Fact Sheet: Disposal of Alkaline Batteries

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Introduction

This fact sheet is intended for users of alkaline batteries. It describes how alkaline batteries should be handled, provided general information on regulations governing these batteries and gives suggested disposal procedures.

Alkaline batteries are also called primary or nonrechargeable batteries. The positive pole (anode) of the battery contains zinc, while the negative pole (cathode) contains manganese dioxide. Potassium hydroxide electrolyte, a strong alkali, is contained within the cells of alkaline batteries. If alkaline batteries are damaged or mishandled, the potassium hydroxide may leak out of the battery cell. Severe chemical burns can result if potassium hydroxide comes into contact with the skin or eyes.

Waste Classification of Alkaline Batteries

RCRA Regulations

Alkaline batteries are not a listed hazardous waste under the Resource Conservation and Recovery Act (RCRA). To be classified as a hazardous waste, the battery must be tested to determine if it meets the definition of one of the four characteristics of a hazardous waste established by the US Environmental Protection Agency. These characteristics are ignitability, corrosivity, reactivity and toxicity. Alkaline batteries do not exhibit the characteristics necessary to be classified as reactive or ignitable wastes.

Toxicity

To determine if a waste exhibits the characteristic of toxicity, the EPA requires the waste to be evaluated using the Toxicity Characteristic Leaching Procedure (TCLP). The procedure involves obtaining a TCLP extract and analyzing that extract for the constituents that are regulated. The criteria for determining toxicity is a comparison of the contaminant concentration in the extract with a stipulated chemical-specific regulatory limit. If the extract concentration exceeds the TCLP limit, the waste source of the extract exhibits the characteristic of toxicity and is classified as a hazardous waste.

Martin Marietta Energy Systems, Inc., under contract to the U.S. Army Toxic and Hazardous Material Agency, conducted a study to test six battery types to ensure that the batteries are disposed of in compliance with applicable laws and regulations.

The Martin Marietta study conducted a TCLP for each battery type including the alkaline battery. Aquatic bioassays(1) were also conducted to further characterize the toxicity of the battery leachates. Such tests may be required by states before the batteries can be disposed. The states of California, Washington, Minnesota, Alaska, and Rhode Island have bioassay requirements to determine if a waste is hazardous.

Results from the Martin Marietta study were reported in 1992. Tables 1 and 2 summarize the TCLP results, which concluded that the alkaline batteries tested did not exceed TCLP limits and therefore do not exhibit the characteristic of toxicity.

The aquatic bioassay analyses indicate that alkaline batteries would be classified as hazardous waste in those states which require a bioassay to characterize wastes. However, alkaline batteries disposed as household waste may be exempt from these stricter requirements. Your state regulatory authorities should be contacted to obtain a current interpretation.

1 Bioassay: A method for quantitatively determining the concentration of a substance by its effect on the growth of a suitable animal, plant or microorganism under controlled conditions.

Corrosivity

In order to meet the definition of a corrosive waste, a representative sample of the waste must have either of the following properties: (1) It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5, or (2) It is a liquid and corrodes steel at a specified rate. Because alkaline batteries do not meet the definition of a material having an aqueous solution or free liquid, they are not a corrosive waste by definition.

Summary

Because alkaline batteries do not exhibit the characteristics to be classified as a reactive or ignitable waste; and because the batteries pass the TCLP test; and because the batteries do not meet the required definitions to be a corrosive waste, alkaline batteries are not hazardous waste under RCRA.

However, if the extracted leachate from an alkaline battery is diluted with water and used to conduct a bioassay, the leachate is lethal to the test animals.

State Regulations

Most states classify alkaline batteries according to RCRA regulations. However, some states, as mentioned above, have more rigorous regulations. The hazardous waste characterization requirements of Alaska, California, Minnesota, Rhode Island and Washington include bioassay. Table 3 summarizes the results from the Martin Marietta Energy Systems, Inc., bioassay analyses. South Carolina regulates all types of batteries as

special waste. Disposal of alkaline batteries in South Carolina, therefore, must be accomplished in accordance with those special waste regulations.

Disposal of Alkaline Batteries

Currently, the Air Force has no specific policies or regulations regarding the disposal of alkaline batteries. The Defense Reutilization and Marketing Office (DRMO) should be contacted to determine current disposal requirements.

The following guidelines, which represent good practice, have been summarized from the U.S. Army Technical Bulletin on Battery Disposition and Disposal (TB 43-0134) issued July 1, 1993. For more detailed guidelines, consult your installation. Environmental Coordinator or TB 43-0134.

Coordinate disposition/disposal:

- with the installation Environmental Office to ensure conformance with environmental regulations;
- with the installation Transportation Office to ensure conformance with transportation regulations;
- with the servicing DRMO to ensure conformance with DOD policies; and
- with the base Safety Office or the Bioenvironmental Engineer to ensure the proper personal protective equipment is available to ensure safe handling,
- with the state regulatory agency.

Handling/Packaging

- Remove batteries from equipment immediately after they fail to operate the equipment.
- If equipment uses two or more batteries, always replace batteries in complete sets.
- Do not attempt to recharge alkaline batteries, they are non-rechargeable.
- Do not handle hot or warm batteries.
- Do not heat, incinerate, crush, puncture or mutilate batteries.
- Do not package damaged batteries with undamaged batteries.
- Wear personal protective equipment if batteries show signs of leakage, bulging, swelling or deformity.

  Warning: If potassium hydroxide electrolyte from an alkaline battery comes in contact with the skin, do not try to neutralize the electrolyte with vinegar or any other acidic solutions. Neutralization may trap electrolyte on the skin. Flush the affected skin area with copious amounts of water. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.

Storage

- The storage area must be equipped with fire suppression equipment. Storage areas and equipment must be approved by the Fire Department. A point of contact at the Fire Department must be provided.
- Batteries should be kept cool and dry, away from open flame, heat and combustibles and in well ventilated areas with temperatures not exceeding 130(o)F (54(o)C).
- Store batteries separately from other hazardous material.
- Do not store batteries in the equipment they operate for longer than 30 days when the equipment is not being used.

Transportation

- Alkaline batteries are not specifically regulated under Department of Transportation 49 CFR Part 172.101 - Hazardous Materials Table (HMT); however, if a battery is shipped to or from one of the states which classify alkaline batteries as a hazardous waste, the battery is regulated under the HMT as an "environmentally hazardous substance."
- If batteries are shipped as a hazardous waste, shipment may require shipping papers and/or manifesting of hazardous waste for disposal. Coordinate with the installation Transportation Office for shipping paper requirements and with the installation Environmental Office for manifest requirements.
- If batteries are shipped as a hazardous waste, they must be protected and packaged securely in either a strong fiberboard or wooden box or in a fiber or metal drum or they must be placed on pallets and shipped in accordance with Department of Transportation requirements.
- If you are shipping batteries to or from a state which classifies batteries as a hazardous waste, use the word "Waste" as a part of the proper shipping name and mark the container as follows:

  HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency.
  Generator's Name and Address:
  Manifest Document Number:

Disposal

- In states without bioassay or other requirements, dispose of alkaline batteries as non-hazardous solid waste with general refuse according to RCRA regulations.
- In states with bioassay requirements (Alaska, California, Minnesota, Rhode Island and Washington), alkaline batteries are classified as hazardous waste and can be disposed through the DRMO or through local contract. There may be an exception for household waste; therefore, contact your state regulator. The DRMO will accept accountability if the batteries are turned in with appropriate documentation and are properly marked, labeled and packaged. Since alkaline

batteries are non-hazardous solid waste according to RCRA, there may not be an MSDS.

- If batteries for disposal are to be managed as a hazardous waste and must be transported off the installation, the batteries are required to be manifested according to regulations found in 40 CFR Part 262. Consult the installation Environmental Office for guidance concerning manifest requirements.
- Alkaline batteries can be recycled; however, distance and cost of shipping must be considered.

Table 1(2) Summary of TCLP Volatile Organic Results (mg/1) For Alkaline Batteries

Table 2(2) Summary of TCLP Metals Results For Alkaline Batteries (mg/1)

Table 3(2) Bioassay Analyses Result (96 hour, acute) Alkaline Battery (All values in mg/1)

(2) Data in Tables 1, 2 and 3 were taken from Toxicity Studies of Selected Military Batteries, Hanson, et al., January 1992, Martin Marietta Energy Systems, Inc.

The data in Table 3 demonstrates that alkaline batteries would be found to be toxic in aquatic bioassays performed by the following states: Alaska, California, Minnesota, Rhode Island and Washington. Even though federal regulations do not list alkaline batteries as hazardous waste in these states, state requirements for aquatic bioassay result in the batteries being classified as hazardous waste. Household waste exemptions may exist, therefore, contact your state regulator.

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