



NAVAL SAFETY COMMAND

SAFETY AWARENESS DISPATCH



SA 23-12

Lithium-Ion Battery Fires

We initiated this dispatch due to the rising concern of lithium battery fires (*“lithium-ion” batteries, to be precise*)¹, particularly in the homes of our service members. With the use of these batteries in cell phones, power tools, laptops, electric bikes, scooters, electric cars, etc., our service members likely own multiple devices containing lithium-ion batteries. These products are generally safe, but when damaged or misused, they pose a fire or explosion hazard that can be especially harmful from gases that can be released and the difficulty in combatting a lithium battery fire. There is limited off-duty data on this subject, as a mishap would only be reported if a severe injury occurred to a service member, but a cursory internet search demonstrates the prevalence of this issue. The following on-duty examples, however, illustrate the importance of using lithium-ion batteries properly, whether at home or on the job.



- How not to respond to a venting battery. While deployed on a ship in a Marine Expeditionary Unit (MEU), a Marine needed to charge several batteries for the following day's mission. He removed the batteries from the container in the vehicle storage area. He brought them to his troop living space to charge overnight (*hardly the place to bring potentially hazardous material*). At 0100, several occupants noticed a burning chemical smell. The Marine checked the batteries and found one was overheating and smoking. He promptly wrapped the battery in a bed sheet and placed it in a paper bag before calling the berthing petty officer to report the issue. (*Hmm; wrapping an overheating device in two sets of flammable material seems entirely logical*). Long story short, the device did not fully ignite, fortunately, and was jettisoned from the ship after it was incorrectly determined not to be hazmat. However, after the incident was resolved, several members of the berthing reported chest pain, eye irritation, and trouble breathing. The NAVSEA manual on lithium battery safety, S9310-AQ-SAF-010 Rev 3, directs that lithium batteries shall not be stored or charged in living spaces and, in the event of a swollen or overheating battery to evacuate the area and call Explosive Ordnance disposal. —*This unit's lack of understanding of policy and lithium-ion battery hazards exposed the team to toxic gases, nearly started a fire in berthing, and resulted in throwing hazmat overboard. Please do better than they did.*
- Improper Storage. After completing operator training with an Otter Unmanned Surface Vehicle (USV), the device was placed in the storage area for the remainder of the day. The next morning, two people entering the storage area found smoke and fire coming from the Otter USV. They were able to put the fire out, but not before it caused \$80,000 of damage to the \$600,000 USV. The investigation concluded a battery caught fire, damaging the system around it. The batteries were not being charged at the time of the fire. Investigators could not identify what caused the fire due to damage, but they did point out that per NAVSEA guidance, the batteries should have been removed from the device and stored separately. The report noted that pre-deployment, post-deployment, and recovery operations checklists provided by the manufacturer were not being filled out and maintained, and there was no Job Qualification/Personnel Qualification Standard (JQR/PQS) or Standard Operating Procedure (SOP) for personnel training on this system. —*Had the unit better implemented JQR/PQS/SOP and relevant checklists, their personnel might have known to remove the batteries when putting their toy away. Commanders and supervisors, this lesson is for you.*
- The Cost of Not Knowing Exactly What You're Buying or How to Use it. A Navy research facility required lithium-ion batteries and was permitted to source them through an other-direct-cost purchase under a specific contract. When the batteries were delivered, the engineer receiving them verified there was no damage and began to charge them. He used sound judgment in monitoring the new batteries as they

¹There is a lengthy explanation of the difference between lithium and lithium-ion batteries, but the short version is that lithium-ion batteries are rechargeable and lithium batteries are single-use (not rechargeable).

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charged, checking the temperature every five minutes until they reached the desired charge after 30 minutes, but other than that he went wrong. He interpreted the batteries' online description as a "direct replacement for lead acid batteries" to mean they could be charged in the same manner (*which they can't*). He used a "Pb charge" (i.e., lead-acid) setting for the batteries. He didn't realize the user manual stated, "never attempt to use NiCd, NiMH, or Pb acid settings with lithium batteries," as they have different charging cycles. The difference in charging is at the end of the cycle, so fortunately, he removed the batteries from the charger before they were fully charged, avoiding a fire/explosion for the moment. Not realizing this first mistake, he moved to his second, placing the batteries on a wooden workbench for overnight storage. The batteries' manual also explicitly stated not to charge or store them on combustible surfaces (*i.e., a wooden bench*). There also happened to be various other flammable materials on and around the workbench (*we imagine you see where this is going*). Several hours after everyone left the building, one battery had a thermal runaway and ignited, causing the other one to do the same and subsequently igniting everything around them (*security cameras observed it*). The post-fire investigation identified the batteries were not certified by a Nationally Recognized Testing Laboratory (NRTL). —We don't know if the thermal runaway resulted from incorrectly charging or some untested defect with the battery. What we do know is the cost of the damage to the building and equipment exceeded one million dollars, all because of two batteries and not understanding basic lithium-ion safety measures.

Key Takeaways

While the above mishaps occurred on duty, the factors that caused them could just as quickly happen at home. Appreciating lithium-ion battery hazards and taking the necessary steps to mitigate them is essential. The naval services have specific requirements for using and handling these items while on duty, (*or at least they should; refer to the "no JQR/PQS/SOP" incident*) but it's a good idea to follow similar procedures at home too. Here is some helpful guidance on lithium-ion battery safety for on or off-duty.

1. **Know what you have.** Be aware of which devices you own contain lithium-ion batteries and make sure you take the safety guidelines and instructions in the manuals seriously. This awareness will help you perform the following steps more effectively.
2. **Charge appropriately.** Always use the correct charger, typically the manufacturer's issued charger. Just because the plug fits doesn't mean it's charging correctly. Monitor what you're charging and unplug once complete.
3. **Store intelligently.** Always store lithium batteries in cool, dry areas, away from combustibles or heat sources. High heat creates high chances for problems.
4. **Take the proper emergency response.** Adhere to the manual's guidance for responding to fire, overheating, or leaking/venting batteries. This response will typically involve calling emergency services. Lithium fires require specific types of fire extinguishers. Many at-home fire extinguishers will not be effective. Also, be aware of the hazard of leaking gas and invisible flames that can occur with lithium-ion batteries. When in doubt, evacuate the area, call the pros, and inform them of the lithium batteries.

Useful Resources

NAVSEA S9310-AQ-SAF-010-Rev 3 – Navy Lithium Battery Safety Program Responsibilities and Procedures

OSHA SHIB 06-20-2019 – Preventing Fire and/or Explosion Injury from Small and Lithium Battery Devices
nyc.gov/fdny/batteries – Fire Department New York Safety Tips



And remember, "Let's be careful out there"