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## 1. Purpose

University of Alaska Anchorage (UAA) employees, student workers, faculty, staff, and outside contractors who use batteries during their work functions, risk incidents which could result in serious injury. The hazards associated with battery handling can be substantially reduced by using the equipment properly and taking precautions. This program for Battery Handling and Storage is intended to ensure workers are knowledgeable in the hazards when using batteries and the steps to be taken to protect themselves and others.

## 2. Objective

UAA, in its continuing effort to provide employees with safe, healthful working conditions, and to comply with the Occupational Safety and Health Act is implementing the following program for Battery Handling and Storage to protect people working at the University, by helping employees, student workers, faculty, staff, and outside contractors better understand the associated hazards.

## 3. Scope

This program applies to UAA employees, student employees, faculty, staff, and outside contractors working on UAA equipment who work with or are around batteries

## 4. Definitions

Alkaline Battery – Most common type of household use battery accounting for 80% of manufactured batteries in the US consisting of types AA, AAA, C, D and 9V. This type of batterie is dependent on a reaction between zinc and manganese dioxide. Alkaline batteries can be disposed of in the regular trash.

Battery - the most common power source for basic handheld devices to large scale industrial applications. A battery can be defined as; it is a combination of one or more electrochemical cells that can convert stored chemical energy into electrical energy

Battery Pack - a set of any number of (preferably) identical batteries or individual battery cells. They may be configured in a series, parallel or a mixture of both to deliver the desired voltage, capacity, or power density

Dry Cell Battery - an electric cell in which the electrolyte is absorbed in a solid to form a paste, preventing spillage

Lantern-type 6-volt batteries - a lantern battery is a rectangular battery, typically an alkaline or zinc-carbon primary battery, used primarily in flashlights or lanterns

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Lithium Battery (Li-ion) - A type of rechargeable battery in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging. Lithium-ion batteries are common in-home electronics. They are one of the most popular types of rechargeable batteries for portable electronics, with a high energy density, tiny memory effect and low self-discharge. ~~Li~~Li-ion batteries are also growing in popularity for military, battery electric vehicle and aerospace applications. Li-ion batteries must be recycled by EHS/RM approved vendor

Lithium Polymer Battery (LiPo) – also a lithium-ion polymer battery is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of a liquid electrolyte. High conductivity semisolid (gel) polymers form this electrolyte

Lead Acid Batteries - Lead Acid batteries are widely used in automobiles, inverters, backup power systems etc. Unlike tubular and maintenance free batteries, Lead Acid batteries require proper care and maintenance to prolong its life. The Lead Acid battery consists of a series of plates kept immersed in sulfuric acid solution

Nickel – Cadmium Battery (NiCad) - Type of rechargeable battery using nickel oxide hydroxide and metallic cadmium as electrodes. Sealed NiCad cells were at one time widely used in portable power tools, photography equipment, flashlights, emergency lighting, and portable electronic devices. Nicad batteries must be recycled by EHS/RM approved vendor

Wet Cell Battery - a battery that contains a liquid electrolyte. Most modern batteries are dry cell or have a paste electrolyte. Car batteries have a liquid electrolyte. They are inconvenient because the electrolyte can be spilled

## 5. Authority and Responsibilities

In addition to the roles and responsibilities outlined in the UAA Training Program, the following apply to the Battery Handling and Storage.

### EHS/RM

- Works with departments to determine proper battery selection, stocking and safe-work practices unique to each department's work activities
- Create, track, and/or conduct inspections on battery storage and handling equipment where applicable with this standard

### Supervisor

- Ensure defective, damaged, or prohibited batteries are removed from service and properly disposed of.
- Conduct periodic inspections of battery and battery storage areas in their department to ensure integrity.

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- Assist in the determination of appropriate battery storage and handling equipment.
- Ensure employees are properly trained in this battery handling and storage program and the use of batteries in their work areas.

#### Department Safety Coordinator

- Assist in the determination of defective, damaged, or prohibited batteries and associated storage and handling equipment.
- Conduct periodic inspections of battery use and storage areas in their department to ensure integrity.
- Assist in the determination of safe methods to work with, store and handle batteries.

#### Employees/Student Workers

- Visually inspect batteries prior to every use for defects and damage.
- Alerts department supervisor when batteries or equipment need replacement.
- Identify potential improvements in battery handling and storage equipment and procedures and communicate to the department supervisor.

#### Outside Contractors

- Perform all work in compliance with their company's Battery and Handling Program, which will be reviewed and approved by the EHS/RM department. ~~as approved by the EHS/RM department~~
- If the company does not have a program, they must comply with this program

## **6. Hazards Associated with Battery Handling and Storage**

The following hazards associated with Battery Handling and Storage can lead to personal injury

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or death:

- Ergonomic hazards associated with the weight and handling of batteries.
- Electrical Shock.
- Production of Hydrogen Gas during charging.
- Chemical hazards associated with battery components.
- Fire due to improper installation or storage.
- Contact with sulfuric acid.

## 7. Engineering Controls

Engineering controls are design plans or changes to the working environment to prevent or reduce employee exposure to potential hazards. The following example of engineering controls should be considered in area design to reduce risks associated with battery handling and storage.

- Adequate storage areas with containment to minimize any spills from batteries.
- Locate battery charging stations in areas with adequate ventilation.

## 8. Administrative Controls

Administrative controls are safe work practices and procedures designed to reduce the risks associated with working with batteries. Examples of administrative controls include the following:

- Train employees who work with batteries.
- Routine inspections of batteries to ensure they are in safe working condition.
- Immediate removal of any batteries that are found to be damaged or defective.
- Provide personnel with the proper batteries for their job tasks.
- Provide proper personal protective equipment PPE

## 9. Procedures

The following procedures will be followed when working with batteries.

### General Battery Guidelines

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- Use the correct SIZE and TYPE of battery specified by the specific manufacturer of your device
- Download or contact the manufacturer to get the specific Safety Data Sheet for the battery you are using. Review and understand the hazards of the battery before using, storing or charging
- Check the fire extinguisher in your area to make sure it can extinguish a potential battery fire of the batteries with which you are working
- Use appropriate equipment to load/unload batteries from mobile equipment
- Ensure you are trained in using the loading equipment
- Keep tools and other metallic objects away from uncovered batteries
- Work on batteries requires non-sparking and insulated tools
  - Insulation must be listed for the voltage present
  - Taped wrenches are not listed
- Batteries should never be lifted by the post

#### Battery Charging

- Never charge a battery overnight or unattended
- Use only the charger recommended by the battery manufacturer
- Minimize the storage of combustible materials, such as wood and cardboard, in battery charging areas
- Batteries should be charged on surfaces such as cement, steel, ceramic or stone. Wooden tables, workbenches, paper and carpeted floors are NOT recommended charging surfaces
- Never leave a battery in the charger once it is fully charged. Overcharging batteries will not increase the performance and can lead to damage, such as swelling and rupturing
- Never charge a battery which has been physically dropped or damaged. An unseen fracture in the encasement can cause the battery to catch fire or explode while charging
- Do not smoke in battery charging areas.
- Prevent open flames, sparks or electric arcs in battery charging areas
- Do not strike the sides of the battery with any spark producing item
- Keep tools and other metallic objects away from uncovered batteries

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- Have an ABC dry chemical fire extinguisher in charging areas or readily available

### Battery Shipment

Shipment of batteries is regulated by many government agencies depending on the type of transportation. All batteries must be made safe for handling prior to packing for shipment. U. S. domestic transportation is regulated by the Department of Transportation (DOT). Internationally, air transportation is regulated by the International Air Transport Association (IATA). Maritime transport is controlled by International Maritime Organization (IMO) whose regulations are contained in the International Maritime Dangerous Goods (IMDG) Code. Various weight limits apply to batteries, batteries with equipment, and batteries in equipment for each of passenger and cargo aircraft. All shipments of hazardous materials must comply with packaging regulation.

Contact EHS/RM for assistance with proper battery packaging and shipment.

### Battery Recycling

UAA recycles batteries through General Support Services.

The following types of batteries can be recycled at UAA:

- Alkaline (e.g. found in remote controllers, stereos, cameras, and CD players,
- Lithium/ Lithium-ion (also known as “rechargeable”; e.g. found in laptops, cell phones)
- Nickel cadmium/“wet cell” (e.g. found in aircraft, and solar applications)
- Nickel cadmium/“dry cell” (e.g. found in remote controllers, telephones, and portable radios)
- Lantern-type 6-volt batteries

Check the UAA General Support Services recycling web page for more information

### Specific Battery Types

#### Alkaline Batteries

- In normal conditions alkaline batteries are sealed and pose little risk when handling
- Never refrigerate alkaline batteries. It is a myth that this makes them last longer
- Keep alkaline battery contact surfaces and battery compartment contacts clean by storing them in the packaging that they came in or rub them with a clean pencil eraser

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or a rough cloth before you replace batteries

- Remove alkaline batteries from a device when it is not expected to be in used for several months
- If an alkaline battery is leaking, or has white powder or crystals:
  - Batteries should be removed with chemical gloves and safety glasses
  - Batteries should be placed in a plastic bag, and can be disposed of in the normal trash
  - Equipment with residue can be cleaned with a vinegar and water
  - Always wash hands after handling leaking alkaline batteries

#### Nickel---Cadmium (NiCad) Batteries

- Cadmium used in nickel-cadmium batteries is considered more harmful than lead if ingested or absorbed through the skin.
- Most NiCad batteries are sealed and are safe to handle under normal circumstances.
- If a NiCad battery is open, the casing is cracked or broken the following should be followed:
  - Proper PPE must be used while handling, including chemical resistant gloves, face-shield over safety glasses, and a chemical apron.
  - Do not touch your face nose or eyes while handling.
  - Wash hands thoroughly after handling and removing chemical gloves.
  - Contact EHS/RM for proper disposal of damaged batteries and any clean up material.
- Store used NiCad batteries in a secondary container and label and date them appropriately until they are recycled.

#### Lithium ion Batteries (Li-ion) and Lithium Polymer Batteries (LiPo)

- Cell phones, laptop computers, GPS systems, iPods, and even cars are now using lithium-ion rechargeable battery technology.
- There are several types of lithium batteries. Often one will see LiPo or Li-ion batteries.
- Lithium cells are like any other technology – if they are abused and not used for their intended purpose catastrophic results may occur, such as:

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- first-, second-, and third-degree burns
- respiratory problems
- fires
- explosions

### Lead Acid Batteries

- Wet-cell batteries contain hazardous materials, including lead electrodes and acid in liquid or gel form
- Used batteries may be damaged or missing a cap, so safety glasses and acid-resistant gloves must be worn when handling them to protect from potentially leaking acid, which can severely damage eyes and skin
- Increased ventilation may be necessary when storing or charging large amounts of lead acid batteries
- Missing caps must be replaced immediately, if possible
- Slowly pour concentrated acid into water; do
- not add water into acid
- Use non-metallic containers and funnels
- Use extreme care to avoid spilling or splashing the sulfuric acid solution
- Use self-levelling filler that automatically fills the battery to a predetermined level - never fill cells above the level indicator
- Used lead-acid batteries must be stored:
  - In a designated area, apart from other types of batteries
  - In a single layer (stacking increases the risk of short circuits and acid leaks)
  - With secondary containment that is resistant to acid (such as polyethylene)
  - If the battery will no longer be used and is going to be disposed of the battery may not be stored for no more than a year, within which they must be shipped off-site for recycling
- An eyewash station must be located in the immediate area and be reached within 10 seconds or be 55 feet or less from the point where personnel may get acid in their eyes.

### Battery Acid Spill



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In the event acid is spilled from a lead acid battery the following steps should be followed:

1. Notify other personnel in the area.
2. If material is in eyes or on clothing, remove any affected clothing and rinse affected areas/eyes for 15 minutes in emergency eyewash/shower
3. Neutralize the spill with soda ash or baking soda. Use 1 pound of baking soda to 1 gallon of water
4. The acid reaction is complete when it stops fizzing. Make certain that the acid is neutralized by checking the pH is neutral between 6 and 8
5. Absorb neutralized material onto clay or other absorbent material, if necessary. If the spill is very large, contain the spill with earth or clay dikes
6. Brush under the battery connectors and remove all grime. Rinse the residue from the battery with clean water with a hose
7. Report the incident to your supervisor
8. If the acid is determined to be neutralized, and all free liquid is absorbed, the clean-up material can be bagged up and disposed of in the regular trash, this does NOT include the battery
9. Determine proper disposal of clean-up materials and batteries by contacting EHS/RM for assistance

#### Battery Pack Fabrication

Personnel assembling battery packs should comply with the following recommendations:

- Safety glasses must be worn at all times. All jewelry should be removed so that the cell is not inadvertently shorted.
- Cells received from the factory should remain in their original containers until they are to be assembled into battery packs.
- Cells should not be placed on electrically conductive surfaces. All work surfaces should be constructed with non-conductive materials.
- Do not solder directly to the cell case. Only solder to the solder tabs welded to the case.
- Solder tabs that extend from the case and terminal cap should be insulated.
- Avoid cutting or piercing the insulating shrink wrap on the cells.
- Loose wires should not be stripped until it is time to install a connector. If no connector is used, wire ends should be insulated.

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- Should wire trimming be necessary, only cut one wire at a time.
- All battery packs should be labeled with the appropriate warnings as they appear on the cell label

## 10. Inspections

To ensure batteries at UAA are maintained and stored in a safe condition and workers to not use defective equipment the following inspections are required:

Prior to every use worker's will visually inspect all batteries to ensure they are in proper working condition. Always look for cracks, damage or leaks.

## 11. Training

UAA shall provide a training program for each employee using batteries as necessary.

The program shall enable each employee to recognize hazards related to handling, storing and recharging batteries, and shall train each employee in the procedures to be followed to minimize these hazards.

Retraining shall be provided for each employee as necessary if an accident occurs, new workplace hazards are identified, a near loss incident has occurred, or there is a change in the type of battery or charging system used, so that the employee maintains the understanding and knowledge acquired through compliance with this section.

## 12. Program Evaluation

The Battery Handling and Storage program shall be evaluated on an annual basis utilizing the protocols set forth by EHS/RM. The evaluation team will consist of a department safety coordinator and a designee from EHS/RM. EHS/RM will define the scope of the evaluation. The final report will be developed by the EHS/RM utilizing the information received during the evaluation. The deficiencies determined in the report will be documented and corrective action plans will be developed.

## 13. References

OSHA regulations that apply to batteries safety are included below.

- 29 CFR 1926.441
- 29 CFR 1910.178

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#### 14. Revision History

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0	<u>05/24/2021</u>	Initial Issue		
1				
2				
3				