Written Representations – West Burton Solar Project - Environmental & Safety Risk from Batteries

Written Representation WR1 - Regulations and Guidelines when using Lithium-Ion Batteries

Batteries can be said to be the beating heart of all large-scale solar farms and like all hearts require continuous monitoring and maintenance to ensure to functionality and reliability. At the very centre of this, is accountability, traceability, and transparency throughout a battery's life.

The high profile of the developer does not rest easily when looking at the submission of the project which is littered with missing and essential and vital information on which to make a comment or judgement.

The detailed Specification, Testing and Certification of batteries and approval by an independent body reveals so much knowledge and confirmation about a product or service, none of which have been submitted by the developer.

There is no information about the metal content in the batteries, type of wafer insulation and testing conditions, Manufacturers Warranties, specific failure rates or life expectancy of batteries.

From the manufacturer to the dealer to the consumer, back to the manufacturer, or to the remanufacturer / recycler, Lithium-ion batteries have a long journey to make in their lifetime.

Yet, with many people's safety at stake, on every move and stop, they need to be handled with the utmost care.

Even though their battery chemistry is considered one of the safest, lithium-ion batteries still pose significant risks when not handled carefully.

The high-voltage nature of a lithium-ion battery comes with electrical hazards, such as short circuit, electrocution, electric shock or burning, whereas the chemical component inside the battery (the electrolyte) could leak out and cause intoxication or corrosion.

Lithium-ion batteries are prone to thermal runaway.
If the temperature exceeds a certain threshold, the cells begin to vent hot gasses, which increases the temperature even further, and ultimately leads to ignition, explosion, and significantly dangerous fires.

The larger the battery storage, the greater the risk of a runaway fire.

There appears to be no updated safety regulations in respect of lithium-ion batteries, but the following three documents appear to be those in use awaiting updates:

- Batteries Directive 2006/66/EC: This is an EU-Directive that provides guidelines to the member states concerning the manufacture and disposal of batteries in the EU. Its aim is to improve the environmental performance of batteries and accumulators.

- General Product Safety Directive (GPSD): The GPSD provides standards for product safety to protect consumers from potential hazards, by means of EN standards. The relevant EN standard for lithium-ion batteries is EN 60086-4. It serves as a reference point for specifications and technical solutions at the product design stage.

- ADR (International Carriage of Dangerous Goods by Road) The ADR is a UN-document, adopted by the European Union, which regulates the transport of hazardous goods over land. Following ADR rules is mandatory for transportation of lithium-ion batteries. The specific requirements for this type of battery can be found under article 2.2.9.1.7. All lithium-ion batteries are Class 9 and get the UN number 3480 and thus the safety rules vary.

What type of battery are you transporting?
Let's look at the different options and their ADR requirements.

New lithium-ion batteries
New batteries at the beginning of their journey are in their most stable state (except for manufacturing defects), as they are charged up to 60 to 70% to ensure stability.

Used lithium-ion batteries for reuse.
Battery Directive 2006/66/EC states that every battery producer has a take-back obligation.

Undamaged waste lithium-ion batteries
When a used battery can't be remanufactured or reused for a different purpose, it gets the 'waste' status and its ADR specifications change.

Damaged and defective lithium-ion batteries
Damaged lithium-ion batteries pose the biggest risk, as they are transported in a potentially highly unstable state.

Given this situation it would seem reasonable to expect the proposed solar farm developers to have included Risk Assessments and Method Statements for dealing with every phase of a battery's life.
How long will a battery last? 3 years, 10 years or 15 years?

What will the effect be on supply to the grid, how long will it take to replace the batteries and what will happen to the spent batteries?

Items such as the temperature under which they are used, whether they have been stored, how quickly they have been charged and discharged, whether they have been left discharged for any period, and a whole number of other factors.

Another big variable is the question of what counts as a charge / discharge cycle. Sometimes the battery will have undergone a deeper charge cycle than others, sometimes it may be a 20% to 80%, other times it may only be a top up, say 30% to 60% and whether this counts as a cycle.

The proposed specification for a LFP 280Ah cell type battery, taken from many sources on the internet suggest a Cycle life of 2,000 which at best would be 1000 charges and discharges per day, or just under 3 years. (CADEX Battery University)

Written Representation WR2 - Fire Risks in Large Scale BESS

Fire risks in large scale BESS I am sure will be dealt with by others but it will be useful to note that in the Liverpool BESS, fire was theoretically protected by a suppression system that failed to activate and would not have had any effect anyway, as the investigator states: Although there was a fire suppression system in the container, the speed of propagation indicated that this hadn't activated.

The McMicken explosion was an object lesson in this. The installed "clean agent" system operated correctly, as designed, on detection of a hot fault in the cabin. There was no malfunction in the fire suppression system, but it was completely useless because the fire was not a conventional fuel-air fire, it was a thermal runaway event. Only water will serve in thermal runaway.

Indeed, in the McMicken explosion the "Novec 1230" clean agent arguably contributed to the explosion by creating a stratified atmosphere with an air/Novec 1230 mixture at the bottom and inflammable gases accumulating at the cabin top.

Written Representation WR3 – Environmental Risks from Water Contamination

The rivers Trent and Till run through the proposed site raising significant questions about the amount of water required and contamination control that a critical event of a fire would result in environmental damage from toxic run-off.

In addition, the field adjacent to the site is an area of flooding which will potentially further increases toxic run-off risk and critical event control.

If a fire occurs in a battery, it is likely that there will be a closure of the solar farm and will remain closed until such time as the contaminated water has been filtered and disposed of to ensure that a further fire can be satisfactorily and safely dealt with?

On the issue of Water Supplies the guidance is substantially inadequate. The suggestion of a water-cooling system capable of delivering 'no less than 1,900 litres per minute for at least two hours' would deliver a total of only 228,000 litres. There is limited data on the measurement of water volumes deployed in previous BESS fires; the best comparison being the report quoted on the July 2021 Victoria Big Battery (VBB) fire where 900,000 litres were required over six hours to extinguish it. The fire was in two units, spreading from the first to the second after 2 hours and involved an estimated BESS size of 4.25 MWh.

Moreover, the volume of water required will be proportional to the size of the BESS on fire, so it is not possible or helpful to suggest a single figure for total water requirement as stated in the NFCC Guidance.

It is suggested that the total water requirement should be expressed as X litres per MWh of energy storage. From the VBB experience, X= 900,000/4.25 = 211,765 litres per MWh.

It is more difficult to specify the rate of delivery required since larger fires will certainly take much longer to extinguish.

It is suggested that a rounded figure for guidance might be:

'at least 200,000 litres per MWh of storage delivered over up to 12 hours. Very large BESS fires will require longer to extinguish and will need longer-term surveillance to monitor any signs of re-ignition'.

Using the recommended figure above, a 20 MWh BESS fire such as that at Basing Fen would require the delivery and storage of 4 million litres of water whilst a complete fire at the proposed 700MWh BESS at Cleve Hill, Kent would involve 140 million litres of cooling water.

Summary

Lithium-ion batteries have a long journey to make in their lifetime from the manufacturer to the dealer to the consumer, back to the manufacturer, or to the remanufacturer / recycler,

Yet, with many people's safety at stake, on every move and stop they need to be handled with the utmost care.

A thermal runaway fire cannot be controlled like a regular (air-fuel) fire. A significant volume of water will be required to cool a BESS fire. It will be contaminated with highly corrosive hydrofluoric acid and other hazardous chemicals.

The activation of a suppression system would have had little or no effect on the resultant fire/explosion in a BESS fire.

I respectively ask that the risks associated with the deployment of large-scale BESS, must be addressed in order to avoid the issues clearly highlighted by the Deputy Fire Safety Commissioner of the London Fire Brigade when he said:

"If we know some things could fail catastrophically or it could have those effects," he said, "it's going to be a difficult day if one of us is standing there in court saying we knew about it but we didn't do anything."

It is important to recognise that the rivers Trent and Till run through the proposed site raising significant questions about the amount of water required and contamination control that a critical event of a fire would result in environmental damage from toxic run-off.

In addition, the field adjacent to the site is an area of flooding which will potentially further increases toxic run-off risk and critical event control.

The fundamental failure mode of Li-ion batteries presenting major hazard is thermal runaway. This paper is far from the first to identify the risk which is now well-known.

However, the BESS industry has still not agreed or implemented adequate engineering standards to address basic Prevention measures to pre-empt thermal runaway accidents.

The developer has not proved their submission to be sound, and contains significant weakness and a lack of depth in their submission should not be approved.