



Waste Reduction and Disposal Options for Specific Hospital Wastes

FACT SHEET

Hospitals generate a variety of wastes that require special treatment and/or waste management. This Fact Sheet presents waste reduction opportunities such as source reduction, reuse, and recycling as well as waste disposal options for the following materials generated at hospitals.

- Mercury
- Batteries
- Radiology Wastes
- Xylene
- Medical Supplies and Equipment
- Cafeteria Grease
- Construction & Demolition Wastes

NOTE: Regulatory information contained in this Fact Sheet assumes that the hospital is either a small quantity generator (SQG) or conditionally exempt small quantity generator (CESQG) of hazardous waste. A CESQG can potentially manage hazardous waste at local household hazardous waste collection sites if the scope of the collection site is sufficient. It is the responsibility of the generator of a waste to select a competent and licensed (as required) recycler or waste management firm to protect the environment and public safety and to protect against future liability associated with improper waste disposal.

Mercury

At most hospitals, mercury is primarily generated from obsolete or broken equipment. In addition, fluorescent lamps and high intensity discharge (HID) lamps also contain low levels of mercury. Waste mercury, such as that generated from spills, should be handled as hazardous waste. Incineration of mercury-containing products may release mercury to the atmosphere. Atmospheric mercury can then deposit in lakes and streams and can lead to contamination of the aquatic food chain and human fish consumption advisories.

Waste Reduction Options for Mercury

1. Start a mercury waste management program by identifying and separating all mercury-containing wastes from the waste stream.
2. Replace equipment such as thermometers and sphygmomanometers that contain mercury with electronic sensing devices. Electronic devices may cost more initially; however, the higher cost is usually justified because mercury cleanups and associated hazards from glass breakage and mercury spills are eliminated. In addition, electronic devices are less fragile than mercury-containing devices.
3. Properly manage fluorescent lamps and HID lamps to prevent releases of mercury to the environment. The Hazardous Waste Section (HWS) of the NC Department of

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Environment, Health, and Natural Resources' Division of Waste Management established an enforcement policy effective January 1996 for proper waste management of lamps containing mercury (LCMs). For more information on this policy and a list of LCM recyclers, contact the NC Division of Pollution Prevention and Environmental Assistance at (9 19) 715-6500 or the HWS.

4. Carefully design and monitor procedures for cleanup of spills and proper handling of waste mercury to protect employee and public health. Use a vacuum apparatus and spill absorbent kits to clean up mercury spills. Properly recycle or dispose residuals from cleanup.
5. Mercury-containing thermostats can be managed under the Universal Waste Rule (15A NCAC 13A .0019) adopted by North Carolina in January 1996. The Universal Waste Rule, which currently includes batteries, pesticides, and thermostats, reduces the regulatory burden of these materials to facilitate environmentally sound collection and increase proper recycling or disposal. Management standards for universal wastes include the following:
 - Waste must be managed to prevent releases;
 - Waste must be specifically labeled and identified;
 - Waste can be accumulated/stored up to one year; and
 - Waste must be shipped to another handler or destination facility under DOT shipping requirements for hazardous materials.

Under the management standard of this rule, handlers do not need to manifest these wastes or count these wastes toward their hazardous waste generator status. Other specific requirements apply for small and large quantity handlers of universal waste. For more information on the Universal Waste Rule, contact the HWS at (919-733-217s).

Mercury Waste Management Services

The following companies may be able to recycle various mercury-containing equipment generated at hospitals.

Company	Address	Telephone
Advanced Environmental Recycling Corp.	2591 Mitchell Avenue, Allentown, PA 18103	(800) 554-2372
Advanced Environmental Technology Services	2176 Will Suitt Rd., Creedmoor, NC 27522	(800) 322-8350
Bethlehem Apparatus Company, Inc.	Post Office Box 4, Hellertown, PA 18055	(610) 838-7034
ECOFLO, Inc.	2750 Patterson St., Greensboro, NC 27407	(919) 855-7925
JC Brothers Trading Co.	1211 Huntington Dr., Ste. E, South Pasadena, CA 91030	(213) 259-8268

Batteries

Below are the various types of batteries that may be generated in a hospital and possible sources of generation.

<u>Type of Battery</u>	<u>Source(s) of Generation</u>
Alkaline	Flashlights, portable cassette players and radios
Lead-acid	Automobiles, wheelchairs, portable generators
Lithium	Cameras, calculators
Mercuric-Oxide (“Button-cell”)	Hearing aids, cameras, tape recorders, oxygen monitors, pagers, fetal monitors, portable EKG monitors
Nickel-Cadmium (Rechargeable battery)	Calculators, alarm systems, pagers, backup power sources for medical equipment
Silver-Oxide	Medical electronics, hearing aids
Zinc-Air	May be used to replace mercuric-oxide batteries in hearing aids, pagers, and medical equipment

Proper Management of Used Batteries

It is the policy of the Solid Waste Section (SWS) of the Division of Waste Management to consider all batteries to be hazardous waste unless knowledge by the generator or TCLP analysis indicates otherwise. Based on independent laboratory test results, most alkaline and zinc-air batteries manufactured after 1992 are considered to be nonhazardous.

The remaining five types of batteries listed above all contain various amounts of heavy metals such as lead, mercury, and cadmium. Thus, these batteries are likely to be classified as hazardous waste. Proper management of used batteries considered to be hazardous is important for several reasons:

- Disposal in sanitary landfills may contribute toxic compounds to landfill leachate, which can potentially contaminate groundwater.
- Disposal in incinerators contributes to the emission of metals, such as mercury, to the atmosphere as well as to heavy metal concentrations in the incinerator ash (which is also disposed in landfills). As mentioned, atmospheric deposition of mercury to the ground, lakes, and streams can lead to advisories on human consumption of fish.

Waste Reduction Options for Batteries

1. Before purchase, investigate various batteries to determine those that contain the lowest amount of mercury, cadmium, and/or lead.
2. Purchase and use rechargeable alkaline and nickel-cadmium (Ni-Cd) batteries. Reusable alkaline batteries that contain no hazardous compounds are recommended over reusable Ni-Cd. Although use of rechargeable batteries reduces the quantity of batteries disposed, the Ni-Cd batteries will eventually also have to be disposed. Because of their cadmium content, spent Ni-Cd batteries are likely to be classified as hazardous and are included in the Universal Waste Rule discussed previously. Contact the Rechargeable Battery Recycling Corp. at 1-800-8-BATTERY for information on recycling Ni-Cd batteries
3. Consider recycling batteries. Batteries could be collected within the hospital through an exchange program in which employees would be required to turn in their old batteries in exchange for new ones. As discussed, spent batteries that are considered hazardous waste can be managed under the Universal Waste Rule (15A NCAC 13A .0019).

Batteries Waste Management Services

The companies below offer recycling services or proper waste management of batteries.

Company	Batteries Accepted	Address	Telephone
Battery Solutions	All types	38680 Michigan Avenue Wayne, MI 48184	(313) 467-9110
Bethlehem Apparatus Company, Inc.	Mercury-oxide	Post Office Box Y Hellertown, PA 18055	(610) 838-7034
Ecoflo (TSDF)	Alkaline, lithium, mercury-oxide, and Ni-Cd	2750 Patterson St. Greensboro, NC 27407	(910)855-7925
Handy and Harman	Silver-oxide	300 Rye Street South Windsor, CT 06074	(203) 291-1453
INMETCO	Ni-Cd	Post Office Box 720 Ellwood City, PA 16117	(412) 758-5515
Mercury Refining Company, Inc.	All types	1218 Central Avenue Albany, NY 12205	(800) 833-3505 (5 18) 459-2334
Portable Rechargeable Battery Association	Ni-Cd	1000 Parkwood Circle Atlanta, GA 30339	(404) 612-8826
Quicksilver Environmental	All types	Post Office Box 25178 Tampa, FL 33672	(813) 249-0608
Recyclights	All types	401 West 86th Street Bloomington, MN 55420	(800) 831-2852
Recyclights	All types	4972 Woodville Hwy. Tallahassee, FL 32311	(800) 831-2852
SAFT America, Inc.	Ni-Cd and mercury-free zinc-air	Post Office Box 1886, Valdosta, GA 3601	(912) 245-2918
<p><i>Notes :</i></p> <ol style="list-style-type: none"> 1. "All types " includes: zinc-air, alkaline, carbon-zinc, nickel-cadmium (Ni-Cd), mercury-oxide, silver oxide, and lithium. 2. TSDF = Treatment Storage and Disposal Facility 			

For more information on management of *used* batteries, request *Fact Sheet: Management of Used Batteries for Business and Industry* from the Division of Pollution Prevention and Environmental Assistance at (9 19-715-6500).

Radiology Wastes

Several waste streams generated in hospital radiology departments are listed below.

- Wastewater containing photographic chemicals and silver removed from the film during processing.
- Spoiled chemicals.
- Scrap film such as that purged from old files or generated from poor photographs.
- Fixer solution.

Waste Reduction Options for Radiology Wastes

1. Store materials properly to prolong shelf life. As many photoprocessing chemicals are light- or temperature-sensitive, proper storage is important.

2. Recycle spoiled or used x-ray film. Several x-ray film handlers are listed under *Waste Management Services and Equipment Vendors* below.
3. As expired materials may still be useful, test them for effectiveness before automatically discarding them. If they are no longer useful, look for a recycling market.
4. Extend the life of fixing baths. Possible techniques include (1) adding ammonium thiosulfate, which doubles the allowable concentration of silver buildup in the fixer, (2) immersing film in an acid stop bath prior to the fixing bath, and 3) adding acetic acid to the fixing bath as needed to keep the pH low.
5. Use squeegees to wipe excess liquid from the film. This cleanup can reduce by 50 percent the chemical carry over from one process bath to the next. Minimizing the chemical contamination of process baths increases recyclability, enhances bath life, and reduces the amount of replenisher chemicals required.
6. Recover silver from x-ray *fixer solution* either on- or off-site and then recycle the recovered silver. The two options are discussed below.
 - On-site recovers. On-site recycling requires the purchase of a silver recovery unit such as a metallic replacement unit or an electrolytic recovery unit. In metallic replacement, an ion exchange occurs between silver and another metal, usually iron or steel wool. In electrolytic recovery, a direct current is applied across two electrodes in the silver-bearing solution. As a result, metallic silver deposits on the cathode. In many cases, the effluent from the silver recovery system can be discharged to the sanitary sewer if the discharge is in compliance with local, state, and federal regulations. The local wastewater pretreatment coordinator can provide regulatory information and guidance. Collected silver is not considered a hazardous waste and can be sold to a silver reclaimer. Advantages and disadvantages of metallic replacement units and electrolytic recovery units are listed below.

	Advantages	Disadvantages
Metallic Replacement	<ul style="list-style-type: none"> - Low investment - Low operating costs 	<ul style="list-style-type: none"> High iron content in effluent. Silver recovered as sludge. High silver content in effluent unless two units are in series.
Electrolytic Recovery	<ul style="list-style-type: none"> - Recovers silver as pure metal - High silver recovery 	<ul style="list-style-type: none"> Potential for sulfide formation

- Off-site recycling. Fixer solution should be segregated, properly contained, labeled as hazardous waste, and then hauled by a hazardous waste transporter to a permitted recycler or treatment, storage, and disposal facility (TSDF). Any silver-containing sludges sent off-site for reclamation are not defined as hazardous waste.

Waste Management Services and Equipment Vendors for Radiology Wastes

Services that handle x-ray film and/or x-ray fixer solution are listed below. Several of these companies also supply x-ray films, equipment, and on-site silver recovery units.

Company	Equipment/Services Provided	Waste Materials Accepted	Address	Telephone
Accu-Tech	Electrolytic recovery units.		P.O. Box 3473 Edmond, OK 73083	(800) 535-3516
B&B X-Ray Inc.	X-ray film and equipment.	X-ray film they supply	324 W. Matthews St. Matthews, NC	(800) 447-9729
Eastman Kodak Company	Metallic replacement and electrolytic recovery units.		343 State Street Rochester, NY 14560	(800) 933 8031
Morris Recovery Systems	Sell/lease electrolytic recovery units.	X-ray film	819-D Purser Dr. Garner, NC 27603	(919) 772-7924
Morris Recovery Systems	Sell/lease electrolytic recovery units.	X-ray film	112 Fairwood Dr. Charlotte, NC 28203	(704) 372-2388
Polyreps		X-ray film	1523 Salisbuty Rd. Statesville, NC 28677	(704) 878 0597
Safety-Kleen	Will pick-up waste fixer and supply new fixer for a fee.	X-ray film and fixer solution	2320 Yadkin Ave. Charlotte, NC 28225	(704) 375-0098
Safety-Kleen	Will pick-up waste fixer and supply new fixer for a fee.	X-ray film and fixer solution	Post Office Box 485 Garner, NC 27529	(919) 772-6622
Safety-Kleen	Will pick-up waste fixer and supply new fixer for a fee.	X-ray film and fixer solution	Post Office Box 7064 High Point, NC 27264	(910) 861-4114
Safety-Kleen	Will pick-up waste fixer and supply new fixer for a fee.	X-ray film and fixer solution	Post Office Box 267 St. Pauls, NC 28384	(910) 865-5081
Thompson Dental Company	Kodak systems and Dentex ion exchange systems		2720 Discovery Drive Raleigh, NC 27604	(919) 790-9995

Xylene

Used xylene, a non-halogenated solvent used in the laboratory area, is considered a listed hazardous waste solvent under the Resource Conservation and Recovery Act (RCRA). Implementation of waste reduction activities could reduce the quantity disposed and associated disposal cost.

Waste Reduction Options for Xylene

1. Consider citrus-based substitutes. Although these substitutes will reduce worker exposure, they may process samples at a slower rate and may also generate a hazardous waste because of their ignitability. Citrus-based alternatives will be most effective on samples in the micrometer range; thicker samples will be difficult to process.
2. Consider purchasing a solvent distillation unit. These units are relatively inexpensive and will significantly reduce purchases of xylene and the cost of hazardous waste disposal. Many distillation units are capable of producing laboratory-grade solvent for reuse. However, the quality and effectiveness of the recovered xylene should be evaluated. An example of the reduction in hazardous waste disposed is provided below.

*Example**: If a hospital uses 10 gallons per week of xylene and does not have a distillation unit, after 4 weeks, 40 gallons (131 kg) of hazardous waste xylene would be generated for off-site disposal and counted toward hazardous waste generator status. If a still is used to recover the xylene, approximately 8 gallons (26 kg) of still bottoms from the distillation unit would be generated and shipped off-site. These 8 gallons along with the 16 gallons of virgin xylene used over the 4 weeks would be counted toward hazardous waste generator status as shown in Table 2: Waste Generation With Distillation Unit. With use of a distillation unit, not only does hazardous waste disposal cost decrease, but the purchase cost of virgin xylene will also decrease.

Table 2: Waste Generation With Distillation Unit

	Week 1	Week 2	Week 3	Week 4	Hazardous Waste Generation, gal
Xylene usage (gal) - Virgin xylene counted toward hazardous waste generator Status	10 virgin	2 virgin + 8 recycled	2 virgin + 8 recycled	2 virgin + 8 recycled	16
Distillation Unit - Still bottoms generated (gal) - Counted toward hazardous waste generator status - Shipped off-site (manifested)	2	2	2	2	8
Distillation Unit - Xylene recovered (gal)	8	8	8	8	
Xylene Contributing to Hazardous Waste Generator Status (gal)	12	4	4	4	24

* From *Writing a Waste Reduction Plan for a Health Care Organization* by Center for Industrial Services. The University of Tennessee.

3. Recycle xylene off site through a recycling company. Several companies are listed in the Division of Pollution Prevention and Environmental Assistance's *Directory of Markets for Recycled Materials*. Xylene sent for recycling off site must be shipped as hazardous waste.

Medical Supplies and Equipment

Unused or outdated medical equipment or unused supplies can be collected by organizations that will send these materials to areas around the world that have serious need. Many organizations throughout the U.S. will accept these materials. The RACORSE (Recycling, Allocation, and Conservation of Operating Room Supplies and Equipment) Network in California gathers and disseminates ideas for utilizing unneeded health

care supplies and equipment. RACORSE can be reached at (510) 832-2868. In Boone, North Carolina. World Medical Missions will accept supplies and equipment, and all contributions are tax deductible to the full extent allowed by law. Contact Rick Wood at (704) 262-1980 for more information.

Cafeteria Wastes

Food waste and grease should not be disposed in the kitchen drain as they will likely contribute to high biochemical oxygen demand (BOD) and Fats, Oils, and Grease (FOG) in the wastewater. Wastewater permits issued by the local wastewater treatment facility generally have a specific limit for Oil & Grease and BOD discharges; if the BOD limit is exceeded, the local wastewater treatment facility usually applies a surcharge. For more information, request the Fact Sheet, "Managing Food Materials," from the Division of Pollution Prevention and Environmental Assistance at (919) 715-6500.

Construction & Demolition Wastes (C&D)

During building renovations or additions, various waste materials are generated that could potentially be segregated and recycled. Opportunities also exist to prevent materials from unnecessarily becoming wastes

Waste Reduction Options for C&D Wastes

1. Keep waste streams separate to increase their potential for reuse, recycling, or treatment and/or to reduce disposal costs. If hazardous and nonhazardous wastes are combined, all the waste may have to be treated as hazardous waste.

Some types of C&D debris waste fall under the category of "beneficial fill" as defined in North Carolina's Solid Waste Management Rules. Beneficial fill includes rock, soil, gravel, concrete, or asphalt pavement. Such materials may be used as fill in a variety of situations. "The fill activity is not exempt from, and must comply with, all other applicable Federal, State, and Local laws, ordinances, rules, regulations, including but not limited to zoning restrictions, flood plain restrictions, wetland restrictions, mining regulations, sedimentation and erosion control regulations." (15A NCAC 13B .0562(4)). Some other C&D wastes such as plastics, rubber, lumber, trees, stumps, and vegetative matter can be taken to a resource recovery facility, or, except for plastic and rubber, to a land clearing and inert debris landfill at a significantly lower tipping fee than to a sanitary landfill. For more information about C&D regulations, contact the NC Division of Waste Management at (919) 733-0692.

2. Practice good inventory control to prevent materials from unnecessarily becoming waste. Choose supplies that will produce the least amount of waste or the least toxic waste. Inspect raw materials upon delivery and immediately return unacceptable materials to the supplier.
3. Protect materials from deterioration. Store them in covered areas if they are subject to degradation by rainwater or sunlight. Store materials that could be ruined by dirt or dust away from high traffic areas.
4. Consider reusing various C&D materials such as bricks and blocks, doors and windows, or plumbing fixtures in new construction projects. Be careful to check the materials for any lead-based paints.
5. Segregate and collect demolition materials to be processed for use as raw materials by a recycler. Consider recycling the following materials:
 - *Aluminum*. Although all aluminum is recyclable, only 15 percent of the aluminum used in construction is recovered and recycled. Recyclers and the aluminum industry will buy any aluminum items brought in to them.

- *Other metal.* Scrap metal dealers have been in the recycling business for years. Metal is a valuable recyclable material.
- *Wood.* Among numerous possible applications, unpainted, untreated wood can be chipped for landscaping or used as fuel in wood boilers. Some local governments accept clean wood waste for grinding to make mulch or compost. Contact local city and county offices for information about such a recycling program.
- *Asphalt Pavement.* Old asphalt can be recycled. A new asphalt mixture can contain up to 10 percent old asphalt milled from road construction or roofing shingles.
- *Concrete.* Waste concrete, the single largest category of demolition waste, can be crushed and used as an aggregate or a base material.
- *Gypsum.* Gypsum can be remanufactured into agricultural, horticultural, and domestic products. An example of domestic use for gypsum is kitty litter.

Waste Management Services

Below are services for nonhazardous C&D waste.

Company	Address	Telephone
Alternative Recycling Technologies, Inc.	Route 1, Post Office Box 742B, Deep Gap, NC 28618	(704)262-9882
Axel Demolition & Salvage	Post Office Box 341, Hillsborough, NC 27278	(919) 6-U-8240
Cleveland Container Service, Inc. (Cleveland City only)	1160 Airport Rd., Post Office Box 193, Shelby, NC 28151	(919) 481-7916
Phoenix Recycling Corporation	Post Office Box 3856, Wilson, NC 27895	(919) 237-2800
TODCO, Inc.	1123 Roy Lopp Road, Lexington, NC 27292	(704)236-2001
Waste Energy, Inc.	197 Indian Trail, Mooresville, NC 28115	(704)661-4907

Additional Information

EPA Pollution Prevention Guides: Selected Hospital Waste Streams. EPA/625/7-90/009.

U.S. Environmental Protection Agency. June 1990.

DPPEA Fact Sheet: Waste Reduction and Proper Waste Management of Products Containing Mercury
July 1996.

NC Enforcement Policy for Lamps Containing Mercury. January 1996.

Supplement to NC's LCM Enforcement Policy Including Lamp Recycler's List. July 1996.

DPPEA Fact Sheet: Proper Management of Spent Dry Cell Batteries. July 1996.

DPPEA Fact Sheet: On-site Solvent Recovery Systems. August 1996.

DPPEA Fact Sheet: Managing Food Materials. June 1996.

NC Directory of Markets for Recyclable Materials (current year).

These publications are available from the Division of Pollution Prevention and Environmental Assistance at 919-715-6500. For regulatory information on regulated medical waste, request a copy of *Look Here First - A Guide to the North Carolina Medical Waste Management Rules* from the NC Division of Waste Management, Solid Waste Section, PO Box 27687, Raleigh, NC 27611-7687 (Telephone: 919-733-0692).



The North Carolina Division of Pollution Prevention and Environmental Assistance provides free, non-regulatory technical assistance and education on methods to eliminate, reduce, or recycle wastes before they become pollutants or require disposal. Telephone DPPEA at (919) 715 4500 or 800-763-0136 or e-mail nowaste@p2pays.org for assistance with issues in this Fact Sheet or any of your waste reduction concerns.

DISCLAIMER

This document is intended to offer information and guidance for waste reduction and management. Compliance with environmental and occupational safety and health laws is the sole responsibility of each business. All legal and regulatory references within this document are intended only for informational purposes and do not supersede any local, state, or federal regulations. Hospitals should contact the appropriate legal and regulatory authorities for current interpretation and implementation of regulatory requirements. Mention of a vendor, recycler, or waste management company does not represent an endorsement by the State of North Carolina. Neither the State of North Carolina nor the authors are responsible for practices or procedures implemented by individual hospitals.

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