Planning Application

Cockenzie Storage Ltd

National Fire Chiefs Council

Battery Storage Safety Management Plan.

V3.0.0

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Version Control

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1.0.0	06/01/2024	
2.0.0	07/01/2014	Following comments.
3.0.0	17.01.2024	Amended site plan

Contents

1 Executive Summary

1.1 Information

This Fire Plan is to support the planning application following the guidelines set out in the National Fire Chiefs Council's Grid Scale Battery Energy Storage System planning – Guidance for FRS'. This report has been prepared on behalf of Energy Hub Developments. The Scheme is a nationally significant infrastructure project.

1.2 Battery Technical Data

The batteries on site will be based on the following Lithium-ion Phosphate (LFP) batteries in a pouch and rack held within containers measuring 6.06M X 2.44 X 2.59]. UL940A test data is available if required. Manufactured by CATL, these are based on the EnerC Battery container.

Specification:

Item	Cell	Module	Container
Configuration	/	1P52S	10P416S
Dimension (W*D*H)(mm)	173.9*207.2*71.7	740*1050*230	2462 *6058*2896
Weight (kg)	5.36±0.30Kg	330±5kg	~35000kg
Rated Voltage (V)	3.2	166.4	1331.2
Voltage Range(V)	2.8 ~ 3.6	145.6 ~ 187.2	1164.8 ~ 1497.2
Rated Energy(kWh)	0.896	46.59	3727.36

1.3 Key Infrastructure

Component	Location	Count
Location Plan	See site plan	
Battery Container	See site plan	
Battery Racks	Within container	
Inverter	See site plan	

1.4 Safety Systems

System	Location	Type	Activation
Gas Detection	In Container	Active Detection	Automatic
Heat Detection	In Container	Active Detection	Automatic
Smoke detection	In Container	Active Detection	Automatic
Flame Detection	In Container	Active Detection	Automatic
Off Gas Detection	In Container	Active Detection	Automatic
Deflagration vents	In Container	Active Detection	Automatic
Water Mist/Sprinkler	In Container	Active Extinguishment	Automatic
Portable Fire Extinguisher	External	Carbon Dioxide	Manual

2 Introduction

2.1 Purpose

The following information is provided to ensure that the relevant persons are aware of the risks posed by the battery storage systems and the measures taken to prevent an incident or fight a fire on the site. The plan has been developed with the safety of the public and emergency responders in mind and based on reducing the risk as far as is reasonably practicable.

The report is based upon National Fire Chiefs Council - Grid Scale Battery Energy Storage System planning – Guidance for Fire and Rescue Services.

Grid scale Battery Energy Storage Systems (BESS) are a fundamental part of the UK's move toward a sustainable energy system. The installation of BESS systems both in the UK and around the globe is increasing at an exponential rate. Several high-profile incidents have taken place and learnings from these incidents continues to emerge and develop.

In preparing this report, regard to the NFCC recommendations and the recommended additional guidance that has been updated in 2023 has been taken into account within this document.

State of Victoria (County Fire Authority) (2023), Design Guidelines and Model Requirements: Renewable Energy Facilities.

FM Global (2017) Property Loss Prevention Data Sheets: Electrical Energy Storage Systems Data Sheet 5-33.

NFPA 855 (2023) Standard for the Installation of Stationary Energy Storage Systems

FM Global Property Loss Prevention Data Sheets 5-33 LITHIUM-ION BATTERY ENERGY STORAGE SYSTEMS

FM Global Property Loss Prevention Data Sheets 1-20 PROTECTION AGAINST EXTERIOR FIRE EXPOSURE

2.2 Limitations

This emergency response plan assumes in good faith that relevant Standards are complied with, maintenance and testing is carried out as required and that there is no foul play or intentional contravention of fire safety measures in relation to the battery storage systems. With appropriate evidence provided to support any claims made on performance, and with appropriate standards cited for installation.

It is also assumed that those parties consulted throughout the planning application stages and those controlling the site are competent and prioritising life safety in respect of the development and management of the site.

Any alterations to the content, usage or layout of the site would require the emergency response plan to be revisited.

2.3 Facility Description

The site is located on land at COCKENZIE STORAGE LTD, COCKENZIE EH32 9SF

The site is split into 2 sites site 1 will consist of 102MW with 56 battery containers 14 transformers and 28 invertors. Site 2 consists of 240MW with 128 battery containers, 32 transformers, 64 invertors. there will be supporting ancillary equipment a control room, office, store, and sprinkler pump container. There will be Hydrant water supplies with a capacity of of 1900lts per minute for a minimum of 2 hours for general firefighting operations, there will be environmental containment (to contain any contaminated firewater runoff) the water suppression system will be supplied via a town mains water supply .

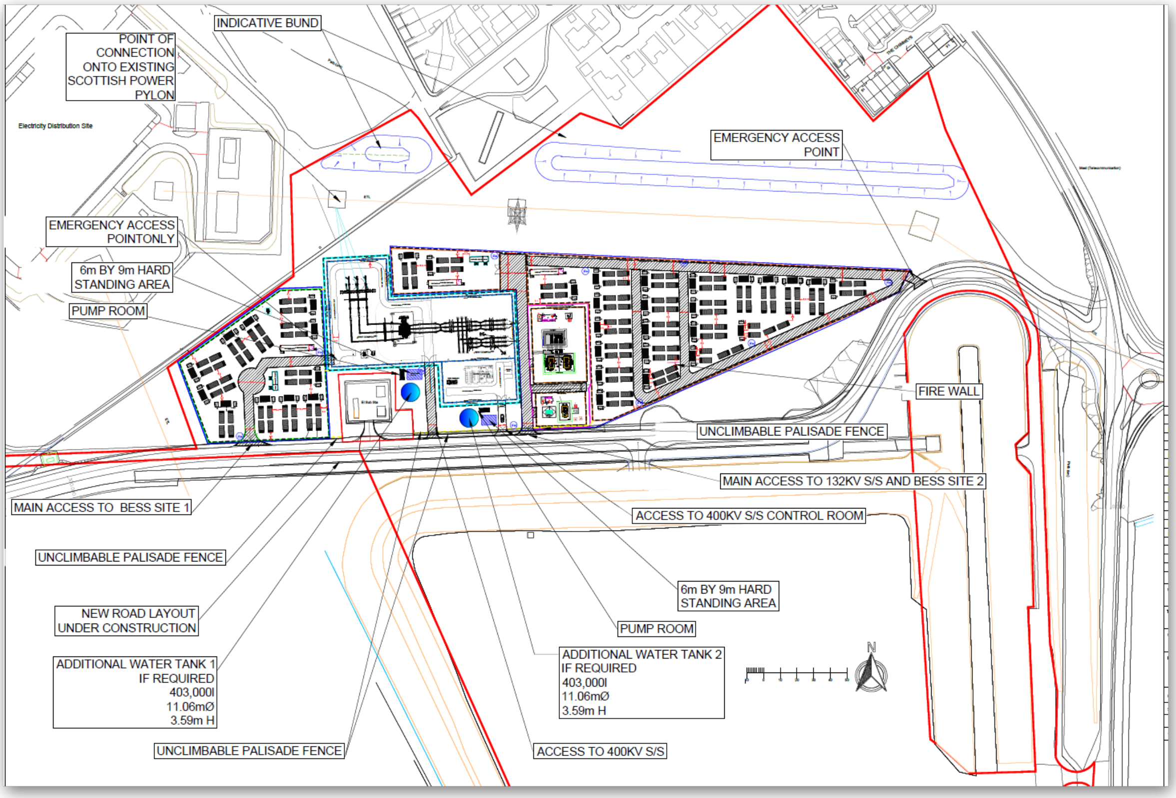


Figure 1 site plan

In accordance with the NFCC agreement with the environment agency and the memorandum of understanding, provision has been made for the containment of firewater run off on site until disposal by a specialist contractor.

There are a number of access points to the site via the access road and one is an emergency access only via the existing access point that will comply with Approved document 'B' Volume 2 Buildings other than dwellings, B5 Access and facilities for the fire service. There is a perimeter road and internal access roads.

2.3.1 Hazards

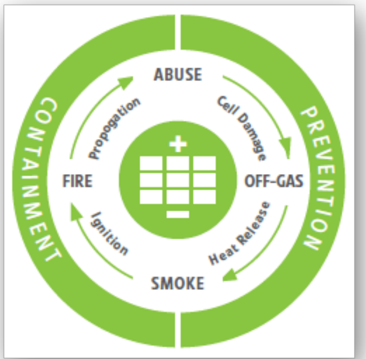
The principal concern with BESS sites is the risk of fire and the possibility of thermal runaway, this is influenced by the battery chemistry. The battery chemistry directly affects the likelihood of an event and dictates the amount of heat released during thermal runaway, the vapour cloud formation, and the toxicity of by-products. The Lithium-ion Phosphate batteries used at this site will have been assessed in accordance with UL 9540A (testing the fire safety hazards associated with propagating thermal runaway within battery systems) according to the information given by CATL the manufacturing company.

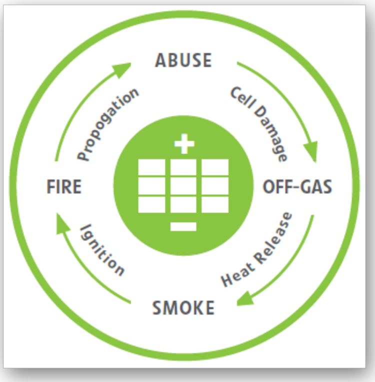
A lithium-ion battery can result in a fire due to electrical, mechanical, or thermal failures. Electrical failures occur most commonly from situations where the battery is overcharged or held in a state of undercharge. Mechanical failures occur from short circuiting, but also from physical issues with the battery where there has been a manufacturing defect or physical damage post-manufacture. A thermal failure can be triggered by the temperature within the container.

Fire can erupt in a lithium-ion battery once it undergoes one of the failures. A thermal, electrical, or mechanical failure, or combination of, can lead to thermal runaway. Thermal runaway is defined as where cell temperature reaches a threshold that causes an uncontrollable rapid release of energy and corresponding temperature rise resulting in a thermal event, such as an explosion and fire. The stability of a lithium-ion cell is primarily dependent on temperature. The temperature of the cell is determined based on the heat generation/dissipation rates. If the heat cannot be dissipated linearly at an equivalent rate of generation, then the internal chemical reactions become stimulated by the increasing temperature and induce the cells into thermal runaway.

Thermal runaway typically occurs at 180°C with low states of charge, 120°C at 100% state of charge, or 80°C when overcharged. Understanding Lithium-ion Battery Failure is crucial. There are 2 main windows of opportunity to implement fire protection measures.

Off-gas generation in a lithium-ion battery should be considered as the critical window of opportunity to take action to Prevent thermal runaway or a fire condition in a BESS. Results from independent testing suggest an average of 11-12 minutes between detection of off-gas and thermal runaway and detection of smoke. If Preventative measures are unsuccessful and a damaged lithium-ion battery ignites, measures must be put in place to contain the resulting fire and minimise the potential for propagation to other battery cells within the BESS.
There are 4 main phases of lithium-ion battery failure:
1. Battery Abuse
Cause of cell damage could be thermal, electrical or mechanical.
2. Off-Gas
Minute quantities of off gas (combination of Volatile Organic Compounds) and other cell vapours are generated, resulting in heat release.
3. Smoke
Catastrophic failure is imminent, level of heat likely to result in ignition, deflagration and thermal runaway.
4. Fire
Likelihood of propagation dramatically increases.





2.3.2 Site information

Battery Storage System

The site is split into 2 sites site 1 will consist of 102MW with 56 battery containers 14 transformers and 28 invertors. Site 2 consists of 240MW with 128 battery containers, 32 transformers, 64 invertors. Spacing between these container packs (4 containers) will be 6m to other container packs, and 10 meters from the site boundary. The containers will have 60-minute fire resistance to the walls. The containers/cabinets will be installed with progressive layers of active and passive fire safety measures.

Other facilities

Other facilities on the site include:

- Inverters and transformers.
- High and low voltage cabling.
- Battery energy storage systems.
- Substations
- Offices/Warehouse
- Boundary fencing and security measures.
- Access roads, both internal and external.
- Car Parking
- Landscaping
- Hard standings

2.3.3 Fire safety Measures and Firefighting Infrastructure

2.3.3.1 Water Supply

Approved document 'B' requires a bulk water supply of 48,000lts or a pressure fed hydrant system The NFCC guidance requests a supply of 1900lts for 2 hours (228,000lts) for general firefighting for initial firefighting plus additional water supplies as required. There will be a pressure fed hydrant system that will comply with BS 9990 (Non automatic fire-fighting systems in buildings. Code of practice).

The water suppression system has been designed following the FM Global large-scale testing of water sprinkler systems, and the FM Global Property Loss Prevention Data sheet (LITHIUM-ION BATTERY ENERGY STORAGE SYSTEMS) this has identified that lithium iron LFP batteries are relatively safer than other types of lithium batteries due to the higher temperature required to trigger thermal runaway. It is the thermal runaway that has been identified as the principal risk in BESS fires.

There are a number of layers of fire safety protection systems designed to prevent thermal runaway, but a safety-first approach has been taken so that all known eventualities have been accounted for within the multi layered approach to fire safety.

If a incident occurred that may lead to a battery catching fire then the water suppression system has been designed based on the FM Global fire suppression testing for BESS, FM GLOBAL have undertaken large scale fire tests that has identified that a battery fire within a rack can be extinguished with a water suppression system, other gas suppression systems did extinguish the initial fire, but failed to prevent reignition and thermal runaway due to a lack of cooling below its thermal ignition temperature, This system is based on the NFCC recommendations within NFPA 855 (NFPA 855 is a safety standard developed by the National Fire Protection Association (NFPA) for the design and installation of on-site energy storage systems, particularly energy storage systems (ESS) like batteries)

The FM Global research into suppression systems involving BESS fires has identified that a water suppression system can extinguish a battery fire within a rack, with a design density of 12mm per minute. Based on this design the system has taken into account the principal issue of reignition, this phenomenon is why gas suppression systems are not considered suitable suppression systems within BESS containers. The capability of the system will ensure that THE suppression system will be able to operate for as long as the fire service deem necessary, within an individual container or pack of four containers if required.

Type of Suppression

Several suppression systems using a range of medias have made claims over extinguishing lithium batteries based on the initial first strike, which is correct. But the Principe issue is not the first strike that may well extinguish any flames, but the reignition issue that regularly occurs if the temperature within the battery is not reduced below its self-ignition temperature.

Water suppression has been proven (FM global Research Technical Report - Development of Sprinkler Protection Guidance for Lithium Ion Based Energy Storage System) and NFPA 855 to cool the batteries due to its high heat absorption capacity, to below temperature at which thermal runaway begins and prevent thermal runaway.

The ideal media is one that has a high thermal capacity so that it can absorb high quantities of heat, this makes water an ideal medium and has the benefit of being widely available. This has been confirmed in the only large scale testing into lithium batteries and suitable suppression systems that has been undertaken FM Global undertaking large scale testing to extinguish a Lithium Battery fire, has shown that a fire within a LFP battery within a rack could be contained by reducing the temperature of the thermal battery and temperature to below its thermal runaway temperature and prevent the effect of thermal runaway to adjacent batteries and racks within a container.

water is a perfect cooling agent because of its high heat of vaporization and heat capacity. It may not only help suppress flaming combustion but also able to slow down and stop propagation of the thermal runaway.

As specified for an EH1 occupancy in NFPA 13 [14] or an HC-3 occupancy in DS 3-26 [16]. The water demand area is typically based on the number of sprinklers needed to provide adequate protection during a large-scale fire test plus a 50% safety factor

The same design parameters have been used in the specification for the automatic water suppression systems within each container.

BESS WATER SUPPLIES REQUIRED

Container Suppression

Design density of 12mm min over the floor area + 946 lpm for firefighting jets

(Firefighting 2hrs NFCC = 228000 LTS)

Standard 20ft Container w 2.43 x l 6.06 x h 2.59 area = 2.43x6.06 = 14.72 (15m2).

12mm min x 15m2 = 180 lpm x 60 = 10,800 hour x 12 hours 129,000lts per container x 4 container = 516000 lts + 228000 for firefighting

Water required 746,000 lts. Based on four containers with water suppression system operating and firefighting requirements.

Hydrant supply

NFCC recommends a supply of 1900 lpm for 120 minutes a total of 228000lts if required for firefighting.

Container 180 lpm x 60 =10,800lts hour = 129600 lts per 12 hours

Pack of four containers = 518,400lts plus firefighting provision of 228000lts

Total water supply over a 12-hour operation 746,400 lts

Firefighting water supply.

It is anticipated that the Local fire hydrant supply will be sufficient for supplying the recommended flow rates as per the NFCC guidance if the flow rates are not adequate then it has been proposed to have bulk water storage tanks on site with a capacity 804,000 lts. The tanks will comply with Loss prevention standard 1276 Requirements for the LPCB certification and listing of above ground suction tanks for sprinkler systems that will have the standard fire service couplings and confirmed by the FRS.

Water suppression testing.

The following charts indicate the benefit of the water suppression systems. There were 2 experiments undertaken in this research to show the issue of reignition and the need for continued application of the water suppression system.

The system was operated for a period of 5 seconds and then stopped to see the effect on temperature and reignition.

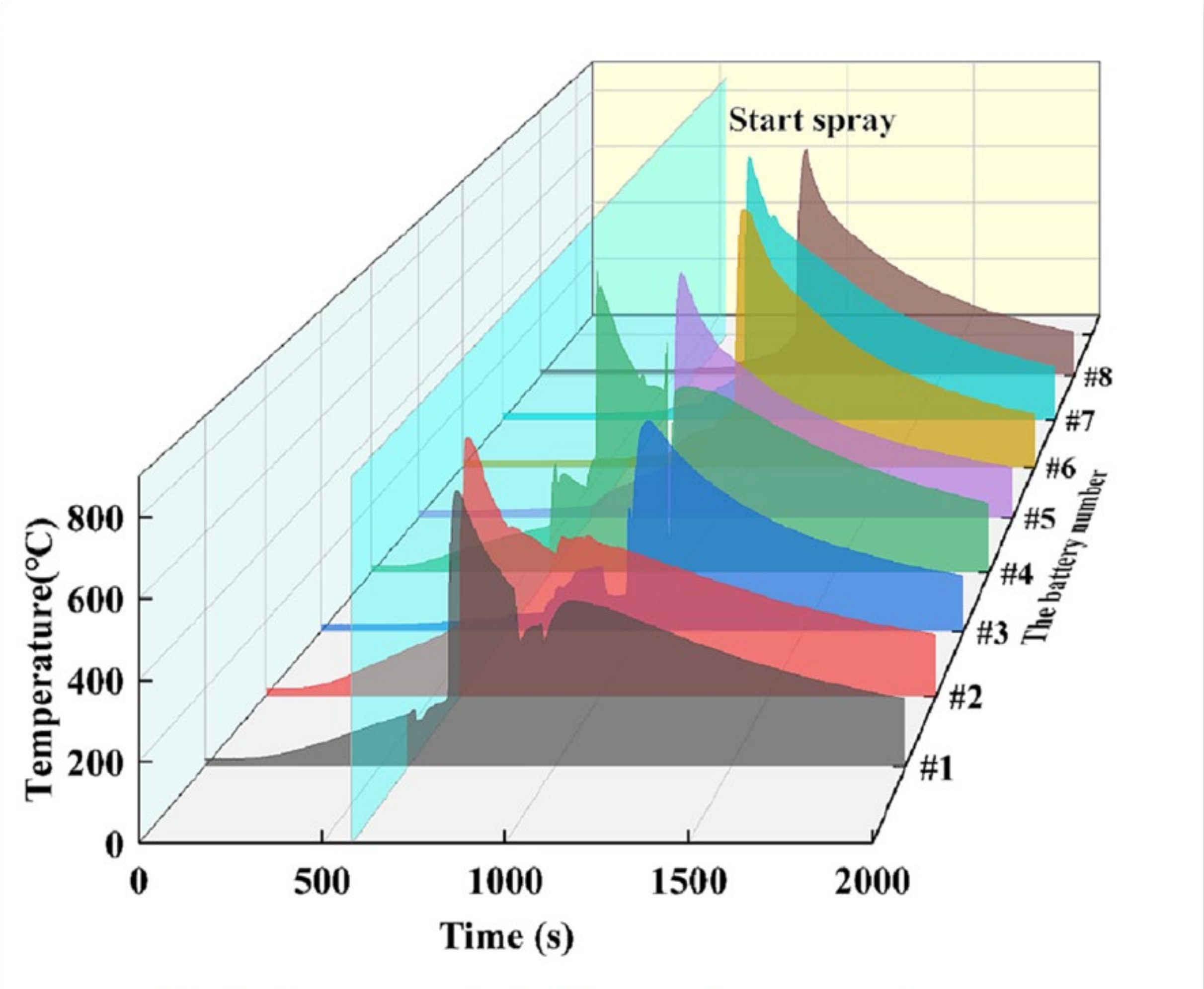


Fig. 4. Temperature in the five-second spray experiment.

In the second experiment there was continuous application of the water suppression system.

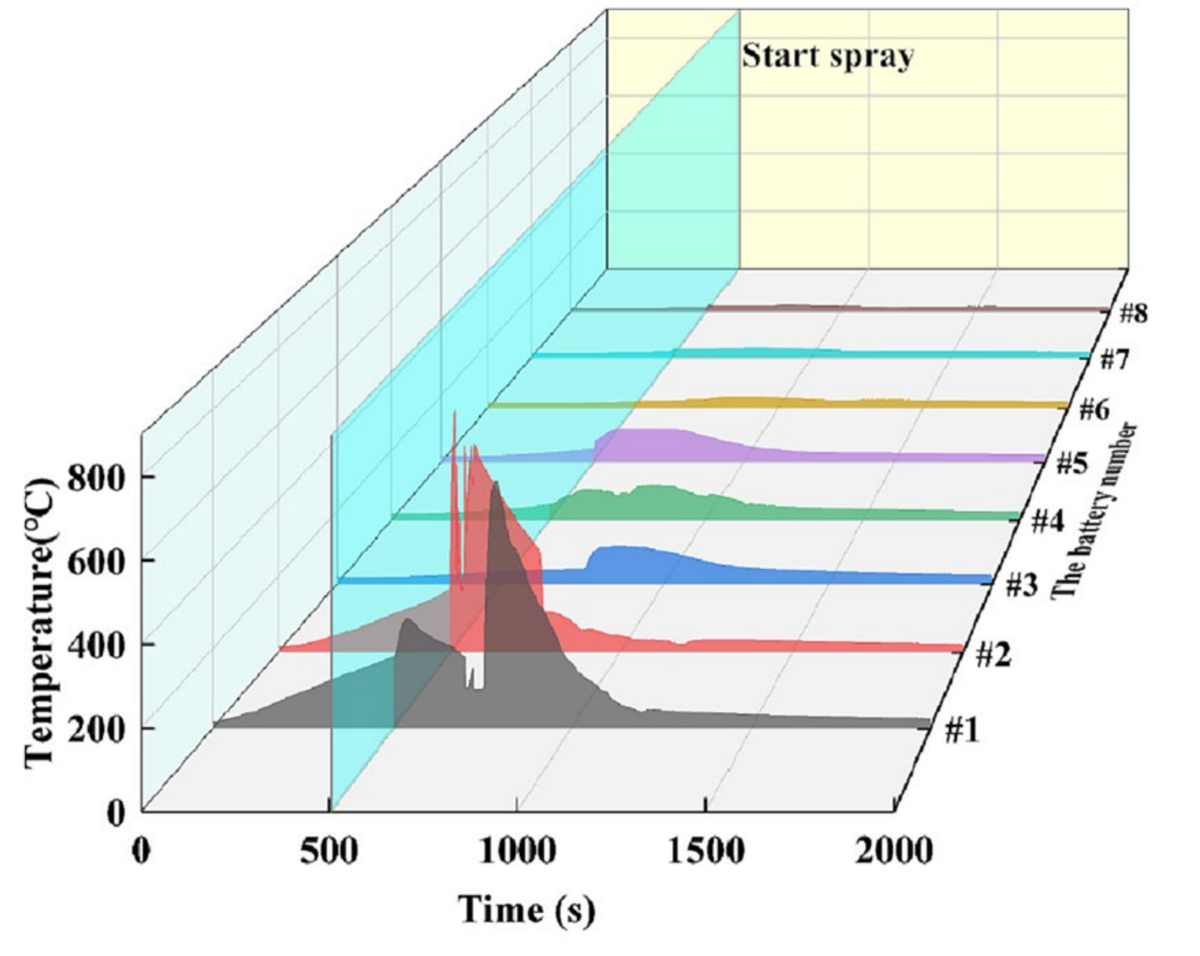


Fig. 5. Temperature in the continuous spray experiment.

2.3.3.2 *Exhaust/Ventilation Systems*

A ventilation system is linked to the battery management system to ensure the container temperature is maintained within the manufacturers recommended temperature range, there is a liquid cooling system within each rack to ensure sufficient cooling as well as internal fans to maintain an airflow. This system will also vent the containers to prevent any concentrations of gases reaching an excessive level. Exhaust systems designed to prevent deflagration should keep the environment below 25% of Lower Explosive Limit (LEL).

2.3.3.3 Deflagration Venting System

In containers with no off-gassing detection capability, there is a likelihood of a possible deflagration taking place due to the delay in the detection of thermal runaway, where off-gassing has occurred due to a separator fail within the batteries, the battery container will begin to fill with explosive gasses which can reach a concentration that causes an explosion. To prevent harm to firefighters, the deflagration vents would allow the pressure to release upwards and away from the container ensuring that the ventilation and dispersion will prevent any build-up of explosive gasses and that the upper and lower explosive limits are not reached as these containers do have an off gas capability the likelihood of a deflagration is remote but as an additional layer of protection for firefighters explosion vents in the roof of the container will be provided to ensure any explosion has a vertical trajectory rather than horizontal, protecting any person in the vicinity.

2.3.3.4 Smoke Detection

Smoke detection in accordance with BS 5839 PT 1 L4 is provided within the ancillary buildings and battery containers for early detection in the event of a fire the fire alarm system will be linked to a remote monitoring station to ensure a rapid response and investigation to an alarm raised.

2.3.3.5 Heat Detection

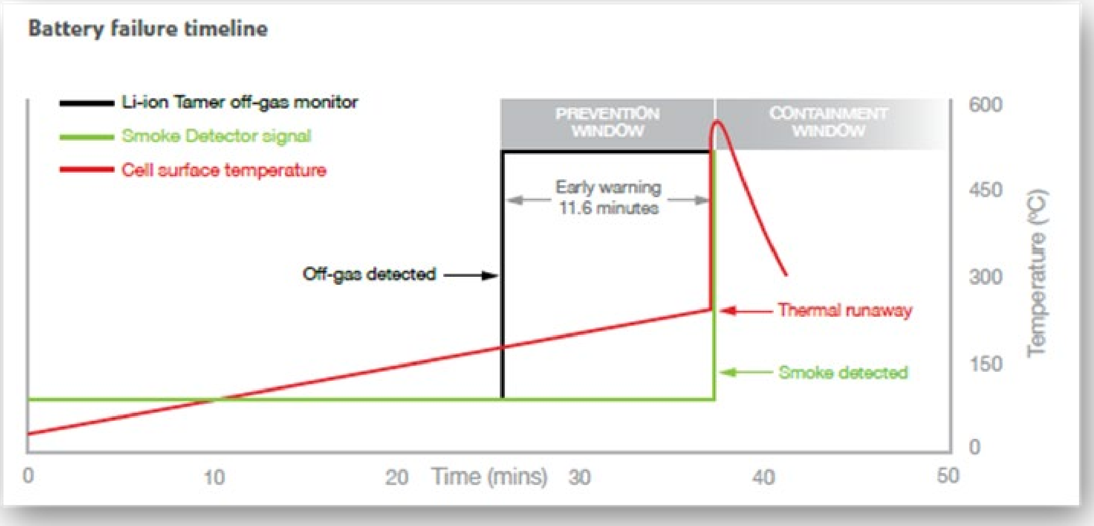
Heat detection in accordance with BS 5839 PT1 is provided as a further activation point for fire safety measures such as the water suppression system. The temperature required for activation of a heat detector would not occur early in the detection phases of an incident but is employed as a further line of defence in activating firefighting systems.

2.3.3.6 Off Gas Detection

Due to the reaction of the process that causes thermal runaway, The very latest research into the prevention of thermal runaway has identified an early detection system that has been proven to prevent thermal runaway this system of detecting what is termed off gassing is part of the chain reaction leading to thermal runaway, this early detection of the Volatile organic compounds that make up the off gas allows early intervention of the BMS to cut the power to the battery/rack and container to prevent energy being supplied and therefore increasing the temperature within the battery as state of charge is directly related to the energy and heat produced in a thermal runaway event. Therefore, the early off-gas detection in the early-stage of thermal runaway of the batteries, off-gassing detection is vital in preventing an explosion and fire. The off-gas detection system is intended to detect an issue with the batteries where the separator fails before thermal runaway occurs. Off gas detection has been proven to detect VOC's prior to and earlier than any conventional gas detection and will be installed within each cabinet at the top and bottom of battery racks due to the off gassing being both heavier and lighter than air depending on the compound ensuring the earliest possible detection and the prevention of thermal runaway.

This off gas detection will be installed in all containers. Off-gas detection equipment detects volatile organic compounds (VOCs) associated with the degradation of the electrolyte during the early stage of cell failure. Before a cell goes into thermal runaway, VOCs produced by degradation of the cell are released in trace amounts. This occurs at a much lower temperature than the thermal runaway threshold.

As indicated in previous sections, heat and flammable and/or toxic gas production are the two basic factors to determine the hazard of the battery failure. Consequently, the safety of a battery system can be improved by first avoiding the condition leading to heat and gas generation, and secondly by managing the heat and gas generation to alleviate the effects of failure.



2.3.3.7 *Flame Detection*

With the off-gas detection installed and the early detection provided the provision of flame detection covering the external areas of the containers. It is not proposed to install a flame detector due to its delayed operation.

2.3.3.8 *Suppression Systems*

In accordance with the latest FM Global research into large scale BESS fires gas suppression systems are not recommended due to the failure to stop reignition. Therefore as part of the fire protection multi layered approach a water suppression system will be installed capable of providing a design density of 12mm per minute discharge capacity over the total container as per point 2.4.1 of the FM Global research report that has proven that an LFP battery fire within a rack can be extinguished due to the design density and volume of water spray used that absorbs and reduces the heat from the fire and prevents thermal runaway of the LFP batteries.

The advantage of water suppression systems is that they have several benefits including, the prevention of radiated heat affecting adjacent containers and allowing reduced spacing (as identified within in the FM Global property loss data sheets) within this site this has been limited to spacing within a pack of four containers to ensure that adequate safety distances are maintained of 6 meters between packs.

Note: The suppression system will reduce the temperature of the battery, therefore re-ignition is not likely to occur, and the effect on boundary conditions will be reduced.

2.3.3.9 *Temperature Monitoring*

In addition to the battery management system temperature controls, there will be further temperature measures installed within the container this is planned to allow the FRS to identify the temperature within the container.

2.3.3.10 *Battery Management System*

The battery management system is intended to identify any electrical issues that may be occurring with the batteries. This includes identifying where a battery may be overcharging, undercharging, or experiencing other electrical faults. As per *NFPA 855*, this will include high cell temperature trip, thermal runaway trip, rack switch trip, inverter trip and voltage protection measures.

There will also be online condition monitoring that will provide online monitoring systems that will monitor battery room temperature and the following parameters, as a minimum, at the battery module and/or cell level:

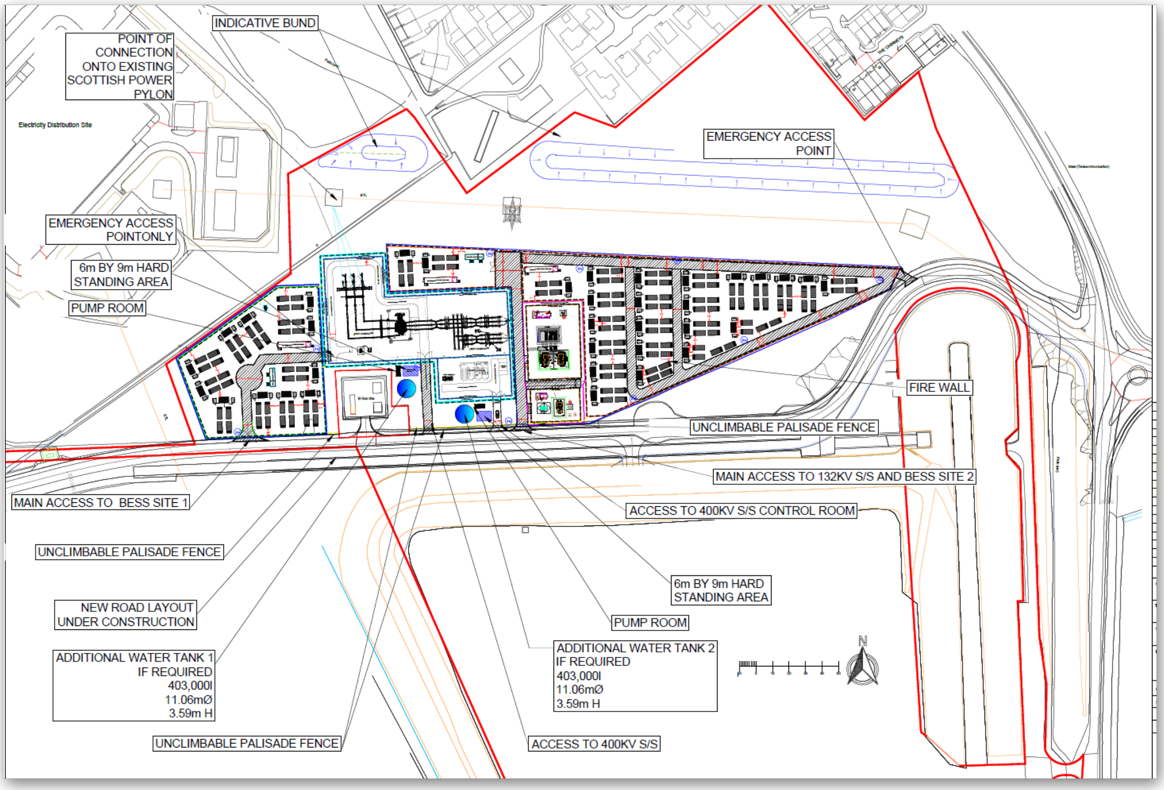
- Charging and discharging voltage and current.
- Temperature.
- Internal ohmic (resistance).
- Capacity.
- State of charge (SOC).
- State of health (SOH).
- Alarm or fault log.

Note: Where a failed separator is the cause of the battery issue, this is unlikely to be recognised by the BMS. In instances where it is detected, the shutting down of power to the battery is not sufficient to prevent off-gassing and thermal runaway.

2.3.4 Site Access

The NFCC guide recommends two access routes based on the assumption that a smoke plume would have toxins that may hinder firefighting operations. This site has a single access point which will allow the entry of fire appliances and access to the site for firefighting efforts. The access points are situated in such a way that fire services will not have to run a length of hose exceeding 60 metres from their point of connection (firefighting appliance/on-site hydrant).

There are a number of access points.



The recommendation for alternative access points assumes that there would be a fire plume that may be toxic. And this fire plume could affect the access route for fire appliances, there is an access road for primary access and an emergency access point at opposite points to the site. There will also be a water fire suppression system within each container that has the benefit of commonly called scrubbing (removal of contaminants within the smoke plume) as per the British Automatic Fire Sprinkler Association report on the benefit of sprinkler systems in residential accommodation. The design of multiple layers of protection within the fire protection systems should prevent any fire occurring and the production of a toxic smoke plume that would affect firefighting access, the design of water suppression system would mean that no firefighting personnel would need to approach any container this safety margin should ensure the safety of firefighters and ensure a significantly reduced fire plume of mainly water droplets due to evaporation that will naturally disperse. The battery containers will also have a 60-minute fire rating reducing the possibility of further radiated heat affecting any adjacent battery container as per FM Global Property Loss Prevention Data Sheets 1-20 PROTECTION AGAINST EXTERIOR FIRE EXPOSURE.

The provision of the water suppression system and the fire resistance provided to the containers, would reduce or eliminate the possibility of radiated heat effecting an adjacent battery container and raising the temperature within the cabinet to a level that may cause thermal runaway. and the likely hood of further fire spread, the water suppression system has a number of advantages in reducing any risk to firefighters and the environmental from the impact of toxic smoke plumes.

Areas within 10 metres of BESS containers will be cleared of combustible vegetation and any other vegetation on site should be kept in a condition such that they do not increase the risk of fire. This is due to a perceived wildfire risk. There will be no grass or vegetation within close proximity to any container or associated infrastructure. There will be reduced spacing between containers within each pack of four containers with a 6-meter spacing between packs, the water suppression system and fire rating of containers as mitigation for any possible radiated heat.

2.3.4.1 Signage

Signage should be installed in a suitable and visible location on the outside of BESS units identifying the presence of a BESS system. Signage should also include details of:

- Relevant hazards posed.
- The type of technology associated with the BESS.
- Any suppression system fitted.
- 24/7 Emergency Contact Information.

Signs on the exterior of a building or enclosure should be sized such that at least one sign is legible at night from 30 metres or from the site boundary, whichever is closer. There will be a fire brigade information box adjacent to the access gate for any first responders so that all information on the site will be available. Both for contingency planning and firefighting operations.

3 Procedures & Management

3.1 Preplanning

3.1.1 Employee Training

Sufficient fire safety training should be undertaken with all employees who are based at or will attend the site. This training will cover all aspects of fire safety including highlighting the risks and hazards of fire at the site, emergency procedures, basic fire prevention and firefighting as well as how to assist others if required. Any fire safety systems the employee is expected to operate or troubleshoot should also be covered.

3.2 Emergency Response Procedures

The response to a fire incident would be dependent on the location and source of the fire. A fire not contained within a battery container poses different immediate and delayed risks to a fire within a sealed unit.

3.2.1 Battery Fire (Internal)

Where a fire occurs within a battery container, the following steps should be taken:

1. The automatic detection systems should operate and automatically alert the control room and fire service as well as initiating the fire procedure that will electrically isolate the site, automatically operate the fixed suppression systems for 12-48 hours depending on the fire service assessment.
2. Ensure the immediate surrounding areas is cleared of any occupants and report to the fire assembly point if free from danger.
3. Contact the emergency services and provide the full address of the facility.
4. Contact the relevant person who oversees fire safety for the facility.
5. Ensure access to the facility and fire location are clear of obstruction such as vehicles or storage.
6. Perform a sweep of all areas of the facility to ensure all occupants are at the assembly point.

3.2.2 Battery Fire (External)

Where a fire occurs outside of a battery container, the following steps should be taken:

1. Raise the alarm by activation of a manual call point ot the automatic fire detection system, ensure the immediate surrounding areas is cleared of any occupants and report to the fire assembly point.
2. Contact the emergency services and provide the full address of the facility
3. If possible, use portable fire extinguishing appliances to tackle the fire.
4. Contact the relevant person who oversees fire safety for the facility.
5. Ensure access to the facility and fire location are clear of obstruction such as vehicles or storage.
6. Perform a sweep of all areas of the facility to ensure all occupants are at the assembly point.
7. Meet the fire service on arrival and brief the officer in charge.

3.2.3 Inverter Fire

If a fire occurs due to the inverter units, the following steps should be followed:

1. Ensure the immediate surrounding areas is cleared of any occupants and report to the fire assembly point if free from danger.
2. Perform a sweep of all areas of the facility to ensure all occupants are at the assembly point.
3. Contact the emergency services and provide the full address of the facility.
4. Contact the relevant person who oversees fire safety for the facility.
5. Ensure access to the facility and fire location are clear of obstruction such as vehicles or storage.
6. Meet the fire service on arrival and inform the officer in charge of the situation.

3.3 Roles & Responsibilities

3.3.1 Site Manager

The site manager will be responsible for the overall fire safety of the site. In the event of a fire incident, the site manager will be required to notify any other stakeholders, as well as liaise with the fire service as to aid firefighting efforts and relay any other information that may be of assistance or relevant to any hazards that may pose a risk to surrounding infrastructure and members of the public.

3.3.2 Employees

If an employee is attending the site at the time of a fire incident, they will be responsible for notifying the fire service and site manager at the earliest opportunity so that firefighting efforts can begin promptly, and any other relevant stakeholders can be notified.

4 Post Incident Recovery

4.1 De-energising & Removal

Following firefighting efforts there is a reasonable expectation that the batteries will pose non-fire related risks to personnel involved in the disposal or recovery of the batteries.

The hazard procedures in place for the site should be consulted for the removal and/or recovery of the batteries following an incident.

4.2 Disposal

4.2.1 Batteries

The disposal or recycling of the batteries will be undertaken by a suitably appointed accredited contractor on behalf of [SITE OPERATOR].

4.2.2 Contaminated Water

The management of contaminated water following a fire incident will be carried out as per the principles of the joint document (2018) issued by Water UK, Environment Agency, NIEA, Natural Resources Wales, DWI, Fera, Defra's CBRN Recovery Team and NFCC National Resilience. This document breaks down the process into four main steps.

4.2.2.1 Contain

The contaminated water should be contained at source or as close to the source as possible. The contaminated water run off at [SITE NAME] will be drained into a holding pond with a maximum capacity of [CAPACITY].

4.2.2.2 Identify

Due to the formulation of the batteries, other materials on site and the firefighting mediums, the contaminated water run-off is expected to contain the following substances:

Substance	Type	Risk
Cobalt	Heavy Metal	High
Nickel	Heavy Metal	Low

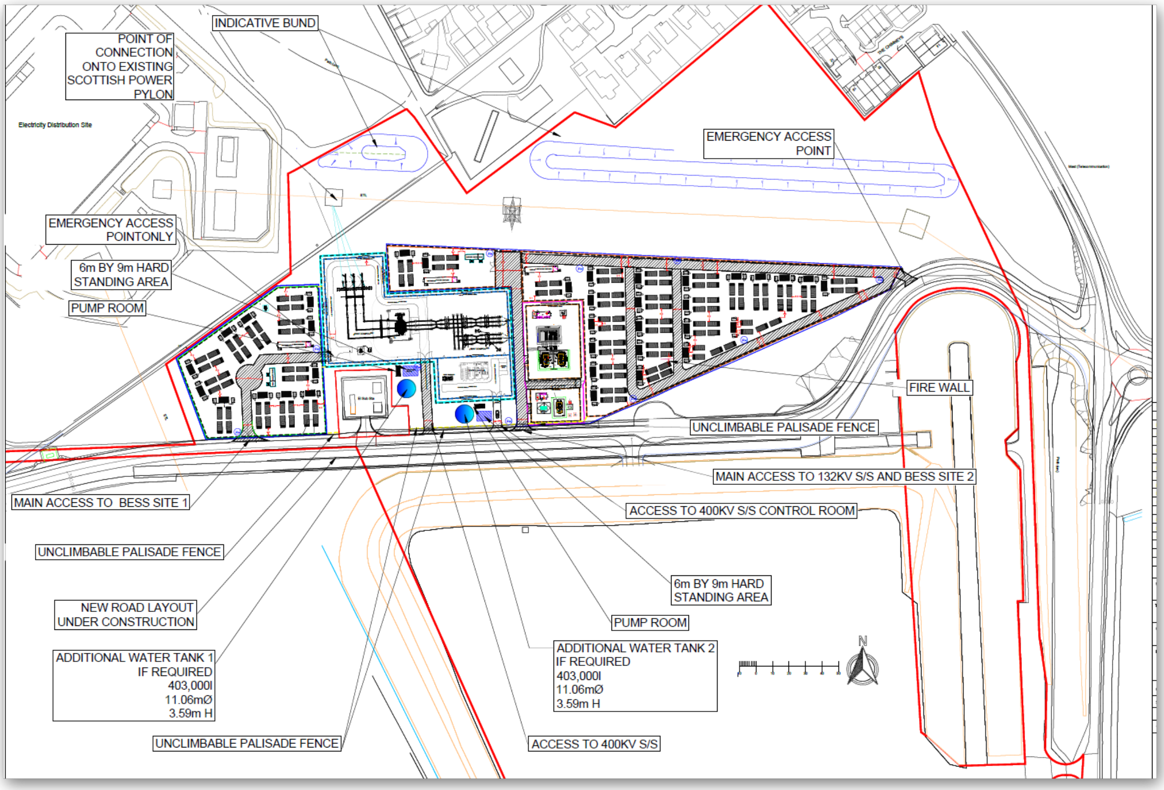
4.2.2.3 Treat

An assessment of the contaminated water will be undertaken by a competent professional to ascertain if treatment is required or feasible.

4.2.2.4 Dispose

The contaminated water will be disposed of, or further assessment carried out based on an evaluation by a competent professional in cooperation with the relevant local authorities.

5 Appendix A – site location



6 References

6.1 Building Regulations

6.1.1 Approved Document B of the Building Regulations

Approved Document B of the Building Regulations provides basic, prescriptive guidance on fire safety in buildings including the construction, location and occupancy characteristics. Approved Document B is primarily used within this plan for firefighting access, water supplies and other firefighting provisions.

6.1.2 British Standard 9999 (Fire safety in the design, management and use of buildings, Code of practice)

British Standard 9999 covers the same subjects as Approved Document B, but allows for management processes and further compensatory measures to allow more leniency in terms of fire safety measures and building occupancy.

6.2 British Standard Compliance

6.2.1 Electrical

6.2.1.1 BS 7671

Also known as the IET Wiring Regulations, BS 7671 provides essential guidelines for electrical installations in the UK.

6.2.2 Fire Detection & Alarm

6.2.2.1 BS 5839-1

Addresses fire detection and fire alarm systems for buildings. It offers guidance on designing, installing, and maintaining these systems to ensure early detection and warning of fires.

6.2.2.2 BS 5266

Focuses on emergency lighting systems in buildings. It outlines requirements for the design, installation, and testing of emergency lighting to provide illumination in the event of power failure.

6.2.2.3 BS EN 60079-29-2

Part of the series for explosive atmospheres, this standard specifies performance requirements for gas detectors. It ensures that gas detection equipment used in potentially explosive environments functions reliably to prevent hazardous situations.

6.2.3 Firefighting

6.2.3.1 BS 9990

Guidelines for non-automatic fire-fighting systems in buildings. It covers the design, installation, and maintenance of such systems, focusing on aspects like hose reels, hydrants, and dry risers. This standard ensures that fire-fighting equipment is readily available and functional in case of emergencies, enhancing overall fire safety.

6.2.4 Portable fire extinguishers

6.2.4.1 BS 5306

Standards for fire extinguishing installations and equipment. It offers guidance on the selection, installation, commissioning, and maintenance of fire extinguishers, hose reels, and other fire-fighting equipment.

6.2.4.2 BS EN 12845

Aligned with European standards (EN), the standard specifies the design and installation requirements for automatic sprinkler systems in buildings. It covers various aspects of sprinkler systems, such as water supplies, pipe sizing, and system components.

6.2.4.3 BS EN 14972-1

Focusing on fixed firefighting systems, this specific part deals with the design and installation of gas extinguishing systems. It provides guidelines for designing systems that utilize gases like carbon dioxide or inert gases to suppress fires.

6.2.5 Product Safety

6.2.5.1 BS EN 62619

Pertains to electrical energy storage systems (EESS) safety requirements. It outlines guidelines for ensuring the safety of EESS installations, covering various energy storage technologies.

6.2.6 EMC Safety

6.2.6.1 BS EN IEC 61000-6-1

Addresses electromagnetic compatibility (EMC) for industrial environments. It provides guidelines for reducing electromagnetic interference in industrial settings.

6.2.6.2 BS EN IEC 6100-6-3

This standard focuses on the emission of radio-frequency disturbances from equipment in residential, commercial, and light-industrial environments.

6.3 Guidance and Recommendations

6.3.1 NFCC

The National Fire Chiefs Council issued a guidance document detailing the current outlook for BESS within the UK, relating specifically to open air environments. Much of the guidance, which covers design, suppression, site access and emergency plans, is taken from some of the guidance mentioned below such as the NFPA guide, FM Global Guides and CFA guides from Australia.

6.3.2 FPA guides

The FPA in conjunction with the RISC Authority, issued a guide in 2022 titled RE1. This guide covers the hazards of a BESS and the risk control recommendations.

6.3.3 FM Global Data Sheets

The primary FM Global data sheet consulted throughout the design and planning of the site is the Property Loss Prevention Data Sheets originally published in January 2017 and revised in July 2023. The guide covers site layout recommendations, fire safety installations and measures to prevent or restrict issues.

6.3.4 NASA Fire and Gas Characterization Studies for Lithium-ion Cells and Batteries (2020)

The report contains similar content to many of the others referenced, including testing of different cell chemistries with venting gas and other test result breakdowns, as well as the impact of fire resisting measures applied to lithium-ion storage systems.

6.3.5 NFPA 855

NFPA 855 is a safety standard developed by the National Fire Protection Association (NFPA) for the design and installation of on-site energy storage systems, particularly energy storage systems (ESS) like batteries. It provides comprehensive guidance to address the unique safety concerns associated with ESS installations, including fire protection, electrical, and structural aspects.

Battery Technologies: It addresses various battery technologies, such as lithium-ion, lead-acid, and more, offering specific safety requirements for each type.