# Mitigating risks in lithium-ion batteries

With the growing use of lithium-ion batteries in commercial and industrial environments, associated risks have also grown. *Asia Insurance Review* spoke with **QBE Insurance**'s **Mr Brendan Dunlea** about how these risks can be mitigated.

By Anoop Khanna

According to the International Energy Agency, the increase in the number of electric vehicles (EVs) is also driving the demand for batteries and related critical minerals. Automotive lithium-ion battery demand increased by about 65% to 550 Gigawatt hour (GWh) in 2022, from about 330 GWh in 2021, primarily as a result of growth in electric passenger car sales.

Rechargeable lithium-ion batteries have been in use since 1991. Today, they can be found in everything from the fitness tracker and other wearables to mobile 'phones, tablets and laptops, e-scooters and e-bikes and EVs.

Speaking with *Asia Insurance Review*, QBE Asia head of underwriting , property and engineering Brendan Dunlea said, "With the growing focus on sustainability influencing many – if not all – businesses, new applications for lithium-ion batteries are being embraced, including use in power tools, forklifts and more."

## Heightened fire risk

"Battery energy storage systems store energy from the sun, wind and other renewable sources and can therefore reduce reliance on fossil fuels and lower greenhouse gas emissions. Compared to competitors, lithium-ion batteries have a high power-to-weight ratio, high energy efficiency, good high-temperature performance and low self-discharge," he said.

"In normal use, lithium-ion batteries are stable and work as intended with no problems," he said. "However, these batteries are particularly sensitive to high temperatures and are inherently flammable, as well as being sensitive to cold temperatures and over-charging."

Speaking about the fire risk associated with these batteries, Mr Dunlea said in certain circumstances – if the battery has been damaged by dropping, piercing or even heavy jolting, for example - a fault inside the battery can be triggered, causing it to short circuit. This can cause the battery to severely overheat very quickly and go into 'thermal runaway': An irreversible pathway to fire.

## Two technologies predominant

Speaking about the technologies used for lithium-based batteries, Mr Dunlea said there are several technologies available, but the most used is referred to as NMC, where nickel, manganese and cobalt are used alongside lithium.

He said, "Compared to other battery technologies, NMC batteries are more often involved in fires

in vehicles, 'phones, laptops, e-scooters and similar devices, as the technology is less stable when damaged and can be more volatile.

"The other most common technology is referred to as LFP (lithium ferrous phosphate, also lithium iron phosphate). This technology is inherently safer, less prone to thermal runaway and less energetic in a fire. Many new buses, coaches, trucks, and battery energy storage systems use LFP type batteries."

## Difficult to deal with

Speaking about fire extinguishing systems for lithium-ion battery fires, Mr Dunlea said, "These fires are incredibly dangerous and can be difficult to deal with because they release a flammable and toxic vapour which helps to further fuel the fire.

"Manual fire extinguishers are available that release a water-based solution of a material called vermiculate. This seals around the damaged battery to limit further fire spread but it does not halt the thermal runaway. The thermal runaway process will continue under the vermiculate and is waiting to accelerate again given the chance. This can reignite the fire even after hours or days or weeks of seeming to be contained."

"An alternative for manual fire extinguishers is a Class B fire extinguisher (powder, foam, CO2) but these can only suppress the fire on the combustible materials around the battery, and the thermal runaway remains largely unaffected," he said.

Mr Dunlea said the benefit of using manual fire extinguishers is that it gives people time to escape whilst giving firefighters time to respond and to move the device to a safer location.

## Best handled by trained personnel

Asked about the precautions that people at large could take to control the lithium-ion batteries, Mr Dunlea said it is something best left to professionally trained fire fighters. Members of the public should move away and call the Fire Brigade. In commercial and industrial premises it is possible that some fire wardens are trained on specific emergency responses to lithium-battery fires – only trained personnel should act.

Dunlea said, "In addition to public places, lithium-ion battery fires are occurring in people's homes. If a fire starts while using a personal mobility device (such as a e-scooter or e-bike), an electronic device (such as a mobile phone or laptop) or while using an electric or hybrid vehicle, no one should attempt to extinguish the battery fire unless they're trained.

"Those impacted, including by-standers who happen to be in the area, should evacuate and stay at least 10 metres away from the fire. This is important as the explosive force of a fire and thermal runaway release can throw hot metal and burning chemicals many metres away."

> All businesses handling lithium should establish a pre-defined emergency response plan to tackle damaged or overheating lithium-ion batteries.

## Storage of batteries

Speaking about storage of batteries Mr Dunlea said lithium-ion batteries should be segregated from other materials if bulk-stored in a warehouse. These should be stored in a non-combustible, well-ventilated structure/room with sufficient clearance between the walls and the battery stacks. There should be clearance between batteries to allow air to circulate.

He said the floor stacking of lithium-ion batteries should be controlled in designated areas with limited stack heights, footprints, and separation distances. Rack storage of lithium-ion batteries should not be permitted unless the building and the racks are fully sprinklered with solid metal horizontal and vertical barriers between each storage bay.

"A hand-held IR gun can be used to perform thermographic inspection for any battery that has or may have sustained damage. Any deviation from the normally expected general temperature by 3℃ or more on any individual lithium-ion battery package should be reported to management immediately so the pre-defined emergency response action plan can be initiated," said Mr Dunlea.

## Mitigation strategy

Mr Dunlea said, "To mitigate the fire risk, the use of lithium-ion batteries and resulting fire risk is something that should be addressed as part of fire protection and emergency response arrangements for business establishments.

He said, "All businesses handling lithium should establish a pre-defined emergency response plan to tackle damaged or overheating lithium-ion batteries. It is important that employees should be trained before lithium-ion batteries are permitted on site."

In industrial or vehicle workshop premises, where the state of charge (SoC) can be checked or changed, the batteries should be stored at 30% SoC if being kept for extended periods, and certainly no more than 50%. This is because the energy in a fire situation has been found to be significantly less at 30% than if the SoC is above 50% and it makes fire-fighting much easier.