

Pollution Prevention Fact Sheet

Used Battery Disposal

Utah Department of Environmental Quality

Promoting a Healthy Environment

Introduction

This fact sheet is intended for users of various types of batteries. It provides general information on proper handling, disposition, and disposal, and the Environmental Protection Agency (EPA) regulations regarding battery hazardous waste determinations and recycling.

Types of Batteries

Batteries come in different configurations, sizes, and voltages. The specific constituents of each battery type influence the requirements for final disposition. The following descriptions provide an overview of the major battery types.

Alkaline Batteries

Alkaline batteries are primary or non-rechargeable batteries. The positive pole (anode) of the battery contains zinc, while the negative pole (cathode) contains manganese dioxide. The electrolyte used in alkaline batteries is either potassium hydroxide or sodium hydroxide. Both are strong alkalis. If alkaline batteries are damaged or mishandled, the alkali electrolyte may leak out of the battery cell. Severe chemical burns can result if the electrolyte comes into contact with the skin or eyes.

Carbon-Zinc (LeClanche) Batteries

Carbon zinc batteries are also primary or non-rechargeable batteries. The anode contains zinc and the cathode contains manganese. The electrolyte is an aqueous solution of ammonium chloride and zinc chloride. Ammonium chloride is a severe eye irritant and zinc chloride is a corrosive material. Depleted batteries may continue to vent hydrogen gas after use or if stored above 130 degrees Fahrenheit.

Lead-Acid Batteries

Lead-acid batteries have a lead anode, a lead dioxide cathode, and an aqueous sulfuric acid electrolyte. The battery cell contains 60 to 75 percent lead and lead oxide, by weight, and the electrolyte contains between 28 and 51 percent sulfuric acid, by weight. The electrolyte is a strong oxidizing agent and can cause severe skin burns or irritation upon contact. If acid contacts the eyes, it can cause severe damage and/or blindness. Contact lenses and smoking should be prohibited in areas where lead-acid batteries are stored or handled.

Lithium Batteries

Lithium battery types include lithium-manganese dioxide, lithium-sulfur dioxide, and lithium-thionyl chloride. The anode is composed of lithium and the cathode is composed of manganese dioxide, (or sulfur dioxide, or thionyl-chloride). Lithium-sulfur dioxide batteries contain pressurized sulfur dioxide gas and lithium-thionyl chloride batteries contain liquid thionyl chloride which vaporizes upon exposure to air, both of which are highly toxic.

Magnesium Batteries

Magnesium batteries have a magnesium anode, manganese dioxide cathode, and an electrolyte of an aqueous solution of magnesium bromide or magnesium perchlorate. These chemicals can emit highly toxic fumes when heated. If batteries show signs of leakage, proper eye and skin protection is recommended during handling.

Mercury Batteries

Mercury batteries have a zinc anode, mercuric oxide cathode, and an electrolyte of an aqueous solution of potassium hydroxide or sodium hydroxide. The cell has a solid cathode of mercuric oxide and contains 20 to 50 percent mercury or mercuric oxide by weight. The battery cell contains a caustic electrolyte and can have the same adverse health effects as alkaline batteries.

Nickel-Cadmium Batteries

Nickel-cadmium (ni-cad) batteries have a cadmium anode, nickel oxyhydroxide cathode, and an electrolyte of an aqueous solution of potassium hydroxide. The battery cells typically contain 13-15 percent nickel, by weight. The electrolyte is a caustic solution and is capable of causing the same health effects as alkaline batteries.

Silver Batteries

Silver batteries have a zinc anode, silver chloride cathode, and an electrolyte of an aqueous solution of lithium chloride or zinc chloride and zinc sulfate. The electrolyte is a mild acid (20 to 30 percent by weight) and can cause serious chemical burns to the skin and eyes.

Thermal Batteries

Thermal batteries have a calcium anode, calcium chromate cathode, and a solid lithium chloride and potassium chloride electrolyte which are strong oxidizers or caustics capable of causing skin irritation. These batteries may also contain asbestos.

The battery manufacturer's Material Safety Data Sheet should always be reviewed for specific environmental and health hazards for the actual battery being used.

Batteries as a Federal Hazardous Waste

Batteries (except lead-acid batteries) are not specifically regulated under Federal RCRA regulations. However, many batteries may exhibit one or more of the characteristics of hazardous waste, including ignitability, corrosivity, reactivity and/or toxicity and require management as such. In addition, some states have promulgated hazardous waste regulations that are more stringent than the Federal regulations. Therefore, the generator must ensure he applies the most stringent regulations when considering hazardous waste disposal. The following information is provided to assist Utah residents in making the proper waste determinations.

Alkaline Batteries: Alkaline batteries are not considered a RCRA- regulated hazardous waste. The electrolyte of an alkaline battery does not meet the definition of an aqueous solution or free liquid; therefore, they are not, by definition, a corrosive waste.

Carbon-Zinc Batteries: Carbon-zinc batteries are not considered a RCRA- regulated hazardous waste.

Lead-Acid Batteries: Lead-acid batteries destined for disposal are considered a RCRA- regulated hazardous waste due to their lead content (EPA Hazardous Waste Number D008).

Lithium Batteries: Lithium batteries are subdivided into the following categories:

- ! Lithium-manganese dioxide batteries are non-hazardous solid wastes.
- ! Lithium-sulfur dioxide batteries (single-cell) are non-hazardous solid wastes.
- ! Lithium-sulfur dioxide batteries (multi-cell) may be non-hazardous solid waste or characteristic hazardous wastes. If equipped with a Complete Discharge Device (ADD), the batteries are considered a non-hazardous solid waste after discharging. If not equipped with an ADD, multi-cell lithium-sulfur dioxide batteries are characteristic hazardous waste due to ignitability (D001) and reactivity (D003).
- ! Lithium-thionyl chloride batteries (multi-cell) are characteristic hazardous wastes. If these batteries have an ADD, after discharge, these batteries are a characteristic hazardous waste due to the toxicity (chromium D007), ignitability (D001) and reactivity (D003).

Magnesium Batteries: Batteries with 50 percent or greater remaining charge are considered a RCRA- regulated hazardous waste due to the characteristic of toxicity (chromium, EPA Hazardous Waste Number (D007). Batteries with less remaining charge are not considered RCRA- regulated waste.

Mercury Batteries: Mercury batteries are considered a RCRA- regulated hazardous waste due to the characteristic of toxicity (mercury, EPA Hazardous Waste Number D009).

Ni-Cad Batteries: Ni-cad batteries are considered a RCRA- regulated hazardous waste due to the characteristic of toxicity (cadmium, EPA Hazardous Waste Number D006).

Silver Batteries: Silver batteries are considered a RCRA- regulated hazardous waste due to the characteristic of toxicity (silver, EPA Hazardous Waste Number D011 and mercury (D009).

Thermal Batteries: Thermal batteries are considered a RCRA- regulated hazardous waste due to the characteristic of toxicity (chromium, EPA Hazardous Waste Number D007).

Regulatory Exemptions

RCRA either reduces the regulatory requirements or exempts certain spent solid wastes from regulation if the materials are household hazardous waste, recycled by use, reuse, or reclamation.

In regards to batteries, the following batteries or recycling methods are exempt:

- ! Spent lead-acid batteries that are being reclaimed;
- ! Batteries from which precious metals are reclaimed;
- ! Batteries returned to the manufacturer for regeneration;
- ! Batteries managed as universal waste; and
- ! Batteries other than lead-acid generated in the home.

General Battery Storage Requirements

Batteries require some care to ensure proper and safe storage. The following suggestions are offered:

- ! Batteries require cool, well ventilated, dry storage areas.
- ! Temperatures should not exceed 130 degrees Fahrenheit.
- ! Protect batteries against being damaged, crushed, punctured, or short-circuited.
- ! Do not smoke or eat in battery storage areas.
- ! Store batteries separately from other hazardous materials.

For More Information, Contact:

Division of Solid & Hazardous Waste (801) 538-6170.
Environmental Hotline (800) 458-0145
Pollution Prevention Coordinator (801) 536-4477

U:\SHW\SPB\JRICHARD\WP\Batteryfact.wpd