REDUCING HAZARDOUS WASTE

Waste Reduction Guidebook for the Photofinishing Industry

with a summary of Washington Dangerous Waste Regulations

Sponsored By:

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Presented By:

The ERM Group

Bellevue, WA

Program Funded by a U.S. EPA RITTA Grant

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Summary of Washington Dangerous Waste Regulations for the Photofinishing Industry

The entire scope of handling hazardous waste, including generation, storage, transportation, treatment and disposal, is governed by state and federal laws and regulations.

These regulations provide for managing, tracking, regulating and minimizing wastes. They also include measures for proper training, contingency planning, operating procedures, and protective equipment to help ensure worker safety.

In Washington, you will be dealing primarily with the Department of Ecology (Ecology). Ecology is responsible for developing the State Dangerous Waste Regulations (Ch. 173 - 303 WAC), providing technical assistance to regulated persons, conducting inspections and enforcement actions, and writing permits for facilities that treat, store or dispose (TSD) of hazardous wastes.

Ecology must administer the state program according to minimum standards and expectations of the U.S. Environmental Protection Agency and the Resource Conservation Recovery Act (RCRA).

Complying with the state Dangerous Waste regulations includes following Department of Transportation (DOT) regulations for hazardous materials. DOT regulations cover labeling, placarding and other handling requirements, for the safe transportation of hazardous wastes.

Identifying and managing your wastes according to Ecology regulations can be complex and confusing. The following discussion is only a summary of the Washington dangerous waste regulations. Contact your regional Department of Ecology office for a complete copy of the State Dangerous Waste regulations. These regulations are often amended on a yearly basis, so make sure you are working with the most current version.

Identifying Hazardous Wastes

Photofinishing businesses generate several different types of wastes. It is the responsibility of each business to determine whether their waste is regulated as dangerous. In general, a dangerous waste is any discarded material which, if improperly disposed of, may pose a threat to human health or the environment. A waste is considered dangerous by the state if it is specifically listed in the state regulations or possesses one of the following characteristics that may be determined by standard test procedures:

- Ignitability - Liquids, solids or gases that burn or combust at temperatures less than 140°F
- EP Toxicity - Heavy metals and/or source pesticides can be leached from the waste
- Corrosivity - Wastes with high or low pH (>12.5, <2)
- Reactivity. - Wastes that chemically react with exposure to air, water, heat, pressure or other materials. Reactions can cause releases of toxic gases, explode or spontaneously ignite.

Tests should be conducted if it is unclear whether or not a waste meets any of the above characteristics or criteria. A waste may also be regulated as a dangerous waste if it meets any of the criteria for designating the waste as toxic, persistent, or carcinogenic.

Criteria for Identifying Hazardous Wastes

- Toxic - A waste may qualify as "toxic" if exposure can contribute to death, injury or illness of humans or wildlife. Tests to determine toxicity include fish toxicity, orally dosed rats, inhalation by rats and the skin of rabbits.

- Persistent - Persistent wastes include wastes which persist in the environment or bioaccumulate. The test for persistence applies only to halogenated hydrocarbons (including many solvents) and certain polycyclic aromatic hydrocarbons (including many solvents).

- Carcinogenic - If a waste contains one or more substances which are determined to cause cancer by the International Agency for Research on Cancer or in other scientific documents, it may be a carcinogenic waste under these regulations. The waste is subject to the hazardous waste regulations if it is generated in quantities over 220 pounds per month or batch and if the concentration of the carcinogenic substance(s) is greater than 0.01% of the waste. (A waste is designated an Extremely Hazardous Waste if the concentrations of the carcinogenic substance is greater than 1%).

The EP Toxicity test will be replaced by the Toxic Characteristic Leaching Procedure (TCLP). This change in regulations will affect small quantity generators beginning March, 1991.

Depending on the level of hazard posed, a waste may be designated as a Dangerous Waste (DW) or an Extremely Hazardous Waste (EHW). The latter wastes are regulated more stringently. Details on the designation of DW and EHW can be found in the Washington Dangerous Waste regulations or in the Guide for Hazardous Waste Generators (see bibliography at the end of this handbook).

Photofinishing Wastes

Wastes produced from photographic processing vary with the type and amount of film being processed and the type of processing being done. The types of photographic processing solutions commonly used include activators, fixers, developers, various bleaches, hardeners, monobaths, neutralizers, stabilizers, and stop baths.

Wastes generated from photographic processing include wash waters and processing solutions that need to be disposed periodically. Wash waters usually contain small amounts of processing solutions. Processing solutions that may be disposed of as waste include spent solutions and process tank overflows. Wastewaters may contain some of the process chemicals not used up during processing, and small amounts of chemicals leached out of the film and paper emulsion during processing, such as silver thiosulfate complex.

The table below provides information for classifying hazardous wastes prior to off-site shipment. The correct designation for a specific waste should be verified with your transporter or the regional offices of the federal Department of Transportation prior to completion of the hazardous waste manifest. ITEMS LISTED ARE EXAMPLES ONLY, and other DOT descriptions and identification codes may be applicable in some circumstances.

Wastes generated as a result of photoprocessing operations include:

WASTE TYPE	WASTE CODE
• Heavy Metal Solutions	
- photoprocessing wastes containing heavy metals	
• cadium	D006,
• chromium	D007,
• lead	D008, or
• silver	D011
• Cyanide bearing solutions	D003

Generators of waste should be careful not to pour liquid hazardous waste down the drain which may lead directly to a waterbody, or dispose of solid hazardous waste in the dumpster.

Process Wastewaters

The discharge of photofinishing wastewater to the sanitary sewer system is a commonly employed practice and currently acceptable method of waste disposal. Such discharges however, are subject to local restrictions and limitations. As long as the photofinishing wastewaters are discharged to the sanitary sewer system along with domestic sewage, the wastewater is not subject to state hazardous waste regulations, even if the wastewaters are classified as hazardous wastes. This is because of an exemption for process wastewaters in the state regulations. However, other hazardous substances may not be added to the wastewaters, and a permit for such discharges is often required from the local sanitary sewer municipality. If process wastewaters are not discharged along with domestic sewage, then the domestic sewage exemption does not apply and the wastewaters may be subject to state regulations. Photofinishers intending to discharge process wastewaters to the sanitary sewer system should consult with local authorities to determine whether this exemption is applicable to the specific operations of their facility.

NOTE: In September 1990, Ecology will propose a new rule to tighten the exemption for discharges of dangerous wastes to sewer systems. When adopted, this new rule will require dischargers to eliminate hazardous constituents or treat wastewaters to concentrations below thresholds for designation as dangerous waste.

In general, there may be local discharge limitations established for a number of wastewater parameters, and those which apply to the photofinishing industry include pH, temperature, and heavy metals.

Wastewaters that do not meet discharge limits may require pretreatment for the removal of the problem constituent(s). Businesses intending to discharge process wastewaters to the sanitary sewer system should check with their local municipality to determine what discharge restrictions or limitations apply and if a discharge permit is required.

In areas not serviced by a municipal sanitary sewer system and treatment facility, other wastewater management alternatives need to be considered, such as a contracted waste pick-up and disposal service. When using this alternative, photoprocessing businesses should be careful to keep potentially hazardous wastewaters segregated from the non-hazardous wastewaters. Mixing hazardous and non-hazardous wastewaters may result in a mixture that is also a hazardous waste. Keeping these wastewaters separated will reduce the total amount of hazardous waste generated and thus minimize the resources and problems associated with the management of hazardous wastes.

Process wastewater discharges to a surface water, such as directly to a lake or stream, or to a storm sewer, are subject to the Federal Clean Water Act, and require an NPDES (National Pollution Discharge Elimination System) discharge permit. The act places restrictions and limitations on specific wastewater parameters that can be discharged. To meet discharge limitations, the process wastewaters must generally be extensively treated on-site prior to discharge. <u>Wastewaters containing hazardous wastes cannot be discharged to surface waters.</u>

Containers

The containers in which photoprocessing chemicals are kept may be considered hazardous waste unless they are being recycled, reused or are legally empty. The EPA waste code and corresponding characteristics assigned containers depends on what has been in them. The definition of "empty" according to regulations is as follows:

- All wastes have been removed that practically can be removed by methods of pouring, pumping, etc., and

- No more than 1 inch of residue remains on the bottom of a container, or

- No more than 3% by weight of the total container capacity remains in a container equal to or smaller than 110 gallons, or

- No more than 0.3% by weight of total container capacity remains for a container larger than 110 gallons.

- For a container which has held acutely hazardous wastes, must be triple rinsed before it is considered legally empty.

Regulatory Status

The more waste produced and/or accumulated by an photofinishing lab, the more regulatory requirements there are to meet. Each company must comply with the requirements set for their generator category. Hazardous waste generators are allowed to temporarily accumulate hazardous waste on site without a storage permit. However, accumulation time and quantity vary depending on the company's generator status as described below:

Fully Regulated Generators
Generate or accumulate 2,200 lbs. (approximately five 55 gallon drums) or more of dangerous waste, or 2.2 lbs. or more of acutely hazardous waste per month.

220-2200 Pound Generators
Generates between 220 lbs. (approximately one 55 gallon drum) and 2,200 lbs. of dangerous waste per month and never accumulates more than 2,200 lbs. at any time.

Small Quantity Generators
Generates less than 220 lbs. of dangerous waste and less than 2.2 lbs. of acutely hazardous waste per month and never accumulates more than 2,200 lbs. of hazardous waste [illegible] 2.2 lbs. of acutely hazardous waste at any time.

Generators under the quantity exclusion limits must make sure that they:

- know what kinds of wastes they produce (i.e. is it dangerous)
- treats or disposes of waste on-site, or,
- ships wastes off-site to a permitted TSD, legitimate recycler, or a facility permitted to manage solid wastes (e.g. solid waste landfill).

If any one of these conditions are not met, then the generator is fully regulated under dangerous waste regulations

If a non-dangerous substance is mixed with a listed or characteristic dangerous waste, it may result in the entire mixture being regulated as a dangerous waste. Additionally, if two non-dangerous waste streams are mixed, the resulting mixture could demonstrate dangerous characteristics and therefore be deemed dangerous waste. The addition of these mixtures to a generator's dangerous waste stream could result in the generator losing small quantity generator or 220-

2200 pound generator status, and thus be subject to the requirements of fully regulated generators.

NOTE: In September 1990, Ecology will propose a new rule changing the conditional exemption for sending small quantity wastes to a solid waste facility. The proposed rule will require that wastes be managed according to a locally adopted moderate-risk waste plan.

An outline of the Dangerous Waste Generator Requirements of each generator category is attached.

The Photofinishing Industry

This summary will begin with a brief background of the photofinishing industry. Hazardous wastes which may potentially be produced during the photofinishing process will be discussed. General waste reduction and recycling techniques will be described in the next section. Beginning with the "Waste Reduction Opportunities" section, specific waste reduction opportunities will be presented. These include process changes, water conservation, silver recovery, and the reuse of bleach, bleach-fix, and fix.

The information presented in this summary was taken in part from the following documents: *Profit from Pollution Prevention* and *Waste Audit Study/Photoprocessing Industry*. Refer to the references for a complete bibliography. We extend our thanks to the authors for the use of their materials.

BACKGROUND

The photographic processing industry includes businesses processing color print films and paper, color slide films, color movie film and black and white film. Typically, only 10% of a commercial photoprocessor's business involves black and white processing. While other users of photography, such as hospitals processing x-ray films and printing plants processing graphic arts films, are not considered part of the photofinishing industry, many of the waste reduction strategies discussed in this guidebook are applicable for these users.

Processing photographic film and paper requires the use of a number of chemicals and lab setups to develop and produce finished photographic goods. Process chemicals may include developers, bleaches, fixing agents (fixer) and stabilizers. Waste streams generated vary widely according to the type and volume of processing, but may include ferrocyanide, silver, cadmium, chromium, ammonium salts, trisodium phosphate, sodium nitrate, and formaldehyde.

In 1962, the price of silver was $.90 per Troy ounce. In 1967, the United States government removed its price restraints on silver, permitting silver prices to respond to market demand and speculative buying; one year later, silver prices had doubled and many of the photographic processing labs not already reclaiming silver were well into recovering silver from their process wastewaters. Today silver prices are averaging $5 - $6 per ounce but have been as high as $40 per ounce in 1980.

The escalation in silver prices did much to steer the film industry along a course of pollution prevention. Along with the knowledge that silver recovery brought higher profits came the awareness that recycling process chemicals and washwaters could heighten profit margins even more. For example, desilvering of spent fix solutions meant that recovered fix could be reused to replenish process fix.

More than a decade of active research in maximizing waste reuse in photofinishing has resulted in the availability of a growing selection of recovery equipment and retrofit design options. Commercially available equipment is capable not only of recovering silver, but also of regenerating spent fix, bleach, bleach-fix and developer process baths using individual closed-loop systems. However, the use of recycling technology in photographic processing does require care in monitoring to guarantee consistent product quality.

Refinement in reuse technology allows many of the dilute contaminants in waste rinsewaters presently discharged to sewers to be recovered economically by medium-sized businesses. Future technology developments may see further scaling down of equipment to be economically attractive to even very small photoprocessing plants.

POTENTIAL HAZARDOUS WASTES PRODUCED

Most small to mid-sized photolabs are located in areas serviced by a public sewer, and photoprocessing wastes are discharged to the sewer along with sanitary wastes. Local authorities regulate the concentration of sewered chemicals. Photolabs usually do not generate large quantities of non-sewered hazardous waste.

Film Processing Wastewaters

Several types of processing chemicals are used in developing films. These processing chemicals include developers, fixers, stabilizers, and activators. Some film processing solutions may be classified as corrosive due to pH values, such as dichromate bleaches, which have a pH less than 1.0. Silver, chromium and cyanides (found in ferrocyanide and ferricyanide bleaches) may also be found in film processing wastewaters.

Wastewaters may contain small amounts of processing chemicals not used up during processing, trace amounts of chemicals such as silver thiosulfate complex, leached out of the film and paper emulsion during processing, and process tank overflows. Many of the chemicals present in photographic processing waste streams are readily biodegradable, however some are not. Listed below are three categories of biodegradability and the process chemicals that fall within each.

- *Rapid Biodegradation* - acetate, benzyl alcohol, hydroquinone, sulfite, thiosulfate.

- *Slow Biodegradation* - developing agents, citric acid, ammonium salts, glycols, hydroxylamine sulfate, formalin, formic acid.

- *No Biodegradation* - phosphate, bromide, ferrocyanide, borate, nitrate.

Sludges
Sludges may be produced as a result of the treatment of spent rinse waters. Sludges may also result from the supersaturation of dissolved metals (silver) and chemicals in rinse baths which settle out in the bottom of tanks. In addition to heavy metals, process chemical residues, sludges contain significant amounts (over 95%) of water. Removing excess water from these sludges will result in a significant volume reduction of the material that must be disposed. Several methods are available for accomplishing volume reduction, including the use of centrifuges, vacuum filters, and filter presses.

Containers
Empty product containers and drums may contain residual processing chemicals. Legally empty containers (see definition of "empty" in the Regulatory Summary) do not constitute hazardous waste. Many vendors will accept emptied containers back for refill and containers recycled in this manner are not regulated as hazardous wastes. If the containers have been adequately rinsed, they may be disposed of at a licensed sanitary landfill. You must check with local authorities for specified restrictions.

Film Negatives and Transfer Papers
These materials may contain significant amounts of recoverable silver. Many of the contract services that pick up reclaimed silver from on-site silver recovery systems will also collect film negatives and transfer papers.

WASTE REDUCTION TECHNIQUES

Introduction

Minimizing the production of hazardous wastes in your photoprocessing business makes sense because it can help you to:

- reduce operating costs by using less raw materials;

- improve workplace health and safety;

- reduce your regulatory requirements, saving time and money;

- reduce the liabilities associated with the management of hazardous waste; and

• reduce potential damage to the environment.

Federal and state regulations require that hazardous waste generators must manage their wastes in accordance with the appropriate hazardous waste regulations. Generators of 220 lbs/month (or 2.2 lbs/month of acutely hazardous waste) must certify that they have a program in place to minimize the volume and/or toxicity of hazardous wastes. The EPA defines waste minimization as both source reduction and recycling.

Source Reduction
Source reduction includes good housekeeping techniques, raw material substitution, and changes in processes which reduce the amount of hazardous wastes produced at the source of generation. For example, using film with less or no silver reduces silver content in process waste streams.

Recycling
This includes the recovery and reuse of hazardous wastes such as spent photoprocessing chemicals. Photoprocessing chemicals can be renewed by using replenishment concentrate and regenerators. Silver can also be recovered from photographic wastes.

SOURCE REDUCTION AND RECYCLING-GENERAL PRACTICES

There are many ways to reduce the amount of hazardous waste produced in your photofinishing business without buying new equipment. Improved "housekeeping" practices can minimize the chance of material losses. They can be as simple as keeping good records of hazardous materials purchased to avoid overstocking or as complex as changing management's perspective on the substitution of raw materials which are less hazardous. However, these changes can affect the amount of hazardous waste leaving your operation which generally means a cost savings for the business.

Source reduction and recycling practices include:

1. Management Initiative
2. Employee Training
3. Good Housekeeping Practices
4. Proper Material Handling and Storage
5. Process and Equipment Modification
6. Raw Materials Substitution
7. Waste Stream Segregation
8. Use of Waste Exchanges

Discussion of each of these practices follow. For more detailed information on waste reduction techniques, refer to the section entitled "Waste Reduction Opportunities".

1. Management Initiative

Management support is critical to any waste reduction program. If there is not enough visible support from management, employees will see little incentive to look for waste reduction opportunities and the waste reduction program will not be as effective as it could be. Employee incentive programs such as awards for waste reduction ideas can help foster awareness of waste reduction policies, goals, and benefits.

2. Employee Training

Employee training is an important part of your waste reduction program. The personnel responsible for operating and monitoring equipment, loading and unloading hazardous materials and purchasing, storing and transferring chemicals should be trained in safe operating procedures, including the handling of hazardous wastes and proper equipment use.

Employees should be made aware of the hazards of the materials they will work with by reviewing the Material Safety Data Sheet (MSDS) prepared for each chemical and through training required under federal and state occupational safety and health regulations. This awareness will help identify their personal responsibility in maintaining safe practices which help minimize hazardous waste production.

Employees should be cautioned not to accept a sample product from a vendor (e.g., a new film or photoprocessing chemical) because it may become a hazardous waste when discarded or may generate a hazardous waste if used. Employees should be trained to read the label and MSDS and understand what is in the product and how to use it. The selection process should have worker safety as a top priority.

3. Good Housekeeping

The following suggestions may be applicable to your shop.

- Keep lids on containers to reduce evaporation and chance of spills;
- Label all containers with contents and use information;
- Conduct regular waste audits;

- Monitor content of chemical baths and wastes produced;
- Monitor amounts of chemicals used to reduce overages;
- Maintain Material Safety Data Sheets to identify the chemical ingredients of waste products;
- Improve water use efficiency.

An important part of good housekeeping is a maintenance program. Whether preventive, corrective, or both, a maintenance program can help cut costs of repairs, waste disposal resulting from leaks and spills and reduce business interruptions.

4. Proper Material Handling and Storage

Store Materials Properly
Many photoprocessing chemicals are sensitive to temperature and light. Photosensitive film and paper storage areas should be designed for economical and efficient use. Chemical containers list the recommended storage conditions, and meeting these conditions will increase shelf life.

Control Inventory
Inventories should be kept using the "first-in, first-out" practice. This will reduce the possibility of expired shelf life, but this practice may not work for specialty materials that are seldom used. Use of a computerized inventory system can help track the amounts and ages of raw materials.

Purchase Quantities According to Needs
Raw material order quantities should be matched to usage. Small photoprocessors should order process chemicals in small containers according to use. Large photoprocessors should order materials in large containers, which may be returnable, thereby eliminating or reducing the need to clean them. Ordering materials in returnable tote bins may maximize these advantages.

Test Expired Material for Usefulness
Materials having expired shelf-life should not automatically be thrown out. Instead, test such materials for effectiveness. The material may be usable, rather than becoming a waste.

Minimize Spills and Leaks
Spilling and leaking of hazardous substances can create hazardous wastes which must be properly managed. If the material used in the clean up, such as water or absorbent, is contaminated with the hazardous substance, it must be discarded as a hazardous waste. Quick response to a spill can minimize the amount of spill material,

including any contaminated soil or water. Therefore, spill and leak prevention are important ways of reducing your hazardous waste generation.

5. Process and Equipment Modification

Presented here is only a summary list. Many of these techniques are discussed in greater detail in the "Waste Reduction Opportunities, Process Changes" section of this summary.

Modifying or modernizing lab equipment and making processes throughout your shop more efficient can help reduce the amount of wastes generated and raw materials used.

- Reduce wastewater volumes by using a washless processing system;
- Use a closed cycle system to enhance silver recovery;
- Recycle wastewater;
- Use non-absorbent "twin check" tabs to reduce the amount of chemicals carried over from one bath to another;
- Use counter-current wash systems to control cross contamination;
- Use water demand zone valves to control water use;
- Use two chemical recovery cartridges in series to maximize silver recovery;
- Use floating lids on bleach and developer containers to retard oxidation;
- Squeegee chemicals from films to minimize cross contamination;
- Renew photoprocessing chemicals by use of replenisher concentrates and regenerators.

6. Material Substitution

One way to reduce waste generation is to use less toxic raw materials or products which reduce waste generated. There are limited opportunities for this type of waste reduction in photoprocessing, and alternate materials may be unavailable, more expensive, or have undesirable effects on product quality. However, there are product substitutions that have proven successful. For example:

- *Use film with less or no silver (films containing bismuth have been used successfully in applications such as black and white graphic arts processes and x-ray film); and*
- *Replace ferricyanide bleach with ferric EDTA (ethylenediaminetetraacetic acid) complex which is less toxic. (Note: mixing from scratch can be hazardous to the chemical mixer)*

7. Waste Stream Segregation

It is important not to mix different waste streams. Once a non-hazardous waste is contaminated with a hazardous waste listed in the regulations, the entire waste stream becomes a "listed" hazardous waste and must be managed as such. Mixing of two non-hazardous wastes could result in the formation of a waste that exhibits a hazardous characteristic. In addition, mixing wastes can increase the volume of hazardous waste you generate and potentially increase your regulatory requirements for the managements of these wastes.

8. Waste Exchanges

Waste exchanges or materials exchanges provide another management alternative. Materials exchanges are organizations that manage or arrange the transfer of wastes between businesses, such that one producer's waste materials or feedstock might be another business's feedstock.

For a copy of the latest catalogues, contact:

PME — Pacific Materials Exchange
S. 3707 Godfrey Blvd.
Spokane, WA 98204
Bob Smee (509) 623-4244

IMEX — Industrial Materials Exchange
172 20th Ave.
Seattle, WA
(206) 296-4899

As an example of the value of these exchanges, a major film processing lab in Seattle was able to use the Industrial Materials Exchange to recycle both unused chemicals and empty containers, avoiding expensive disposal fees.

WASTE REDUCTION OPPORTUNITIES

Process Changes

Process modification techniques are designed to use materials more efficiently, reducing the generation of waste. However, because much of the photoprocessing equipment is integrated, and each process step is part of an overall unit, it may be difficult for a photolab operator to modify equipment and improve material use. Additionally, major modifications must either originate with the equipment manufacturer or result from the strong commitment, and often expertise, of the owner/operator to invest in a costly retrofit of existing equipment.

Despite such barriers, a number of techniques can be applied to both manual and automated photoprocessing operations to enhance materials use and minimize waste generation. These practices may include process adjustments and installation of low cost, waste reduction devices compatible with existing equipment. Examples are:

- ***Reuse Solutions***
  When using a tray method, solutions can be reused until test strips indicate they are chemically exhausted.

- ***Cover Tanks***
  When not in use, tanks should be kept covered to reduce contamination, evaporation, and oxidation. Oxidations can be further reduced by using a tight-fitting "floating lid" of buoyant plastic and limiting the amount of time the solution is in use.

- ***Use Cylinders***
  Additional chemical savings can be realized by changing the shape of the container. A cylinder can achieve higher efficiency than a rectangular tank, due to smaller container volume and surface area, and the ability to evenly distribute solutions by rolling the tube.

- ***Replenish Carefully***
  Photofinishers demand a high quality product, and there is a tendency by some to overcompensate by using more chemicals in the process than are necessary. This overcompensation often results in an increase in the strength of the waste stream and higher chemical expenditures. The careful addition and monitoring of chemical replenishers to process baths will save

money in the long term by reducing total chemical costs. The use of replenishment gauges can help ensure that the chemical make-up of process baths is optimum, in addition to minimizing unnecessary chemical losses to the sewer.

- ***Use Squeegees***
  Squeegees reduce chemical carry-over on film and paper moving from one process to the next by removing excess liquid. Squeegees typically reduce chemical carry-over by 50%. By minimizing chemical contamination of process baths, the total quantity of replenisher chemicals required is drastically reduced and the lifetimes of process baths are increased. This reduces the frequency of process bath dumps and the total quantity of wastewater discharge. It is best to place squeegees at the exit points of each different process bath for all continuous processors.

  The earliest form of wiper-blade squeegee was a rubber blade which deteriorated quickly with chemical contact. Regular inspection of squeegee equipment should be part of a normal maintenance program. Newer polyurethane blades are more resistant to chemical deterioration and may be preferable to traditional rubber. Other squeegee types are available and should be examined as possible improvement to an existing system. You need to choose what works best for your specific processes. Listed below are a few of the squeegee types available.

  - Air-knife
  - Venturi
  - Rotary Buffer
  - Polyurethane Blade
  - Belt turn-around and soft-core roller

Wastewater Reduction

The costs of wastewater treatment can be significant. Options for reducing the need to treat wastewater include water conservation and counter current rinsing. The goal here is to avoid the discharge of valuable residues and process water. A good place to start looking at your opportunities is with an inventory of all the sources of wastewater. Major sources include:

- Rinsewater is the major component of the wastewater stream. Rinsing is necessary to remove excess process solution.

- Spills, drips, leaks and clean-up wastes taken as a composite can be significant.

- Other large scale accidental losses are not usually accommodated and can be expensive due to the loss of process chemicals.

1. *Water Conservation*

Water consumption can be reduced by shutting off the water when film is not being processed. Also, a solenoid valve can be installed to automatically reduce water flow when film processing stops.

It is not uncommon for a photofinishing lab to have a rinse system which is overdesigned for some uses. A close examination of your specific processes may reveal an opportunity to reduce the total volume of washwater used without impairing photo or film quality.

Water savings may be realized through simple equipment readjustments. For example, one company halved their water consumption in one year by attending to leaks and running hoses, cutting stand-by flows to a minimum, adjusting control valves that were found to be over specification, and encouraging employees in "water awareness". The company also recycled water from the final wash to supply the stop wash.

Improving water use efficiency is a low-cost investment that can yield considerable savings. Because washing of photographic material is a principle use of water in the photofinishing industry, more efficient rinse techniques will greatly reduce the total volume of wastewater that is treated on-site or discharged to the sewer system. As water is reduced, however, the percentage of wastes may increase to problem levels.

2. *Counter-Current Rinsing*

The counter-current system is an important waste reduction technique. It is preferable because it uses much less water than its parallel tank counterpart. Rinsing (also referred to as washing) has two major functions in the photofinishing process: reduce processing solution contamination and ensure long-term stability of the photographic image.

In a parallel system, fresh water enters each wash tank and effluent flows out of each tank. Counter-current washing utilizes a system where fresh water enters only the final wash tank near the exiting film. Each of the wash tanks overflows into the preceding tank, with effluent leaving only the first tank near the entering film.

Conversion of an existing wash system to a counter-current system, where space permits, will pay off because of reduced water use and costs. For example, a two-stage counter-current system can be one hundred times more efficient when compared to washing in a single deep tank with the same total volume of washwater.

Silver Recovery

There are several sources of recoverable silver from the photofinishing process: photoprocessing solutions, spent rinse water, and scraps of film and printing paper. The silver in these materials can exist as insoluble silver halide, soluble silver thiosulfate complex, silver ion, or silver precipitate depending on the type of process and the stage in the process from which the silver is being recovered.

The fix stage is the most economical source for silver recovery. As much as 80% of the total silver processed for black and white positives and close to 100% for color work will end up in the fixer solution. Color films yield 3 to 4 times as much recoverable silver in process baths as do black and white films.

Rinse water following the fixer or bleach-fix will also contain silver due to carry-over. Because the silver content of rinse waters is fairly dilute, large amounts of this effluent may be needed to make silver recovery economical.

Improved recovery processes have given small photo processing labs the possibilities of economically recapturing their silver. The five basic methods used for silver recovery are metallic replacement, electrolytic recovery, chemical precipitation, ion exchange and reverse osmosis. Ion exchange and reverse osmosis are most often used for silver recovery from rinsewaters. Which system you choose depends on the size of your business.

1. Metallic Replacement

Metallic replacement occurs when a metal such as iron contacts with a solution containing dissolved ions of a less active metal such as silver. The dissolved silver, present as a thiosulfate complex, reacts with the iron and settles out as a sludge.

Although silver ions will displace many of the common metals from their solid state, iron in the form of steel wool is preferred because of its convenience and economy. Zinc and aluminum are effective as replacement metals, however zinc is shunned because of its relative toxicity and greater cost; while aluminum is avoided because of the simultaneous generation of hydrogen gas, which can be explosive.

The pH of the solution passing through the metallic replacement unit should be between 4 and 6.5. The optimum is between 5 and 5.5 for the most effective operation of the unit. Below a pH of 4, the dissolution of the steel wool is too rapid; above a pH of 6.5, the replacement reaction may be so slow that silver removal is incomplete.

Commercially available units consist of a steel wool-filled plastic canister with needed plumbing. Waste fixer is fed to two or more canisters in series or series-parallel combinations. For two canisters used in series, the first canister removes the bulk of the silver and the second polishes the effluent of the first. Silver concentration in the effluent from a single canister averages 40 to 100 milligrams per liter (mg/L), over the life of the system. If two canisters are used in series, the silver concentration drops to a range of 0.1 to 50 mg/L. The second canister is also a safety factor if the first unit is overused. Over the life of the canister, the average iron concentration in the effluent is 4,000 mg/L. Because of this iron contamination, the desilvered fixer cannot be recycled, until an economical iron removal process can be developed.

2. Electrolytic Recovery

Electrolytic recovery may be the most promising silver recovery technique for even small photofinishing labs. During the electrolytic recovery process, a controlled direct electrical current is passed between two electrodes (a cathode(+) and an anode (-)) which are suspended in the silver-bearing solution. Silver deposits on the cathode in the form of silver plate with a purity of close to 99%. The cathode is removed periodically and the silver stripped off. Lower levels of purity usually result from tailing unit applications due to the lower concentration of silver in the influent solution.

Care must be taken to control current density in the cell. High density can cause "sulfiding", the decomposition of thiosulfate into sulfur at the cathode, which contaminates the deposited silver and reduces recovery efficiency. The higher the silver concentration in the solution, the higher the current density can be without the occurrence of sulfiding; therefore, as the silver is plated out of solution, the current density must be reduced.

An electrolytic unit can be used for a primary or tailing waste stream, and can be batch or continuous. Batch and continuous applications of electrolytic recovery units are discussed below. Recirculating electrolytic recovery is also discussed below.

- **Batch Electrolytic Recovery**

  In batch recovery, overflow fixer from one or more process lines are collected in a tank. When sufficient volume is reached, the waste fixer is pumped to an electrolytic cell for silver removal. Once desilvered, the fixer can usually be discharged to the sewer system, disposed of as solid waste, or reused. If the fixer is to be reused, it is transferred to a mix tank where sodium thiosulfate and potassium chrome alum are added to bring it to replenishment strength.

Primary batch system cells are usually designed to desilver the fixing bath with initial silver concentrations of about 5,000 mg/L. Silver concentration in the effluent is typically 200-500 mg/L. Effluent with a silver concentration of 20-50 mg/L can be achieved with additional treatment time and careful current density control.

- **Continuous Electrolytic Recovery**

  Electrolytic recovery units are also capable of treating the overflow fixer stream continuously. The volume of the electrolytic unit must be large enough relative to the incoming flow volume to ensure adequate treatment time for the fixer. This can be achieved with two or more units placed in series, with the continuous flow of incoming fixer supplying a constant quantity of silver for recovery. As a result, the units can be operated at a relatively stable current density and can be an automatic system. Some units are available that can sense silver concentration in solution and adjust current densities accordingly. Continuous flow units usually discharge desilvered fixer directly to the sewer system.

- **Recirculating Electrolytic Recovery**

  Silver can also be removed from in-use fixer solution by a continuously recirculating system. With this system, the silver is removed at approximately the same rate it is added by the processing of film. The recovery cell is connected "in-line" as part of the recirculating system. This technique of continual removal has the 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. Recirculating electrolytic recovery has the capability of maintaining silver concentration in the fixer in the range of 500 to 1,000 mg/L, depending upon the flow rate and hydraulic capacity of the system.

  Once installed, the unit may be fully automatic with little daily maintenance required. By sensing the flow of fixer through the electrolytic cells (which themselves contain no moving parts), the unit turns itself on. Solution is circulated by the pumped flow of fixer. Silver is usually collected every 2-3 months.

  By maintaining low silver concentrations in the fixer processing solution, the recirculating silver recovery system minimizes the silver lost through carry-over into the waste tank, which results in two benefits:

- More silver is recovered, increasing monetary return.
- Because the concentration of silver in the wash water is decreased, the photofinishing lab is less likely to exceed allowable discharge limits when releasing the wash water to the sewer.

Desilvered fixer solution can be reused, whether from an "in-line" continuous system or from batch. However, this requires adequate monitoring and process control to protect product quality. Parameters such as pH, silver, and sulfate-concentrations should be monitored to maintain the physical and chemical properties of the fixer solution. This usually requires the addition of make-up chemicals.

Not all the fix can be reused. With some processes, the reuse of as little as 50% of the desilvered fix added to new fix has resulted in the serious staining of the sensitized product unless proper precautions are taken such as sulfiting the replenisher solution. Because of such problems, some processing labs avoid using certain recycling techniques, and some prefer to use an in-line electrolytically desilvered system.

The in-line system continuously desilvers the fix in the tank and allows the use of a reduced replenishment rate for the fix. However, to use this system successfully, it may be necessary to modify the replenisher solution by adding sulfite.

Residual silver in the electrolytically desilvered fix can be captured using a metallic replacement cartridge as a secondary silver recovery step. This is known as tailing.

3. *Chemical Precipitation*

Chemical precipitation, though the oldest and cheapest method of silver recovery, is rarely used by photoprocessors, but used widely by manufacturers of photographic supplies. The two primary disadvantages of this process is the generation of hydrogen sulfide gas and the resulting sludge which must be handled as a hazardous waste. Recovery of silver from the sludge is more difficult than other methods.

Sodium sulfide and sodium borohydride are effective precipitants of silver; the sodium borohydride method, however, requires significantly more excess chemicals to complete the reaction.

The process mixes the precipitating agent with the silver-bearing wastewater in a batch reaction tank equipped with automatic pH control. When sodium sulfide is used, the pH must be maintained above seven to avoid the release of toxic hydrogen sulfide gas. The optimum pH range for sodium borohydride precipitation is 6.5 to 6.8. Solid particles of 1-2 microns are formed and allowed to settle out before filtering.

Solutions treated by sodium sulfide or sodium borohydride cannot be reused in the photographic process.

4. *Ion Exchange*

The basis of the ion exchange system is the ability of certain resins to act on ion solutions and selectively replace some of their own ions with ions from the solution. The process is essentially cyclic, with the solution being treated passing through the resin until its absorption capacity is exhausted. The resin is then regenerated by another chemical that replaces the ions given up by the exchange process, converting the resin back to its original composition.

One of the disadvantages associated with ion exchange is that silver thiosulfate complex has a high affinity for the resin used, which makes it difficult to reclaim the silver and regenerate the resin. The column is regenerated with 2% H_2SO_4 which forces silver into the bead matrix as sulfides. The acid solution must be neutralized. Other potential problems include plugging of the resin by suspended matter such as gelatin. However, changes in equipment design and operational procedures have addressed these problems.

5. *Reverse Osmosis*

Reverse osmosis (RO) combines physics with modern membrane technology, and is based on the principle of natural osmosis. When a concentrated salt solution is separated from pure water by a semi-permeable membrane, the natural tendency is for the water to flow into the concentrated solution until some equilibrium is maintained. If the natural osmotic pressure is overcome by applying external force to the concentrated solution, then water can be made to flow from the salt solution through the membrane to the dilute solution.

With RO technology, the wastewater stream flows under pressure over the surface of a selectively permeable membrane. Water molecules pass through the membrane, leaving other constituents behind. The extent of separation is determined by membrane surface chemistry and pore size, fluid pressure, and wastewater characteristics. The RO unit itself consists of one inlet to receive wastewaters, and two outlets to discharge the purified water and the concentrated wastewater.

For removal of silver from photoprocessing wastewaters, after-fix rinsewater is flow-equalized, filtered, and pumped through the RO unit, and silver is recovered from the concentrate. Problems with this system arise from fouling of the membrane and biological growth. Proper maintenance and control can help alleviate such problems; one company, for example, solved its membrane fouling problem by installing a sandbed filter preceding the RO unit.

6. *Low Flow Prewash*

With a low flow prewash system, the after-fix wash tank is segmented, providing a small prewash tanks with separate rinsewater make-up and overflow. The after-fix washing is then done in two stages; most of the silver carry-over is washed off in the low volume, after-fix prewash tank. This system lessens the dilution of the silver carry-over, which allows concentrations of fixer, silver, and other chemicals to reach higher levels in the prewash tank.

There are problems associated with this system. One is that the work being processed may receive additional fix time and exposure to concentrated contaminants while immersed in the prewash, and there is concern that this may harm the quality of the processed material. Also, if you are using a resin bead system, the build-up of fix can strip silver from the resin. Another problem arises from the development of organic matter that increases the need for maintenance of the wash tank.

7. *Evaporation*

With evaporation systems, wastewaters are collected and heated to evaporate all liquids, with the resulting sludge collected in filter bags. These bags can then be sent to a silver reclaimer for recovery. Evaporation systems can accommodate operations that do not have access to sewer connection or wastewater discharge.

The major advantage to this approach is it achieves "zero" water discharge. Virtually all of the silver in the waste solutions is captured with the solids. However, evaporation has drawbacks. Organics in the waste solution may also be evaporated, creating an air pollution problem; some evaporation systems are equipped with filters made of charcoal to capture organics. Ammonia releases are also of concern. In addition, fewer silver reclaimers are able to handle the sludge for economical recovery of silver. The expense of filter purchase and disposal and increased electrical needs also makes evaporation less attractive as a management alternative.

Bleach, Bleach-Fix and Fix Reuse

Ferricyanide bleach was once widely used in color processing to convert developed metallic silver and bromide to silver bromide that could be removed by fixer in subsequent process baths. About 50% of the ferricyanide changes to ferrocyanide (before the solution is spent) during the silver conversion, and leaves the process as overflow, which at one time was discharged untreated into the sewer.

Because of environmental concerns, ferricyanide bleach has been replaced in some color processes by a combined bleach-fix solution consisting of a ferric EDTA complex as the oxidizing agent and a thiosulfate as the fixing agent. The regeneration of bleach-fix solution can be very economical due to its relatively high cost and high oxygen-demanding property.

Some color processes have been successfully switched to less toxic iron-complexed bleaches and bleach-fixes, but these alternative bleach-fixes have not been widely used in processing Kodachrome, Ektachrome and certain professional motion picture films. As long as ferricyanide bleaches remain in use there will exist the incentive to recover and reuse these chemicals rather than discharge them to the environment. Ferricyanide, however, is only a small problem overall in the industry. Two options are recycling bleach and bleach-fix.

1. Bleach Recycling

There are four methods for the regeneration of spent ferricyanide bleach. These are ozone oxidation, electrolysis, use of persulfate salts, and the use of liquid bromine.

- **Ozone Oxidation**

  Regeneration of spent ferricyanide bleach depends on the production of ozone gas, a relatively simple operation that requires, however, the purchase of costly ozone generators.

  In a continuous processor, the film or paper moves from the bleach bath to a wash bath and on to the fix bath. By keeping the ferricyanide concentration in the waste streams as high as the process will allow, regeneration of the ferricyanide can be enhanced. Counter-current fixes and washes can significantly reduce the total volume of solution while maintaining process quality. The dilute rinsewater and ferricyanide bleach are then put through an ion exchange column to concentrate the ferricyanide to the point that allows it to be added to the regeneration tank. Overflow from the ferricyanide bleach tank is controlled and regenerated. Bleach regeneration through the ozone process can reduce the effluent ferricyanide concentration by about 90%.

  The investment for such bleach recovery equipment is significant, but return on the investment can be realized through the reduction of costs for new chemicals.

- **Electrolysis**
  During the electrolytic regeneration of spent bleach, an electrical current is applied to the ferrocyanide overflow. This causes the solution to be converted from a non-active ferrocyanide to active ferricyanide, generating byproducts of hydroxide and hydrogen gas. By separating the hydroxide from the ferricyanide solution and adding to it a solution of hydrobromic acid, the bromide and water replenishment is made, completing the requirements for an active regenerated bleach.

- **Use of Persulfate Salts**
  The addition of persulfate salts is the most common method used to regenerate ferricyanide bleach. It is an inexpensive technique and utilizes relatively safe chemicals. It is however, less efficient than electrolytic and ozone oxidation methods. Additional problems can stem from the saturation of the ferricyanide bleach with sulfate after several regenerations with persulfate. This build-up of sulfate reduces bleaching efficiency, fouls piping and pumps, and may require the elevation of ferricyanide to higher concentrations in an attempt to maintain adequate bleaching.

- **Use of Liquid Bromine**
  The use of liquid bromine to regenerate ferricyanide is very efficient and provides the bromine ions required for bleaching. The major drawback of this method is the potential health and safety hazard associated with handling the liquid bromine.

2. ***Bleach-Fix Recycle***

- **Electrolytic System**
  Most of the techniques used to recover silver from fix can also be applied to bleach-fix solutions. However, silver recovery from bleach-fix must be done in batch systems because closed-loop recovery is not possible. Generally, the use of electrolytic recovery for the desilvering of bleach-fix allows for greater reuse of the chemicals from the overflow than does the use of metallic replacement cartridges.

  Regeneration of the bleach-fix for color paper processing includes three steps because bleach-fix solution containing ferric EDTA is frequently used in this process. First, the silver is recovered; then the iron EDTA complex is oxidized back to ferric EDTA to regain bleaching ability. Finally, certain chemicals lost through carry-over must be added to bring the solution up to replenisher strength.

There are electrolytic silver recovery systems that automatically collect, desilver and aerate the bleach-fix for reuse. Aeration is important because it allows the iron in solution to be oxidized from ferrous EDTA to ferric EDTA. This not only restores the properties of the bleach-fix, but also minimizes cyan dye loss which could occur when residual ferrous EDTA reduces cyan dye to leuco dye.

The resulting solution of desilvered bleach-fix should not cause adverse effects during its reuse as long as a high enough sulfite concentration is maintained. Failure to ensure that the electrolytic recovery system is operating properly can result in serious staining. If sulfite levels are allowed to drop, benzyl alcohol carried over from the developer could be oxidized to benzaldehyde, interact with chemicals in the color paper and cause yellow staining.

Oxidized bleach-fix is regenerated by adding chemicals and reused as replenisher.

- **Ion Exchange**
  With this system, bleach-fix overflow from the processing tanks is passed through an ion exchange resin column to eliminate the silver complex in the overflow. The desilvered overflow is collected, sent to the replenisher tank after proper pH and chemical concentration has been achieved, and reused as replenisher solution.

  Silver is recovered from the column containing the ion-exchange resin by treating it with a solution that will dissolve the absorbed silver out of the resin. The resin is thus regenerated and ready for reuse.

  Ion exchange resin technology has proven successful in prototype development, but has met with little commercial success in bleach-fix reuse to date.

- **Highly Concentrated Bleach-Fix Replenishment**
  Use of highly concentrated bleach-fix replenishment offers an alternative to bleach-fix recycle systems, and a twist: instead of re-using spent bleach-fix, the system strives to minimize the generation of spent process chemicals. Known as bleach-fix NR, the system uses a more concentrated replenisher solution and reduces the rate of replenishment by 75%.

  Although the bleach-fix NR is not regenerated, the loss of chemicals to the environment is slightly less than with a regenerated system. This system can also be utilized by almost any photofinishing lab of moderate productivity without encountering problems of interference with photographic paper.

By following the bleach-fix NR with a counter-current low-flow wash, photofinishers can collect 98% of the total available silver in a very small volume of water The bleach-fix NR and low-flow wash mixture can then be electrolytically desilvered from a level of 3 to 4 grams of silver per litre to as low as 50 mg/L of silver. With this complete system, the silver could be recovered in the form of electrolytic plate. Additionally, 3 to 5% more could be recovered by tailing the bleach-fix NR low-flow wash mixture through a recovery cartridge.

Many labs also use a straight bleach recycling method. Overflow is collected, concentrate is added, the specific gravity is taken, and the pH is adjusted, usually with acetic acid. This is done for labs using separate bleach and fix in their paper process and for C-41 bleach. (Both are ammonium iron EDTA bleaches.)

Developer Reuse

Since color developer has become one of the most expensive processing chemistries, recycling technology has come into wider use. The technology was actually first developed in the early 1950s, but it took the recent surge in the price of organic chemicals to make the application fo the technology economically feasible.

During film development, silver halide salts in the emulsion such as silver bromide are reduced to elemental silver. Bromide ions are subsequently released into solution with the corresponding oxidation of the developing agent. Before spent developer can be reused, the bromide ions must be removed and the concentration of the developing agent must be increased.

Currently, there are two main systems for the recycling of developer: ion exchange and electrodialysis.

1. Ion Exchange System

Ion exchange developer recycling systems depend on strongly basic anion exchange resins. By doing batch processing of spent developer, equipment needs for this system can be simplified.

These systems work by passing a specific volume of color developer through the resin and stripping it of bromide ions. The ion exchange bed is regenerated using a double rinse of salt (6%), and then bicarbonate (4%), thus restoring its capacity for subsequent bromide removal. Eventually resin efficiency will drop as the surface becomes blocked with oxidized byproducts from the spent developer. However, there are commercial systems in use that after a year or two have shown no reduced efficiency. The resin lasts longer on developers without benzyl alcohol.

After the bromide ions are removed, the solution must be analyzed and the proper new chemicals added to bring the solution up to replenishment specifications. Because carry-over accounts for 17 to 30% of the replenisher volume used, fresh replenisher must be mixed into the recycled developer to maintain processing volume.

The ion exchange system is most suitable for those labs that use bulk chemicals and have analytical facilities at their disposal. Some equipment manufacturers claim that such analytical facilities are unnecessary, however, those labs that use this system claim such facilities help ensure adequate quality control on developer recycling operations.

2. *Electrodialysis System*

An electrodializer consists of cation-exchange membranes layered alternately with a pair of electrodes at each end. By applying a direct current, anions and cations in the developer solution compartments are attracted toward the electrode of the opposite charge. Recycling of developer with a electrodialysis system requires only halide ions such as bromide to be accumulated and removed from the solution, leaving other ions in the developer. Not all developers, however, are compatible with electrodialysis.

This a commercially available system that is generally compact and requires no analytical work.

KEY REFERENCES

Alaska Health Project, Protect Your Business Investment, The Small Business Hazardous Materials Management Technical Assistance Packet, Waste Reduction tips for Photofinishers.

Alaska Health Project, July 15, 1987, On-Site Consultation Audit Report: Photofinishing Shop. Waste Reduction Assistance Program (WRAP).

California Department of Health Services, Alternative Technology Section, Toxic Substances Control Division, April 1989, Waste Audit Study: Photoprocessing Industry. Arthur D. Little, Inc.

Campbell, M. E., W. M. Glenn, and L. R. Pim, Profit from Pollution Prevention, A Guide to Industrial Waste Reduction and Recycling: Photography. Pollution Probe Foundation.

Montana Department of Health and Environmental Sciences, June 1988, The Small Quantity Generator's Handbook for Managing RCRA Wastes: Photofinishing.

SUMMARY OF WASHINGTON DANGEROUS WASTE GENERATOR REQUIREMENTS

Washington Regulations	Fully Regulated Generators ≥2,200 lbs DW, ≥2.2 lbs AHW*	220 - 2,200 lbs. Generators >220 lbs but <2,200 lbs DW	Small Quantity Generators <220 lbs DW, <2.2 lbs AHW*
Inventory	• Identify all dangerous wastes on-site • Determine pounds per month or batch generated/max. amount accumulated at any one time	• Identify all dangerous wastes on-site • Determine pounds per month or batch generated/max. amount accumulated at at any one time	• Identify all dangerous wa • Determine pounds per m generated/max. amount a at any one time
Notification	• Notify State Agency to obtain a State/EPA ID #	• Notify State Agency to obtain a State/EPA ID #	• Notify State Agency to ol a State ID#
Accumulation	• Up to 90 days • In containers which are: - compatible with dangerous wastes stored - closed unless adding/removing waste - handled to avoid damage • Segregation - ignitable or reactive waste stored 50ft from property line - incompatibles stored separately	• Same as other fully regulated generator except: - Up to 180 days, 270 days if TSD is more than 200 miles away (not to exceed 2,200 lbs. of waste)	• Same as other fully regul except: - No time limit if less than and 2.2 lbs of AHW are a
Satellite Accumulation	• No more than 55 gallons of DW or 1 quart AHW	• Same as fully regulated generator	• Not applicable
Labeling	• RCRA hazardous waste labels • DOT labels • Accumulation start date	• Same as full regulated generator	• DOT labels (if necessary) • Accumulation start date
Inspections	• Storage area weekly • Tanks daily • Facility for potential dangerous waste spills • Emergency prevention/detection equipment	• Same as fully regulated generator	• No inspections required
Transport	• Follow DOT regs for packaging, labeling marking and placarding • Use HW manifest • Use transporters and TSD facilities with State/EPA ID#'s • File any necessary exception reports • Ship wastes within 90 days	• Same as fully regulated generator except: -Ship wastes within 180 days (270 if TSD is located more than 200 miles away)	• No manifest required • Use licensed hazardous s facility with prior appro

* For a complete list of substances which are regulated at 2.2lbs, see the Dangerous Waste Regulations.

SUMMARY OF WASHINGTON DANGEROUS WASTE GENERATOR REQUIREMENTS

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Waste Minimization	• Certify on each manifest that you have a waste minimization program in-place • Annual reports require documentation of waste minimization efforts	• Same as fully regulated generator	• No requirement
Training	• Each employee who handles dangerous waste must be thoroughly trained in -regulatory compliance -emergency response -emergency equipment	• Employees must be familiar with proper waste handling and emergency procedures	• No requirement
Emergency Response	• Contingency Plan • Preparedness/Prevention requirements • Incident reports to Ecology • Emergency Procedures	• Emergency Procedures • Preparedness/Prevention requirements	• No requirement
Reporting	• Exception Reports (file within 45 days) • Annual Reports	• Same as fully regulated generator	• No requirement
Recordkeeping	• Manifests (3 yrs) • Exception reports (3 yrs) • Test results/sample analyses (3 yrs) • Training documentation • Inspection logs • Annual report (3 yrs)	• Manifests (3 yrs) • Exception reports (3 yrs) • Test results/sample analysis (3 yrs) • Inspection logs	• No requirement

KEY TO ABREVIATIONS / ACRONYMS

DW	Dangerous Waste
AHW	Acutely Hazardous Waste
EPA	Environmental Protection Agency
DOT	Department of Transportation
RCRA	Resource Conservation and Recovery Act
TSD	Treatment Storage and Disposal Facility

For Additional Information, Call Regional Offices:

Northwest:	(206) 867-7000
Southwest:	(206) 753-2353
Central:	(509) 575-2490
Eastern:	(509) 456-2926

* For a complete list of substances which are regulated at 2.2lbs, see the Dangerous Waste Regulations.

WASHINGTON - PHOTOFINISHING INDUSTRY REFERENCES AND INFORMATION SOURCES

COMPANY	DIVISION	Contact Person	ADDRESS	CITY	STATE	ZIP	PHONE NUMBER
Waste Reduction							
WA Dept. of Ecology	Waste Reduction Program						1-800-RECYCLE
General							
Washington Department of Ecology Regional Office	Northwest Region						(206) 867-7000
Washington Department of Ecology Regional Office	Southwest Region						(206) 753-2353
Washington Department of Ecology Regional Office	Central Region						(509) 575-2490
Washington Department of Ecology Regional Office	Eastern Region						(509) 456-2926
Regulatory							
EPA's Office of Pollution Prevention							(202) 382-4335
RCRA Hotline							1-800-424-9346
Trade Contacts							
Photo Marketing Association International			3000 Picture Place	Jackson	MI	49201	1-800-762-9287
Waste Exchanges							
Industrial Materials Exchange (IMEX)			172 20th Avenue	Seattle	WA	98122	(206) 296-4899
Pacific Materials Exchange		Bob Smee	S. 3707 Godfrey Blvd.	Spokane	WA	98204	(509) 623-4244
Waste Handling/Recycling							
AGCO Metalex	Silver-Bearing Waste		3701 S. Road	Lynnwood	WA	98037	743-7886
Case Equipment Sales				Ridgefield	WA		263-3186
Chem Security			P.O. Box 1866	Bellevue	WA	98009	827-2774
Chemical Processors, Inc.			P.O. Box 222	Washougal	WA	98671	835-8743
Chemical Processors, Inc.			2203 Airport Way South, Suite 400	Seattle	WA	98134	223-0500
Chempro, Inc.				Seattle	WA		223-0500
CMX	Silver-Bearing Waste		1317 Republian	Seattle	WA	98109	467-7045
Crowley Environmental Services			6305 N.W. Lower River Road	Vancouver	WA	98666	(503) 286-3210
ECOVA Corporation			15555 N.E. 33rd Street	Redmond	WA	98052	(800) LIVEBAC
Envirotech Systems, Inc.			19936 Ballinger Way N.E. "A"	Seattle	WA	98155	546-8332/762-6977
Envirotech Systems, Inc.				Seattle	WA		363-4442
Hallmark Metals	Silver-Bearing Waste		1743 Cedardale Road	Mount Vernon	WA	98273	1-800-255-1895
LMD Silver Resources	Silver-Bearing Waste		5722 119th Avenue E.	Puyallup	WA	98372	845-5123
M2 Refining	Silver-Bearing Waste		P.O. Box 1049	Woodinville	WA	98072	483-9199
Northwest Enviro Service			P.O. Box 24443	Seattle	WA	98124	622-1090
Pacific X-Ray	Silver-Bearing Waste		649 Industrial Drive	Seattle	WA	98188	575-0202
Safety-Kleen			9516 E. Montgomery, No. 16	Spokane	WA	99206	928-8353
Sol Clean			Route 10, P.O. Box 255	Spokane	WA	99206	(509) 928-8353
Van Waters & Rogers, Inc.			P.O. Box 3541, Terminal Annex	Seattle	WA	98124	872-5065
Van Waters & Rogers, Inc.		Tracy Erb		Kent	WA		872-5000
Van Waters & Rogers, Inc.				Pasco	WA		545-8401
Venus Products, Inc.			1862 Ives Avenue	Kent	WA	98032	854-2660
Washington Chemical Co.			P.O. Box 743	Spokane	WA	99210	(509) 489-9176
Western Equipment				Lynnwood	WA		774-2933