Appendix I.3

Outline Battery Safety Management Plan

Abbott Risk Consulting Limited

ARC-1259-002-R1

Outline Battery Safety Management Plan – for the Bodelwyddan Battery Energy Storage System

Issue 3 – September 2025

Prepared for:

Bodelwyddan Solar & Energy Storage Limited
Unit 25.7 Coda Studios
189 Munster Road
London
SW6 6AW

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Abbott Risk Consulting Ltd
11 Albyn Place
Edinburgh
EH2 4NG

Phone: +44 (0) 131 220 0164

wwww.consultarc.com

Executive Summary

This Outline Battery Safety Management Plan (OBSMP) is for the proposed Battery Energy Storage System (BESS) installation with ancillary infrastructure on land by Glascoed Rd, Saint Asaph, LL17 0LJ, and has been developed on behalf of Bodelwyddan Solar & Energy Storage Limited (the Client). Henceforth this site and installation will be referred to as the Bodelwyddan BESS.

The aim of this OBSMP, at this planning phase of the programme, is to define the proposed safety strategy, requirements, and processes necessary to meet derived safety objectives and to set a level of safety performance that the installation is to be measured against. These standards are best practices and are derived from the following sources:

1. Planning Practice Guidance (PPG) for Renewable and Low Carbon Energies [Ref. 1].

2. Fire and Rescue requirements detailed in the National Fire Chiefs Council (NFCC) Report Grid Scale BESS Planning – Guidance for Fire and Rescue Service (FRS) [Ref. 2] dated November 2022 (2023 version), plus the updated but not yet formally issued NFCC Grid Scale BESS Planning – Guidance for FRS [Ref. 12], expected to be finalised and issued late-2025.

3. Factory Mutual (FM) Global Loss and Prevention Datasheet 5-33 [Appendix B and Ref. 3] (as cited in the NFCC Report [Ref. 2]).

It also provides the basis for the safety management processes and procedures required to satisfy the identified safety requirements for a BESS system capability.

A preliminary safety hazard identification and analysis has been conducted, based on comparable energy storage systems utilising Lithium Ferrous Phosphate (LFP) battery technology. This has identified the likely hazards and causes associated with this type of BESS and has facilitated the initial identification of potential control measures. When implemented, these measures are expected to reduce the associated risks to an acceptable level. All identified hazards and corresponding mitigations have been documented in the Proposed Development-specific Hazard Log (HL) [Ref. 4]. The precise battery technology to be used will be selected post-determination to account for rapidly evolving technology.

It is concluded that, as far as reasonably practicable and for this planning stage of this BESS installation, that the currently foreseeable hazards associated with the technology proposed have been identified. These will form the initial safety foundation going forward and will be actively managed as the Proposed Development and installation matures. At this juncture of the programme the selection of the BESS technology to be positioned at the Proposed Development has yet to be decided.

The design, development, and manufacture of the BESS requires the development and maintenance of high standards in respect of safety and operational sustainability. It will be the responsibility of all personnel involved in the future development of the proposed undertaking to strive to reduce the potential for accidents to the lowest practicable level by being ‘risk aware’ and promoting a supportive safety and environmental culture at all stages of the development. This OBSMP is the starting point from which the Proposed Development will progress.

It will be essential that the design process is subject to a Design Risk Analysis by a competent person in compliance with the Construction Design and Management (CDM) Regulations 2015 [Ref. 5].

Abbreviations

ALARP	As Low As Reasonably Practicable
ARC	Abbott Risk Consulting Ltd
BESS	Battery Electrical Storage System
BMS	Battery Management System
CDM	Construction Design and Management
DBSMP	Detailed Battery Safety Management Plan
ERP	Emergency Response Plan
FAQs	Frequently Asked Questions
FDSS	Fire Detection and Suppression System
FRS	Fire and Rescue Service
HSAWA	Health and Safety at Work Act
HSE	Health and Safety Executive
IEC	International Electrotechnical Commission
NFCC	National Fire Chiefs Council
NFPA	National Fire Prevention Association
OBSMP	Outline Battery Safety Management Plan
PCIP	Preconstruction Information Plan
PPG	Planning Practice Guidance
UK	United Kingdom
UL	Underwriters Laboratory
US	United States

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1.0 OBSMP Purpose

1.1 Aim

The aim of this report is to outline the safety management approach that will be adopted for the Proposed Development. Furthermore, the overall BESS safety aim is that the levels of risk of accident, death or injury to personnel or other parties, and to the environment due to BESS activities are to be mitigated and managed as far as possible through diligent development, design, construction, and operational control measures. In accordance with the Health and Safety Executive (HSE) Reducing Risk, Protecting People (R2P2) - Guidance [Ref. 6], the BESS development should aim to reduce risks to 'As Low As Reasonably Practicable' (ALARP).

1.2 Scope

The scope of this report is for the Proposed Development BESS capability, covering the physical and functional aspects of the equipment. The BESS safety management will cover design, validation, siting, operation, fire strategy and emergency response, and removal from site (decommissioning). It will also include any remote monitoring and control, maintenance, storage / transportation, and calibration.

1.3 Context

This OBSMP has been developed by Abbott Risk Consulting Ltd (ARC) in the role of the Safety Subject Matter Expert (SME) and aims to identify the safety requirements (and any additional derived safety requirements) such that the Proposed Development can be assessed against a common benchmark, criteria set and safety targets.

This BESS OBSMP has been developed at this early planning stage with the client to identify and assess the potential risks associated with the BESS design, installation, and operating capability, and to provide a robust safety argument, supported by evidence, prior to full commissioning. It is proposed that the safety programme will develop following 3 phases reflecting the maturity of the programme:

1. **OBSMP (Planning)** - informs how safety management is to be conducted. The OBSMP:

    a. Outlines the processes, procedures and means by which the BESS safety management is to be conducted, implemented, and assessed, such that the BESS design and development, initial construction, and operational safety performance can be conducted with an acceptable level of residual risk.

    b. Provides the criteria and targets against which the installation will be assessed.

    c. Provides the initial compliance status against key requirements contained in the PPG [Ref 1] (and referenced guidance).

    d. Identifies the generic hazards associated with BESS installations of this type and tabulate these in the supporting HL [Ref. 4].

2. **Detailed Battery Safety Management Plan (DBSMP) (Installation and Implementation)** – The DBSMP will be produced post planning consent (secured

by planning condition) and will build upon the OBSMP and reflect the maturity of the Proposed Development and availability of detailed information and evidence to support safety claims. The DBSMP will:

a. Assess the level of residual risk posed by the BESS design to individuals (both those directly involved in the operation and 3rd parties), the immediate environment, the asset (i.e. the BESS), interfacing / interdependent assets and property / equipment that could be affected by the operation of the BESS (noise, radiated emissions etc.).

b. Contain the Emergency Response and Contingency Plans.

c. Reference supporting evidence.

d. Detail any recommendations for improvement.

3. **Site Safety Audit (Operation)** – Validates the BESS installation against the safety requirements and identified control measures in the DBSMP. It also validates that the safety processes and procedures required to assure that the risk posed by the design remains within the bounds established and associated requirements have been implemented i.e., training, provision of Personal Protective Equipment, calibration, scheduled maintenance etc. Appropriate reports by the manufacturers and installers will be included in the Site Safety Audit to validate competency and technical due diligence.

The incumbent technology at the time of writing is primarily based on Lithium-Ion batteries. Due to the pace at which battery technology is developing, the precise battery chemistry will not be selected, and solution confirmed until the detailed design phase of the development. As such, this report is written leaning on the subject matter expertise that ARC have in this technological domain, more widely, industry good practice and regulation. Selection of equipment will be based on proven and evidential technical and safety performance.

A section of Frequently Asked Questions (FAQs) is provided at Appendix A to the OBSMP.

2.0 Proposed Development Overview

2.1 The Proposed Development

The Proposed Development is the construction, operation and maintenance of a proposed solar photovoltaic electricity generating system and battery energy storage system ('BESS'), associated solar arrays, inverters, transformers, cabling, substations, access tracks, landscaping, ecological enhancement areas and associated ancillary development. The Proposed development will connect into the National Grid Bodelwyddan substation. Refer to the Proposed BESS Site Layout Rev.03 which forms part of the planning drawing pack, Figure 2-1 is an extract from the planning drawing pack for illustration of access points only.

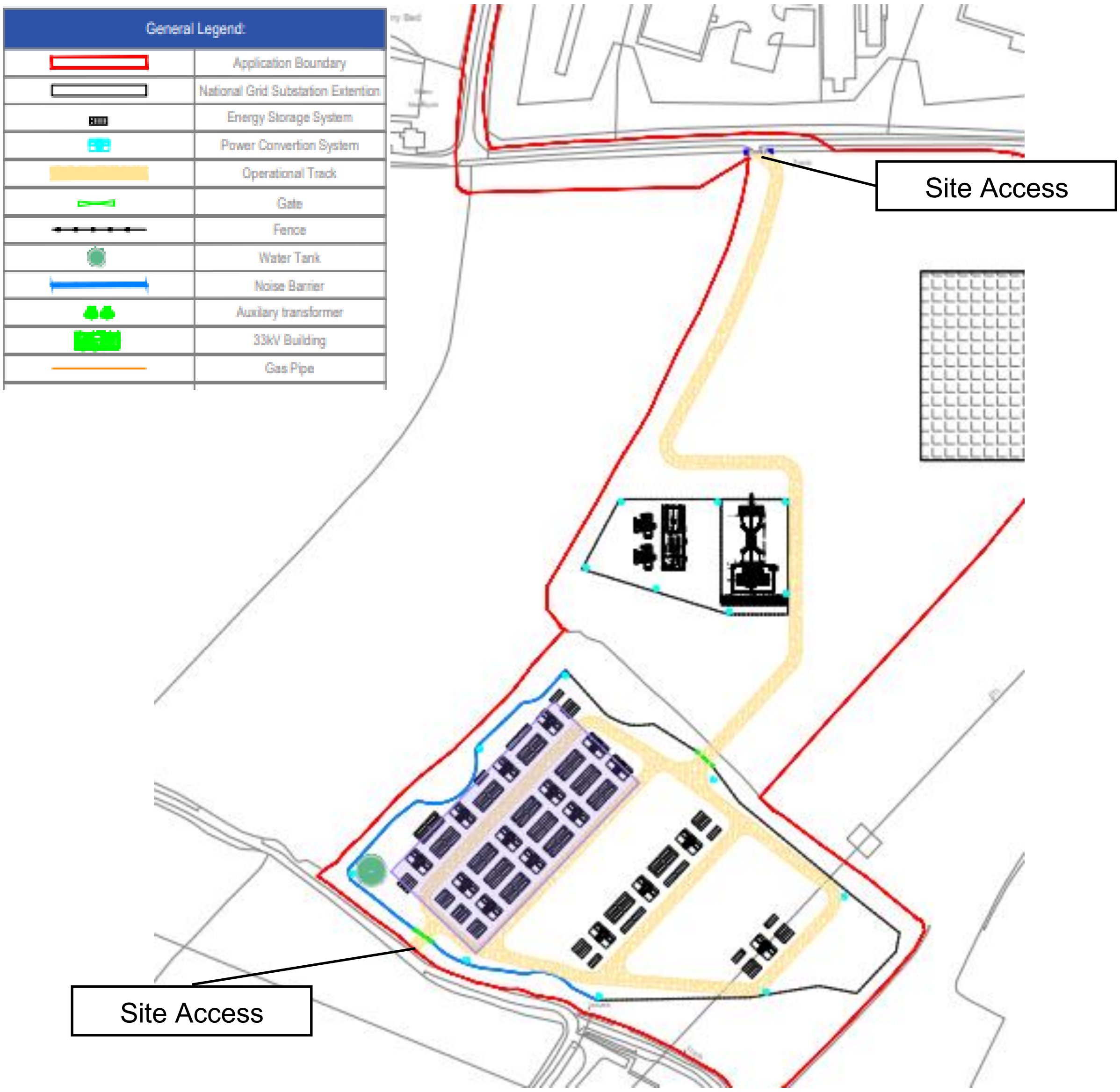


Figure 2-1 - Proposed Development Site Layout and Boundary

3.0 Safety Objectives

3.1 High Level Safety Objective

The primary safety objective across the Proposed Development is to minimise risk to health and safety of the public, employees, property, and the environment by complying with applicable legal requirements and relevant emerging good practice for grid scale connected BESS. These will be distilled into safety requirements that will be included in the requirements for prospective suppliers during the tendering and contracting stage.

Compliance with these safety requirements (by the potential suppliers) will be used as part of the safety argument, to demonstrate that '***The risk posed to individuals, the environment and property from the BESS programme of work has been reduced to a level that is Broadly Acceptable or Tolerable and ALARP' as directed by the***

HSE. Compliance with the CDM Regulations 2015 [Ref. 5] will require the following documentation:

- Pre-Construction Information Plan (PCIP).
- Review of Contractor Competency and Prequalification.
- Review of Contractor Construction Phase Plan.
- Registration of the Proposed Development on HSE UK F10 form, under Regulation 6 of CDM 2015 [Ref. 5].
- On completion of the BESS installation a competent Health and Safety File is produced by the Principal Contractor for BESS which clearly identifies all Residual Risks.
- A comprehensive set of Operational Manuals and “As Built” including all Single Line Diagrams and Schematics.
- A Fire Strategy and Emergency Response Plan (ERP).

These derived safety requirements will be fundamental to the Proposed Development and will be used to assure that all direct and indirect safety requirements for BESS are met, and the supplier(s) and installers are safety competent and compliant.

4.0 Legislation and Compliance Requirements

Legislative compliance, specifically safety, for the BESS will be demonstrated by compliance with the UK Health and Safety at Work Act (HSAWA) 1974 and the appropriate underlying legislation that is enacted through the HSAWA. The following current legislation has been determined as applicable to the Proposed Development:

1. Health and Safety at Work etc. Act 1974 – UKSI1974/0037.
2. Control of Noise at Work Regulations 2005 – UKSI 2005/1643.
3. Control of Substances Hazardous to Health Regulations 2002 – UKSI 2002/2677.
4. Control of Vibration at Work Regulations 2005 – UKSI2005/1093.
5. Electrical Equipment (Safety) Regulations SI 1994/3260.
6. Electro-magnetic Compatibility Regulations SI 2006/3418.
7. Lifting Operations and Lifting Equipment Regulations 1998 – UKSI1998/2307.
8. Management of Health and Safety at Work Regulations 1999 – UKSI1999/3242.
9. Manual Handling Operations Regulations 1992 – UKSI1992/2793.
10. Personal Protective Equipment Regulations 2002 – UKSI2002/1144.
11. Provision and Use of Work Equipment Regulations 1998 – UKSI1998/2306.
12. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations SI2013/1471.
13. Supply of Machinery (Safety) Regulations 2008 – UKSI2008/1597.
14. Workplace (Health, Safety and Welfare) Regulations 1992 – UKSI1992/3004.

15. Registration, Evaluation, Authorisation & Restriction of Chemicals Regulations (REACH) – 1907/2006.
16. Restriction of Hazardous Substances Directive (RoHS) – 2011/65/EU.
17. Dangerous Substances and Explosive Substances Regulations 2002 - SI 2002/2776.
18. Construction (Design and Management) Regulations - SI 2015/51.
19. Health and Safety (Safety Signs and Signals Regulations 1996)
20. Waste Batteries and Accumulators Regulations 2009.
21. Fire Safety (Employees' Capabilities) (England) Regulations SI 2010/471.
22. Fire Safety Order 2023.
23. Fire Safety Act 2021.
24. Protocol on Persistent Organic Pollutant SI 2007/310. (missing)

4.1 Relevant Regulation and Industry Benchmarks

Safety Guidance for the BESS installation will be demonstrated by alignment with prevailing industry guidance, both national and globally. The following industry guidance / best practice has been determined as applicable to this BESS installation:

1. PPG Renewables and Low Carbon Energy [Ref. 1], which refers out to.
    a. National Fire Chiefs Council (NFCC) Grid Scale BESS planning – Guidance for Fire and Rescue Services (FRS) [Ref. 2].
    b. Factory Mutual (FM) Global Property Loss Datasheet 5-33 – Lithium-Ion BESS [Appendix B and Ref. 3].
2. National Fire Protection Association (NFPA) 885 [Ref. 10] – Stationary Energy Storage Systems, which refers out to:
    a. Underwriters Laboratory (UL)1973 – Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail Applications [Ref. 7].
    b. UL9540A – BESS Test Methods [Ref. 8].
    c. United Nations (UN)38.3 – Standard Requirements for Lithium-Ion Battery Production [Ref. 9].
3. Department for Energy Security and Net Zero – Health and Safety Guidance for Electrical Energy Storage Systems. Health and Safety Guidance for Grid Scale Electrical Energy Storage Systems [Ref. 11].

4.2 NFCC Guidance

The NFCC Report Grid Scale BESS Planning – Guidance for FRS [Ref. 2] details the FRS recommendations for BESS installations. The alignment of the Proposed Development with these guidelines are outlined in Table 6-1 based on the site layout detailed in Figure 2-1.

5.0 Safety Controls and Good Practice

5.1 BESS Procurement

The client operates with a stringent prequalification process that leverages the global technological capabilities of the Developer in the selection of all components. The Developer is therefore experienced in conducting thorough tendering processes for procuring battery storage equipment and services, working with Tier 1, bankable, suppliers of battery cell manufacturers, inverters, and transformers.

This limits the selection of manufacturers to only those which are approved by the client.

Only suppliers and products that conform to ISO 9001, UN38.3, CE, and local regulation, as well as pass both technical and financial auditing will be considered.

The client procurement processes look to inspect manufacturing facilities and periodically monitor production lines. The inspections evaluate production quality documentation and production line process, against pre-defined documentation to verify that the quality requirement is respected and correctly implemented. The following aspects are specifically checked:

- Material management.
- Procurement and supplier management.
- Manufacturing processes.
- Quality system.
- Reliability program.
- Training.
- Corrective action and non-confirming process and process improvements.
- Corporate social responsibility, environmental, health and safety.

The Developer employs a robust quality process at the development and procurement stages that assures safe and continuous operation. This is an illustrative example of the procurement process as it is not yet known who is delivering the project, so some details may be subject to change.

The Developer requires the designs to incorporate the most advanced fire detection and suppression systems, including adhering to the UL9540A [Ref. 8] and NFPA 855 [Ref. 10] standards, as well as conform to local and industry standards.

5.2 Design Safety

As a minimum it is anticipated that the BESS supplier and operator will provide a layered protection approach from cell to container to remote monitoring. The envisaged safety control measures and design features under consideration, and those that will be flowed to the prospective suppliers, include:

1. Appropriate battery chemistry selection - balancing energy density requirements against available volume and operating parameters.

2. Cell module level control – consideration of the use of battery technology incorporating Current Interrupt Devices (CID) and Positive Thermal Coefficient (PTC) protection, enabling the cell to disconnect from the battery in the event of cell failure.

3. Implementation in the design of an approved Battery Management System (BMS) and a layered protection system in accordance with UL1973 [Ref. 7] guidelines.

4. Safety certification and qualification to UL9540A [Ref. 8] or equivalent.

5. The ability for 24/7 Remote Monitoring and Control and automated shut-down.

6. Off-gas detection to allow for preventative interaction.

7. Battery chemistry bespoke Fire Detection and Suppression Systems (FDSS) fitted to containers.

8. Site Security and Monitoring.

9. At a site and installation level:

    a. The segregation of containers in accordance with the national and international guidance detailed in this report.

    b. The landscaping of land adjacent to and between BESS containers, BESS container spacing, and maintenance of vegetation to provide a natural firebreak.

    c. The provision of suitable and sufficient accesses / passing points for emergency services.

    d. Access to the emergency water supply.

    e. Communication with local emergency services and the provision of site maps, detailing BESS locations, access points and water sources.

    f. Drainage Study and other groundwater studies, Soil Investigations, Ground Resistance, Hydrology, Roads, and access assessment. Environmental Impact Assessments, existing buildings and services, for contractors.

5.3 Testing

Once chosen, the battery system will be tested in accordance with UL9450A [Ref. 8] or its successor. UL9540A [Ref. 8] was developed to address safety concerns identified by the building codes and the fire service in the United States and is considered the global standard for evaluating the propensity of BESS to suffer from thermal propagation at cell, module, rack and enclosure level. The results of all four tests at each level will be made available on request.

5.4 Decommissioning

Disposal activities will be considered at the procurement contract stage and will be included within the BESS safety management process and detailed in the DBSMP. As the programme matures the hazard log will be expanded to cover each phase of product development and installation.

The chosen BESS supplier will be designated as the producer of the battery components and the party placing the battery components on the UK market, and as such has certain obligations in respect of battery disposal pursuant to the Waste

Batteries and Accumulators Regulations 2009 (or such equivalent regulations in force at the time of decommissioning).

It is assumed that all components replaced during the defects notification and warranty period will be returned to the manufacturer and recycled.

The BESS development will be subject to a decommissioning plan for submission to the Denbighshire County Council on request. (Note this is essentially a reverse engineering exercise with a large component on safe disposal of the batteries) to comply with the Waste Batteries and Accumulators Regulations 2009.

The client will follow the hierarchy of waste management throughout the life of the Scheme and during construction (subject to monthly reports) as follows:

- Reduce – batteries have a finite life based on several factors, primarily the total number of cycles undertaken. The operation will attempt to manage the degradation by the selection of services and cycling that maximises the overall life. Consideration will be given to supplementation of the equipment or operation at a lower output.

- Recycle – The supplying manufacturer will have obligations under the Waste Batteries and Accumulators Regulations 2009 (as amended) (or such equivalent regulations in force at the time of decommissioning) and will be contractually obliged to offer a recycling service.

- Recovery – The recycling should allow any useful materials to be recovered and re-enter the supply chain.

- Disposal – Any disposal of batteries shall be undertaken in compliance with all applicable Laws and all regulatory requirements, product stewardship, registration disposal and recycling or take back requirement.

5.5 Maintenance

Any hazardous materials used in the BESS development will need to be fully justified and captured in the BESS Hazardous Materials Register, a sub-set of the Bill of Materials (BoM). The register is used to highlight the hazardous materials contained within BESS and provides justification as to why they cannot be eliminated and to highlight exact quantities of hazardous materials that are present to satisfy legislative requirements. The BESS Hazardous Materials Register will be made available to the local emergency services.

The site will be regularly kept free of vegetation, litter, and any combustible materials.

All internal roads will be maintained to a standard suitable for use during usual operation and emergency response.

All required hazard signage, contact information for emergency response and security will be attached to main gates and boundary fencing. (compliant with the Health and Safety (Safety Signs and Signals Regulations 1996)).

5.6 Emergency Plans

Prior to construction of the BESS, Emergency Plans and Risk Assessment will be developed that will outline how the operator will respond to incident and accident scenarios at site. This will include the interfaces with external first responder organisations. An onsite fire containment strategy will be incorporated into the overall site drainage design at the detailed design stage and details of this will be contained in the DBSMP and ERP.

The ERPs will be developed in an iterative manner in parallel to technical safety requirements. This will demonstrate that the BESS design and Emergency Plans are properly integrated (e.g., that BESS layout provides access for first responders) and that appropriate information can be provided to first responders (e.g., the type and meaning of external indication on containers) to include in their planning activities.

It is important to note that current guidance states that Lithium battery fires will not be tackled with water other than for the purpose of containing the fire and supressing the smoke plume emanating from the BESS.

The ERP will be formed through 2 distinct elements, both of which will be communicated to the FRS on commissioning of the asset, these being:

1. The Risk Management Plan, a distillation of the OBSMP and DBSMP which will include:

    a. The hazards and risks at and to the facility and their proposed management.

    b. Any safety issues for the FRS responding to emergencies at the facility.

    c. Safe accesses to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems.

    d. The fire detection and suppression systems (i.e., bespoke FDSS fitted to BESS containers, off-gas detection systems, enclosure fire rating etc.)

    e. Any natural or built infrastructure and on-site processes that may impact or delay effective emergency response.

2. The ERP will be developed and include:

    a. How the FRS will be alerted.

    b. The site layout including infrastructure details, operations, number of personnel, and operating hours. Key points on site such as entrances and availability of hydrants and shut off isolations as identified by “What 3 Words Codes” for the Local Fire and Rescue Service. This will require consultation and site visits by the regional FRS.

    c. A site plan depicting key infrastructure, site access points and internal roads.

    d. Details of emergency resources, including fire detection and suppression systems and equipment; gas detection; emergency eyewash and shower facilities; spill containment systems and equipment; emergency warning systems; communication systems; personal protective equipment; first aid.

e. Up-to-date contact details for facility personnel, and any relevant off-site personnel that could provide technical support during an emergency.

f. A list of any dangerous goods stored on site.

g. Site evacuation procedures.

h. Emergency procedures for all credible hazards and risks, including building, infrastructure, vehicle and vegetation / flora fires.

6.0 Site Specific Safety

6.1 Siting

The site has been selected due to its minimal environmental constraints, screening from nearby residences and proximity to the National Grid Bodelwyddan substation, directly adjacent to the east of the BESS site. The nearest residential property is approximately 380m to the west of the BESS Units.

There are no public footpaths or rights of way within the site boundary.

Figure 2-1 illustrates the site layout for the BESS installation.

6.2 Security

During construction, the site will be secured with temporary fencing, Closed Circuit Television (CCTV) and in-person security. During operation, a palisade fence and security cameras will be in place that are remotely monitored 24/7.

6.3 Fire and Rescue Service

The North Wales FRS is the regional FRS for the Proposed Development.

6.4 NFCC Planning Guidance

The NFCC has provided planning guidance to regional FRS regarding grid scale BESS and planning. This NFCC Guidance [Ref. 2] has been distilled into the 14 key salient points arising from the guidance and is presented at Table 6-1, this details the site layout and compliance status reflecting the NFCC guidance.

Ser	NFCC Recommendations	Site Status	Options / Comments
1	Access - Minimum of 2 separate access points to the site	**Compliant**	There are two points of access into the BESS site, allowing access from the north and the south.
2	Roads/hard standing capable of accommodating fire service vehicles in all weather conditions. As such, there should be no extremes of grade.	**Compliant**	The site service road is a metalled surface a minimum of 4.0m wide. There is no extreme of gradient at the site. The site access road is suitable for HGV traffic – asphalt in construction. All internal services roads have been designed with a 10m radii and are compatible for a DB32 Fire Appliance.
3	A perimeter road or roads with passing places suitable for fire service vehicles	**Compliant**	There is perimeter road in the BESS compound, that is intersected with service roads, allowing for FRS vehicles to manoeuvre and relocate as necessary – Figure 2-1 refers. Section 13.4 of Approved Document B5 states that FRS vehicles should not have to reverse more that 20m from the end of an access road – given the provision of a circular perimeter service road the requirement for FRS vehicles to reverse is minimised to situations in which use of the perimeter service road is not possible, and in these circumstances, reversing more than 20m is not a requirement. Section 13.4 references Table 13.1 of the Approved Document B5 which contains typical FRS vehicle access route specifications – the site meets these specifications.

Ser	NFCC Recommendations	Site Status	Options / Comments
4	Road networks on sites must enable unobstructed access to all areas of the facility	**Compliant**	Access to all BESS units is afforded from the network of services roads in the BESS compound. The site is designed such that all routes have the capacity to allow for a Fire Tender (based on DB32 Fire Appliance).

Ser	NFCC Recommendations	Site Status	Options / Comments
5	Turning circles, passing places etc. size to be advised by FRS depending on fleet	**Compliant**	There is perimeter road in the BESS compound, that is intersected with service roads, allowing for FRS vehicles to manoeuvre and relocate as necessary – Figure 2-1 refers.

Ser	NFCC Recommendations	Site Status	Options / Comments
6	Distance from BESS units to occupied buildings & site boundaries. Initial min distance of 25m	**Compliant**	There are no occupied buildings within 25m of the BESS units.

Ser	NFCC Recommendations	Site Status	Options / Comments
7	Access between BESS unit – minimum of 6 metres suggested. If reducing distances, a clear, evidence based, case for the reduction should be shown.	**Compliant with Caveats**	The suggested 6.0m separation is based on a 2017 Issue of the FM Global Loss and Prevention Datasheet 5-33 (footnote 9 in the NFCC Guidance refers). This Datasheet was revised in Jan 2024; it now details the following: 1. For containerized LIB-ESS comprised of Lithium Ferrous Phosphate (LFP) cells, provide aisle separation of at least 5 ft (1.5 m) on sides that contain access panels, doors, or deflagration vents. 2. For containerized LIB-ESS comprised of Lithium nickel manganese cobalt (NMC) cells where wall construction is unknown or has an ASTM E119 rating less than 1 hour, provide aisle separation of at least 13 ft (4.0 m) on sides that contain access panels, doors, or deflagration vents. For containerized NMC LIB-ESS where wall construction is documented as having at least a 1-hour rating in accordance with ASTM E119, aisle separation of at least 8 ft (2.4 m) is acceptable. Additionally, the Department for Energy Security and Net Zero (DESNZ) published in March 2024 their Health and Safety Guidance for BESS in which it is stated that the separation distance, for sides with access panel, doors or deflagration panels should be a minimum of 1.5m for LFP. It has been noted that the current NFCC guidance is being revised, and a consultation document has been promulgated. The draft consultation version removes the 6.0m separation distance and refers out to NFPA 855 for guidance on separation. Following this revision to the Datasheet, the BESS containers on-site will be compliant with the minimum distances and conformance to ASTM E119 1-hour fire rating will be confirmed on the down select of the BESS units to be procured. Current NFCC guidance recommends 6.0m, unless deemed acceptable to be closer based on manufacturers UL testing / fire rating qualification. The BESS units on the site are 3.0m apart, which given current FM Global and DESNZ guidance, is twice the recommended 1.5m spacing.
8	Site Conditions – areas within 10m of BESS Units should be cleared of combustible vegetation	**Compliant**	The BESS units will sit on concrete slabs or supporting feet. Internal access tracks will comprise crushed stone and the access road for the abnormal load will be asphalt. Within fence line and between BESS containers units the surface is laid over to gravel. All areas within 10m of the BESS are cleared of vegetation.
9	Water Supplies	**Compliant**	Water storage tanks form part of the design intent for the site layout, with a 228m^3 capacity water tank, for fire fighting use, positioned to the southwest corner of the BESS compound, Figure 2-1 refers
10	Signage	**Compliant**	Signage is to be positioned at the entrance to the site. Signage to be confirmed through design process and will be detailed in the ERP.
11	Emergency Plans	**Compliant at this juncture**	Future iteration of the OBSMP to DBSMP will roll up the ERP outlining who and how the FRS will be alerted, facility description, number of operatives, detailed site plan etc.

Ser	NFCC Recommendations	Site Status	Options / Comments
12	Environmental Impacts	**Compliant at this juncture**	There has been no comment on the site received from Natural Resources Wales.
13	System design, construction, testing and decommissioning	**Compliant at this juncture**	Several of the elements under this aspect of the NFCC Guidance are contained in this plan, however details of the construction, testing and decommissioning will only be available in later stages of the programme and be contained in the DBSMP. Compliant at this juncture in the planning procedure.
14	Deflagration Prevention and venting	**Compliant at this juncture**	Elements of this requirement are contained in this plan, but the actual technique to be adopted will not be apparent up to the point the decision is made as to what BESS is being used. Deflagration venting is possibly most effective when fitted to the roof of the BESS Units, as such deflecting blast upwards and away from FRS personnel. Compliant at this juncture in the planning procedure.

Table 6-1 – Proposed Development alignment with NFCC FRS Recommendation

The main change between the currently issued 2023 NFCC Grid Scale Battery Energy Storage System Planning – Guidance for FRS [Ref. 2] and the not yet formally issued NFCC guidance (2025) [Ref. 12] is the increased flexibility regarding BESS spacing. This is detailed within serial 7 of Table 6-1 above. This revision of guidance reduces the required separation of BESS units from a distance of 6.0m down to a distance of 1.5m, which this BESS design adheres to. This flexibility allows for more site-specific designs, particularly for smaller more constrained sites. The guidance is also tailored to enhance clarity on the interaction between the guidance and local planning authorities, with additional information provided for emergency response planning. These changes have been made following incorporation of real-world experience and industry feedback, and will supersede the initial 2023 version of the BESS planning document.

7.0 Conclusions and Recommendations

7.1 Conclusions

At this juncture of the Proposed Development the identification of potential hazards, causes and controls is limited to the concept stage. As a result, the controls have been identified are also conceptual and subject to technological assessment, as such no ALARP statements can yet be formulated, as the evidence to support such claims requires validation once the selection of the infrastructure has been finalised.

All the control measures listed are founded on good practice and based on previous knowledge of BESS. These mitigations may in some instances require further development and ratification as the programme progresses. Upon successful implementation, and with suitable evidence available to validate effectiveness, reassessment can be conducted and an ALARP claim substantiated.

It is concluded that, as far as reasonably practicable and for this planning stage of the Proposed Development, that currently foreseeable hazards associated with the equipment have been identified, and these will be developed and managed within the HL [Ref. 4]. These hazards will be actively managed throughout the life of the installation and added to as necessary as the Proposed Development develops and will be reported on regularly.

This OBSMP has been developed using existing knowledge of the BESS capability and leans heavily on the subject matter expertise that ARC have in this technological domain. Further development of the BESS design will provide more detailed information that will enhance future safety analysis and management, where further understanding of the hazards and development of mitigations can be undertaken to reduce the potential level of risk posed by BESS.

7.2 Recommendations

It is recommended that the BESS safety management and criteria (for assessment and analysis) as defined in this OBSMP, is adhered to throughout the Proposed Development lifecycle to assure that safety management is developed as the programme progresses and remains valid through the life of the BESS capability.

During the construction of the site it will be essential that the design process is subject to a Design Risk Analysis by a competent person in compliance with the Construction Design and Management (CDM) Regulations 2015 [Ref. 5].

It is recommended that to maintain an acceptable level of residual risk, that all the identified control measures are assessed as the design matures to elicit; applicability, feasibility and the potential amelioration afforded. At this juncture of the programme, it is not possible to declare ALARP, however successful implementation of the proposed framework for safety management presented in this OBSMP will provide the necessary arguments and supporting evidence to make such a claim.

8.0 References

1. Practice Planning Guidance Renewables and Low Carbon Energies dated July 2023.

2. NFCC Grid Scale Battery Energy Storage System Planning – Guidance for FRS dated Nov 2022.

3. Factory Mutual – Loss and Prevention Datasheet 5-33 – dated Jan 2024.

4. Bodelwyddan BESS Hazard Log – ARC-1259-002-R2 dated July 2025.

5. Construction (Design and Management) (CDM) Regulations 2015 – SI2015/51 dated Dec 2017 (as revised)

6. Reducing Risk, Protecting People (R2P2) (HSE Publications) - https://www.hse.gov.uk/risk/theory/r2p2.pdf.

7. UL1973 – Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail Applications.

8. UL9540A – BESS Test Methods.

9. UN38.3 Standard Requirements for Lithium Battery Production - 4th Revision.

10. NFPA 855 Standard for the Installation of Stationary Energy Storage Systems dated Aug 2023.

11. Department for Energy Security and Net Zero – Health and Safety Guidance for Electrical Energy Storage Systems. Health and Safety Guidance for Grid Scale Electrical Energy Storage Systems (publishing.service.gov.uk).

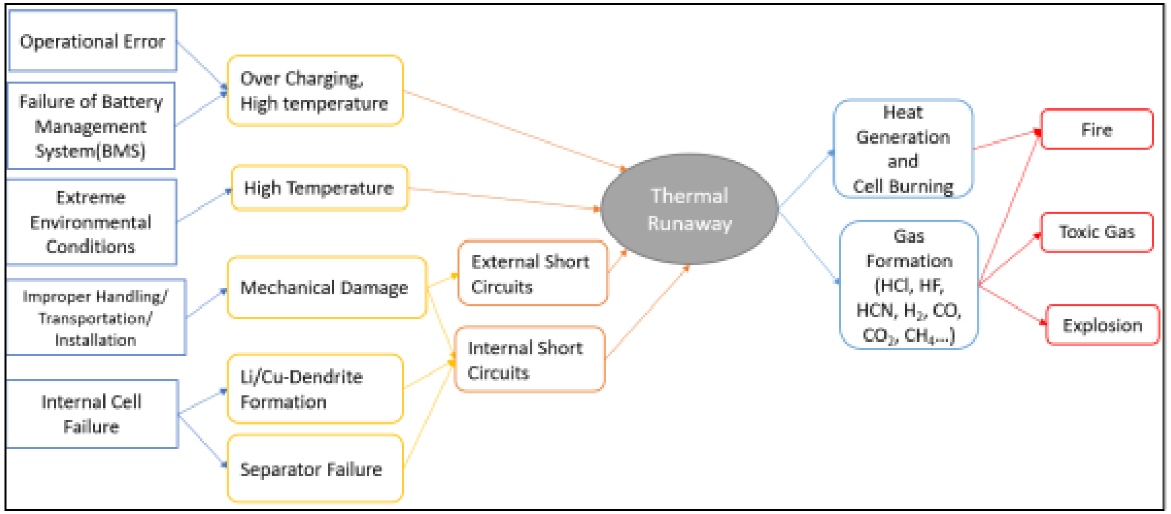
12. NFCC Grid Scale Battery Energy Storage System Planning – Guidance for FRS (Not yet formally issued (2025)) - https://nfcc.org.uk/wp-content/uploads/2023/10/Grid-Scale-Battery-Energy-Storage-System-planning-Guidance-for-FRS.pdf.

Appendix A - FAQs

Ser	Question	Answer
1	How does a BESS work?	A BESS employs technology to temporarily store electrical energy, very much in the same manner as a mobile phone or laptop battery, but on a much bigger scale. The energy can be stored and released when demand on the National Grid is high and assists in balancing out variations in demand. The primary use for BESS is to store electrical energy generated by energy suppliers during period of low demand and releasing in periods of high demand, thus balancing out changes in supply and demand on the National Grid.
2	How safe is a BESS?	The Department for Energy Security and Net Zero promulgates on a regular basis the Renewable Energy Planning Database (REPD). From the quarterly extract (dated Apr 2025) the data has been filtered for BESS installations in the UK and the following salient points are deduced[1]: 1. As of Apr 2025, there are approx. 132 operational BESS sites listed in the REPD[2], 8 having been decommissioned, 96 are under construction and a further 834 have planning consent and are awaiting construction. 2. The current operational BESS provides the UK with an estimated 2.6GWelec storage and those awaiting construction will provide an additional 5.4GWelec of storage. 3. Since 2006 UK BESS installations have accumulated an estimated 700 years of operation, this equates to 240,000 days of operation. 4. There have currently been only two reported BESS fires in the UK that have required FRS attendance, these occurred at Carnegie Road, Liverpool in Sept 2020 and East Tilbury in Feb 2025, the cause of the latter is yet to be declared. Given the estimated 6 million hours of operation, extrapolates out to approx. 3.3E-07 (0.00000014) failures per hour (fph) for BESS in the UK. 5. To date nobody in the UK has been killed in a BESS incident and there has been no damage to 3rd parties or the environment due to a BESS fire.
3	LFP is sensitive to temperature variations – how is this controlled?	The batteries are housed in an ISO container which is fitted with an Environmental Control Unit (ECU). The ECU maintains the temperature and humidity within the container, allowing the LFP batteries to operate within the optimum temperature range. The temperature of individual cells in each battery is monitored by the battery management system (BMS) and is reported back to the container level BMS which adjusts the internal temperature in response. Should the

[1] The REPD tracks the progress of energy proposed developments, including BESSs, through the planning system. Until 2021, the REPD only recorded proposed developments with a capacity over 1 MW). Since 2021, it also includes proposed developments with a capacity over 150 kilowatts (kW). Therefore, BESSs that were going through the planning system before 2021 may not have been captured in the REPD – Source: Commons Library Research Briefing, 19 April 2024 – BESS.

[2] This is a conservative figure as the REPD did not account for proposed development under 1MW until 2021.

Ser	Question	Answer
		ECU develop a fault the container will isolate charge and discharge to the batteries until the fault has been rectified. All faults in the BESS are remotely fed to a centralised Control Room.
4	What is Thermal Runaway?	Thermal Runaway (TR) is the term used to describe an internal short-circuit in one of the battery cells that can lead to cell over-pressure and the venting of combustible gases. Should this gas ignite then the cell will increase in over-pressure and the resulting fire will be self-sustaining until all the material in the cell is expended. Short-circuits in cells are generally a result of: 1. Cell penetration by a foreign object (not usually an issue for a BESS as the batteries are housed in sturdy containers). 2. Impurities in the electrolyte (deposited during the manufacturing process), which over time can lead to the formation of dendrites (electrolytic crystals) which puncture the membrane isolating the anode and cathode – this can, but not always, result in a short-circuit and TR. 3. Over-temperature in the cell because of: . Over-charging (which is controlled by 2 separate BMS – battery and rack). . High ambient temperature – controlled by the ECU. The illustration below provides an outline of the possible causes of TR. 
5	How can TR be controlled?	TR is not always inevitable, and the nature of the cell design is such that early warning signs of a stressed cell can be detected by the BMS. Initial signs of cell degradation are an increase in the time it takes the cells to reach full charge

Ser	Question	Answer
6		(maximum voltage) and a decrease in the time it takes to discharge. These indicators are picked up by the BMS and if persistent the BMS will isolate (prevent charge and discharge) to the battery and inform the centralised Control Room. In turn an engineer will be dispatched to remove the battery and replace it with a serviceable item. Since the early inception of BESS safeguards in the design have developed and are now details in UL1973 and BESS are assessed against UL9540A. If these indicators are not present, and the cell enters early stages of short-circuit the over-pressure in the cell will result in the venting of off-gas which is detected by the off-gas detectors built into the container Heating, Ventilation and Air Conditioning unit (the ECU). This will result in the container disabling the charge and discharge (the act of charging and discharging the batteries generates heat, which is what we want to avoid) and setting the ECU to maximum volume setting. This has a twofold effect, it clears the container of combustible gas and cools the internals, taking the energy out of the cells (the cells used in BESS, like other batteries do not perform well in low temperature conditions). It should be noted that most BESS only operate at between 80-90% of capacity provide an engineering margin that mitigates the probability of over-charging the cells.
6	How is a BESS fire controlled and suppressed?	If the TR is not controlled and spreads, known as Thermal Runaway Propagation, the fire detection and suppression system (FDSS) will activate. There are currently two types of FDSS that are used in BESS; gaseous systems and aerosol systems. Each system has advantages and disadvantages: 1. Aerosol systems are better in terms of extinguishing the fire and benefit against gaseous systems, which generally supress the fire by reducing the level of oxygen in the container. 2. Gaseous systems are instantaneous in operation; the gas being kept under pressure in bottles. Aerosol, by the nature of the deployment as a fine mist, take a little longer to reach all areas of the container. 3. Aerosol systems generally require a more complex and intricate delivery system to reach all areas of the container. 4. Gaseous systems require a sealed environment in which to operate. As such if the container is opened and oxygen reintroduced it can lead to the fire reigniting, as such they require the ECU to close prior to activation (to prevent the ECU from pushing out the extinguishing medium). 5. Various FDSS aerosols (also known as aqueous) and gaseous systems are available, and they use a variety of aerosol solutions. Under consideration for this site is the use of an aerosol aqueous solution containing potassium carbonate (K_2CO_3) – this inhibits the fire by isolating at a molecular level with the chemical chain reactions forming the flame front. This aerosol is non-harmful to the environment and presents no health and safety concerns to first responders.

Ser	Question	Answer
7	Can water be used to extinguish a LPF fire?	The use of water to extinguish a BESS fire has some drawbacks and disadvantages over bespoke FDSS aerosol mediums, these being: 1. Due to the design of the BESS batteries and racks (in which they are contained), the inability of water to cool the cell interiors may result in re-ignition of a fire once the water application is halted. 2. The high conductivity of water may cause short circuiting of cells presenting collateral damage risk and increase the spread of the fire internal in the BESS. 3. A high volume of water is required to cool the cells below the critical temperature to prevent TR propagation, this results in a high volume of fire water run-off and a potential environmental impact. 4. The application of water on a BESS fire increases the generation of gases such as carbon monoxide (CO), hydrogen (H_2) and hydrogen fluoride (HF). Applying water causes incomplete combustion of organic substances inside the battery resulting in production of CO rather than CO_2; when water is applied, H_2 is released that, without combustion, can react with phosphorus pentafluoride, if present in free form, to produce gaseous HF.
8	What are the environmental consequences of a BESS fire?	In the event of a BESS fire several chemicals in gaseous form can be released and the composition and concentration of the plume (also referred to as the vapour cloud). In the event of a BESS fire amongst the general gases released are CO, HF, oxygen and hydrogen. The BESS fire at Carnegie Road, Liverpool – Sept 2020 was monitored, and the resultant composition of the plume was determined as being negligible in toxic gas concentration. Should the resulting fire be treated with water in the presence of HF the result can be the formation of a HF acid which can be detrimental to the environment, especially the aquatic habitat. To prevent this, it is possible to contain the fire run-off water but often best to let the fire run its course and burn out. It is worth noting that the fire run-off water at Carnegie is considered to have been neutralised by the lime-based gravel covering used at the base of the BESS and on testing was found to be a low alkaline level, as opposed to acidic. Further to this the recent fire at Moss Landing California (Feb 2025), was monitored at 1 second intervals for toxic substances in the smoke plume. It was established that the composition of the plume emanating from the fire was within US Air Pollution limits.
9	How is the BESS site secured?	The BESS Site is secured through fences / walls and monitored remotely via security cameras. Warning signs along the fence indicates the presence of electrical storage facilities within the site.
10	How is the serviceability of the BESS assured?	The Health and Usage data for each BESS is remoted to a centralised Control Room and the serviceability of each battery determined on an hour-to-hour basis. Given that the batteries have a finite number of cycles over a given period it is envisaged that the batteries will be renewed multiple times in the life of the site.