Lithium-Ion Batteries – What are the Risks?

By Andrew Kyle | December 16, 2024

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Article

Battery power is set to gradually replace diesel-fueled generators on many U.K. train routes as the rail industry seeks to cut greenhouse gas emissions and reduce toxic pollutants. Some locomotive manufacturers are reportedly trialing lithium-ion batteries, but there are concerns that this technology could pose unique fire safety challenges. The potential environmental impact of such an event is also a significant consideration that should be factored into the equation.

Over the last 20 years, the environmental insurance industry has seen a change in the severity of contamination incidents, as well as a transition over causation and the options for waste disposal. While the U.K.'s legally binding target is to achieve net zero emissions by 2050, it is essential to also take into account the risks associated with the new technologies that will help reach this goal and how any failures might impact the environment.

Environmental Remediation

The commercial U.K. environmental remediation industry is well established, with standard guidelines for investigating and assessing contaminated land and water. During the 1990s, advances in remediation technologies drove more sustainable 'in-situ' techniques. This saw a transition from a traditional "dig and dump" approach in removing contaminated soil to using new solutions, such as chemical or biological treatments, soil stabilization to encapsulate contamination, or soil removal and cleansing prior to reuse on-site.

Within the insurance sector, the majority of contamination incidents involve loss of fuel, primarily heating oil, to the ground. The claims resolution process is well understood. It involves collecting samples to assess the extent of contamination, delivering the remediation works and then collecting additional samples for validation to ensure concentration levels are below those that would cause a risk to any receptors – whether that be humans, buildings or the wider environment.

The applicability of in-situ remediation techniques is often limited by other driving factors, such as timescale, when the customer wants to return to the property as soon as possible, for example. Cost, including the provision of alternative accommodation or premises, will also impact the remediation option that's applied.

Despite the development of new technologies aimed at providing greener solutions, there are emerging environmental risks associated with them. When failures occur, they can challenge existing environmental remediation practices and often prove costly and time-consuming to put right.

Thermal Runaway

Lithium-ion batteries have become widely used globally, and the U.K. is no exception. They are used in everything from e-scooters and mobile phones to power tools and electric vehicles (EVs). Within the domestic environment, many different devices have the same type of charging sockets, and the wrong charger, which isn't correctly rated for that particular item, can sometimes be used. Using an incorrect charger and poor battery management may lead to the device charging too quickly, which can cause overheating issues and potential thermal runaway.

On a larger scale, high numbers of EVs are often stored in one place, on transport ships, in car parks and bus depots, for example. Failure and thermal runaway of an EV battery can be explosive, and jets of flames might be emitted several meters from each side of the car. In modern car parks, with tight parking spaces, this can easily lead to the propagation of the fire to adjacent vehicles.

Battery recycling centers are another example of areas where multiple batteries stored in close proximity to each other present a similar risk. In February this year, a French warehouse storing 900 tonnes of old lithium-ion batteries caught fire following an explosion. Thick black smoke billowed around the local town of Viviez in Aveyron, and local authorities ordered residents to stay indoors and keep windows shut. Over 70 firefighters worked to put out the blaze, which had spread to nearby storage units.

According to Sedgwick's claims data, lithium-ion battery fires have increased by 81% this year compared to 2023, and the total cost of settled claims is up 140%. This trend is leading to a change in the type of environmental claims we manage in the insurance sector.

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It's worth mentioning at this point that lithium-ion batteries also pose an issue for traditional fire suppression procedures. When a lithium-ion battery enters thermal runaway, it causes a rapidly accelerating chemical reaction, releasing large amounts of flammable gases. Trying to extinguish the fire with water is unlikely to be successful, although it could help stop the spread to other buildings.

Metal Contamination

In these types of fire incidents, high concentrations of lithium-ion and other base metals (including iron and manganese) are released and spread. Where many batteries are stored in one location, the concentrations of resulting heavy metal contamination can be very high. If surface water or groundwater becomes contaminated, a specialist resin is required to remove the metals from the water, which, in a large-scale incident, will often have to be imported from Europe. This treatment is costly and can take months, in some cases years, to resolve.

In terms of soil contamination, concentrations can also be very high, often at levels only generally seen at industrial sites. This limits the options for soil treatment, and if the concentration levels are greater than U.K. landfills can accept, it dramatically reduces the possibilities for soil disposal. Given these constraints, we must consider less sustainable approaches, such as exporting the polluted material overseas.

Understanding the Risk

Of course, battery technologies continue to evolve, and it's reported that their potential has yet to be reached. A recent Statista report (1) projects that between 2022 and 2030, the global demand for lithium-ion batteries will increase seven-fold, but their safety regularly comes under question.

While a recently published study found that EVs suffer 25 fires per 100,000 sold, compared to 1,530 fires in petrol or diesel vehicles, concerns remain around the storage of multiple batteries in one place. By 2035, it's estimated that 150,000 tonnes of lithium-ion batteries will reach their end of life annually, so it's crucial to appreciate the potential risk of operating any large-scale recycling facilities.

However, our understanding of the risk and the required level of insurance cover for such activities is improving, and new EV fire suppression systems can help prevent fires, reduce damage and minimise the risk of propagation. Particular care and appropriate precautionary measures should be taken if that facility is also located in an environmentally sensitive area—close to a river system or on an aquifer used for public groundwater abstraction and supply. Fast responses to these types of incidents will limit the spread of highly contaminated water, helping avoid significant environmental damage and reducing the potential third-party exposure and costs involved.

If the U.K. rail industry decides to adopt battery power across its entire network, no doubt the potential environmental risks will be assessed against the distinct benefits this form of clean energy can deliver.

Kyle is head of environmental consultancy, EFI Global, Sedgwick.

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