



## LITHIUM BATTERY SAFETY

### SUMMARY

Lithium batteries have become the industry standard for rechargeable storage devices. They are common to some RCSI (Royal College of Surgeons in Ireland) operations and used in research and maintenance activities. However, lithium batteries are everywhere, and everyone has a least one personal device that has this type of battery.

Lithium battery fires and accidents are on the rise and present risks that can be mitigated if the technology is well understood. This procedure provides information to help prevent fire, injury, and loss of property.

This procedure is specific to RCSI activities however much of this information is just as relevant for homes also - think about e-bikes, e-scooters, hoverboards etc.

### LITHIUM-ION (RECHARGEABLE) BATTERY HAZARDS

Lithium-ion battery fire hazards are associated with the high energy densities coupled with the flammable organic electrolyte. This creates new challenges for use, storage, and handling. Studies have shown that physical damage, electrical abuse such as short circuits, overcharging or exposures to high temperatures all increase the risk of adverse incidents with such batteries.

The resulting reaction can look anywhere from:

- a rapid venting of thick smoke (i.e., smoke bomb)
- heating of the battery, which in turn can cause fire.

Stop using the battery if you spot these signs:

- odour
- change in colour
- too much heat
- change in shape
- leaking
- odd noises.

If on campus and safe to do so, move the device away from anything that can catch fire e.g., upholstery, clothing, chemicals, paper, boxes etc. If not possible to move it take immediate appropriate action and notify RCSI Security immediately.

If RCSI Estates & Security Teams notice a battery in poor condition, they will remove it, place in safe location, and then advise the relevant department.

### SAFE USE AND STORAGE OF LITHIUM BATTERIES

1. Never charge on a soft or combustible surface

Due to the possibility of the battery succumbing to fire while on charge, it is important to create the safest possible environment while the battery is charging. If on or near



soft surfaces and combustible material the fire can take hold quickly and spread quickly.

As lithium-ion battery fires produce toxic emissions, it is vital that any fire / smoke is dealt with as quickly as possible. Immediately contact RCSI Security for help and support:

LOCATION	EMERGENCY NUMBER
St. Stephens Green Campus (all buildings)	191 or 01 4022219
Beaux Lane House	2706 or 01 402 2760 (7am - 7pm); 2219 / 01 4022219 (7pm - 7am)
Reservoir House, Sandyford	8679 or 01 402 8679
Smurfit Building, Beaumont	3700 or 01 809 3700 (7am-8pm); 8653 or 01 8528653 (8pm - 11pm); 2110 Beaumont Hospital Security (11pm - 7am)
Library, Beaumont	2110 Beaumont Security; 2999 (Emergency Only)
GEM Building, Connolly Hospital	5438 / 5294 - Security (01- 6465438 / 5294 from outside line)

\*191 from landline only.

RCSI Emergency Evacuation procedure will commence. Only if safe to do so, use a water or lithex fire extinguisher. If the fire is too large for you to tackle, leave the area and evacuate the building. RCSI Security will contact Emergency Services.

**Action:**

- Dedicate a charging area on a non-combustible surface to charge your batteries.
- Ensure that a water / foam fire extinguisher is nearby.

2. Handle with care

Poor handling of batteries can contribute to the hazards that they create. Batteries that are dropped, damaged, or show signs of swelling should never be put back in your store or placed on charge. It is the responsibility of every staff member and researcher to make sure that any suspicious batteries are taken out of storage and charging and disposed of in the correct way (disposed of via Estates as electrical / battery waste but noted as potentially damaged).



Figure 1: Lithium-ion battery for power drill on charge

Do not ever leave batteries lying around on work benches or out in the sun. These cells require special conditions for handling and storage if you are to reduce the likelihood of hazards. Choosing dedicated battery storage is key to reducing hazards.

If you notice a dented and damaged battery or any other hazards as listed above, alert your supervisor or Estates, and seek advice on what to do.

If RCSI Estates & Security Teams notice a battery in poor condition, they will remove it, place in safe location, and then advise the relevant department.

**REMEMBER:** Lithium-ion battery fires can create harm for people, property, and the environment. These fires are notoriously difficult for fire crews to contain and can quickly engulf the building, surrounding buildings and the natural environment.

### 3. Keep Battery Stores Ventilated

Lithium-ion batteries should be kept in well-ventilated areas and not in the vicinity of hot surfaces, mechanical equipment, open flames, or other ignition sources. These types of cells do not react well with excessive heat or humidity. Therefore, keeping the storage areas ventilated through natural or mechanical means is necessary for the safe storage of battery cells.

### 4. Leak Containment

Damaged or split batteries are a serious hazard, but the electrolyte can also be released, causing a greater fire hazard. Spill containment solutions for battery stores can include banded battery cabinets or drip trays placed under perforated battery store shelving.

### 5. Charge Batteries with the Correct Charger

Lithium-ion batteries are made to be recharged.

The simplest way to reduce hazards in your lithium-ion battery stores is by always using a *certified charger (EU approved and recommended by the manufacturer)* that is suitable for the battery product that you have onsite. Choose a charger that is

suitable for your battery type and capacity of charge. As lithium batteries cannot absorb extra charging, overcharging must be avoided. The easiest way to do this is simply unplug your charger once the battery's charged to about 80 - 100%.

#### 6. Do not overcharge

Lithium-ion batteries should be charged in a careful manner, with staff avoiding overcharging and the deep discharging of cells. Only charge devices during university opening hours. If there is a timer charging function, use this to avoid overcharging. Refer to the safety instructions from the battery manufacturer or supplier to learn more about issues with maximum current load, mechanical and thermal loads, and charging and end-point voltages.



Figure 2: Do not overcharge or over discharge Lithium-ion batteries in the workplace or at home

#### 7. Be prepared for fire

Like any emergency in RCSI, we follow the same emergency procedure for lithium-ion battery fires. The smoke will activate the smoke head in the room / area, and once this occurs the emergency procedure commences by RCSI Security.

**Only if safe to do so and if trained** - If there is suitable fire extinguisher (water or foam) nearby, attempt to put out the fire. If too large and 1 extinguisher cannot manage to extinguish the fire, evacuate immediately.

#### 8. Use a Lithium-ion battery cabinet

If your department has many lithium-ion batteries, ensure they are stored in dedicated storage areas. If kept in random cupboards or no storage area at all, then this may increase the risk of the hazard occurring.

There are purpose-built lithium-ion battery storage cabinets available. These cabinets are designed and constructed specifically to reduce the risks associated with this energy source. They can assist with reducing hazards such as overheating,



spills and charging on unsafe surfaces. Estates can advise further on this as required.

#### 9. Train Staff and Researchers

Raise awareness in your department of this procedure, about the correct handling, usage, storage and charging of these batteries so to prevent catastrophic situations that are increasingly appearing in news streams.

Standard operating procedures, based on best practice and the battery manufacturer's instructions, should be implemented for all staff and researchers that are using lithium-ion batteries.

Make sure your stores are installed, used, and maintained in a similar way to your chemical stores. That is, conducting a risk assessment for your lithium-ion batteries and determining the potential hazards that are present, as well as the controls necessary for your stores to remain safe. These controls will include administrative controls, including your standard operating procedures and RCSI emergency plans.

Ensure all staff and researchers in your department complete the fire safety course [here](#).