Lithium-ion Batteries – guidance on safe use

Lithium-ion (Li-ion) are now commonplace, used in mobile phones, laptops and battery power tools amongst other items. The use and charging of these batteries can pose a significant risk, the bigger the battery, the bigger the risk.

Staff must remain extra vigilant as high temperatures can be reached with a significant risk of a fire developing:

- Do not cover a battery (e.g. phone) when on charge (including bedding and pillows).
- Do not charge a battery on or near combustible material (e.g. carpet, paper, fabric).
- Try to avoid charging overnight (unsupervised).

Risks

The greatest risk from these batteries is from a fault causing a fire to develop. A number of cases have been reported on numerous occasions through the national news.

In a thermal runaway event Li-ion batteries generate oxygen ensuring that associated fires burn extremely hot and have a tendency to reignite after being initially extinguished. Fires can escalate with subsequent explosions which can spread the fire further. Additionally, toxic compounds are released by these fires in significant amounts & are extremely harmful.

There are a number of factors that can cause these batteries to ignite, the most likely being overheating and physical damage;

- **Overheating**: When a Li-ion battery is exposed to high temperatures an event known as thermal runaway can occur which results in the battery heating up uncontrollably. Some of the more common reasons for thermal runaway are exposure to heat sources, being left in direct sunlight or internal factors such as a short circuit or internal damage.
- **Physical damage**: Damage to the battery through events such as punctures or crushing can cause internal short circuiting and lead to thermal runaway, resulting in ignition and potential fire.
- **Manufacturing defects**: In low-cost batteries with less stringent quality controls, manufacturing defects such as impurities in the electrode materials or the incorrect assembly of the battery itself can increase the risk of thermal runaway and potential fires.
- **Overcharging or over-discharging**: Issues can occur when Li-ion batteries are charged beyond the manufacturers recommended voltage limits or when the batteries are discharged to extremely low levels. Operating the batteries at these extremes can lead to failure of internal components and overheating.

- **Incorrect usage**: The incorrect usage of Li-ion batteries can lead to the increased risk of fire. Incorrect usage includes things such as DIY up-graded batteries fitted to e-bikes to increase range or adaptions to the batteries which increases power output.

Controls

- Battery & charger **must** be the original manufactured and sold with the equipment. Replacements **must** be from the manufacturer and **not** an after-market supplier.

- Charger **must** display the UKCA Safety Standard.

- Visual condition checks **must** be in place.

- Charger **must** be PAT tested annually.

- Charging **must** take place in a safe controlled area:
    - Not within a room where numerous staff work (busy, populated area)
    - Not along Emergency Exit Routes or shared areas (corridors, kitchens etc)
    - Not in bedrooms (residential care facilities)
    - Not in an area containing other combustible materials (minimal only)
    - Area fitted with a smoke detector and fire door (kept shut), or in an outside weatherproof building such as a garage or shed.

- Staff (persons) to be reminded of the risks:
    - Fire ignition possible due to reasons above
    - Thermal runaway occurring very quickly
    - Oxidising – causing the fire to spread very quickly & hot
    - Extremely dangerous and toxic gases produced in quantity

- Emergency Procedure:
    - **Do Not** attempt to fight a fire involving Li-ion batteries
    - Evacuate all persons in the immediate area immediately, closing doors behind you.
    - Raise the alarm at the nearest call point or by whatever means is possible.
    - Proceed with the full evacuation of the premise & Emergency Plan.
    - Call the Fire Service and tell them the fire has resulted from a Li-ion battery.
    - Ensure all persons moved away from any smoke (toxic gases) being produced, to a safe location depending on wind direction.