A Guide to Batteries Used in Health Care[1]

The Problem with Batteries

Many types of batteries are used in hospitals. Pagers, infusion pumps, fetal monitors, portable EKG monitors, flashlights, smoke detectors, hearing aids, and portable generators are just a small sampling of devices that use batteries in hospitals. Several types of batteries contain mercury and may also contain other heavy metals such as lead and cadmium. These metals may be a potential threat to human health and the environment if improperly disposed.

In landfills, the heavy metals have the potential to leach slowly into soil, ground water, and surface water. When incinerated, metals such as cadmium and lead can concentrate in the ash produced by combustion and enter the atmosphere through incinerator smokestack emissions. When the ash is disposed of, the metals in the incinerator ash can leach into the environment. In the environment, certain types of heavy metals can also concentrate in the tissues of organisms and make their way up the food chain. Several metals, such as cadmium, are known carcinogens. The possible health effects associated with ingestion or inhalation of water, food, or air that has been contaminated with high levels of heavy metals range from headaches and abdominal discomfort to seizures, cancer, comas, and even death. The severity of the health effects are usually dependent on the total concentration of the metals to which one is exposed over time. [2]

In response, the federal government and many states have passed legislation prohibiting incineration and landfilling of mercury-containing and lead-acid batteries, and at least one state has banned landfilling the common household alkaline battery. Californians can no longer dispose of any household batteries in their municipal waste and must take them to collection centers. EPA has classified batteries as universal waste instead of as hazardous waste in order to make it easier to collect, store, transport and recycle them. So manufacturers and retailers have joined together to offer increased collection and more recycling options.

Many hospitals have battery recycling programs for a portion of their batteries. Unfortunately, there is considerable confusion on proper management methods for batteries. This confusion can lead to poor capture rates, and improper disposal of batteries in red bag waste.

[1] This document is based on Health Care Without Harm's Fact Sheet, “Battery Round Ups"

[2] “Implementation of the Mercury-Containing and Rechargeable Battery Recycling Act,” U.S. Environmental Protection Agency, November 1997, EPA530-K-97-009.

Types of Batteries

Batteries are classified in several ways. This document will distinguish batteries as either single use (or primary, meaning they must be replaced when their charge is used up), or rechargeable (or secondary, which can be recharged back to a useable charge level many times). Batteries are also categorized as "dry cell" or "wet cell" batteries. A dry cell differs from wet cell because its electrolytes are contained in a low-moisture paste. A wet cell's electrolytes are contained in a liquid, such as the lead-acid batteries in most cars.

Single Use batteries

Some single use batteries may contain mercury. Because of their chemistry, alkaline, zinc air and silver oxide button cell batteries are allowed by federal law to contain up to 25 milligrams of mercury in order to prevent the build up of pressure inside. On average, however, the mercury content is much less than 25 milligrams.[3]

Table 1. Single Use (Primary) Batteries

Single Use (Primary)	Types	Common Uses	Environmental Issues	Recycling Disposal Options	Regulations/Notes
Mercury (mercuric-oxide)	Button, some cylindrical and rectangular	Cameras, medical devices such as pacemakers, defibrillators, fetal monitors, health monitors, pagers, telemetry devices, temperature alarms and blood analyzers.	May contain mercury	Recycle to reclaim mercury	Banned under Mercury-Containing Battery Act, 1994; replaced with new technology; California bans from landfill
Alkaline, alkaline manganese	9-volt, D, C, AA, AAA, alkaline button	Pumps, diagnostic equipment, defibrillators, otoscopes, opthalmoscopes, dictation machine, pen lights, glucometers, flash lights and telemetry devices.	Pre-1996 and imported ones may contain mercury; button cells contain small amounts of mercury	Recycle older alkalines to reclaim mercury; recycle newer alkalines to reclaim zinc	California bans from landfill
Lithium (Primary)	Button cells, AA, AAA, 9-volt, small cylinder, custom sizes	Cameras, alarms, pacemakers, handheld electronics, memory backup, flashlights, and calculators	Contains lithium	Recycle to reclaim lithium or lithium alloy. Do not incinerate; lithium can be explosive	California bans from landfill

[3] "Household Batteries and the Environment," The National Electronic Manufacturers Association brochure, www.nema.org

Single Use Batteries (continued)

Single Use (Primary)	Types	Common Uses	Environmental Issues	Recycling Disposal Options	Regulations/Notes
Silver-Oxide (or silver-zinc)	Button cells, high voltage small cylinder, large custom sizes	Watches, hearing aids, cameras	Silver oxide batteries become hazardous when they leak which generally takes a period of five years (which is their normal life). Until recently, all silver oxide batteries contained mercury; button cells contain small amount of mercury	Recycle to reclaim mercury and silver oxide	Long life; expensive due to high cost of silver; new technology could make them rechargeable; California bans from landfill
Zinc Air (also known as Carbonaire)	Button cells, 9-volt, custom sizes	Hearing aids, 9-volt, custom sizes, experimental electric vehicles; stacks of zinc air button cells are used in medical devices;	Small amounts of mercury are used in zinc air button cells	Recycle to reclaim the zinc oxide	California bans from landfill
Zinc carbon, carbon zinc	9-volt, D, C, AA, AAA	Remote controls, flashlights, toys, transistor radios	No longer contain mercury	Recycle to reclaim the zinc oxide	Have been replaced by alkalines; California bans from landfill
Rechargeable Alkaline Battery	AAA, AA, C, D and 9-volt	Remote controls, flashlights	Some types of cells contain nickel, cadmium and mercury		As of August 2007 many companies are making these batteries non-toxic and free from heavy metals

Rechargeable Batteries

Rechargeable batteries may contain lead and cadmium, both toxic materials. These heavy metals may penetrate into the air, water, and soil if disposed of in landfills or incinerators. Once in the environment, the can increase up the food chain and cause serious human health issues.

Table 2. Rechargeable (Secondary) Batteries

Rechargeable	Types	Common Uses	Environmental Issues	Recycling Disposal Options	Notes
Lithium-ion	Custom sizes in hard plastic case, small cylinder, button cells	Cell phones, PDA's, headsets, portable mp3 players, laptops, video cameras, handheld devices	Contains lithium cobalt dioxide, manganese, titanium disulfide and vanadium oxides	Recycle to reclaim lithium or lithium alloy. Do not incinerate; lithium can be explosive	Introduced in 1990
Nickel-cadmium (NiCd)	9-volt, C, D, AA,AAA, battery packs	Portable communication devices and defibrillators	Contains high levels of nickel and cadmium, a toxic heavy metal	Recycle to claim nickel, cadmium	Classified as hazardous under Federal law

Rechargeable (Secondary) Batteries (continued)

Rechargeable	Types	Common Uses	Environmental Issues	Recycling Disposal Options	Notes
Silver-cadmium	9-volt, C, D, AA, AAA, battery packs	Medical electronics	Contains cadmium, a toxic heavy metal	Recycle to claim silver and cadmium	
Nickel-Metal Hydride (NiMH)	AA, AAA, C, D, poly-wrapped cell packs, small cylinder, custom sizes	Portable computers, cell phones, cameras, camcorders, portable information devices, audio visual equipment, premium electronic products and other devices	40% more service life than Nickel-Cadmium (and doesn't contain toxic cadmium)	Recycle to reclaim nickel (also contain cobalt, titanium and zirconium. Precautions: discharge fully prior to disposal; do not incinerate; do not open or puncture cells; observe all applicable rules and regulations	Introduced in 1990
Small sealed lead-acid flat plates	Rectangular, custom sizes in hard plastic case	Emergency lighting; portable communication devices; medical equipment backup, laptops, wheelchairs	Contains high levels of lead, a toxic material; can cause fire if short-circuited	Recycle to reclaim lead and plastic	U.S. Federal law classifies as hazardous waste; the oldest type of rechargeable battery
Silver-Zinc (or silver Oxide)	Sizes vary	Medical devices, watches, greeting cards, soon in laptops and cell phones	After five years, the batteries may begin to leak their contents which contain mercury, posing a serious health risk	Recycle to reclaim zinc, mercury and silver	Introduced in 2008; 40% more run time than lithium-ion and more expensive
Nickel-Zinc (NiZn)	AA	Cordless power tools, cordless telephone, digital cameras, battery operated lawn and garden tools, professional photography, electric bike and light electric vehicle sectors.	Does not contain heavy metals	Zinc and nickel are fully recyclable	New technology breakthrough is increasing its use in the market; may replace lead-acid and NiCd batteries

Battery Recycling Laws

Congress passed the Mercury-Containing and Rechargeable Battery Management Act in 1996 to prohibit handlers (collectors, etc.) from disposing of nickel cadmium (Ni-Cd) and small sealed lead-acid (SSLA) batteries. The act made the Universal Waste Rule effective in all 50 states classifying specific rechargeable batteries as universal waste. Universal wastes are hazardous wastes that are common and pose a lower risk to people and the environment. The rule facilitated increased recycling and collection of Ni-Cds and SSLA rechargeable batteries and reduced the regulatory burden and paperwork on battery handlers and transporters. (Note: The universal waste rule does not apply to spent automotive lead-acid batteries which remain as hazardous waste.)

Standard alkaline batteries are not hazardous waste, and they are not regulated by the United States Department of Transportation (DOT) as hazardous materials. Only California bans single use batteries from landfill.

State legal requirements for rechargeable batteries vary by state. Listed below are states that ban specific types of batteries from municipal waste, and batteries must be returned for recycling through retailers, distributors or manufacturers.[4]

States Banning Disposal of Ni-Cd and SSLA Batteries

Florida	Maine*	Minnesota	Rhode Island
Iowa	Maryland	New Jersey	Vermont

*applies to government, industrial, communications, medical employees, or contractors

States Banning Disposal of Lead Batteries

Arizona	Indiana	Mississippi	North Dakota	Utah
Arkansas	Iowa	Missouri	Oregon	Vermont
California	Kentucky	Nebraska	Pennsylvania	Virginia
Connecticut	Louisiana	New Hampshire	South Carolina	West Virginia
Florida	Maine	New Mexico	South Dakota	Wisconsin
Hawaii	Minnesota	North Carolina	Texas	Wyoming

States Banning Disposal of All Types of Rechargeable Batteries

California	New York

States Banning Disposal of Cell Phones

California	Maine

For information about battery recycling, please see Practice Greenhealth's "Planning A Battery Recycling Program for Your Health Care Facility," www.practicegreenhealth.org

Other Resources

"Household Batteries and the Environment" Brochure, The Association of Electrical and Medical Imaging Equipment Manufacturers (NEMA), http://www.nema.org/gov/env_conscious_design/drybat/upload/NEMABatteryBrochure2.pdf

EPA's Universal Waste Battery website, http://www.epa.gov/osw/hazard/wastetypes/universal/batteries.htm

Battery Council International, http://www.batterycouncil.org/

[4] Data collected from the Rechargeable Battery Recycling Corporation website, www.rbrc.org

"Used Batteries – Management and Disposal for Businesses," Environment, Health and Safety Online website, http://www.ehso.com/battery.php

"Cell Phone and Battery Recycling Laws in Europe and the U.S.," INFORM, December 2006. http://www.informinc.org/candbre.pdf

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