



Department of Public Health & Environment

NOVEMBER 2001

## POLLUTION PREVENTION IDEAS FOR THE PRINTING, PUBLISHING, AND ALLIED INDUSTRY SECTORS

The environmental aspects of the printing industry are regulated by numerous federal and state regulations that address air emissions, hazardous waste management, and in some instances, wastewater discharges. The Colorado Department of Public Health and Environment (CDPHE) prepared this bulletin to convey information about source reduction practices for businesses in the printing sector. Source reduction, or pollution prevention (P2), practices complement or greatly reduce the need for emission control measures and waste management procedures required by regulations. CDPHE defines P2 as the reduction or elimination of pollutants or wastes at the source, by using less hazardous raw materials or using more efficient practices or processes. It includes reducing the use of energy, water, and other resources through increased efficiency or through conservation. For more information about regulations that apply to the printing sector, contact Joe Schieffelin at (303) 692-3356 or visit [www.cdphe.state.co.us/hm/hmhom.asp](http://www.cdphe.state.co.us/hm/hmhom.asp).

The objective of this bulletin is to stimulate generators of hazardous waste to consider implementing various P2 strategies. This document provides an overview of the waste streams associated with printing process, identifies commonly applicable P2 opportunities, and provides a P2 scorecard for printing sector facilities. For more detailed information on P2 opportunities for the printing sector, please consult the information sources included in this document.

After June 2002, contact the CDPHE P2 Program: Kirk Mills at (303) 692-2977 or Margo Griffin at (303) 692-2979. The CDPHE P2 Program ([www.coloradoP2.org](http://www.coloradoP2.org)) provides confidential, non-enforcement, P2 assessments for Colorado businesses and follows up with a report that summarizes P2 opportunities.

### HOTLINE!

Through June 2002, CDPHE is offering focused P2 research and implementation support through a P2 Hotline (303-312-8880). Take advantage of this free and confidential opportunity to obtain assistance investigating process improvements that are on your "wish list" or address waste streams that are expensive to manage or cause compliance problems. Call now!

Remember, P2 pays - on the "front end" through improved raw material utilization and on the "back end" by decreasing waste management and compliance costs.

## PRINTING INDUSTRY OVERVIEW

The printing industry is comprised of firms that perform printing by one or more common processes, firms that provide printing related services (e.g., platemaking, bookbinding, typesetting, and photoengraving), and firms that publish newspapers, books, and periodicals. The five most common printing processes are lithography, gravure, flexography, letterpress, and screen printing. These processes are distinguished by the method of image transfer and by the type of image carrier (or plate) employed. Each of the printing processes involves three major steps: prepress (including image processing, plate making, and make-ready), press, and post-press. Each step has its own set of potential outputs and regulated wastes, as summarized in the following table:

<b>PREPRESS</b>	
	<u>Imaging</u>
Used film	Contaminated rinse water
Scrap paper	Rags containing solvents
Air vapors and odors	Waste solvents
Spent developer	Waste proofs
Spent fixer and silver from film	Empty chemical containers
	<u>Plate making</u>
Damaged and unusable plates	Used rinse water
Waste metals, paper, and plastic	Spent plate developer (may contain alcohol)
Waste silver halides from silver master plates	
	<u>Make-ready</u>
Waste paper and ink	Volatile organic compounds (VOCs) from ink, cleaners, and fountain solutions
Empty ink containers	
<b>PRESS</b>	
Empty ink containers	Used or damaged blankets
Waste or obsolete ink	Spent equipment oil
Spent fountain solutions	Unacceptable prints
VOCs from ink, cleaners, and fountain solutions	Unusable plates
Waste water and solvents used in blanket wash	Rags containing ink and solvents
<b>POST-PRESS</b>	
Rejected prints and trim scrap	Glue/adhesive waste
Paper scrap	Waste water containing adhesives or solvents
Rags containing oil, grease, solvents, and adhesives	Packaging waste

## P2 OPPORTUNITIES FOR PRINTERS

A wide variety of P2 opportunities are available to printers. This section briefly describes some commonly applicable P2 opportunities involving silver recovery, managing ink waste, reducing alcohol in fountain solutions, and managing solvents and wipes. Facility managers and staff are encouraged to obtain more detailed information about these and many other P2 opportunities through the information sources included in the section titled "P2 Information Sources and Links."

### ❖ *Silver Recovery*

Commercial printers generate used fixer from film developing as a normal part of doing business. Used fixer usually contains thousands of parts per million (ppm) of silver, well above the federal hazardous waste limit for silver of 5 ppm. Therefore, used fixer should never be discharged to the sanitary sewer without proper silver recovery, and should never be put into storm drains, septic systems or dry wells, or poured onto the ground.

Several technologies exist for recovering silver onsite. The most common methods of onsite recovery from bleach-fix processing solutions involve metallic replacement, electrolytic recovery, and chemical precipitation. Ion exchange and reverse osmosis may also be used alone or in combination with conventional silver recovery systems; however, these are generally considered suitable only for dilute solutions of silver.

Cost and local discharge limits should be considered when determining the most appropriate silver recovery system for your business:

- **Consider Cost:** For most small-volume printers, metallic replacement using two chemical recovery cartridges (CRCs) in series will likely provide the best return on investment. If your processing waste is large, electrolytic recovery may be more appropriate in order to avoid changing the cartridges frequently. While the cost of electrolytic recovery systems is higher initially, you will not have the additional cost of replacement cartridges. For very large-volume photoprocessing, an in-line electrolytic recovery system may be an option. These systems offer the ability to reuse the fixer.

#### Did You Know?

Scrap film and paper contain silver salts or elemental silver. Silver recovery services may agree to recycle scrap film and paper with the silver recovered from spent film.

Another option is to remove the silver from unprocessed scrap film and paper by treating the material with sodium hypochlorite solution to oxidize elemental silver to silver salt. Once dissolved in the fixer, silver can be recovered using metallic replacement, electrolytic recovery, chemical precipitation, ion exchange, and reverse osmosis.

- **Consider Discharge Limits:** CRCs can achieve recovery levels greater than 90 percent, but the recovery rates may be inconsistent, making CRCs unreliable for low discharge limits. It is difficult to achieve very low silver levels with only electrolytic recovery, but when used in series with at least one CRC cartridge, printers can achieve levels of about 5 ppm. For extremely low discharge limits, an ion-exchange system may be necessary.

### ❖ *Managing Ink Waste:*

Printing inks may contain material that makes them hazardous, such as metals used for coloring, and oil or alcohol used as solvent carriers. In addition, petroleum-based printing inks may emit high levels of VOCs, which are regulated under the Clean Air Act Amendments. Facilities determined to reduce the purchase of raw materials, disposal costs, monitoring requirements, and liability issues may benefit from investigating P2 opportunities such as using alternative inks and reusing excess ink.

- **Consider Alternative Inks:** Many lithographers have successfully substituted alternative inks that emit little or no VOCs for petroleum-based inks. Information on alternative inks can be obtained through the information sources included in the section titled "P2 Information Sources and Links." The most appropriate alternative ink for your business depends on your print process, the substrate to be printed on, and the use of the end product. Typical alternatives include:

- Vegetable/soy inks
- Water-based inks
- Waterless inks
- Electron beam curable inks
- Ultraviolet curable inks



- **Consider Reusing Excess Ink:** Excess ink is the result of overestimating ink usage at the press or at the time of ink purchase. Reusing excess ink can reduce both disposal and purchase costs: Some options include:

- Mix excess ink on-site to produce black ink
- Mix non-contaminated excess in with virgin ink of the same color
- Use a computer controlled mixing program in conjunction with a digital scale for mixing colors.

**P2 Tip:** Estimate ink needs accurately and manage your ink inventory wisely to reduce the overall volume of waste ink generated.

❖ *Reducing Alcohol in Fountain Solutions:*

The use of isopropyl alcohol (IPA) in fountain solutions is a significant source of VOC emissions for lithographic printers. Many printers have been able to reduce these emissions by 1) reducing the alcohol concentration in their fountain solutions to 5 - 10 percent or 2) eliminating alcohol completely through the use of alcohol substitutes. Before changing to an alcohol substitute, ask your vendor what options are available for the specific press, dampening system, ink roller, blanket wash, and paper used. Provide vendors with samples of your makeup water to determine which solutions are compatible, and make sure that your inks are compatible with any new solutions. You may need to investigate a foam-free recirculating system when using alcohol substitutes.

*Some Disadvantages of Using IPA:*

- ✓ IPA is often more expensive than most alcohol substitutes on a total use basis.
- ✓ IPA use may trigger regulatory obligations under the Clean Air Amendments.
- ✓ IPA is flammable and must be stored and dispensed in accordance with OSHA and fire code requirements.
- ✓ The fumes from IPA can be irritating without proper ventilation.

❖ *Managing Solvents and Wipes:*

Solvent cleaning typically generates hazardous waste solvents and used 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.

*Methods for:*

<b>Reducing Solvent Wastes</b>	<b>Removing Solvents from Wipes</b>	<b>Dispensing and Storing</b>
<ul style="list-style-type: none"> <li>✓ Reduce the need for cleaning</li> <li>✓ Use alternative solvents</li> <li>✓ Reduce solvent use in cleanup</li> <li>✓ Separate excess solvents from wipes</li> <li>✓ Collect all solvent wastes for recycling</li> <li>✓ Establish accountability for solvent use and waste generation</li> </ul>	<ul style="list-style-type: none"> <li>✓ Squeeze out wipes by hand</li> <li>✓ Use a hand-operated wringer</li> <li>✓ Install an explosion-proof centrifuge to spin wipes dry</li> </ul>	<ul style="list-style-type: none"> <li>✓ Cover solvents to reduce evaporation</li> <li>✓ Dispense solvents from a central source</li> <li>✓ Track usage at individual press or operator level</li> <li>✓ Limit access to number of disposable wipes</li> </ul>

## P2 INFORMATION SOURCES AND LINKS

P2 opportunities for reducing printing process wastes have been widely researched and documented by various federal and state agencies and organizations. This section contains references to some resources that are relevant to the printing sectors.

RESOURCE	DESCRIPTION
<p><b>Printer's National Environmental Assistance Center (PNEAC)</b>  <a href="http://www.pneac.org">www.pneac.org</a></p>	<p>PNEAC is a communications-based center linking trade, governmental, and university service providers to efficiently provide the most current and complete compliance assistance and P2 information to the printing industry. The website provides fact sheets, checklists, case studies, and other documents relating to P2 opportunities for printing industry. The site also provides links to other printing sector contacts, suppliers, and forums.</p>
<p><b>Pollution Prevention Resource Exchange</b>  <a href="http://www.p2rx.org/">http://www.p2rx.org/</a></p>	<p>The Exchange is a national network of regional centers dedicated to improving the dissemination of P2 information in the service provider community. The website provides a guide to the essential P2 information for printers, as well as a compilation of pertinent on-line resources.</p>
<p><b>Pacific Northwest Pollution Prevention Resource Center</b>  <a href="http://www.pprc.org/">http://www.pprc.org/</a></p>	<p>The PPRC is a non-profit organization working collaboratively with business, government, non-government organizations, and other sectors to promote environmental protection through P2. The website provides PPRC developed resources for the printing industry, including 1) Pollution Prevention and Compliance Workbook, 2) environmental compliance and P2 fact sheets, 3) technical and regulatory information links, and 4) research projects.</p>
<p><b>USEPA's Office of Compliance (EPA/OECA) Industry Sector Notebook for Printing Industry</b>  <a href="http://es.epa.gov/oeca/sector/">http://es.epa.gov/oeca/sector/</a></p>	<p>Multimedia summary of the printing industry includes: industrial process, pollution outputs, toxic release inventory (TRI) data, P2, federal regulations, compliance history, compliance assistance, and voluntary programs.</p>

RESOURCE	DESCRIPTION
<p><b>Montana State University Extension Service <i>Pollution Prevention for Commercial Printers, August 1995</i></b>  <a href="http://www.montana.edu/wwwated/">http://www.montana.edu/wwwated/</a></p>	<p>Package provides an overview of the printing industry, and checklists and fact sheets with detailed P2 opportunity information.</p>
<p><b>University of Wisconsin Cooperative Extension Solid and Hazardous Waste Education Center - <i>Lithographic Ink Wastes: How to Reduce, Reuse, and Recycle Ink Waste</i></b>  <a href="http://www.uwex.edu/shwec/">http://www.uwex.edu/shwec/</a></p>	<p>Fact sheet discusses several ink management techniques that increase the opportunities to prevent, reuse, and recycle ink waste.</p>
<p><b>Iowa Waste Reduction Center, University of Northern Iowa - <i>A Pollution Prevention Manual for Lithographic Printers</i></b>  <a href="http://es.epa.gov/program/regional/trade/litho-mn.html">http://es.epa.gov/program/regional/trade/litho-mn.html</a></p>	<p>Manual provides specific on P2 approaches associated with each step of the printing process. Provides examples for incorporating P2 concepts into current waste management practices.</p>
<p><b>EnviroSense</b>  <a href="http://es.epa.gov/cooperative/stateandlocal/">http://es.epa.gov/cooperative/stateandlocal/</a></p>	<p>The EnviroSense website provides many printing sector links to information on P2 /cleaner production solutions, compliance and enforcement assistance, and innovative technology and policy options.</p>
<p><b>Design for the Environment Lithographic Printing Partnership</b>  <a href="http://www.epa.gov/dfe/pubs/allpubs.htm#lith">http://www.epa.gov/dfe/pubs/allpubs.htm#lith</a></p>	<p>Website provides a variety of information to help lithographers design operations that are more environmentally sound, safer for workers, and more profitable.</p>
<p><b>Graphic Arts Information Network (GAIN)</b>  <a href="http://www.gain.org/servlet/gateway/">http://www.gain.org/servlet/gateway/</a></p>	<p>Website provides information, solutions, training, and networking for the graphic arts industry as well as print buyers, graphic arts students, and educators.</p>
<p><b>Graphic Arts Technical Foundation (GATF)</b>  <a href="http://www.gatf.org/">http://www.gatf.org/</a></p>	<p>GATF is a member-supported, nonprofit, technical, and education organization serving the international graphic communications industries.</p>

## P2 SCORECARD FOR PRINTING SECTORS FACILITIES

This checklist highlights common P2 opportunities for the printing sector<sup>1</sup>. While this list of P2 opportunities is not exhaustive, it will help printing facilities assess how well P2 is being implemented at their facility. The goal is to achieve more "Yes" answers by changing techniques or technologies, as appropriate and feasible.

DOES YOUR FACILITY...	Yes	No	NA
<b>FILM DEVELOPING</b>			
1. Recycle scrap film?			
2. Keep chemical baths covered to prevent oxidation and contamination of chemicals and to reduce emissions?			
3. Ensure that no photo chemicals are discharged to a septic system?			
4. Use squeegees to wipe excess chemicals from prints?			
5. Avoid chrome-based film cleaners?			
6. Use and maintain chemicals as long as they are reactive?			
7. Remove or recover silver from used fixer prior to discharge?			
8. Ensure that discharge from on-site silver recovery systems meets sewer code requirements?			
<b>PLATE PROCESSING</b>			
9. Use plastic or photopolymer plates (they typically are processed with water solutions containing little or no hazardous waste)?			
10. Use presensitized aqueous plates?			
11. Recycle aluminum plates?			
12. Recycle metal etching developer?			
13. Use a recycling service for depleted plate developer?			
14. Use low- or non-hazardous materials, such as low-hydroquinone developers and low-replenishment developers, whenever possible?			
15. Use counter-current rinsing techniques?			
16. Use automatic flow controls for rinse water and rinse bath agitators?			
17. Properly maintain and adjust equipment?			

<sup>1</sup> The opportunities listed in this scorecard were derived from the following sources: *P2 Checklist*, Printer's National Environmental Assistance (PNEAC). [www.pneac.org](http://www.pneac.org); and *Self-Assessment Checklist for Commercial Printing*. Montana State University Extension Service Pollution Prevention Program. June, 1996. Refer to these sources for extended P2 checklists.

DOES YOUR FACILITY...	Yes	No	NA
<b>MAKE-READY</b>			
18. Have an effective program to ensure that color requirements are understood and can be tracked throughout prepress and production?			
19. Review and maintain communications, both internally and externally, to know what customers want (i.e., get the order right the first time and minimize waste)?			
20. Establish and track goals to reduce make-ready waste.			
21. Check paper and ink for compatibility before initiating make-ready, and record problems and solutions with ink/paper matches ?			
<b>PRESS OPERATIONS</b>			
22. Establish and review ink estimation methods to assure minimal ink usage and waste?			
23. Schedule, when possible, similar-color jobs simultaneously to reduce waste generation between cleanup and start of next run?			
24. Use less hazardous inks such as soy- and water-based inks (for non-lithographic printers)?			
25. Eliminate lead, mercury, cadmium, and chromium based pigments?			
26. Use fountain solutions with reduced concentrations of isopropyl alcohol (IPA)?			
27. Maintain proper conditions for the fountain solution by routinely checking pH and conductivity?			
28. Refrigerate fountain solution to reduce evaporative loss of IPA?			
29. 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 xylene?			
30. Collect and reuse cleaning solvent?			
31. Clean with reusable, launderable shop towels instead of disposable paper?			
32. Recover and reuse solvents from shop towels?			
33. Ensure that solvent saturated towels and wipes are not disposed of in the trash?			
34. Maintain the condition of roller cleanup blades and ensure blade angles are properly set?			

DOES YOUR FACILITY...	Yes	No	NA
<b>FINISHING</b>			
35. Properly size paper to reduce cutting waste and recycle cuttings and cardboard?			
36. Replace solvent-based adhesives with water-based adhesives when possible?			
37. Recycle spent waste lube oil?			

Notes:

NA = Not applicable to your facility

Calculate the P2 score for your facility using the following equation:

$$\frac{(\text{Total "Yes" answers})}{(37 - \text{Total "NA" answers})} \times 100\%$$

- > 76% = **Excellent** Keep up the good work!
- 51% to 75% = **Good** But there is still room for improvement.
- 26% to 50% = **Fair** Incorporate more P2 opportunities.
- < 25% = **Poor** Many P2 opportunities are available that are easy to implement and will result in immediate cost savings and reduced environmental impacts.