Appendix 4.3:
Battery Safety Statement

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Shepherds' Rig Section 36C

Appendix 4.3: Battery Safety Statement

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1. Introduction

1.1.1. The Proposed Varied Development is planned to comprise approximately 127 megawatts (MW) of renewable energy generation and energy storage output capacity, consisting of approximately 77 MW of wind energy (from 11 turbines) and a maximum of 50 MW of battery energy storage capacity.

1.1.2. The power generation of wind installations is dependent on wind resource availability and therefore cannot be adjusted to demand. For the decarbonisation of the UK power system, the requirement of technologies that can respond to fluctuations in supply and demand are required. In this context the role of battery energy storage systems (BESS) is becoming fundamental.

1.1.3. The capabilities of a BESS include, amongst others, storing electricity during periods of excess generation to support the grid during peak demand hours, enhancing energy security and reducing reliance on fossil fuels. This helps balance supply and demand more efficiently, particularly with the growing use of renewable energy sources.

2. Battery Technology and System Description

2.1.1. The Proposed Varied Development will involve a BESS with up to 4 hours discharge duration. It is expected to utilise Lithium-ion batteries, which currently dominate the UK market for systems of this duration. Lithium-Ion provides longer lifespans, higher energy densities compared to other technologies, higher roundtrip efficiency and system costs have been falling over the last decade.

2.1.2. The outline information provided below is based on an assumption of Lithium-ion technology being used for the BESS. However, technology in the energy storage sector continues to develop rapidly, and it is therefore possible that the BESS could utilise an alternative technology. Confirmation of the selected technology and final design details would be provided nearer to the commencement of construction, proposed to be secured by an appropriately worded planning condition. The design would conform with relevant safety standards and requirements for the selected technology.

2.1.3. The battery cells within the BESS will not be of the Lithium-ion NMC (Nickel Manganese Cobalt) type which is considered to be of a higher thermal runaway risk relative to other cell types, such as Lithium Iron Phosphate cells (LifePO4).

2.1.4. A typical Lithium-ion BESS consists of key components that are responsible for the storage and energy management. The battery cells are organised into modules and packs where electricity is stored.

2.1.5. The Power Conversion System (PCS) involves a bi-directional inverter that controls the flow of energy between DC storage and AC grid power. The Battery Management System (BMS) is responsible for the safety in the system operation by monitoring variables such voltage, current, temperature and State of Charge (SoC). The Energy Management System (EMS) is responsible for the optimisation of the charge and discharging processes to enhance performance and longevity. The safety systems such as fire suppression, and

monitoring contribute to the safe operational conditions and minimisation of risks such as fires, thermal runaway or system failures.

3. Risk Management and Mitigation

3.1.1. Lithium-ion BESS have safety aspects that need to be addressed to support safe operation. It shall be noted that safety incidents for BESS are rather rare and potential fire events are normally driven by what is called a 'thermal runaway' event. This involves a condition where the heat generated inside a battery exceeds the ability of the BESS cooling system to dissipate that heat, potentially resulting into a fire event or even explosion. There are key points to consider for risk mitigation and management, these include the following measures:

- **BESS Operational Requirements:** The system operation will be monitored through the BMS and EMS to maintain optimal performance and identify any potential issues at an early stage.
- **BESS Maintenance Requirements:** Preventative maintenance for BESS requires scheduled, proactive actions to minimise the potential risk of plant failures, extension of system lifetime and contribute to system performance. This will result in a reduction of unplanned downtime, reactive repair needs, less frequent component replacements, and improve plant reliability and system efficiency.
- **Fire Suppression Systems (FSS):** The FSS will be fully detailed as part of the detailed BESS design; this is fundamental to detect, control, and extinguish fires before they propagate, especially under a potential thermal runaway scenario. A rapid response from the suppression system helps prevent fire spreading to other cells or modules.
- **Project Design:** The detailed design will allow for proper spacing between BESS units, inclusion of enclosures with suitable thermal resistance allowances, the allocation of water tank(s) with proper water volume sizing, storage containers with deflagration vents, etc. This will contribute to the potential reduction of fire propagation spread under a potential thermal runaway event.
- **Design & Installation Standards and Regulations:** The BESS will be designed and installed according to recognised national and international standards and guidelines (please refer to **Section 4**).
- **Water Supply:** The design will integrate fire hydrants and/or static water tanks depending on the site conditions and presence of a fire main. The placement of water access points near to the BESS is critical for supporting effective firefighting and maintaining the safety of personnel.
- **Drainage Systems:** A Sustainable Drainage Systems (SuDS) will be included within the detailed design of the BESS, as this is fundamental for the potential management of water runoff from a potential thermal runaway event to protect the environment and prevent contamination of water sources.

- **Site Access:** The BESS design will include provision of adequate access for the Fire and Rescue Service (FRS); firefighters should not have to enter the BESS site and drive through a vapour or gas cloud to reach the scene of operation. An alternative access point will therefore be provided, taking account of the prevailing wind direction.
- **Outline Battery Storage Safety Management Plan (OBSMP):** This will be developed at an early project stage, and a Battery Storage Safety Management Plan (BSMP) will be developed at the detailed design work stage, to include an emergency response plan.

3.1.2. These measures collectively help in minimising the risk and managing the consequences of thermal runaway in BESS.

4. Safety Standards and Guidance for BESS

4.1.1. The compliance with relevant safety standards is essential for mitigating risks such as electrical faults, thermal runaway, fire and explosion. A summary list of safety standards to adhere to when developing a large scale has been included below:

- National Fire Chiefs Council (NFCC), Grid Scale Battery Energy Storage System Planning – Guidance for Fire and Rescue Services (FRS), Version 2.0 (2025), published in February 2026.
- UL 9540: Standard for Energy Storage Systems and Equipment.
- UL 9540A: Test method to evaluate thermal runaway fire propagation behaviour across cell, module, unit and installation levels.
- National Fire Protection Association (NFPA) 855 Standard for the Installation of Stationary Energy Storage Systems.
- International Electrotechnical Commission (IEC) 62619: International standard for rechargeable battery safety in industrial applications, focusing on electrical, mechanical and environmental safety. It sets the design and test requirements to reduce risk under fault conditions, such as thermal runaway.
- FM Global Datasheet 5-33: Offers guidelines for fire protection and hazard mitigation specific to Lithium-Ion battery systems, including guidance on suppression systems for large battery arrays.
- UL 1973 (ANSI/CAN/UL 1973): Batteries for Use in Stationary Applications. This is the key battery/module-level standard that complements UL 9540.
- BS EN IEC 62933-5-2: Electrical Energy Storage (EES) systems – Safety requirements for grid-integrated EES systems – Part 5-2: Electrochemical-based systems.
- UK Government / DESNZ Health and Safety Guidance for Grid Scale Electrical Energy Storage Systems

4.1.2. It should be noted that the listing shown represents a summary of BESS safety standards and that these may be updated or superseded during the lifecycle of the Proposed Varied Development.

References

Florence, L.B., Hopper, D. (2020). UL 9540 Standard for Energy Storage Systems and Equipment. Available at: https://www.ul.com/news/ul-9540-energy-storage-system-ess-requirements-evolving-meet-industry-and-regulatory-needs

FM Global (2023). FM Global Datasheet 5-33: Offers guidelines for fire protection and hazard mitigation specific to Li-ion battery systems, including guidance on suppression systems for large battery arrays. Available at: https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjq7NSF57GKAxXaQkEAHUfDNP0QFnoECBwQAQ&url=https%3A%2F%2Fwww.fm.com%2FFMAApi%2Fdata%2FApprovalStandardsDownload%3FitemId%3D%257BFB314761-0A9C-4B8C-9410-A31D6792170B%257D&usg=AOvVaw0grfv1VcA-XZ70Zo4TfWWe&opi=89978449

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Abbreviations

Abbreviations	Definition
BESS	Battery Energy Storage System
BMS	Battery Management System
BSMP	Battery Safety Management Plan
EES	Electrical Energy Storage
EMS	Energy Management System
FRS	Fire and Rescue Services
FSS	Fire Suppression Systems
IEC	International Electrotechnical Commission
MW	Megawatts

NFCC	National Fire Chiefs Council
NFPA	National Fire Protection Association
NMC	Nickel Manganese Cobalt
PCS	Power Conversion System
SoC	State of Charge
SuDS	Sustainable Drainage Systems