

**Web Page Appendix H**  
**Lithium Battery Safety Orientation and Training Checklist**  
(Available from [NPS LiPo SOP](#))

**To be completed before laboratory work begins:**

1. **Read and sign Safety Overview (this page). Bring a signed copy to the lab you are working in.**
2. \_\_\_\_\_ (initials): **Read and review Navy Lithium Battery Safety: [TECHMAN S9310-AQ-SAF-010](#)**
3. \_\_\_\_\_ (initials): **Read and review [NPS Standard Operating Procedure “Safety and Usage Procedures for Lithium Polymer Batteries Version 1.4b January 2016”](#)**
4. \_\_\_\_\_ (initials): **Read and review [Capacity Limited Lithium Battery Site Clearance for NPS.](#)**
5. \_\_\_\_\_ (initials): **Read and review [NPS LiPo 300Whr Site Clearance Reissue.](#)**
6. \_\_\_\_\_ (initials): **Read and review [Managing Lithium Batteries.](#)**
7. \_\_\_\_\_ (initials): **Read and review [Acquiring Lithium Batteries.](#)**
8. \_\_\_\_\_ (initials): **Review your project’s Li Battery manufacture specifications and manuals (if any)**
9. \_\_\_\_\_ (initials): **An introduction to the specific lab facilities and equipment by the Lab manager**

**Summary of SOP Procedures:**

(Note: most coin, phone, and laptop batteries are excepted from testing, formal requests, and NPS LiPo battery controls by Chapter 3 of NAVSEA S9310-AQ-SAF-010 Second Revision – however, **all batteries must be marked for SAFETY review at time of purchase to meet the acquisition requirements, and disposed of as Universal Waste in the designated NPS battery buckets**)

\*\*\* **This checklist is a reminder** of NAVSEA S9310-AQ-SAF-010 and the NPS SOP procedures detailed in “Safety and Usage Procedures for Lithium Polymer Batteries Version 1.4a April 2015”. This checklist is **not a substitute for the proper application of all the details in the SOP**, nor will it substitute for completion of the training specified above.

Be aware of danger of battery **ignition**

Be aware of the potential for **swelling** to lead to ignition

Be aware of the **hazards of over-discharging below 3.2V**

**Normal disposal: DO NOT PUNCTURE UNLESS SPECIFICALLY DIRECTED**

- Contact HM representative (project specific who): \_\_\_\_\_, Phone #: \_\_\_\_\_
- Drain to 3.8V/cell or note otherwise to HM representative

**Material criteria hazards requiring disposal:**

- Punctures
- Significant deformation
- Swelling of any one cell
- Total voltage less than 3.2V per cell
- An imbalance exceeding 0.1V after a charge that cannot be balanced per manufactures instruction
- Bare wires that create risk of shorting
- Electrolyte smell
- Unexplained heating
- Pouch discoloration (discoloration of the aluminum layer or the cell case)

**Repair criteria**

- Damage limited to heat-shrink wrapper that does not penetrate any cell
- Bare leads that do not pose a significant risk of shorting

- Damaged connectors leads that do not pose a significant risk of shorting

### **Acquisition**

- Note as SAFETY in NPS purchasing system
- Inspect for material hazards. Deficiency = return. Do not repair new batteries.
- Check charge of each individual cell (3.4V-4.0V) if possible
- Check imbalance not greater than 0.1V
- Designate with unique identifier and date (project specific) and begin Log

**Adding or changing connectors:** See SOP 3.1.3.1-2 for checklist details

### **Repairs**

- Heat shrink can be repaired with electrical tape
- Bared leads can be resoldered and treated with heat shrink one at a time.
- Log repair event

### **Charging**

- Shall not be charged in aircraft or vehicle unless:
  - Battery built in as shipped by manufacturer
  - Battery Management System (BMS) to manage cell charging and balance
- Check temperature as ambient
- Check pack cell count and voltage before recharge (example: 2 cells should be close to 6.4V)
- Only use charger qualified according to manufactures specifications
- On variable chargers check cell count and voltage selected properly– verify cells and voltages match
- For any standalone multicell, charge with a balancer or balancing charger
- Post an attendant
- Maintain standoff of non-attendants and potentially flammable materials
- If not charge rating specified, charge at 1C (one times the capacity)
- If using a balancer, balance per manufacture instructions
- Log duty cycle and charge event

### **Storage**

- For short term (two weeks or less), at least 3.5V/cell
- For longer storage 3.8V-3.9V/cell, inspect voltage every 3 months, recharge if required
- 40-70F (no refrigeration)
- Metal HAZMAT storage cabinet away from combustible materials on ceramic tiles, or...
- A LiPo bag from LiPoGuard, LiPoSafe, LiPoSack, or Dynamite. Bags kept on ceramic tiles. No more than 5 batteries per bag, no more than 100 Watthours per bag.
- Labeled “Lithium Battery Storage Only”
- 4 inches clearance between top of battery and next shelf
- Log storage event

### **Retrieval from storage**

- Inspect for material hazards. Deficiency = dispose
- Check charge of each individual unit (3.2V-4.2V)
- Check imbalance not greater than 0.1V.
- Repair only if no material hazard criteria evident.
- Log events

### **Inventory**

- Log each event – acquisition, duty cycle, crash, repair, charge anomaly, etc

### **Transport**

- 20-150F degrees for transport purposes only
- Sealed hard case, only batteries
- Multiple batteries per case OK, but damaged batteries must have own case for isolation.
- Do not mix charging with transport
- No direct sunlight for extended periods

### Fire Emergency

- Use ABC fire extinguisher for non-battery items
- If charging remove power from charger
- Call emergency services
- Ignition of water quenchable battery – quench with water
- Ignition of non-water quench battery – let the battery ignite to completion
- After fire out, watch smoking area for 15 minutes, if charging disconnect the charger
- Keep in safe place for 24 hours prior to disposing of remains

**Unmanned Aircraft Systems (UAS) Special Procedures:** See Appendix A of NPS SOP

**Multipack Requirements:** See Appendix B of NPS SOP

**Use in Marine Research:** See Appendix G of NPS SOP

**For High Voltage Batteries introduced after 2015:** See Appendix I of NPS SOP

## Safety Program Overview Lithium Battery Safety Program

The Navy's Lithium Battery Safety Program (LBSP) is structured around four steps:

1. Submission of a Safety Data Package by the requesting program manager.
2. Safety Testing of the battery by LBSP approved personnel.
3. Safety Review of the data package and test results by the LBSP's designated technical agents.
4. Approval: formal recommendation, by the LBSP manager, for approval of the proposed battery's use by the requesting program manager.

The NPS Lithium Polymer safety program complies with the Navy Lithium Battery Safety Program. Clearances have been requested and approved only after submitting the above required Safety Data Packages to the LBSP technical agents. On 11 August 2014, "use of lithium ion batteries limited to less than 300 watt-hours during research efforts (unmanned aerial systems (UAS), unmanned underwater vehicles (UUV), and robotics) at the NPS and research operations under their supervision conducted at controlled airspace at shore facilities" was granted by the Naval Ordnance Safety and Security Activity (NOSSA).

Part of this approval was consideration of elements of the President's requesting letter, which cited that participating researchers will receive training on the NPS Lithium Polymer SOP (#3 above) and will be accountable for procedures in that document as well as restrictions delineated in the requested clearance document (#4 above).

This Safety Orientation ensures your acknowledgement of those documents, the Navy LBSP, the NPS LiPo SOP, plus a general review of Lithium Battery Safety to raise your awareness and apply to your research effort.

### Please Complete the Following:

**Having read the safety guidelines above and those contained in the manufactures reference materials, I am fully aware of the Lithium battery safety guidelines of the Navy, NPS, and the laboratory I am working in.**

Name: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Project Supervisor: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**Bring a copy of this document to:**

**NPS Research Safety: POC - Scott Giles, Research Safety Department, x7568, 285 Halligan**

NPS Safety Engineer: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**NPS Safety POC: Scott Giles, Research Safety Department, x7568**