

Chapter 8: Pollution Prevention and Waste Reduction

This chapter describes pollution prevention and waste reduction opportunities as a means of complying with environmental regulations. These practices also increase overall environmental performance and cost competitiveness.

What is Pollution Prevention?

Historically, printers and regulators focused on pollution (and waste) *after* it was generated, relying on “end-of-pipe” controls or treatment (e.g., incineration). Businesses now realize that *pollution prevention*—reducing or eliminating waste *before it’s created*—can result in significant cost savings. Adding money to the bottom line and protecting the environment are two powerful reasons for all printers to incorporate pollution prevention in their day-to-day operations.

Pollution prevention is closely tied to quality improvement. Successful business-owners know it’s better to achieve quality by controlling processes than to catch problems at the end of the line. Catching errors after the fact means wasted raw materials, labor, and energy. The same philosophy applies to achieving environmental quality. Eliminating wastes and emissions at the source is far more productive than managing byproducts. Why manage waste when you can avoid it?

A Checklist to Help Printers Reduce and Prevent Pollution

The following checklist describes practical action-steps printers can take to reduce wastes and emissions. These actions will help a company improve its environmental compliance, while reducing costs and liabilities from wastes.

The action-steps in this checklist are grouped by functional area in the print shop. The first column in the checklist indicates all applicable print processes (lithography, flexography, screen printing, digital and gravure). The second column uses symbols illustrating the necessity, degree of difficulty, or cost involved in implementing each action-step. The following coding system is used:

- - essential, easy and/or low-cost options
- - actions that are optional and modest cost/difficulty
- - actions that are optional and have substantial cost/difficulty

Review this list for ideas and check those action-steps that might benefit your facility. Engage managers, press operators, and quality control managers in the review process. Together, prioritize feasible action-steps. Look for changes that make the most sense and offer the greatest benefit to your organization—and implement them.

These action-steps are recognized as best management practices. Further details are available at <http://www.pneac.org/sheets/>

Applicable Printing Process(es)	Difficulty/ Cost	Action Steps to Reduce and Prevent Pollution in Your Print Operations	Done	Needs Attention	Not Applicable
L=litho; F=flexo; S=screen; D=digital; G=gravure		O= low; ●= moderate; ●= high			
Section A: Pre-Press					
L,F	○	Extend life of plate developer through monitoring and replenishing.			
L,F	○	Use recycling service for depleted plate developer.			
L,F	○	Use countercurrent rinsing techniques.			
L	○	Recycle aluminum plates.			
L,F,S,G	○	Use squeegees to remove excess chemicals.			
L	○	Recycle or treat metal etching developer to remove metals.			
L	○	Use water-based plate developers.			
L	○	Use presensitized aqueous plates.			
F	○	Recycle plate developing chemicals.			
F	○	Collect and recycle any uncured portions of liquid photopolymer plates.			
F	○	Use the smallest sheet plate possible to achieve the desired image.			
G	○	Recycle copper shavings from gravure cylinder sizing process.			
L,F,G,S	○	Ensure that no photochemicals are discharged to septic system. Collect and send off-site for treatment and disposal or treat as necessary and discharge to sanitary sewer system.			
F	●	Use perc-alternative solvent (PAS), water-washable, or dry plate development system.			
L,F	●	Save water by using "intermittent" rinsewater flow (no flow when processor is on idle).			
L,F,G,S	●	Transition to direct-to-film system.			
L,F	●	Use digital systems (direct-to-press) that eliminate plate processing and associated chemicals.			
A2. Pre-Press; Proofing					
L,F,S,D,G	●	Transition to water-based, ink jet or dry sublimation digital proofing system.			
L,F,D,G	●	Transition to soft (on-screen) proofing.			
S	●	Transition to direct-to-screen system.			
A3. Pre-Press; Film Developing					
L,F,G,S	○	Recycle scrap film.			
L,F,G,S	○	Keep chemical baths covered to prevent oxidation and contamination of chemicals, and to reduce emissions.			

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L,F,G,S	○	Ensure that no photochemicals are discharged to septic system. Collect and send off-site for treatment and disposal or treat as necessary and discharge to sanitary sewer system.			
L,F,G,S	○	Recover silver from used fixer by either: <ul style="list-style-type: none"> • installing equipment to recover silver from pre-press wastewater discharge on-site; or • contracting with a service for shipment and treatment of silver-containing wastewater 			
		<i>If you recover silver on-site:</i>			
L,F,G,S	○	Check that your installation and operation meet the local sewer code. Where possible, use practices recommended by the Silver Council (see www.silvercouncil.org for a copy of the Code of Management Practice).			
L,F,G,S	○	Verify that the flow rate through your silver recovery system does not exceed the flow rate recommended by the manufacturer.			
L,F,G,S	○	If flow is intermittent, check after each use and prior to discharge to ensure proper operation. Intermittent flow can rapidly deteriorate chemical recovery cartridge (CRC) performance.			
L,F,G,S	○	Implement procedures to ensure that discharge from your on-site silver recovery system meets sewer code requirements including: <ul style="list-style-type: none"> • test effluent for silver concentration as directed • employees are trained on proper system operation • discharge from the system is checked at least weekly with test strips to ensure proper performance. • a log is maintained documenting system checks and results 			
L,F,G,S	○	If you use CRCs, verify that you have two cartridges, installed in series, and clear tubing between units (brown liquid in tubing indicates need to change first unit). When changing the CRC's make sure you backflush the one being removed three times, ensuring all residual fluid is transferred into the new cartridge to avoid hazardous waste issues.			
L,F,G,S	○	Check pH of solution entering CRCs with pH operating range recommended by manufacturer (usually 4.5 to 5.5). Typical fixer is in the range of 4.5 to 6.5 and may not need adjustment, depending on CRC specifications.			
L,F,G,S	○	Train employees for proper changeout of CRC units. Second unit should be moved to the first position and the new unit installed in the second position (after filling new CRC unit with water to prevent channeling and premature failure).			
L,F,G,S	●	Use a terminal electrolytic silver recovery unit in front of CRC units for initial silver recovery. Then pump to a holding tank where the partially desilvered solution can be metered into the CRC system.			
L,F,G,S	●	Use in-line electrolytic silver recovery to permit reuse of fixer/replenisher in combination with recycling system. Use replenishers and bath extenders according to supplier recommendations.			

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L,F,G,S	●	Make certain that automated processing equipment is properly maintained to ensure maximum life of chemicals and minimal waste.			
L,F,G,S	●	Install "squeegees" (cannot be installed on all developers) to remove excess chemicals prior to immersing film in a different chemical bath. This will reduce chemical carryover and extend bath life. Periodically check and replace squeegees.			
L,F,G,S	●	Use photochemical recycling services provided by suppliers or other vendors.			
L,F,G,S	●	Save water by using intermittent rinsewater flow (no flow when processor is on idle).			
L,F,G,S	●	Replace film with direct-to-plate (computer-to-plate) systems.			
Section B: Press					
L,F,S,D,G	○	Set goals to minimize make-ready waste. Regularly track and compare make-ready wastes (as a percentage of acceptable printed product) with goals.			
L,F,S,G	○	Establish and follow standard procedures for checking on-press registration.			
L,F,S,D,G	○	Develop and document recommended press settings for each press, for most common substrate and ink combinations.			
L,F,S,D,G	○	Record substrate, ink, press, and press settings for all possible re-run jobs, to reduce make-ready on subsequent runs.			
L,F,S,D,G	○	Implement an effective program to ensure that color requirements and other job specifications are thoroughly understood and can be tracked throughout prepress and production.			
L,F,S,D,G	○	Check substrate, coatings, adhesives, ink (and other input materials, such as fountain solution) for compatibility before initiating make-ready. Record problems and solutions with ink/substrate matches to reduce future problems and wastes.			
L,F,S,D,G	○	Use industry-standard light sources for checking color match, and change lights at manufacturer-prescribed intervals.			
L	○	Establish a regular system for cleaning dampening fountains and recirculation systems.			
L	○	Establish and follow standard procedures for mixing fountain solution. Check concentration by measuring pH and conductivity prior to use. Periodically measure pH and conductivity during the course of the run or day to ensure they stay within acceptable parameters. Incoming water pH and conductivity should also be measured and recorded to predict printing problems.			
F	○	Improve press-side housekeeping to prevent ink from drying on anilox rolls. To prevent: monitor and adjust ink viscosity and pH; correctly adjust doctor blade pressure; monitor ambient air humidity and adjust if necessary; maintain proper press speed.			

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F,G	○	Clean anilox rolls, gravure cylinders, and other press parts adequately and immediately to reduce amount of solvent needed for cleaning.			
L,F,S,D,G	●	Keep all equipment maintained to avoid oil leaks and minimize equipment wear.			
F	●	Consider alternate anilox cleaning methods such as blasting with baking soda or carbon dioxide.			
L,F,S,D,G	●	Schedule jobs to reduce press cleanup by running lighter colors, then darker colors, whenever possible.			
L,F,S,G	●	Dedicate a press or presses to running the same types of products to reduce press cleanup.			
L,F,S,D,G	●	Develop a checklist to detail requirements for basic press maintenance, including what should be done, when it will be done, who should do it, and procedures for documenting that it has been done.			
L,F,S,G	●	Check color during make-ready and production with spectrophotometer and densitometer.			
L	●	Implement a comprehensive roller maintenance program that includes recorded, regularly scheduled visual inspections, checks on roller durometer, deglazing, and reconditioning.			
F,G	●	Store and organize anilox rolls and gravure cylinders so that they are not damaged or misplaced.			
L,F,S,G	●	Equip presses with automatic registration systems to reduce makeready waste.			
L,F,S,G	●	Equip presses with web-break detectors to reduce scrap material.			
		B2. Press: Inks			
L,F,S,G	○	Reduce ink waste by reviewing ink estimation methods to ensure they are as accurate as possible.			
L,F,S,G	○	When adding ink to press, add only enough ink required to complete the scheduled job (reduces waste and cleanup).			
L,F,S,G	○	Schedule work on presses to minimize color changes and print station cleanups.			
L,F,S,D,G	○	Evaluate waste-ink management practices to assure that no inks are improperly disposed of and potential liabilities are minimized.			
L,F,S,D,G	○	Eliminate lead, mercury, cadmium, and chromium-based pigments.			
L,F,S,D,G	○	Maintain and use an accurate, current, and readily accessible inventory of ink stock, including partially-used containers. Use current ink stock whenever possible.			
L,F,S	○	Return unused ink to supplier, when possible.			
L,F,S,D,G	○	Keep good records on stock for recall and reuse, and maintain a first-in, first-out use plan.			
L,F,S,G	○	Contact supplier to determine if off-spec or obsolete inks can be rebled instead of discarded.			

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L,F,S,G	○	Reblend inks to black (either on-site or off-site) for internal or external use.			
L,F,S	○	Properly cover, seal and store partially-used containers of ink.			
F	○	Use press-return ink prior to using virgin ink, whenever possible, for job start-ups.			
F,G	○	Keep ink sump lids intact and closed on press to minimize evaporation.			
L,F,S,G	○	Train employees on proper product-transfer techniques, including pumping and pouring, to minimize waste.			
D	○	Follow manufacturers' recommendations for proper backflushing of digital printheads to ensure proper operation. When cleaning with solvent, minimize solvent use.			
L,F,S,D,G	●	Increase use of low-VOC inks. Consult supplier to determine if you are using the ink with the lowest VOC content to achieve desired results.			
D,F,G	●	Increase use of low-HAP inks. Work with supplier to select inks that minimize HAP content.			
L,F,S,G	●	Blend leftover inks into required colors using software designed to generate colors from existing inventory.			
L	●	Consider using "stay open" (non-skin forming) sheetfed inks.			
L,F,S,G	●	Consider computer-controlled ink mixing with digital scales.			
F	●	Use a reverse-angle doctor blade to reduce ink consumption and improve print quality.			
F,G	●	Use automatic ink delivery system to reduce the amount of waste ink generated.			
L	●	Consider automatic ink levelers for even distribution and ink agitators to help reduce oxidation of inks in the tray.			
F,D,G	●	Consider water-based inks			
L,F,S,D	●	Consider ultraviolet (UV) curable inks.			
L,F	●	Consider electron beam (EB) curable inks.			
L	●	Consider cartridge ink delivery system.			
F,G	●	Run ink sumps as low as possible at the end of a run to minimize press-return ink.			
F	●	Use enclosed doctor blade chambers which minimize ink evaporation and have automated cleaning to reduce solvent use.			
Section C: Solvents, Rags and Press Cleanup					
L,F,S,D,G	○	Use containers that deliver a controlled amount of solvent to a shop towel, and keep containers closed.			
L,F,S,D,G	○	Use lightly-soiled shop towels for the initial cleaning, then clean towels for final cleaning.			
L,F,S,G	○	Use parts washer with low-VOC or low-vapor pressure solvent to clean removable press parts (e.g., trays).			

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L,F,S,G	○	Keep solvent parts washers in good condition, with lids that close easily and completely. Be sure employees understand importance of keeping lid closed to reduce evaporation.			
L,F,S,D,G	○	Eliminate or minimize use of cleaners that contain HAPs.			
L,F,S,D,G	○	Collect and reuse cleaning solvent. Used solvent may be perfectly acceptable for initial cleaning applications. After the heaviest cleaning is completed, new solvent may be used for final cleaning.			
L,F,S,G	○	Recover solvent from shop towels for reuse or recycling. Use gravity-draining through false bottom containers or hand wringing.			
L,F,S,D,G	○	Ensure that used solvents and solvent-containing towels or wipes are not disposed of in trash.			
L,F,S,D,G	○	Keep shop towels in closed containers while on site. Do not allow shop towels or other cleaning pads to air dry.			
L,F,S,D,G	○	Reduce VOC emissions from cleanup solvents, by using reduced-VOC-content cleaners or lower-vapor pressure solvents. Use solvents with vapor pressure less than 10mm of Hg (millimeters of mercury as measured at 20°C or 68°F).			
L,F,S,D,G	○	Conduct training in proper cleaning methods to ensure success using new materials and practices.			
D	○	When cleaning ink jet heads, keep solvent collection containers covered.			
S	○	Test the possibility of further dilution of emulsion remover to reduce strength and amount of chemical used.			
S	○	Reduce haze remover use by rapidly removing ink from screen once production is complete.			
L,F,S,D,G	○	If waste is being shipped out for recycling or reuse, fill drums as completely as possible prior to sealing to reduce number of drums shipped.			
L,F,S,D,G	●	Send solvents that can't be reused off-site for recycling.			
L,F,S,D,G	●	Avoid solvent cleaners with flashpoints lower than 140°F or those that contain listed hazardous waste solvents.			
S	●	Consider use of water-based adhesive for platens used for textile screen printing operations.			
L,F,S,D,G	●	Consider installing a mechanical wringer, centrifuge, or self-contained towel/wiper cleaning system to recover solvents from shop towels and wipes for reuse.			
L,F,S,D,G	●	Consider on-site distillation unit to recover solvent for reuse. Feasibility is dependent on amount of used solvent.			
L,G	●	Consider installing automated press wash system.			
S	●	Use high-pressure water system to reduce amount of ink remover used.			

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Section D: Finishing					
L,F,S,G	○	Replace solvent-based adhesives with water-based adhesives when possible.			
L,F,S,D,G	○	Avoid or minimize use of coatings and adhesives that interfere with recyclability of the finished product.			
L,G	○	Use mechanical binding in place of chemical adhesives when acceptable to the customer.			
L,F,S,D,G	○	Optimize size and layout of substrate to minimize waste. Segregate and recycle trim cuttings.			
L,G	○	Maintain good inventory practices, including use of older binding materials first to avoid waste from outdated or unusable materials.			
L,F,D,G	●	Investigate use of dry rather than wet laminate system.			
L,F,D,G	●	Investigate use of solid-based laminate system.			
L,F,S,D,G	●	Bale and recycle scrap and production waste. Baling will decrease shipping costs, improve marketability of material, and reduce storage requirements.			
L,F,S,G	●	When using inkjet printing for address labels, etc., use water-based inks whenever possible.			
Section E: Management and Communication					
L,F,S,D,G	○	Develop communication/education strategy to help top management understand importance and value of pollution prevention as a sound business strategy. Engage their support for pollution prevention efforts.			
L,F,S,D,G	○	Establish, clearly communicate, and demonstrate to employees the commitment of top management to environmental compliance and reducing waste of all types.			
L,F,S,D,G	○	Positively acknowledge pollution prevention initiatives by employees, and the impact of those initiatives.			
L,F,S,D,G	○	Provide ongoing education and training to help employees see how understanding and controlling print processes improve quality and reduce wastes.			
L,F,S,D,G	●	Link environmental performance and quality team objectives; find and pursue common ground.			
L,F,S,D,G	●	Consider incorporating pollution prevention or environmental performance into performance standards and appraisals for managers and production personnel.			
L,F,S,D,G	●	Consider adapting an environmental management system (EMS), appropriate for your operation, to focus and sustain environmental compliance and pollution prevention efforts.			

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Section F: Customer Relations					
L,F,S,D,G	○	Review and maintain clear communication, both internally and externally; know what your customers want so that you get the order right the first time and minimize waste.			
L,F,S,D,G	○	Work with customers during the job design to show how to modify layout to minimize substrate and trim wastes.			
L,F,S,D,G	○	Work with customers in selection of substrate to increase recycled content of substrate, increase selection of environmentally preferable (e.g., reduced-chlorine) substrate, and reduce weight.			
L,F,S,D,G	○	Whenever using alternative materials, follow up on customer jobs to sample satisfaction with products. This will help you fully understand customer interest and satisfaction with environmentally preferable inks and substrates.			
L,F,S,D,G	●	Encourage customers, through use of incentives (e.g., price, time, or services) to make choices that help you achieve your environmental objectives. For example, provide incentives that encourage use of: existing inventory of ink; inks rebled from stock; recycled ink; substrates left over from other jobs; soft proofing technologies; or inks, coatings, or adhesives that reduce VOCs.			
L,F,S,D,G	●	Provide training to staff to help them recognize the opportunities in working with customers to reduce wastes and emissions.			
Section G: Input Materials					
L,F,S,D,G	○	Keep lids closed when not transferring materials.			
L,F,S,D,G	○	Work with vendors to explore how they can help you reduce VOCs, HAPs, hazardous waste, and other waste materials. Make it clear that you want and appreciate their help in reducing wastes and emissions.			
L,F,S,D,G	○	Require a review of all new material purchase requests to minimize or eliminate the use of materials that make it difficult to meet compliance requirements and your company's environmental, health and safety goals.			
L,F,S,D,G	○	Limit samples to smallest required amount. Return unused portions of samples to suppliers to reduce waste costs.			
L,F,S,D,G	○	Inspect incoming materials. Refuse delivery of damaged or improperly labeled containers or materials.			
L,F,S,D,G	○	Make sure materials are properly stored and managed to minimize the potential for damage to inventory, resulting in additional wastes.			
L,F,S,D,G	○	Ensure inventory management practices intentionally use oldest materials first.			
L,F,S,D,G	○	Train employees on proper product-transfer techniques, including pumping and pouring to minimize waste.			
L,F,S,D,G	●	Recycle substrate cores, wraps and packaging.			

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L,F,S,D,G	●	Use returnable totes, drums or other appropriately-sized containers whenever possible. Return empties to supplier. If returnable containers are not available, recycle non-returnable containers.			
L,F,S,D,G	●	Reduce container waste by ordering bulk purchases (e.g., ink, solvent) if high-volume usage is occurring.			
L,F,S,D,G	●	Avoid creating wastes in an attempt to reduce wastes (e.g.; using solvents to clean residual inks from empty containers, or ordering bulk quantities that lead to wastes from date expiration or spoilage from poor storage).			
L,F,S,D,G	●	Centralize responsibility for ordering solvents, and managing their distribution and usage tracking at your facility.			
L,F,S,D,G	●	Track material purchases and maintain good inventory practices to facilitate reporting, and to minimize waste and spoilage.			
L,F,S,D,G	●	If the product expiration date listed by the manufacturer has passed, when economically/technically feasible, test materials to determine if they are still suitable for use.			
Section H: Good Housekeeping					
L,F,S,D,G	○	Ensure facility is clean, neat and well lighted.			
L,F,S,D,G	○	Keep garbage separate from recyclable materials.			
L,F,S,D,G	○	Segregate hazardous waste from nonhazardous waste.			
L,F,S,D,G	○	Keep all recyclable waste streams separate. Work with recycling markets to understand pricing and contamination limits, so you can select the most appropriate segregation strategies for collecting and storing recyclables.			
L,F,S,D,G	○	Keep all waste drums properly labeled.			
L,F,S,D,G	○	Filter and reuse waste oil.			
L,F,S,D,G	●	Install and maintain a system to prevent unintentional spills or leaks from entering sanitary sewers (for example, seal floor drains and/or install leakproof berms around chemical storage areas.)			