfied. Some ink recyclers will mix colored inks to produce black inks. Others have the capability of recycling color for color, if large volumes of colored ink are generated.

Current Status of the Availability of Ink Recycling Services

SHWEC has identified ink recyclers that serve printers located throughout the United States and Canada. Each of these companies offers recycling services for both heatset and non-heatset inks from web presses. Currently only two companies recycle sheetfed inks.

See Table 1 for a list of sheetfed ink recyclers, and Table 2 for a list of web-ink recyclers.

Economies of scale associated with ink volumes affect the feasibility of recycling; therefore, accumulating a large quantity of waste ink reduces the cost of recycling the ink on a per pound or per drum basis. This is one reason why there are more web-ink recyclers in operation than sheetfed ink recyclers. However, as demand increases, and the technology for processing sheetfed ink improves, it is likely that the availability and affordability of sheetfed ink recycling will increase. Another limitation on the recycling of sheetfed inks is the difficulty of removing "skinning" layers, which are caused by drying agents in the ink.

Removing and disposing of each "skin," or dry layer, is necessary to produce good quality recycled ink; however, the process is labor intensive, and reduces the overall volume of ink available for recycling. "Skinning" can be prevented by placing an anti-oxidant material in waste sheetfed ink drums, or by covering the ink with a thin layer (1/2 inch) of oil that is compatible with the ink.

EXAMPLE OF A MINNESOTA LITHOGRAPHIC PRINTER THAT REUSES & RECYCLES INK

General Litho Services, a sheetfed offset printer with 60 employees in the Minneapolis area had been purchasing almost all of its inks pre-mixed to job color specifications. Orders always included "a little extra" so that the press wouldn't run out in the middle of a job. Over a few years $7,000 of extra ink had accumulated in the storeroom. To avoid high disposal costs, and get the optimum benefit from the ink that had been purchased, General Litho decided to try "The MixMaster" software program and begin mixing its own inks from the accumulation in their storeroom. The company used "The MixMaster" to store a profile of its ink inventory and develop recipes for using those inks to produce PMS colors. General Litho also achieved cost savings by increasing the accuracy of its ordering process for inks used on incoming jobs. A table was developed that helped production staff better realize the different coverages of different colors of ink. By using this tool, mixing ink on-site, and placing additional emphasis on accurately ordering ink, General Litho achieved substantial reductions in ink wastes and purchase costs. In 3 months time, ink waste quantities were reduced by 10% even though sales increased by 22%. More recently, General Litho has been sending its waste inks to Envirecycle Ink Recovery, in Bloomington, MN.

General Litho effectively uses the ink that accumulates in their storeroom by mixing their own colors right in the plant.

EXAMPLE OF A WISCONSIN LITHOGRAPHIC PRINTER THAT REUSES & RECYCLES INK

By reusing and recycling ink, Quad/Graphics reduced their rate of waste ink generation from 17 drums per month to 1 drum.

Quad/Graphics, headquartered in Pewaukee, Wisconsin, is a 5,300-employee, web offset and rotogravure printer of catalogs, magazines, and coupon inserts for newspapers. A team of press operators was asked by company management to study ink waste generation and to recommend a reduction plan. The team found that the Pewaukee plant was generating more than seventeen 55-gallon drums of heatset waste ink each month. As a result of the study, Quad/Graphics' ink manufacturer was asked to evaluate opportunities for producing new ink from waste ink. The recycling strategy used includes the separation of uncontaminated, excess ink from contaminated, combined ink. Excess ink is reused after being blended with virgin ink, and contaminated ink is recycled and then mixed with virgin black ink. Consequently, ink waste volumes dropped to one 55-gallon drum per month, saving more than $257,000 a year in ink purchases and nearly $39,000 a year on ink disposal.

SUMMARY

Cost savings and a reduction in environmental liability can be achieved by following the guidelines for reducing, reusing, and recycling ink. Environmental initiatives such as those described in this fact sheet are sound business practices with positive economic benefits. In addition, waste ink reduction, reuse and recycling appeals to environmentally sensitive customers. Printers can reduce costs, liabilities, and wastes by using the suggestions contained in this fact sheet.

Prepared by: Wayne Pferdehirt, Dan Boehm, and Kristin Andersen (08/95).

The information in this fact sheet is provided to assist printers in identifying ink reuse and recycling alternatives; it is not an endorsement of companies/products.

The following publications are also available from SHWEC:

"Management of Solvents and Wipes in the Printing Industry"

"Waste Reduction Opportunities for Printers"

"Roll the Presses But Hold the Wastes: P2 and the Printing Industry"

"Pollution Prevention: A Guide to Program Implementation"

☞ For More Information, Contact Your County Extension Agent or SHWEC ☜

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Ink Recycling: Service Providers (Tables 1 & 2)

TABLE 1: Sheetfed Lithographic Printer's Ink

Company	Ink Recycled	Process	Service Area	Min. Requirements	Reporte
Envirecycle Ink Recovery 7854 12th Avenue South Bloomington, MN 55420 Contact: Dave Erickson (612) 854-5630	Sheetfed recycled into sheetfed ink Mixed colors to black Black to black Color to black	Filtration off-site	Entire U.S. and Central and Western Canada	200 lbs or 1/2 drum.	Recycled 15 to 25 pound tha new blac
3R Corporation 800 Vinial St. Pittsburgh, PA 15212 Contact: Katie Jones (412) 323-1733	Sheetfed recycled into heatset web ink Mixed colors to black Black to black Color to black	Filtration off-site	Entire U.S.	No minimum.	Recycled with virgi

TABLE 2: Web Lithographic Printer's Ink

Company	Ink Recycled	Process	Service Area	Min. Req'ts	Report
Envirecycle Ink Recovery 7854 12th Avenue South Bloomington, MN 55420 Contact: Dave Erickson (612) 854-5630	Web heatset and non-heatset Mixed colors to black Black to black Color to black	Filtration off-site Also handles flexographic ink	Entire U.S. and Central and Western Canada	400 lbs or 1 drum.	Recycle pound th
MRS 1115 Shore Street West Sacramento, CA 95691 Contact: Greg Pope (713) 621-1874	Web heatset and non-heatset Mixed colors to black Black to black Color to color	Centrifuge-based system Processes on-site in trucks	Entire U.S.	Variable.	Ink recla Modifyi the press costs an Cost incl avoiding
3R Corporation 800 Vinial St. Pittsburgh, PA 15212 Contact: Katie Jones (412) 323-1733	Web heatset and non-heatset Mixed colors to black Black to black Color to color	Filtration off-site	Entire U.S.	No minimum.	Recycle with vir
Pro Active Recycling 1180 20th St. East P.O. Box 368 Owen Sound, Ontario Canada N4K 5P5 Contact: Bert Wakeford (519) 371-6511	Web heatset and non-heatset Mixed colors to black Black to black Color to color	Centrifuge and filter based Processes on-site in trucks	Canada, and Eastern and Central U.S.	200 gal/month depending on existing services provided in your area.	Recycle 66% of or blendi

*Additional savings result from avoiding disposal costs for used ink.

PRINTING WITH ALCOHOL SUBSTITUTES

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Graphic Arts Technical Foundation
4615 Forbes Avenue
Pittsburgh, Pennsylvania 15213

Printed in the United States of America

Supplementary Notes

Dampening Solution

Dampening solution is a water-based mixture specially formulated to dampen lithographic printing plates before they are contacted by the inking rollers.

Composition of a Dampening Solution

Dampening solution composition varies for a number of reasons. A metallic or fluorescent ink, for example, may require an alkaline dampening solution. Most dampening solutions, however, are acidic with a pH between 4 and 6. The dampening system itself also influences the composition of the dampening solution. For example, some dampening systems require the use of a percentage of alcohol (or alcohol substitute) due to the method of applying the solution to the printing plate. Sometimes, in a conventional dampening system, the use of such an *additive* improves print quality although its presence in the dampening solution may not be essential.

In general, a dampening solution will consist of the following ingredients:

- **Water,** with minimal impurities.
- **Acid** or **base,** depending to a large extent on the ink being used. Acids used include phosphoric acid, acid phosphate compounds, citric acid, or lactic acid.
- **Gum,** either natural (gum arabic) or synthetic, to **desensitize** nonimage areas, i.e., to make them prefer water instead of ink.
- **Corrosion inhibitors,** to prevent the dampening solution from reacting with the plate. Magnesium nitrate is sometimes used; it also acts as a scratch desensitizer and **buffer**—a substance capable of neutralizing acids and bases in solutions and thereby maintaining the acidity or alkalinity level of the solution.
- **Wetting agents,** such as isopropyl alcohol or an alcohol substitute, which decrease the surface tension of water and water-based solutions.
- **Drying stimulator,** a substance—e.g., cobalt chloride—that complements the drier in the ink. Drying stimulator is an additive that is used only if ink is not drying fast enough. Typical concentrations are 1–2 oz. of stimulator per gallon (8–16 mL per liter) of dampening solution.
- **Fungicide,** to prevent the formation of mildew and the growth of fungus and bacteria in the dampening system.
- **Antifoaming agent,** to prevent the buildup of foam. Foam can interfere with the even distribution of dampening solution on the dampening rollers.

Suppliers of dampening solutions provide a premixed (usually proprietary) one-step concentrate that contains all of the additives, except for the water and the alcohol or alcohol substitute, although some also include the alcohol substitute.

One-step dampening solution concentrates already contain a natural or synthetic gum. Two-step concentrates require the addition of gum, which permits the press operator to control the gum/acid ratio. The supplier of the concentrate usually indicates the amount of gum to be added. The addition of 0.5–1.0 oz. of gum per gallon of dampening solution (4–8 mL per liter) is common.

Local water conditions affect the dampening solution. Hard water requires a stronger acid than does soft water. Some concentrates are formulated especially for a certain type of water. In some cases, water conditioning may be necessary. Ion-exchange systems can be used to soften or demineralize the water.

Alcohol

When discussing dampening systems, the word "alcohol" means 98% pure isopropyl alcohol (isopropanol, or IPA). However, many of the alcohol substitutes are technically alcohols (although they can also be surfactants).

The use of alcohol in dampening systems is common, but the U.S. Environmental Protection Agency (EPA) has increased the pressure to use alcohol substitutes. In recent years, numerous alcohol substitutes have been introduced, with varying degrees of success.

Including alcohol in the dampening solution became popular for several reasons:

- **Easier control of the press.** Alcohol allows the press operator more time to devote to other aspects of quality control. Ink/water balance can be attained more rapidly, and quality signatures can be produced more quickly at startup.
- **Reduction of the surface tension of water.** Alcohol is a wetting agent. By reducing the surface tension of the water, the alcohol helps the

water to wet the dampener form roller evenly, requiring less dampening solution. A thinner film of solution keeps the nonimage areas of the plate clean. Alcohol also helps to properly spread water over the ink on rubber or bareback form rollers that apply both ink and dampening solution to the plate.

- **Rapid evaporation.** Less dampening solution is carried to the blanket due to the rapid evaporation of alcohol. Consequently, less moisture is transferred to the printing paper, and ink drying is faster.
- **Reduction in contamination of system components.** The use of alcohol reduces the tendency of ink to emulsify. It also minimizes **snowflaking,** the tiny, white, unprinted specks that appear in type and solids. Snowflaking occurs when water becomes **emulsified** (dispersed) in the ink.
- **Reduction of time and materials.** With alcohol in the dampening system, quality printing is achieved sooner after startup. This saves paper, ink, and time. In addition, since less dampening solution is needed on the printing plate, less ink is required, resulting in decreased consumption of dampening solution and ink.

Despite alcohol's numerous advantages, several disadvantages may lead to constrained usage:

- **Expense.** Alcohol is more expensive than alcohol substitutes and conventional dampening solutions.
- **Toxicity.** Alcohol is highly toxic if ingested orally.
- **Flammability.** Alcohol is flammable and must be stored in approved, fireproof containers.
- **Irritability.** Alcohol fumes can be an irritant, especially in pressrooms without adequate ventilation.
- **Volatile organic compound (VOC) emissions.** Alcohol is a VOC that contributes to the formation of ozone in the atmosphere.

Storage and Handling of Isopropyl Alcohol and Other Flammable Liquids

Many chemicals and materials used in the printing industry can cause fires or explosions. Other chemicals are toxic and can harm the user through skin contact or inhalation. Isopropanol is both flammable and toxic.

Fire prevention practices are essential when handling flammable materials like isopropanol. Isopropanol must be kept in fireproof cabinets or rooms and stored in clearly labeled, approved safety containers; all sources of ignition should be removed from this area. The flame-arresting screen in the spout of these containers should be left in place. Bulk storage of flammable liquids is regulated by specific U.S. Occupational Safety and Health Administration (OSHA) standards. If possible these liquids should be stored in buildings other than the printing plant. Only immediately required quantities (limits are set by OSHA standards) should be brought into work areas. A practical rule of thumb is to keep no more than a day's needs in the work area.

The storage area must be away from any exits or escape routes; it must be well-ventilated, cool, clean, and orderly; and it must allow for grounding of the bulk containers. Smoking is prohibited in the areas where flammable liquids are stored, handled, or used.

All bulk containers should be bonded and grounded to prevent static electricity sparks. **Bonding** is the elimination of a difference in electrical potential between objects, while **grounding** is the elimination of a difference in electrical potential between an object and the ground.

Hazardous chemicals must be stored in properly labeled containers using the Hazardous Materials Identification System (HMIS). In addition, all users of chemicals in the plant must be familiar with the Material Safety Data Sheet and first-aid procedures for each chemical. Protective gloves, goggles, and aprons must be used when handling hazardous chemicals.

Alcohol Substitutes

Alcohol substitutes generally do not have any of the disadvantages of isopropyl alcohol, but using an alcohol substitute is more complicated.
Following are the principal advantages of alcohol substitutes:

- Less volatile than alcohol
- Used in lower concentrations (5% or less)
- Meets the Control Techniques Guideline (CTG) recommended by the Environmental Protection Agency (EPA)
- Odorless

The disadvantages of some alcohol substitutes are numerous, but continuing research and development may solve some of these:

- Increased paper debris on the blanket
- Buildup of dampening solution on the blanket
- Incapable of being mixed directly with concentrated gum and etch
- Increased drying time in some cases
- Occasional roller stripping
- Difficulty in running with nonabsorptive substrates, such as plastic papers

Dampening Solution pH

For a dampening solution to perform effectively, its acidity or alkalinity must be controlled not only during the initial mixing of the solution but also during the pressrun. If the proper level of acidity or alkalinity is maintained, quality printing should be easier to produce.

Acidic solutions. The gum arabic film protecting the nonimage areas of the plate is slightly acidic; however, it requires additional acid to adhere properly. The acidic compounds added to the dampening solution enable the gum arabic to cling to the nonimage areas of the plate.

Insufficient acid in the dampening solution lessens the gum's ability to adhere to the plate. Eventually, ink starts to replace the gum in nonimage areas, causing **plate scumming,** the pickup of ink in nonimage areas of the plate. Scumming can be caused by excessive acid if it attacks the plate metal and the protective coating. This type of scumming appears darker and more uneven than scumming due to insufficient acid.
Excessive acid also causes **plate blinding,** the loss of ink receptivity in the image area. The extra acid attacks the plate in the image areas, causing the image to deteriorate.

Another problem associated with excessive acid in the dampening solution is **roller stripping,** the failure of ink to adhere to the inking rollers. Stripping that occurs at the beginning of a pressrun is usually caused by glazed roller surfaces, and stripping that occurs during a pressrun is probably caused by an excessively acidic dampening solution.

Poor drying or nondrying of ink can be caused by excessive acidity. Drying problems can arise independently of scumming, blinding, and stripping problems and become obvious only after the completion of the pressrun. Excess acid reacts with the cobalt drier in the ink, rendering it practically useless as a drying stimulator.

Alkaline, or base, solutions. Most dampening solutions are slightly acidic. Some dampening solutions, however, are alkaline, particularly those for offset newspaper presses. These alkaline solutions do not contain a desensitizing gum and are made more basic by adding sodium carbonate or sodium silicate. An alkaline dampening solution sometimes contains a **sequestering agent,** a substance that prevents the calcium and magnesium compounds in the solution from precipitating, and a **wetting agent,** which lowers the surface tension of the water in the dampening solution.

The use of an alkaline solution in commercial offset lithography often results in the production of foam in the dampening solution, excess water emulsified in the ink, and bleeding of some pigments into the dampening solution, causing tinting.

pH measurement. pH—the potential of hydrogen—is a relative measure of a solution's acidity or alkalinity. **pH** is the negative logarithm of the concentration (in moles/liter) of the hydrogen ions in a solution.

If the pH of a solution is 7, it is neutral; it is neither acidic nor alkaline. A solution with a pH of 5 is slightly acid; a pH of 3 is considerably more acidic. The lower the pH reading, the more acidic a solution is. The opposite is true as the pH rises above 7. Thus, a solution with a pH of 8 is slightly alkaline, while one with a pH of 10 is considerably more alkaline, or basic.

Since the pH scale is logarithmic, a solution with a pH of 3 is 10 times more acidic than one with a pH of 4. Similarly, a solution with a pH of 3 is 100 times more acidic than one with a pH of 5.

As a general rule, an acidic dampening solution should have a pH between 4.0 and 5.0.

Three general methods are used to measure the pH of a solution. One colorimetric method of pH measurement depends on the color change of indicator dyes added to the solution. Each indicator changes color over a range of about two pH units. To determine the approximate pH of the solution, three dyes are used: one to determine the maximum pH, one to determine the minimum pH, and the last one to determine the approximate midpoint between the maximum and minimum pH levels.

Another colorimetric method of pH measurement depends on the color change of dye-impregnated papers. Short-range pH testing papers have an effective range over a shorter portion of the pH scale and, consequently, are accurate to within 0.3–0.5 pH of the actual pH value.

The most accurate method of measuring pH uses electronically operated meters. Although more expensive than indicator dyes and pH papers, some pH meters are accurate to within 0.01–0.05 pH.

Conductivity of a Dampening Solution

Conductivity is a measure of the capacity of a material to conduct electricity. Extremely pure water is a very poor conductor of electricity. As materials dissolve or go into a solution, they form ions and the water becomes conductive. The conductivity of water increases directly with increases in the amount of dissolved matter (ions). Low (partially) ionizable materials such as alcohol and gum arabic are poor electrical conductors and usually lower conductivity of dampening solutions.

Pure water approaches a conductivity of zero micromhos. Typical tap water might have a conductivity of 200 micromhos or more. As the amount of dissolved matter increases, the conductivity increases directly in a straight line. Thus, conductivity is commonly used as a measure of water purity. Soft water has a conductivity of 0–225 micromhos, and hard water has a conductivity greater than 450 micromhos. The relationship between water hardness and conductivity varies somewhat, depending upon the specific minerals and compounds in the water.

If the conductivity of different amounts of dampening solution concentrates in water is known, it is easy to measure the strength of a solution by measuring its conductivity. The following procedure can be used to develop a graph that plots conductivity and pH against concentration:

1. Measure the conductivity and pH of the water normally used to make the dampening solution. Place water in a clean 1-gal. (3.8-L) bottle.
2. Add 1 oz. (29.6 mL) of fountain solution concentrate. Remeasure both conductivity and pH. Record these values.
3. Add another ounce (2 oz. total) of fountain solution concentrate and remeasure both conductivity and pH. Repeat this process until the amount of fountain solution concentrate added exceeds the manufacturer's recommendations.
4. Plot these values on a graph that has concentration (oz./gal. or mL/L) on the horizontal axis and conductivity and pH on the vertical axis.

A similar graph can be developed if alcohol is also used in the dampening solution. New graphs must be made whenever the water or fountain solution concentrate changes.

If the conductivity of the dampening solution is known, the amount of either dampening solution concentrate or alcohol can be read directly from the graph.

The most important factor in preparing dampening solution is to make sure that it is the proper concentration. Most acidic dampening solutions are buffered so that, as the amount of concentration increases, the pH drops initially but then levels off, while the solution's conductivity increases in a straight line. Thus, conductivity is better than pH for determining the amount of concentrate in the dampening solution. However, the pH must still be measured, because the pH must be between 4.0–5.5 for good printing.

With neutral dampening solutions and neutral (pH 7) water, the pH of the solution is constant, regardless of concentration. Therefore, conductivity must be used to measure the concentration of neutral or slightly alkaline dampening solutions.

Any unusual conductivity readings justify rechecking the conductivity of the water and the dampening solution concentrate. It is normal for the conductivity to increase during the pressrun because materials from the ink and paper contaminate the dampening solution. Therefore, conductivity measurements should be made before the dampening solution is used on the press.

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Management of Solvents and Wipes in the Printing Industry

Printers use solvents and wipes to clean oil-based ink from equipment. Solvent cleaning typically generates hazardous waste solvents, and used cleanup wipes contaminated with ink and solvent residue. By minimizing and recycling hazardous solvent waste, printers can save money while protecting their workers and the environment. This fact sheet provides general guidance on reducing and managing solvent related wastes. For an official interpretation of regulatory requirements for specific situations, contact the nearest district office of the Department of Natural Resources (DNR).

Why is Proper Management of Cleanup Wipes Important?

Printers typically use either leased fabric towels or disposable wipes for cleaning presses. Either type of wipes can become an environmental hazard, and expose printers to expensive environmental cleanup costs, if not managed properly.

Leased Towels

Leased towels are typically sent to an industrial laundry for cleaning. Rags contaminated with solvent are **not** considered hazardous wastes under federal and state regulations if they are **not saturated** (saturated rags can be rendered non-hazardous by wringing or centrifuging) and are **laundered** and **reused**. The effluent emitted from the spent towels at the laundry can become a concern to the local regulatory agency that oversees the sanitary system as the contaminants are washed out into the wastewater. It is the presence of these inks and solvents that create problems for the industrial laundry and the community sanitary sewer system that handles the effluent from the laundry. Printers can be part of the solution by reducing the amount of solvents in rags sent to laundries. Please see side bars on last page for vendors of launderable towels.

Disposable Wipes

Users of disposable wipes need to be very careful about how the used wipes are disposed if they are to remain in compliance with regulatory requirements and minimize corporate environmental liabilities. Used wipes may be subject to hazardous waste regulations if the wipes contain solvents or residues (e.g. heavy metals such as lead and chrome) that are classified as hazardous. However, even if the wipes do not contain hazardous solvents or residues, it may not be in the best interest of the generating printer to dispose of their wipes with the rest of its trash. Contaminants that can leach out of the wipes at a landfill can expose the generator to expensive remediation costs if the landfill that is used is determined to be causing ground water contamination. If disposable wipes are used, it is important that the generators have an accurate, comprehensive picture of all of the solvents and residual contaminants that could remain on used wipes from the plant.

Why Reduce and Recycle Solvent Waste?

- ***Reduced*** compliance requirements
- ***Reduced*** hazardous waste management and liability costs
- ***A safer*** workplace for employees
- ***Cost savings*** when total volume of solvents used is reduced
- ***Improved*** corporate image with customers and neighbors
- ***Reduced*** tax burden from generator and land disposal fees
- ***Reduced*** threat to the environment

Note: For additional information about preventing waste in the printing industry, contact SHWEC Pollution Prevention Specialists at **608\262-0385.**

How can the amount of solvent waste be reduced?

Reduce the Need for Cleaning

Improve production methods by coordinating runs according to color, type or quantity, thereby reducing the number of cleanups.

- Use standard sequence on process colors to minimize color changes for presses.
- Run similar jobs simultaneously to reduce cleanup.
- Clean ink fountains only when changing color; use spray skin overnight.

Use Alternative Solvents

Review the types of inks used, and the solvents needed to clean presses after their use. Possible alternatives include:

- Choose a solvent that ***minimizes hazardous waste and air pollution***. Carefully review the material safety data sheets (MSDS) when considering purchasing a cleaner. Try to avoid cleaning solutions with solvents or chemicals that would cause used cleaners to be classified as hazardous because of toxicity or flammability (see DNR's "Very Small Generator Guide" for further information). To reduce air pollution, try to use cleaners with a low (no more than 30%) VOC content, and a low vapor pressure (less than 10 mm mercury).
- ***Use water-based inks*** whenever possible in flexographic and gravure applications. These inks, are typically less toxic and have a much lower volatile organic compound (VOC) content, and therefore will reduce disposal costs and air emissions.

Reduce Solvent Use in Cleanup

When solvents are essential to cleanup, alternative cleaning methods can reduce the amounts of solvents used and can result in cost savings.

- Avoid soaking wipes in solvent. Use pump or squeeze bottles to dampen wipes.
- Use automatic blanket washes.
- Utilize parts washing equipment as an alternative to towels for cleaning the trays that collect the solvents and inks below each press roller.
- A parts washing unit with recirculating solvent can be used. Trays are removed from the press and placed in the washer unit where solvent is used in a closed washing system to remove the ink.

Methods for Reducing Solvent Wastes

- ***Reduce*** the need for cleaning
- ***Use*** alternative solvents
- ***Reduce*** solvent use in cleanup
- ***Closely manage*** the dispensing and storage of solvents and wipes
- ***Separate*** excess solvent from cleanup wipes
- ***Collect*** all solvent wastes for recycling
- ***Establish accountability*** for solvent use and waste generation
- ***Educate*** customers

Remove Excess Solvent from Wipes

Excess solvent can be removed from used wipes by hand wringing, mechanical wringing, or spinning in a centrifuge. Be sure that the recovered solvent is stored in a closed, clearly marked container. When installing a centrifuge, be sure to check local fire codes that may affect ventilation and electrical requirements.

Collect Solvent Waste for Recycling

Use efficient methods of collecting solvent waste while reducing the chance of spills.

- ***Provide*** clearly marked drums or containers to collect solvent waste.
- ***Modify*** drain trays as necessary to make it easy and neat to pour or drain collected solvents into storage drums.
- ***Add*** receiving funnels with automatically closing covers to storage containers to decrease spills and air pollution from evaporation.

Increase Accountability for Solvent Usage

Using an inventory control program that tracks solvent use and waste generation, make departments financially accountable for their waste streams. Have one person responsible for oversight of solvent storage and dispensing. Provide regular feedback to departments on waste minimization performance.

Educate Customers

Printers can help customers understand the processes and environmental impacts associated with the use of various inks, papers, and coatings. Show customers that their choices can reduce your need to use cleanup solvents and inks with environmentally problematic constituents. Most customers want to do the right thing, when presented with affordable, environmentally-preferable choices.

Who makes waste reduction a success?

Employee cooperation and commitment is essential. Encourage employees to help identify waste reduction opportunities and understand the changes in procedures and equipment required to achieve waste reduction goals.

Management commitment to a workable solution shows employees that waste reduction is a priority. Keep waste reduction programs visible and communicate goals and accomplishments regularly.

Dispensing and Storage Tips

- ***Cover*** solvents to reduce evaporation
- ***Dispense*** solvents from a central source
- ***Track usage*** at individual press or operator level
- Do not allow ***personal supplies*** of cleanup solvents
- ***Limit the access*** to disposable wipes and number of wipes available

Methods for Removing Solvents from Wipes

- ***Use*** a hand-operated wringer
- ***Squeeze*** or ***wring*** out wipes by hand
- ***Install*** an explosion-proof centrifuge to spin wipes dry

* DNR regulations prohibit air drying of wipes contaminated with solvents that classify as hazardous waste

* See following page for **vendor of solvent recovery equipment.**

Vendors of Solvent Recovery Equipment

Hand-Operated Wringers

Environmental Management Products, Inc.
P.O. Box 1310
Ballwin, MO 63022-1310
(800) 779-2047
(314) 256-0047

Alden Industries
2716 Royal St. Box 3027
New Orleans, LA
(504) 944-7681

Local Sales Rep:
Lab Safety Supply
P.O. Box 1368
Janesville, WI 53547-1368
(800) 356-0783

Ostrin Laundry and Machinery Co.
842 12th Ave. N.E.
Minneapolis, MN 55413
(612) 378-9631

Solvent Recovery and Recycling Systems

Environomics, Inc.
955 Industrial Road
San Carlos, CA 94070
(415) 592-2552

On-Site Solvent Extraction Service

McCarty Water and Waste
6250 Highway 12W
Maple Plain, MN 55359
(612) 479-4343

Explosion-proof Centrifuges

Bock
3600 Summit Street
Toledo, OH 43611
(419) 726-2645

SHWEC, by providing this list, does not endorse or certify specific companies.
Wayne P. Pferdehirt, P.E., and Kristin Andersen, 10/94.

Suppliers of Launderable Towels

- *Industrial Towel and Uniform*
  Local ITU Rep
  (414) 782-1950
- *Spic and Span Industrial Services Division*
  Milwaukee
  (414) 964-5050
- *Ideal Uniform Service*
  Milwaukee
  (414) 257-2262
  Madison
  (608)251-5442
- *Bay Towel-Linen & Uniform Rental*
  Green Bay
  (800) 242-5606
- *All Rental Garment Company, Inc.*
  Madison
  (608) 256-5060

❖ **For More Information, Contact Your County Extension Agent or SHWEC** ❖

County Extension Information

SHWEC Offices

UW—Green Bay
University of Wisconsin
Environmental Science 317
2420 Nicolet Drive
Green Bay, WI 54311
414/465-2707
FAX 414/465-2143

UW—Madison
610 Langdon Street, Rm. 529
Madison, WI 53703
608/262-0385
FAX 608/262-6250

UW—Stevens Point
College of Natural Resources
University of Wisconsin
Stevens Point, WI 54481
715/346-2793
FAX 715/346-3624

Minnesota Pollution Control Agency

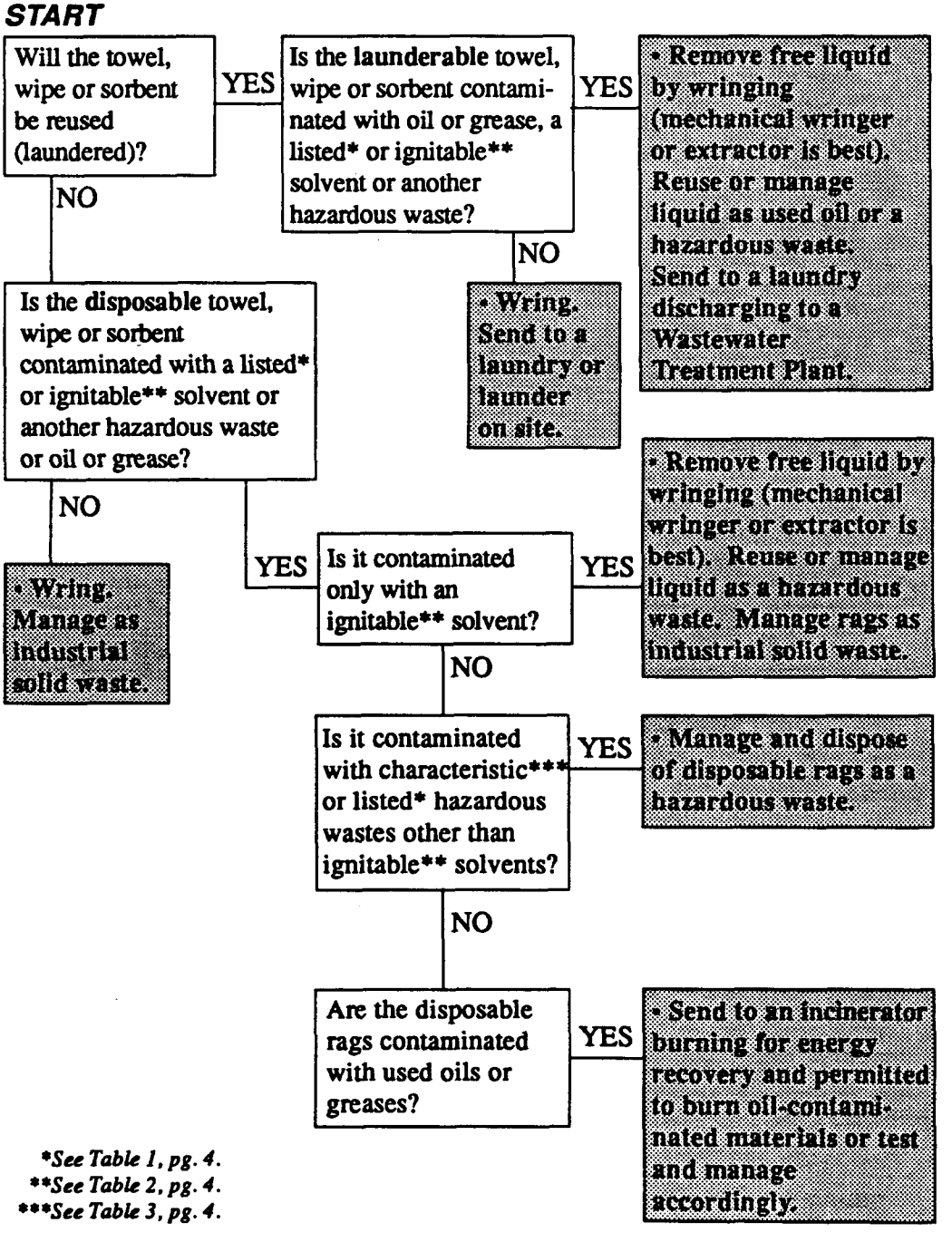
Managing Towels, Wipes and Sorbents

Hazardous Waste Division Fact Sheet #4.61 (9/95)

Many businesses use cloth towels, paper wipes or other sorbents with solvents, paint, ink, or oil. Soiled towels, wipes and sorbents may be hazardous and require special handling. In addition to the information contained in this fact sheet, consult your laundry service and your local fire marshal for other requirements.

The Minnesota Pollution Control Agency strongly recommends improving housekeeping methods, using towels, wipes and sorbents until they are no longer usable, and utilizing every method possible to reduce the number of towels, wipes and sorbents generated by your business.

In this fact sheet



*See Table 1, pg. 4.
**See Table 2, pg. 4.
***See Table 3, pg. 4.

Chart 1: Towels, Wipes and Sorbents that are Reused and/or Laundered

Used with:	Management:	Notes:
• F001, F002, F004, or F005 solvents (see Table 1) • Solvent mixtures containing 10% or more F-listed solvents. • Hazardous paints or inks containing toxic metals such as barium or chromium (see Table 3)	1. Remove free liquid by wringing (mechanical wringer or extractor is best). Reuse extracted liquid or manage liquid as hazardous waste. 2. Manage towels as hazardous on site. ◦ Store in a covered container marked with the words *Hazardous Waste - Solvent Towels*. 3. Towels may be sent to a commercial laundry which has a discharge permit from its local wastewater treatment plant. ◦ If these towels are picked up weekly or more often, keep a chart of pick-up dates and pounds of used towels picked up. ◦ In this case, an accumulation start date and weekly container inspections are not necessary.	◦ Report amount of used towels on annual hazardous waste license application. ◦ If you are a small or large quantity generator, train employees on proper management of used towels. ◦ Do not launder these towels on site. ◦ Do not add waste solvents to used towels or towel storage container. If you send towels to a commercial laundry, current MPCA policy states: ◦ No manifest is needed for transport. ◦ The laundry does not need a hazardous waste facility permit.
• Ignitable solvents only - D001 or F003 (See Table 2)	1. Remove free liquid by wringing (mechanical wringer or extractor is best). Reuse extracted liquid or manage it as a hazardous waste. 2. Towels containing no free liquid (wrung) can be managed as nonhazardous; no hazardous waste rules apply. 3. Send towels to a commercial laundry which has a discharge permit from its local wastewater treatment plant.	◦ Mark container *Used Towels - Wrung* to distinguish from hazardous towels. ◦ Do not report these towels on your annual hazardous waste license application. ◦ Notify your wastewater treatment plant; laundering on site may require a discharge permit.
• Oil	1. Remove free liquid by wringing (mechanical wringer or extractor is best). Reuse extracted liquid or manage it as used oil. 2. Send towels to a commercial laundry which has a discharge permit from its local wastewater treatment plant.	◦ Mark the container with the words *Used Oil Towels*. ◦ No manifest is needed for transport. ◦ Laundry does not need a hazardous waste facility permit. ◦ Do not report these towels on your annual hazardous waste license application. ◦ See Chart 2 for management of spent launderable sorbents that are no longer reusable.

Note: Provided your laundry service approves, it is acceptable to co-mingle hazardous and nonhazardous towels, wipes and sorbents that will be sent to a commercial laundry. While on site, follow storage and marking requirements for hazardous waste. If you cannot keep accurate records of the amount of hazardous towels, wipes and sorbents, you must report them all as hazardous.

Chart 2: Towels, Wipes and Sorbents that are Disposed of After Use

Used with:	Management:	Notes:
• F001, F002, F004, or F005 solvents (see Table 1) • Solvent mixtures containing 10% or more F-listed solvents • Hazardous paints or inks containing toxic metals such as barium or chromium (see Table 3)	1. Remove free liquid by wringing (mechanical wringer or extractor is best). Reuse extracted liquid or manage it as a hazardous waste. 2. Manage wipes/sorbents as hazardous; all hazardous waste rules apply. • Store in a covered container marked with the accumulation start date and the words *Hazardous Waste - Wipes/ Sorbents.* • Inspect containers weekly and keep a record of inspections. • Ship within required storage time limits. (Satellite accumulation is an option if you accumulate slowly.) • Use a hazardous waste manifest and licensed hazardous waste transporter and send to a hazardous waste facility.	• Do not air dry wipes/sorbents. • Report amount on annual hazardous waste license application. • Small and large quantity generators must train employees on proper management. • Storage time limits are based on generator size. (For more information, request MPCA fact sheet #1.04, *Marking and Storing Hazardous Waste.*)
• Ignitable solvents only - D001 or F003 (see Table 2) • Nonhazardous paints or inks	1. Remove free liquid by wringing (mechanical wringer or extractor is best). Reuse extracted liquid or manage it as a hazardous waste. 2. Wipes/sorbents that have been wrung dry or become dry through use are nonhazardous; manage as an industrial solid waste. 3. If you choose not to wring, manage as F001 Rags above.	• Do not air dry wipes/sorbents. • Do not report nonhazardous wipes on your annual license application.
• Oil	1. Remove free liquid; manage liquid as used oil. Reuse sorbent until unusable. 2. Store wipes/sorbents in a closed, leakproof container marked with the words *Used Oil Wipes/Sorbents.* 3. Send to an incinerator burning for energy recovery and permitted to burn oily wipes and sorbents. If not burning, evaluate and manage as solid or hazardous waste based on evaluation.	• Optional management: Evaluate for toxicity characteristics (see Table 3). If hazardous, manage like wipes/sorbents used with F001 solvents above. If nonhazardous, manage as an industrial solid waste. • Report wipes/sorbents that are burned for energy recovery on your annual license application. Do not report nonhazardous wipes/sorbents. • For more information, request MPCA fact sheet #5.15, *Managing Used Oil Sorbents.*)

For more information, call. . .
- your Metropolitan County Hazardous Waste Staff
- the MPCA at 612/ 296-6300 or 800/ 657-3864

Prepared in cooperation with. . .
- Metropolitan County Hazardous Waste Staff
- Minnesota Technical Assistance Program (MnTAP)
- Metropolitan Council Wastewater Services

Table 1: F-listed Solvents (Toxic)

- **F001 solvents** *(halogenated, degreasing):* carbon tetrachloride; chlorinated fluorocarbons; methylene chloride; tetrachloroethylene; 1,1,1-trichloroethane; trichloroethylene; and, all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more by volume of one or more F001, F002, F004, or F005 solvents.

- **F002 solvents** *(halogenated):* chlorobenzene; methylene chloride; orthodichlorobenzen; tetrachloroethylene; 1,1,1-trichloroethane; 1,1,2-trichloroethane; trichloroethylene; trichlorofluoromethane; 1,1,2-trichloro-1,2, 2-trifluoroethane; and, all spent solvent mixtures/blends containing, before use, a total of ten percent or more by volume of one or more F001, F002, F004, or F005 solvents.

- **F004 solvents** *(nonhalogenated):* cresols and cresylic acid; nitrobenzene; and, all spent solvent mixtures/blends containing, before use use, a total of ten percent or more by volume of one or more F001, F002, F004, or F005 solvents.

- **F005 solvents** *(nonhalogenated):* benzene; carbon disulfide; 2-ethoxyethanol; isobutanol; methyl ethyl ketone; 2-nitropropane; pyridine; toluene; and all spent solvent mixtures/blends containing, before use, a total of ten percent or more by volume of one or more F001, F002, F004, or F005 solvents.

Table 2: Ignitable Solvents (F003 & D001)

- **F003 solvents** *(nonhalogenated)* include: acetone; cyclohexanone; ethyl acetate; ethyl benzene; ethyl ether; methanol; methyl isobutyl ketone; n-butyl alcohol; xylene; and, all spent solvent mixtures/blends containing, before use, only the above spent nonhalogenated solvents.

- **D001 solvents** include all liquid solvents and mixtures not listed above having a flash point below 140° F. The flash point can be found on the Material Safety Data Sheet.

Table 3: Toxicity Characteristic Wastes, Hazardous Concentrations & Waste Codes

Hazardous Contaminant	Hazardous Concentration Level in mg/L	Waste Code
•Arsenic	5.0	D004
•Barium	100.0	D005
Benzene	0.5	D018
•Cadmium	1.0	D006
Carbon tetrachloride	0.5	D019
Chlordane	0.03	D020
Chlorobenzene	100.0	D021
Chloroform	6.0	D022
•Chromium	5.0	D007
o-Cresol	200.0*	D023
m-Cresol	200.0*	D024
p-Cresol	200.0*	D025
Cresol*	200.0	D026
1,4-Dichlorobenzene	7.5	D027
1,2-Dichloroethane	0.5	D028
1,1-Dichloroethylene	0.7	D029
2,4-Dichlorophenoxyacetic acid (2,4-D)	10.0	D016
2,4-Dinitrotoluene	0.13	D030
Endrin	0.02	D012
Heptachlor	0.008	D031
Hexachlorobenzene	0.13	D032
Hexachloro-1,3-butadiene	0.5	D033
Hexachloroethane	3.0	D034
•Lead	5.0	D008
Lindane	0.4	D013
•Mercury	0.2	D009
Methoxychlor	10.0	D014
Methyl ethyl ketone (MEK)	200.0	D035
Nitrobenzene	2.0	D036
Pentachlorophenol	100.0	D037
Pyridine	5.0	D038
•Selenium	1.0	D010
•Silver	5.0	D011
Tetrachloroethylene	0.7	D039
Toxaphene	0.5	D015
Trichloroethylene	0.5	D040
2,4,5-Trichlorophenol	400.0	D041
2,4,6-Trichlorophenol	2.0	D042
2,4,5-Trichlorophen oxypropionic acid (Silvex)	1.0	D017
Vinyl chloride	0.2	D043

**Laboratory analyses that show any individual cresol above the 200.0 mg/L level are hazardous for that reason. For analyses where o-, m-, and p-cresol concentrations cannot be differentiated, the total cresol concentration is used.*

•Toxic Metals

Solid and Hazardous Waste Education Center

Waste Education Series

Cooperative Extension • University of Wisconsin-Extension

Reading and Using a Material Safety Data Sheet (MSDS)

According to the Hazard Communication Standard of the Occupational Safety and Health Act of 1970 and its amendments an employer is required to maintain Material Safety Data Sheets (MSDS) for all products used in their production process, and make this information available to the employees. It is the responsibility of the material manufacturer to provide the MSDSs to the employer. An MSDS is a useful source of information for employee safety and health, but can also be a valuable tool for and hazardous waste minimization programs.

Contents of an MSDS

Although the format of an MSDS can vary slightly from one manufacturer to the next, all MSDS are required to contain certain information. This information can be broken down into seven categories:

1. Product Identification
2. Material Composition/Ingredients
3. Physical and Chemical Characteristics (including fire and reactivity hazard information)
4. Health Hazard Information (includes first aid procedures)
5. Storage and Handling Procedures
6. Protective Clothing and Equipment Recommendations
7. Manufacturer's Information and Date of MSDS Completion

Product Identification

Product Identification includes the product name as it appears on the product label. Other information may include a copy of the warning label statement and the National Fire Protection Association's (NFPA) hazard ratings (zero to four: where zero constitutes minimal hazard and four an extreme hazard) for health, flammability, and reactivity. Health represents the potential for exposure to the material to produce injury or sickness. Flammability represents the susceptibility

MSDS:
Valuable Information for Pollution Prevention

Physical and Chemical Characteristics can **help you identify regulations that apply** to the use and disposal of the material.

Storage and Handling Procedures can **help you prevent and minimize the impacts of spills and leaks.**

Physical and Chemical characteristics and health hazard information can **help you in choosing a less hazardous material** for your company.

Note: For additional information about pollution prevention opportunities for your business, contact SHWEC Pollution Prevention Specialists at **608/262-0385.**

of the material to burning. Reactivity indicates the susceptibility of the material to release energy under certain conditions. NFPA ratings provide a good summarization of the material's hazardous characteristics.

Material Composition/Ingredients

This information includes chemical or common names, and the CAS (Chemical Abstract Service) numbers of the ingredients which may contribute to health or safety hazards.

Physical and Chemical Characteristics

This section describes many of the properties of the chemical. Physical and chemical characteristics include vapor pressure, flashpoint, flammability, and reactivity.

- Vapor pressure indicates the rate at which the product evaporates. Lower vapor pressure means a slower rate of evaporation.

- Flash point is the lowest temperature at which a material's vapors will ignite and burn when exposed to an ignition source.

- Flammability of a material can be determined from the data provided on the upper and lower flammability limits. These values are expressed as a percentage of fuel vapors in air. Vapor concentrations below the lower limit will not have sufficient fuel to ignite, and concentrations above the upper limit will be too 'rich' to ignite.

- Reactivity concerns any physical or chemical transformation of the material due to contact with air, water or other materials, or the ability of the material to self-react under certain environmental conditions. If certain types of reactions are possible, they will be specifically mentioned by name. Two of these special reactions are oxidation, and corrosion. Oxidizers are compounds which promote combustion when in contact with flammable materials. Corrosives are materials which erode or dissolve other materials (this may include bodily tissues).

Other valuable information that may be presented includes the material's vapor density as compared to air (denser vapors tend to collect and travel at ground level), percent volatiles by volume, and material appearance and odor.

Health Hazard Information

Health hazard information on the material will include any signs or symptoms of exposure and any medical conditions which are known to be aggravated by exposure to the material is given here. Primary routes of entry, or how people are commonly exposed to the material (i.e., inhalation, skin contact, etc.), are discussed here. Exposure limits for the material or its chemical constituents are listed. These limits include the OSHA Permissible Exposure Limit (PEL), the maximum exposure

allowed by law; and the Threshold Limit Value (TLV), the recommended maximum exposure by the American Conference of Governmental Industrial Hygienists. Any information on the material or its component's ability to cause cancer will also be found here. Emergency first aid procedures for overexposure based on the route of entry should also be included.

Storage and Handling Procedures

This section includes information on any generally applicable precautions for safe storage and use of the material. These precautions include: storage guidelines, protective measures during repair and maintenance of equipment involved with the material, and procedures for clean up of spills and leaks. It is important to note that just because a raw material is not a hazardous material does not mean that the material remains nonhazardous throughout your production process. For example, hazardous residues can render a used cleaning solution a hazardous waste. Remember determination of hazardousness is based on the characteristics of the waste, which may have changed during production from the characteristics of the virgin material.

Protective Clothing and Equipment Recommendations

Information on general applicable control measures to reduce the risk associated with the material will be found here. These measures include appropriate engineering controls, work practices, and personal protective equipment (such as gloves, eye protection, etc.).

Manufacturer's Information and Date of MSDS Completion

This section includes the name, address, and telephone number of the material manufacturer. Most manufacturers have customer service operations which can be an excellent source of additional information.

Using an MSDS in Your Pollution Prevention Program

The information in an MSDS can help improve your waste reduction and management efforts. In particular, you can use the information on an MSDS to help you (1) select products that generate less hazardous wastes or emissions; (2) identify regulations that certain materials may be subject to; and (3) ensure that your material and waste management procedures are appropriate for current material usage. A discussion of each of these follows.

Selecting the Appropriate, Less Hazardous Materials for Your Company

Substituting hazardous materials with less hazardous ones is not only good for the environment, it's good for your bottom line. The waste produced from hazardous materials becomes hazardous waste with all the special storage, handling and disposal costs mandated by regulation. Hazardous materials in your workplace can be a health and safety risk for your employees, and may be reflected in higher insurance premiums. Perhaps most importantly, hazardous waste can expose your company to significant long-term financial liabilities if those wastes are determined to have contributed to environmental damage. In short, using hazardous materials typically adds cost.

Each section of the MSDS can be used to evaluate current materials in use versus possible substitutes. Specific areas that should be looked at are:

- Product Identification - Are any of the products NFPA health, flammability, or reactivity hazard ratings high? Does the products warning label state *danger*? (This information can be used as a 'first-cut' screen to raise flags when reviewing products or comparing alternatives.)

- Material Composition/Ingredients - Are there ingredients that would define this material as a hazardous material or hazardous waste?

- Physical and Chemical Characteristics - Does this material have a high percent of volatiles? Does it evaporate rapidly? (This information will relate to the material's tendency to produce air emissions.) How flammable is this material? Is it corrosive or reactive? (This information will identify special handling required.)

- Health Hazard Information - Does this material present a health and safety risk to my employees?

- Storage and Handling Procedures and Protective Clothing and Equipment Recommendations - Are special (and potentially costly) storage and handling procedures or equipment needed with this material?

Be aware when comparing MSDSs that not all manufacturers are equivalent in the amount of information they provide. Many manufacturers go beyond providing the minimum required information. Don't penalize a product because the manufacturer is particularly forthcoming about product content and precautions. Be suspicious about non-technical 'enviro-marketing' terms such as biodegradable, non-toxic, and environmentally-friendly. Always review specific data in the MSDS to determine the validity of such claims. Do not hesitate to call the manufacturer if more information is needed.

Identifying Hazardous Materials Regulations that Apply to Your Company

Hazardous materials require special tracking, handling, and disposal procedures according to federal

and state regulations. Which regulations apply to a company depend on the particular materials present and the quantities stored and disposed of. Information under the Material Composition/Ingredients and Physical and Chemical Characteristics sections can help you identify which regulations apply to you. Material ingredients listed under Material Composition/Ingredients should be compared to the listing of substances covered by the particular regulation in question. For example: reportable air contaminants in Wisconsin are listed in Table 1 of Section NR 438 Wisconsin Administrative Code; Air Contaminant Emission Inventory Reporting Requirements. First, compare this list to the ingredients of the materials used in your facility. Second, if there is a match, then more detailed information on emission quantities will need to be gathered. If there is no match between the materials you use and the listed materials, then this particular regulation does not apply to you.

Physical and Chemical Characteristics can also be helpful in identifying environmental regulations that must be complied with. For example under the federal Resource Conservation and Recovery Act (RCRA) a list of hazardous wastes is provided, but additional wastes may be characterized as hazardous based on the characteristics of the waste. So a comparison of lists alone is not sufficient. In this case the waste in question must be evaluated against the four characteristics of hazardous waste in RCRA. These characteristics are (1) ignitability, (2) corrosivity, (3) reactivity, (4) toxicity. Ignitable substances can be identified by flash points less than 140 degrees F. Corrosive materials may be labeled directly, or can be detected from the pH (if given). A pH of 2 or less or 12.5 or more is a corrosive. Reactivity of a material will be specifically mentioned. Toxicity, as defined by RCRA, cannot be identified directly from the MSDS.

Audit to Improve Your Hazardous Material Storage and Handling Procedures

Proper storage and handling can prevent or minimize the impact of spills and leaks. Spills and leaks can waste raw materials, threaten employee health and safety, or contaminate soil or groundwater, all of which adds up to unwanted costs. The information in the MSDS represents sound practices for the storage, handling, and spill or leak response. A point by point comparison of your procedures against those in the MSDS can show you where procedural changes are needed, personnel training required, or modifications may be necessary.

☞ For More Information, Contact Your County Extension Agent or SHWEC ☜

County Extension Information	SHWEC Offices
	UW-Green Bay University of Wisconsin Environmental Science 317 2420 Nicolet Drive Green Bay, WI 54311 414/465-2707 Fax: 414/465-2143 **UW-Madison** 610 Langdon Street, Rm.529 Madison, WI 53703 608/262-0385 Fax: 608/262-6250 **UW-Milwaukee** SHWEC 161 W Wisconsin Ave., Suite 6000 Milwaukee, WI 53203-2602 414\227-3160 Fax: 414\227-3165 **UW-Stevens Point** College of Natural Resources University of Wisconsin Stevens Point, WI 54481 715/346-2793 Fax: 715/346-3624

Green and
Profitable Printing

III. SUPPLEMENTAL MATERIALS:

C. Case Studies

BUSINESS MANAGEMENT

April 1992

ADVISORY PRINTING INDUSTRIES OF AMERICA, INC.

Running "Green," An Environmental Case Study

By Stu McMichael

CUSTOM PRINT is a full service printing company in Virginia, just across the river from Washington, D.C. — that place where they write all those environmental regulations that get business people so steamed. I don't propose to preach, but I *will* tell you that we've discovered the value of environmental consciousness. It's good for everyone who works in our printing plant, it's good for the planet, and it's very good for our business.

We didn't arrive at full environmental consciousness overnight. We got started in earnest about five years ago, when we began to be concerned about the amount of isopropyl anhydrous alcohol we were using on our presses. As every printer knows, when alcohol dissipates it creates fumes — volatile organic compounds (VOCs) that create a problem for the environment.

Doesn't proper ventilation take care of the problem, you ask? No, because when VOCs are released into the atmosphere they react with nitrogen oxides from vehicle exhausts, producing ozone, an irritating component of smog. With a twelve-lane commuter artery just yards from our door, we figured the local smog problem didn't need a boost from us. So we began experimenting with various alternative chemicals that we hoped would give us equivalent ability to control water emulsification and to lay ink on our plates with just the right density.

We have high standards. In five years we've been through seven products, each better than the last. Today we're using Prisco "Hi-Tech" Fountain Solution Concentrate. We have two 40" 2/C Heidelbergs and one 40" 5/C Heidelberg, each with different dampening systems, and "Hi-Tech" works well on all of them. As with any chemical, it's not 100 percent environmentally benign (read the accompanying Material Safety Data Sheet before you use it), but it's far superior to alcohol, with a much lower VOCs-per-gallon ratio. You should also look for other hazards that might result from using substitute chemicals.

As we worked on improving our pressroom environment, we soon realized that we needed to do a full-scale environmental review of *every* department, from camera and stripping to platemaking to bindery to shipping to front office. So we asked each department head to review all of the chemicals then being used and to come up with better alternatives whenever possible.

Surpassing Government Standards

Educating ourselves as a group made sense. We all want to work in a healthier environment, and we all need to know more about what we're working with. And, like it or not, we've got to keep up with the demands of the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA). Their rules now fill thousands of pages in the Code of Federal Regulations, and many of those regs affect the printing industry in some way, as do many state and local regs. With a team effort, we can do a much better job of keeping abreast of these requirements. We can also stay one step ahead of them.

OSHA sets standards governing the use of chemicals, but OSHA doesn't require us to change chemicals and become "toxic-free" even though the technology is available. Using OSHA and EPA standards as benchmarks, we've taken several steps that go beyond any existing requirements. Some examples:

- Conventional plate developers create a polymer effluent that may have to be contained and treated as hazardous waste. To control that problem, we found that we had to completely change our method of making plates. We ended up going to aqueous plate processing, which uses water and requires an entirely different kind of plate. Now we use a Kodak aqueous platemaking machine, and we've drastically cut our polymer waste problem.
- We were early converts to soy inks. Petroleum-based inks have long been the industry staple, but they can release VOCs into the atmosphere and some inks can create problems as hazardous waste or if they find their way into groundwater. In contrast, soybeans are a renewable resource, and depending on the pigments, soy inks can be less invasive to the environment and less hazardous in landfills. We now use soy inks exclusively, with excellent results.
- We have to keep four dehumidifiers operating 24 hours a day to control moisture buildup in our paper. The

Stu McMichael is president of Custom Print, a mid-sized commercial printer located in Arlington, Virginia.

dehumidifiers trap a lot of water. In our pre-consciousness days, we just allowed that water to drain away. Now we recycle it. The water is pH-neutral — which makes it ideal for re-use in our press water fountains.

- Waste paper is an unavoidable byproduct of printing. Like other printers, we arrange to recycle it — but we've gone a step further by systematically recycling all office paper waste as well. Everyone can see the difference. Before, one day's waste would fill a large dumpster. Now we use a smaller dumpster — and it takes us a week to fill it up.
- We print the great majority of our jobs on recycled paper these days. We encourage our clients to use it, and we've built a first-class network of suppliers, including some who are offering increasingly fine papers featuring high post-consumer waste content. Although some art directors are still resistant, we're finding that few jobs really require virgin materials. We think it's our responsibility to educate our customers about what's available and what will work for them, and we're doing that — aggressively.
- We now retrieve film from our camera and stripping departments and recycle it. The silver from the film and developing fluid — which used to go into the waste stream to become a hazard to the environment — is extracted and collected, then sent to a mint and pressed into one-troy-ounce coins of pure silver. These coins make nice Christmas gifts for the folks who work here — reminding us that there's real value in environmentalism.

On Balance

Becoming a "green" company was not easy or inexpensive. For example, an alcohol substitute we experimented with early on seemed to work well during the day in our 5-color press. But the next morning we found that a chemical reaction had created a shop full of bubbles overnight. No damage was done, but the lesson we learned was to make that kind of trial in just one unit instead of five. We have also had occasional difficulty printing on recycled paper, because the quality of some paper is not good.

The transition to environmentally friendly materials has been expensive due to the need to experiment with different chemicals, plates and papers. On the bottom line, it does cost more to produce our products. But our marketing edge in this environmentally conscious community is a benefit that far outweighs the downside.

Making Business Better

These days we market Custom Print as "The Environmentally Conscious Printer." It's a good promotional slogan in a region where many environmental and other like-minded organizations are based. They're bringing us a lot of their business. And we've been profiled in the *Wall Street Journal* and *Washington Business Journal*, among other publications.

All of which is great. But the best thing about our slogan is — it's true. Everything we do today is done with an eye on the environment — our plant environment *and* the environment beyond our door. Working in an industry that has its share of environmental problems, we're pleased to be contributing to some solutions.

For more information on this subject, see the Management Action page in this issue.

Case Study H

Selecting Alcohol Substitutes

Woolverton Printing Company, Cedar Falls, Iowa, wanted to reduce VOC emissions to improve interior air quality and meet environmental regulations being drafted by the EPA. Mitch Weinberg, operation manager, learned about alcohol free printing. With the assistance of the Iowa Waste Reduction Center, Woolverton began testing low VOC fountain solutions.

Woolverton's three, two-color Heidelberg presses are equipped with chilled and filtered, recirculating fountain reservoirs. Since installation, Woolverton had never discarded fountain solution. Never changing the fountain solution meant Woolverton began adding more alcohol to "fix" print problems, averaging 15 percent alcohol in the fountain solution.

Consistent water quality eases the reliance on alcohol in the fountain solution. As an industry partner, the IWRC installed a reverse osmosis water treatment system. Cedar Falls' water supply has a high concentration of calcium.

With the installation of the water treatment system, Woolverton reduced the alcohol content to 5 percent because calcium carbonate was removed from the water. Calcium carbonate acts as a buffer, requiring more fountain solution concentrate to achieve the desired pH. The reverse osmosis unit also provides water with a consistent conductivity, allowing this measurement, in addition to pH, to predict the quality of the fountain solution.

For this study, Woolverton printed 45 jobs. All used low VOC fountain solutions designed to be used with water with low mineral content. The first 15 used water treated with a water softener; 15 used water treated through reverse osmosis and 5 percent alcohol in the fountain solution; and 15 used water treated through reverse osmosis, alcohol substitute, and fountain solution.

The softened water had a conductivity of 700 micromhos and required a large amount of fountain solution to bring the pH into the recommended range of 3.8-4.2. During this run, the amount of fountain solution necessary to bring the pH into the recommended range suddenly spiked and caused print quality problems.

Traditional trouble shooting focused on cleaning rollers, changing ink and adding alcohol. When reformulating fountain solution, press operators discovered that the water softener exhausted the sodium supply. Once recharged, the water quality stabilized and the print quality improved.

The reverse osmosis unit achieved acceptable print quality using only 5 percent alcohol without any major modifications. Conductivity ranged from 1200 to 3050. Conductivity readings

may vary for several reasons including: temperature of the fountain solution when the measurement is read, calibration of the meter, concentration of alcohol and effectiveness of the charcoal filter. As a result of the conductivity variability, Woolverton determined fountain solution quality by measuring both conductivity and pH.

Alcohol free printing requires many changes. Trade associations recommend using softer rollers, tight control of roller settings and water feed rate. Furthermore, when fountain solution is recirculated, printers are encouraged to measure conductivity and pH to predict fountain solution concentration and quality.

Before the 15 runs with the alcohol substitute, Woolverton replaced the water pan metering roller with one of a lower durometer reading. The press manufacturer recommended a durometer reading of 25, slightly higher than published recommendations. Once the press was equipped, Woolverton began testing fountain solution mixtures to find the optimum mix. After much trial and error, they found that a mixture of one gallon of water, two ounces fountain solution concentrate, and two ounces alcohol substitute was determined to give the best print quality.

Woolverton followed the published recommendation to create a conductivity curve of the fountain solution. This is important because both the fountain solution and the alcohol substitute have a vapor pressure lower than water's and will not evaporate like alcohol. Over time, Woolverton should see a general increase in conductivity and will need to add water. The conductivity can be correlated to fountain solution concentration and help predict when water should be added.

Once the optimum mix was determined, the conductivity ranged from 1890 to 2450. The conductivity readings are still influenced by temperature, calibration, and filter performance. When using the conductivity curves to predict fountain solution concentration, a printer must standardize when a measurement is made, check calibration daily, and note filter changes to determine if filter age is a factor.

Even while adjusting the fountain solution/alcohol substitute ratio, Woolverton was printing successfully. The first press run demonstrated the second factor influencing the success of printing without alcohol: roller settings. The press was not achieving proper half-tones. Formerly, the press operator would assume that the screens were not cleaning up properly and adjust the water feed rate. The next run had proper half-tones, but black ink density was too low. The PMT negative was checked to determine the correct half-tone. The operators adjusted the rollers, and achieved good print quality. Monitoring roller settings became part of routine.

Woolverton recognizes the value of flexible press operators willing to try new products. "Before, the press operator would use alcohol to cover up little problems but then spend half a day trouble-shooting a problem when all the little ones added up," said Mitch Weinberg.

Giving the press operators the tools to measure fountain solution conductivity,

pH and roller settings based on paper type makes them more involved in the print process. When a problem comes along, like roller settings, minor changes can be made that prevent the loss of valuable time later.

Despite the success Woolverton has had with the alcohol free fountain solution, its testing is not complete. All three Heidelbergs have different dampening systems. Woolverton intends to try other products even though the first alcohol substitute worked.

United States Environmental Protection Agency

Pollution Prevention and Toxics (7406)

EPA 744-K-93-001
October 1995

A Cooperative Project between the U.S. Environmental Protection Agency and the Printing Trade Associations Nationwide

design FOR THE ENVIRONMENT

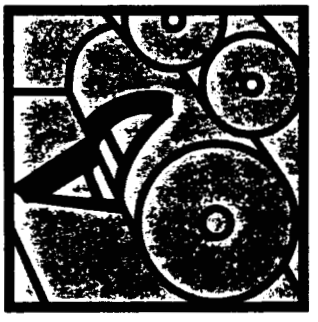
PRINTING PROJECT

EPA 744-K-93-001

LITHOGRAPHY CASE STUDY 1

MANAGING SOLVENTS AND WIPES

CASE STUDY 1



LITHOGRAPHY

Being responsive to the environment means learning new procedures and using new tools to do the same job with less hazard. Decisions about the purchase of equipment and chemicals for press rooms or other production processes depend not only on cost, availability, and performance, but also on whether environmental requirements can be met. Meeting environmental requirements means understanding the comparative human and ecological risks of the alternatives being considered.

This case study is brought to you by the U.S. Environmental Protection Agency's (EPA's) Design for the Environment (DfE) Program. Through the DfE Program, government and industry are working together to identify alternative products and processes that are safer for the environment.

This is the first in a series of case studies that EPA is developing to illustrate how the DfE theme can be applied to lithographic printing operations. This study describes a successful pollution reduction program at the John Roberts Company in Minneapolis, Minnesota. Although the company did not have access to risk and impact information, the way in which it searched out safer alternatives illustrates how printers can achieve significant environmental results.

In particular, this case study illustrates:

- How a self-audit of solvents used in printing operations led to the substitution of more environmentally appropriate solvents.
- How the use of a centrifuge to extract solvents from industrial wipers prior to laundering resulted in reduced solvent in the laundry's wastewater.
- How this company saved money through its efforts to use safer solvents and reduce waste.

The story of this company's experience and the steps it followed show how problems can become opportunities and how environmental planning can be good for business.

Background

The John Roberts Company is a commercial printer of annual reports, brochures, catalogs, forms, limited edition fine art prints, and direct mail pieces using both sheet-fed offset and web offset printing processes. The company began to really understand its solvent use practices as a result of a problem encountered by the industrial laundry that washes the company's press wipers. The effluent from the laundry had become a concern to the local regulatory agency that oversees the sanitary sewer system in the Minneapolis metropolitan area.

Understand the Problem

The John Roberts Company uses leased towels as wipers for press cleanup. The company was sending its leased towels to an industrial laundry for cleaning, and with them went a great deal of ink and "spent" solvents. The presence of these solvents in the wipers was creating a problem for the laundry and for the local sanitary sewer system that handles the effluent from the laundry. The two major concerns were volatility and flammability.

The local regulatory agency approached the industrial laundry because too much solvent was being washed out of the towels, causing the vapors from the laundry's effluent to exceed the lower explosive limit (LEL).

The laundry, in turn, asked its major printer customers and a trade association, the Printing Industry of Minnesota, Inc. (PIM), to work out a solution. There were incentives for both parties: the laundry would be able to retain its business, and the printers would be able to continue using leased towels.

Consider Possible Solutions

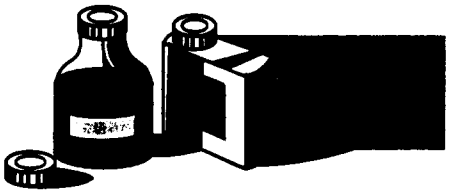
The John Roberts Company decided to concentrate on two main objectives: (1) to change the *nature* of the solvent that was left in the towels from cleaning presses, and (2) to reduce the *volume* of solvent left in the towels.

Change The Nature Of The Solvents

Finding An Alternative

The first step was to examine the nature of the solvents used to clean the presses to see if a less volatile substitute could be used. More information was needed about the tasks solvents must accomplish and the conditions under which these solvents perform.

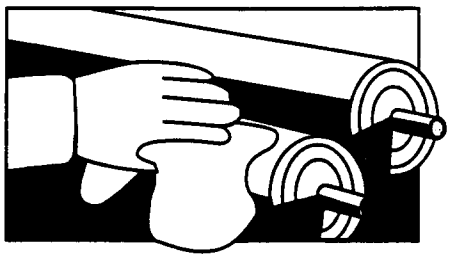
As a result of thorough discussion with everyone involved in the process, the company prepared a list of necessary solvent criteria:



- For washing press blankets, a solvent must work quickly to cut ink, require minimal wiping to remove any oily residue, and dry quickly. Time and the ability to get back up to color quickly is critical during a press run.
- For cleaning the metal parts of a press, a slower-working solvent would be suitable as a general press wash.
- For cleaning the chain of ink rollers, a solvent that is slow to evaporate is needed. This solvent must not flash off before it has gone through the entire sequence of rollers or it will fail to clean them adequately.
- On a limited basis, a very aggressive solvent is needed for removing hardened ink that sometimes collects on the press.

In light of these criteria, the company's first task was to find a blanket wash that balanced these production needs with the environmental needs of less volatility and flammability.

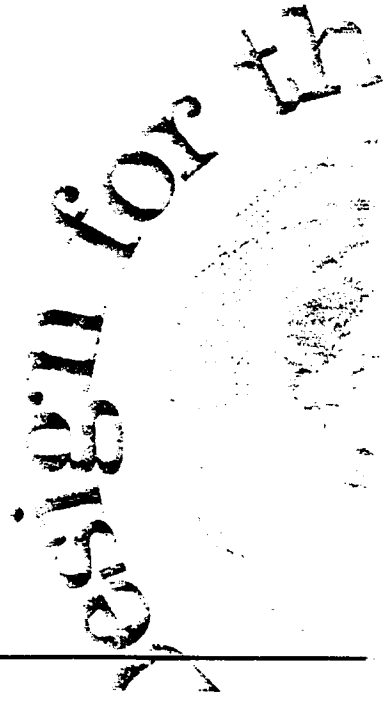
Press operators prefer solvents that do not require a lot of wiping or leave behind an oily film. Unfortunate-



ly, most solvents with these desirable properties also create problems for industrial laundries by exceeding the LEL level. When the John Roberts Company audited its operations, it discovered that press operators had been using a highly volatile solvent called type wash as a general, all-purpose solvent, including for blanket cleaning. This product was a blend of acetone, toluene, methyl ethyl ketone (MEK), and isopropyl alcohol and contributes not only to in-plant volatile organic compounds (VOC's) in the air, but also to problems with the laundry's effluent.

This solvent was never intended for all-purpose use, but using the solvent had become a habit that was hard to break. Because it flashed off so readily, no time was lost by press personnel. It was easy to see why the solvent was so popular.

As the company analyzed the product's properties further, however, it found that almost one half the total vol-



ume of the solvent was wasted. It simply evaporated before the work could be performed! The goal was to find a solvent that was better matched to the tasks it was to perform and that did not substantially affect work procedures or productivity.

Work Together To Implement Changes

It is important to recognize that **it was not sufficient to simply look for a technical solution to the problem.** For success to be possible, the support of upper management was vital, as well as the cooperation and understanding of press personnel. Management gave its support by assuring plant personnel that learning to work with new solvents might involve some procedural changes that could affect productivity slightly, but that small losses would not reflect negatively on overall performance evaluations. **Input was sought from each press person and floor helper.** The reasons why it was necessary to change solvents and how the change was to be accomplished were explained to them.

The raising of awareness in the effort to find a substitute resulted in a

reduction in the misuse of the type wash solvent. Type wash usage was reduced from 152 to 5 fifty-five gallon drums in the first year. The company still uses type wash, but only where its use can be justified. A new replacement solvent, an ultra-fast blanket wash, was blended especially for the company and performed well with respect to speed and lack of an oily film. Only 38 fifty-five gallon drums of this new blanket wash were purchased in the first year. Even after including the purchase of the replacement solvent, the John Roberts Company realized a savings of more than $18,000 in the first year by changing solvents and using them more prudently. More importantly, by selecting a replacement solvent with a lower evaporation rate and by strictly limiting the use of type wash, the contribution of vapors from the John Roberts Company to the laundry's effluent no longer exceeded the LEL and was no longer a concern.

Make Additional Improvements

There were, however, some lingering concerns with the new solvent. One ingredient in the new blanket wash was 1,1,1 trichloroethane (TCA), which gave the blend some of its performance characteristics, but is being phased out because it is an ozone depleter and a suspected health hazard. TCA will soon be banned by the Montreal Protocol, an international treaty to eliminate the manufacture of ozone depleters.

The company therefore continued its investigation of alternatives, this time with an emphasis on reduction of fugitive VOC emissions. It reformulated its blanket wash to a less volatile press wash that contains no TCA. The company approached its search for a substitute with reduced VOC emissions with the realization that vapor pressure plays an important role. A solvent with a lower vapor pressure will evaporate less readily will release less VOC emissions to the air. Therefore, when the goal is reduction of fugitive VOC emissions, volatility should be considered.

Early results from this change show that because considerably less solvent is lost to the air through evaporation, the company is purchasing four fewer drums of solvent each month. However, four more drums of spent solvent are removed from the rags and sent off-site for fuel blending. In spite of the costs to manifest and ship this solvent, the company still saves $100 per month. In addition, the John Roberts Company has lower fugitive emissions and a healthier workplace.

During trials for new solvent blends, the company's management came to a critical realization: the way in which a product is used is key to its performance. The company found that testing the same product on different presses using different crews produced widely varying results. The success of the solvent changes the company made was due largely to the development of a very specific procedure for solvent use, which was developed by the press operators themselves.

Reduce The Volume Of Solvent

The second objective was to reduce the volume of solvents left in the towels. With the help of its trade association, the Printing Industry of Minnesota, Inc. (PIM), the company began to explore ways to "wring out" the wipers.

The first step was to make sure efforts to train employees not to dump excess solvent in the pile of used

wipers had not eroded. Confident that training had assured that the rags put in the used rag container retained the "minimum" amount of solvent, **the company explored the use of a commercial grade laundry centrifuge to separate out any remaining solvent.** The company was surprised to learn that the "minimum" amount of solvent was much more than originally thought.

Now, before wipers are sent to the laundry, they are spun in a safe, explosion-proof centrifuge, which extracts between 2 1/2 and 3 1/2 gallons of "spent" solvent for every load of approximately 220 wipers. This amounts to quite a lot of solvent over time. The recovered solvent is now reused throughout the plant in a series of parts washers to clean press ink trays, instead of going out with the laundry, and the spent solvent is then sent to a fuel blender. Reuse of this solvent eliminated the purchase of more than one drum a week of virgin solvent for use in parts washers throughout the plant. The centrifuge recovery program has saved the company more than $34,000 in the first year alone, resulting in a quick payback on the $15,000 centrifuge. The centrifuge has also resulted in a sizeable reduction in the volume of solvent sent to the sewer system. Using a centrifuge for this purpose might not be allowed in all states, but other options could be available.

The Design for the Environment Approach

This case study described how a company systematically assessed a problem, applied knowledge acquired through that assessment (along with the assistance of its trade association), and dealt with the problem in its context.

The result is a methodology that is affordable, effective, readily adaptable, and can be transferred to other printers. Environmental benefits demonstrated in this case study include reduced fugitive air emissions, less solvent discharged to the water system, and decreased toxic chemical purchases. Waste solvent is being used for energy recovery. In addition, the company has completely eliminated its use of TCA, and the safety of its work environment was greatly improved.

The methodical evaluation of a problem, leading to solutions aimed at reducing the creation of pollutants at their source, is what EPA's Design for the Environment Program is seeking to encourage. While this story illustrates a method for evaluating alternatives, the company did not have access to important risk information. The DfE Printing Project seeks to provide information to industries and companies (often through their trade associations) on the comparative risk and performance of alternative chemicals, processes, and technologies, so that printers are able to make more informed decisions. EPA will make this information available in the form of a "Substitutes Assessment" later in 1996.

The search for alternative chemicals and new technologies begins with today's success. Assisting in the search for and evaluation of alternatives is the goal of EPA's DfE program. With this case study and others like it, we hope to illustrate the application of this goal and the pursuit of continuous improvement.

If you would like more information about John Roberts Company's experience, contact:

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Telephone: 612-755-5500
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For more information about EPA's Design for the Environment Program contact:
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401 M Street, SW (3404)
Washington, DC 20460
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United States Environmental Protection Agency | Pollution Prevention and Toxics (7406) | EPA744-F-95-005 September 1995

EPA

Design for the Environment
Lithography Project

What Is Design for the Environment?

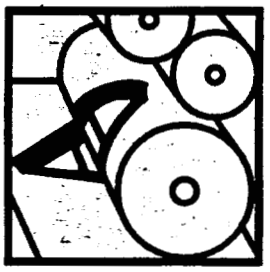
The Design for the Environment (DfE) Program harnesses EPA's expertise and leadership to facilitate information exchange and research on risk reduction and pollution prevention efforts. DfE works with both large and small businesses on a voluntary basis, and its wide-ranging projects include:

- Changing general business practices to incorporate environmental concerns.
- Working with specific industries to evaluate the risks, performance, and costs of alternative chemicals, processes, and technologies.
- Helping individual businesses undertake environmental design efforts through the application of specific tools and methods.

DfE partners include:

- Industry
- Professional Institutions
- Academia
- Environmental and Public Interest Groups
- Other Government Agencies

Blanket Wash Solutions for Small Printers



Why Is EPA Working With Lithographers?

There are more than 52,000 lithographic printers in the United States. These small and medium-sized businesses print materials such as books, brochures, newspapers, magazines, and other items that are fixtures in our daily lives. In doing so, they make an important contribution to the nation's economy.

Offset presses utilized in the industry transfer the printed image from a plate to a rubber or plastic blanket and then to the paper or other medium for the final printed product. The cleanliness of the blanket is a primary concern for producing high-quality images. Blanket washes, consisting of varying types of solvents, are employed in removing ink, paper dust, and other debris from the blanket cylinder. However, some of these solvents can pose risks to human health and the environment. New, potentially less harmful blanket washes are appearing on the market, giving printers the opportunity to reduce impacts on the environment and minimize risks to workers. Testing new blanket washes, however, can be a time-consuming and expensive process.

The Design for the Environment (DfE) Lithography Project is a unique voluntary effort between the lithographic printing industry and the U.S. Environmental Protection Agency that provides information about less polluting materials and process alternatives. DfE's goal in working with printers is to help them make more informed choices by easing the search for and evaluation of cleaner processes, products, and technologies. Since blanket washes are the primary concern, they have been the project's first focus. Through the demonstration of manufacturer supplied, commercially available products at volunteer printing shops, the assessment of associated human health and environmental concerns, and the evaluation of other factors, the project will make information available that will help printers make more informed decisions about the products they bring into their shops.

How Did the DfE Printing Project Get Started?

DfE began working with the printing industry in 1992, when the Printing Industries of America (PIA) requested EPA's assistance in evaluating environmental claims for products. This effort ultimately grew into projects with three separate sectors of the printing industry: lithography, flexography, and screen printing. Each project

addresses a different area of environmental concern: for flexography the focus is on the types of inks used; for screen printing the focus is on screen reclamation; and for lithography the project partners chose to look at blanket washes. DfE lithography partners include PIA, the Graphic Arts Technical Foundation (GATF), the Environmental Conservation Board of the Graphic Communications Industry (ECB), The University of Tennessee, and individual printers and suppliers.

What Has the DfE Lithography Project Accomplished?

DfE's work with the lithographic printing industry is conducted under three distinct project areas: technical studies, implementation, and outreach.

Technical Studies

The DfE Lithography Project focused its efforts on developing specific risk, performance, cost, and other technical information on blanket washes to help small and medium-sized lithographic printers. The project partners agreed to focus their efforts initially on the needs of small shops using small (less than 26" wide) presses.

The DfE Lithography Project is examining the environmental and human health risks of more than 38 potential substitute blanket washes. The project is collecting health hazard and environmental release information (i.e., releases to air, water, land) associated with the use of generic formulations found in these blanket washes.

Between November 1994 and February 1995, performance evaluations were conducted. Performance was evaluated in two phases: 1) GATF's laboratory performed screening evaluations of certain characteristics of the blanket washes, and 2) eighteen printing shops across the country volunteered to provide performance information under real world conditions of production. These shops used the substitute blanket washes for one week. Press operators at the shops recorded the amount of product used, the length of time needed to clean the blanket cylinders, and their opinion of how well the products worked.

The information collected in the performance demonstration is being used to develop cost data for each of the demonstrated blanket washes. In addition, the DfE Lithography Project is identifying simple workplace practice changes, pollution prevention options, and other steps that printers can implement easily and cheaply.

Information on the comparative risk, performance, and cost of each of the substitute blanket washes will be included in the DfE Lithography Project's full technical report—the Blanket Wash Cleaner Technologies Substitutes Assessment (CTSA). A draft of this document should be available for comment in the fall of 1995.

Implementation Efforts

In an effort to encourage pollution prevention in the lithography sector of the printing industry, the DfE Lithography Project is developing a variety of technical assistance for lithographic printers. For example, plans are in place to develop computer software that can help lithographic printers assess the profitability of pollution prevention investments using total cost assessment techniques. DfE is also planning to conduct pilot workshops for lithographic printers on how to use the software.

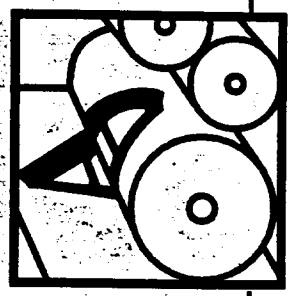
Outreach Activities

The project will create different informational materials based on the Blanket Wash CTSA. The project partners will produce a simple, concise brochure to explain to printers the results of the technical work. A series of case studies will also be developed to help lithographic printers sort through some of the different factors that can make one product a more attractive substitute than another. Other information products geared to small and medium-sized printers will also be developed.

How Can I Get More Information?

To learn more about the Lithography Project of EPA's Design for the Environment Program or to obtain the documents described in this fact sheet, contact:

EPA's Pollution Prevention Information Clearinghouse (PPIC)
U.S. Environmental Protection Agency
401 M Street, S.W. (3404)
Washington, DC 20460
Tel: 202 260-1023
Fax: 202 260-0178



NEENAH PRINTING

MENASHA CORPORATION

Waste Reduction at Neenah Printing
A Division of Menasha Corporation

The Neenah Printing Division employs approximately 340 people in its four locations which are located in Neenah, WI. The Neenah Printing - Commercial Plant uses sheetfed offset printing to produce commercial printing, folding cartons, litho labels and mattress labels. Our Wide Web Flexo Plant uses wide web flexographic presses to print on paper, tyvek, mylar, plastic, and other substrates. The Web/Forms Plant produces business forms and direct mail promotional pieces using web offset printing. Our Distribution Center provides custom fulfillment and distribution services to meet our customers needs. The following is a brief summary of some successes in Neenah Printing's environmental program.

ENVIRONMENTAL PROJECTS

Neenah Printing Division of Menasha Corporation is the perfect example of how small projects can lead to big steps in preserving the environment. Each of its four plants voluntarily participates in pollution prevention in some way, and all are well below limits on emissions and discharges.

Inks...

At the Wide Web Flexo Plant, significant gains have been made in switching from solvent-based to water-based inks. By working closely with customers, ink vendors, and press operators, the plant has significantly reduced the amount of solvent-based ink used at the plant. The percentage of water-based ink usage has risen from 81% in 1993 to a current level of 94%. This push to reduce solvent-based ink usage has resulted in hazardous waste reduction, less VOC air emissions, reduced usage of solvents for clean-up and ink reductions, and improved working conditions for employees.

The Wide Web Flexo Plant formerly used water-based inks having flash points low enough to cause the waste ink to be classified as hazardous waste. Employees worked with that plant's water-based ink suppliers to have solvent content of the water based inks reduced, so that any waste water-based ink would have a flash point above 140 °F. This was accomplished and the result was that this waste stream was reclassified as non-regulated waste and hazardous waste generation was significantly reduced.

In late 1993, the Commercial Plant along with the in-house ink vender began using a computerized in work-off program to take excess inks and re-blend them into different PMS colors. This program re-blended approximately 780 pounds of ink in 1994 and 800 pounds of ink in 1995. This excess ink otherwise would have been shipped off as non-regulated waste for fuel blending. The Commercial Plant's in-house vendor also has the ability to take excess inks that can not be re-blended into other PMS colors and make them into black ink. This ability further reduced the amount of non-regulated ink that had to be disposed of.

Soy-based inks account for over 80% of all sheetfed offset inks used at the Commercial Plant. This percentage is up from the 1993 level of 50%. The usage of soy-based inks since 1992 has limited increases of VOC emissions when compared with production growth.

Neenah Printing's Web/Forms Plant continues to use 100% soy based or UV inks. Petroleum-based offset web form inks have not been used at this facility since 1992. The use of lower VOC soy-based inks and zero VOC UV inks have contributed to this facility's low emissions of VOCs.

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1-800-937-1115 Wats
414-751-1798 Fax

Non-Alcohol Fountain Solution...
1995, Neenah Printing's Commercial Plant successfully switched its last presses from alcohol fountain solutions to non-alcohol fountain solutions. This project took over three years to find the proper fountain solution that would work on all nine large and four small sheetfed offset presses. The project involved members of the pressroom working closely with our chemical suppliers to select, test, and evaluate many different solutions until the proper solution was found. In addition, the Web/Forms Plant has successfully run "alcohol free" on its six web offset presses since 1992.

Silver Recovery...
The Commercial Plant has three silver recovery units which are periodically checked or tested to insure that they are properly removing silver from our waste water discharge. In 1994, the plant added secondary silver removal units to increase the percentage of silver removed from our waste water discharge.

Chemical Management...
All new chemicals are approved (or denied) by the Environmental & Safety Manager prior to the chemical being used. This ensures that the chemicals which are used are safe to use, easily recycled, reused, or disposed of and do not pose a risk to employees or the environment.

Environmental Stewardship...
Neenah also demonstrates its emphasis on environmental stewardship by participating in the Buy Recycled Business Alliance and by promoting environmental awareness in the workplace.

RESULTS

In 1990, the Wide Web Flexo Plant's hazardous waste generation peaked at 79,062 pounds. In 1995, the plant generated only 31,751 pounds of hazardous waste. Coinciding with this, the plant's VOC air emissions which peaked at 89.7 tons in 1987 have gone down to 29.1 tons in 1995.

In 1992, the Commercial Plant's hazardous waste generation peaked at 25,511 pounds. This has been greatly reduced to a level of 304 pounds in 1995. This facility's VOC air emissions were at 19.2 tons in 1995, which is slightly lower than the previous year even with a significant increase in production.

The Web/Forms Plant ceased generating hazardous waste on January 31, 1992. This facility's VOC emissions are holding steady at approximately 1.8 tons per year.

The Neenah Printing - Commercial Plant has removed 106.26 pounds of silver from our process waste water discharge to the sanitary sewer since 1988.

AWARDS

Neenah Printing Division has received the following environmental awards for its environmental program:

1994	Wisconsin Manufacturers & Commerce Business Friend of the Environment Award
1996	Associated Recyclers of Wisconsin Business Recycler of the Year

FOR MORE INFORMATION

For more information about Neenah Printing's pollution prevention programs, contact:

Peter A. Schmitz
Environmental & Safety Manager
Neenah Printing
2255 Brooks Avenue
P.O. Box 506
Neenah, WI 54747-0506
414/751-1700

Green and
Profitable Printing

III. SUPPLEMENTAL MATERIALS:

D. Worksheets

Using Worksheets to Assess Your Shop's Operations

The worksheets provided in this packet were taken from a number of sources, which are identified at the botton of each sheet. They were specifically selected as being likely to be of value to printers who want to identify pollution prevention opportunities within their shops.

We encourage you to make copies of these worksheets and use them as applicable in your shop. Feel free to make changes to these sheets or to design your own as you see fit.

The worksheets are organized into sections based on the pollution prevention steps that have been outlined in this video conference. The first five worksheets are designed to help you evaluate your facility from a birds-eye view. They help you look at your processes, the products you use and the wastes you create in order to identify which processes you might want to look at more closely to reduce wastes or improve productivity.

The second set of worksheets help you evaluate a particular process in a greater level of detail. After selecting a process you'd like to improve or a waste you'd like to reduce, you'll examine the inputs that go into a particular process as well as the wastes and emissions which are created. These worksheets will help you apply the three major pollution prevention strategies — modifying the *process*, the *inputs*, or the *product* itself — to your shop operations to begin reducing waste and saving money. At this point you'll be able to identify where your shop currently is on the pollution prevention spectrum.

The third set of worksheets present possible pollution prevention and waste minimization opportunities you may want to apply to the processes you have selected for evaluation. These are presented in the form of "best management practices", broken down into low cost practices you can adopt immediately, advanced practices which require some operating changes, and alternative technologies which require new equipment purchase. These sheets can be used to help you track your progress and set goals for future pollution prevention projects.

Finally, the last set of worksheets are designed to help you select among potential pollution prevention projects to find those that are most cost-effective and feasible for your shop. These worksheets will help you weigh the advantages of different projects as well as calculate the expected investment payback that accompanies waste reduction projects.

WORKSHEET 1 - SELF-ASSESSMENT ENVIRONMENTAL GUIDE FOR PRINT SHOP OWNERS OR MANAGERS

Commitment

- How have you demonstrated your environmental goals and objectives to employees (actions, memos, posters etc.)?
- Which materials or chemical products have been targeted for pollution prevention or waste minimization activities (paper, cleanup solvent, isopropyl alcohol, etc.)?
- What specific measurable goals have been established for environmental activities (i.e., obtain PTI for new press, eliminate using isopropyl alcohol in six months)?

Communication

- By what means (*HAZCOM* training, informal department meetings, etc.) have you discussed the importance, and benefits, of reducing chemical product usage, lowering emissions and reducing waste disposal amounts?
- When (and how) was the last time an employee was recognized for his/her environmental efforts?
- What would your employees tell an inspector about your environmental program?

Training

- Which employee training programs explain your expectation for environmental performance, *pollution prevention*, or waste minimization?
- What initial and ongoing training is provided to employees who have been assigned environmental responsibilities?

Baseline Assessment

- Do you know your total facility (and press-by-press) VOC emissions over the last 12 months?
- Do you know the *potential emissions* of hazardous air pollutants (*HAPs*) from your facility?
- Which chemical products (cleanup solvent, ink, isopropyl alcohol, etc.) have experienced a decrease in usage over the last two years?
- Do you know which operations (plate processing, film processing, fountain solution, etc.) discharge to a *POTW* (the sanitary sewer) versus discharge to a stream or ditch on your property?
- Which materials are disposed or recycled off-site (and where are they disposed/recycled)?
- Do you generate *hazardous wastes*? (Are you sure?)
- If you generate *hazardous waste*, how much per month?

Documentation

- When was the last time your operation was inspected by a regulatory agency?
- What system do you have to track and record chemical product usage?
- Where are records kept to document permits or exemptions for every printing press?
- What systems do you have for updating and tracking *MSDSs* for every chemical product?

Operational Discipline

- Have employees, customers or visitors commented on odors (from inks, solvent or other chemical products)?
- What materials, wastes, equipment, etc. are stored, staged or kept outside your facility?
- How would you rate the overall housekeeping (inside and outside) of your facility?
  Excellent / Good / Needs Improving

The following forms and information are presented for your use and reference. Because it is critical to be thorough and complete, additional space will be required in certain sections. It is suggested these forms are photocopied for convenience.

WASTE MINIMIZATION ASSESSMENT WORKSHEETS

Formal Waste Minimization Status
Date:_____
Prepared By: _____
Does this business have a formal waste minimization program? (Yes or No)
If yes, who is responsible for overseeing the program?_____
Describe the goals of the program and results:

_____
_____
_____
_____
_____

Has a waste minimization assessment been performed previously at this business? (Yes or No)
If so, describe the results: _____
_____
Has waste minimization techniques and options been discussed with:

_____
_____
_____

Chemical suppliers? (Yes or No)
Equipment vendors? (Yes or No)
Regulatory agencies? (Yes or No)
If so, describe the results:

_____
_____
_____
_____

Does this business have emission or waste disposal problems now?
Aqueous effluent: (Yes or No)
Air emissions: (Yes or No)
Solid waste: (Yes or No)
If the answer is YES, describe the problem(s):

_____
_____
_____
_____

PROCESSOR OPERATIONS

Date:_____
Prepared By: _____
Are formalized operating procedures used to control your processing operations? (Yes or No)
If your answer is YES:
Are these problems in writing? (Yes or No)
Are these procedures available to each processing work area? (Yes or No)
Do these procedures include replenishment rates, wash water flow rates and the use of test strips? (Yes or No)
Do the procedures include operation and maintenance of silver recovery equipment? (Yes or No)
Are your processors inspected regularly? (Yes or No)
If the answer is YES, do the inspections include:
Equipment leaks? (Yes or No)
Replenishment rates and wastewater flow settings? (Yes or No)
Chemical and wash water flows shut off when processor is not being used? (Yes or No)
Covers on photoprocessing chemicals containers when not being used? (Yes or No)
How are chemical replenishment rates set?

_____
_____

Use test strip:
Operator experience_____
Processor Instructions_____
Other_____
Chemical supplier recommendations_____
_____

When are batch chemical solutions discarded?_____
When product quality degrades?_____
After a pre-set time? _____
When production run is finished? (e.g. weekly)_____
Other _____
How are rinse water rates set?_____
Use test strips: _____
Operator Experience_____
Processor instructions_____
Other _____
Chemical supplier recommendations _____
_____
How is rinse water used? _____
Once-through _____
Still rinse_____
Usages per week _____
Recycled Flowing rinse_____
Recycled through clean-up system _____
Are any chemicals recovered and reused? (Yes or No)
If so, list:
_____
_____
_____
Meeting format (e.g., brainstorming, nominal group technique)
Meeting Coordinator _____
Meeting Participants_____
Suggested Waste Minimization Options ____
_____
_____
Currently use _____
_____
Done (Yes or No)_____
Rational/Remarks on Options_____
_____

Records of Waste Sources _____
_____
Waste/Materials Documentation _____
_____
Provide Operating Manuals/Instructions (Yes or No)
Employee Training (Yes or No)
Increased Supervision (Yes or No)
Establish Waste Minimization Policy (Yes or No)
Set Goals for Source Reduction_____
Set Goals for Reduction _____
Set Goals for Recycling_____
Set Goals for Implementation Plans _____
Date Implemented_____
Results _____
_____
Monitoring done by whom/when_____
_____
Conduct Annual Assessments _____
Test Strips used (Yes or No)
Recover Silver from Effluents (Yes or No)
Regenerate Bleach or Bleach-Fix (Yes or No)

SILVER RECOVERY

Date:_____
Prepared By:_____
Has the quantity of silver reprocessed been determined? (Yes or No)
If no, estimate the amount based on film processed: _____
Enter quantity processed:_____Troy oz./mo.
Is silver now recovered from:
Fixer solutions (Yes or No)
Bleach or bleach-fix solutions (Yes or No)
Rinsewater (Yes or No)
Combined aqueous effluents (Yes or No)
Silver-bearing solids (e.g., paper, film) (Yes or No)
Quantity of silver recovered:
_____Troy oz./mo.

Quantity of silver potentially recoverable:_____Troy oz./mo.

Which silver recovery processes are used?

On which streams?

Metal replacement (one cartridge)

Metal replacement (series cartridge)

Electrolytic

Batch electrolytic

Precipitation

Ion Exchange

(two or more processes)

METALLIC REPLACEMENT

Do you use silver test strips on the discharge water to make sure that the canister is operating efficiently? (Yes or No)

Do you change the canister immediately whenever the test strip indicates?(Yes or No)

Do you inspect the canister system regularly for the following:

Leaks from the hose connections? (Yes or No)

Date checked:_____

Plugging and channeling? (Yes or No)

Date checked:_____

Do you make sure that your canister has a constant flow of solution running through it? (Yes or No)

ELECTROLYTIC RECOVERY

Do you check the current on the electrolytic unit(s) regularly (at least daily) to ensure it is within the range specified by the manufacturer? (Yes or No)

If NO, when are checks done?_____

Do you check the unit(s) to ensure that agitation is adequate and cleaned (the cathode or anode and the solution pumps are working)? (Yes or No)

Is a filter used to remove dirt and other particles from the fixer solution before it enters the electrolytic unit? (Yes or No)

Do you use silver test strips on the discharge water daily to make sure that the electrolytic unit(s) is operating efficiently? (Yes or No)

_____

Water savings from water recirculation system:_____

WASTE MINIMIZATION:

Material Handling

Date:_____

Prepared By:_____

A. GENERAL HANDLING INSTRUCTIONS

Are all input materials tested for quality before being accepted from suppliers? (Yes or No)

Describe safeguards to prevent the use of materials that may generate off-spec product:_____

_____

_____

Is obsolete material returned to the supplier?

If YES, what?_____

_____

Is inventory used in first-in, first-out order? (Yes or No)

If NO, inventory method used:_____

Is the inventory system computerized? (Yes or No)

Does the current inventory control system adequately prevent waste generation? (Yes or No)

If NO, proposed action to reduce waste generation:_____

_____

What information does the system track?_____

_____

Is there a formal personnel training program on material handling, spill prevention, proper storage techniques and waste handling procedures? (Yes or No)

Does the program include information on the safe handling of the types of drums, containers and packages received? (Yes or No)

Are written procedures available and easily accessible? (Yes or No)

How often is training given and by whom?_____

What spill containment methods are used?

_____

_____

Quality Control Check_____

Return Obsolete Material to Supplier Plan_____

Minimize Inventory_____

Computerize Inventory_____

Formal Training_____

Recycle Film (Yes or No)

B. DRUMS, CONTAINERS AND PACKAGES

Are drums, packages and containers inspected for damage before being accepted? (Yes or No)

By whom:_____

Are employees trained in ways to safely handle the types of drums and packages received? (Yes or No)

Are they properly trained in handling of spilled chemicals? (Yes or No)

Are stored items protected from damage, contamination or exposure to heat, light and air? (Yes or No)

Describe handling procedures for damaged items:_____

_____

_____

Does the layout of the facility result in heavy traffic through the raw material storage area? (Yes or No)

Can traffic through the storage area be reduced? (Yes or No) If YES, how? _____

_____

_____

_____

_____

Are all empty bags, packages and containers that contained hazardous materials segregated from those that contained nonhazardous wastes?

Describe method currently used to dispose ink properly:_____

_____

_____

_____

Hazardous Waste Hauler:_____

Hazardous Waste DOT#:_____

Hazardous Waste Insurance Company:_____

Hazardous Waste Insurance Liability:_____

Raw Material Inspection (Yes or No)

Proper Storage/Handling_____

Pre-mixed Solutions of Recyclable Chemistry_____

Bulk Delivery, if so what?_____

Waste Segregation_____

C. BULK LIQUIDS HANDLING

High level Shutdown/Alarm System_____

Secondary Containment_____

Air Emission Control_____

Leak Monitoring_____

Spilled Material Plan_____

Cleanup Methods to Promote Recycling Procedures_____

WORKSHEET 3

CHEMICAL USE AND PROCESS/APPLICATION INFORMATION RECORD

INSTRUCTIONS: MAKE ONE COPY OF THIS FORM TO DOCUMENT EACH PROCESS/APPLICATION BEING REVIEWED. USE THE FORM TO ORGANIZE THE INFORMATION YOU COLLECTED IN STEPS #1, 2 AND 3 IN THIS CHAPTER.

MATERIAL	QUANTITY PURCHASE COST	USE(S) PROCESS/APPLICATION	REASON(S) FOR USE OR PROCESS	DEGREE OF TOXICITY/ HAZARD

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APPENDIX A

Worksheet 1: Identifying (and documenting) a Hazardous Waste

(to document the type of hazardous waste)

1. Describe the material (e.g. "waste blanket wash"): _____

2. Identify the type of hazardous waste and enter waste code

Type of Hazardous Waste	Applicability (Yes or No)	Waste Code(s)
Ignitable (liquids with flash point < 140°F)		D001
Corrosive (aqueous material with pH < 2.0 or pH ≥ 12.5)		D002
Reactive (normally unstable, reacts violently with water)		D003
Toxic (due to the presence of chemical constituents) (Waste codes D004 through D043)		
Listed Waste - Non-specific sources (Waste codes F001 through D039)		
Listed Waste - Specific source (Waste codes K001 through K136)		
Commercial Chemical Products (Waste codes P001 through P123 and U001 through U359)		
Waste Mixtures (listed hazardous waste and non-hazardous waste, hazardous waste and special nuclear material)		
Waste derived from hazardous waste		

3. Is this determination based on:

   1 - Your knowledge of the waste (attach MSDS or other documentation) or
   2 - Laboratory analysis (attach lab results)

4. Enter proper DOT shipping name and DOT description (required for shipping hazardous waste off-site. Consult with waste disposal company or transporter for assistance).

APPENDIX A

Worksheet 1 - Identifying Wastewater Discharges

(identifies water supply and wastewater discharge location)

Water Supply: Water (for drinking and process use) to the facility is provided by (check those that apply):

_____ Local Water Utility
(may be city, county or private company)

_____
(Insert utility's name)

_____
(Insert utility contact and telephone number)

_____ On-site well[1]

Wastewater: Processes that produce wastewater and where the wastewater is discharged:

Applicable Yes/No	Process	Discharge Location (sanitary sewer, river, stream, ditch, shipped off-site, storm sewer, etc.)
	Film Developing	
	Plate Processing	
	Fountain Solution	
	Cooling Water	
	others...	

If you discharge to the sanitary sewer (POTW - Publicly Owned Treatment Works):

_____
(Enter POTW's name)

_____
(Enter POTW telephone number)

Storm Water: A storm water permit[2] is required if storm water comes in contact with raw materials, wastes, containers, etc.;

Are your waste and raw materials kept inside, or protected from storm water? _____ (Yes or No)

Notes:
1. If you provide drinking water from an on-site well to more than 25 persons, you have certain responsibilities for testing and monitoring the water quality.
2. A storm water permit is also required for construction projects over 5 acres in size.

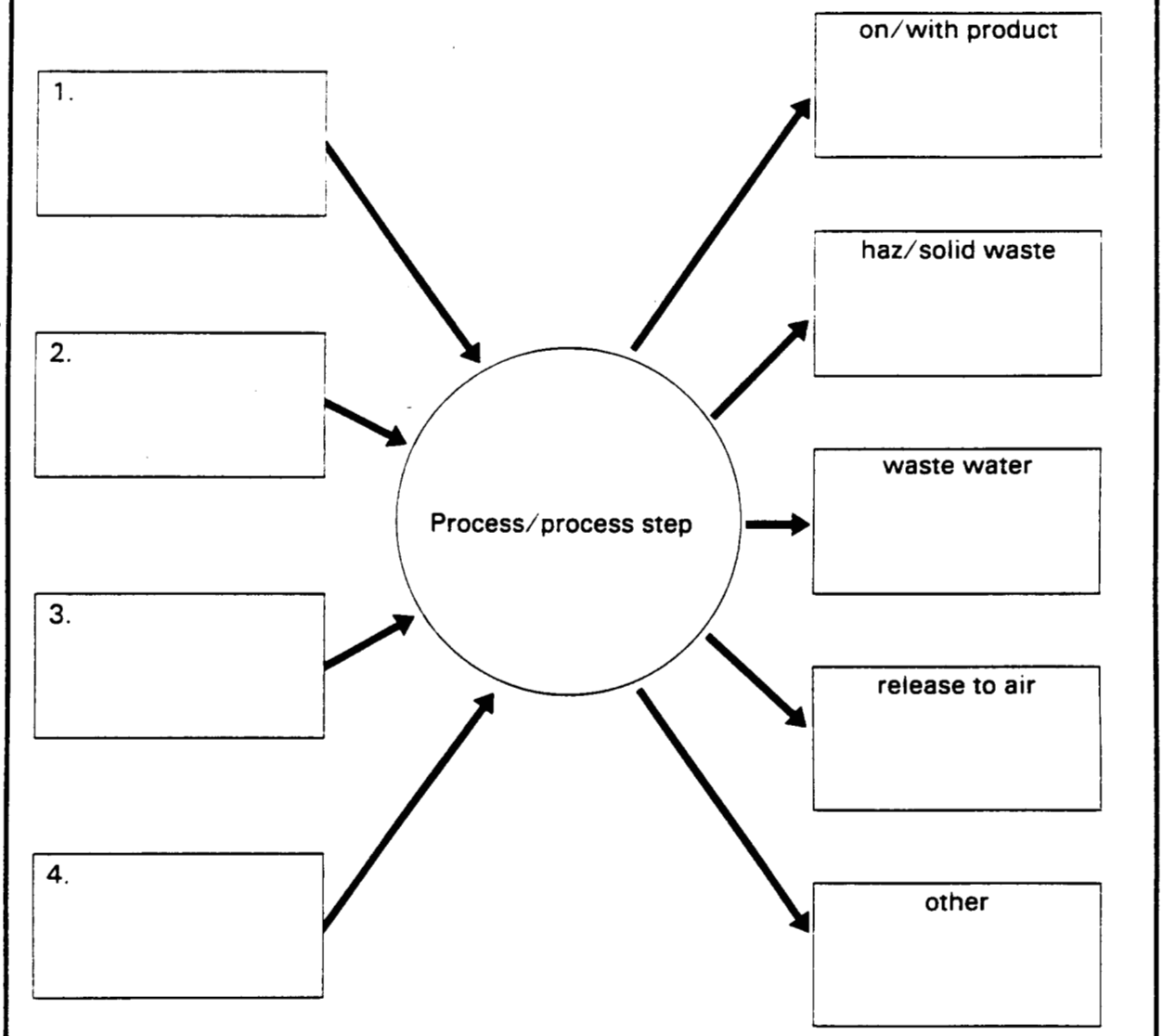
WORKSHEET 4

PROCESS-LEVEL MATERIAL BALANCE

INSTRUCTIONS

COPY AND COMPLETE ONE WORKSHEET FOR EACH PROCESS IDENTIFIED ON WORKSHEET 3 WHICH WILL BE TARGETED. WHERE APPLICABLE, IDENTIFY THE QUANTITY OF PURE CHEMICAL (TARGETED) WHICH IS PRESENT IN THE PROCESS. THEN USE WORKSHEET 5 TO EXAMINE THE PROCESS IN MORE DETAIL.

INPUTS	OUTPUTS



TOTAL INPUT VOLUME	TOTAL OUTPUT VOLUME

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WORKSHEET 6

PROCESS REVIEW CHECKLIST

Instructions: Make one copy for each material to be reviewed.

Date of inspection:
Team member(s):
Material use/waste/release to be observed and verified:
Current pollution prevention practices on this use/waste/release:
Record any undocumented changes to equipment or operations:
Record any possible changes to operating practice:
Other issues to be addressed, during the inspection or later:

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POLLUTION PREVENTION OPTIONS/WORKSHEET 1

STEP 1: EXAMINE THE PRODUCT

QUESTIONS	OPTIONS
PRODUCT DESIGN (SOURCE REDUCTION)	
Does product design require use of toxic materials in later stages of production?	
Could negotiation with the customer produce desirable changes in product formulation or design?	
MATERIALS SUBSTITUTION (SOURCE REDUCTION)	
Would different materials result in a less-hazardous or less-toxic product?	
Do raw materials require use of toxic materials in later stages of production?	

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STEP 2: EXAMINE FABRICATION/FORMULATION

QUESTIONS	OPTIONS
MATERIALS HANDLING (SOURCE REDUCTION)	
Is the form in which raw materials are received constraining design or processing?	
Are materials delivered in just-enough, just-in-time fashion?	
PROCESS MODIFICATION (SOURCE REDUCTION)	
Would upgrading machinery result in less use or release of toxic materials?	
Operational design: do production runs and schedules optimize the use of material?	
PROCEDURES: HOUSEKEEPING (SOURCE REDUCTION)	
What housekeeping or operations procedures cause problems later on?	
PROCEDURES: MAINTENANCE (SOURCE REDUCTION)	
Is maintenance adequate, regularly scheduled, and implemented?	
PROCEDURES: TRAINING (SOURCE REDUCTION)	
Are operators trained in (and using) the most efficient production processes?	
IN-PROCESS RECYCLING/REUSE (ENVIRONMENTALLY-SOUND)	
Are there ways to recycle materials within the production process for later reuse?	
ON-SITE RECYCLING/REUSE (ENVIRONMENTALLY-SOUND)	
Are there ways to recycle materials outside the process, at the facility, in a way that minimizes the risk of worker exposure or release to the environment?	

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STEP 3: EXAMINE SECONDARY PROCESSES

QUESTIONS	OPTIONS
MATERIALS HANDLING (SOURCE REDUCTION)	
Is the form in which raw materials are received constraining design or processing?	
Are materials delivered in just-enough, just-in-time fashion?	
PROCESS MODIFICATION (SOURCE REDUCTION)	
Would upgrading machinery result in less use or release of toxic materials?	
Operational design: do production runs and schedules optimize the use of material?	
PROCEDURES: HOUSEKEEPING (SOURCE REDUCTION)	
What housekeeping or operations procedures cause problems later on?	
PROCEDURES: MAINTENANCE (SOURCE REDUCTION)	
Is maintenance adequate, regularly scheduled, and implemented?	
PROCEDURES: TRAINING (SOURCE REDUCTION)	
Are operators trained in (and using) the most efficient production processes?	
IN-PROCESS RECYCLING/REUSE (ENVIRONMENTALLY-SOUND)	
Are there ways to recycle materials within the production process for later reuse?	
ON-SITE RECYCLING/REUSE (ENVIRONMENTALLY-SOUND)	
Are there ways to recycle materials outside the process, at the facility, in a way that minimizes the risk of worker exposure or release to the environment?	

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Figure 2-1: Where Are You on the Spectrum?

(identify where you fit on this listing of environmental and waste reduction activities)

Process Equipment or Operation	Where Are you on the Spectrum? Environmentally Sound Operation ⇔ Wasted Money and Resources		
Film Processing Fixer	Closed-loop recycling of fixer, with silver recovery	Silver recovery without recycling of fixer solution	Discharge fixer solution to *POTW*, septic tank. May exceed hazardous waste limits
Developer	Aware of hydroquinone in developer, unused developer may be hazardous waste		Discharge unused (old) developer to *POTW*, or septic tank. May exceed hazardous waste limits
Rinse Water	Counter current rinsing, variable flow rate for rinse		Continuous flow of rinse water
Film	Recycling scrap film and recovered silver; Direct plate technology		Throw away scrap or old films
Plate Processing	Recycling aluminum plates; Reuse of plates (back side)	Recycling aluminum plates	Throw used plates in dumpster
	Digital printing systems		
	Closed loop recycling, with off-site metal reclamation, for metal etching solutions		Discharge metal etching solutions directly to sewer
Fountain Solution	Low or Zero-VOC fountain solutions	Replace isopropyl alcohol (IPA) with alcohol substitutes	Non-refrigerated fountain solution with IPA
	Waterless printing		
Blanket and Roller Wash (Cleanup Solvent)	Low vapor pressure (<10 mm Hg @ 20°C) materials (slow to evaporate) or water miscible solvents	Low vapor pressure materials for blanket washes. Higher vapor pressure (faster to evaporate) materials to hard clean roller (spot cleaning)	Use of only higher vapor pressure materials
	No hazardous air pollutants (e.g.,toluene, MEK, trichloroethane)		"Type" Wash; Use of acetone, MEK, toluene
	Automatic blanket washers		
	On-site reclamation of solvent	Off-site solvent reclamation	Off-site disposal of waste solvent
Parts Washers	Non-hazardous waste solvent (flash point >140°F)	Kerosene or mineral spirits	Soak in type wash or other flammable solvents
Shop Towels (Cleanup Rags)	Centrifuge (or other equipment or methods) to remove excess solvent before laundering	Managed laundry service to clean towels	Disposal of used shop towels
Ink	Blending and reuse of inks		Off-site disposal of waste ink
Paper	Recycle waste paper and office paper		Dispose of waste office paper
Housekeeping	Facility is clean, neat and well lighted		Aisles crowded and unkept; Messy floors
Chemical Management	System to track current chemical inventory (chemical inventory)		No tracking of historical chemical usage
	Emphasis on spill prevention		Sloppy handling

Worksheet 1a - Film Developing Pollution Prevention and Waste Minimization Opportunities

(Identifies opportunities, tracks progress)

Best Management Practice **Recommended Practices (in bold)** are followed by Advanced Practices (which require operating changes) and *Alternative Technologies* (which require new equipment) Note: Some practices and technologies will not be feasible for all printers.	**Did It**	**Not Applicable**	**Will Do It by** _____ **(date)**
Treat used fixer prior to discharge to POTW by removing silver with at least two chemical recovery cartridges (canisters) units in series. (Note: See Section 5, Sub-Section 8.) Install clear tubing and sample port between canisters. Sampling can be done to test treatment effectiveness. Brown solution indicates first canister should be replaced. Remove first canister, put second canister in position 1 and add new canister to position 2.			
Fill canisters with water prior to installing to prevent steel wool from dissolving prematurely.			
Track developer and fixer usage to predict effective life of canister silver recovery units.			
Recycle scrap film and silver recovered from treatment equipment (electrolytic and canister systems). Flush canisters with clean water (discharge effluent into new canister) to remove free silver prior to reclaiming silver.			
Discharge non-hazardous developer and fixer to sanitary sewer (POTW). Septic tanks and leach fields may not be designed to handle this waste stream.			
In-line filters for developing machines should be managed by your silver reclaimer. Drain filters completely.			
Keep pH of waste fixer discharged into canister treatment units between 7 and 8 for optimal treatment and preserve canister life. Ensure flow of fixer through canisters is slow enough to properly treat and remove silver.			
Keep chemical baths covered to prevent oxidation of chemicals and retard emissions.			
Use electrolytic silver recovery units to remove silver from spent fixer.			
Reuse fixer (after electrolytic silver recovery process) with assistance from chemical supplier.			
Conserve water with automatic processing units by using clean water for final rinse, then reusing this water for initial rinsing in the preceding stage (countercurrent rinsing). This allows for more cost efficient treatment of wash waters.			
Consider installing "squeegees" (cannot be installed on all developers) to remove excess chemicals prior to immersing film in a different chemical bath. This will reduce chemical carry over (carry over reduces bath life). Hand squeegees can be used for "tray" developing operations.			
Treat fixer wash water using canister or ion exchange units to reduce silver content.			
Consult with chemical supplier about using developer and fixer replenishers and regenerating developer.			
Install acid "stop baths" prior to fixing bath, or use acetic acid, to maintain proper low pH for fix. Higher pH developer will neutralize fix bath pH over time.			
Consult chemical supplier about adding ammonium thiosulfate (hypo) to fixer to increase soluble silver concentrate and extend fixer bath life.			
Use closed loop (zero discharge) recycling of film processing chemicals (off-site recycling such as DuPont's Du-Care Program).			
Use intermittent rinse water flow (no flow when processor is on idle).			
Consider silver-free film (diazo, vesicular, photopolymer, electrostatic or selenium-based).			
Consider direct-to-plate (computer-to-plate) systems.			
Consider Digital Proofing technology.			

Worksheet 1b - Plate Processing Pollution Prevention and Waste Minimization Opportunities

(Identifies opportunities, tracks progress)

Best Management Practice **Recommended Practices (in bold)** are followed by Advanced Practices (which require operating changes) and *Alternative Technologies* (which require new equipment) Note: Some practices and technologies will not be feasible for all printers.	**Did It**	**Not Applicable**	**Will Do It by** _____ (date)
Recycle aluminum plates.			
Recycle or treat metal etching developer solution to remove metals.			
Off-site recycle or dispose of developer used with waterless plates.			
Reuse plates (backside).			
Use presensitized aqueous plates.			
Use closed loop recycling of plate developer coupled with off-site disposal/recycling.			
Use non-hazardous plate developers.			
Use counter current rinsing techniques.			
Use "intermittent" rinse water flow (no flow when processor is on idle).			
Use digital printing systems (direct-to-press).			

Worksheet 1c - Blanket and Roller Washer Pollution Prevention and Waste Minimization Opportunities

(Identifies opportunities, tracks progress)

Best Management Practice **Recommended Practices (in bold)** are followed by Advanced Practices (which require operating changes) and *Alternative Technologies* (which require new equipment) Note: Some practices and technologies will not be feasible for all printers.	**Did It**	**Not Applicable**	**Will Do It by** _____ **(date)**
Use parts washer to clean press trays.			
Check the condition of roller cleanup blades and ensure blade angles are properly set.			
Dispense solvent from safety cans that deliver a controlled amount of solvent to a shop towel.			
Eliminate (or use only on hard to clean spots) use of "type wash" cleaners or cleaners that contain hazardous air pollutants (such as toluene, MEK, and xylenes).			
Use pre-used shop towels for the initial cleaning, then use clean towels for the final cleaning.			
Reduce the VOC content of the cleanup solvents you use, either by using reduced VOC content cleaners or water miscible cleaners.			
Reduce VOC emissions from cleanup solvents by using lower vapor pressure solvents. Use solvents with vapor pressures of 10 mm of Hg (millimeters of mercury) or less, as measured at 20°C (Celsius).			
Use low vapor pressure, low VOC content or water miscible solvents for cleanup activities that do not require instant (or very fast) drying (such as weekly cleanups).			
Collect and reuse cleaning solvent. Used solvent may be perfectly acceptable for initial cleaning applications like cleaning out an ink tray. After the majority of the ink is removed, clean solvent may be used for the final cleaning.			
Recover solvent from shop towels for reuse or recycling using hand wringer or centrifuge equipment.			
Recycle used solvent on-site, either with your own recycling or reclamation equipment or using a vendor who brings a portable recycling unit to your facility.			
Consider automating blanket washers.			

Worksheet 1d - Fountain Solution Pollution Prevention and Waste Minimization Opportunities

(Identifies opportunities, tracks progress)

Best Management Practice Recommended Practices (in bold) are followed by Advanced Practices (which require operating changes) and *Alternative Technologies* (which require new equipment) Note: Some practices and technologies will not be feasible for all printers.	Did It	Not Applicable	Will Do It by _____ (date)
Keep containers with solvents, such as safety cans, closed at all times unless adding or removing solvent from the container.			
Refrigerate your fountain solution. Refrigeration (to about 60°F) will greatly reduce emissions of isopropyl alcohol.			
Switch to low VOC alcohol replacements or substitutes to eliminate isopropyl alcohol from your fountain solution. A switch to an alcohol substitute can reduce VOC emissions on the order of 90 percent and save money as compared to using isopropyl alcohol.			
Make it a management objective to eliminate isopropyl alcohol.			
Install recirculating and automatic mixing units for fountain solution.			
Before trying alcohol substitutes, consult your ink, fountain solution chemistry, plate, and roller and blanket suppliers. Run ink compatibility tests with alcohol substitutes or low VOC one-step fountain concentrates prior to trying them on press.			
Monitor the consistency of the quality of your incoming makeup water over an extended period of time. Since most fountain solutions are mixed to achieve a target conductivity and pH, swings in the incoming water's conductivity, pH, and mineral content can greatly affect the performance of your fountain solution.			
Check roller durometer, especially the metering form roller, to make sure all rollers are within your, or the manufacturers tolerances. Metering form rollers may range from 18 to 30, with many using durometers in the high teens to low twenties.			
Use in-line filters in your recirculating units to reduce or eliminate the need to discharge or dispose of fountain solution.			
Check the content of glycol ethers or other *SARA* reportable chemicals in your alcohol substitute or eliminate the use of these chemicals			
Consider waterless printing technology.			

Worksheet 1e - Inks Pollution Prevention and Waste Minimization Opportunities

(Identifies opportunities, tracks progress)

Best Management Practice Recommended Practices (in bold) are followed by Advanced Practices (which require operating changes) and *Alternative Technologies* (which require new equipment) Note: Some practices and technologies will not be feasible for all printers.	Did It	Not Applicable	Will Do It by _____ (date)
When adding ink to an ink fountain, add enough ink as is required to complete the scheduled job (reduces cleanup time and waste generated).			
Schedule work on presses with a goal to minimize color changes and print station cleanups.			
Eliminate lead, mercury, cadmium and chromium based pigments.			
Use spray anti-skin overnight on ink fountains; keep ink kits sealed to prevent oxidation.			
Recycle and reblend inks (either on-site or off-site).			
Return unused ink to supplier. Reblend specialty colors into house color inks.			
Mix waste inks to make black ink for internal or external use.			
Recycle ink on-site using mobile recycling units.			
Try vegetable oil based inks (such as soy oils). Vegetable oils have lower VOC contents than petroleum oils.			
Consider automatic ink levelers.			
Consider an ink and cleanup system to eliminate solvent based cleaners.			
Consider ultraviolet (UV) and electron beam (EB) curable inks.			

Worksheet 1f - Facility Management Pollution Prevention and Waste Minimization Opportunities

(Identifies opportunities, tracks progress)

Process or Operation	Best Management Practice (All are Recommended Practices) Note: Some practices and technologies will not be feasible for all printers.	Did It	Not Applicable	Will Do It by _____ (date)
General Raw Materials	Use water-based adhesives for finishing.			
	Recycle waste (and scrap) paper.			
	Recycle paper cores.			
	Recycle containers (use deposit only drums).			
	Use non-hazardous (flash point greater than 140°F) parts washer solvent.			
Good Housekeeping	Segregate hazardous wastes.			
	Ensure facility is clean, neat and well lighted.			
Chemical Product Inventory and Tracking	Use oldest materials first.			
	Limit samples to smallest required amount. Ask supplier to take back unused trial chemicals.			
	Inspect incoming materials. Refuse delivery of damaged containers or material.			
	Order bulk purchases (ink, solvent) if practical.			
	Centralize responsibility for ordering and distributing solvents.			
	Use returnable containers.			
	Track chemical purchases and disposals.			
Communication	Establish, communicate, and demonstrate to employees a management commitment to the concept of pollution prevention.			
	Positively acknowledge pollution prevention initiatives by company personnel.			
	Encourage training personnel interested in pollution prevention activities.			
	Incorporate pollution prevention or environmental performance into manager's performance appraisals.			

The following blank version of Acme's worksheet is only one of the possible ways that you can organize your information. Use it as a guide to weight and rank pollution prevention options for your facility.

To fill out the worksheet, first independently weigh each of the criteria on a scale of 1 to 10. For instance, if future liability is your most important business objective, enter a 10 in the left-hand column on worksheet 6. If use and toxicity reduction is moderately important, enter a 6 in the left-hand column of the worksheet.

Once each of the criteria in the left-hand column has been assigned a weight, score each of your pollution prevention options. Your scores will range from 1 (the lowest) to, for instance, 3 if you have 3 options. The score reflects how well each option impacts the criterion. Enter the score in the right-hand column. Acme had three options to choose from, and for each criterion Acme gave the three options a score of 1, 2, or 3, with 3 being the highest score. For instance, for health and safety, Acme decided that option #1 gave the most protection and assigned it a score of 3; option #3 protected health and safety the least and it was assigned a score of 1. If you only have two options, you'll assign a score of 1 or 2 for each criteria. If you have 5 options, for each criteria the options will be given a score of 1,2,3,4, or 5.

The following list of criteria suggests ways to score them for each of your options (a high score for the most desirable option, a low score for the least desirable option):

FUTURE LIABILITY: Give a high score to an option that reduces liabilities associated with environmental issues.

TOXIC CHEMICAL USE AND TOXICITY REDUCTION (POLLUTION PREVENTION): Give high scores to options that reduce the quantity or toxicity of materials used in an operation. Options which do both receive the highest score.

HEALTH AND SAFETY: If options reduce the exposure level and toxicity of process materials for employees and the public, assign a high score.

INPUT COSTS: Options that result in low input costs receive a high score.

EXTENT USED IN INDUSTRY: Off-the-shelf technologies or other options already widely used in industry can be less expensive and more readily available, and receive a high score.

QUALITY: Options which maintain a high level of quality will be given a high score.

LOW CAPITAL COST: Options that can be implemented with low capital outlays should receive high scores.

LOW OPERATING COST: Options with low operating costs, including low maintenance costs, should receive a high score.

EASE OF IMPLEMENTATION: Options requiring little additional employee training, minimal changes in operating procedure, readily available materials and equipment, reduced down-time, little impact on quality, and minimal research and development

needs should be given high scores. If regulatory or delivery deadlines demand speedy implementation, these factors may be especially important, and perhaps should receive even greater scores.

OPERATING PERSONNEL: Options which do not require additions or reductions in personnel, new training efforts and no changes in shifts and procedures should receive a high score.

LEVEL OF CHANGE REQUIRED: Extensive changes may only be possible in new facilities. Options which match a facility's ability to change will receive a high score.

LOCAL SUPPLIER: If transportation is a large element of supply costs or if laws require the use of specified products, options that reduce costs should receive a high score.

WORKER ACCEPTANCE: Options which can be introduced easily to employees and do not violate any contracts or understandings should receive a high score.

FLEXIBILITY: Options which are adaptable to changes in the product, the process, delivery deadlines, or raw materials, or to existing equipment or employee turnover should be highly scored.

WORKSHEET 6

CRITERIA	WEIGHT (1 to 10)	Option #1 (aqueous cleaning) SCORE	Option #1 SCORE × WEIGHT	Option #2 (water-base coating) SCORE	Option #2 SCORE × WEIGHT	Option #3 (powder coating) SCORE	Option #3 SCORE × WEIGHT
Future liability (most liability incurred = 1)							
Use & toxicity reduction							
Health and safety							
Input costs							
Extent used in industry							
Quality (no effect = 3)							
Low capital cost							
Low operating cost							
Easy & fast to implement							
Operating personnel							
Level of change required							
Local supplier							
Worker acceptance							
Flexibility							
Sum by Option (W × S)							
Option Ranking							

KEY: Weight: 1 to 10 scale, 10 being most important Score: 3-2-1, 3 being highest score

Worksheet 2 - Investment Payback Analysis

(calculate payback period for pollution prevention investment)

Project Description:

Capital Costs:

Purchased Equipment	$ _____
Installation	$ _____
Engineering and Procurement (planning, permits, etc.)	$ _____
Startup and Training	$ _____
Misc. Capital Costs (related equipment)	$ _____
Total Capital Costs	$ _____

Annual Operation and Maintenance Cost Savings

Saving in Disposal Costs	$ _____
Savings in Long Term Disposal Liability	$ _____
Savings in Raw Material Costs	$ _____
Savings in Regulatory Compliance Costs	$ _____
Savings in Operating Costs	$ _____
Total Annual O & M Cost Savings	$ _____

$$\text{Payback Period (in years)} = \frac{\text{Total Capital Costs}}{\text{Total Annual O \& M Cost Savings}} = \_\_\_\_\_ \text{ yrs}$$

Green and
Profitable Printing

III. SUPPLEMENTAL MATERIALS:

E. Additional Sources of Assistance

National Printers Trade Associations
(Current as of December 1995)

American Institute of Graphic Arts (AIGA)
212/807-1990
212/807-1799 fax

Association of the Graphics Arts (AGA)
212/279-2100
212/279-5381 fax

Business Forms Management Association
503/227-3393
503/274-7667 fax

Environmenal Conservation Board of the Graphic Communications Industries (ECB)
703/648-3218
703/648-3219

Flexographic Technical Association (FTA)
516/737-6020
516/737-6813

Flexible Packaging Association
202/842-3880
202/842-3841

Graphic Arts Technical Foundation (GATF)
412/621-6941
412/621-3049 fax

Graphics Arts Marketing Information Service/Printing Industries of America (PIA)
705/519-8100

Gravure Association of America (GAA)
716/436-2150
716/436-7689

International Association of Printing House Craftsmen
612/560-1620
612/560-1350 fax

International Digital Imaging Association (IDIA)
910/854-5697
910/854-5956 fax

International Prepress Association
612/896-1908
612/896-0181 fax

National Association of Printers and Lithographers (NAPL)
201/342-0700
201/692-0286 fax

National Association of Printing Ink Manufacturers
201/288-9454
201/288-9553 fax

National Assocation of Quick Printers (NAQP)
312/664-6610
312/321-6869 fax

International Business Forms Industries
703/841-9191
703/522-5750 fax

Newspaper Association of America (NAA)
703/648-1007
703/620-4557

North American Graphic Arts Suppliers (NAGASA)
202/328-8441
202/328-8513 fax

NPES, The Assocation For Suppliers of Printing and Publishing Technologies
703/264-7200
703/620-0994 fax

Screen Printing and Graphic Imaging Association International (SGIA)
703/385-1335
703/273-0456 fax

Technical Association of the Graphic Arts
716/475-6662

on-line Printers' National Environmental Assistance Center

http://www.inhs.uiuc.edu/pneac/pneac.html

Introducing the Printers' National Environmental Assistance Center

Hazardous Waste Research and Information Center
University of Illinois
One E. Hazelwood
Champaign, IL 61820
217-333-8940

Solid & Hazardous Waste Education Center
University of Wisconsin
610 Langdon St. #529
Madison, WI 53703
608-262-0385

Graphic Arts Technical Foundation
4615 Forbes Ave.
Pittsburgh, PA 15213-3796
412-621-6941

Printing Industries of America
100 Daingerfield Rd.
Alexandria, VA 22314
703-519-8114

United States Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

Advisory Council Members

Center for Hazardous Materials Research at the University of Pittsburgh

Council of Great Lakes Governors

Environmental Defense Fund

Flexographic Technical Association

Gravure Association of America

National Institute of Standards and Technology

National Pollution Prevention Roundtable

Screenprinting and Graphic Imaging Association, International

Small Business Assistance Programs

Small Business Development Centers

PURPOSE: EPA's Office of Compliance and the Administrator's Pollution Prevention Policy Staff have partnered with industry and environmental expertsto develop an environmental assistance center for the printing industry which includes compliance assistance and pollution prevention information. This industry is comprised largely of small businesses and is subject to significant regulation. The Center has been set up to initially serve compliance and technical assistance providers, including small business technical assistance programs, small business development centers, regulatory agencies, pollution prevention programs, and key trade associations in the printing industry.

PARTNERS:

- Printing Industries of America
- Graphic Arts Technical Foundation
- Screenprinting and Graphic Imaging Association, International
- Gravure Association of America
- Flexographic Technical Association
- Council of Great Lakes Governors
- National Pollution Prevention Roundtable
- Environmental Defense Fund
- U.S. Environmental Protection Agency
- Hazardous Waste Research and Information Center; Illinois Department of Natural Resources
- University of Wisconsin-Extension, Solid & Hazardous Waste Education Center

CENTER LOCATION: This center uses Internet technology to electronically link trade, government, and university service providers to efficiently provide the most current and complete compliance assistance and pollution prevention information to the printing industry. Computer hardware is maintained at the University of Illinois Champaign-Urbana campus.

INITIAL SERVICES:

- Conduct a needs survey and focus groups with small- and medium-sized printers to identify environmental and compliance needs.
- Provide electronic links to technical information on pollution prevention technologies and regulatory compliance, including Internet-based "listservs," to facilitate sharing of technical expertise to address questions from printers.
- Establish electronic library/repository of information and compliance assistance materials.
- Provide "Best-in-Class" pollution prevention materials
- Develop model training packages for state delivery
- Lend support to Great Printers Project's consolidated reporting project.

CONTACTS:

- Graphic Arts Technical Foundation; Gary Jones (412/621-6941)
- Printing Industries of America; Ben Cooper (703/519-8114)
- Illinois Hazardous Waste Research and Information Center; Gary Miller (217/333-8940)
- University of Wisconsin Solid & Hazardous Waste Education Center; Wayne Pferdehirt (608/265-2361)

Welcome to...

The Printers' National Environmental Assistance Center

Hazardous Waste Research & Information Center
Illinois Department of Natural Resources

Solid & Hazardous Waste Education Center
University of Wisconsin—Extension

The Environmental Information Resource for Printers

GATF
Graphic Arts Technical Foundation

IPA Inc.
Printing Industries of America, Inc.

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The Printers' National Environmental Assistance Center (PNEAC) was established in 1995 to provide environmental assistance to the printing industry. The main approach used by the PNEAC to accomplish this objective is to improve communications and coordination among environmental technical assistance organizations and key printing industry associations.

The goal of this Home Page is to provide access to electronic information about the environmental impacts of printing, effective means to achieve compliance with environmental regulations, successful pollution prevention practices in the printing industry, and descriptions of related projects. Also for your information, a calendar of events is provided. Your comments on this Home Page are welcome. Also, let us know if you have information to add to this directory including additional organizations that should be listed, corrections, case studies, bibliographies, and linkages that should be established to related information on the Internet.

For a text-only version of this page click here

Hot News	Regulatory Initiatives and Requirements	Pollution Prevention Initiatives and Case Studies	Organizations and Information Resources	Conferences and Training	Previously Asked Questions with Answers

This information is printed from the Printers' National Environmental Assistance Center (PNEAC) homepage, http://www.inhs.uiuc.edu/pneac/pneac.html.

Comments, Questions, and E-Mail

ThePrinters' National Environmental Assistance Center is a joint effort of the following:

- ☐ Graphical Arts Technical Foundation (GATF)
- ☐ Printing Industries of America (PIA)
- ☐ Illinois Hazardous Waste Research and Education Center (HWRIC)
- ☐ Solid and Hazardous Waste Research Education Center (SHWEC) at the University of Wisconsin-Extension
- ☐ Sponsored, in part, by a grant from the United States Environmental Protection Agency (USEPA)

This Home Page is maintained by the Illinois Hazardous Waste Research and Information Center (HWRIC). E-mail comments, questions and suggestions to the maintainer George Krumins

APPENDIX A
STATE P2 PROGRAMS

REGION 1

Connecticut Technical Assistance Program
(ConnTAP)
50 Columbus Blvd. 4th floor
Hartford, CT 06106
Phone: 203/241-0777
Fax: 203/244-2017
Contact: Rita Lomasney

Maine Department of Environmental Protection
State House Station #17
Augusta, ME 04333
Phone: 207/287-2811
Fax: 207/287-7826
Contact: Ronald Dyer

Maine Waste Management Agency
160 Capitol Street, SHS# 154
Augusta, ME 04333-0154
Phone: 207/287-5300
Fax: 207/287-5425
Contact: Gayle Briggs

Massachusetts Dept of Environmental Protection
1 Winter Street
Boston MA 02108
Phone: 617/292-5870
Contact: Suzi Peck

Massachusetts Dept of Environment
Office of Technical Assistance
100 cambridge Street
Boston, MA 02202
Phone: 617/272-3260
Contact: Barbara Kelley

Toxics Use Reduction Institute
University of Massachusetts at Lowell
1 University Ave
Lowell, MA 01854
Phone: 508/934-3346
Fax: 508/934-3050
Contact: Janet Clark

Rhode Island Dept of Environmental Management
Office of Environmental Coordination P2 Section
83 Park Street
Providence, RI 02903
Phone: 401/277-3434
Fax: 401/277-2591
Contact: Richard Girasole, Jr.

Vermont Department of Environmental Conservation
Pollution Prevention Division
Hazardous Materials Div West Office Building
103 South Main Street
Waterbury, VT 05676
Phone: 802/241-3888
Fax: 802/241-3296
Contact: Paul Van Hollebeke

REGION 2

New Jersey Department of Environmental Protection
Office of Pollution Prevention
CN423; 401 East State Street
Trenton, NJ 08625
Phone: 609/777-0518
Fax: 609/777-1330
Contact: Jeanne Herb

New Jersey Technical Assistance Program for Industrial Pollution Prevention (NJTAP)
CEES Building University Heights
Newark, NJ 07102-1982
Phone: 201/596-5864
Fax: 201/596-6367
Contact: Kevin Gashlin

New York State Dept of Environmental Conservation
Pollution Prevention Unit
50 Wolf Rd
Albany, NY 12233-8010
Phone: 518/457-2480
Fax: 518/457-2570
Contact: William F. Eberle

Reprinted from the National Pollution Prevention Roundtable's "Pollution Prevention Yellow Pages", September 1994.

Pennsylvania Dept of Environmental Resources
Source Reduction Program
PO Box 8472
Harrisburg, PA 17105
Phone: 717/787-7382
Fax: 717/787-1904
Contact: Meredith Hill

Pennsylvania Technical Assistance Program
Penn State University
117 Tech Center
University Park, PA 16802
Phone: 814/865-0427
Fax: 814/865-5909
Contact: Jack Gido

REGION 3

Delaware Department of Natural Resources
and Environmental Conservation
Pollution Prevention Program
P.O. Box 1401, 89 Kings Highway
Dover, DE 19903
Phone: 302/739-6242
Fax: 302/739-5060
Contact: Andrea Farrell

Virginia Department of Environmental Quality
Office of Pollution Prevention
P.O. Box 10009
Richmond, VA 23240-0009
Phone: 804/762-4344
Fax: 804/762-4346
Contact: Sharon K. Baxter

West Virginia Division of Environmental
Protection, Office of Water Resources
Pollution Prevention Services
2006 Robert C. Byrd Dr.
Beckley, WV 25801-8320
Phone: 304/256-6850
Fax: 304/256-6948
Contact: Barbara Taylor

REGION 4

Alabama Department of Environmental
Management
Special Projects
P.O. Box 301463
Montgomery, AL 36130-1463
Phone: 205/260-2777
Fax: 205/260-2795
Contact: Gary Ellis

Florida Dept of Environmental Resource Mgmt
Pollution Prevention Program
33 SW Second Ave., Suite 800
Miami, FL 33130
Phone: 305/372-6804
Fax: 305/372-6729
Contact: Lori Cunniff

Georgia Department of Natural Resources
Pollution Prevention Assistance Division
7 Martin Luther King, Jr. Drive Suite 450
Atlanta, GA 30334
Phone: 404/651-5120
Fax: 404/651-5130
Contact: G. Robert Kerr

Kentucky Partners
State Waste Reduction Center
Rm 312 Ernst Hall, University of Louisville
Louisville, KY 40292
Phone: 502/852-7260
Fax: 502/852-0964
Contact: Joyce St. Clair

Mississippi Dept of Environmental Quality
Waste Reduction/Waste Minimization Program
PO Box 10385
Jackson, MS 39289-0385
Phone: 601/961-5171
Fax: 601/354-6612
Contact: Thomas E. Whitten

North Carolina Department of Environment,
Health, and Natural Resources
Office of Waste Reduction
P.O. Box 27687
Raleigh, NC 27611-7687
Phone: 919/571-4100
Fax: 919/571-4135
Contact: Gary Hunt

South Carolina Dept of Health & Env Control
Center for Waste Minimization
2600 Bull St
Columbia, SC 29201
Phone: 803/734-4761
Fax: 803/734-5199
Contact: Robert E. Burgess

Univ of South Carolina Inst of Public Affairs
Hazardous Waste Management Research Fund
937 Assembly Street
Columbia, SC 29208
Phone: 803/777-8157
Fax: 803/777-4575
Contact: Doug Dobson

Pennsylvania Dept of Environmental Resources
Source Reduction Program
PO Box 8472
Harrisburg, PA 17105
Phone: 717/787-7382
Fax: 717/787-1904
Contact: Meredith Hill

Pennsylvania Technical Assistance Program
Penn State University
117 Tech Center
University Park, PA 16802
Phone: 814/865-0427
Fax: 814/865-5909
Contact: Jack Gido

REGION 3

Delaware Department of Natural Resources
and Environmental Conservation
Pollution Prevention Program
P.O. Box 1401, 89 Kings Highway
Dover, DE 19903
Phone: 302/739-6242
Fax: 302/739-5060
Contact: Andrea Farrell

Virginia Department of Environmental Quality
Office of Pollution Prevention
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Richmond, VA 23240-0009
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Fax: 804/762-4346
Contact: Sharon K. Baxter

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Pollution Prevention Services
2006 Robert C. Byrd Dr.
Beckley, WV 25801-8320
Phone: 304/256-6850
Fax: 304/256-6948
Contact: Barbara Taylor

REGION 4

Alabama Department of Environmental
Management
Special Projects
P.O. Box 301463
Montgomery, AL 36130-1463
Phone: 205/260-2777
Fax: 205/260-2795
Contact: Gary Ellis

Florida Dept of Environmental Resource Mgmt
Pollution Prevention Program
33 SW Second Ave., Suite 800
Miami, FL 33130
Phone: 305/372-6804
Fax: 305/372-6729
Contact: Lori Cunniff

Georgia Department of Natural Resources
Pollution Prevention Assistance Division
7 Martin Luther King, Jr. Drive Suite 450
Atlanta, GA 30334
Phone: 404/651-5120
Fax: 404/651-5130
Contact: G. Robert Kerr

Kentucky Partners
State Waste Reduction Center
Rm 312 Ernst Hall, University of Louisville
Louisville, KY 40292
Phone: 502/852-7260
Fax: 502/852-0964
Contact: Joyce St. Clair

Mississippi Dept of Environmental Quality
Waste Reduction/Waste Minimization Program
PO Box 10385
Jackson, MS 39289-0385
Phone: 601/961-5171
Fax: 601/354-6612
Contact: Thomas E. Whitten

North Carolina Department of Environment,
Health, and Natural Resources
Office of Waste Reduction
P.O. Box 27687
Raleigh, NC 27611-7687
Phone: 919/571-4100
Fax: 919/571-4135
Contact: Gary Hunt

South Carolina Dept of Health & Env Control
Center for Waste Minimization
2600 Bull St
Columbia, SC 29201
Phone: 803/734-4761
Fax: 803/734-5199
Contact: Robert E. Burgess

Univ of South Carolina Inst of Public Affairs
Hazardous Waste Management Research Fund
937 Assembly Street
Columbia, SC 29208
Phone: 803/777-8157
Fax: 803/777-4575
Contact: Doug Dobson

REGION 5

Illinois Environmental Protection Agency
Office of Pollution Prevention
2200 Churchill Road P.O. Box 19276
Springfield, IL 62794-9276
Phone: 217/782-8700
Fax: 217/782-9142
Contact: Michael J. Hayes

Illinois Hazardous Waste Research and Information Center
One East Hazelwood Drive
Champaign, IL 61820
Phone: 217/333-8940
Fax: 217/333-8944
Contact: David Thomas

Indiana P2 & Safe Materials Institute
1291 Cumberland Ave. Suite C1
West Lafayette, IN 47906
Phone: 317/494-6450
Fax: 317/494-6422
Contact: Lynn A. Corson, Ph.D. or Jim Noonan

Indiana Dept of Environmental Management
Office of P2 and Technical Assistance
100 North Senate Avenue P.O. Box 6015
Indianapolis, IN 46206-6015
Phone: 317/232-8172
Fax: 317/233-5627
Contact: Tom Neltner

Michigan Depts of Commerce & Natural Resources Environmental Services Division
Office of Waste Reduction Services
P.O. Box 30004
Lansing, MI 48909-7504
Phone: 517/335-1178
Fax: 517/335-4729
Contact: Nan Merrill

Minnesota Office of Environmental Assistance
1350 Energy Lane, Suite 201
St. Paul, MN 55108
Phone: 612/649-5750
Fax: 612/649-5749
Contact: Kevin McDonald

Minnesota Pollution Control Agency
Environmental Assessment Office
520 Lafayette Road
St. Paul, MN 55155
Phone: 612/296-8643
Contact: Eric Kilberg

Ohio Environmental Protection Agency
Pollution Prevention Section
1800 Watermark Dr.
PO Box 163669
Columbus, OH 43266-3669
Phone: 614/644-3469
Fax: 614/644-2329 or 614/728-1245
Contact: Michael W. Kelley

Wisconsin Department of Natural Resources
Hazardous Waste Minimization Program
PO Box 7921
Madison, WI 53707
Phone: 608/267-3763
Fax: 608/267-2768
Contact: Lynn Persson

Wisconsin Department of Natural Resources
Pollution Prevention Program
PO Box 7921
Madison, WI 53707
Phone: 608/267-9700
Fax: 608/267-5231
Contact: Tom Eggert

REGION 6

Oklahoma Department of Environmental Quality
Pollution Prevention Program
1000 NE 10th Street
Oklahoma City, OK 73117-1212
Phone: 405/271-1400
Fax: 405/271-1317
Contact: Dianne Wilkins

Texas Natural Resource Conservation Commission
Office of Pollution Prevention and Recycling
P.O. Box 13087
Austin, TX 78711-3087
Phone: 512/239-3100
Fax: 512/239-3165
Contact: Andrew C. Neblett

University of Texas at Arlington
Environmental Institute for Technology Transfer
PO Box 19050
Arlington, TX 75080
Phone: 817/273-2300
Fax: 817/794-5653
Contact: Gerald Nehman

REGION 7

Iowa Department of Natural Resources
Waste Reduction Assistance Program
Wallace State Office Bldg
Des Moines, IA 50319-0034
Phone: 515/281-8941
Fax: 515/281-8895
Contact: Larry Gibson

Iowa Waste Reduction Center
University of Northern Iowa
Cedar Falls, IA 50614-0185
Phone: 319/273-2079
Fax: 319/273-2926
Contact: John L. Konefes

Kansas Department of Health and Environment
Office of Pollution Prevention
Building 740, Forbes Field
Topeka, KS 66620
Phone: 913/296-6603
Fax: 913/296-6247
Contact: Theresa Hodges

Missouri Department of Natural Resources
Technical Assistance Program
Pollution Prevention Unit
P.O. Box 176
Jefferson City, MO 65102
Phone: 314/526-6627
Fax: 314/526-5808
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REGION 8

Colorado Dept of Public Health & Environment
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4300 Cherry Creek Drive South
Denver, CO 80222
Phone: 303/692-3003
Fax: 303/782-4969
Contact: Parry Burnap

Montana Pollution Prevention Program
Montana State University Extension Service
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Bozeman, MT 59717
Phone: 406/994-3451
Fax: 406/994-5417
Contact: Karen Bucklin Sanchez

State of Montana Water Quality Division
PO Box 200901
Helena, MT 59620
Phone: 406/444-7343
Fax: 406/444-1374
Contact: Patrick Burke

Energy and Environmental Research Center
University of North Dakota
PO Box 9018
Grand Forks, ND 58202-9018
Phone: 701/777-5000
Fax: 701-777-5181
Contact: Gerald Groenewold

North Dakota Department of Health
Environmental Health Section
P.O. Box 5520
Bismark, ND 58502-5200
Phone: 701/221-5150
Fax: 701/221-5200
Contact: Jeffrey L. Burgess

South Dakota Dept of Environment & Natural Resources
Joe Foss Building
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Pierre, SD 57501-3181
Phone: 605/773-4216
Fax: 605/773-4068
Contact: Dennis Clarke

Utah Department of Environmental Quality
Office of Planning and Public Affairs
168 N 1950 W, P.O. Box 144810
Salt Lake City, UT 84114-4810
Phone: 801/536-4477
Fax: 801/536-4401
Contact: Stephanie Bernkopf

Wyoming Department of Environmental Quality
Solid and Hazardous Waste Division
122 West 25th Street
Cheyenne, WY 82002
Phone: 307/777-6105
Fax: 307/777-5973
Contact: Patricia Gallagher

REGION 9

Arizona Department of Environmental Quality
3033 N Central Ave
Phoenix, AZ 85012
Phone: 602/207-4247 or 800/234-5677
Fax: 602/207-4346
Contact: Linda Allen

California State Department of Toxic Substances Control
Office of Pollution Prevention and Technology Development
P.O. Box 806
Sacramento, CA 95812-0806
Phone: 916/322-3670
Fax: 916/327-4494
Contact: David Hartley

State of Hawaii Department of Health
Environmental Management Division
919 Ala Moana Blvd.
Honolulu, HI 96814
Phone: 808/586-4226
Fax: 808/586-4370
Contact: Jane Dewell, Waste Minimization Coordinator

Nevada Small Business Development Center
Business Environmental Program
MS-032 University of Nevada at Reno
Reno, NV 89557-0100
Phone: 702/784-1717
Fax: 702/784-4337
Contact: Kevin Dick

REGION 10

Guam Environmental Protection Agency
IT & E Harmon Plaza Complex Unit D-107, 130 Rojas Street
Harmon, Guam 96911
Phone: 671/646-8863/5
Fax: 671/646-9402
Contact: Fred Castro

Idaho Division of Environmental Quality
Prevention and Certification Bureau
1410 North Hilton
Boise, ID 83706
Phone: 208/334-5860
Fax: 208/334-0576
Contact: Katie Sewell

Oregon Department of Environmental Quality
Waste Reduction Assistance Program
811 SW 6th Ave
Portland, Oregon 97204
Phone: 503/229-5918
Fax: 503/229-6977
Contact: Sandy Gurkewitz

Washington Department of Ecology
Hazardous Waste and Toxics Reduction Program
P.O. Box 47600
Olympia, WA 98504-7600
Phone: 206/407-6705
Fax: 206/407-6715
Contact: Peggy Morgan

National Small Business Environmental Resources
Quick Reference List

Federal Hotlines

Chemical Information: Chemical Referral Center (Chemical Manufacturers Association)
9 am - 6 pm EST, M-F
800/262-8200
800/424-9346

Chemical Safety: Emergency Planning and Community Right-to-Know Act (EPCRA)
8:30 am - 7:30 pm EST, M-F
800/535-0202

Groundwater/Stormwater: US EPA Office of Water Resource Center
202/260-7786

Ozone Depleting Chemicals: Stratospheric Ozone (Clean Air Act - CAA)
800/296-1996

Pesticides: National Pesticide Telecommunications Network
8 am - 6 pm CST, M-F
800/858-7378

Pollution Prevention: US EPA Information Clearinghouse
8 am - 5:30 pm EST, M-F
703/821-4800

Small Business: US EPA Ombudsman
8 am - 5 pm EST, M-F
800/368-5888

Solid & Hazardous Waste: (RCRA)
8:30 am - 7:30 pm EST, M-F
800/424-9346

Spill Response: National Response Center (US Coast Guard)
24 Hours
800/424-8802

Superfund (CERCLA)
8:30 am - 7:30 pm EST, M-F
800/424-9346

Toxic Substances: Toxic Substances Control Act (TSCA) and Asbestos
8:30 am - 5:30 pm EST, M-F
202/554-1404

Transportation: Hazardous Materials (US DOT)
9 am - 4 pm EST, M-F
202/366-4488

Underground Storage Tanks (USTs)
8:30 am - 7:30 pm EST, M-F
800/424-9346

Water: Safe Drinking Water
9 am - 5:30 pm EST, M-F
800/426-4791

Printing-Related Homepage Sites on the Internet

Printers' National Environmental Assistance Center (PNEAC) - The PNEAC is jointly sponsored by the Illinois Hazardous Waste Research and Information Center (HWRIC), the University of Wisconsin's Solid & Hazardous Waste Education Center (SHWEC), the Graphic Arts Technical Foundation (GATF), and Printing Industries of America (PIA). The goal of the center is to provide information about the environmental impacts of printing, and effective means to achieve compliance with environmental regulations.

`http://www.inhs.uiuc.edu/pneac/pneac.html`

GATF Home Page - The Graphic Arts Technical Foundation home page provides information about GATF membership, workshops, products, services, NSTF scholarships, etc.

`http://www.gatf.lm.com`

PIA Home Page - The Printing Industries of America home page provides information about PIA membership and a search feature to locate local PIA members.

`http://www.printing.org`

NAPL Home Page - The National Association of Printers and Lithographers home page describes NAPL, lists NAPL resources, equipment vendors and manufacturers, etc.

`http://www.napl.org/napl/home.html`

Envirosense: Printing P2 - This home page contains case studies, pollution prevention practices, regulations and vendor information of interest to printers.

`http://www.seattle.battelle.org/es-guide/print/print.htm`

The U.S. Screen Printing Institute - This home page lists SPI products, services, industry suppliers, etc.

http://www.usscreen.com/

Craftnet Web Site - The International Association of Printing House Craftsmen home page describes the Craftsmen's clubs, seminars, etc.

`http://craftnet.eas.asu.edu/welcome.html`

GREAT PRINTERS STATE PILOT PROJECTS
Pilot Steering Group Members - January 1996

Illinois

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Regional GPP Steering Group

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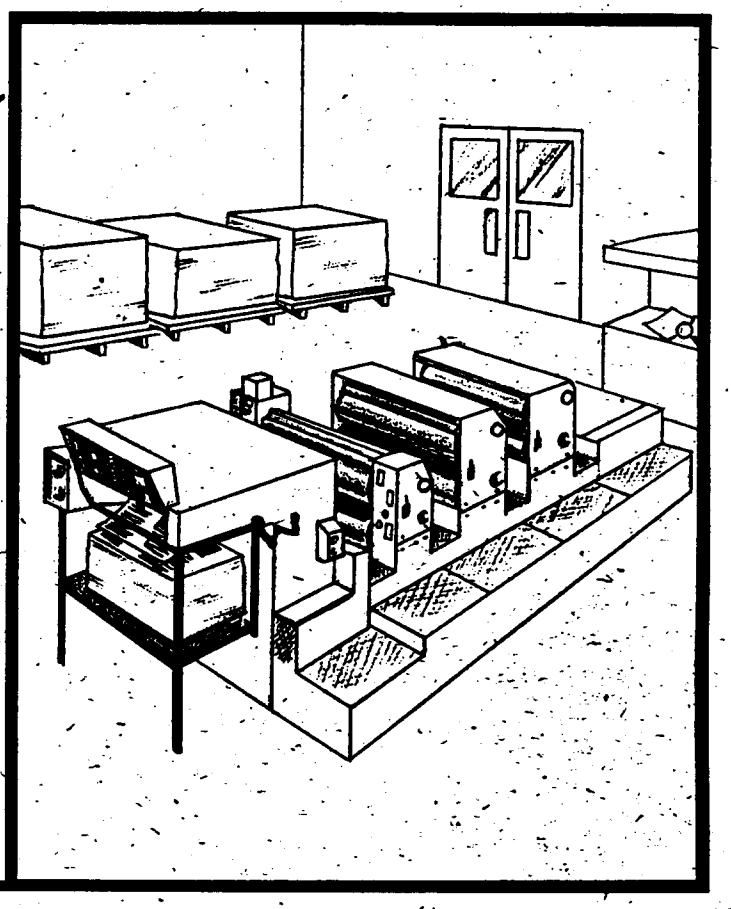
THE GREAT PRINTERS PROJECT



Recommendations to Make Pollution Prevention a Standard Practice in the Printing Industry

COUNCIL OF GREAT LAKES GOVERNORS

194

INC.

ENVIRONMENTAL DEFENSE FUND

Executive Summary

Objectives

This report discusses the recommendations of the Great Printers Project, the first in the nation to seek to create a business environment conducive to pollution prevention for an entire industry sector. The project intends:

- to make pollution prevention the primary choice of the Great Lakes states lithographic printing industry in meeting and exceeding its environmental and human health protection responsibilities.

- to recast our approach to environmental policy by bringing together representatives from government, industry, labor, and environmental groups to focus on the common goals of environmental protection and economic strength.

Lithographic printing, like most industrial activities, uses a variety of materials and potentially hazardous chemicals, requires energy, and generates wastes. The average small print shop is not a major source of pollution, but the aggregate impact on the environment of all them together is substantial. Many opportunities exist to lessen the impact of printing on the environment, while increasing the competitiveness of the individual printer through pollution prevention.

The Great Printers Project seeks to influence factors, usually beyond the control of the average printing business, which can constrain the business' environmental decisions. It focuses on changing those factors that lead the business away from preventing pollution at the source. The project focuses especially on customer demands, regulatory requirements, and access to technology and financial resources.

The project works through a team made up of Great Lakes regulatory and economic development agencies, the U.S. Environmental Protection Agency (USEPA), state and federal technical assistance providers, printers, suppliers and customers, and members of labor and environmental groups. This report follows the lead of the U.S. Environmental Protection Agency in defining "pollution prevention" as essentially equal to "source reduction" as defined in the Pollution Prevention Act of 1990.

This information is reprinted with permission from "The Great Printers Project: Recommendations to Make Pollution Prevention a Standard Practice in the Printing Industry," produced in partnership by the Council of Great Lakes Governors, Printing Industries of America, and the Environmental Defense Fund, 1994.

Recommendations

The primary objective of the Great Printers Project is to establish pollution prevention as standard business practice in the lithographic printing industry. This will require efforts not only on the part of the printers, but also by all who supply them with materials, purchase their products, and regulate their operations. Toward this end, the Great Printers Project is recommending roles to be played by

- printers,
- print buyers,
- print suppliers and distributors,
- government regulators, and
- government and private assistance organizations.

The report assumes that each group will play its part, and that all of the project recommendations will be instituted.

The Role of Printers: Continuous Effort in Great Printing

The Great Printers Project recommends that printers voluntarily adopt the Great Printers Principles, which can be achieved by:

- seeking out information on their shop's environmental performance, and communicating its environmental impacts to buyers;
- performing compliance and pollution prevention assessments, and correcting any compliance problems; and
- measuring their own progress in preventing pollution.

Printers can use the principles as a pathway to environmentally-sound printing, while producing a quality product. Adherence to these principles also can be used by printers as a marketing tool, to attract consumers who want "Great Printing."

The Role of Print Buyers: Building Markets for Great Printing

The Great Printers Project recommends that printers work with their customers to develop job specifications that protect the environment, while meeting their customers' requirements for a quality product. To promote this interaction, the Great Printers Project has developed a set of questions, intended as a flexible tool to help both printers and print buyers end up with a product that does not compromise the environment. The questions are intended to encourage a cooperative exchange of information so that both buyers and printers

Great Printing Principles

A Great Printer is one who minimizes impact on human health and the environment, while producing a quality printed product for the customer.

Toward that end, the goals of a Great Printer are to:

* Comply with applicable environmental and worker health and safety laws;
* Go beyond compliance by employing the most environmentally sound practices, consistent with the following management principles:
  a. Maximizing pollution prevention as the first course of action;
  b. Reusing or recycling waste that cannot be prevented; and
  c. Maximizing energy efficiency within the print shop.
* Seek continuous environmental improvement through periodic assessments of operations, materials and products, and by drawing on information and ideas from employees, print buyers, suppliers, and neighbors.

understand the benefits and limitations associated with environmentally progressive printing practices.

The Role of Printers' Suppliers and Distributors: Empowering the Printer as Customer

The Great Printers Project recommends that printers, suppliers, and distributors work together to seek out environmentally superior materials, chemicals, and equipment to produce high-quality print jobs. Inadequate information makes it difficult for printers to choose environmentally preferable alternatives. This report includes questions that may help identify the kinds of environmental information which printers will likely require from suppliers and distributors, to improve the environmental performance of the print shop and respond to customer requests for "Great Printing." In addition, a model information sheet will be developed by the Great Printers Project, for the use of suppliers and distributors in disseminating environmental information about a product.

The Role of Government Regulators: Creating a Pollution Prevention-Friendly Regulatory Framework

The Great Printers Project recommends that USEPA and its state regulatory partners should:

- present printers with reporting and permitting requirements stated in a way that minimizes redundancy and confusion, is conducive to preventing pollution, and can be understood by an intelligent businessperson who is not an expert in environmental matters;

- clarify how findings from voluntarily-performed and state-performed compliance and pollution prevention assessments will or will not be used; and

- create a level playing field through more efficient enforcement, as an incentive to printers to go beyond compliance.

The Role of Government and Private Assistance Programs: Providing Printers with Easy Access to Coordinated, Industry-Specific Finance and Technical Assistance

Making technical and financial assistance and regulatory information more accessible to small businesses is a critical step toward integrating pollution prevention into the printing industry. The goal should be to seamlessly deliver a comprehensive array of services that fully integrates pollution prevention, financing, and technical assistance. Toward that end, the Great Printers Project recommends that

- a national resource center be established to provide reliable, up-to-date information specifically for the printing industry;

- delivery of services to small printers be better coordinated and packaged to minimize the number of calls and time spent by printers to obtain financing and technical assistance; and

- the printing industry associations should aggressively market these upgraded services.

EPA's Design for the Environment Program

Why Design for the Environment?

Businesses operating in the 1990s face a variety of competing demands - keeping costs low and quality high, staying competitive in a global marketplace, and meeting consumer preferences for environmentally friendly products.

Designing for the Environment is a down-to-earth strategy for organizing and managing these challenging demands. Building on the concept of Design for the Environment (DfE) pioneered by industry, EPA's DfE program aims at helping business incorporate environmental considerations into the design and redesign of products, processes, and technical and management systems.

How does a business "design for the environment?

- By implementing pollution prevention, energy efficiency, and other resource conservation measures;
- By using and producing less toxic and non-toxic materials;
- By making products that can be refurbished, disassembled, and recycled; and
- By keeping careful track of the environmental costs associated with each product or process.

What is EPA's DfE Program?

Through its DfE program, EPA creates voluntary partnerships with industry, professional organizations, state and local governments, other federal agencies, and the public. EPA's efforts are directed at giving businesses the information needed to design for the environment, and at helping businesses use this information to make environmentally informed choices. Within each business, the DfE program works to make sure that the information reaches the people who make the choices -- from buyers to industrial design engineers.

For example, EPA is developing several analytical tools for businesses to use in evaluating their processes and products. These include the following:

- **Cleaner Technology Substitutes Assessments (CTSAs):** These assessments help companies compare different technologies or products, with an eye toward selecting the most environmentally friendly alternatives. The assessments look not only at environmental impacts (releases to the environment, energy impact, comparative risk), but also at the cost and performance profiles of each alternative. The DfE program is developing a generic assessment with a guidance manual to help companies perform their own assessments.

Reprinted from US EPA Design for the Environment information. Text available on the Internet at http://www.epa.gov/docs/dfe/broc.txt.html.

- **Life-Cycle Assessment Tools:** EPA is continuing work on development of a standardized method for comprehensively evaluating the environmental effects of a product, process or activity throughout all stages of its life, from materials extraction and production through final disposal.

What DfE projects are underway?

EPA's DfE projects include broad institutional projects aimed at changing general business practices, as well as more targeted joint projects with trade associations and businesses in specific industry segments. Current projects include the following:

Institutional Projects:

- **Accounting & Capital Budgeting:** EPA is working with the private sector to develop new and modified accounting tools that will incorporate environmental costs and benefits into managerial accounting and capital budgeting practices, thus allowing businesses to more fully understand their environmental costs. The project also involves curriculum development and research activities.

- **Chemical Design:** Many of the traditional ways of synthesizing new high-volume industrial chemicals use toxic feedstocks or catalysts, or they create hazardous and toxic byproducts. In cooperation with the National Science Foundation, EPA is encouraging university research into alternative methods for producing chemicals that minimize or eliminate hazardous substances.

- **Curriculum Development:** EPA has established a National Pollution Prevention Center at the University of Michigan. The Center is developing curricula in multiple discilplines (e.g. business, engineering, accounting, marketing) which incorporate pollution prevention, lifecycle analysis, and DfE principles, rather than traditional end-of-pipe pollution control techniques.

- **Risk Management/Insurance:** EPA has entered into a cooperative effort with the American Institute of Chartered Property Casualty Underwriters, an independent non-profit organization offering educational programs and professional certification for the property and liability insurance industry. EPA is helping to incorporate pollution prevention into the curriculum for the Institute's certification program for Associates in Risk Management. Through efforts such as this, EPA hopes to facilitate pollution prevention principles becoming a part of the insurance underwriting and risk management decision-making process.

- **Financing:** An important constraint on the adoption of new technologies is the availability of financing. The financial community tends to associate environmental investment more with liability than with opportunity. In addition, companies and financial institutions generally have not known how to estimate the returns on pollution prevention investments. EPA will conduct outreach to businesses and the financial community to find ways to address these problems.

Cooperative Industry Projects

- **Dry Cleaning Project:** Through the DfE program, EPA is working in partnership with the dry cleaning industry and environmental organizations to reduce exposure to perchloroethylene ("perc"). Perc is a chemical solvent used by most dry cleaners which poses potential health and environmental concerns. EPA will examine alternative technologies, solvents, and control methods as part of a Cleaner Technology Substitutes Assessment.

  At the conclusion of the assessment, EPA plans to publish a technical summary of alternative solvents and processes and an information document on costeffective, environmentally safer choices identified through the project. An important part of the project will be finding ways to provide small dry cleanerswith both technical assistance and incentives to implement pollution prevention measures.

- **Printing Project:** The DfE Printing Project is a cooperative EPA-industry project aimed at developing pollution prevention information specific to small and medium-sized printers. Six different methods of printing are in use today and each has a different set of chemical and technological alternatives. Industry representatives identified several priority environmental concerns for lithographic, screen printing, and flexographic printing methods.

  Project committees made up of both EPA and industry representatives are developing cleaner technology substitute assessments as well as outreach strategies and information products to communicate the results of the project to printers. The committees are also working to identify incentives that will encourage printers to use the information developed.

- **Cleaning Products:** EPA and the General Services Administration (GSA) are collaborating on a long-term project to promote the use of environmentally preferred cleaning products in government-owned buildings. This effort will involve developing standards for cleaning products, performing integrated risk assessments, and evaluating product performance. The project coincides with a federal Executive Order mandating that government agencies use environmentally preferred cleaners.

The DfE program is also considering starting a number of new projects under the Environmental Technology Initiative. Industries being considered include the computer industry, the aerospace industry, and the metal finishing industry. EPA is interested in exploring future projects and partnerships with other partners.

COMMON SENSE INITIATIVE UPDATE April 1995

WHAT IS THE COMMON SENSE INITIATIVE?

EPA's Common Sense Initiative (CSI) is a fundamentally different vision of environmental policy. Through this initiative, representatives from federal, state, and local governments, industry, community-based and national environmental organizations, environmental justice groups and labor come together to examine the full range of environmental requirements affecting six industries: automobile manufacturing, computers and electronics, iron and steel, metal finishing, petroleum refining, and printing. For the first time, these diverse interests, in the past often playing adversarial roles, are joining together with the shared goal of creating environmental protection strategies that are cleaner for the environment and cheaper for industry and taxpayers.

The participants are looking for solutions that are:

Focused on industries as a whole rather than one pollutant at a time.
Ensure that pollution is prevented and cleaned up, rather than shifted and shuffled.

Consensus-based rather than adversarial and entrenched.
Consensus solutions will move beyond the current conflict, gridlock, and unnecessarily adversarial relationship between the concepts of a cleaner environment and a healthy economy.

Based on the concept of Pollution Prevention rather than End-of-Pipe-Only Controls.
Ensure that producing less pollution from the outset, rather than cleaning it up afterwards, becomes a standard way of doing business.

Industry specific rather than one-size-fits-all.
Ensure that requirements fit the way different businesses work and achieve real results for the environment.

Flexible means of achieving tough environmental standards, rather than rigid and stifling.
Ensure that innovation and common sense are encouraged, not stifled, in the search for cleaner business practices.

HOW CSI WORKS

CSI operates under the Federal Advisory Committee Act (FACA), which specifies how federal agencies may seek advice from outside stakeholders. The Common Sense Initiative Council (CSIC) consists of a parent council and six subcommittees (one per industry sector), with participants representing the stakeholder groups listed above. The Council is chaired by EPA Administrator Carol Browner and co-chaired by EPA Deputy Administrator Fred Hansen. Each of the six subcommittees is co-chaired by an EPA Assistant Administrator and a Regional Administrator. The Council will hold its first meeting on May 19 in Washington, D.C. Each of the subcommittees has met and identified a number of issues and project areas for emphasis. Subcommittee workgroups have been established to analyze and make recommendations to the subcommittees on these issues.

Reprinted from US EPA Common Sense Initiative information. Additional text available on the Internet at http://www.epa.gov/docs/CSI/CSI/background.factshee.txt.html.

NEW YORK CITY EDUCATION PROJECT

Project Objective

- Achieve fundamental change within the printing sector to incorporate the philosophy of pollution prevention and cost reduction into everyday work practices.
- Develop better, more effective means of outreach and education.

Project Highlights

- Giving small printers, print customers, suppliers, and community groups environmental compliance and pollution prevention and cost reduction information in a user friendly form.
- Evaluating how they choose to use the information.
- Helping printers become more aware of the effects that small businesses have on their neighbors and workers as well the environment.
- Making available methods to reduce these effects while encouraging competitiveness and increased efficiency.
- Teaching printers, customers, and regulators the value of pollution prevention and fostering cooperation in environmental improvement.

Status of Project

- Workgroup has finalized several products needed to initiate this project including: facility contact lists, community contacts, incentive package, introductory letter to printers, benchmarking survey, draft bibliography, and follow-up telephone survey.
- Workgroup is working on drafts of the letter to environmental justice and environmental groups, the NYC project fact sheet and the CSI printing fact sheet.
- Initial letters will go to printers, a proposed meeting will occur with environmental and environmental justice groups, and follow-up telephone surveys will be completed in March.

Expected Timeline

Mid to Late Summer 1996

Project Contact

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MULTI-MEDIA FLEXIBLE PERMITTING PROJECT

Project Objective

- To develop a permit system applicable to printers that allows for operational flexibility, pollution reduction across all media, and improved protection of the environment, workplace, and community.

- The system will be simpler to implement and manage for regulatory agencies and businesses, will assure compliance, and will enhance access for the public.

Project Highlights
(Three task groups are conducting the work described below as the components which will be integrated together to achieve the project objectives.)

- The permits task group is reviewing a draft model proposal for registration air permit for small printers that is based on the system currently used in Minnesota. The group seeks to streamline the permit process and reduce permitting and compliance demonstration costs to regulatory agencies and printing facilities without compromising environmental and public health standards.

- The pollution prevention task group is making final a request for information to states/EPA/individual printers and others to gather information regarding existing regulatory barriers to pollution prevention. The group seeks to incorporate incentives in permits to increase pollution prevention.

- The environmental justice/public participation task group is continuing to prepare a template for an EJ program, legal public notices requirements, EJ-federal efforts with state agencies, and private and self-funding for communities. The group seeks to enhance community participation and involvement in the permit process be developing a structure for an EJ training program between communities and industry and developing a template for EJ and public participation to address industry and community concerns.

Status of Project

The three tasks groups anticipate completing work currently in progress by April, and intend to integrate the work into the overall project team objectives for the purpose of developing draft recommendations for the CSI Printing Subcommittee and then to the CSI Council during the summer.

Project Contacts

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CLEAN AIR ACT
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MT	Mark Lambrecht	(406) 444-2960 (N) (800) 433-8773	Robert Donovan	(406) 444-3454 (N) (800) 433-8773
NE	Dan Eddinger	(402) 471-3413		
NV	Ralph Capurro	(702) 687-4670, x3162 (S) (800) 992-0900, x4670	David Cowperthwaite	(702) 687-4670, x3118 (S) (800) 992-0900, x4670
NH			Rudolph Cartier	(603) 271-1379
NJ	John Serkies	(609) 633-7308 (N) (800) 643-6090	Chuck McCarty	(609) 292-3600
NM	Edgar Thornton	(505) 827-2855 (N) (800) 879-3421	Cecilia Williams	(505) 827-0042 (N) (800) 879-3421
NY	Doreen Monteleone	(212) 803-2282 (N) (800) 782-8369, x 157	Marian Mudar	(518) 457-3833 (S) (800) 780-7227
NC	Edythe McKinney	(919) 733-1267 (N) (800) 829-4841	Fin Johnson	(919) 733-0824
ND	Jeff Burgess	(701) 328-5153 (S) (800) 755-1625	Tom Bachman	(701) 328-5188 (S) (800) 755-1625
OH	Mark Shanahan	(614) 224-3383	Rick Carleski	(614) 728-1742
OK	Steve Thompson	(405) 271-8056	Alwin Ning	(405) 271-1400
OR	Paul Burnet	(503) 229-5776 (S) (800) 452-4011	Terry Obteshka	(503) 229-6147 (S) (800) 452-4011
PA	Richard Segrave-Daly	(717) 772-2889	Cecily Beall	(215) 656-8709 (S) (800) 722-4343
PR	Juan Woodroffe	(809) 728-5585	Francisco Claudio	(809) 767-8071
RI	Roger Green	(401) 277-2771	James Saletnick	(401) 277-2601 (S) (800) 253-2674
SC	Robin Stephens	(803) 734-6487 (N) (800) 819-9001	Chad Pollock	(803) 734-2765 (N) (800) 819-9001
SD	Joe Nadenicek	(605) 773-3151 (S) (800) 438-3367	Bryan Gustafson	(605) 773-3351
TN	Ernest Blankenship	(615) 532-0734	Linda Sadler	(615) 532-0779 (S) (800) 734-3619
TX	Tamra Shae-Oatman	(512) 239-1062 (N) (800) 447-2827	Kerry Drake	(512) 239-1112 (N) (800) 447-2827
UT	Tamara Wharton	(801) 536-4231	Frances Bernards	(801) 536-4056 (N) (800) 270-4440
VT			Kevin Bracey	(802) 241-3841
VA			Richard Rasmussen	(804) 698-4394 (S) (800) 592-5482
VI			Marylyn Stapleton	(809) 774-3320
WA	Leighton Pratt	(360) 407-7018	Jerry Jewett	(360) 407-6805
WV	Kenneth Shaw	(304) 558-1213 (S) (800) 247-2474	Fred Durham	(304) 558-1217 (S)(800) 247-2474
WI	Roger Nacker	(608) 266-1386 (N) (800) 435-7274	Pam Christenson	(608) 267-9214 (N)(800) 435-7274
WY	Kelly Pelissier	(307) 777-7388	Charles Raffelson	(307) 777-7391

NOTE: (S) = State; (N) = National

CLEAN AIR ACT
SMALL BUSINESS OMBUDSMEN AND TECHNICAL ASSISTANCE DIRECTORS

STATE	OMBUDSMAN	PHONE	TECH. ASST. DIR.	PHONE
AL	Blake Roper	(334) 271-7925 (N) (800) 533-2336	James Moore	(334) 271-7861 (S) (800) 533-2336
AK	Priscilla Wohl	(907) 269-7500 (S) (800) 510-2332		
AZ			Martin Todd-Dorris	(602) 207-4337 (S) (800) 234-5677, x 4337
AR	Robert Graham	(501) 682-0708	Michael Core	(501) 682-0759
CA	James Schoning	(916) 323-6791	Peter Venturini	(916) 445-0650 (S) (800) 272-4572
CA	La Ronda Bowen	(909) 396-3235 (N) (800) 388-2121	Natalia Porche	(909) 396-3218 (N) (800) 388-2121
CO	Jocelyn Mills	(303) 894-7839 (N) (800) 333-7798	Nick Melliadis	(303) 692-3175
CT	Tracy Babbidge	(860) 424-3382	Bob Kaliszewski	(860) 424-3003
DE	George Petitgout	(302) 739-6400	Darryl Tyler	(302) 739-4791
DC	Henry Lopez	(202) 645-6617, x3087	Olivia Achuko	(202) 645-6093, x 3071
FL	Joe Schlessel	(904) 488-1344 (S) (800) 722-7457	Ed Huck	(904) 488-1344 (S) (800) 722-7457
GA	Marvin Lowry	(404) 363-7020	Anita Dorsey-Word	(404) 362-4842
HI			Robert Tam	(808) 586-4200
ID	Doug McRoberts	(208) 373-0497	(Vacant)	(208) 373-0298
IL	Don Squires	(217) 785-1625	Mark Enstrom	(217) 524-0169 (S) (800) 252-3998
IN	Mike O'Connor	(317) 232-8165 (S) (800) 451-6027	Rainford Hunter	(317) 233-0726
IA	Kristie Hirschman	(515) 281-3592 (S) (800) 358-5510	John Konefes	(319) 273-2079 (S) (800) 422-3109
KS	Janet Neff	(913) 296-0669 (N) (800) 357-6087	Frank Orzulak	(913) 864-3978 (S) (800) 578-8898
KY	Rose Marie Wilmoth	(502) 564-3350 (N) (800) 926-8111	Gregg Copley	(606) 257-1131 (N)(800) 562-2327
LA	John Dykes	(504) 922-3252 (S) (800) 256-1488	Vic Tompkins	(504) 765-2453 (S) (800) 259-2890
ME	Ron Dyer	(207) 287-4152 (S) (800) 452-1942	Brian Kavanah	(207) 287-6188 (S) (800) 789-9802
MD	John Mitchell	(410) 631-3003 (S) (800) 633-6101, x3172	Linda Moran	(410) 631-4158
MA	George Frantz	(617) 727-3260, x 631	Jay Eberle	(617) 556-1067
MI	Gregory Burkart	(517) 335-1847	Dave Fiedler	(517) 373-0607 (N) (800) 662-9278
MN	Laurel Mezner	(612) 297-8615 (S) (800) 985-4247	Leo Raudys	(612) 297-2316 (S) (800) 657-3938
MS	Jesse Thompson	(601) 961-5171 (N) (800) 725-6112		
MO	Brad Ketcher	(314) 751-3222	Byron Shaw, Jr.	(314) 526-5352 (N)(800) 361-4827

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