General Lithium Ion Battery Safety

General Safety Considerations:

- Proper lithium-ion battery charging, storage, and handling is critical for maintaining battery performance and reducing the risk of fire and/or explosion.
    - Incidents regarding lithium battery fires have been reported due to inadequate charging and storage conditions.
- Spontaneous fires involving these batteries are rare, but an internal short circuit can start a series of reactions that may lead to a fire.
- An exploded battery can result when the battery is overheated or mechanically damaged.
- In the event of an explosion involving a lithium battery, the room can fill quickly with dense white smoke that can cause severe irritation of the respiratory tract, eyes, and skin.
- Approved lithium-ion batteries and devices that contain lithium-ion batteries shall not be operated, charged, or stored anywhere on the NJIT campus unless the battery bears the seal of an independent testing laboratory accredited by the Consumer Product Safety Commission and/or OSHA's Nationally Recognized Testing Laboratory Program.
- Such certification, logo, or name of an accredited laboratory shall be displayed directly on the device and/or the battery for the device.

The following information will provide guidance for charging, storage, handling, and disposing of lithium batteries used in approved applications.

Purchasing:

- Purchase from a reputable vendor. If your purchasing from a vendor not currently included in Unimarket, contact Procurement to request the vendor be properly set up in the system.
- Only purchase lithium-ion batteries using purchase orders. Many lithium-ion batteries are considered hazardous materials and should be vetted and approved through the Unimarket system and be properly packaged and shipped according to Department of Transportation requirements.
- Purchase lithium-ion batteries from approved manufacturers that bears the seal of an independent testing laboratory accredited by the Consumer Product Safety Commission and/or OSHA's Nationally Recognized Testing Laboratory Program.

Charging:

- Follow all safety instructions provided by the manufacturer.
- Never leave a battery pack unobserved during charging.
- Always stay in the charging location so that you can check for signs of battery or charger distress.
- Remove lithium batteries from chargers immediately after charging is complete.
- Never burn, overheat, disassemble, solder, puncture, crush, or otherwise mutilate battery packs or cells.
- Keep batteries away from water.
- Do not mix different types of batteries during use and recharging.
- Avoid hot and humid conditions (e.g., steam sources, ovens, furnaces, and other heat producing equipment).
- Do not charge batteries in direct sunlight, on hot surfaces, or in hot locations.
- Keep batteries and chargers away from flammable materials and ignition sources.

- Immediately disconnect the batteries if, during operation or charging, the batteries become overheated, emit an unusual odor, or change shape.
- Batteries must only be charged with a charger or charging method designed to safely charge cells or battery packs at the specified parameters. Be absolutely sure that the charger settings are correct for the battery pack being charged – both voltage and current settings.
- Chargers should be plugged directly into wall receptacles without the use of extension cords.
- Make sure that batteries do not exceed manufacturers recommended operating temperatures during charging or discharging.
- Use caution if charging a battery that is still warm from usage, or using a battery that is still warm from charging.
- There are many commercially available safety packages available to assist with the storage and charging of lithium-ion batteries, such as: https://www.commonsenserc.com/product_info.php?cPath=32_40&products_id=186

Storage:

- Store batteries away from combustible materials.
- Do not place batteries in direct sunlight, on hot surfaces, or in hot locations.
- Remove batteries from the device for long-term storage.
- Store the batteries in a well-ventilated place at room temperature or lower.
- If practical, store securely packaged batteries within metal storage cabinets.
- Avoid bulk storage in non-laboratory areas such as offices.
- Visually inspect battery storage areas at least weekly.
- Charge batteries in storage to approximately 50% of capacity at least once every six months.
- Charge or discharge batteries to approximately 50% of capacity before long term storage.
- The ideal surface for storing lithium batteries is concrete, metal, ceramic, or any nonflammable material.
- When storing unpackaged lithium-ion batteries, make sure that batteries are not touching each other.
- There are many commercially available packages available to assist with the storage and charging of lithium-ion batteries, such as: https://www.commonsenserc.com/product_info.php?cPath=32_40&products_id=186

Handling and Use:

- Handle batteries and or battery-powered devices cautiously to not damage the battery casing or connections.
- Inspect batteries for any signs of damage before use.
- Keep batteries from contacting conductive materials, water, strong oxidizers, and strong acids.
- Inspect batteries for signs of damage before use.
- Never use and promptly dispose of damaged or puffy batteries following the instructions below.
- Keep all flammable materials away from the operating area.
- Allow time for cooling before charging a battery that is still warm from usage and using a battery that is still warm from charging.

Disposal:

- Properly dispose of damaged lithium batteries that no longer hold a substantial charge.
- Lithium-ion batteries may not be disposed of in the regular trash.

- Do not mix lithium batteries with other types of batteries, such as alkaline, cadmium, or other rechargeable spent batteries.
- Lithium-ion batteries should be collected by the NJIT Environmental Health and Safety (EHS) department for recycling and disposal through the Universal Waste Management Program.
- Submit a Waste Removal Request Form found on the EHS website to facilitate disposal.
    - https://www.njit.edu/environmentalsafety/sites/njit.edu.environmentalsafety/files/Waste%20Removal%20Request%20Form%208-26-22.pdf
    - The proper waste category and waste label is Universal Waste.
    - Place intact lithium-ion batteries in an appropriate container, label with the Universal Waste Label and submit the Waste Removal Request form to EHS for processing.
    - Please contact EHS at healthandsafety@njit.edu for instructions when disposing of bulging, discolored, over-heated, or otherwise damaged lithium-ion batteries.

Laptops and Similar Devices:

Lithium-ion batteries found in most commercial smart devices, laptops, cell phones, and similar devices, if procured from a reputable manufacturer, require no user input for charging other than connecting it to the provided charging cable. The devices contain a Battery Management System (BMS) in the battery pack that controls the charging process. The following guidelines should be followed:

- Use the supplied charging cable and AC adapter from the manufacturer.
- Do not use if there are any signs of damage to the charger or power cord.
- Do not use if the battery shows signs of damage such as heating, discoloration, deformation, bulging or swelling.
- Follow all manufacturer recommendations and be alert for anomalies like unusually hot batteries.

Research:

- A rupture of the external battery casing can cause the spillage of electrolyte which may contain corrosive materials, release flammable gas, and emit volatile organic compounds.
    - Always work with lithium-ion batteries in a well-ventilated area, under a fume hood, a point exhaust, or other suitable exhaust system.
- Potential electrical energy hazards and sudden release of energy may produce heat, sparks, fire, smoke, and the ejection of shards and particulates.
    - Always work on non-conductive and non-flammable work surfaces.
- Use appropriate control measures when working with lithium-ion batteries, including:
    - Wear appropriate Personal Protective Equipment (PPE), such as electrically rated gloves, flame resistant lab coat, eye protection, and/or face shield.
    - Work on non-combustible and non-conductive surfaces such as floor pads and table pads
- Follow NJIT lab safety rules when working with lithium-ion batteries including appropriate work practices, control measures, personal protective equipment (PPE), waste disposal, and emergency response as outlined in the NJIT Chemical Hygiene Guide.

Transport:

For the purpose of these guidelines, transport refers to hand carrying lithium-ion batteries around campus buildings and campus properties typically in teaching and research applications. This does not apply to batteries in personal devices such as smart phones, laptops, tablets, etc.

- Do not transport unpackaged/unsealed lithium-ion batteries in a metal box or metal container.

- Do not carry unpackaged/unsealed lithium-ion batteries in your pocket as keys or coins can cause batteries to short circuit.
- Transport lithium-ion batteries in the original container or a plastic or padded bag to prevent shock if dropped.
- Tape battery terminals to prevent exposed contacts and potential short circuiting.
- Avoid transporting fully charged lithium-ion batteries. Recommended level of charge for transport is approximately 30%.
- There are many commercially available packages available to assist with the storage, charging, and transport of lithium-ion batteries, such as: https://www.commonsenserc.com/product_info.php?cPath=32_40&products_id=186

Shipping:

For the purpose of these guidelines, shipping refers to sending lithium-ion batteries to off-campus destinations using a private carrier. Lithium-ion batteries should never be sent by regular US Mail. Shipping lithium-ion batteries is heavily regulated. Improper shipping may result in significant violations as well as catastrophic accidents. Lithium-ion batteries contain hazardous materials and are subject to International Air Transport Association (IATA) and Department of Transportation (DOT) regulations for the proper packaging, marking, and labeling of the shipping container.

- Please contact EHS at healthandsafety@njit.edu for shipping recommendations if lithium-ion batteries need to be shipped to off-campus locations via private carrier.

Emergency Response:

Follow these steps if there is evidence of a battery malfunction or damage (e.g., swelling, heating, or irregular odors).

- If batteries are showing evidence of thermal runaway failure, be very cautious because the gases may be flammable and toxic and failure modes can be hazardous.
    - Disconnect the battery (if possible)
    - Remove the battery from the equipment/device (if possible)
    - Place the battery in a safe location free from combustible materials (i.e., metal container) (if possible)
    - Contact NJIT Department of Public Safety at 973-596-3114
- In the event of an exploded cell
    - Evacuate all personnel from the area
    - Secure the area so no unnecessary personnel may enter
    - Contact NJIT Department of Public Safety at 973-596-3114
- In case of a Fire
    - Activate the building alarm
    - Evacuate to a safe area
    - Dial 911 from a campus phone
        - If calling 911 from your cell phone, state your location as NJI.
    - Attend to any person that has been exposed to the materials, if safe to do so.