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# FIRE STRATEGY REVIEW REPORT

**Project Name:** BESS Facility at Knockraha, Co. Cork

**Date:** January 2026

**Fire Strategy Review Report for BESS (Battery Energy Storage System) at**

**Knockraha BESS facility, Co. Cork**

**Document Control Sheet**

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## 1. INTRODUCTION

The proposed Battery Energy Storage System (BESS) is to be installed at the Knockraha BESS facility, Co. Cork. ORS has been appointed to carry out a Desktop review in terms of Part B and Part M compliance.

This review report has been prepared based on documents received from the client.

**Following review of this report and the documents attached herein, Drumkee LCIS Ltd is in agreement with this review and acknowledges that the Fire Strategy for the BESS site will be developed and maintained in accordance with applicable guidance and best practice.**

| ***Table 1 – Fire Safety Audit Review*** | | |
|---|---|---|
| ***Produced By:*** | ***Drawing Title*** | ***Drawing Number:*** |
| Noriker Power | NPL_KNK_110kV-Compound-Drawing-0.0_P | 090 |
| Noriker Power | NPL_KNK_AIS-Equipment Elevations_0.0_P | 091 |
| Noriker Power | NPL_KNK_Drainage-Plan_0.0_p | 092 |
| Noriker Power | NPL_KNK_Fire-Water-Resevoir_0.0_P | 093 |
| Noriker Power | NPL_KNK_Proposed-Site-Sections_0.0_P | 094 |
| Noriker Power | NPL_KNK_Site-Layout-Map-3.6_P | 100 |
| Noriker Power | NPL_KNK_Site Layout Map-A_3.5_P | 102 |
| Noriker Power | NPL_KNK_Site Layout-Map B_3.5_P | 103 |
| Noriker Power | NPL_KNK_Site-Location-Map-Scale-1_10,560_0.0_P | 104 |
| Noriker Power | NPL_KNK_Site-Location-Map-Scale-1_2500_0.0_P | 105 |

Consequently, this site will be assessed using,

- ✓ Technical Guidance Document B 2024.
- ✓ NFPA 855 Standard for the Installation of Stationary Energy Storage Systems (2023/2026 *Annex C for 2026 updates*)
- ✓ UL 9540 / UL 9540A
- ✓ Manufacturer requirements

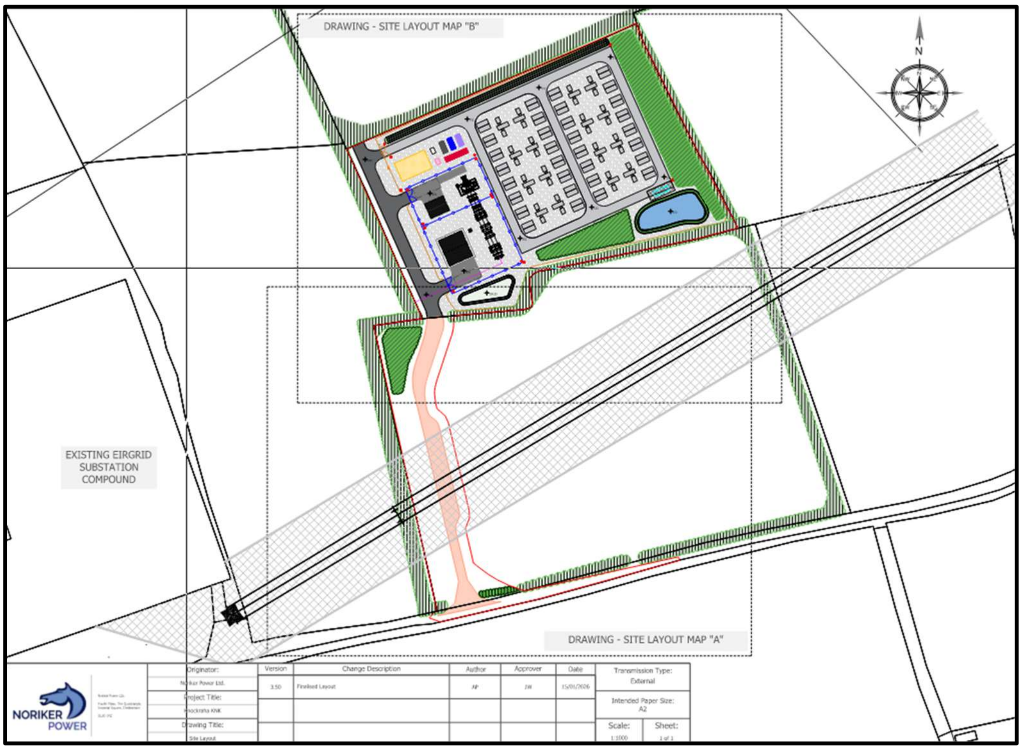


*Figure 1 Proposed BESS Site Location*

## 2. LIMITATIONS OF THE ASSESSMENT

This assessment is based solely on the drawings and documentation made available at the time of review. Internal container systems such as detection, suppression, isolation mechanisms and ventilation arrangements have not been evaluated due to the absence of technical data. Thermal runaway modelling for the specific battery system has also not been provided. The report does not verify the functionality of emergency shutdown systems, SCADA monitoring arrangements, or any manufacturer-supplied safety features.

Given these limitations, the conclusions of this report should be validated through a physical site inspection, confirmation of operational practices, review of full manufacturer documentation, and consultation with Cork County Council Fire Authority during design development.

## 3. INTERNATIONAL GUIDANCE SOURCES

Due to the unique hazards associated with grid-scale lithium-ion BESS installations, the assessment also references several international documents, including NFPA 855 (Energy Storage Systems), NFPA 69/70/72 for explosion and electrical safety concepts, the UK DCLG/HSE BESS Safety Position Paper, UL 9540 / UL 9540A thermal runaway testing, and reports issued by the European Fire Safety Alliance and EPRI.

These sources support the interpretation of TGD-B in areas where no local prescriptive guidance exists. This interpretation will support a best practice approach to considering fire safety within the BESS site

## 4. PROJECT DESCRIPTION

The development will consist of a 10-year planning permission for the construction of a:

1 No. enclosed battery energy storage system compound on a total of c. 2-hectare site to include: up to 64 battery storage blocks on concrete support foundations including heating, ventilation and air conditioning units (HVAC units), and 32 Power Conversion Systems

(PCS) contained within 16 twin skid units, 1 no. 110 kV AIS electrical substation building and 1 no. single-storey customer substation building, control and switch room, 33/110 kV transformer and 1 no. auxiliary transformers, construction compound, firewater reservoir, store room, welfare unit, dam along the northern boundary, a retention basin, soakage swale, and a diesel backup generator, on lands at Ballynanelagh, Knockraha., Co. Cork.

Works will include upgrading the access road and site entrance, associated electrical cabling and ducting, security gates, perimeter security fencing, CCTV system, landscaping works and all associated ancillary infrastructure. The site entrance and access road will be constructed or completed in accordance with the adjacent site's approved Planning application (ABP-321518-24). Operational right of way for that facility will be maintained through construction and operation.

The proposed development will have a projected life span of 35 years. The proposed site will be used as a single purpose site as a BESS facility, supporting the decarbonisation of the electrical grid.

## 5. MEANS OF ESCAPE

- The proposed area is an external BESS (Battery Energy Storage System) located in a secured open area, is classified as Purpose Group 6(b), Industrial High Hazard.
- The BESS area is considered a place of special fire risk in line with the definition of TGD-B, V1 2024, as it contains:
  - ✓ 64 Nos. lithium-ion battery units arranged in 16 clusters of 4 battery units and 1 PCS unit.
  - ✓ Outdoor transformer, Invertor and EMS Electrical Panels.
- The area is enclosed by a 2.40 m high paladin fence with a 5.3 m wide gate and has a total fenced floor area of approx. 430m² per BESS cluster.
- Occupancies are estimated as per Table 2 of Technical Guidance Document B 2024 as follows:

*Table 1 Occupancy Calculation*

| Room/Storey | Area $m^2$ | Use | Occupancy Load Factor | Proposed Occupancy |
|---|---|---|---|---|
| BESS Cluster(2) | 430 approx | Special Fire Risk | N/A | 2(1) |
| | | | **TOTAL** | 2 |

***Notes***

1) *It is assumed that access to the area will be restricted solely to authorised maintenance staff, and no general occupancy is anticipated.*
2) *Applicable to each BESS Cluster onsite. Each cluster should be analysed in conjunction with surrounding BESS Clusters when considering escape routes.*
3) *Approximate area relates to each island of battery clusters.*

- The proposed area is provided with a single escape route available along the fenced gate.

- All areas with an occupancy of 2 persons should be provided with a minimum of one exit having a width of not less than 800mm.

*Table 2 Minimum Exit Capacity Calculation*

| Room/Area / Situation | Total Occupancy | Exits Available (Minimum dimension/capacity) | Capacity provided |
|---|---|---|---|
| BESS area | 2 | 1 x 800mm | > 2 |

- A single exit is acceptable since the number of occupants is less than 60 and designated for maintenance purposes only.
- The maximum allowable travel distance in a single direction is 60m, where only one exit is provided, as the occupancy is less than 60 and the area is located in open space. The current single travel distance of <60m complies with this requirement.
- All gates should be provided with simple fastening mechanisms, unless electrically powered or secured doors shall be equipped with provisions in accordance with I.S. EN 13637:2015.
- Floors on all escape routes should have non slippery and even surfaces.
- The Emergency Lighting and Escape Signage should be designed and installed in accordance with IS 3217:2023.
- All new electrical works must comply with IS 10101 2020 as a minimum.

## 6. INTERNAL FIRE SPREAD

The containerised BESS units themselves do not fall under the conventional provisions of Part B2 or Part B3 of TGD-B 2024, the ancillary enclosed buildings within the compound—namely the welfare unit, switchboard building, customer switch building, and any associated store rooms—are required to comply with the relevant internal fire spread requirements of TGD-B 2024 for buildings classified under Purpose Group 7(b) High Hazard (Storage – High Hazard).

Under Part B2 (Internal Fire Spread – Linings), the internal wall and ceiling linings of these buildings must achieve a surface spread of flame class appropriate to their function, ensuring that internal finishes do not contribute to undue fire growth within these spaces. Finishes should meet the performance levels required for high-hazard industrial or storage buildings, with particular consideration given to ignition susceptibility, maintenance conditions and potential material degradation due to environmental exposure.

Under Part B3 (Internal Fire Spread – Structure), the structural elements of these ancillary buildings are required to achieve a fire resistance rating commensurate with Purpose Group 7(b) risk, ensuring stability, containment of fire within the building of origin, and prevention of premature structural failure. Depending on the final design, this typically requires that loadbearing elements, compartment walls, floors, and roof structures separating distinct risk areas achieve a minimum 60-minute fire resistance rating, or higher where dictated by layout or building size. Compartmentation must also prevent fire and smoke movement from ancillary buildings into critical operational infrastructure or towards the external BESS units.

Internal subdivisions within these buildings—such as electrical rooms, battery control panels, and storage rooms—must be assessed for their individual hazard profiles. Areas containing electrical switchgear or critical control equipment may require enhanced fire resistance, fire-stopping, and the use of non-combustible construction materials. Any service penetrations must be sealed with tested fire-stopping systems in accordance with Part B3 to maintain the continuity of the fire-resisting envelope.

## 7. EXTERNAL FIRE SPREAD

- The external fire spread shall be mitigated with the following requirements such as but not limited to the distance between the units, unit sizing, vegetation clearance etc. as stated in NFPA 855 Table 9.5.2(1).
  - ✓ Clearance to Exposures = 3m
  - ✓ Means of Egress Separation = 3m
  - ✓ Vegetation Control clearance = 3m

  *Note 1: The BESS system designer adopts IEC 62933-5-2, which aligns closely with NFPA 855. The spacing requirements must be supported by performance testing in accordance with UL 9540A. Although NFPA 855 provides prescriptive spacing criteria that are not specified in the IEC 62933-5-2, it allows the system designer or manufacturer to utilise higher battery energy capacities with reduced spacing, provided that UL 9540A testing demonstrates thermal runaway containment and the absence of further propagation. The system designer has agreed to comply with these requirements and to provide sufficient test data at the detailed design stage.*

## 8. FIRE PROTECTION SYSTEM

- Each lithium-ion battery unit may be protected with the following integral fire protection as per manufacturer guidelines.
  - ✓ Smoke and heat detection.
  - ✓ Aerosol suppression system.
  - ✓ Dry pipe system.
  - ✓ Deflagration panel for pressure relief.

**Dry Pipe System**

Although integral aerosol suppression and deflagration panels may be provided within each BESS cabinet, the dry pipe sprinkler system will be considered and piped along the external enclosures to enhance cooling performance during thermal runaway or off-gassing scenarios and potential reignition of battery fires.

Water remains effective for lithium-ion battery fires, particularly for heat control and prevention of propagation. The dry pipe system arrangement also provides fire fighters with a reliable suppression medium to cool down the battery unit enclosure when opening access panels during tactical firefighting operations.

- Each storage cabinet may be provided with a dry pipe sprinkler system, which is an optional recommendation by the manufacturer.
- The dry pipe sprinkler system protecting the Battery Energy Storage System (BESS) may be provided with a Manual Fire Service Inlet Connection located along the BESS perimeter fence.
- As per NFPA 855, for BESS units greater that 50kWh, the guidelines for design criteria for dry pipe system (Design density, number of nozzles, flow duration) for the unit, tested in accordance with UL9540 / UL9540A will be provided by manufacturer during the further design development stage.

## 9. FIRE-FIGHTING FACILTIES

- The area of BESS is greater than 1000 m² located in ground floor open yard and there is no basement level; therefore, there is no requirement to provide fire hydrants in accordance with Section 5 of TGD-B 2024. However, given the nature of the site hydrants may be included throughout the site to facilitate fire-fighting operations without restriction.
- The on site fire water reservoir within the BESS site is located on the South-East Elevation of the site, providing access to a water source for the fire brigade.
- Fire engine vehicle access should be provided to the entrance of the BESS area. Where access is provided it shall adhere to the following guidance of TGD-B 2024
  - ✓ Type of appliance = Pump
  - ✓ Minimum width of road between kerbs = 3.7m
  - ✓ Minimum width of gateways between kerbs = 3.1m
  - ✓ Minimum turning circle between kerbs circulation = 16.8m/Continuous
  - ✓ Minimum vehicle clearance height = 3.7m
  - ✓ Minimum carrying capacity = 12.5 tonnes
  - ✓ The design of access routes and hard standings should be in accordance with 5.4 and Table 25 of TGD-B V2 2024.
- Appropriate signage to be provided throughout the site noting electrical risks including electrocution through firefighting water.

## 10. SMOKE CONTROL SYSTEM

The proposed BESS is located in an external open area; therefore, a mechanical ventilation system is not required.

Nevertheless, in order to relieve excess pressure buildup within the racks, deflagration panels may be incorporated on the top of each rack unit, which shall be in compliance with NFPA 68 (Explosion Protection by Deflagration Venting) and NFPA 69 (Explosion Prevention Systems).

## 11. BESS-SPECIFIC HAZARDS

Lithium-ion BESS installations create risk profiles significantly higher than those associated with conventional electrical systems.

**Thermal runaway** can produce extreme temperatures, ejection of burning material and the possibility of multi-container involvement if separation distances are inadequate.

**Toxic off-gassing** may include hydrogen fluoride, carbon monoxide, carbon dioxide and volatile organic compounds, which can affect firefighter safety, ventilation needs and emergency planning.

**Re-ignition or prolonged burning** is common, with some events requiring extended cooling and water application over many hours.

**Explosion hazards** arise due to rapid gas release within enclosed steel containers, which can result in over-pressure, structural failure, or projection of hot debris.

## 12. EMERGENCY MANAGEMENT AND PROCEDURES

In accordance with Part B12 of TGD-B 2024 (Provision of Information), the duty holder is required to ensure that all relevant fire-safety information relating to the BESS facility is compiled, documented and made available to those responsible for ongoing operation, maintenance and emergency procedures. For a high-hazard installation such as a lithium-ion BESS compound, this includes the provision of detailed information on the construction of the ancillary buildings, the arrangement of the BESS containers, the location of isolation points, ventilation and suppression systems, and the design performance of any fire-resisting elements. B12 also requires that information relating to emergency controls, shutdown mechanisms, gaseous hazards, and firefighting considerations be provided in a format that is accessible to the Fire Authority. This includes as-built drawings, equipment specifications, UL 9540A test data (where applicable), operational manuals, site-wide fire strategy documentation and clearly identified hazard signage. Ensuring full compliance with Part B12 is critical for effective long-term emergency management, supporting both internal site personnel and responding fire services during pre-incident planning and emergency operations.

## 13. Enclosed on-site container rooms

It is proposed to include an LV Control Room, Store Room, Switch Room and Welfare Unit. Each of these form individual units enclosed within steel containers. Where a room is enclosed within four walls & a roof it is considered a building and will require an Fire Safety Certificate (FSC) & Disability Access Certificate (DAC) application.

For the storeroom, LV Control Room & Switch Room. Due to the nature of these proposed units, it is not practical or suitable to submit a Disability Access Certificate (DAC) application. In these instances a DAC dispensation can be submitted to the fire officer as these areas are specialist task areas not suitable for persons with mobility difficulties.

The Welfare Unit will likely require a DAC application, the argument could be made to the fire officer that due to the nature of the site as a whole being unsuitable for persons requiring accessibility, a DAC dispensation should be applicable to the Welfare Unit. This would be subject to the opinion of the fire officer reviewing the justification.

Any unit forming four walls and a roof will be subject to an FSC, the nature of these units being steel containers limits the scope of what is required. The primary focus being means of escape, detection & emergency lighting.

**ORS Site Summary**

The revised BESS site layout provides a more functional arrangement for fire brigade access, incorporating an interconnected internal road network that allows for unobstructed fire tender access throughout the site. The layout facilitates straightforward manoeuvring and circulation exceeds the minimum access requirements set out in Table 25 of TGD-B 2024.

Provisions for a designated pumping bay are identified on the drawings. Located horizontally adjacent to the reservoir, the updated internal road network offers greater coverage for operations within the BESS site.

Lighting columns are indicated across the site layout. In addition to general site lighting, it is noted that where lighting is relied upon to support escape, emergency lighting designed and installed in accordance with IS 3217:2024 should be considered when determining luminance levels and coverage across the site.

The proposed containerised units accommodating the welfare building, switch room, LV control room and store room should be designed with reference to the requirements of TGD-B 2024. In particular, consideration should be given to provisions relating to means of escape, internal fire spread, fire linings, external fire spread, and access for the fire brigade.

Where a proposed unit comprises four walls and a roof, it is considered an enclosed building and should comply with the requirements of the Building Regulations 1997–2024, including the relevant guidance set out in TGD-B 2024.

Switch rooms, LV rooms and other technical containers should be provided with automatic fire detection and should be interlinked with the on-site fire detection and alarm system to ensure that an alarm is raised in the event of a fire within any containerised occupancy.

Overall, the proposed BESS site layout provides a well-considered, open, and manoeuvrable arrangement with clear emphasis on access for firefighting facilities. The on-site hydrant strategy (not yet indicated on the drawings) should be distributed throughout the site to ensure that all battery clusters can be accessed by the fire brigade without delay.

The review of the site layout and fire safety provisions indicates that the proposed BESS development has been designed with consideration to the key principles and intent of NFPA 855: *Standard for the Installation of Stationary Energy Storage Systems*.

The site layout, access arrangements, separation distances, fire service provisions and overall risk management approach are consistent with the requirements and guidance set out within the standard.

# APPENDIX A

**NFPA 855: Standard for the Installation of Stationary Energy Storage Systems**

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

NFPA 855: *Standard for the Installation of Stationary Energy Storage Systems (2023)* is an internationally recognised benchmark for fire, explosion and thermal-runaway safety associated with lithium-ion energy storage installations. Although NFPA 855 is not used as a statutory standard in Ireland, it represents the most comprehensive global reference for the safe design, operation and siting of BESS facilities. This appendix summarises the NFPA 855 concepts most relevant to this Fire Safety Audit and outlines how they support the observations and recommendations made within the main body of this report.

**A1.0 Introduction**

NFPA 855 sets out minimum safety criteria for the installation of stationary energy storage systems across a range of battery chemistries, including lithium-ion, sodium-ion, lead-acid and flow batteries. The standard addresses matters such as system siting, fire and explosion hazard control, thermal management, detection and alarm requirements, fire service access, emergency operations planning, electrical system control and the need for manufacturer-supported testing, including UL 9540A thermal-runaway assessment. NFPA 855 applies to indoor rooms, dedicated ESS buildings and outdoor containerised systems of the type installed on large-scale grid applications.

**A2.0 Hazard Mitigation Analysis (HMA)**

NFPA 855 identifies the Hazard Mitigation Analysis (HMA) as the primary mechanism for demonstrating that ESS hazards have been suitably identified and mitigated, including thermal runaway, propagation potential, flammable and toxic gas release, deflagration risk, failure of ventilation/thermal management, and interaction between adjacent ESS units and exposures. Under the NFPA 855 (2023) edition, an HMA is required where triggered by the standard (including circumstances where a project seeks to deviate from prescriptive provisions or exceed defined allowances). Under the NFPA 855 (2026) edition, the approach is strengthened and an HMA is generally the default requirement for installations within the scope of the standard, unless specifically modified or exempted by the relevant technology-specific provisions. In the context of this desktop review, the HMA is therefore identified as a key deliverable to be provided during design development, informed by the manufacturer's safety documentation and representative system test evidence (e.g. UL 9540A and, where applicable, large-scale fire testing), and coordinated with the Authority Having Jurisdiction and Fire Authority as part of the project's overall risk management and emergency planning framework.A3.0 Fire and Explosion Testing

The standard identifies system-level testing as essential in verifying the safety performance of energy storage systems. NFPA 855 references fire and explosion testing intended to characterise thermal-runaway behaviour, assess the volume and toxicity of gases released, determine whether a single-module failure can propagate beyond its origin, identify potential deflagration hazards, evaluate the performance of explosion venting systems and demonstrate system stability under high thermal loads. UL 9540A is recognised as the primary international test method used for these purposes, which aligns with this audit's requirement that the 20 ft and 40 ft BESS containers provide verified thermal, fire-spread and over-pressure performance.

**A3.0 Fire and Explosion Testing**

NFPA 855 identifies system-level fire and explosion testing as a key means of verifying safety performance for energy storage systems and demonstrating that proposed siting, spacing, fire protection measures and operational controls are appropriate to the behaviour of the selected technology. Fire and explosion testing is intended to characterise thermal runaway behaviour, assess the volume and toxicity of gases released, determine whether a single-cell or module failure can propagate beyond its origin, identify deflagration hazards, evaluate the performance of explosion venting or pressure-relief arrangements, and demonstrate system stability under high thermal loads. UL 9540A is recognised internationally as the principal test method used to generate this evidence and is commonly relied upon to support design decisions for containerised BESS installations.

Where the provisions of NFPA 855:2026 are applied as best practice or are adopted by the relevant authority, the standard strengthens the testing expectation by explicitly referencing UL 9540A in conjunction with large-scale fire testing (LSFT) where fire and explosion testing is required elsewhere in the standard, in order to characterise gas production and thermal runaway propagation potential at multiple scales, including between ESS units. The 2026 edition also introduces additional testing expectations in circumstances where thermal runaway results in the release of flammable gases at cell- or module-level, including unit-level assessment involving ignition of vent gases to evaluate fire/deflagration and propagation hazards. Accordingly, for this site, representative manufacturer test evidence (and any applicable laboratory reports) should be provided at detailed design stage to support the proposed spacing, fire protection strategy, venting/pressure-relief approach and firefighting provisions.

**A4.0 Separation Distances**

NFPA 855 establishes outdoor separation distances for lithium-ion BESS installations, with the opportunity to modify these clearances where supported by UL 9540A test results. The principles behind these distances include preventing fire spread from one enclosure to another, controlling radiant heat exposure, mitigating the risk of fragment or debris projection and protecting adjacent structures and property. Where thermal-runaway propagation cannot be confidently ruled out, NFPA guidance supports greater spacing—typically around 6 m—or the use of engineered measures such as firewalls or blast-resistant panels. This aligns with the audit conclusion that the current 3 m spacing requires further justification based on manufacturer test data.

**A5.0 Gas Detection, Venting and Deflagration Control**

NFPA 855 acknowledges that lithium-ion BESS units can generate hydrogen, carbon monoxide, volatile organic compounds and other toxic or flammable vapours during abnormal conditions. As such, the standard places strong emphasis on early gas detection, the provision of explosion-relief or deflagration venting within enclosed systems, and ventilation strategies designed to prevent the accumulation of gases above fractions of the lower explosive limit. It also highlights the need for HVAC reliability, redundancy and ignition-source control. These principles directly support this audit's findings regarding limited container ventilation, the absence of confirmed explosion-relief features and the potential for over-pressurisation in the steel enclosures.

**A6.0 Fire Detection, Monitoring and Alarming**

NFPA 855 requires suitable detection and monitoring systems, including smoke or particulate detection, gas detection in proximity to battery modules and HVAC air paths, thermal monitoring through the BMS and independent sensors, and alarm annunciation at a supervised location. Dedicated interface points must be available for fire service communication. These provisions mirror the gaps identified in the audit relating to unverified detection coverage, unclear thermal-runaway monitoring capability, and the absence of annunciation, shutdown and isolation arrangements.

**A7.0 Thermal Management Requirements**

NFPA 855 mandates that ESS installations maintain safe operating temperatures under normal and fault conditions. The thermal management system must be suitable for the local environment, capable of preventing overheating, effective during high-load or abnormal scenarios, and fully integrated with the system safety controls. It must also support the containment of thermal-runaway events. These principles reinforce the recommendations made within this report regarding the need to confirm HVAC capacity, cooling adequacy, and defined fail-safe behaviour during power loss.

**A8.0 Fire Service Access and Coordination**

The standard sets out detailed provisions for fire service access, including clear and reliable approach routes, direct access to ESS enclosures, access to system isolation points, the availability of manual overrides, and the preparation of pre-incident plans. Requirements also extend to hazard identification signage and documentation available to responding crews. These expectations support the audit's concerns regarding the site's single access route, hedgerow obstructions, undefined hardstanding areas and the lack of a formal pre-incident plan.

**A9.0 Combustible Clearances and Site Management**

NFPA 855 requires that vegetation, rubbish and combustible materials are not stored in proximity to outdoor ESS installations. The standard prohibits brush, debris or similar combustible encroachments and mandates that external compounds remain free of unnecessary ignition or fuel sources. These provisions reinforce the audit's findings that site vegetation and boundary hedgerows must be actively managed to prevent unnecessary fire exposure and preserve reliable access.

**A10.0 Signage, Labelling and Information Provision**

NFPA 855 requires ESS installations to be clearly labelled with the system type, battery chemistry, known fire and explosion hazards, emergency contact details, system isolation information and relevant hazard symbols. The audit likewise identified the absence of hazard placards, formal signage and on-site information documentation, which will need to be provided during detailed design and operational planning.

**A11.0 Emergency Operations Plan (EOP)**

The standard requires the development of a comprehensive Emergency Operations Plan, addressing roles and responsibilities, shutdown procedures, thermal-runaway response actions, firefighting strategies, communications, staff training and formal liaison with the local fire service. This aligns strongly with the audit recommendation that a dedicated site-specific Emergency Response Plan be developed for this facility.

**A12.0 Environmental and Geotechnical Considerations**

NFPA 855 also references environmental criteria for site selection and operation, including drainage design, flood risk, soil stability, lightning protection and seismic considerations. While these matters were not assessed in detail during this desktop review, they remain relevant to the ongoing design and operational planning for the site.

**Appendix B - UL 9540 – System-Level Safety Certification for BESS**

In contrast to CE marking, UL 9540 is a dedicated safety certification for energy storage systems and is the benchmark standard recognised in North American building and fire codes, including NFPA 855 and the International Fire Code (IFC).

Where CE marking governs market entry, UL 9540 governs installation and operational approval. It is widely required by Authorities Having Jurisdiction (AHJs) in North America before a BESS can be commissioned.

UL 9540 includes:

- Full third-party evaluation by a nationally recognised testing laboratory
- Assessment of the entire energy storage system, including batteries, inverters, control systems, wiring, interconnections and enclosure construction
- Verification that all components meet their respective standards (e.g. UL 1973 for batteries, UL 1741 for inverters)
- Thermal runaway and fire propagation testing, including UL 9540A as the fire/explosion test method
- Ongoing compliance monitoring through factory inspections

A UL-9540-certified system carries a UL Listing Mark and an associated Certificate of Compliance, which serve as evidence of system-level safety performance. Without this certification, BESS installations in North America are unlikely to receive approval from local regulatory authorities.

While UL 9540 is not required by EU law, it is a benchmark for assessing the fire and explosion performance of containerised BESS systems, particularly where thermal runaway, propagation and deflagration hazards are central considerations. This is directly applicable to the Knockraha site, where such hazards form a core part of the risk profile.

**Why CE Marking and UL 9540 Are Not Interchangeable**

It is often incorrectly assumed that CE marking indicates that a product has been “certified” or independently tested. In reality:

- CE marking enables market access in the EU, but does not confirm that the BESS has undergone third-party safety testing.
- UL 9540 confirms system-level fire, electrical and explosion safety, but does not replace EU regulatory requirements.

Therefore:

- A CE-marked system would not satisfy AHJ requirements in North America.
- A UL 9540-certified system still requires CE compliance to be marketed in the EU.
- The two certifications serve different regulatory and safety functions and are not interchangeable.

For projects involving global suppliers or international technology platforms, designers should plan for both CE and UL 9540 compliance during the procurement phase. This includes:

- Selecting components certified to appropriate international safety standards
- Designing with fire safety, thermal management and hazard mitigation in mind
- Engaging early with laboratories, fire consultants and regulatory bodies to streamline certification and acceptance

**UK Grid-Scale BESS Safety Guidance**

*(Based on “Health and Safety Guidance for Grid Scale Electrical Energy Storage Systems”, DESNZ/HSE, March 2024)*

The 2024 UK Grid-Scale ESS Guidance identifies thermal runaway as the dominant hazard in lithium-ion battery systems and describes it as a failure mode that can escalate into fire, over-pressure, deflagration and toxic gas release. The document notes that thermal runaway may propagate within modules and potentially between containers if layout and control measures are insufficient. This aligns directly with the hazard profile expected for large containerised ESS installations.

The guidance emphasises that flammable gas accumulation is a critical risk in enclosed BESS housings. It states that containerised designs require suitable ventilation and exhaust systems to prevent the build-up of gases generated during cell venting. Gas concentrations should be controlled to remain below fractions of the Lower Explosive Limit (LEL) to avoid conditions that could result in a deflagration or over-pressure event. Where gas generation rates could exceed ventilation capability, the document notes that engineered explosion-relief mechanisms may be necessary to provide predictable venting during fault conditions.

A further key theme in the guidance is the importance of site layout and separation distances as a primary means of controlling fire spread. It notes that adequate spacing between ESS units, ancillary plant and site boundaries is required to ensure that a fire or thermal-runaway event in one container does not propagate to adjacent structures. The guidance also highlights that separation zones must be maintained free of vegetation or stored materials, as such encroachment can create additional ignition pathways or restrict emergency access.

In relation to fire detection, monitoring and suppression, the guidance specifies that early identification of abnormal conditions—including temperature rise, state-of-charge deviations and off-gas indicators—should be incorporated into monitoring systems. Fire detection appropriate to the enclosure type should be provided, and suppression strategies should be selected based on the chosen hazard-mitigation approach. The guidance supports an integrated alarm strategy where system status and alarms are routed to a central monitoring point with defined response protocols.

For fire service access and emergency operations, the guidance notes that access routes must be designed to permit appliance movement and safe approach even during an ongoing incident. It indicates that large-scale lithium-ion ESS fires may require prolonged cooling periods and significant water supplies, and therefore drafting points, hydrants or reservoir access points should be included early in the design phase. It strongly recommends early engagement with the local Fire and Rescue Service to ensure pre-incident planning reflects the specific risk profile of the installation.

Finally, the guidance places clear responsibility on the duty holder to ensure that measures for preventing fire, limiting fire spread and protecting both site personnel and responders are in place throughout the lifecycle of the facility. It notes that the document is non-prescriptive and must be applied proportionately to the characteristics of the site, the technology in use and the surrounding environment.

# Annex C

**NFPA 855 Summary of Key Additions Introduced in the 2026 Edition**

**Role and Regulatory Standing of NFPA 855**

NFPA 855, *Standard for the Installation of Stationary Energy Storage Systems*, published in 2020 and is now in its third edition. NFPA 855 is considered an international benchmark for the fire and explosion safety of stationary energy storage systems (ESS). Its rapid evolution reflects the pace of development in battery technologies and the increasing recognition of ESS-specific fire and explosion hazards.

**Expansion of Covered Battery Technologies**

NFPA 855:2026 continues the trend of expanding the range of battery technologies explicitly addressed by the standard. This is of particular importance due to the presence of a catch-all category for “all other battery technologies,” which historically applied conservative threshold quantities. In the 2026 edition, both the Threshold Quantities table in Chapter 1 and the technology-specific provisions in Chapter 9 have been updated to include additional battery chemistries. By explicitly naming emerging technologies, the standard reduces uncertainty and limits unnecessary application of conservative default provisions, supporting clearer interpretation and more proportionate design responses.

**Strengthened Fire and Explosion Testing Requirements**

The 2026 edition introduces materially stricter fire and explosion testing expectations. The testing provisions have been relocated from Section 9.1.5 to a new Section 9.2, titled “Fire and Explosion Testing,” and the language has been expanded to explicitly require both UL 9540A testing and large-scale fire testing where fire and explosion testing is mandated elsewhere in the standard.

While UL 9540A remains the foundational test method for evaluating thermal runaway and gas generation at the cell, module, unit, and installation levels, the revised language addresses a key limitation of prior practice: testing could conclude early if a system passed at a given level. NFPA 855:2026 now requires additional large-scale fire testing to ensure that system behaviour under more severe and realistic fire scenarios is understood, particularly where external or cascading failure modes may occur.

**Ignition of Vented Gas During Testing**

A further addition in Section 9.2.1.2 requires intentional ignition testing where flammable gases are released during cell- or module-level thermal runaway. In such cases, an additional unit-level test must be conducted to assess fire and propagation hazards associated with vented gases. This provision reflects industry experience indicating that gas release and ignition can be a dominant hazard mechanism in ESS incidents and ensures that this behaviour is explicitly evaluated.

**Expanded Guidance on Large-Scale Fire Testing**

Annex G has been significantly expanded in the 2026 edition, including new Section G.11, which provides guidance on implementing large-scale fire testing. While UL 9540A remains the primary referenced test method, the annex clarifies objectives, limitations, and expectations associated with large-scale fire testing and its role in demonstrating system performance. This guidance supports more consistent interpretation by designers, testing laboratories, and AHJs.

**Hazard Mitigation Analysis as a Default Requirement**

NFPA 855:2026 introduces a fundamental change by making the Hazard Mitigation Analysis (HMA) the default requirement for ESS installations, unless specifically modified by technology-specific chapters. Previously, HMAs were typically triggered only when prescriptive limits were exceeded, such as when proposing to exceed maximum stored energy limits in Chapter 9. With the removal of the Maximum Stored Energy table in the 2026 edition, there is no longer a compliance advantage associated with remaining below fixed energy thresholds. Instead, hazard identification, evaluation, and mitigation through an HMA now form the primary basis for demonstrating safety.

This change has direct implications for project planning, as most ESS installations should now assume that a formal HMA will be required as part of the design and approval process.

**Reframing of Fire Control and Suppression Provisions**

The fire control and suppression requirements in Section 4.9 have been reorganised and reworded in the 2026 edition. The term “alternate” has been removed, and automatic sprinkler systems designed in accordance with NFPA 13 are now listed alongside other recognised fire control and suppression standards. This restructuring places all referenced suppression approaches on a more equal footing within the standard.

The requirement permitting “other systems” supported by fire and explosion testing has been repositioned within the section, which may be interpreted as reducing the presumption that certain suppression systems are inherently secondary or exceptional. The practical interpretation of this change will depend on AHJ expectations and committee intent, and early coordination with approving authorities remains essential.

**Enhanced Emergency Response Planning and Training Requirements**

NFPA 855:2026 strengthens emergency response planning requirements by clarifying that Emergency Response Plans must be developed in coordination with the Authority Having Jurisdiction and submitted prior to the training of required personnel. This change addresses common implementation challenges where responsibility for emergency planning may otherwise be unclear or deferred.

The revised provisions reinforce the importance of coordinated planning between ESS owners, designers, and emergency responders, ensuring that response procedures, system shutdown methods, and site-specific hazards are clearly understood before an incident occurs.

# DISABILITY ACCESS REVIEW

The proposed BESS is located in an external open area and access to the area will be restricted solely to authorised maintenance staff, and no general occupancy is anticipated. Therefore, there is no requirement for Part M Disability Access Review.

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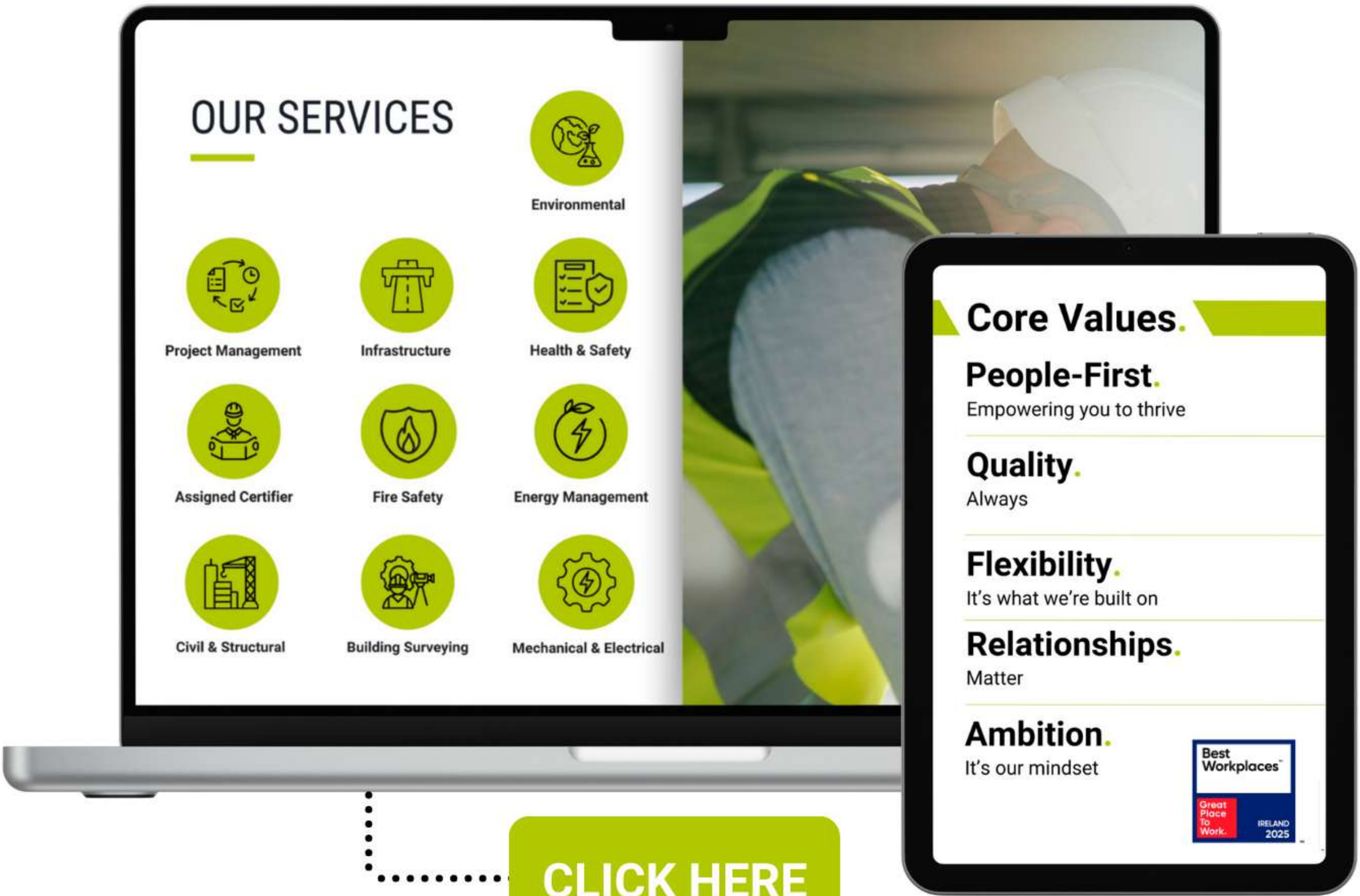


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