TB 43-0134*

TECHNICAL BULLETIN

BATTERY DISPOSITION AND DISPOSAL

*This manual supercedes TB-43-0134, dated 1 October 1996

Distribution Statement A: Approved for public release; distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY
19 MAY 2008

WARNING SUMMARY

WARNINGS for Fire Control/Suppression

DO NOT use water to extinguish a battery fire if a shock hazard exists due to high voltage electrical equipment in the immediate vicinity (greater than 30 volts, alternating current (ac) or direct current (dc)).

Halon fire extinguishers SHALL NOT be used to combat fires involving non-rechargeable Lithium batteries.

Class D extinguishers shall be used by professional fire-fighting personnel ONLY.

WARNING for Packaging

DO NOT package any battery if it is warm/hot. Package batteries only when they are cool to the touch.

WARNINGS for LEAD-ACID BATTERIES

DO NOT use metal or galvanized equipment when.draining electrolyte from Lead-Acid batteries.

DO NOT use small water fire extinguishers on fires involving sulfuric acid (H_2SO_4) battery electrolyte. H_2SO_4 is highly reactive and can react with finely divided combustible materials (eg., sawdust) on contact.

WARNINGS for LITHIUM BATTERIES

Lithium-Sulfur Dioxide (Li-SO_2) batteries contain pressurized sulfur dioxide (SO_2) gas. The gas has a pungent odor and is highly toxic. The battery **MUST NOT** be abused in any way which may cause the battery to rupture.

Lithium-Thionyl Chloride (Li-$SOCl_2$) batteries contain liquid thionyl chloride ($SOCl_2$), which fumes upon exposure to air. The vapor is highly toxic, and the battery **MUST NOT** be abused in any way which may cause the battery to rupture.

IMMEDIATELY turn off the equipment if battery or battery compartment shows signs of overheating or becomes hot to the touch. Allow the battery to cool (at least 60 minutes) before removing it. Remove the battery or battery or battery compartment to a well ventilated, low occupancy area as soon as soon as the temperature is stabilized, and allow it to cool there.

If you hear a hissing sound (battery venting), or smell irritating gas, **IMMEDIATELY** Turn Off the equipment, and **LEAVE** the area until any smell or signs of leaking gas have been cleared from the area.

First Aid WARNING for Caustic Electrolyte

DO NOT try to neutralize caustic electrolyte with vinegar or any other acidic solutions. Neultralization will do more harm than good, as it will trap caustic under the skin, preventing it from coming out. Flush with copious amounts of cool water.

WARNING for THERMAL BATTERIES

When activated, Thermal battery temperatures can exceed 500 ^{o}F. This is a severe burn hazard.

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HEADQUARTERS
DEPARTMENT OF THE ARMY
TB 43-0134* WASHINGTON, DC, 19 MAY 2008

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BATTERY DISPOSITION AND DISPOSAL

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Reports, as applicable by the requiring Service, should be submitted as follows:

(A) Army - Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) located in the back of this manual, directly to: Commander, U.S. Army CECOM Life Cycle Management Command (LCMC) Fort Monmouth, ATTN: AMSEL-LC-LEO-E-ED, Fort Monmouth, NJ 07703-5006. You may also send in your recommended changes via electronic mail or by fax. Our fax number is 732-532-1556, DSN 992-1556. Our e-mail address is MONM-AMSELLEOPUBSCHG@conus.army.mil. Our online web address for entering and submitting DA Form 2028s is http://edm.monmouth.army.mil/pubs/2028.html.

A reply will be furnished to you.

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CHAPTER 1 INTRODUCTION

1-1. Purpose and Scope

This Technical Bulletin (TB) establishes general procedures for disposition and disposal of damaged, defective, depleted (spent) or unserviceable batteries. This TB applies primarily to batteries for which technical support is provided by the US Army CECOM Life Cycle Management Command (CECOM LCMC). It also provides general guidance on batteries managed by other SOS. These batteries are listed in Table 2-1A and Table 2-1B. Questions concerning disposition and disposal procedures for batteries not procured by CECOM LCMC should be referred directly to the appropriate procuring Agency, Service or Command. This TB does not apply to the air shipment of unserviceable batteries for disposition. Refer to Air Force Joint Manual AFJMAN 24-204, PREPARING HAZARDOUS MATERIALS FOR MILITARY AIR SHIPMENT. Refer to SB 11-6, CECOM BATTERIES, SUPPLY AND MANAGEMENT DATA for batteries and their applications.

1-2. How to Use this TB

a. General requirements for disposition and disposal of all batteries are covered in chapter 2. These include solid waste characterization, hazardous characteristics, handling, fire protection, storage, and transportation. Personal protective equipment and first aid are covered in chapter 3. Battery profiles are contained in chapter 4.

b. Publications referenced in this TB are listed in Appendix A, along with their sources. General reference materials are also cited. Terminology and abbreviations are defined in Appendix B.

1-3. General Requirements

a. The principal purpose of this TB is to provide solid waste characterization guidance under Resource Conservation and Recovery Act (RCRA) regulations and the Universal Waste Rule. The guidance and procedures in this TB are consistent with US Environmental Protection Agency (EPA), US Department of Transportation (DOT) regulations and Department of Defense (DoD) policy. This TB will aid in complying with environmental solid waste requirements. Information about state environmental regulations reflects the requirements in effect at the time of publication. Readers must ensure compliance with state and local regulations in effect when disposing of batteries. **This TB does not supersede or take precedence over any regulations or other official directives.** If there is a conflict between this TB and regulations or DoD directives, you must follow appropriate regulations and directives.

b. **Foreign, state and local regulations may be more stringent than the procedures in this TB.** It is necessary to coordinate with appropriate officials at your installation/activity to ensure that disposition and disposal actions comply with all existing regulations and policies. Refer to "e." below.

c. In accordance with DoD Directive 6050.16, DoD Policy for Establishing and Implementing Environmental Standards at Overseas Installations, the US Air Force (USAF) has been given the lead as the local DoD Executive Agent and has the responsibility for establishing guidance/standards for the disposal of hazardous materials/waste at OCONUS (outside of continental United States) installations. Refer to e. (2) below.

d The local Installation/Unit Environmental Office/Officer (IEO) MUST coordinate with the local servicing Defense Reutilization and Marketing Office (DRMO) and advise all affected units regarding local procedures for management of batteries as hazardous material (HM) and/or hazardous waste (HW). Manifesting under Title 40, Code of Federal Regulations (CFR). Part 262.20 may be required. The requirements for manifesting will be in accordance with federal, state and local regulations. When affected units are at a remote site, the IEO will coordinate with the remote site environmental official to ensure proper management of batteries.

e. Coordinate all disposition and disposal of batteries with:

(1) Local Installation Environmental Office (IEO) to ensure conformance with environmental regulations.

(2) Local environmental DoD Executive Agent (DoDEA) through your local IEO to ensure conformance with environmental regulations at OCONUS locations.

(3) Local servicing Defense Reutilization and Marketing Office (DRMO) to ensure conformance with DoD disposition/disposal policies.

(4) Local Installation Transportation Office (ITO) to ensure conformance with transportation regulations.

(5) Supporting Safety Office/Officer (SO) and/or Industrial Hygienist (IH)/Preventive Medicine Office/Officer (PMO) to ensure safe handling, and for coordination of personal protective equipment (PPE), when recommended.

1-4. Reporting Product Quality Deficiencies

All battery deficiencies should be reported to: Commander, US Army CECOM LCMC, ATTN: AMSEL-LCECOMD-CFO, Fort Monmouth, NJ 07703-5000 on a Product Quality Deficiency Report (PQDR). You may use the Standard Form (SF) 368; however, the automated Electronic Deficiency Reporting System (EDRS) is preferred. It can be accessed online at http://aeps.ria.army.mil/aepspublic.cfm. Once there, you'll need a username and password. Once you sign in, select the EDRS link and submit the report. Save the battery(ies) if possible. Your activity will be contacted by CECOM with disposition instructions.

1-5. Reporting Safety Incidents

In addition to reporting via a PQDR; safety incidents involving batteries, where the battery has bulged, leaked, vented or ruptured, or if personal injury or equipment damage resulted from a battery deficiency or malfunction, MUST be reported to the CECOM LCMC Directorate for Safety, Fort Monmouth, New Jersey. See paragraph (para) 1-7 for safety support.

1-6. Reporting Errors and Recommending Improvements

Readers are encouraged to submit beneficial suggestions on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to:

Commander,
US Army CECOM LCMC
ATTN: AMSEL-LC-LEO-E-ED
Fort Monmouth, New Jersey 07703-5000

Copy furnish suggestions regarding this TB to Safety/environmental support at the address shown below.

1-7. Technical Support

To obtain further information and guidance, Contact the appropriate support activity at CECOM. The mailing address is: Commander, US Army CECOM LCMC Directorate for Safety, ATTN: AMSEL-SF, Fort Monmouth, New Jersey 07703-5024.

CECOM LCMC Points of Contact

Safety/Environmental Support
ATTN: AMSEL-SF-SI
Voice:
DSN 987-7445 or Commercial (732) 427-7445
Datafax:
DSN 992-6403 or Commercial (732) 532-6403
MILNET Address:
MONM-AMSELSF@conus.army.mil
Message Address:
CDR CECOM LCMC FT MONMOUTH NJ//AMSEL-SF//

CHAPTER 2 DISPOSITION AND DISPOSAL

CAUTION

Personal protective equipment (PPE) **MUST** be used when handling batteries that show signs of leaking, bulging, swelling, or deformity. See Chapter 3 for PPE.

Batteries which have been abused or mishandled may be hazardous even though they are otherwise characterized as non-hazardous for disposal purposes.

2-1. Solid Waste Characterization of Batteries

Battery classes are shown in Table 2-1A and Table 2-1B by chemical composition, type numbers, and solid waste (SW) classification. The classification relates how the various classes of batteries, by chemical composition, are characterized for disposal. Batteries classified as hazardous waste (HW) under the federal Resource Conservation and Recovery Act (RCRA) administered by the US Environmental Protection Agency (EPA) or under state regulation should be disposed of through your local servicing Defense Reutilization and Marketing Office (DRMO) or via local contract. See paragraph (para) 2-7.

a. Batteries that do not exceed regulatory criteria as established in Title 40, Code of Federal Regulation (CFR), Part 261, Subpart C of RCRA regulations are classified as nonhazardous solid waste (NHSW). These batteries may be disposed of in accordance with local regulations.

b. Batteries which exceed regulatory criteria may be hazardous waste (HW). Batteries which are defined as HW are identified by US Environmental Protection Agency (EPA) HW number (HW#) for disposal. Batteries are not a listed waste in accordance with EPA's RCRA regulations. All states are required to enforce RCRA regulations. In states without additional requirements, federal and state requirements and classifications will be similar. The Universal Waste Rule has now been accepted in all 50 states, and the provisions of that Rule may be applied where appropriate.

c. States may have more stringent regulations. In addition to RCRA requirements, Alaska (AK), California (CA), Minnesota (MN), Rhode Island (RI) and Washington (WA) utilize bioassay to characterize the solid waste as HW.

d. Local activities (eg., county landfill) may not allow the disposal of certain classes of non-hazardous batteries. In some localities these batteries may be disposed as solid waste, e.g.. industrial waste. Therefore coordination of disposal with the Installation/Unit Environmental Office/Officer (IEO) is essential to ensure regulatory compliance.

e. The SW characterization of battery classes in Tables 2-1A and 2-1B provides information on how to characterize batteries as SW for disposal. If battery disposition is through the local servicing DRMO, the DRMO will determine if the batteries will be recycled or disposed through other means. Therefore, when battery disposition is through the DRMO, the DRMO determines whether the batteries will be handled as HW, HM, Universal Waste or as unregulated solid waste. Contact your local IEO and/or DRMO prior to turn-in of these batteries to determine how they will be received and managed.

f. Batteries shipped for analysis back to USA CECOM LCMC, the battery manufacturer, or a contractor are shipped as "laboratory samples" for test and failure analysis. They are not HW. They may be classified as HM for shipping. Consult with your local ITO and SO. See paragraph 2-6, below.

2-2. Hazardous Characteristics

Refer to individual battery profiles in Chapter 4 for specific information and requirements for each battery.

2-3. Handling

a. Hot/warm battery(ies) may vent or leak. **DO NOT** handle hot or warm batteries. Wait until they are cool to the touch.

b. Inspect batteries for obvious physical damage or defect prior to use. **DO NOT** use defective batteries.

c. If batteries show signs of leakage, **PROTECT YOUR HANDS** with chemical resistant gloves. If you must handle batteries that are hot or warm; eye, face, hand and respiratory protection is required. Refer to Chapter 3 for Personal Protective Equipment (PPE).

d. **DO NOT** heat, incinerate, crush, puncture, or mutilate batteries. Exercise care in handling batteries and container(s) of batteries to prevent damage.

e. **DO NOT** charge any primary (non-rechargeable) battery.

f. **DO NOT** disassemble any battery unless authorized by the battery Technical Manual (TM). (Note: Rechargeable aircraft Ni-Cd batteries are the only batteries designed for disassembly.)

g. **DO NOT** short circuit batteries.

h. **DO NOT** bypass an internal fuse, or replace fuse with one of a different rating.

i. **DO NOT** over-discharge batteries. Remove the battery(ies) from equipment after they fail to operate the equipment.

j. If equipment uses two or more batteries, **ALWAYS** replace batteries in complete sets. Use batteries from the same manufacturer with the same contract number and a similar date code. Store batteries in sets**. NEVER** mix new and used batteries. **NOTE:** This requirement does not apply to different battery types used in the same equipment, such as a prime power source battery and a memory hold battery.

k. **DO NOT** store batteries in equipment for longer than 30 days when not in use.

l. **USE ONLY** the correct batteries authorized by the equipment TM.

m. **DO NOT** use any battery which does not easily fit into the battery compartment of the equipment.

Table 2-1A. Solid Waste Characterization of Non-Rechargeable Batteries

CAUTION

Refer to individual battery profiles in Chapter 4 for additional required information. RCRA and State bioassay solid waste classifications are independent. All battery users **MUST**:

1. Coordinate with local Installation/Unit Environmental Off ice/Officer to ensure conformance wfth federal, state and local environmental regulations.
2. Dispose of hazardous material and waste through the local servicing DRMO or via local contract. See para 2-7.
3. Note that generic Material Safety Data Sheets (MSDS) are contained in Appendix E of this bulletin.

		Solid Waste Classification	
Battery Class	**Type Number**	**RCRA Class (EPA HW Number)**	**States with bioassay[1]**
Alkaline (ALK)	BA-3000 Series	NHSW	HW
Carbon-Zinc (LeCianche) (LCE)	BA-2 through BA-471 (except BA-245), BA-500 Series & BA-800 Series	NHSW	HW
Lithium-Manganese Dioxide ($Li-MnO_2$)	BA-5300/U Series & BA-5516/U		
Completely Discharged:		NHSW	HW
Not Completely Discharged:		HW (D001, D003)	HW
Lithium-Sulfur Dioxide[3] ($Li-SO_2$)	BA-5000 Series (except BA-5300/U's, BA-5516/U & BA-5567/U)	(Classified as Universal Waste because of Acetonitrile)	
Completely Discharged:		UW	UW
Not Completely Discharged:		HW (D001, D003)	HW
Lithium-Thionyl Chloride ($Li-SOCl_2$)	BA-6000 Series		
Completely Discharged:		HW (D007)	HW
Not Completely Discharged:		HW (D001, D003 & D007)	HW
Magnesium (MG)	BA-4000 Series		
Discharged (≤ 50% charge remaining)		NHSW	NHSW
Not Discharged (> 50% charge remaining)		HW (D007)	HW
Mercury (HG)[2]	BA-1000 Series	HW (D009)	HW
Silver (AG)[2]	BA-245/U, BA-2245/U, BA-XXXX, & BB-622B/U	HW (D009, D011)	HW
Thermal (THR)	BA-605/U, BA-617/U, BA-618A/U & BA-63O/U	HW (D007)	HW
Zinc-Air (Zn-Air)	BA-8XXX	NHSW	HW

Notes:
1. AK, CA, MN, RI and WA utilize bioassay to characterize hazardous waste in addition to EPA's RCRA requirement.
2. These batteries should be considered candidates for recycling.
3. These batteries may not be landfilled by reason of the Acetonitrile content before and after discharge.

EPA HW NUMBER	HW CHARACTERISTIC	EPA HW NUMBER	HW CHARACTERISTIC
D001	Ignitability	D007	Chromium
D003	Reactivity	D009	Mercury
D006	Cadmium	D011	Silver

Table 2-1B. Solid Waste Characterization of Rechargeable Batteries

CAUTION

Refer to individual battery profiles in Chapter 4 for additional required information. RCRA and State bioassay solid waste classifications are independent. All battery users **MUST**:

1. Coordinate with local Installation/Unit Environmental Off ice/Officer to ensure conformance wfth federal, state and local environmental regulations.
2. Dispose of hazardous material and waste through the local servicing DRMO or via local contract. See para 2-7.
3. Note that generic Material Safety Data Sheets (MSDS) are contained in Appendix E of this bulletin.

Battery Class	Type Number	Solid Waste Classification RCRA Class (EPA HW Number)	Solid Waste Classification States with bioassay[1]
Lead-Acid (LA)[2]	BB-XXX	HW (D002, D008)	HW
Lithium Ion (Li-Ion)[2]	BB-2XXX	NHSW	HW
Nickel-Cadmium (Ni-Cd)[2]	BB-5XX	HW (D002, D006)	HW
Nickel-Metal Hydride (Ni-MH)[2]	BB-3XX	NHSW	HW

Notes:
1. AK, CA, MN, RI and WA utilize bioassay to characterize hazardous waste in addition to EPA's RCRA requirement.
2. These batteries should be considered candidates for recycling.

EPA HW NUMBER	HW CHARACTERISTIC	EPA HW NUMBER	HW CHARACTERISTIC
D001	Ignitability	D007	Chromium
D002	Corrosivity	D008	Lead
D003	Reactivity	D009	Mercury
D006	Cadmium	D011	Silver

2-4. Fire Control/Suppression

Fire suppression equipment, approved by the local Fire Department (FD) for the type and quantity of batteries stored, **MUST** be provided by the activity storing batteries.

WARNING

DO NOT use water to extinguish a battery fire if a shock hazard exists due to high voltage electrical equipment in the immediate vicinity (greater than 30 volts, alternating or direct current).

Halon fire extinguishers SHALL NOT be used to combat fires involving Lithium non-rechargeable batteries.

DO NOT use small water fire extinguishers on fires involving sulfuric acid (H_2SO_4) battery electrolyte. H_2SO_4 is highly reactive and can react with finely divided combustible materials (e.g., sawdust) on contact.

NEVER attempt to extinguish a Lithium fire. In the event of a Lithium fire, immediately evacuate the area and contact the Emergency Authorities.

a. A carbon dioxide (CO_2) extinguisher, such as NSN 4210-00-202-7858, 10-B:C, Source of Supply (SOS): S9I, or equivalent, is recommended for battery storage areas. This is a good general purpose extinguisher for all types of battery fires. It will not extinguish burning lithium metal; however, it will cool the battery mass and may prevent other battery types from venting.

b. A dry chemical extinguisher, such as 4210-00-7750127, 10-B:C, SOS: GSA, or equivalent, is recommended for flammable liquids and gases. This is a general purpose extinguisher and for all types of battery fires.

c. An approved Class-D fire extinguisher, such as NSN 4210-01-303-3999, SOS: S9I, or equivalent, such as Lith-X, is recommended for Lithium battery storage areas to be made available for professional fire fighter use ONLY.

2-5. Storage

a. General.

(1) An activity storing batteries MUST provide fire suppression equipment. The storage areas and equipment MUST be approved by the local Fire Department (FD). A point of contact to the local FD must also be provided.

(2) Batteries should be kept cool and dry, and away from open flame, heat and combustibles, in well ventilated areas with temperatures not exceeding 130 ^{o}F. (54 ^{o}C.). However, refrigeration or air conditioning is not required.

(3) Protect batteries from being damaged, crushed, punctured or short circuited.

(4) **DO NOT** smoke or eat in battery storage areas.

(5) Store batteries separately from other hazardous materials.

(6) Open flame devices shall be used only under proper supervision and with adequate safeguards.

b. ***Special Requirements:***

(1) **DO NOT** accumulate waste batteries. Dispose of them as they are generated. Separate the batteries by type before turning them in.

(2) Batteries being collected for turn-in to the DRMO **SHALL NOT** be stored more than 90 days following RCRA guidance or for more than one year for those areas following the guidelines of the Universal Waste Rule.

2-6. Transportation

Shipments of batteries within the United States MUST be in accordance with federal DOT requirements (Title 49 CFR, Part 172.101 Hazardous Materials Table (HMT)) when the batteries are listed in this table. The regulation includes packaging, marking and labeling requirements. Transportation from OCONUS locations to CONUS is governed by international regulations. The International Maritime Organization (IMO) "International Maritime Dangerous Goods (IMDG) Code" must be used for vessel movement. The provisions of the International Civil Aviation Organization (ICAO), "Technical Instructions for the Safe Transport of Dangerous Goods by Air," must be used for commercial airlift, as well as the International Air Transport Association, Dangerous Goods Regulations. Air Force Joint Manual AFJMAN 24-204, "Preparing Hazardous Materials for Military Air Shipment," should be used for military airlift. Consult your Installation Transportation Office (ITO) to ensure compliance with all applicable transportation regulations.

Note that as of December 2004, Lithium Non-Rechargeable battery bulk shipments are barred from the cargo holds of all passenger aircraft.

WARNING

DO NOT package any battery if it is hot or warm. Package batteries only when they are cool to the touch.

CAUTION

DO NOT mix hazardous and non-hazardous solid waste in the same package.

a. Packaging Requirements. Title 49, CFR Parts 173.24 and 173.24a require that packaging be designed and constructed to control contents under conditions normally incident to transportation. For batteries listed in the HMT, use packaging as specified by federal transportation regulations *(i.e.,* 49 CFR). Original packaging materials, when suitable for re-use, may be saved for subsequent packaging and shipping. Packaging materials are listed in Appendix D. In addition, the following requirements apply:

(1) It should be noted that not all batteries are regulated under federal hazardous material transportation regulations *(i.e.,* the HMT, 49 CFR 172.101). However, if a battery is shipped as hazardous waste (HW), it is regulated under the HMT as an "environmentally hazardous substance."

(2) Batteries must be provided with an effective means of preventing external short circuits. When single cell *(eg.,* BA-5567/U) or multi-cell batteries with exposed connectors are packaged, they must be protected against external short circuiting by taping the exposed contacts or by placement in a small individual plastic bag or cardboard box, which is sealed with a non-conductive, non-metallic closure, such as tape.

(3) The batteries must be adequately protected and securely packaged in a strong fiberboard or wooden box, a fiber or metal drum, or palletized, in accordance with DOT regulations, to withstand conditions normal to shipment.

(4) When single or multi-cell batteries are packed and then overpacked in another container, all free space must be taken up by using suitable packing materials (such as Vermiculite, Absorbent grade, Hazardous Material, NSN 5640-01-324-2664, SOS: GSA, Advice Code 2B) which are non-conductive and non-combustible.

(5) Packaging Damaged Batteries:

(a) Damaged batteries should not be packaged with undamaged batteries.

(b) Damaged batteries with cells that have ruptured, or otherwise have sharp edges, should first be placed in a sealable plastic bag and then packed in a fiberboard container which is sealed by non-conductive, non-metallic means. This container may then be overpacked in another container and sealed by non-conductive, non-metallic means. All free space between boxes should be taken up by using suitable non-combustible packaging materials. The overpacking should be able to contain any leakage from the batteries.

b. Marking Requirements. The HMT specifies marking requirements for listed hazardous materials. In addition, marking and labeling of the top and sides of the package shall be in accordance with MIL-STD 129.

(1) General rules:

(a) When shipping hazardous batteries which are listed be in accordance with HMT requirements, in the HMT, use the item's proper shipping name as listed in the HMT. If the batteries are not listed in the HMT, use their technical name.

(b) When shipping hazardous waste, use the word "Waste" as a part of the proper shipping name, or 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: _____

(c) Markings must be durable, in English, and printed on or affixed to container, plastic sheeting, or on a hang tag.
(d) Markings must be in a contrasting color to the packaging materials, and must not be obscured.
(e) The names and addresses of the consignor and the consignee must be marked on the container.
(f) The container must be marked for proper orientation with directional arrows on two sides, if applicable *(e.g.,* for a battery with a vent/filler cap).
(g) Proper shipping name from the HMT must be included.
(h) Proper United Nations identification number (UNID) from the HMT must be included.
(1) If shipping name contains "N.O.S.," then the technical name must be provided by the shipper. In addition, the National Stock Number (NSN) and type number may be provided by the shipper:

(2) Examples:

For a lithium battery listed in the HMT, which is being shipped as HW
Waste, lithium battery
UN3090
6135-01-036-3495, BA-5590/U (Optional)

For a mercury battery not listed in the HMT, which is being shipped as HW:
Waste, environmentally hazardous substances, solid, nos.
UN3077 -
Mercury battery
6135-.00-125-5265, BA-1030/U (Optional)

For a nickel-cadmium battery with vent/filler caps listed in the HMT, which is being shipped as hazardous material:
Battery, wet, filled with alkali
UN2795
Nickel-cadmium battery, vented (Optional - electric storage, 8)
6140-M-35-3394, BB-403/U (Optional)

c. Labeling. For batteries listed in the HMT, labeling must be in accordance with HMT requirements.

(a) The label must be printed or affixed near the proper shipping name.
(b) Hazardous warning labels are PROHIBITED on packages that DO NOT contain hazardous materials.

d. Shipment of batteries may require shipping papers and/or manifesting of hazardous waste for disposal. Coordinate with your local ITO for shipping paper requirements, and your local IEO if manifesting of hazardous waste is required.
(a) Shipping papers are required for shipment of hazardous material on public roads and highways.
(b) A manifest is required for shipment of HW on public roads and highways.
(c) It is recommended that a Manufacturer's Safety Data Sheet also accompany the shipping papers.

2-7. Disposition and Disposal

CAUTION

DO NOT accumulate or store waste batteries for disposal for more than 90 days.
For those areas following the guidance of the Universal Waste Rule, do not store waste batteries for more than one year.

In accordance with DoD Consolidated Hazardous Material/ Hazardous Waste Disposal Guidance, batteries designated in Table 2-1A and 2-1B as HW for disposal may be disposed of via the local servicing DRMO. In addition, HW may be disposed via local contract. Disposal of HW via local contract must be coordinated with and approved by HQDA, Office of the Directorate of Environmental Programs (ENVR-E), prior to finalization and signature of the local contract. All disposition/ disposal actions **MUST BE** in accordance with federal, state and local regulations and requirements. Coordinate all actions with the local IEO to ensure proper management of waste batteries.

a. Disposal of non-hazardous Solid Waste (NHSW). Batteries classified as NHSW in Tables 2-1A and 2-1B are to be disposed of in accordance with local refuse regulations.

(1) DO NOT accumulate waste batteries. Good practice dictates that waste materials be disposed of on a regular basis, at least within 90 days. Dispose of small quantities (less than 150 lbs.) of unserviceable or depleted NHSW batteries as generated.

(2) Disposal of a large quantity (150 lbs. and over) of unserviceable or depleted NHSW batteries, or any quantity of damaged NHSW batteries, may be through the local servicing DRMO, or via local contract, as unregulated waste.

b. Disposal of Hazardous Material (HM) and Hazardous Waste (Hw. For any turn-in of HM or HW, a Material Safety Data Sheet (MSDS) and/or Hazardous Waste Profile Sheet (HWPS) (DRMS Form 1930, see appendix G) is required. If a MSDS is required, contact your local supporting SO or IEO. Data required to complete the HWPS is in chapter 4 and appendix H. See para 1-7 for NICP Safety/ Environmental support.

(1) A MSDS is required for turn-in of HM. Note that generic MSDS's are contained in Appendix E of this bulletin.

(2) A HWPS is required for turn-in of HW. Data from this TB may be used in completion of the HWPS; list this TB as a reference if it is a source for technical data. In addition, a MSDS or laboratory analysis may be required.

(3) If batteries or battery electrolyte for disposal are to be managed as HW, and you must transfer/transport the batteries off your installation, you are required to manifest these waste batteries under Title 40 CFR Part 262 regulations. Consult your local IEO for guidance about manifest requirements.

(4) Batteries designated in Tables 2-1A and 2-1B as RW for disposal, and battery electrolyte from vented LA or NI-CD batteries, may be disposed via the local servicing DRMO, or via local contract.

c. Recycling:

(1) Some batteries identified as RW in Table 2-1 *(e.g.,* HG batteries, BA-1000 series) may be recycled under RCRA regulations, and therefore managed as HM.

(2) Recycling and/or reclamation is the recommended option for disposition of batteries in lieu of disposal. Lead-acid, Mercury, Nickel-Cadmium, Nickel-Metal Hydride and silver batteries should be considered for recycling or reclamation based on federal and state requirements.

d. Transfer to the Defense Reutilization and Marketing Office: The DRMO will accept accountability provided the batteries are properly marked, labeled, packaged and turned in with appropriate documentation. The DRMO will accept physical custody depending upon the availability of conforming, or most nearly conforming storage areas. The disposing activity must turn in the material (batteries) with an accompanying Disposal Turn-in Document (DTID (DD Form 1348-1)), and provide a HWPS or MSDS for the item(s) as required.

e. For additional information on the disposal of HW, beyond the scope of this handbook, refer to Technical Guide (TG) No. 126, "Waste Disposal Instructions", TG No. 126 can be obtained from your local IEO or PMO, or contact USAEHA, Waste Disposal Engineering Division at DSN 584-3651 or commercial (410) 671-3651.

CHAPTER 3 SAFETY AND CONTROL MEASURES

3-1. Introduction

a. Personal protective equipment (PPE) MUST be used when handling batteries that show signs of leaking, bulging, swelling or deformity, or handling corrosive electrolyte. See Table 3-1 below for equipment.

b. Additional PPE, such as a respirator, may be required when servicing lead-acid and nickel-cadmium secondary (i.e., rechargeable) batteries, or when going into an area where Li-SO_2 batteries have vented. See Table 3-2 below for respirators. Consult with your Installation Safety Office (ISO), and your local support Industrial Hygienist (IH). These functions can advise regarding requirements for battery recharging facilities and battery storage areas.

c. If PPE is recommended, coordination is **REQUIRED** with the supporting ISO/Safety Officer (SO), local IH or local servicing Preventive Medicine Office (PMO). Appropriate PPE is listed in the applicable battery technical manual (TM).

3-2. Personal Protective Equipment

CAUTION

All Personal Protective Equipment (PPE) **MUST** meet applicable ANSI or NIOSH/ MSHA requirements, or equivalent.

Table 3-1 Personal Protective Equipment

Item	NSN	SOS	Size	Remarks
Eye and Face Protection				
Eyewash, Self-Contained, Portable	6850-01-353-9947	S9G		item w/o eyewash solution
Eyewash, Solution	6850-01-444-3371	S9G		
Shower, Emergency Drench	4230-01-026-9305	S9I		for fixed installation
Faceshield, Industrial	4240-00-202-9473	S9I		
Goggles, Industrial	4240-01-292-2818	GSA		
Apron, Utility, Impermeable	8415-00-82-6108	S9T		
First Aid Kit, General Purpose	6545-01-433-8399	S9M		
Flashlight	6230-00-299-3035	GSA		watertight, explosion proof
Foot Protection				
Fireman's Boots	8430-00-753-5935	S9T	5	hard-top boots, chemical and electrical resistant.
	8430-00-753-5936	S9T	6	
	8430-00-753-5937	S9T	7	
	8430-00-753-5938	S9T	8	
	8430-00-753-5939	S9T	9	
	8430-00-753-5940	S9T	10	
	8430-00-753-5941	S9T	11	
	8430-00-753-5942	S9T	12	
	8430-00-753-5943	S9T	13	
	8430-00-753-5944	S9T	14	
	8430-00-753-5945	S9T	15	
Hand Protection				
Gloves, Electrical Worker, Type1, Class 0	8415-01-158-9453	S9T	9	electrical protection
	8415-01-158-9455	S9T	10	
	8415-01-158-9457	S9T	11	
Gloves, Heat Protective, Type II	8415-01-092-3910	S9T	large	thermal protection
Gloves, Rubber Industrial, Type 1, Chemical	8415-00-266-8679	S9T	9	chemical protection or when handling corrosive electrolyte
	8415-00-266-8677	S9T	10	
	8415-00-266-8675	S9T	11	
	8415-00-266-8673	S9T	12	

Table 3-2 Air Purifying Respirators

Type	SOS	Size/NSN			Remarks
		Small	Medium	Large	
Half Mask					
Respirator, Air Filtering	S9I	4240-01-301-0754		4210-01-246-5404	Mask
Filter, Respirator, Air Filtering	S9I	4240-01-246-5411			Acid mist, used with mask above
Cap, Retainer, High Efficiency	S9I	4240-01-231-7718			Used with mask and filter above
Full Mask					
Respirator, Air Filtering	S9I	4240-01-314-2780	4240-01-342-5239	4240-01-301-3200	mask
Filter, Respirator, Air Filtering	S9I	4240-01-246-5411			Acid mist, used with mask above
Cap, Retainer, High Efficiency	S9I	4240-01-231-7718			Used with mask and filter above
Additional Filter		No Size			
Cartridge, Respirator, Air Filtering	S9I	4240-01-246-5408			Acid gas, may be stacked w/above filter
Retainer, cartridge	S9I	4240-01-235-0823			If stacking two filters, use this retainer

a. Sources of Supply
GSA: General Services Administration, Washington, DC 20406
S9G: Defense General Supply Center, Richmond, VA 23297
S9I: Defense Industrial Supply Center, Philadelphia, PA 19111
S9M: Defense Supply Center Philadelphia, Director of Medical Materiel, Philadelphia, PA 19145
S9T.- Defense Supply Center, Philadelphia, PA 19101

b. Respirator. Properly fitted air purifying respirator, with NIOSH/MSHA certified cartridge for organic vapors/acid gases, or equivalent, is recommended. Respirator use should follow an approved program including medical survellance, testing for proper fit, and training. Ensure a proper fit by coordination with the supporting SO, IH or PMO. SOS: S9G2 or may be obtained through your local procurement system. This is a Paperless Ordering Placement System (POPS) item. Refer to Table 3-1.

c. Emergency Shower and Eye Wash. All emergency eyewashes/showers must meet the requirements of ANSI Z358.1. An approved emergency shower and eye wash station must be available, where recommended. Emergency eyewashes/showers, are required to be flushed weekly for three (3) minutes. In addition, a source of **FRESH** water should be close at hand before attempting any service to vented Lead-Acid or vented Nickel-Cadmium batteries. Obtain through local procurement.

3-3. Regulatory Requirements

Coordinate the use of this equipment with your local safety and industrial hygiene support personnel.

a. Eye and Face protection, and Eyewash. IAW 29 CFR 1910.133 and 1910.151 protective eye and face devices shall comply with ANSI Z87.1-1989, "American National Standard Practice for Occupational and Educational Eye and Face Protection," which is incorporated by reference as specified in Sec. 1910.6. Adequate first aid (e.g., eyewash station) and first aid supplies shall be readily available.

b. Occupational foot protection. IAW 29 CFR 1910.136 protective footwear shall comply with ANSI Z41-1991, "American National Standard for Personal Protection-Protective Footwear," which is incorporated by reference as specified in Sec. 1910.6, or shall be demonstrated by the employer to be equally effective.

c. Hand and body protection. IAW 29 CFR 1910.138 and 1915.157 affected employee shall use appropriate hand protection and other protective clothing where there is exposure to hazards such as skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, harmful temperature extremes, and sharp objects.

d. Respirators Respiratory Protection. IAW 29 CFR 1910.134 respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program.

3-4. First Aid

WARNING

- **DO NOT** try to neutralize caustic electrolyte with vinegar or any other acidic solutions if it gets on your skin. Neutralization will do more harm than good, as it will trap caustic under the skin, preventing it from coming out.
- **Flush** with copious amounts of water.
- If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness. **Flush** with water for at least 15 minutes. Seek immediate medical attention!

a. Skin. If battery contents or electrolyte are spilled and come in contact with the skin, **IMMEDIATELY** flush the affected area for at least 15 minutes with clean WATER and seek medical attention promptly.

b. Eyes. If battery contents or electrolyte come in contact with the eyes, **IMMEDIATELY** flush the affected area for at least 15 minutes with clean **WATER** and have someone else summon medical attention for you. Personnel must be trained in how to assist individuals in the vital first flushing of the eyes, in the event of eye contact. Such assistance is necessary for effective irrigation, as the eyelids go into spasms and remain shut making it difficult for a person to flush the eyes without assistance. Obtain immediate medical attention.

CHAPTER 4 BATTERY PROFILES

4-1. Introduction

a. This chapter is a ready reference for specific guidance for each class of battery listed in Tables 2-1A and 2-1B. Handling, fire suppression, storage, transportation and disposition requirements in chapter 2 apply to all classes of batteries. This TB is intended to provide useful information in a convenient format; **IT DOES NOT REPLACE** federal or state environmental or transportation regulations or DoD policies.

b. Coordination with all installation/facility personnel, as required under paragraph (para) 1-3 e, **is essential** for your safety and the protection of the environment. Installation/facility personnel will assist you in ensuring compliance with requirements under federal, state and local regulations.

c. Generic Material Safety Data Sheets for each of the Battery Chemistries are contained in Appendix E to this bulletin.

4-2. Alkaline (ALK) Batteries

Alkaline batteries are primary (non-rechargeable) batteries.

a. Chemical characterization.

(1) Anode: Zinc (Zn).
(2) Cathode: Manganese dioxide (MnO_2).
(3) Electrolyte: Aqueous solution of potassium hydroxide (KOH).
(4) The battery cell contains caustic KOH electrolyte, which may leak if the battery is abused. KOH is a strong alkali similar to caustic soda (sodium hydroxide). Serious chemical burns can result if the electrolyte comes into contact with the skin or eyes. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.

b. Type number BA-3000 series.

c. Solid waste characterization.

(1) Under federal RCRA: Non-hazardous solid waste (NHSW).
(2) Bioassay findings: Hazardous waste (HW) in states which utilize bioassay characterization criteria for HW identification. Presently AK, CA, MN, RI and WA utilize this criteria.

d Handling. See para 2-3.

e. Fire controt1suppression. A carbon dioxide (CO_2) fire extinguisher is recommended. See para 2-4.

f. Storage. See para 2-5.

CAUTION

Depleted batteries may continue to vent hydrogen gas after use, and if stored at high temperatures above 130 °F. Avoid sparks or other sources of ignition.

g. Transportation requirements. See para 2-6 for packaging, marking and labeling requirements. Not regulated under Title 49 CFR, Part 172.101 Hazardous Materials Table (HMT)-

h. Disposition and disposal. DO NOT accumulate and store waste batteries for disposal for more than 90 days or for more than one year for Universal Waste Areas. See para 2-7.

(1) Dispose of ALK batteries as NHSW in accordance with RCRA regulations.
(2) In states with bioassay requirements, ALK batteries are classified as HW, and dispositiontdisposal may be through your local servicing Defense Reutilization and Marketing Office (DRMO), or via local contract.

4-3. Carbon-Zinc (LeClanche (LCE)) Batteries

LeClanche batteries are primary (non-rechargeable) batteries.

a. Chemical characterization.

(1) Anode: Zinc (Zn).
(2) Cathode: Manganese dioxide (MnO2).
(3) Electrolyte: Aqueous solution of ammonium chloride (NH_4Cl) and zinc chloride ($ZnCl_2$).

b. Type number. BA-2 through BA-471 series (except BA-245, 259 & 380); BA-5XX series; BA-8XX series.

c. Solid waste characterization.

(1) Under federal RCRA: NHSW
(2) Bioassay findings: HW in states which utilize bioassay characterization criteria for HW identification. Presently AK, CA, MN, RI and WA utilize this cyiteria.

d. Handling. See para 2-3.

e. Fire contro/lsuppression. A $C0_2$ fire extinguisher is recornmended. See para 2-4.

f Storage. See para 2-5.

CAUTION

Depleted batteries may continue to vent hydrogen gas after use, and if stored at high temperatures above 130 °F. Avoid sparks or other sources of ignition.

g. Transportation requirements. See para 2-6 for packaging, marking and labeling requirements. Not regulated under Title 49 CFR, Part 172.101 HMT.

h. Disposition and disposal. DO NOT accumulate and store waste batteries for disposal for more than 90 days or for more than one year for Universal Waste Areas. See para 2-7.

(1) Dispose of LCE batteries as NHSW in accordance with RCRA regulations.
(2) In states with bioassay requirements, LCE batteries are classified as HW, and disposition/disposal may be through your local servicing DRMO or via local contract.

4-4. Lead-acid (LA) Batteries

Lead-acid batteries are secondary (rechargeable) batteries. There are two kinds of LA batteries: sealed batteries without vent-filler caps, and vented batteries with vent-filler caps for servicing the battery.

a. *Chemical characterization.*

(1) Anode: Lead (Pb).
(2) Cathode: Lead dioxide (PbO_2)
(3) Electrolyte: Aqueous solution of sulfuric acid (H_2SO_4).
(4) The battery cell contains 60 % to 75 % Pb and PbO_2 by weight. The battery cell contains an acidic electrolyte solution of between 28.3 % and 50.5 % H_2SO_4 by weight. The electrolyte is a strong oxidizing agent and can cause severe skin burns or irritation upon contact. If acid gets into your eyes, it can cause severe damage and/or blindness. Repeated or prolonged exposure to low concentrations of H_2SO_4 fumes or mist will cause tooth erosion and irritation of the mucous membranes, eyes and upper respiratory tract.

CAUTION

Contact lenses should not be worn and smoking should be prohibited in areas where H_2SO_4 is stored or handled. Contact lenses can concentrate the acid vapors behind the lenses and smoking will draw the vapors into the lungs.

(5) Pb and Pb salts are toxic and hazardous materials. It is recommended that LA batteries be turned in wet. If you must drain the battery, the H_2SO_4 electrolyte MUST be tested for pH prior to disposal. If pH is below the RCRA regulatory limit (5.0 mg/L), then the electrolyte may be disposed in accordance with TG No. 126 with the concurrence of the IEO and the affected waste water treatment authority.

b. type number. BB-XXX.

c. *Solid waste characterization.*

(1) Under federal RCRA: HW with a US Environmental Protection Agency (EPA) HW number (EPA HW#) of D008 for Pb.
(2) Bioassay findings: Not tested, presumed to be toxic based on Pb content.

d. Handling. See para 2-3.

WARNING

DO NOT use metal or galvanized equipment when draining electrolyte from Lead-Acid batteries.

DO NOT use finely divided combustible materials (e.g., sawdust) to absorb a H_2SO_4 spill. H_2SO_4 is highly reactive and can react with finely divided combustible materials on contact.

(1) **DO NOT** attempt to drain electrolyte from sealed secondary batteries.
(2) **DO NOT** drain electrolyte from vented secondary batteries unless authorized.
(3) If H_2SO_4 electrolyte spills or leaks, **DO NOT** touch spilled material. Stop the leak if you can do it without risk. Spread sand or other noncombustible material, then flush area with water. Notify the local SO and IEO.
(4) If battery contents or electrolyte come in contact with the skin, **IMMEDIATELY** flush the affected area for at least 15 minutes with clean WATER and seek medical attention promptly.

e. Fire control suppression: See para 2-4.

WARNING

DO NOT use water on fires involving H2SO4. H2SO4 is highly reactive and can react with finely divided combustible materials (e.g. sawdust) on contact. Small fires may be extinguished with a dry chemical extinguisher approved by the local fire department. A CO2 fire extinguisher is recommended. See para 2-4.

f. Storage. See para 2-5.

CAUTION

Batteries should be protected from freezing. Battery electrolyte should NOT be drained from a vented LA battery, unless the battery cannot be protected from freezing. Refer to Table 4-1 for freezing points. Refer to Appendix C for instructions it batteries need to be drained.

Table 4-1. Freezing Points of Solutions of Pure Sulfuric Acid

Specific Gravity	**Freezing Points**	
	°C.	**°F.**
1.000	0.0	+32.0
1.050	-3.3	+26.0
1.100	-7.7	+18.0
1.150	-15.0	+5.0
1.200	-27.0	-17.0
1.250	-52.0	-61.0
1.300	-70.0	-95.0

g. Transportation requirements. See para 2-6 for packaging, marking and labeling requirements. In accordance with Title 49 CM Part 172. 101 HMT, Hazard Class 8, and 49 CFR, Part 173.159.

(1) Packaging: For vented LA batteries with vent-filler caps.

(a) Batteries must be protected against short circuits.

(b) Batteries may be either packaged in boxes or secured to pallets. Drum(s) are **NOT** approved.

(c) Requirements for packaging batteries in boxes.

1. All batteries, vent-filler caps and terminals of batteries **MUST** be protected against physical damage and short circuiting.

2. Vent-filler caps should be taped in place, and the vent holes sealed with the same tape.

3. In order to protect packaging, place battery(ies) in a plastic bag to control any residue or battery electrolyte leakage and seal the bag(s) with a nonmetallic closure (tape).

4. Place bagged batteries in a DOT Specification 4C1, 4C2, 4D or 4F wooden, or 4G fiberboard box(es). **DO NOT** overfill boxes. Batteries should fit snugly in the boxes. An inside top clearance of at least 1/2 inch above the battery terminals and/or vent-filler caps must be provided, with reinforcement to prevent them from being crushed. Any empty spaces inside the boxes should be filled with suitable noncombustible absorbent packing materials.

(d) Requirements for palletizing batteries:

1. Batteries which are placed on pallets must be securely fastened using non-metallic strapping.

2. Height of the palletized unit (including batteries, strapping and pallet) must not exceed 1 1/2 times the width of the pallet, and may not contain less than one complete layer or more than two layers of batteries per unit.

3. The palletized unit must be able to support twice its own weight without damage to batteries, pallet or strapping.

4. Battery terminals must not be relied upon to support any weight from batteries or units stacked above them.

5. Package and stack vented batteries in an upright position. **DO NOT** stack batteries on their sides, in order to prevent unintentional draining.

6. If the palletized batteries cannot be protected from exposure to the weather (rain, snow, etc.), the unit must be protected with plastic sheeting. Refer to SB 38-100.

(e) Packaging for sealed LA batteries: In accordance with Title 49 CFR, Part 173.159(d), sealed LA batteries without vent-filler caps **MUST** be protected against short circuits and securely packaged.

(2) Marking and labeling:

(a) For vented LA batteries with vent-filler caps**,** proper shipping name: Batteries, wet, filled with acid; Hazard Class: 8; UN Identification Number (UNID) UN2794; Packing Group: III; label in accordance with 49 CM Part 172.442: CORROSIVE label. See figure 4-1.

(b) For sealed LA batteries without vent-filler caps, proper shipping name: Batteries, wet, non-spillable; Hazard Class: 8; UNID: UN2800; Packing Group: III; label in accordance with Title 49 CFR, Part 172.442: CORROSIVE label. See figure 4-1.

Figure 4-1. CORROSIVE label

h. Disposition and disposal. **DO NOT** accumulate and store waste batteries for disposal for more than 90 days or for more than one year in areas utilizing the Universal Waste Rule. See para 2-7.

(1) Dispose of LA batteries as HW under federal RCRA regulations. Disposition may be through your local servicing DRMO or via local contract. The EPA HW# is D008 for Pb.

(2) LA batteries may be recycled under provisions of Title 40, CFR Part 266.80. Many states ban land disposal and regulate recycling of LA batteries. Recycling is recommended; see appendix E.

(3) In states with bioassay requirements, LA batteries are classified as HW, and disposition/disposal may be through your local servicing DRMO or via local contract.

4-5. Lithium-Ion (Li-Ion) Batteries

Lithium-Ion (Li-Ion) batteries are secondary (rechargeable) batteries. The cells contain an anode of Lithium Cobalt Dioxide and a carbon cathode. Batteries need protective control circuits to insure that they are not overcharged (4.2 VDC/Cell) nor over discharged (3.0 VDC/Cell).

a. Chemical characterization.

(1) Anode: Lithium Cobaltite or Lithium Cobalt Dioxide ($LiCoO_2$).

(2) Cathode: Graphite

(3) Electrolyte: A blend of organic solvents that may vary with each manufacturer. They may include Diethyl Carbonate, Ethylene Carbonate, Propylene Carbonate, Poly (vinylidene fluoride), and Lithium Hexaflurophosphate.

b. Type number. BB-2XXX/U.

c. Solid waste characterization.

(1) Under federal RCRA: NHSW.

(2) Bioassay findings: HW in states which utilize bioassay characterization criteria for HW identification. Presently AK, CA, MN, RI and WA utilize this criteria.

d Handling. See para 2-3.

e. Fire control/suppression.

A CO_2 fire extinguisher is recommended for combustible packaging materials. See para 2-4. Halon or approved Halon substitutes are suitable for controlling Li-Ion fires.

f. Storage. See para 2-5. Storage shall be in a dry, well ventilated, facility. Sprinkler protection is desirable if available. A non--combustible building or structure without sprinklers will be the second choice. A combustible storage facility may be used temporarily if neither of the above types are available. Other hazardous materials shall be stored separately. Temperatures should be limited to 130 ^{o}F. or less. However, air conditioning is not required.

g. Transportation requirements. See para 2-6 packaging, marking and labeling requirements.

Li-Ion batteries **MUST** be shipped in accordance with Title 49 CFR, Part 172.101 HMT and 49 CFR, Part 173.185(j). Li-Ion batteries have a solid cathode and are regulated if they contain more than 1 gram equivalent of Lithium/cell or 2 grams equivalent/battery. The equivalent Lithium content of Li-Ion cells in grams is equal to 0.3 times the fully charged capacity in ampere-hours.

(a) Packaging: All CECOM procured batteries meet the requirements of 49 CFR, Part 173.1850)(1) (*ie.,* cells contain less than 12.0 equivalent grams of Li. When packaged, batteries **MUST** be protected from external short circuits and packaged in a strong outer packaging.

(b) Marking and labelling: Proper shipping name:Dry Battery. If the battery contains more than 12.0 equivalent grams of Lithium, the marking and labelling requirements of Lithium non-rechargeable batteries may apply.

h. Disposition and disposal. **DO NOT** accumulate and store waste batteries for disposal for more than 90 days or for more than one year for those areas following the Universal Waste Rule. See para 2-7 for general requirements.

(1) Dispose of Li-Ion batteries as NHSW, in accordance with RCRA regulations. These batteries may be disposed as non-regulated waste in accordance with local regulations.

(2)In states with bioassay requirements, Li-Ion batteries are classified as HW, and disposition/disposal may be through your local servicing DRMO or via local contract.

4-6. Lithium-Manganese Dioxide (Li-MnO_2) Batteries

Li-MnO_2 batteries are primary (non-rechargeable) batteries. The cell has an anode of Lithium metal and a solid cathode of manganese dioxide (MnO_2). CECOM LCMC has only procured "balanced cell" Li-MnO_2 batteries. These are cells which are stoiciometrically balanced to completely consume the anode and cathode when fully discharged.

a. Chemical characterization.

(1) Anode: Lithium (Li).

(2) Cathode: Manganese dioxide (MnO_2).

(3) Electrolyte: A blend of organic solvents that vary with each manufacturer. They may include Ethylene Carbonate, Propylene Carbonate and 1,2 Dimetboxyethane, Lithium Trifluoromethanesulfonate and Lithium Perchlorate.

(4)There are no capacity test sets available that will accurately indicate the true capacity of the cells or batteries.

b. Type number. BA-5516/U and BA-53XX/U

c. Solid waste characterization.

(1) Under federal RCRA: NHSW.

(2) Bioassay findings: HW in states which utilize bioassay characterization criteria for HW identification. Presently AK, CA, MN, RI and WA utilize this criteria.

d Handling. See para 2-3.

e. Fire control/suppression.

WARNING

Halon fire extinguishers **SHALL NOT** be used to combat fires involving Li-$Mn0_2$ batteries.

(1) If Li-MnO_2 batteries are involved in or near fire, the principal concerns are to prevent its spread and minimize cell venting. Flood the burning materials with water. This will cool the batteries to reduce the risk of the Lithium metal melting and control the combustion of surrounding flammables.

(2) $C0_2$ extinguishers will not extinguish burning Li metal, but will extinguish other combustible materials within or near the battery.

(3) Use of an approved Class-D fire extinguisher, such as Lith-X, for Li metal fires, is recommended for use only by professional fire fighters..

f. Storage. See para 2-5. Storage shall be in a dry, well ventilated, facility. Sprinkler protection is desirable, if available. A non-combustible building or structure without sprinklers will be the second choice. A combustible storage facility may be used temporarily if neither of the above types are available. Other hazardous materials shall be stored separately. A Class-D fire extinguisher should be available in storage areas only for the use of trained professionals, when sprinkler protected facilities are not available. Temperatures should be limited to 130 ^{o}F. or less. However, air conditioning is not required.

g. Transportation requirements. See para 2-6 packaging, marking and labeling requirements.

(1) BA-5372/U is not regulated under Title 49 CFR, Part 172. 101 HMT, see 49 CFR, Part 173.185(i).

(2) Multi-cell Li-MnO_2 batteries **MUST** be shipped for disposal in accordance with Title 49 CFR, Part 172.101 HMT and 49 CFR, Part 173.185(j).

(a) Packaging: All CECOM procured batteries meet the requirements of 49 CFR, Part 173.1850)(1) (*ie.,* cells contain less than 12.0 grams of Li). They may be shipped for disposal by motor vehicle only. When packaged, batteries **MUST** be protected from external short circuits and packaged in a strong outer packaging.

(b) Marking and labeling: Proper shipping name: Lithium battery, Hazard Class: 9; UNID: UN3090; Packing Group: 11; label in accordance with 49 CM Part 172.446: CLASS 9 label; see figure 4-2.

(3) No Non-rechargeable Lithium cells or batteries may be transported in the cargo holds of passenger aircraft. See Figure 4-3 for Passenger Aircraft Ban Label.

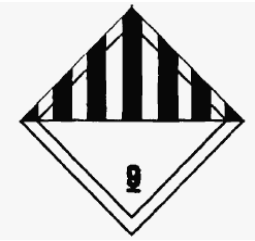

Fig. 4-2 Class 9 Label

Fig. 4-3 Passenger Aircraft Ban Label

h. Disposition and disposal. **DO NOT** accumulate and store waste batteries for disposal for more than 90 days or for more than one year for those areas following the Universal Waste Rule. See para 2-7 for general requirements.

(1) Dispose of discharged Li-MnO_2 batteries as NHSW, in accordance with RCRA regulations. These batteries may be disposed as non-regulated waste in accordance with local regulations.

(2) In states with bioassay requirements, discharged Li-MnO_2 batteries are classified as HW, and disposition/disposal may be through your local servicing DRMO or via local contract.

(3) Li-MnO_2 Batteries without a Complete Discharge Device (CDD).

(a) These batteries do not contain sufficient Lithium to render them reactive or ignitable.

(b) These batteries are classified as NHSW, but must be disposed of in accordance with local regulations.

(4) Li-MnO_2 Batteries with a CDD.

(a) A battery with a CDD can be identified by a removable label over the manual switch which contains, as a minimum:

WARNING

DISCHARGE FOR DISPOSAL
BY DESIGNATED PERSONNEL ONLY

It will also contain pertinent instructions for activating the CDD. Only authorized personnel may activate the battery CDD prior to disposal. Your installation should establish an SOP for Li-SO_2 battery deactivation, disposition, and disposal. In addition, certain batteries have a means of indicating that the CDD has been activated.

WARNING

Multi-cell Li-MnO2 batteries may vent during complete discharge. DO NOT pack batteries with built-in CDD in a box, barrel or drum during discharge. DO NOT pack until cool.

CAUTION

If Li-MnO2 batteries with the built-in CDD, show signs of damage prior to discharge; complete deactivation can not be ensured. If the battery shows evidence of overheating during use (too hot to hold, melted plastic case, vented cell, etc.); complete discharge similarly cannot be ensured. Such Li-MnO2 batteries MUST BE disposed as HW.

(b) For Li-MnO_2 batteries with a CDD,the following procedure **MUST** be followed to eliminate the battery's reactivity to permit disposal as NHSW in accordance with federal regulations. **ONLY** authorized (trained, designated) personnel may activate the battery CDD prior to disposal.

(1) Activation of the Complete Discharge Device (CDD) is to be done by trained designated personnel. These are personnel who are aware of the correct procedures for safely discharging Lithium batteries and have been designated by their supervisor to complete the operation.

(2) Place the batteries to be discharged in a ventilated area that is away from high occupancy areas that can be secured to prevent inadvertent entry.

(3) It is recommended that batteries be marked with the date that the CDD is activated with a grease pencil or marker pen.

(4) Remove the Label covering the CDD and activate the switch for the CDD according to the instructions on the label. The current batteries either have a plastic tab that is pulled out of the battery or a switch below the surface of the case that is depressed with a small screwdriver or ballpoint pen. This latter type of switch should be depressed until a click is heard to indicate that the switch has been closed. Some of the newer batteries contain a LED that lights to indicate successful activation. In this case, verify that the LED does light.

(5) Once the CDD has been activated, place the batteries on the floor or on a shelf separated at least 2 inches on all sides. Allow the batteries to sit for at least 5 days.

(6) After 5 days, providing there is no indication of a venting, the batteries may be packed for disposal according to local procedures. The strong pungent odor of Sulfur dioxide for Lithium-Sulfur Dioxide batteries or a sweet ether-like odor accompanied by leakage of the electrolyte for Lithium-Manganese Dioxide batteries is the indication of a venting.

(7) If any of the batteries do vent, allow the area to clear until the odor is dissipated. Examine the batteries to determine those that have vented. Set the vented batteries aside for disposal as hazardous waste IAW local procedures.

(8) Those batteries that have fully discharged for a minimum of 5 days without venting may be packed as Non-Hazardous Solid Waste once they are cool to the touch. Dispose of the discharged batteries IAW local procedures for non-hazardous waste. Note that local deformation of the battery case that exhibits no indication of leaking or venting may be considered fully discharged providing it is cool to the touch.

(9) It is recommended that the voltage across the terminals be checked on a sampling of the batteries with a simple voltmeter or multi-meter to verify successful discharge. The voltage must be less than 1 volt per cell for the cells in a series string. If the voltage is greater than 1 volt per cell on any of the batteries, recheck the CDD switch and allow the batteries to sit for another 5-day period. If the voltage remains high, dispose of those batteries as Hazardous Waste.

(10) Note that a reading of 0.000 volts indicates an open circuit. An open circuit will prevent the batteries from discharging, and those batteries must be processed as Hazardous waste.

4-7. Lithium-Sulfur Dioxide (Li-SO_2) Batteries

Li-SO_2 batteries are a primary (non-rechargeable) battery. The cell has an anode of Lithium Metal and a liquid cathode of sulfur dioxide (SO_2) with up to 2.8 grams of lithium (Li) per cell. There are two types of batteries presently available, without a Complete Discharge Device (CDD), and with a CDD. The CDD is built into most multi-cell Li-SO_2 batteries produced after January 1989. Batteries with a built-in CDD can be identified by a label over the switch instructing users to activate the switch prior to disposal. Since 1980, CECOM LCMC has only procured "balanced cell" Li-SO_2 batteries. These are cells which are stoiciometrically balanced to completely consume the anode and cathode when fully discharged.

a. Chemical characterization.

(1) Anode: Lithium (Li).
(2) Cathode: Sulfur dioxide (SO_2) that is liquified under pressure. SO_2 gas has a sharp suffocating odor and is a corrosive and poisonous material. It may irritate the eyes, nose, throat, and upper respiratory tract. Personnel can detect SO_2 at 1 part per million (ppm) concentration, and concentrations above 10 ppm are dangerous.
(3) Electrolyte: Organic solvent (acetonitrile (CH_3CN) solution with lithium bromide (LiBr).
(4)There are no capacity test sets available that will accurately indicate the true capacity of the cells or batteries.

WARNING

Li-SO_2 batteries contain pressurized SO_2 gas. The gas has a pungent odor, and is highly toxic. The battery **MUST NOT** be abused in any way which may cause the battery to rupture.

IMMEDIATELY turn off the equipment if battery or battery compartment shows signs of overheating or becomes hot to the touch. Allow the battery to cool (at least 60 minutes) before removing it.

If you hear a hissing sound (battery venting), or smell irritating gas, **IMMEDIATELY** turn off the equipment, and **LEAVE** the area until any smell or signs of leaking gas have been cleared from the area.

b. Type number BA-5XXX/U (except BA-53XX/U).

c. Solid waste characterization.

(1) Under federal RCRA: Li-SO_2 batteries are NHSW, when completely discharged. However, the Acetonitrile content of Li-SO_2 batteries precludes their disposal in RCRA Class D (municipal) Landfills.
(2) Bioassay findings: . Based on testing of multi-cell batteries, USW, when completely discharged.

d. Handling. See para 2-3.

e. Fire control/suppression. See para 2-4.

WARNING

Halon fire extinguishers **SHALL NOT** be used to combat fires involving Li-SO_2 batteries.

(1) If Li-SO_2 batteries are involved in or near fire, the principal concerns are to prevent its spread and minimize cell venting. Flood the burning materials with water. This will cool the batteries, control the combustion of surrounding flammables and reduce the hazards of gaseous SO_2 in case of venting, by removing some of the gas from the air.
(2) $C0_2$ extinguishers will not extinguish burning Li metal, but will extinguish other combustible materials within or near the battery.
(3) Use of an approved Class-D fire extinguisher, such as Lith-X, for Li metal fires, is recommended for use only by professional fire fighters only.

f Storage. See para 2-5. Storage shall be in a dry, well ventilated, facility. Sprinkler protection is desirable if available. A non-combustible building or structure without sprinklers will be the second choice. A combustible storage facility may be used temporarily if neither of the above types are available. Other hazardous materials shall be stored separately. A Class-D fire extinguisher should be available in storage areas only for the use of trained professionals, when sprinkler protected facilities are not available. Temperatures should be limited to 130 ^{o}F. or less. However, air conditioning is not required.

g. Transportation requirements. See para 2-6 for packaging, marking and labeling requirements.

(1) BA-5567/U is not regulated under Title 49 CFR, Part 172. 101 HMr; see 49 CFR, Part 173.185(i).

(2) Multi-cell Li-SO_2 batteries **MUST** be shipped for disposal in accordance with Title 49 CFR, Part 172.101 HMT and 49 CFR, Part 173.185(j).

(a) Packaging: All CECOM procured batteries meet the requirements of 49 CFR, Part 173.1850)(1) (*ie.,* cells contain less than 12.0 grams of Li). They may be shipped for disposal by motor vehicle only. When packaged, batteries **MUST** be protected from external short circuits and packaged in a strong outer packaging.

(b) Marking and labeling: Proper shipping name: Lithium battery, Hazard Class: 9; UNID: UN3090; Packing Group: 11; label in accordance with 49 CM Part 172.446: CLASS 9 label; see figure 4-2.

(3) No Non-rechargeable Lithium cells or batteries may be transported in the cargo holds of passenger aircraft. See Figure 4-3 for Passenger Aircraft Ban Label.

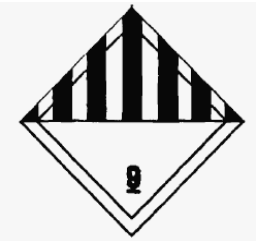

Fig. 4-2 Class 9 Label

Fig. 4-3 Passenger Aircraft Ban Label

h. Disposition and disposal. **DO NOT** accumulate and store waste batteries for disposal for more than 90 days or for more than one year for those areas following the Universal Waste Rule.. See para 2-7.

(1) Dispose of discharged Li-SO_2 batteries as USW, in accordance with RCRA regulations, providing they are completely discharged. However, they may not be disposed of in a RCRA Class D (municipal) landfill because of the Acetonitrile content. These batteries must be disposed in accordance with local regulations.

(2) These batteries are classified as NHSW in states which utilize bioassay to characterize solid wastes.

(3) Li-SO_2 Batteries without a Complete Discharge Device (CDD).

(a) Depleted batteries which have **NOT** been completely discharged with a CDD (except the BA-5567/U), and damaged or unservicable multi-cell Li-SO_2 batteries must be disposed as regulated waste. They may be disposed through you local servicing DRMO or via local contract. The EPA HW# are D001 for ignitable and D003 for Reactive. The user **MUST** certify on the DTID (DD Form 1348-1) that the batteries are "balanced cell batteries." See para 4-7 a.

(b) These batteries are classified as NHSW in states that utilize bioassay to characterize solid wastes. However, they MUST be disposed as HW, because the battery's reactivity exceeds regulatory limits.

(4) Li-SO_2 Batteries with a CDD.

(a) A battery with a CDD can be identified by a removable label over the manual switch which contains, as a minimum:

WARNING

DISCHARGE FOR DISPOSAL
BY DESIGNATED PERSONNEL ONLY

It will also contain pertinent instructions for activating the CDD. Only authorized personnel may activate the battery CDD prior to disposal. Your installation should establish an SOP for Li-SO_2 battery deactivation, disposition, and disposal. In addition, certain batteries have a means of indicating that the CDD has been activated.

WARNING

Multi-cell Li-SO2 batteries may vent during complete discharge. DO NOT pack batteries with built-in CDD in a box, barrel or drum during discharge. DO NOT pack until cool.

CAUTION

If Li-SO2 batteries with the built-in CDD, show signs of damage prior to discharge; complete deactivation can not be ensured. If the battery shows evidence of overheating during use (too hot to hold, melted plastic case, vented cell, etc.); complete discharge similarly cannot be ensured. Such Li-SO2 batteries MUST BE disposed as HW.

If you hear a hissing sound (battery venting), or smell irritating gas, **LEAVE THE AREA IMMEDIATELY** until any smell or signs of leaking gas have been cleared from the area.

CAUTION

Li-SO2 batteries will get warm/hot during discharge with a built-in CDD, and the battery jacket may deform. This does not constitute a failure of the discharge process. A battery venting as evidenced by a strong pungent odor will constitute failure and will require disposal as HW. If the vented battery cannot be identified and isolated in a group of batteries. All of them must be disposed of as HW.

(b) For Li-SO_2 batteries with a CDD,the following procedure **MUST** be followed to eliminate the battery's reactivity to permit disposal as NHSW in accordance with federal regulations. **ONLY** authorized (trained, designated) personnel may activate the battery CDD prior to disposal.

(1) Activation of the Complete Discharge Device (CDD) is to be done by trained designated personnel. These are personnel who are aware of the correct procedures for safely discharging Lithium batteries and have been designated by their supervisor to complete the operation.

(2) Place the batteries to be discharged in a ventilated area that is away from high occupancy areas that can be secured to prevent inadvertent entry.

(3) It is recommended that batteries be marked with the date that the CDD is activated with a grease pencil or marker pen.

(4) Remove the Label covering the CDD and activate the switch for the CDD according to the instructions on the label. The current batteries either have a plastic tab that is pulled out of the battery or a switch below the surface of the case that is depressed with a small screwdriver or ballpoint pen. This latter type of switch should be depressed until a click is heard to indicate that the switch has been closed. Some of the newer batteries contain a LED that lights to indicate successful activation. In this case, verify that the LED does light.

(5) Once the CDD has been activated, place the batteries on the floor or on a shelf separated at least 2 inches on all sides. Allow the batteries to sit for at least 5 days.

(6) After 5 days, providing there is no indication of a venting, the batteries may be packed for disposal according to local procedures. The strong pungent odor of Sulfur dioxide for Lithium-Sulfur Dioxide batteries or a sweet ether-like odor accompanied by leakage of the electrolyte for Lithium-Manganese Dioxide batteries is the indication of a venting.

(7) If any of the batteries do vent, allow the area to clear until the odor is dissipated. Examine the batteries to determine those that have vented. Set the vented batteries aside for disposal as hazardous waste IAW local procedures.

(8) Those batteries that have fully discharged for a minimum of 5 days without venting may be packed as Non-Hazardous Solid Waste once they are cool to the touch. Dispose of the discharged batteries IAW local procedures for non-hazardous waste. Note that local deformation of the battery case that exhibits no indication of leaking or venting may be considered fully discharged providing it is cool to the touch.

(9) It is recommended that the voltage across the terminals be checked on a sampling of the batteries with a simple voltmeter or multi-meter to verify successful discharge. The voltage must be less than 1 volt per cell for the cells in a series string. If the voltage is greater than 1 volt per cell on any of the batteries, recheck the CDD switch and allow the batteries to sit for another 5-day period. If the voltage remains high, dispose of those batteries as Hazardous Waste.

(10) Note that a reading of 0.000 volts indicates an open circuit. An open circuit will prevent the batteries from discharging, and those batteries must be processed as Hazardous waste.

4-8. Lithium-Thionyl Chloride (Li-$SOCl_2$) Batteries

Lithium-Thionyl Chloride (Li-$SOCl_2$) batteries are primary (non-rechargeable) batteries. The cell has a liquid cathode of $SOCl_2$. The only $SOCl_2$ currently in the US Army inventory is the "AA" size, single cell, 3.6 V. Battery. Other services may have larger batteries in use, specific information on these batteries should be obtained directly from that branch of service.

a. *Chemical characterization.*

(1) Anode: Lithium (Li).
(2) Cathode: Thionyl chloride ($SOCl_2$).
(3) Electrolyte: Non-aqueous thionyl chloride ($SOCl_2$) solution containing Lithium Aluminum chloride ($LiAlCl_4$) salt.

WARNING

Li-$SOCl_2$ batteries contain liquid $SOCl_2$ which fumes upon exposure to air. The vapor is highly toxic, and the battery **MUST NOT** be abused in any way which may cause the battery to rupture.

IMMEDIATELY turn off the equipment if the battery or battery compartment shows signs of overheating or becomes hot to the touch. Allow the battery to cool (at least 60 minutes) before removing it.

If you hear a hissing sound (battery venting), or smell irritating vapor, **IMMEDIATELY** Turn Off the equipment, and **LEAVE** the area until any smell or signs of leaking gas have been cleared from the area.

(4) $SOCl_2$ vapor has a sharp suffocating odor and is a corrosive and poisonous material. It may irritate the eyes, nose, throat, and upper respiratory tract. Personnel can detect $SOCl_2$ at 1 part per million (ppm) concentration, and concentrations above 10 ppm are dangerous.

(5) **NEVER** test batteries Li-$SOCl_2$ for capacity with a conventional test set.

b. Type number: BA-6000 series except for "AA" size which typically use a commercial part number.

c. Solid waste characterization.

(1) Under federal RCRA: HW with an EPA HW# of DOO1 for ignitable, D003 for reactive and D007 for chromium.

(2) Bioassay findings: HW in states which utilize bioassay characterization for HW identification. Presently AK, CA, MN, RI and WA utilize this criteria.

d Handling. See para 2-3.

e. Fire control/suppression. See para 2-4. A Li-$SOCl_2$ battery does not catch fire easily. Typically, lithium (Li) metal is less than two percent of total battery weight. A battery heated in a fire will probably vent toxic and corrosive $SOCl_2$ vapors.

WARNING

Halon fire extinguishers **SHALL NOT** be used to combat fires involving Li-$SOCl_2$ batteries.

(1) In the event that Li-$SOCl_2$ batteries are involved in or near a fire, the principal concerns are to prevent its spread and minimize cell venting. Flood the burning materials with water. This will cool the batteries, control the combustion of surrounding flammables, and reduce the hazards of gaseous $SOCl_2$ in case of venting, by removing some of the vapor from the air.

(2) CO_2 extinguishers will not extinguish burning Li metal, but will extinguish other combustible materials within or near the battery.

(3) Use of an approved Class-D fire extinguisher, such as Lith-X, for Li metal fires, is recommended for use only by trained professionals.

f. Storage. See para 2-5. Storage shall be in a sprinkler protected facility, if available. A noncombustible building or structure without sprinklers will be the second choice. A combustible storage facility may be used temporarily if neither of the above types are available at the time storage is required. Other hazardous materials shall be appropriately segregated from the batteries. A class-D fire extinguisher should be available in storage areas, when sprinkler protected facilities are not available for the use of trained firefighting prsofessionals only.

g. Transportation requirements. See para 2-6 for packaging, marking and labeling requirements.

(1) Packaging: CECOM procured batteries meet the requirements of 49 CM Part 173.1850)(1) *(ie.,* cells contain less than 12.0 grams of Li). They may be shipped for disposal by motor vehicle only. When packaged, batteries MUST be protected from external short circuits, and packaged in a strong outer packaging.

(2) Marking and labeling: Proper shipping name: Lithium Thionyl Chloride battery; Hazard Class: 9; UNID: UN3077; Packing Group: 11; label in accordance with 49 CFR, Part 172.446: CLASS 9 label; see Figure 4-2. However, they may be shipped for disposal as HW:

"Waste, environmentally hazardous substances, n.o.s.,
UN3077,
Lithium Thionyl Chloride Battery."

h.Disposition and disposaL: DO NOT accumulate and store waste batteries for disposal for more than 90 days or for more than one year for those areas following the Universal Waste Rule. See para 2-7 for general requirements. All depleted Li-$SOCl_2$ may be disposed through the local servicing DRMO or via local contract.

(a) These batteries may be disposed as HW through your local servicing DRM0 or via local contract with EPA HW#'s of D001 for ignitable, D003 for reactive and D007 for chromium.
(b) In states with bioassay requirements, Li-$SOCl_2$ batteries are classified as HW for disposal.

4-9. Magnesium (MG) Batteries

A MG battery is a multi-cell primary (non-rechargeable) battery. The cell has a solid cathode of manganese dioxide (MnO_2). CECOM LCMC presently manages only the BA-4386/U and BA-4840/U batteries.

a. Chemical characterization.

(1) Anode: Magnesium (Mg).
(2) Cathode: Manganese dioxide ($Mn0_2$).
(3) Electrolyte: Aqueous solution of magnesium bromide ($MgBr_2$) or magnesium perchlorate ($MgClO_4$).

b. Type number: BA-4000 series.

c. Solid waste characterization.

(1) Under federal RCRA:

(a) Partially discharged MG batteries which have greater than 50% remaining charge are HW with an EPA HW# of D007 for Chromium.
(b) MG batteries with 50% or less remaining charge are NHSW. The disposing activity must test MG batteries as described below to ensure that they are properly discharged prior to declaration as NHSW.
(c) Test BA-4386/U MG batteries using Battery Test Set AN/PSM-13 with adaptor U-410/PSM-13 in accordance with TM 11-6625-823-15. Batteries with less than 8 hours of useful life remaining may be disposed as NHSW.
(d) BA-4840/U MG battery cannot be tested. Dispose as HW with an EPA HW# of D007 for Chromium.

(2) Bioassay findings: NHSW in states which utilize bioassay characterization criteria for HW identification, unless they exceed the regulatory limit for chromium *(i.e.* eight hours or more of remaining useful-life).

d. Handling. See para. 2-3.

e. Fire control/suppression. A CO_2 fire extinguisher is recommended. See para 2-4.

f. Storage. See para 2-5.

g. Transportation requirements. See para 2-6 for packaging, marking and labeling requirements. Not regulated under Title 49 CFR, Part 172.101 HMT.

CAUTION

Depleted batteries may continue to vent hydrogen gas after use, and if stored at high temperatures above 130 ^{o}F. Avoid sparks or other sources of ignition.

(1) **DO NOT** seal batteries in gas tight plastic bag(s), drum(s), or any non-vented container.
(2) When over-packing damaged batteries, double packaging and absorbent packaging materials should be relied upon for containment.

h. Disposition and disposal. DO NOT accumulate and store waste batteries for disposal for more than 90 days. See para 2-7.

(1) Dispose of MG batteries with less than eight hours of useful-life remaining as NHSW in accordance with RCRA regulations. The batteries must be tested and certified by the disposing activity to have less than 8 hours of useful life remaining; see c (1) (c) above. These batteries may be disposed as non regulated waste in accordance with local regulations..
(2) Partially discharged MG batteries may be disposed as HW through your local servicing DRMO or via local contract with an EPA HW# of D007 for chromium.
(3) Under state bioassay requirements, MG batteries are classified as NHSW. However, they MUST be disposed as HW through your local servicing DRMO, of via local contract, if the battery's chromium content exceeds the regulatory limit *(ie.,* eight hours or more of remaining useful life).

4-10. Mercury (Hg) Batteries

Hg batteries are primary (non-rechargeable) batteries. These batteries have one or more cells depending on configuration. These batteries are no longer procurred and are being replaced with other chemistries, generally Li-MnO_2, because of the toxic nature of Mercury.

a. Chemical characterization.

(1) Anode: Zinc (Zn).
(2) Cathode: Mercuric oxide (HgO).
(3) Electrolyte: Aqueous solution of potassium hydroxide (KOH) or sodium hydroxide (NaOH).
(4) The cell has a solid cathode of mercuric oxide (HgO) and contains 20 to 50 percent mercury (Hg) and HgO by weight.The battery cell contains caustic KOH or NaOH electrolyte, which may leak if the battery is abused. Chemically, KOH and NaOH are strong alkalies. Serious chemical bums can result if the electrolyte comes into contact with skin or eyes. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.
(5) Hg and Hg salts are toxic and hazardous materials for disposal.

b. Type number BA-1000 series.

c. Solid waste characterization.

(1) Under federal RCRA: HW with an EPA HW# of D009 for mercury (Hg).
(2) Bioassay findings: Not tested. Presumed to be toxic based on Hg content.

d. Handling. See para 2-3.

e. Fire control/suppression. A CO_2 fire extinguisher is recommended. See para 2-4.

f Storage. See para 2-5.

g. Transportation requirements. See para 2-6 for packaging, marking and labeling requirements. Not regulated under Title 49 CFR, Part 172.101 HMT.

CAUTION

Depleted batteries may continue to vent hydrogen gas after use, and if stored at high temperatures above 130 ^{o}F. Avoid sparks or other sources of ignition.

(1) **DO NOT** seal batteries in gas tight plastic bag(s), drum(s), or any non-vented container.
(2) When over-packing damaged batteries, double packaging and absorbent packaging materials should be relied upon for containment.

h. Disposition and Disposal. **DO NOT** accumulate and store waste batteries for disposal for more than 90 days. Recycling is recommended. See para 2-7.

(1) Hg batteries may be disposed through your local servicing DRMO or via local contract with an EPA HW# of D009 for Hg.
(2) In states with bioassay requirements, based on Hg content, these batteries are HW, and disposition/disposal may be through your servicing DRMO or via local contract.

4-11. Nickel-Cadmium (Ni-Cd) Batteries

Ni-Cd batteries are secondary (rechargeable) batteries. There are two kinds of Ni-Cd batteries: sealed batteries without vent-filler caps, and vented batteries with vent-filler caps in order to service the battery.

a. Chemical characterization.

(1) Anode: Cadmium (Cd).
(2) Cathode: Nickel oxyhydroxide (NiOOH).
(3) Electrolyte: Aqueous solution of potassium hydroxide (KOH).

WARNING

DO NOT try to neutralize caustic electrolyte with vinegar or any other acidic solutions if it gets on your skin. Neutralization will do more harm than good, as it will trap caustic under the skin, preventing it from coming out. Flush with copious amounts of water. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.

(4) The battery cell typically contains 13 to 15 percent Cd, and 20 to 30 percent nickel by weight. The battery cell typically contains a caustic electrolyte solution composed of 31 % KOH by weight. Chemically, KOH is a strong alkali similar to caustic soda. Serious chemical burns can result if this electrolyte comes into contact with the skin or eyes. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.
(5) Cd and Cd salts are toxic and hazardous materials. It is recommended that Ni-Cd batteries be turned in wet. If you must drain the battery, the KOH electrolyte **MUST** be tested for Cd prior to disposal. If Cd is below the RCRA regulatory limit (1.0 mg/L), then the electrolyte may be disposed in accordance with TG No. 126 with the concurrence of the EEO and the affected waste water treatment authority.

b.Type number. BB-XXX.

c. Solid waste characterization.

(1) Under federal RCRA: HW with an EPA HW # of D006 for Cd.
(2) Bioassay findings: Not tested. Presumed to be toxic based on Cd and nickel (Ni) content.

d Handling . See para 2-3.

(1) **DO NOT** attempt to drain electrolyte from sealed secondary batteries.
(2) **DO NOT** drain electrolyte from vented secondary batteries unless authorized.
(3) If battery contents or electrolyte are spilled and come in contact with the skin, **IMMEDIATELY** flush the affected area for at least 15 minutes with clean **WATER** and seek medical attention promptly.

e. Fire control/suppression. A CO_2 fire extinguisher is recommended. See para 2-4.

f. Storage. See para 2-5.

(1) Given reasonable protection, vented Ni-Cd batteries should not freeze. Avoid temperatures of less than –40 ^{O}F. or greater than 130 ^{o}F.

(2) If KOH electrolyte spills or leaks, **DO NOT** touch spilled material. Stop leak if you can do it without risk. Take up with sand, or other noncombustible material, then flush area with water. Notify the local SO and IEO.

g. Transportation requirements. See para 2-6 for packaging, marking and labeling requirements. In accordance with Title 49 CFR, Part 172. 101 HMT, Hazard Class 8, and 49 CFR. Part 173.159.

(1) Packaging for vented Ni-Cd batteries with vent-filler caps:

(a) Vented Ni-Cd batteries, and the cells contained therein, should be fully discharged, prior to shipment, with Equalization Discharge Fixture, NSN 6110-00-014-6225, in accordance with procedures in the battery TM.

(b) Must be protected against short circuits.

(c) Batteries may be either packaged in boxes or secured to pallets. Drum(s) are **NOT** approved.

(d) Requirements for packaging batteries in boxes

1. All batteries, vent-filler caps and terminals of batteries **MUST** be protected against physical damage and short circuiting.
2. The vent/filler caps of vented battery cells should be taped in place, and the vent holes sealed with the same tape.
3. In order to protect packaging, place battery(ies) in a plastic bag to control any residue or battery electrolyte leakage, and seal the bag(s) with a nonmetallic closure such as tape.
4. Place bagged batteries in a DOT Specification 4C1, 4C2, 4D or 4F wooden, or 4G fiberboard box(es). **DO NOT** overfill boxes. Batteries should fit snugly in the boxes. An inside top clearance of at least 1/2 inch above the battery terminals and/or vent/filler caps must be provided, with reinforcement to prevent them from being crushed. Any empty spaces inside the boxes should be filled with suitable absorbent, non-combustible packing materials.

(e) Requirements for palletizing batteries:

1. Batteries which are placed on pallets must be securely fastened by non-metallic strapping.
2. Height of the palletized unit (batteries, strapping, and pallet) must not exceed 11/2 times the width of the pallet, and may not contain less than one complete layer or more than two layers of batteries per unit.
3. The completed unit must be able to support twice its own weight without damage to the batteries, pallet or strapping.
4. Battery terminals must not be relied upon to support any weight from batteries or units stacked above them.
5. Package and stack vented batteries in an upright position. DO NOT stack batteries on their sides, in order to prevent unintentional draining.
6. If the palletized batteries cannot be protected from exposure to the weather (rain, snow, etc.), the unit must be protected with plastic sheeting. Refer to SB 38-100.

(2) In accordance with Title 49 CFR, Part 173.159(d), packaging for sealed Ni-Cd batteries without vent-filler caps are exempt from requirements provided they meet the test requirements of this para, protected against short circuits and securely packaged.

(3) Marking and labeling: See para 2-6 b.

(a) For vented Ni-Cd batteries **with vent-fi1ler caps:** proper shipping name: Battery, wet, filled with alkali; Hazard Class: 8; UNID: UN2795; Packing Group: III; label in accordance with 49 CFR, Part 172.442: CORROSIVE label; see figure 4-1.

(b) For sealed Ni-Cd batteries **without vent-filler caps**: proper shipping name: Battery, wet, non-spillable; Hazard Class: 8; UNID: UN2800; Packing Group: III; label in accordance with Title 40 CFR, Part 172.442: CORROSIVE label; see figure 4-1.

h. Disposition and disposal. **DO NOT** accumulate and store waste batteries for disposal for more than 90 days. Recycling is recommended. See para 2-7.

(1) Ni-Cd batteries may be disposed as HW through your local servicing DRMO, or via local contract, with an EPA HW# of D006 for Cd.

(2) In states with bioassay requirements, based on cadmium and nickel content, these batteries should be considered HW, and disposition may be through your local servicing DRMO or via local contract.

4-12. Nickel-Metal Hydride (Ni-MH) Batteries

Ni-MH batteries are secondary (rechargeable) batteries. They are similar to Ni-Cd cells except that the toxic Cadmium is replaced with a more environmentally friendly Metal Hydride. Ni-MH cells are sealed to prevent leakage.

a. Chemical characterization.

(1) Anode: Metal Hydrides (typically Cobalt and Rare earths)
(2) Cathode: Nickel oxyhydroxide (NiOOH).
(3) Electrolyte: Aqueous solution of potassium hydroxide (KOH).

WARNING

DO NOT try to neutralize caustic electrolyte with vinegar or any other acidic solutions if it gets on the skin. Neutralization will do more harm than good, as it will trap caustic under the skin, preventing it from coming out. Flush with copious amounts of water.

b.Type number. BB-3XX.

c. Solid waste characterization.

(1) Under federal RCRA: NHSW.
(2) Bioassay findings: HW in states which utilize bioassay characterization criteria for HW identification. Disposition should be through your local servicing DRMO or via local contract. Presently AK, CA, MN, RI and WA utilize this criteria. Batteries for disposal should not be accumulated for more than 90 days.

d Handling. See para 2-3.

e. Fire control/suppression. A CO_2 fire extinguisher is recommended. See para 2-4.

f. Storage. See para 2-5.

g. Transportation requirements. See para 2-6 for packaging, marking and labeling requirements. In accordance with Title 49 CFR, Part 172. 101 HMT, Hazard Class 8, and 49 CFR. Part 173.159.

h. Disposition and disposal.

DO NOT accumulate and store waste batteries for disposal for more than 90 days. Recycling is recommended. See para 2-7.
(1) Ni-MH batteries may be disposed as NHSW through your local servicing DRMO, or via local contract, in accordance with local regulations. These batteries should be considered as candidates for recycling.
(2) In states with bioassay requirements these batteries are HW, and disposition may be through your local servicing DRMO or via local contract.

4-13. Silver (Ag) Batteries

a. Primary (non-rechargeable) batteries containing silver (Ag).

(1) Chemical characterization.
(a) BA-245/U and BA-2245/U:

1. Anode: Zinc (Zn).
2. Cathode: Silver chloride (AgCl).
3. Electrolyte: Aqueous solution of lithium chloride (LiCI) or zinc chloride (ZnCI2) and zinc sulfate (ZnSO4).
4. BA-245/U and BA-2245/U have sealed cells containing a mild acid which may leak if the battery is abused. A typical cell contains 20 to 30 percent AgCl by weight. Serious chemical bums can result if this electrolyte comes into contact with the skin or eyes. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.
5. Ag and Ag salts are toxic and hazardous materials for disposal.

(b) BA-472()AJ, BA-485/U, and BA-48601U:

1. Anode: Zinc (Zn).
2. Cathode: Silver oxide (Ag_2O).
3. Electrolyte: Aqueous solution of potassium hydroxide (KOH).

WARNING

DO NOT try to neutralize caustic electrolyte with vinegar or any other acidic solutions if it comes in contact with the skin. Neutralization will do more harm than good, as it will trap caustic under the skin, preventing it from coming out. Flush with copious amounts of water. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.

4. BA-472( )/U, BA-485/U and BA-486( )/U have sealed cells containing caustic KOH electrolyte and may leak if the battery is abused. Chemically, KOH is a strong alkali. Serious chemical burns can result if the electrolyte comes in contact with skin or eyes. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.

5. Ag and Ag oxides are toxic and hazardous materials for disposal,

(2) Type Number: BA-245/U, BA-472( )/U, BA-485/U, BA-486( )/U, and BA-2245/U.

(3) Solid waste characterization.

(a) Under federal RCRA: HW with EPA HW# s D009 for mercury (Hg) and D011 for silver (Ag).
(b) Bioassay findings: Not tested. Presumed to be toxic based on Ag content.

(4) Handling: See Para 2-3.

(5) Fire control/suppression: A CO_2 fire extinguisher is recommended. See Para 2-4.

(6) Storage: See Para 2-5.

(7) Transportation requirements: See Para 2-6 for packaging, marking and labeling requirements. Not regulated under Title 49 CFR, Part 172.101 HMT.

(8) Disposition and Disposal: DO NOT accumulate and store waste batteries for disposal for more than 90 days. Recycling is recommended. See Para 2-7.

(a) Ag batteries may be disposed through your local servicing DRMO, or via local contract, with an EPA HW# of DOI I for AS.

(b) In states with bioassay requirements, based on Ag content. these batteries are HW, and disposition/disposal may be through your servicing DRMO or via local contract.

b. Secondary (rechargeable) batteries containing Ag (BB-622B/U):

(1) Chemical characterization:

(a) Anode: Zinc (Zn).
(b) Cathode: Silver oxide (Ag2O).
(c) Electrolyte: Aqueous solution of potassium hydroxide (KOH).

WARNING

DO NOT try to neutralize caustic electrolyte with vinegar or any other acidic solutions if it comes in contact with the skin. Neutralization will do more harm than good, as it will trap caustic under the skin, preventing it from coming out. Flush with copious amounts of water. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.

(d) A battery cell typically contains 20 to 30 percent Ag_2O by weight. The battery cell typically contains a caustic electrolyte solution. Chemically, KOH is a strong alkali similar to caustic soda. Serious chemical burns can result if this electrolyte comes into contact with the skin or eyes. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.

(e) Ag and Ag oxides are toxic and hazardous materials for disposal. It is recommended to turn in AG batteries wet. If you must drain the battery, the KOH electrolyte MUST be tested for Ag prior to disposal. If Ag is below the RCRA regulatory limit (5.0

mg/L), then the electrolyte may be disposed in accordance with TG No. 126 with the concurrence of the IEO and the affected waste water treatment authority.

(2) Type number BB-622B/U.

(3) Solid waste characterization.

(a) Under federal RCRA: HW with an EPA HW#'s D009 for mercury (Hg) and DOI I for Ag.
(b) Bioassay findings: Not tested. Presumed to be toxic based on Ag content.

(4) Handling: See Para 2-3.

(a) DO NOT drain electrolyte from vented secondary batteries unless authorized.
(b) If battery contents or electrolyte are spilled and come in contact with the skin, **IMMEDIATELY** flush the affected area for at least 15 minutes with clean WATER and seek medical attention promptly.

(5) Fire control/suppression: A CO_2 fire extinguisher is recommended. See Para 2-4.

(6) Storage: See para 2-5.

(a) Given reasonable protection, vented Ag batteries should not freeze. Avoid temperatures of less than minus 40 ^{o}F. or greater than 130 ^{o}F.
(b) If KOH electrolyte spills or leaks, DO NOT touch the spilled material. Stop the leak if you can do it without risk. Take up with sand, or other noncombustible material, then flush area with water. Notify the local SO and IEO.

(7) Transportation requirements: See para 2-6 for packaging, marking and labeling requirements. In accordance with Title 49 CFR, Part 172. 101 HMT, Hazard Class 8, and 49 CFR, Part 173.159.

(a) Packaging for vented AG batteries with vent-filler caps.

1. Batteries must be protected against short circuits.
2. Batteries may be either packaged in boxes or secured to pallets. Drum(s) are **NOT** approved.
3. Requirements for packaging batteries in boxes.

a. All batteries, vent-filler caps and terminals of batteries MUST be protected against physical damage and short circuiting.
b. The vent-filler caps of vented battery cells must be taped in place, and the vent holes sealed with the same tape.
c. In order to protect packaging. place battery(ies) in a plastic bag to control any residue or battery electrolyte leakage, and seal the bag(s) with a nonmetallic closure such as tape.
d. Place bagged batteries in a DOT Specification 4C 1, 4C2,41) or 4F wooden, or 4G fiberboard box(es). DO NOT overfill boxes. Batteries should fit snugly in the boxes. An inside top clearance of at least 1/2 inch above the battery terminals and/or vent/filler caps must be provided, with reinforcement to prevent them from being crushed. Any empty spaces inside the boxes should be filled with suitable absorbent, non-combustible packing materials.

4. Requirements for palletizing batteries:

a. Batteries which are placed on pallets must be securely fastened by non-metallic strapping.
b. Height of the palletized unit (including batteries, strapping and pallet) must not exceed 11/2 times the width of the pallet and may not contain less than one complete layer or more than two layers of batteries per unit.
c. The completed unit must be able to support twice its own weight without damage to the batteries, pallet or strapping.
d. Battery terminals must not be relied upon to support any weight from batteries or units stacked above them.
e. Package and stack vented batteries in an upright position. DO NOT stack batteries on their sides, in order to prevent unintentional draining.

5. If the palletized batteries cannot be protected from exposure to the weather (rain, snow, etc.), the unit must be protected with plastic sheeting. Refer to SB 38-100.

(b) Marking and labeling: For vented AG batteries with vent-filler caps: proper shipping name: Battery, wet, filled with alkali; Hazard Class: 8; UNID: UN2795; Packing Group: III; label in accordance with 49 CFR, Part 172.442: CORROSIVE label; see figure 4-1.

(8) Disposition and disposal: DO NOT accumulate and store waste batteries for disposal for more than 90 days. Recycling is recommended. See para. 2-7.

(a) AG batteries may be disposed as HW through your local servicing DRMO, or via local contract, with an EPA HW# of D011 for Ag.

(b) In states with bioassay requirements, based on silver content, these batteries are HW, and disposition may be through your local servicing DRMO or via local contract.

4-14. Thermal (THR) Batteries

WARNING

When activated, THR battery temperatures can exceed 500 ^{o}F. This is a severe skin burn hazard.

THR batteries are primary (non-rechargeable) batteries. The battery contains an inorganic salt electrolyte that is a nonconductive solid at ambient temperatures, and a pyrotechnic mixture sufficient to melt the electrolyte. The battery is activated by an electrical squib or mechanical striker which activates a primer, which in turn ignites the pyrotechnic and melts the salt electrolyte.

a. Chemical characterization.

(1) Anode: Calcium. (Ca).
(2) Cathode: Calcium chromate ($CaCrO_4$).
(3) Electrolyte: Solid lithium chloride (LiCI) and potassium. chloride (KCI).

b. Type number

(1) BA-605/U, mechanical.
(2) BA-617/U, mechanical.
(3) BA-618/U, (data unavailable).
(4) BA-630/U, electrical.

c. Solid waste characterizatiom

(1) Under federal RCRA: HW with an EPA HW# D007 for Chromium.
(2) Bioassay findings: Not tested. Presumed to be toxic based on chromium content.
(3) NOTE on turn-in documentation that these batteries may contain ASBESTOS.

d Handling. See para 2-3.

e. Fire control/suppression.

WARNING

Halon fire extinguishers SHALL NOT be used to combat fires involving THR batteries.

A CO_2 fire extinguisher is recommended. See para 2-4.

f. Storage. See para 2-5.

g. Transportation requirements.

See para 2-6 for packaging, marking and labeling requirements. Not regulated under Title 49 CFR, Para. 172.101 HMT. THR batteries MUST be deactivated prior to shipping for disposal. See Appendix F for deactivation of THR batteries.

h. Disposition and Disposal.

DO NOT accumulate and store waste batteries for disposal for more than 90 days. See para 2-7. THR batteries MUST be deactivated prior to disposition and disposal.

(1) Dispose THR batteries as HW in accordance with RCRA regulations. Disposition may be through the local servicing DRMO, or via local contract, with an EPA HW# of D007 for chromium.

(2) THR batteries have not been tested under bioassay requirements. Disposition may be through the local servicing DRMO, or via local contract, due to chromium content.

4-15. Zinc-Air (Zn-Air) Batteries

Zinc-Air batteries are primary (non-rechargeable) batteries that are very similar to the non-mercury containing alkaline batteries.

a. Chemical characterization.

(1) Anode: Zinc (Zn).

(2) Cathode: Ambient air

(3) Electrolyte: Gelled aqueous solution of potassium hydroxide (KOH).

(4) The battery cell contains caustic KOH electrolyte, which may leak if the battery is abused. KOH is a strong alkali similar to caustic soda (sodium hydroxide (NaOH)). Serious chemical burns can result if electrolyte comes into contact with the skin or eyes. If the battery electrolyte gets into your eyes, it can cause severe damage and/or blindness.

b. Type number BA-XXX series.

c. Solid waste characterization.

(1) Under federal RCRA: Non-hazardous solid waste (NHSW).

(2) Bioassay findings: Hazardous waste (HW) in states which utilize bioassay characterization criteria for HW identification. Presently AK, CA, MN, RI and WA utilize this criteria.

d Handling. See para 2-3.

e. Fire controt1suppression. A carbon dioxide (CO_2) fire extinguisher is recommended. See para 2-4.

f. Storage. See para 2-5.

g. Transportation requirements. See para 2-6 for packaging, marking and labeling requirements. Not regulated under Title 49 CFR, Part 172.101 Hazardous Materials Table (HMT)

h. Disposition and disposal. DO NOT accumulate and store waste batteries for disposal for more than 90 days. See para 2-7.

(1) Dispose of ALK batteries as NHSW in accordance with RCRA regulations.

(2) In states with bioassay requirements, ALK batteries are classified as HW, and disposal may be through your local servicing Defense Reutilization and Marketing Office (DRMO), or via local contract.

APPENDIX A References

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A-2. Publication Sources

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b. For A-1 d: US Department of Transportation Office of Hazardous Ma=W Transportation/DIHM 51 Research and Special Programs Administration 400 7th Street, SW Washington, DC 20590 Telephone: Commercial (202) 366-2301

c. For A-1 e:
GSA Centralized Mailing Lists Services
P * 0. Box 17077
819 Taylor Street
Fort Worth, TX 761024M7
Telephone: DSN 739-7369 or Commercial (817) 334-5212

d For A-1 h through j: US Army Publications Distribution Center, St. Louis 1655 Woodson Road St. Louis, MO 63114 Telephone: DSN 693-7305 or Commercial (314) 263-7305.

e. For A-1 t and u: Superintendent of Documents US Government Printing Office Washington, DC 20402 Telephone: Commercial (202) 783-3238

f. For A-I v: Commander, US Army Center for Health Promotion and
Waste Management
ATTN: MCHB-DE-HM
Aberdeen Proving Ground, MD 21010-5422
Telephone: DSN 584-3651 or Commercial (410) 671-3651

g. For A-I *aa* through A-1 ab: American National Standards Institute Sales Department 1430 Broadway New York, NY 10018 Telephone: Commercial (212) 642-4900

h. For 4c, ad, af, ap and aq: National Technical Information Service 5285 Port Royal Rd. Springfield, VA 22161 Telephone: Commercial 1-800-553-9847 or (703) 497-4650

i. For ar:.
Contact CECOM LAR or CECOM Safety Office
(See para 1-7.)

APPENDIX B Explanation of Terms

Section I. GLOSSARY

B-1. Purpose

To explain and define terms as used in the context of this technical bulletin.

B-2. Definitions

a. Balanced Cell. A battery cell so designed, that during discharge, its reactive constituents (anode and cathode) are depleted in a quantitatively even manner.

b. Battery. A portable power supply unit made up of one or more cells with all necessary connectors, fusing, wiring, and jacket to provide power to an end article application.

c. Bioassay. Chemically independent test used by some states to characterize solid waste as hazardous waste.

d. Cell. The smallest power producing unit of a battery.

e. Con.forming Storage. Storage which meets acceptable standards for the m-aterial being stored. Your local servicing Defense Reutilization and Marketing Office (DRMO) may take accountability, but not physical custody unless they can provide adequate and safe storage.

f. Consignee. The person or activity receiving a shipment of hazardous material (batteries) for disposition and disposal, *e.g.,* the local DRMO.

g. Consignor The person or activity shipping the material (batteries) to the local DRMO, for disposition and disposal.

h. Damaged. A cell or battery which is broken, bulged, cracked. split, etc., to the degree that one or more cells or the case have lost physical integrity and the cell contents may leak, or have leaked out.

i. Defective. Any battery, other than depleted, which will not operate its assigned equipment, provided the equipment is not responsible for this lack of operation.

j. Depleted Any battery which has been used to the end of its duty cycle *(i.e.,* to its cut-off or end of life voltage).

k Disposal. Burying, crushing, destroying, burning, incinerating, recycling, or discarding into the general refuse/trash (where permitted to do so).

l. Disposition. T'he transfer of unserviceable battery(ies) or electrolyte to the local servicing DRMO for disposal. The DRMO has the option to recycle this transferred material.

m. Dry Cell. A cell in which the electrolyte is not free flowing.

n. Duty Cycle Discharge. A battery discharged to the point where it will no longer operate its intended equipment.

o. Electrolyte. 'Me electrically conductive fluid or paste contents of a cell.

p. EPA Hazardous Waste Number A number assigned to a particular hazardous waste under Resource Conservation and Recovery Act regulations.

q. Hazardous Material. A substance or material containing a substance, which has been determined by the Secretary of Transportation to be capable of health, safety, and/or hazardous property when transported in commerce, and which has been so designated.

r. Hazardous Werial Table (HMT). Table (Title 49, Code of Federal Regulations, Part 172.101) which lists materials which are considered hazardous during transportation. Materials listed in this HMT are regulated under US Department of Transportation regulations.

s. Hazardous Waste. A waste that is listed or exhibits any of the characteristics as defined in accordance with existing federal *(ie.,* Title 40 CFR, Part 26 1, subpart C or D), state or local regulations.

t. Non-hazardous Solid Waste. A solid waste which is not a hazardous waste.

u. Primary battery. A non-rechargeable battery.

v. Recycled Material. Material that is reutilized, instead of being disposed as waste. IAW federal and state regulations material may be recycled, thereby removing potentially hazardous material from the waste steam so that it may be reused. The process is regulated under Title 40 CFR Parts 264, 265, 266, 268 and 270.

w. Resource Conservation and Recovery Act. Federal law, enacted under Title 40, Code of Federal Regulations, which protects the environment by regulating the disposal and recycling of potentially hazardous wastes.

x. Sealed battery. A battery without vent/filler caps.

y. Secondary battery. A rechargeable battery.

z. Serviceable battery. A battery which can be used for its original intended purpose.

aa. Solid Waste. A material which is normally considered as trash, refuse or garbage, which is not a waste defined as a hazardous waste; see r, above. It may be solid or liquid.

ab. Spent. See "depleted."

ac. Unserviceable battery. A battery which is damaged, defective, depleted, spent or has exceeded its shelf life.

ad Vented battery. A battery with vent/filler cap(s). Typically contains wet cells which may be serviced by adding electrolyte or water.

ae. Waste. Material determined to no longer have economic value or useful purpose.

af. Wet cell. A cell with a fluid electrolyte.

Section II. **Abbreviations**

ac	alternating current
AMDF	Army Master Data File
ANSI	American National Standards Institute
Ag	silver
AG	Silver, as in Silver battery
ALK	Alkaline, as in Alkaline battery
C	carbon
C	Centigrade
CDD	Complete Discharge Device
CFR	Code of Federal Regulations
Cd	cadmium
CONUS	continental United States
$C0_2$	carbon dioxide
Cr	chromium
cu. ft.	cubic feet
DA	US Department of the Army
DA Pam	US Department of the Army Pamphlet
Datafax	Facsimile machine
dc	direct current
DoD	US Deparunent of Defense
DoDEA	DoD Executive Agent
DOT	US Departnicrit of Transportation
DRMO	Defense Reutilization and Marketing Office
DRMS	Defense Reutilization and Marketing Service
EPA	US Environmental Protection Agency
EPA HW#	USEPA Hazardous Waste Number
EOD	explosive ordnance disposal
F	Fahrenheit
FD	Fire Department
Gal.	Gallon
GSA	General Services Administration
>	greater than
≥	greater than or equal to
H_2	hydrogen
Hg	mercury
HG	Mercury, as in Mercury battery
HM	hazardous material
HMT	Hazardous Material Table
HW	hazardous waste
HWPS	Hazardous Waste Profile Sheet
H_2SO_4	sulfuric acid
IAW	in accordance with
ICAO	International Civil Aviation Organization
IEO	Installation/Unit Environmental Office/Officer
IH	Industrial Hygienist
IMDG	international Maritime Dangerous Goods
IMO	International Maritime Organization
ITO	Installation Transportation Office
KOH	potassium hydroxide
L	liter
LA	Lead-Acid, as in Lead-Acid battery
lbs.	pounds
LCE	LeClanche, as in LeClanche battery
<	less than
LC_{50}	lethal concentration 50%
Li	lithium
LIN	line item number
$Li-MnO_2$	Lithium-Manganese Dioxide, as in Lithium-Manganese Dioxide battery
$Li-SO_2$	Lithium-Sulfur Dioxide, as in Lithium-Sulfur Dioxide battery
$Li-SOC1_2$	Lithium-Thionyl Chloride, as in Lithium-Thionyl Chloride battery
mg	milligram
Mg	magnesium
MG	Magnesium, as in Magnesium battery
$Mg(OH)_2$	magnesium hydroxide
Mn	manganese
MnO_2	manganese dioxide
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
NHSW	non-hazardous solid waste
NIOSH	National Institute of Occupational Safety and Health
Ni	nickel
NI-CD	Nickel-Cadmium, as in Nickel-Cadmium battery
NICP	National Inventory Control Point
n.o.s.	not otherwise specified
NSN	national stock number
º	degree
OCONUS	outside continental United States
OD	open detonation
Pam	Pamphlet
para	paragraph
Pb	lead
%	percent
PMO	Preventive Medicine Office/Officer
PPE	personal protective equipment
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
SB	Supply Bulletin
so	Safety Office/Officer
$S0_2$	sulfur dioxide
$SOC1_2$	thionyl chloride
SOS	source of supply
SW	solid waste
TB	Technical Bulletin
TCLP	Toxic Characteristic Leaching Procedure
THR	Thermal as in thermal battery
TM	Technical Manual
UNID	United Nations Identification Nuniber
w	with
w/o	without
Zn	zinc

APPENDIX C Procedures for Draining Vented Lead-Acid Batteries and Disposition of Drained Sulfuric Acid Electrolyte

C-1. Purpose

To establish procedures for the draining of vented Lead-Acid (LA) batteries and the disposition of drained sulfuric acid (H_2SO_4) electrolyte, through the local servicing Defense Reutilization and Marketing Office (DRMO). DO NOT drain batteries unless:

a. Batteries are damaged, or
b. Batteries cannot be protected from freezing.

C-2. Application

This procedure applies to Army procured vented Lead-Acid batteries, described in this technical bulletin (TB), which cannot be protected from freezing. Refer to paragraph (para) 4-4f and Table 4-1 for guidance.

C-3. Safety and Control Measures

a. Refer to Chapter 3 for required Personal Protective Equipment (PPE).

b. Battery electrolyte should be stored in a cool, dry, well ventilated area and protected from freezing or excessive heat (greater than 130° F). If the local servicing DRMO cannot provide adequate storage, the user MUST provide protected storage to prevent the electrolyte from freezing.

C-4. Procedure

Packaging and shipping instructions contained herein are consistent with US Department of Transportation (DOT) and US Environmental Protection Agency (EPA) regulations, and Department of Defense (DoD) guidance.

a. Transfer of electrolyte to local servicing DRMO is controlled by DoD guidance. Coordinate packaging and shipping with your local Installation Environmental Office (IEO), Installation Transportation Office (ITO), and local servicing DRMO.

WARNING

DO NOT use metal or galvanized equipment when draining electrolyte from LA batteries.

CAUTION

Personnel **MUST** wear PPE while draining vented batteries. Refer to chapter 3.

b. Draining:

(1) Drain batteries into a plastic bucket, and transfer the spent electrolyte into a DOT specification 34 plastic drum, or any other DOT approved drum for H_2SO_4. See table C-1 for equipment.

(2) The exterior of all drained batteries should be rinsed with water to remove acid residue. Use care and avoid splashing. Allow exteriors to dry. The exteriors of all batteries must be completely dry prior to packaging.

(3) The vent/filler caps should be replaced and taped in place after draining, and the vent holes sealed with the same tape.

Item	NSN	SOS
Pail, 12 qt., plastic	7240-00-943-7105	G0[1]
Funnel, 1/2 gal., plastic	7240-00-404-9795	GO
Drum	8110-01-150-677'	S9G[2]
Tape, elec., 3/4 in.	5970-00-644-3167	GO

Notes:

[1] G 0: General Services Administration, 819 Taylor St., Fort Worth, TX 76102 at Commercial (817) 334-2051.
[2] S9G: Defense General Supply Center, Richmond, VA 23297; DSN 6954490 or Commercial (804) 2794490

C-5. Transportation Requirements

a. For LA battery casings, refer to para 4-4 g for packaging of drained battery casings for disposition to the local servicing DRMO.

b. For spent electrolyte, in accordance with Title 49, CFR Part 172.101 HMT, Hazard Class 8, and Part 173.154:

(1) Packaging in accordance with 49 CFR Part 173.154; see paragraph 26a, Chapter 2 of this TB.

(2) Marking: See paragraph 2-6 b. Proper shipping name: Battery fluid, acid; UNID: UN 2796; label IAW 49 CFR Part 172.442: CORROSIVE label. See Figure 4-1.

C-6. Disposition and Transportation

a. Coordinate and obtain guidance regarding this turn-in from the local servicing DRMO and ITO. Battery electrolyte may be turned in to the DRMO for disposition, or may be disposed via local contract (see para 2-7). A Disposal Turn-in Document (DD Form 1348-1), and a Hazardous Waste Profile Sheet (DBMS Form 1930) or Material Safety Data Sheet are required by the servicing DRMO.

b. The DRMO will accept accountability, provided the materials are properly identified, packaged, and marked, and will accept physical custody depending upon the availability of conforming storage areas.

APPENDIX D Packaging Materials

D-1. Barrier Material (Plastic Sheeting)

Refer to barrier material, waterproof in SB 38-100.

D-2. Boxes

a. Fiberboard box. DOT Specification 12B fiberboard box, type CF or SF, class weather-resistant, Federal Specification PPP-B-636. Reference class 8115, entitled "Box, Shipping, " cited in General Services Administration (GSA) Supply Catalog, Office Products, Industrial Products, Tools, Furniture.

b. Wooden box. DOT Specification 15D wooden box (see chart below), Federal Specification PPP-B-621 or PPP-B-585. Reference box, wood, cited in SB 38-100.

DOT Volume Specification 15D:

National Stock Number (NSN)	Volume Cu. Ft.	Source of Supply (SOS)
8115-01-019-1633	3.7	G 0
8115-01-024-5961	7.9	G 0
8115-01-025-1669	30.6	G 0

D-3. Drums

a. Fiber Drum. DOT Specification 21C or 21P fiber drum, Federal Specification PPP-D-723 (see chart below)

National Stock Number (NSN)	Capacity gal.	Source of Supply (SOS)
8110-00-132-9600	55	S9G
8110-00-802-1211	15	S9G
8110-00-802-1215	45	S9G

b. Metal drum. DOT Specification 5B, 17C, 17E, and 17H, Drums, Steel; Federal Specification PPP-P-704, type 1, class 4 and 11; PPP-D-705, type V, PPP-D-729, type IV, PPP-D-736; PPP-P-704, type II, class 8; and Military Specifications MIL-D-6054 (see chart below)

National Stock Number (NSN)	Capacity gal.	Source of Supply (SOS)
8110-00-030-7779	30	S9G
8110-00-030-7780	55	S9G
8110-00-082-2623	77	S9G
8110-00-082-2625	27	S9G
8110-00-082-2626	57	S9G
8110-00-082-2629	45	S9G
8110-00-118-5765	80	S9G
8110-00-254-5713	6	S9G
8110-00-254-5714	7	S9G
8110-00-254-5716	12	G 0
8110-00-254-5717	16	G 0
8110-00-254-5722	4	G 0
8110-00-282-2520	5	S9G
8110-00-292-9783	55	S9G
8110-00-366-6809	30	S9G
8110-00-431-8670	3	S9G
8110-00-597-2353	55	S9G
8110-00-753-4643	19	G 0
8110-00-820-0854	28	S9G
8110-00-823-8121	55	S9G
8110-00-866-1728	30	S9G
8110-00-880-7074	58	S9G

D-4. Label

"CORROSIVE MATERIAL LABEL, " NSN 7540-00-118-0611, Standard Form 416, SOS is G 0. To be discontinued. Use until deleted.

D-5. Pallet

Refer to pallet, cited in SB 38-100.

D-6. Plastic Bag

Refer to class 8105, entitled "Waste receptacle," cited in General Services Administration (GSA) Supply Catalog, Office Products, Industrial Products, Tools, Furniture.

D-7. Tape

Use electrical tape, 3/4 inch wide, NSN 5970-00-644-3167, SOS: GSA, or equivalent.

APPENDIX E Generic Material Safety Data Sheets

E-1. Introduction

Generic Material Safety Data Sheets have been prepared for each of the battery types described in Chapter 4 of this bulletin. The constituent composition is expressed as a range based upon information obtained from manufacturers of the specific battery chemistry.

E-2. Alkaline Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Alkaline (ALK) Battery

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 1/19/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Alkaline battery Item Dimensions (inches):
Contract Number:

Manufacturer's Identification:
Manufacturer's Name and Address
and ZIP code :
Preparer's Federal Supply Code (CAGE): 81349
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Hazardous Components[2] (Chemical Name, (Symbol), & [CAS#])	Exposure Limits[1] ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Zinc (Zn) [7440-66-6][3]	5, 10 (STEL)	5	5, 10 (STEL)	10-25
Manganese dioxide (MnO_2) [1313-13-9][4]	0.2	C 5	1, 3 (STEL)	30-45
Potassium hydroxide (KOH) [1310-58-3]	C 2 (STEL)	---	C 2	4-10
Graphite (C) [7440-44-0][5]	2	5	2.5	1-6

(1) All values reported in mg/m^3 unless otherwise specified.
(2) ALK batteries manufactured after January 1993, i.e., with a date code ≥ 0193A, do not contain mercury (Hg). Check the manufacturer's date code on the battery.
(3) As zinc oxide (ZnO) CAS 1314-13-2
(4) As manganese compounds CAS 7439-96-5
(5) As graphite CAS 7782-42-5

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point:	Melting Point:
Vapor Pressure (mmHg):	Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1):	Solubility in Water:
Specific Gravity (water=l):	pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of potassium oxide and zinc oxide.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Graphite: Reproductively Active
Manganese dioxide: Reproductively active.
Potassium hydroxide: Mutagenic data reported.
Zinc: Mutagenic data reported.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin and Eye Contact: Remove any contaminated clothing as necessary. Flush battery electrolyte from the skin or eye(s) for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of potassium oxide and zinc oxide.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area.. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA) to protect against hazardous decomposition products.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves, wear eye protective goggles, and use non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING and STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z7

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z7.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves and wear eye protective goggles as necessary. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA to protect against toxic fumes.
Skin Protection: Use chemical resistant rubber gloves, and wear eye protective goggles, when cleaning up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Alkaline batteries are not hazardous waste (HW) under Resource Conservation and Recovery Act (RCRA) regulations. They are HW in the states of AK, CA, MN, RI and WA, which utilize bioassay to characterize HW in addition to RCRA requirements. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations.

2. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

Regulation: Alkaline batteries are “dry batteries” and they are not regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation. They are subject to USDOT 49 CFR 172.102 (a) (1) Special Provision 130 for dry batteries.

Procedures: They must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits.

E-3. Carbon-Zinc (LeClanche) Batteries (LCE)

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Carbon-Zinc Battery, (LeClanche (LCE))

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 1/19/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Carbon-Zinc battery (LeClanche (LCE)) Item Dimensions (inches):
Contract Number:
Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code :
Preparer's Federal Supply Code (CAGE): 81349
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Hazardous Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits[1] ACGIH TLV	OSHA PEL	NIOSH REL	by Item %Weight
Carbon black (C) [1333-86-4]	3.5	3.5	3.5	1-13
Zinc (Zn) [7440-66-6] [2]	5, 10 (STEL)	5	5, 10 (STEL)	7-42
Zinc chloride ($ZnCl_2$) [7646-85-7]	1, 2 (STEL)	1	1, 2 (STEL)	2-25
Manganese dioxide (MnO_2) [1313-13-9] [3]	0.2	C 5	1, 3 (STEL)	15-42
Ammonium chloride (NH_4Cl) [12125-02-9]	10, 20 (STEL)	---	10, 20 (STEL)	0.001-15 (1)

All values reported in mg/m^3 unless otherwise specified.
(2) As zinc oxide (ZnO) CAS 1314-13-2
(3) As manganese compounds, CAS 7439-96-5

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X
Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of ammonia, chlorides, oxides of nitrogen, and zinc oxide.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:

Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**

Ammonium chloride: Mutagenic data reported.
Carbon Black: Mutagenic data reported, Potential carcinogen.
Manganese dioxide: Reproductively active.
Zinc: Mutagenic data reported.
Zinc chloride: Mutagenic data reported, Reproductively active.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin and Eye Contact: Remove any contaminated clothing as necessary. Flush battery electrolyte from the skin or eye(s) for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of ammonia, chlorides, oxides of nitrogen, and zinc oxide.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area.. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA).

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves, wear eye protective goggles, and use non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING and STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z7
Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z7.
DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves.
If the battery is burning, leave the area immediately.

Protective Equipment :
Respiratory Protection: During fire fighting firemen should use SCBA to protect against toxic fumes.
Skin Protection: Use chemical resistant rubber gloves, and wear eye protective goggles, when cleaning up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. LeClanche batteries are not hazardous waste (HW) under Resource Conservation and Recovery Act (RCRA) regulations. They are HW in the states of AK, CA, MN, RI and WA, which utilize bioassay to characterize HW in addition to RCRA requirements. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations.

2. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

Regulation: Alkaline batteries are "dry batteries" and they are not regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation. They are subject to USDOT 49 CFR 172.102 (a) (1) Special Provision 130 for dry batteries.

Procedures: They must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits.

E-4. Lead Acid (Pb) Batteries

E-4a. Rechargeable Lead-acid battery, vented

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Rechargeable Lead-acid battery, vented

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 3/10/2005
National Stock Number:
Type Number: Weight of Item(pounds):
Common Name: Lead-acid battery (vented) with vent-filler caps Item Dimensions (inches):
Contract Number:
Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code:
Preparer's Federal Supply Code (CAGE): 81349
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445

2. COMPOSITION OF ITEM:

Hazardous Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits(1) ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Lead (Pb) [7439-92-1] & compounds	0.05	0.05	0.05	60-75
Sulfuric acid (H_2SO_4)[7664-93-9]	1, 3 (STEL)	1	1	10-35
Antimony (Sb)[7440-36-0]	0.5	0.5	0.5	1.5-6
Tin (Sn)[7440-31-5]	2	2	2	0.2-0.6

(1) All values reported in mg/m^3 unless otherwise specified.

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item
Boiling Point: Melting Point:
Vapor Pressure(mmHg): Vapor Density(Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity(water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: Do Not abuse, mutilate or short circuit the battery. Do Not overcharge. Incompatible with alkali materials, and DO NOT store in the same stacks with Nickel-Cadmium batteries.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of lead, and oxides of sulfur.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.):
Lead: Suspected carcinogenic agent, Mutagenic agent, and Reproductively active.
Sulfuric acid: Suspected carcinogenic agent, Reproductively active.

Medical Conditions Generally Aggravated by Exposure: Recharging: Exposure to acid mist may damage and/or aggravate lungs.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin and Eye Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of lead, and oxides of sulfur.

Extinguishing Media: Carbon dioxide (CO2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:
Personnel: Fight the fire in a defensive mode, while exiting the area. When using a CO2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA).

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: DO NOT use of finely divided combustibles materials (e.g., sawdust) for cleaning up spills. If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING and STORAGE:

Handling: Recharge batteries IAW methods specified in applicable technical manuals.
DO NOT: Overcharge this battery.
- Abuse, mutilate or short circuit the battery.
- Drain unless authorized, nor invert or spill.
- Use a metal or galvanized container, when draining the battery.

Hazardous Characteristic Code (HCC): C1
Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., 130F), dry and well ventilated area. Store batteries IAW TM 38-410 HHC C1.
DO NOT: Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:
Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :
Respiratory Protection: During fire fighting firemen should use SCBA to protect against toxic fumes.
Skin Protection: Use chemical resistant rubber gloves, and wear eye protective goggles, when cleaning up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Lead-acid batteries are hazardous waste (HW) (i.e., D002 and D008) under Resource Conservation and Recovery Act (RCRA) regulations. No bioassay data available. All batteries will be managed IAW equipment TM requirements, and disposal/recycling will be IAW requirements under the Universal Waste Rule (i.e., USEPA regulations), state and local regulations.

2. These batteries should be recycled, if possible. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION: Lead-acid batteries are regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation.

Applicable Regulation: 49 CFR parts 172.101 and 172.159
DOT Proper Shipping Name: Batteries, wet, filled with acid, *electric storage*
DOT Hazard class: 8
DOT Identification Numbers: UN2794
DOT Packaging Group (PG): III
DOT Label codes: 8

Procedures: Securely package batteries to withstand conditions normal to shipping. Protect batteries against short circuiting. Package and ship IAW DOT regulations.

Special Precautions: Isolate and remove damaged and/or leaking batteries, if possible. Notify local health, safety and environmental agencies.

E-4b. Rechargeable Lead-acid Battery, Sealed

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Rechargeable Sealed Lead-acid Battery (SLAB)

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer' Identification data may be provided by the user.

Item Identification: **Date:** 1/31/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Sealed Lead-acid battery (SLAB) Item Dimensions (inches):
Contract Number:
Manufacturer's Identification:
Manufacturer's Name and Address
and ZIP code :
Preparer's Federal Supply Code (CAGE): 81349
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

	Exposure Limits(1)			%
Hazardous Components	ACGIH	OSHA	NIOSH	by Item
(Chemical Name, (Symbol), & [CAS#])	TLV	PEL	REL	Weight
Lead (Pb) [7439-92-1] & compounds	0.05	0.05	0.05	50-80
Sulfuric acid (H_2SO_4)[7664-93-9]	0.2	1	1	10-25
Antimony (Sb) [7440-36-0]	0.5	0.5	0.5	1-5

(1) All values reported in mg/m^3 unless otherwise specified.

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item
Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: Do Not abuse, mutilate or short circuit the battery. Do Not overcharge.

Incompatibility: Incompatible with alkali materials. Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of lead, and oxides of sulfur.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Lead: Suspected carcinogenic agent, Mutagenic agent, and Reproductively active.
Sulfuric acid: Suspected carcinogenic agent, Reproductively active.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin and Eye Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of lead, and oxides of sulfur.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA).

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: DO NOT use of finely divided combustibles materials (e.g., sawdust) for cleaning up spills. Absorb small spills with dry sand, earth, and/or vermiculite. If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING and STORAGE:

Handling: Recharge batteries IAW methods specified in applicable technical manuals. **DO NOT** over-charge this battery.

DO NOT:
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Attempt to Drain sealed batteries.
- Mix battery types, and replace All batteries at the same time.

Hazardous Characteristic Code (HCC): Z4

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z4.

DO NOT:
- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves and wear eye protective goggles as necessary. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA to protect against toxic fumes.

Skin Protection: Use chemical resistant rubber gloves, and wear eye protective goggles, when cleaning up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate

1. Lead-acid batteries are hazardous waste (HW) (i.e., D002 and D008) under Resource Conservation and Recovery Act (RCRA) regulations. All batteries will be managed IAW equipment TM requirements, and disposal/recycling will be IAW requirements under the Universal Waste Rule (i.e., USEPA regulations), state and local regulations.

2. These batteries should be recycled, if possible. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION: Lead-acid batteries are regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation.

Applicable Regulation: 49 CFR parts 172.101 and 173.159
DOT Proper Shipping Name: Batteries, wet, non-spillable, *electric storage*
DOT Hazard class: 8
DOT Identification Numbers: UN2800
DOT Packaging Group (PG): III
DOT Label codes: 8

Procedures: Securely package batteries to withstand conditions normal to shipping. Protect batteries against short circuiting. Package and ship IAW DOT regulations.

E-5. Lithium-Ion Rechargeable Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Lithium-ion (Li-ion), Rechargeable sealed battery

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 2/15/2005
National Stock Number:
Type Number: Weight of Item(pounds):
Common Name: Lithium-ion (Li-ion), Rechargeable sealed battery Item Dimensions (inches):
Contract Number:
Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code :
Preparer's Federal Supply Code (CAGE): 80063
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

	Exposure Limits[1]			%
Components	**ACGIH**	**OSHA**	**NIOSH**	**by Item**
(Chemical Name, (Symbol), & [CAS#])	TLV	PEL	REL	Weight
Lithium cobaltite ($LiCoO_2$)[12190-79-3][2] and	.02	0.1	.05	8-25
Lithium compounds	---	---	---	
Graphite (C) [7440-44-0][3]	2	5	2.5	10-30
Polyvinylidene fluoride ($(C_2H_2F_6)_x$) [24937-79-9]	---	---	---	1

(1) All values reported in mg/m^3 unless otherwise specified.
(2) As cobalt (Co) compounds CAS 7440-48-4
(3) As CAS # 7782-42-5

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT expose to fire or excessive heat, or overcharge. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit acrid smoke irritating fumes, and toxic fumes of fluoride.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Cobalt: Suspected human carcinogenic agent.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin and Eye Contact: Remove any contaminated clothing as necessary. Flush battery electrolyte from the skin or eye(s) for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit acrid smoke irritating fumes, and toxic fumes of fluoride.

Extinguishing Media: Class-D dry chemical fire extinguisher, e.g., LITH-X (powdered graphite).

Fire Fighting Instructions:

Personnel: If fire or explosion occurs when batteries are on charge, shut off power to charger. Fight the fire in a defensive mode, while exiting the area. Copious amounts of water, CO_2, dry chemical, and foam extinguishers may be used to cool adjacent batteries and control the spread of fire. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA). Burning lithium ion batteries can produce toxic fumes including HF. Use a Class-D extinguisher, e.g., LITH-X (powdered graphite), or copper powder fire extinguishers, sand, or soda ash may also be used. These materials act as smothering agents.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: Recharge batteries IAW methods specified in applicable technical manuals.

DO NOT:
- Overcharge this battery.
- Abuse, mutilate or short circuit the battery.
- Mix battery types, and replace All batteries at the same time.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z6

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z6.

DO NOT:
- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves and wear eye protective goggles as necessary. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA to protect against toxic fumes.
Skin Protection: Use chemical resistant rubber gloves, and wear eye protective goggles, when cleaning up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate

1. Li-ion batteries are nonhazardous solid waste (NHSW) under Resource Conservation and Recovery Act (RCRA) regulations. They are HW in the states of AK, CA, MN, RI and WA, which utilize bioassay to characterize HW in addition to RCRA requirements. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations.

2. These batteries should be recycled, if possible. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

IAW US DOT regulations 49 CFR Section 173.185 they are not regulated as hazardous material. Securely package batteries to withstand conditions normal to shipping. When they offered for transportation protect batteries against short circuiting (e.g., effective insulation of exposed terminals to prevent short circuiting of the battery), and dangerous heat and thermal conditions in order to minimize the potential for overheating and fire.

E-6. Lithium-Manganese Dioxide Non-Rechargeable Batteries

E-6a. Single Cell batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Lithium-Manganese dioxide (Li-MnO_2) Battery, Single-cell

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 3/18/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Lithium-Manganese dioxide (Li-MnO_2) battery Item Dimensions (inches):
Contract Number:

Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code :
Preparer's Federal Supply Code (CAGE): 80058
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits[1] ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Lithium (Li) [7439-93-2]	---	---	---	2-3
Manganese dioxide (MnO_2) [1313-13-9] [2]	0.2	C 5	1, 3 (STEL)	30-35
Tetrahydrofuran (C_4H_8O) [109-99-9]	147, 295 (STEL) (skin)	590	590,735 (STEL)	2-4
Carbon black (C) [1333-86-4]	3.5	3.5	3.5	3-4

(1) All values reported in mg/m^3 unless otherwise specified.
(2) As manganese compounds CAS 7439-96-5

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item
Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from other hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of lithium oxide, and irritating organic vapors.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Carbon black: Mutagenic data reported, Potential carcinogen.
Manganese dioxide: Reproductively active.
Tetrahydrofuran: Mutagenic data reported.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin and Eye Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of lithium oxide, irritating organic vapors, and toxic fumes.

Extinguishing Media: Use a Class-D extinguisher, e.g., LITH-X (powdered graphite), Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area. Copious amounts of water, CO_2, dry chemical, and foam extinguishers may be used to cool adjacent batteries and control the spread of fire. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA). Burning lithium batteries can produce toxic fumes. Use a Class-D extinguisher, e.g., LITH-X (powdered graphite), or copper powder fire extinguishers, sand, or soda ash may also be used. These materials act as smothering agents.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING and STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z6

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z6.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA.

Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Lithium-Manganese dioxide batteries with ■ 0.5g of lithium are not hazardous waste (HW) under Resource Conservation and Recovery Act (RCRA) regulations. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (i.e., USEPA regulations), state and local regulations. All Li-MnO_2 batteries are HW in the states of AK, CA, MN, RI and WA, which utilize bioassay to characterize HW regardless of state of charge.

2. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

These Lithium-Manganese dioxide (Li-MnO_2) batteries contain ≤1.0.g of lithium/cell, and they are exempt from the other provisions of 49 CFR part 173.185, when they are packaged IAW 49 CFR part 173.185(b). However, note that as of December 2004, Lithium Non-Rechargeable battery bulk shipments are barred from the cargo holds of all passenger aircraft. Packages of Lithium-Manganese Dioxide batteries must be appropriately labeled with the banned from passenger aircraft label.

Procedures: Batteries must be packaged IAW 49 CFR part 173.185(b), and must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits.

E-6b. Lithium-Manganese Dioxide Multi-cell batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Lithium-Manganese dioxide (Li-MnO_2) Battery, multi-cell

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 3/31/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Lithium-Manganese dioxide (Li-MnO_2) battery, multi-cell Item Dimensions (inches):
Contract Number:

Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code :
Preparer's Federal Supply Code (CAGE): 80058
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits[1] ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Lithium (Li) [7439-93-2]	---	---	---	3-5
Manganese dioxide (MnO_2) [1313-13-9] [2]	0.2	C 5	1, 3 (STEL)	40-55
Tetrahydrofuran (C_4H_8O) [109-99-9]	147, 295 (STEL)(Skin)	590	590,735 (STEL)	2-4
Carbon black (C) [1333-86-4]	3.5	3.5	3.5	2-4

(1) All values reported in mg/m^3 unless otherwise specified.
(2) As manganese compounds CAS 7439-96-5

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from other hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of lithium oxide, and irritating organic vapors.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Carbon black: Mutagenic data reported, Potential carcinogen.
Manganese dioxide: Reproductively active.
Tetrahydrofuran: Mutagenic data reported.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin and Eye Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of lithium oxide, irritating organic vapors, and toxic fumes.

Extinguishing Media: Use a Class-D extinguisher, e.g., LITH-X (powdered graphite), Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area. Copious amounts of water, CO_2, dry chemical, and foam extinguishers may be used to cool adjacent batteries and control the spread of fire. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA). Burning lithium batteries can produce toxic fumes. Use a Class-D extinguisher, e.g., LITH-X (powdered graphite), or copper powder fire extinguishers, sand, or soda ash may also be used. These materials act as smothering agents.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING and STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z6

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z6.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA.

Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Some multi-cell lithium-manganese dioxide (Li-MnO_2) batteries have a complete discharge device (CDD) , see the equipment TM or TB 43-0134. After final use and prior to disposal activate the CDD. This will deactivate any remaining lithium to ■ 0.5g of lithium/cell. Batteries with ■ 0.5g of lithium/cell are not hazardous waste (HW) IAW Resource Conservation and Recovery Act (RCRA) regulations.

2. Used multi-cell Li-MnO_2 batteries without a CDD should be considered HW RCRA regulations. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (i.e., USEPA regulations), state and local regulations. All Li-MnO_2 batteries are HW in the states of AK, CA, MN, RI and WA, which utilize bioassay to characterize HW regardless of state of charge.

3. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION: Multi-cell lithium-manganese dioxide (Li-MnO_2) are regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) parts 172.101 and 173.185. Note that as of December 2004, Lithium Non-Rechargeable battery bulk shipments are barred from the cargo holds of all passenger aircraft. Packages of Lithium-Manganese Dioxide batteries must be appropriately labeled with the banned from passenger aircraft label.

Applicable Regulation: 49 CFR parts 172.101 and 173.185
DOT Proper Shipping Name: Lithium Battery
DOT Hazard class: 9
DOT Identification Number: UN3090
DOT Packaging Group (PG): II
DOT Label codes: 9

Procedures: Package batteries IAW 49 CFR parts 172.101 and 173.185. Securely package batteries to withstand conditions normal to shipping. Protect batteries against short circuiting.

E-7. Lithium-Sulfur Dioxide Non-Rechargeable Batteries

E-7a. Lithium-Sulfur Dioxide Single Cell Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Lithium-Sulfur dioxide ($Li-SO_2$) battery, single-cell

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 4/26/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Lithium-Sulfur dioxide ($Li-SO_2$) battery single-cell Item Dimensions (inches):
Contract Number:
Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code :
Preparer's Federal Supply Code (CAGE): 80063
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits[1] ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Lithium (Li)[7439-93-2]	---	---	---	2-3
Sulfur dioxide (SO_2)[7446-09-5]	5, 13 (STEL)	13	5, 13 (STEL)	18-29
Acetonitrile (CH_3CN)[75-05-8]	34 (Skin)	70	34	6-8
Carbon black (C) [1333-86-4]	3.5	3.5	3.5	6-7

(1) All values reported in mg/m^3 unless otherwise specified.

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item
Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from other hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of cyanide, lithium dioxide, oxides of nitrogen, and oxides of sulfur.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.):
Acetonitrile: Mutagenic data reported, Reproductively active.
Carbon Black: Mutagenic data reported, Potential carcinogen.
Sulfur dioxide: Mutagenic data reported, Reproductively active.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of cyanide, lithium dioxide, oxides of nitrogen, and oxides of sulfur.

Extinguishing Media: Use a Class-D extinguisher, e.g., LITH-X (powdered graphite), Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area. Copious amounts of water, CO_2, dry chemical, and foam extinguishers may be used to cool adjacent batteries and control the spread of fire. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA). Burning lithium batteries can produce toxic fumes. Use a Class-D extinguisher, e.g., LITH-X (powdered graphite), or copper powder fire extinguishers, sand, or soda ash may also be used. These materials act as smothering agents.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING and STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z6

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z6.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment:

Respiratory Protection: During fire fighting firemen should use SCBA.

Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Single cell, i.e., BA-5567/U, Lithium-Sulfur dioxide batteries containing ■ 0.5g of lithium are not hazardous waste under Resource Conservation and Recovery Act (RCRA) regulations. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations. Note that they may not be disposed of in a non-regulated landfill because of the Acetonitrile content.

2. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

Single cell, i.e., BA-5567/U, Lithium-Sulfur dioxide battery containing ■ 0.5g of lithium are exempt from the other provisions of 49 CFR part 173.185, when they are packaged IAW 49 CFR part 173.185(b). However, note that as of December 2004, Lithium Non-Rechargeable battery bulk shipments are barred from the cargo holds of all passenger aircraft. Packages of Lithium-Sulfur Dioxide batteries must be appropriately labeled with the banned from passenger aircraft label.

Procedures: Batteries must be packaged IAW 49 CFR part 173.185(b), and must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits.

E-7b. Lithium-Sulfur Dioxide Multi-cell Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Lithium-Sulfur dioxide ($Li-SO_2$) battery, Multi-cell

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 5/3/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Lithium-Sulfur dioxide ($Li-SO_2$) battery multi-cell Item Dimensions (inches):
Contract Number:
Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code :
Preparer's Federal Supply Code (CAGE): 80063
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits[1] ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Lithium (Li)[7439-93-2]	---	---	---	2-3
Sulfur dioxide (SO_2)[7446-09-5]	5, 13 (STEL)	13	5, 13 (STEL)	18-29
Acetonitrile (CH_3CN)[75-05-8]	34 (Skin)	70	34	6-8
Carbon black (C) [1333-86-4]	3.5	3.5	3.5	6-7

(1) All values reported in mg/m^3 unless otherwise specified.

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item
Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of cyanide, lithium dioxide, oxides of nitrogen, and oxides of sulfur.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Acetonitrile: Mutagenic data reported, Reproductively active.
Carbon Black: Mutagenic data reported, Potential carcinogen.
Sulfur dioxide: Mutagenic data reported, Reproductively active.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of cyanide, lithium dioxide, oxides of nitrogen, and oxides of sulfur.

Extinguishing Media: Use a Class-D extinguisher, e.g., LITH-X (powdered graphite), Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area. Copious amounts of water, CO_2, dry chemical, and foam extinguishers may be used to cool adjacent batteries and control the spread of fire. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA). Burning lithium batteries can produce toxic fumes. Use a Class-D extinguisher, e.g., LITH-X (powdered graphite), or copper powder fire extinguishers, sand, or soda ash may also be used. These materials act as smothering agents.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code: Z6

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z6.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:
Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :
Respiratory Protection: During fire fighting firemen should use SCBA.
Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Multi-cell Lithium Sulfur dioxide batteries are nonhazardous solid waste (NHSW) under Resource Conservation and Recovery Act (RCRA) regulations, when discharged to ≤1 vdc/cell/string (e.g. a five cell string discharged to ≤5 vdc). Discharged batteries are USW under bioassay criteria.

2. Batteries with a remaining charge of >1 vdc/cell/string are HW under RCRA (i.e., D001 and D003).

3. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations. Note thet they may not be disposed of in a non-regulated landfill because of the Acetonitrile content.

12. TRANSPORTATION INFORMATION: Multi-cell Lithium Sulfur dioxide batteries are regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) parts 172.101 and 173.185. Note that as of December 2004, Lithium Non-Rechargeable battery bulk shipments are barred from the cargo holds of all passenger aircraft. Packages of Lithium-Sulfur Dioxide batteries must be appropriately labeled with the banned from passenger aircraft label.

Applicable Regulation: 49 CFR parts 172.101 and 173.185
DOT Proper Shipping Name: Lithium Battery
DOT Hazard class: 9
DOT Identification Numbers: UN3090
DOT Packaging Group (PG): II
DOT Label codes: 9

Procedures: Package batteries IAW 49 CFR parts 172.101 and 173.185. Securely package batteries to withstand conditions normal to shipping. Protect batteries against short circuiting.

E-8. Lithium-Thionyl Chloride Non-Rechargeable Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Lithium-Thionyl chloride ($Li\text{-}SOCl_2$) battery, Single cell

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 5/5/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Lithium-Thionyl chloride ($Li\text{-}SOCl_2$) battery single-cell Item Dimensions (inches):
Contract Number:
Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code :
Preparer's Federal Supply Code (CAGE): 80063
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits[1] ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Lithium (Li)[7439-93-2]	---	---	---	3.5-5
Thionyl chloride ($SOCl_2$) [7719-09-7]	C 5 (STEL)	---	C 5	40-46
Aluminum chloride ($AlCl_4$) [7446-70-0][2]	2	---	2	1-5
Carbon black (C) [1333-86-4]	3.5	3.5	3.5	3-4

(1) All values reported in mg/m^3 unless otherwise specified.
(2) As CAS 7429-90-5

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Specific Gravity (water=l):
Solubility in Water: pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes including but not limited to hydrogen chloride, lithium oxide, and oxides of sulfur.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:** Aluminum chloride: Mutagenic data reported, Reproductively Active.
Carbon black: Mutagenic data reported, Potential carcinogen.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes including but not limited to hydrogen chloride, lithium oxide, and oxides of sulfur.

Extinguishing Media: Class-D fire extinguisher approved for lithium; or a carbon dioxide (CO_2), or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area. Copious amounts of water, CO_2, dry chemical, and foam extinguishers may be used to cool adjacent batteries and control the spread of fire. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA). Burning lithium batteries can produce toxic fumes. Use a Class-D extinguisher, e.g., LITH-X (powdered graphite), or copper powder fire extinguishers, sand, or soda ash may also be used. These materials act as smothering agents.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code: Z6

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z6.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA.

Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Lithium-Thionyl chloride batteries are hazardous waste (HW) (i.e., D001, D003 and D007) under Resource Conservation and Recovery Act (RCRA) regulations. They are HW in the states of AK, CA, MN, RI and WA, which utilize bioassay to characterize HW in addition to RCRA requirements. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations.

2. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION: Lithium-Thionyl chloride batteries are regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) parts 172.101 and 173.185. Note that as of December 2004, Lithium Non-Rechargeable battery bulk shipments are barred from the cargo holds of all passenger aircraft. Packages of Lithium-Thionyl Chloride batteries must be appropriately labeled with the banned from passenger aircraft label.

Applicable Regulation: 49 CFR parts 172.101 and 173.185
DOT Proper Shipping Name: Lithium Battery
DOT Hazard class: 9
DOT Identification Numbers: UN3090
DOT Packaging Group (PG): II
DOT Label codes: 9

Procedures: Package batteries IAW 49 CFR parts 172.101 and 173.185. Securely package batteries to withstand conditions normal to shipping. Protect batteries against short circuiting.

E-9. Magnesium Non-Rechargeable Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Magnesium (Mg) battery

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 5/13/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Magnesium (Mg) battery Item Dimensions (inches):
Contract Number:
Manufacturer's Identification:
Manufacturer's Name and Address
and ZIP code :
Preparer's Federal Supply Code (CAGE): 81349
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Components	Exposure Limits[1] ACGIH	OSHA	NIOSH	% by Item
(Chemical Name, (Symbol), & [CAS#])	TLV	PEL	REL	Weight
Magnesium-aluminum alloy	---	---	---	10-15
Magnesium perchlorate ($Mg(ClO_4)_2$)[10034-81-8]	---	---	---	5-10
Manganese dioxide (MnO_2) [1313-13-9] [2]	0.2	C 5	1, 3 (STEL)	25-35
Barium Chromate ($BaCrO_4$)[10294-40-3]	0.01	C 0.1	0.001	0.5-1.5
Lithium Chromate (Li_2CrO_4)[14307-35-8]	0.05	C 0.1	0.001	0.5-1.5
Carbon black (C)[14762-74-4][3]	3.5	3.5	3.5	5-10

(1) All values reported in mg/m^3 unless otherwise specified.
(2) As manganese compounds CAS 7439-96-5
(3) As CAS 1333-86-4

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of barium chromate and magnesium oxide.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Chromates: Human carcinogenic agent.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of barium chromate and magnesium oxide.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area.. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA).

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z7

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z7.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA.

Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Magnesium batteries with ☒50% remaining charge (i.e., more than or equal to 50% discharged) are not hazardous waste (HW) under Resource Conservation and Recovery Act (RCRA) regulations. Discharged batteries are NHSW under bioassay criteria.

2. Batteries with a >50% remaining charge (i.e., less than 50% discharged) are HW (i.e., D007) under RCRA.

3. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations.

12. TRANSPORTATION INFORMATION:

Regulation: Magnesium batteries are "dry batteries" and they are not regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation. They are subject to USDOT 49 CFR 172.102 (a) (1) Special Provision 130 for dry batteries.

Procedures: They must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits.

E-10. Mercury Non-Rechargeable Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Mercury (Hg) battery

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided

Item Identification: **Date:** 5/9/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Mercury (Hg) battery Item Dimensions (inches):
Contract Number:

Manufacturer's Identification:
Manufacturer's Name and Address
and ZIP code :
Preparer's Federal Supply Code (CAGE): 80058
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Hazardous Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits[1] ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Zinc (Zn) [7440-66-6][2]	2, 10 (STEL)	5	5, 10 (STEL)	5-15
Mercuric oxide (HgO) [21908-53-2][3] & Mercury (Hg) [7439-97-6]	0.025 (skin)	C 0.1	0.05(skin)	15-50
Manganese dioxide (MnO_2) [1313-13-9][4]	0.2	C 5	1, 3 (STEL)	5-15
Potassium hydroxide (KOH) [1310-58-3]	C 2 (STEL)	---	C 2	5-10
Graphite (C) [7440-44-0][5]	2	5	2.5	3-10

(1) All values reported in mg/m^3 unless otherwise specified.
(2) As zinc oxide (ZnO) CAS 1314-13-2
(3) As mercury (Hg) CAS 7439-97-6
(4) As manganese compounds CAS 7439-96-5
5) As graphite CAS 7782-42-5

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: Solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from other hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of mercury, potassium oxide and zinc oxide.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Manganese dioxide: Reproductively active.
Mercury: Mutagenic data reported; Reproductively active.
Potassium hydroxide: Mutagenic data reported.
Zinc: Mutagenic data reported.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of mercury, potassium oxide and zinc oxide.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area.. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA) to protect against hazardous decomposition products.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z7

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z7.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA to protect against toxic fumes.
Skin Protection: Use chemical resistant rubber gloves, and wear eye protective goggles, when cleaning up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Mercury batteries are hazardous waste (HW) (i.e., D009) under Resource Conservation and Recovery Act (RCRA) regulations. No bioassay data available. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations.

2. These batteries should be recycled, if possible. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

Regulation: Mercury batteries are “dry batteries” and they are not regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation. They are subject to USDOT 49 CFR 172.102 (a) (1) Special Provision 130 for dry batteries.

Procedures: They must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits.

E-11. Nickel-Cadmium Rechargeable Batteries

E-11a. Vented Ni-Cd Rechargeable Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Rechargeable vented Nickel-Cadmium (Ni-Cd) Battery

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer' Identification data may be provided by the user.

Item Identification: **Date:** 5/17/2005
National Stock Number:
Type Number: Weight of Item(pounds):
Common Name: Nickel-Cadmium (Ni-Cd) battery (vented) with vent-filler caps Item Dimensions (inches):
Contract Number:

Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code:
Preparer's Federal Supply Code (CAGE): 81349
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445

2. COMPOSITION OF ITEM:

Hazardous Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits(1) ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Cadmium (Cd)[7440-43-9] & compounds	0.002	0.005	(2)	10-30
Nickel (Ni) [7440-02-0] & compounds	0.1	1.0	0.015	15-35
Potassium hydroxide (31%sol. KOH)[1310-58-3]	C 2 (STEL)	---	C 2	2-10
Cobalt (Co)[7440-48-4] & compounds	0.02	0.1	0.05	0.5-2

(1) All values reported in mg/m^3 unless otherwise specified.
(2) Reduce all cadmium (Cd) and Cd-compounds to lowest feasible level.

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item
Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: Do Not abuse, mutilate or short circuit the battery. Do Not overcharge. Incompatible with acidic materials, and DO NOT store in the same stacks with Lead-acid batteries.

Incompatibility: Incompatible with acidic materials. Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of cadmium, nickel and potassium oxide.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Cadmium: Human carcinogenic agent, Mutagenic agent, and Reproductively active.
Cobalt: Human carcinogenic agent.
Nickel: Human carcinogenic agent, Mutagenic agent, and Reproductively active.
Potassium hydroxide: Mutagenic agent

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of cadmium, nickel and potassium oxide.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.
Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area.. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA).

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: DO NOT use of finely divided combustibles materials (e.g., sawdust) for cleaning up spills. If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: Recharge batteries IAW methods specified in applicable technical manuals.
DO NOT: Overcharge this battery.
Abuse, mutilate or short circuit the battery.
Drain unless authorized, nor invert or spill.

Hazardous Characteristic Code (HCC): B1
Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., 130F), dry and well ventilated area. Store batteries IAW TM 38-410 HHC B1.
DO NOT: Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.

Smoke and keep batteries away from open flame or heat.
Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:
Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves.
If the battery is burning, leave the area immediately.

Protective Equipment :
Respiratory Protection: During fire fighting firemen should use SCBA.
Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Nickel-cadmium batteries are hazardous waste (HW) (i.e., D002 and D006) under Resource Conservation and Recovery Act (RCRA) regulations. All batteries will be managed IAW equipment TM requirements, and disposal/recycling will be IAW requirements under the Universal Waste Rule (i.e., USEPA regulations), state and local regulations.

2. These batteries should be recycled, if possible. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION: Nickel-cadmium batteries are regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation.
Applicable Regulation: 49 CFR parts 172.101 and 173.159

DOT Proper Shipping Name: Batteries, wet, filled with alkali, *electric storage*
DOT Hazard class: 8
DOT Identification Numbers: UN2795
DOT Packaging Group (PG): III
DOT Label codes: 8

Procedures: Securely package batteries to withstand conditions normal to shipping. Protect batteries against short circuiting. Package and ship IAW DOT regulations.

Special Precautions: Isolate and remove damaged and/or leaking batteries, if possible. Notify local health, safety and environmental agencies.

E-11b. Sealed Ni-Cd Rechargeable Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Rechargeable Sealed Nickel-Cadmium (Ni-Cd) Battery

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer' Identification data may be provided by the user.

Item Identification: **Date:** 5/16/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Nickel-Cadmium (Ni-Cd) battery, Rechargeable Sealed Item Dimensions (inches):
Contract Number:

Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code :
Preparer's Federal Supply Code (CAGE): 81349
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Hazardous Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits(1) ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Cadmium (Cd)[7440-43-9] & compounds	0.002	0.005	(2)	10-30
Nickel (Ni) [7440-02-0] & compounds	0.1	1.0	0.015	15-35
Potassium hydroxide (31%sol. KOH)[1310-58-3]	C 2 (STEL)	---	C 2	2-10
Cobalt (Co)[7440-48-4] & compounds	0.02	0.1	0.05	0.5-2

(1) All values reported in mg/m^3 unless otherwise specified.
(2) Reduce all cadmium (Cd) and Cd-compounds to lowest feasible level.

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item
Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: Do Not abuse, mutilate or short circuit the battery. Do Not overcharge.

Incompatibility: Incompatible with acidic materials. Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of cadmium, nickel and potassium oxide.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Cadmium: Human carcinogenic agent, Mutagenic agent, and Reproductively active.
Cobalt: Human carcinogenic agent.
Nickel: Human carcinogenic agent, Mutagenic agent, and Reproductively active.
Potassium hydroxide: Mutagenic agent

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of cadmium, nickel and potassium oxide.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area.. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA).

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: DO NOT use of finely divided combustibles materials (e.g., sawdust) for cleaning up spills. If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: Recharge batteries IAW methods specified in applicable technical manuals. **DO NOT** over-charge this battery.

DO NOT:
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Attempt to Drain sealed batteries.
- Mix battery types, and replace All batteries at the same time.

Hazardous Characteristic Code (HCC): Z5

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z5.

DO NOT:
- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves and wear eye protective goggles as necessary. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA to protect against toxic fumes.
Skin Protection: Use chemical resistant rubber gloves, and wear eye protective goggles, when cleaning up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate

1. Nickel-cadmium batteries are hazardous waste (HW) (i.e., D002 and D006) under Resource Conservation and Recovery Act (RCRA) regulations. All batteries will be managed IAW equipment TM requirements, and disposal/recycling will be IAW requirements under the Universal Waste Rule (i.e., USEPA regulations), state and local regulations.

2. These batteries should be recycled, if possible. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION: Nickel-cadmium batteries are regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation.

Applicable Regulation: 49 CFR parts 172.101 and 173.159
DOT Proper Shipping Name: Batteries, wet, non-spillable, *electric storage*
DOT Hazard class: 8
DOT Identification Numbers: UN2800
DOT Packaging Group (PG): III
DOT Label codes: 8

Procedures: Securely package batteries to withstand conditions normal to shipping. Protect batteries against short circuiting. Package and ship IAW DOT regulations.

E-12. Nickel-Metal Hydride Rechargeable Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Nickel-Metal hydride (NiMH) battery, Rechargeable sealed

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 1/18/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Nickel-Metal hydride (NiMH) battery, rechargeable sealed Item Dimensions (inches):
Contract Number:
Manufacturer's Identification:
Manufacturer's Name and Address and ZIP code :
Preparer's Federal Supply Code (CAGE): 80063
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Hazardous Components (Chemical Name, (Symbol) and [CAS#])	Exposure Limits(1) ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Nickel (Ni)[7440-02-0] & compounds	0.1	1	0.015	0-40
Cobalt (Co)[7440-48-4] & compounds	0.02	0.1	0.05	3-8
Manganese (Mn)[7439-96-5]	0.2	C 5	1, 3 (STEL)	1-2
Potassium hydroxide (KOH)[1310-58-3]	C 2 (STEL)	---	C 2	3-15

(1) All values reported in mg/m^3 unless otherwise specified.

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Specific Gravity (water=l):
Solubility in Water: pH:

Odor and Appearance: Solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: Do Not abuse, mutilate or short circuit the battery. Do Not overcharge.

Incompatibility: Incompatible with acidic materials. Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of nickel oxide and potassium oxide.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Nickel: Human carcinogenic agent, Mutagenic agent, and Reproductively active.
Cobalt: Human carcinogenic agent.
Potassium hydroxide: Mutagenic agent

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin and Eye Contact: Remove any contaminated clothing as necessary. Flush battery electrolyte from the skin or eye(s) for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of nickel oxide and potassium oxide.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: If fire or explosion occurs when batteries are on charge, shut off power to charger. Fight the fire in a defensive mode, while exiting the area. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA).

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: DO NOT use of finely divided combustibles materials (e.g., sawdust) for cleaning up spills. If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: Recharge batteries IAW methods specified in applicable technical manuals.
DO NOT:
- Overcharge this battery.
- Abuse, mutilate or short circuit the battery.
- Attempt to Drain sealed batteries.

Hazardous Characteristic Code (HCC): Z7
Storage: Store batteries IAW DLAI 4145.11 (TM 38-410), Storage and Care of Hazardous Materials, Chapter 4. Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z7.
DO NOT
- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA.

Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Nickel-Metal hydride batteries are not hazardous waste (HW) under Resource Conservation and Recovery Act (RCRA) regulations. They are HW in the states of AK, CA, MN, RI and WA, which utilize bioassay to characterize HW in addition to RCRA requirements. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW USEPA's requirements under the Universal Waste Rule, state and local regulations.

2. These batteries should be recycled, if possible. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

Regulation: Nickel-metal hydride batteries are "dry batteries" and they are not regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation. They are subject to USDOT 49 CFR 172.102 (a) (1) Special Provision 130 for dry batteries.

Procedures: They must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits.

E-13. Silver Non-Rechargeable Batteries

E-13a. Silver Chloride Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Silver chloride (AgCl) Battery

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 5/25/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Silver chloride (AgCl) Battery Item Dimensions (inches):
Contract Number:

Manufacturer's Identification:
Manufacturer's Name and Address
and ZIP code :
Preparer's Federal Supply Code (CAGE): 81349
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

	Exposure Limits[1]			%
Components	ACGIH	OSHA	NIOSH	by Item
(Chemical Name, (Symbol), & [CAS#])	TLV	PEL	REL	Weight
Zinc (Zn) [7440-66-6][2] & Zinc chloride ($ZnCl_2$) [7646-85-7] & Zinc sulfate ($ZnSO_4$) [7733-02-0]	1, 2 (STEL)	1	1, 2 (STEL)	30-32
Silver (Ag) [7440-22-4][3] & Silver chloride (AgCl) [7783-90-6]	0.01	0.01	0.01	5-6
Lithium chloride (LiCl) [7447-41-8]	---	---	---	1-2

(1) All values reported in mg/m^3 unless otherwise specified.
(2) All zinc and zinc compounds as $ZnCl_2$ CAS 7646-85-7
(3) All silver and silver compounds as Ag CAS 7440-22-4

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of lithium chloride, zinc chloride and zinc oxide.

Hazardous Polymerization: May Occur: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Lithium chloride: Mutagenic data reported, Reproductively Active.
Silver chloride: Mutagenic data reported.
Zinc: Mutagenic data reported.
Zinc chloride: Mutagenic data reported, Reproductively Active.
Zinc sulfate: Mutagenic data reported, Reproductively Active.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of lithium chloride, zinc chloride and zinc oxide.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area.. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA) to protect against hazardous decomposition products.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z7

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z7.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA.

Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Silver batteries are hazardous waste (HW) (i.e., D011) under Resource Conservation and Recovery Act (RCRA) regulations. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations.

2. These batteries should be recycled, if possible. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

Regulation: Silver chloride batteries are "dry batteries" and they are not regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation. They are subject to USDOT 49 CFR 172.102 (a) (1) Special Provision 130 for dry batteries.

Procedures: They must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits.

E-13b. Silver Oxide Non-Rechargeable Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Silver oxide (Ag_2O) Battery

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification: **Date:** 6/3/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Silver oxide (Ag_2O) Battery Item Dimensions (inches):
Contract Number:

Manufacturer's Identification:
Manufacturer's Name and Address
and ZIP code :
Preparer's Federal Supply Code (CAGE): 81349
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Hazardous Components[2] (Chemical Name, (Symbol), & [CAS#])	Exposure Limits[1] ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Zinc (Zn) [7440-66-6][2]	2, 10 (STEL)	5	5, 10 (STEL)	10-40
Silver oxide (Ag_2O) [20667-12-3]	0.01	0.01	0.01	10-35
Potassium hydroxide (KOH) [1310-58-3]	C 2 (STEL)	---	C 2	3-8
Graphite (C) [7782-42-5]	2	5	---	1-5
Manganese dioxide (MnO_2) [1313-13-9][3]	0.2	C 5	1, 3 (STEL)	1-5
Mercury (Hg) [7439-97-9]	0.025 (skin)	C 0.1	0.05(skin)	0.3-1

(1) All values reported in mg/m^3 unless otherwise specified.
(2) As Zinc oxide (ZnO) CAS 1314-13-2
(3) As Manganese compounds CAS 7939-96-5

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: Solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of mercury, potassium, silver oxide, and zinc oxide.

Hazardous Polymerization: Will not occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Graphite: Reproductively active.
Manganese dioxide: Reproductively active.
Mercury: Mutagenic data reported; Reproductively active.
Potassium hydroxide: Mutagenic data reported.
Zinc: Mutagenic data reported.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of potassium oxide, silver oxide, and zinc oxide.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area.. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA) to protect against hazardous decomposition products.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves and non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z7

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z7.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA.

Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Silver oxide batteries are hazardous waste (HW) (i.e., D011) under Resource Conservation and Recovery Act (RCRA) regulations. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations.

2. These batteries should be recycled, if possible. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

Regulation: Silver oxide batteries are "dry batteries" and they are not regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation. They are subject to USDOT 49 CFR 172.102 (a) (1) Special Provision 130 for dry batteries.

Procedures: They must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits.

E-14. Thermal Non-Rechargeable Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Thermal (THR) battery

1. PRODUCT AND MANUFACTURER:*

***Note:**

This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided by the user.

Item Identification:
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Thermal (THR) battery Item Dimensions (inches):
Contract Number:

Manufacturer's Identification:
Manufacturer's Name and Address
and ZIP code :
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Hazardous Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits[1] ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Calcium chromate (CaCrO4)[13765-19-0]	0.001[2]	C 0.1[3]	0.1[4]	1-10
Asbestos [1332-21-4]	0.1 fb/cc	0.1 fb/cc	0.1 fb/cc	0.1-1

(1) All values reported in mg/m^3 unless otherwise specified.
(2) as Cr
(3) as CrO3
(4) Cr(VI)

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item
Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Specific Gravity (water=l):
Solubility in Water: pH:
Odor and Appearance:

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products:

WARNING

When activiated, THR battery temperatures can exceed 500F.

When exposed to extreme heat/fire, the internal pyrothechnic material may ignite.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:
Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Asbestos and calcium chromate: Human carcinogenic agent.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation:

Skin Contact:

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of potassium chlorides and potassium oxides.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area.. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA).

8. ACCIDENTAL RELEASE MEASURES:

Small Spill:

9. HANDLING AND STORAGE:

Handling: DO NOT:
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery.

Hazardous Characteristic Code: Z1
Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area.

DO NOT:
- Store batteries in direct sunlight or under hot conditions.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in the same stacks with hazardous materials.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is burning, leave the area immediately.

Protective Equipment :
Respiratory Protection: During fire fighting firemen should use SCBA.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method:

WARNING

When activiated, THR battery temperatures can exceed 500F

1. Thermal batteries should be discharge (i.e., deactivated) IAW Appendix F of TB 43-0134 prior to disposal.

2. Thermal batteries are hazardous waste (HW) (i.e., D007) under Resource Conservation and Recovery Act (RCRA) regulations. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations.

3. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

Regulation: Thermal batteries are “dry batteries” and they are not regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation. They are subject to USDOT 49 CFR 172.102 (a) (1) Special Provision 130 for dry batteries.

Procedures: They must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits. Protect batteries terminals of electrically fired THR batteries against receiving an induced electrical current, which could inadvertently activate the battery. Protect the firing and safety pins of mechanically fired THR batteries from inadvertent removal, which could activate the battery.

E-15. Zinc-Air Non rechargeable Batteries

CECOM Life Cycle Management Command (CECOM LCMC)
Material Safety Data Sheet
Zinc-Air Battery

1. PRODUCT AND MANUFACTURER:*

***Note:** This is a generic MSDS. Specific Item and Manufacturer's Identification data may be provided

Item Identification: **Date:** 5/23/2005
National Stock Number:
Type Number: Weight of Item (pounds):
Common Name: Zinc-Air Battery Item Dimensions (inches):
Contract Number:

Manufacturer's Identification:
Manufacturer's Name and Address
and ZIP code :
Preparer's Federal Supply Code (CAGE): 81349
Preparer: USA CECOM Life Cycle Management Command
Directorate for Safety
ATTN: AMSEL-SF-SI
Ft. Monmouth, New Jersey 07703-5024
Emergency & Information telephone numbers: COMM: 732-427-7445, DSN: 987-7445
800-793-4093

2. COMPOSITION OF ITEM:

Hazardous Components (Chemical Name, (Symbol), & [CAS#])	Exposure Limits(1) ACGIH TLV	OSHA PEL	NIOSH REL	% by Item Weight
Zinc (Zn) [7440-66-6](2)	5, 10 (STEL)	5	5, 10 (STEL)	30-45
Potassium hydroxide (KOH) [1310-58-3]	C 2 (STEL)	---	C 2	3-12
Manganese dioxide (MnO_2)[1313-13-9](3)	0.2	C 5	1, 3 (STEL)	1-2
Nickel (Ni) [7440-02-0]	0.1	1.0	0.015	1-5
Copper (Cu) [7440-50-8]	0.2	1	1	1-5
Graphite (C) [7440-44-0](4)	2	5	2.5	1-5

(1) All values reported in mg/m^3 unless otherwise specified.
(2) As zinc oxide (ZnO) CAS 1314-13-2
(3) As manganese compounds CAS 7439-96-5
(4) As graphite CAS 7782-42-5

3. PHYSICAL AND CHEMICAL PROPERTIES: N/A for item

Boiling Point: Melting Point:
Vapor Pressure (mmHg): Vapor Density (Air=1):
Evaporation Rate (butyl acetate=1): Solubility in Water:
Specific Gravity (water=l): pH:

Odor and Appearance: solid object

4. STABILITY AND REACTIVITY:

Chemical Stability: Stable: X

Conditions to avoid: DO NOT attempt to recharge this battery. Do Not abuse, mutilate or short circuit the battery.

Incompatibility: Store in separate stacks from hazardous materials.

Hazardous Decomposition Products: When exposed to extreme heat/fire batteries may rupture leaking corrosive material and/or emit toxic fumes. Burning batteries may emit toxic fumes of potassium oxide and zinc oxide.

Hazardous Polymerization: Will not Occur: X

5. HEALTH HAZARD IDENTIFICATION:

Emergency Overview (including **Signs** and **Symptoms, Route(s) of Entry,** etc.)**:**
Intact batteries present no specific hazards.

Acute Health Hazards (e.g., Inhalation, Eye Contact, Skin Contact, Ingestion, etc.)**:**
Burning batteries: AVOID inhalation of toxic fumes. Burning batteries emit toxic fumes, which are irritating to the lungs.
Leaking batteries: AVOID exposure to leaking electrolyte, it can cause severe irritation and/or damage to the skin, mucous membrane or eyes.

Chronic Health Effects (e.g., Carcinogenicity, Teratology, Reproduction, Mutagenicity, etc.)**:**
Copper: Reproductively Active
Graphite: Reproductively Active
Manganese dioxide: Reproductively active.
Nickel: Human carcinogenic agent, Mutagenic agent, and Reproductively active.
Potassium hydroxide: Mutagenic data reported.
Zinc: Mutagenic data reported.

Medical Conditions Generally Aggravated by Exposure: None.

6. FIRST AID MEASURES:

Inhalation: If battery is burning, leave the area immediately. If exposed to fumes, seek medical attention promptly.

Skin Contact: If battery electrolyte leaks on to the skin flush the affected area for at least 15 minutes with clean water. DO NOT attempt to neutralize. Seek medical attention promptly.

7. FIRE FIGHTING and EXPLOSION HAZARD DATA:

Flammable Properties: N/A

Flammable Limits: N/A

Hazardous Combustion Products: Burning batteries may emit toxic fumes of potassium oxide and zinc oxide.

Extinguishing Media: Carbon dioxide (CO_2) or dry chemical fire extinguisher, 10-B:C.

Fire Fighting Instructions:

Personnel: Fight the fire in a defensive mode, while exiting the area. When using a CO_2 fire extinguisher, DO NOT re-enter the area until it has been thoroughly ventilated (i.e., purged) of the CO_2 extinguishing agent.

Firefighters: Use a self-contained breathing apparatus (SCBA) to protect against hazardous decomposition products.

8. ACCIDENTAL RELEASE MEASURES:

Small Spill: If batteries show signs of leaking, AVOID skin or eye contact with the material leaking from the battery. Use chemical resistant rubber gloves, wear eye protective goggles, and use non-flammable absorbent materials for clean-up. Coordinate disposition with the Installation Environmental Office.

9. HANDLING AND STORAGE:

Handling: DO NOT:

- Mix battery types, and replace All batteries at the same time.
- Attempt to recharge this battery.
- Abuse, mutilate or short circuit the battery, and always install it with proper polarity.
- Carry batteries loose in a pocket or bag.

Hazardous Characteristic Code (HCC): Z7

Storage: Gain approval for storage areas from the Installation Fire Department. Store batteries in a cool (i.e., <130° F), dry and well ventilated area. Store batteries IAW TM 38-410 HCC Z7.

DO NOT:

- Store batteries in direct sunlight or under hot conditions.
- Store unpackaged batteries or cells to Protect Against short circuiting.
- Smoke and keep batteries away from open flame or heat.
- Store batteries in office areas, or other areas where personnel congregate.

Work/Hygienic Practices: Thoroughly wash hands after cleaning-up a battery spill (i.e., leaking or venting batteries). NO eating, drinking or smoking in battery storage areas.

10. EXPOSURE CONTROL/PERSONAL PROTECTION EQUIPMENT:

Engineering Controls:

Special: If the battery is damaged and leaking, protect hands with chemical resistant rubber gloves. If the battery is burning, leave the area immediately.

Protective Equipment :

Respiratory Protection: During fire fighting firemen should use SCBA.

Skin Protection: Use chemical resistant rubber gloves, when cleaning-up leaking batteries.

11. DISPOSAL CONSIDERATIONS/ECOLOGICAL INFORMATION:

Waste Disposal Method: DO NOT incinerate.

1. Zinc-air batteries are not hazardous waste (HW) under Resource Conservation and Recovery Act (RCRA) regulations. All batteries will be managed IAW equipment TM requirements, and disposal will be IAW requirements under the Universal Waste Rule (USEPA), state and local regulations.

2. Coordinate battery disposition and disposal with the Installation Environmental Office and the servicing Defense Reutilization and Marketing Office.

12. TRANSPORTATION INFORMATION:

Regulation: Zinc-air batteries are "dry batteries" and they are not regulated under the federal hazardous materials provisions of 49 Code of Federal Regulations (CFR) for transportation. They are subject to USDOT 49 CFR 172.102 (a) (1) Special Provision 130 for dry batteries.

Procedures: They must be securely packaged to withstand conditions normal to shipping and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits.

APPENDIX F Deactivation of Thermal (THR) Batteries

F-1. Purpose

To provide a method to ensure the deactivation of CECOM managed THR batteries prior to disposition and disposal.

F-2. Equipment

The materials, equipment and tools listed below are suggested to facilitate the required deactivation prior to any disposition and disposal actions. Any other suitable equivalent items are acceptable.

a. Necessary hand tools are contained in tool kit TK-101, NSN 5180-00-064-5178.
b. Any 24 vdc power supply capable of supplying five amps is adequaW e.g., two automotive rAn batteries in senes, jeep ignition system, etc.
c. Concrete block, brick or other fireproof material.
d Wire, uninsulated, 16 AWG or larger, as needed.
e. 12 foot wire, in . sfilated twin lead, 18 AWG or Larger.
f. 10 foot lanyards, parachute cord or twine.
g. **Heat protecdve** gloves, NSN 8415-01-092-3910, SOS: S9T.
h. Two small alligator clips with insulating sleeves (nipple) on clips, NSN 5999-00-857-4914, insulating nipple, NSN 5975-00-763-4442.
i. Two battery clips, NSN 5999-00-014-0433.

F-3. Deactivation Methods

a. Mark battery with masking tape. Discoloration of the tape will show that the battery has been fired.

WARNING

When activated, THR battery temperatures can exceed 500 ^{o}F.

b. Place the battery on a safe heat-resistant surface. DO NOT hold or touch the battery during activation (firing).
c. Deactivation.
(1) Mechanical firing of BA-4605AJ and BA-617/1j:
(a) Inspect the unit to determine if the safety cotter pin (fig. F-I) and the firing pin are in place. If both pins are missing, check to see if the striker arm is resting on the primer cap. If both the safety pin and firing pin are missing from the unit, the battery has already been activated.
(b) If both the cotter pin and stainless steel wire pin are still in place, the unit has NOT been activated. Handle these batteries with care to avoid accidental activation.

(c) Perform the following steps to render the mechanically fired thermal batteries safe:

1. Place the THR battery on a concrete block or other fireproof material as shown in figure F-2. Secure each battery with two pieces of 16 AWG gauge or larger uninsulated wire. Copper, steel baling wire or other uninsulated w= may be used for this purpose.
2. Attach 10 foot lengths of cord to the safety cotter pin and the stainless steel wife firing pin.
3. Straighten any bends or crimps in the cotter pin or the firing pin. DO NOT activate the battery yet.
4. Move all personnel at least 10 feet away.
5. Pull out the safety cotter pin using its lanyard.
6. Pull out the firing pin using its lanyard.
7. Let the battery cool for at least one hour before removing it from its secured position.

(d) Repeat steps I through 7 for the quantity of batteries on hand. If sufficient materials are available, multiple battery activations may be done.

(2) Electrical Faing of BA-629/LJ and BA-630/LJ:

(a) To fire the battery, an electrical current must be applied to pins J and K (the two centrally located pins) of the battery connector. See figure F-3.

(b) Connect a switched power supply to pins J and K as indicated in figure F-3. Fue the battery by closing the switch for no more than three (3) seconds.

F-4. Alternative Deactivation Methods

If unserviceable thermal batteries, when fired, do not beat up or if it cannot be determined whether the battery has been fired, the following procedures are suggested:

a. TUrmal Treatment. Thermally treat the batteries in order to ignite the pyrotechnic within the battery. Perform this treatment in pans to prevent any ground contamination and to facilitate collection of the residue. This procedure is ther-

mal treatment of hazardous waste (Title 40, Parts 260 and 270) and requires a permit. Coordinate with and obtain concurrence from your local Installation Environmental Coordinator (IEO) for the installation or facility before conducting this procedure.

b. Explosive Ordnance Disposal (EOD). This method is by open detonation (OD) in accordance with AMC Regulation 7554. Request assistance for this action from the local servicing EOD Control Center or EOD Activity. The EOD tearn will ascertain whether it is appropriate for them to conduct this procedure.

F-5. Disposition

The deactivated battery should be disposed via the servicing DRMO, or via local coniract; see paragraph 2-7. Activities MUST certify that THR batteries have been deactivated prior to disposition and disposal actions. If the user does not know or cannot demonstrate that the battery has been deactivated, it must be assumed that the battery still contains "live" pyrotechnic material.

WARNING

DO NOT package any battery if it is hot/ warm. Only package batteries when they are cool to the touch.

a. After firing, allow the deactivated battery to completely cool down before packaging (at least one hour), and ship for disposition and disposal. Coordination with the local
Installation Transportation Office (ITO) is recommended to ensure compliance with local packaging and transportation regulations.

b. Deactivated THR batteries and THR batteries contain
chromates and are classified as hazardous waste (HW) with
an EPA HW number of D007 for chromium.

APPENDIX G Battery Toxicity Data for Nickel-Metal Hydride and Lithium-Ion Military Batteries

G-1 Purpose

This study was designed to provide the data necessary to allow CECOM LCMC to comply with State and Federal for the disposal of solid and hazardous wastes. The study was conducted by the Tennessee Valley Authority Water Management Laboratories in 1998 and reported May 5,1998. The Toxic Characteristic Leachate Procedure (TCLP) was performed to determinine if the spent battery material leacheate exceeded any of the maximum contaminant levels for TC metals and volatile organics. Other selected inorganics including Copper, Beryllium, Nickel, Tin, Zinc, Hexavalent Chromium and Cyanide are determined to assess the potential toxicity of these contaminants.

Bio-toxicity assays were performed to evaluate the potential for toxicity to aquatic organisms. 96 hour acute toxicity test using C_1 Daphnia and Flathead minnows assess the toxic effect of constituents dissolved in the SPLP leachate on sensitive aquatic species.

G-2 Methodology

Solid waste in the form of two kinds of spent re-chargeable batteries were evaluated using USEPA SW 846 methods for chemical and physical characterization. Methods1311 (TCLP) and 1312 (SPLP) both require particlesize reduction of waste material. The batteries were dismantled and reduced into particles capable of passing through a 9.5 mm sieve. Batteries for volatiles by Zero Headspace Extraction (ZHE) were maintained at 4 ^{o}C before, during, and after particle size reduction. Extractions were performed in accordance with the required method on seven replicates of each battery type.

Leachates for the Bio-toxicity tests were prepared for each battery type using method 1312 (SPLP) modified by using the organism nutrient media as the leaching fluid. The data is presented on the following pages.

TCLP Inorganics
Results

Li Ion Battery TCLP LEACHATE REPLICATES
mg/L

	Ba	Cr	Cr+6	Pb	Ag	As	Se	Cd	Hg	Cu	Ni	Zn	Be	Sn	Cyanide
ECHE ID															
98/02260	0.38	0.08	< 0.01	0.74	< 0.01	< 0.10	< 0.10	0.02	< 0.002	0.05	1.50	1.30	0.004	< 0.05	< 0.05
98/02261	0.91	0.55	< 0.01	0.59	< 0.01	< 0.10	< 0.10	0.05	< 0.002	0.46	2.00	1.50	< 0.001	0.10	< 0.05
98/02262	0.12	< 0.05	< 0.01	0.77	< 0.01	< 0.10	< 0.10	< .005	< 0.002	< 0.01	3.90	0.14	0.002	0.08	< 0.05
98/02263	0.32	< 0.05	< 0.01	0.28	< 0.01	< 0.10	< 0.10	0.01	< 0.002	0.13	1.40	3.40	0.002	0.08	< 0.05
98/02264	0.13	0.61	0.01	1.00	< 0.01	< 0.10	< 0.10	0.04	< 0.002	0.98	10.00	4.90	0.004	0.65	< 0.05
98/02265	0.22	0.07	< 0.01	0.63	< 0.01	< 0.10	< 0.10	0.02	< 0.002	0.28	4.50	4.40	0.001	0.16	< 0.05
98/02266	0.17	0.45	< 0.01	1.20	< 0.01	< 0.10	< 0.10	0.04	< 0.002	1.80	8.80	0.85	0.005	0.72	< 0.05
TC MCL	100.00	5.00	5.00	5.00	5.00	5.00	1.00	1.00	0.20	NA	NA	NA	NA	NA	NA
mean	0.32	0.35	0.01	0.74	< 0.01	< 0.10	< 0.10	0.03	< 0.002	0.58	4.63	2.38	0.003	0.39	< 0.05
std dev	0.28	0.26	0.00	0.30	0.00	0.00	0.00	0.02	0.00	0.59	3.47	1.86	0.001	0.36	0.00

Ni-metal hydride Battery TCLP LEACHATE REPLICATES
mg/L

	Ba	Cr	Cr+6	Pb	Ag	As	Se	Cd	Hg	Cu	Ni	Zn	Be	Sn	Cyanide
ECHE ID															
98/02267	0.66	0.08	< 0.01	1.20	< 0.01	< 0.10	< 0.10	< 0.005	< 0.002	0.09	750.00	12.00	0.058	< 0.05	< 0.05
98/02268	0.93	0.05	0.02	1.20	< 0.01	< 0.10	< 0.10	< 0.005	< 0.002	0.11	530.00	7.20	0.069	< 0.05	< 0.05
98/02269	0.63	0.10	0.02	1.50	< 0.01	< 0.10	< 0.10	0.01	< 0.002	0.12	940.00	15.00	0.066	< 0.05	< 0.05
98/02270	0.61	0.12	< 0.01	1.30	< 0.01	< 0.10	< 0.10	< 0.005	< 0.002	0.08	860.00	15.00	0.066	< 0.05	< 0.05
98/02271	0.57	0.09	< 0.01	1.50	< 0.01	< 0.10	< 0.10	0.01	< 0.002	0.11	950.00	17.00	0.060	< 0.05	< 0.05
98/02272	0.62	0.13	0.03	1.60	< 0.01	< 0.10	< 0.10	0.01	< 0.002	0.18	110.00	0.97	0.100	< 0.05	< 0.05
98/02273	0.10	0.18	< 0.01	2.20	< 0.01	< 0.10	< 0.10	0.03	< 0.002	0.16	1700.00	36.00	0.100	< 0.05	< 0.05
TC MCL	100.00	5.00	5.00	5.00	5.00	5.00	1.00	1.00	0.20	NA	NA	NA	NA	NA	NA
mean	0.63	0.11	0.02	1.50	< 0.01	< 0.10	< 0.10	0.01	< 0.002	0.12	834.29	14.74	0.060	< 0.05	< 0.05
std dev	0.28	0.04	0.00	0.35	0.00	0.00	0.00	0.01	0.00	0.04	482.87	10.89	0.017	0.00	0.00

TC MCL= Toxicity Characteristic Maximum Contaminant Level

TCLP Volatile Organics Results

Li Ion Battery TCLP LEACHATE REPLICATES Ni-metal hydride Battery TCLP LEACHATE REPLICATES
mg/L

	Benzene	Carbon tetrachloride	Chloro benzene	Chloroform	1,2-Dichloro ethane	1,1-Dichloro ethylene	Methyl Ethyl Ketone	Tetrachloro ethylene	Trichloro ethylene	Vinyl Chloride
ECHE ID										
98/02260	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02261	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02262	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02263	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02264	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02265	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02266	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
TC MCL	0.50	0.50	100.00	6.00	0.50	0.70	200.00	0.70	0.50	0.20
mean	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
std dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Ni-metal hydride Battery TCLP LEACHATE REPLICATES
mg/L

	Benzene	Carbon tetrachloride	Chloro benzene	Chloroform	1,2-Dichloro ethane	1,1-Dichloro ethylene	Methyl Ethyl Ketone	Tetrachloro ethylene	Trichloro ethylene	Vinyl Chloride
ECHE ID										
98/02267	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02268	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02269	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02270	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02271	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02272	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
98/02273	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
TC MCL	0.50	0.50	100.00	6.00	0.50	0.70	200.00	0.70	0.50	0.20
mean	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
std dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TC MCL= Toxicity Characteristic Maximum Contaminant Level

3.0 RESULTS

3.1 Fathead Minnows

Observed survival and calculated LC_{50} endpoints for each battery type are summarized below:

	Survival				
	2-hour	24-hour	48-hour	72-hour	96-hour
Control	100	100	100	100	100
pH adjusted Control	100	100	100	100	100
Lithium Battery					
1.0%	100	100	100	100	100
6.25%	100	100	100	100	100
25.0%	100	10	0	0	0
50.0%	100	0	0	0	0
75.0%	100	0	0	0	0
100.0%	100	0	0	0	0
Nickel Battery					
1.0%	100	100	100	100	100
6.25%	100	100	100	100	100
25.0%	100	100	100	100	100
50.0%	100	90	90	90	90
75.0%	100	5	5	5	5
100.0%	100	0	0	0	0
Unadjusted pH	0	0	0	0	0
Blank	100	100	100	100	100

	LC_{50}			
	24-hour	48-hour	72-hour	96-hour
Lithium Battery		12.50	12.50	12.50
95% C.I.		NA	NA	NA
Nickel Battery	58.98	58.98	58.98	58.98
95% C.I.	(54.38-63.96)	(54.38-63.96)	(54.38-63.96)	(54.38-63.96)

3.2 Daphnids

Observed survival and calculated LC_{50} endpoints for each battery type are summarized below:

	Survival				
	2-hour	24-hour	48-hour	72-hour	96-hour
Control	100	100	100	100	100
pH adjusted Control	100	100	100	100	100
Lithium Battery					
1.0%	100	100	100	100	100
6.25%	100	0	0	0	0
25.0%	100	0	0	0	0
50.0%	100	0	0	0	0
75.0%	100	0	0	0	0
100.0%	60	0	0	0	0
Nickel Battery					
1.0%	100	100	100	100	100
6.25%	100	100	100	100	100
25.0%	100	100	100	95	95
50.0%	100	45	0	0	0
75.0%	75	0	0	0	0
100.0%	0	0	0	0	0
Unadjusted pH	0	0	0	0	0
Blank	100	100	100	100	100

	LC_{50}			
	24-hour	48-hour	72-hour	96-hour
Lithium Battery	2.50	2.50	2.50	2.50
95% C.I.	NA	NA	NA	NA
Nickel Battery			33.56	33.56
95% C.I.			(30.33-37.14)	(30.33-37.14)

APPENDIX H Battery Toxicity Data for Selected Military Batteries,

H-1. Purpose

To provide toxicity data for identification of hazardous waste characteristics associated with selected military batteries.

H-2. Method

The data from the source study represents findings from two basic analytical approaches.

a. Federal Regulations: Under federal regulations, 40 CFR Part 261, Appendix II-Method 13 11 Toxic Characteristic Leaching Procedure (TCLP) was employed to determine toxicity in accordance with this federal regulation. This is a chemical dependant test. The specific chemical at or above its specified regulatory level must be present for the sample to be considered toxic under this criteria. Regulatory levels of target chemicals are reported in milligrams/liter (mg/L).

b. State Bioassay Regulations. Some states utilize a bioassay in addition to TCLP to identify hazardous wastes. Live organisms are.exposed to concentrations of test materials in order to determine toxicity. Typically the method requires a ninety-six hour (96-h) LC50 acute toxicity test be preformed on organisms at various concentrations of sample materials. The 96-h LC50 is that concentration of sample material, reported in mg/L, which kills fifty (50) percent of the test organisms after 96-hours of exposure is to be standard used to gauge toxicity is a value of less than 500 mg/L. Material exhibiting a value of less than 500 mg/L is considered toxic under this method.

c. Batteries Sampled., A representative sample of six battery classes procured under US Army Communications-Electrunics Command (USA CECOM) battery contracts were selected. Each sample consisted of seven subsamples (n--7) for each batteq type. They are:

(1) Alkaline (ALK., BA-3517/Ll). (2) Carbon-Zinc (LeClanche (LCE), BA-2/U). (3) Magnesium(MG, BA-4386/U). (4) Lithium-Manganese Dioxide (Li-MnO2, BA-537VU). (5) Lithium-Sulfur Dioxide (Li-SO2, BA-55981U). (6) Lithium-Thionyl Chloride (Li-SOC12, BA- 65981U). *d Sample Conditioning:*

(1) AL& LCE, MG and Li-MnO2 batteries 50% discharged prior to testing to simulate field disposal field conditions.

(2) Li-SO2 and Li-SOC12 batteries are designed with a built-in complete discharge device (CDD). User's instructions require complete discharge prior to disposal. Samples of these batteries *were totally discharged prior to testing.

H-3. Data

Table H-I. Summary of TCLP Results by Battery Chemical Type

	Mean (mg/L)						
Battery Chemistry Type:	ALK	LCE	MG	Li-MnO2	Li-S02	Li-SOC12	TCLP Regulatory Limit (mg/L)
Constituent							
Arsenic	0.053	0.190	0.15	0.062	<0.050	0.10	5.0
Barium	<0.10	0.18	0.88	<0.10	<0.10	0.15	100.0
Cadmium	<0.0030	0.052	0.0033	<0.0030	0.017	<0.0030	1.0
Chromium	<0.010	0.010	9.12	0.012	<0.010	4.23	5.0
Lead	<0.050	0.186	<0.050	<0.050	<0.050	<0.050	5.0
Mercury	0.033	0.040	N/A4	N/A4	NIA4	N/A4	0.20
Selenium	<0.050	0.058	0.088	<0.050	<0.050	0.082	1.0
Silver	<0.010	0.036	<0.010	<0.010	<0.010	<0.010	5.0

Notes:

1. n=7 for each Battery Chemistry Type.
2. Mean value exceeds regulatory limit.
3. 95% confidence limit exceeds regulatory limit.
4. Lithium and Magnesium batteries do not contain mercury.

b. Bioassay data.

Table H-2. Summary of Bioassay Results by Battery Chemistry 96-h LC_{50} In mg/L

Battery	Fathead minnow	Ceriodaphnia
MG	22, 928	18, 067
Li-SO2	691	702
Li-MnO2	288	73
ALK	246	51
LCE	See belowl	See below1
Li-SOC12	See helow2	See below2

Notes:

1. Preliminary Ceriodaphnia 48-h LC_{50} test results indicate the battery would be classified as toxic (LC5o=289 mg/L).
2. Preliminary Ceriodaphnia 48-h LC_{50} test results indicate the battery would be classified as toxic (LC5o <2.5 mg/L).

1. Report, Martin Marietta Energy Systems Inc., Contract DE-AC05-840R21400, January, 1992, Subject: Toxicity Study of Selected Military Batteries.

H-4. Results

The results reported at Tables H-1 and H-2 indicate that:

a. Partially discharged MG and completely discharged LiSOC12 batteries are hazardous waste under RCRA regulations because they exceed regulatory limits for chromium. They are classified with an EPA Hazardous Waste # of D007.

b. ALK and Li-MnO2 batteries exhibited acute toxic- 'ty for two organism (Table H-2), with values less than 500 mg/L, for each 96-h acute LC5iy toidcity test series. LCE and Li SOC12 batteries exhibited toxicity durIng preliminary 48-hour acute LC50 toxicity testing, and no further testing was required.

H-5

". Discussion i

a. MG and U-SOC12 batteries are hazardous waste under RCRA regulations. It must be remembered that this is a chemically dependent test. ALK, LCE, Li-MnO2 and LiSOC12 batteries exhibited acute biotoxicity. Bioassay testing is chemically independent.

b. The philosophical difference between chemically dependent and chemically independent tests cannot be resolved here, and is beyond the scope of the TB. Ile tests provide two different measures of toxicity. Federal and State regulations must be met when disposing solid wastes. "Me cbaracterization of batteries for waste disposal depends on the location of the installation and applicable regulations.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE 30 August 2002
TO: *(Forward to proponent of publication or form) (Include ZIP Code)* Commander, US Army CECOM LCMC ATTN: AMSEL-LC-LEO-E-ED Fort Monmouth, NJ 07703-5006	**FROM:** *(Activity and location) (Include ZIP Code)* Jane Q. Doe, SFC 1234 Any Street Anytown, AL 34565	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 11-1234-567-14	16 Sep 2001	Operator, Field and Sustainment Support Maintenance Manual for Radio, AN/ABC-123

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON
1	WP0005 PG 3		2			Test or Correctiive Action column should identify a different WP number.

EXAMPLE

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Jane Q. Doe, SFC	123-4567	

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	**DATE**

PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	**DATE**

PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

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PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	**DATE**

PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	**DATE**

PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM NUMBER	DATE	TITLE

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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
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