

Fosse Green Energy Park DCO
Application by Fosse Green Energy Park Limited

POST HEARING SUBMISSIONS
ON BEHALF OF LINCOLNSHIRE COUNTY COUNCIL
AT DL1

Introduction

1. Lincolnshire County Council (“LCC”) attended the Preliminary Meeting (PM) and Issue Specific Hearings (ISH) 1 and 2 held between the 6th and 8th January 2026. A summary of LCC’s oral representations for these hearings appears below.

Preliminary meeting

2. LCC expressed support for including the topics listed in Annex C as principal issues for the examination. LCC noted that the reference to waste under climate change and sustainability relates specifically to decommissioning waste arisings. However, LCC also raises concern about solar PV waste arisings, not only from decommissioning but also from the construction phase due to breakages and operational failures, as being important issues, particularly in relation to cumulative waste arisings given the increasing number of large-scale solar developments in the County.
3. LCC notes that ISH1 is relatively narrow in scope and requests that the ExA give consideration to holding ISHs in relation to other topics that are not on the agenda for ISH1, in particular landscape and visual, public health and cumulative effects.
4. LCC remains concerned to ensure that members of the public wishing to participate in the examination are able to do so, noting that an Open Floor Hearing (OFH) was not included in the first week of examination hearings. LCC welcomed the ExA intention to consider holding an OFH during the week reserved for hearings in March 2026 and would encourage the ExA to schedule an OFH at a time and in a manner that would allow residents to attend in person if so desired.
5. LCC is concerned that requiring submission of a final signed SoCG by Deadline 3 may not allow sufficient time for outstanding matters to be resolved, and result in more matters remaining ‘not agreed’ but acknowledged that the ExA are seeking clarity as to what matters are agreed or not agreed at this mid-point stage in the examination.

ISH1

6. Under agenda item 3.1, in relation to the delivery of the proposed Navenby substation, LCC reiterated the points made in its Relevant Representation. Responding to the applicant’s justification for submitting a separate application for the substation, the Council stated that it does not consider the evidence provided within the DCO application to be sufficient.

Furthermore, LCC noted that the reasoning presented as to why the application should not be refused is also lacking within the application documents. These concerns are set out in greater detail within Section 8 of the Council's Local Impact Report (LIR).

7. Under agenda item 3.2 in respect of the applicant's assessment of alternatives LCC raised the following concerns. LCC raised concern that the site selection process has been driven primarily by landowner willingness. LCC acknowledged that technical and environmental factors have been considered within the site selection report, in line with what is set out in NPS EN-3 (November 2023) Section 2 for solar development. However, the initial driver appears to be availability of land offered by landowners, which was a starting point, and shaped the search area. Landowner willingness is also a factor later in the site selection process, during Stage Five. LCC acknowledged that landowner willingness is an important aspect of delivery for any developer, however LCC are of the opinion that further explanation is needed on when this factor should enter the assessment, whether it comes before or alongside the consideration of land use policy.
8. LCC raised a further point regarding the size of sites that have been considered as part of the site selection process. While acknowledging that smaller sites in excess of 40 ha were considered, the applicant's stated preference in the site selection report is for a single, contiguous site of approximately 1,000 ha. Commercial viability seems to have driven this choice. LCC highlighted that there are other solar projects in Lincolnshire, such as the nearby Cottam solar scheme, that have successfully combined smaller, non-contiguous sites and have been considered viable by their developers. Therefore, LCC are of the opinion that some further justification is required on those points. Further detail on the assessment of alternatives and site selection is provided within Section 7 of the Council's LIR.
9. Under agenda item 3.3 (Effects for agriculture and land use), LCC made a number of points, some of which were touched on by NKDC. LCC referred to the Council's high-level, strategic starting position in respect of Best and Most Versatile (BMV) land, which is essentially enshrined in LCC's Energy Infrastructure Position Statement from December 2023 – that position is one where the Council will object to proposals on BMV land, acknowledging that the County proportionately has a much higher percentage of BMV land compared to the rest of the country. Building on this, those concerns extend to potential cumulative impacts arising from various NSIP and other (TCPA) projects within the County in terms of their land take and the impact on BMV soils. With the continuing trend of an increasing number of NSIPs, the potential impacts on BMV and agricultural land within the County is of significant concern to the Council.
10. To briefly put its position into context, LCC explained that the County has the largest combinable crop output of any UK county, constituting around 12% of England's arable crop area. High level of production is vital to the county's economy - in 2023 total crop output was valued at of over £1,564 million, while total livestock output was valued at £555 million.

11. LCC raised the point previously picked up by NKDC, and Natural England in their Relevant Representation, on the discrepancy in the application documents in respect of the quantity of Grade 3a land. In the ALC survey report [APP-161] it states that 3a land covers 241 hectares (Table 6, page 14), whilst the ES Chapter 12 [AS-016] at Table 12-15 (page 12-037) reports that 3a land accounts for 282.9 ha (on a smaller survey area). Clarification on which of these figures is correct would be welcome.
12. LCC raised a further point in respect of the reference at 12.6.2 of ES Chapter 4 (Alternatives and Design Evolution) [APP-029], where it states that BMV land had been considered in the evolution of site design and layout. However, from LCC's perspective, it is not clear how this evolutionary process has been approached iteratively, i.e. demonstrating clearly how the site design and layout was modified in response to the results from the ALC survey, to ensure full compliance with national/local policy to seek to use poorer quality land in preference to higher quality land, and avoid BMV where possible. LCC considers that the alternatives and design evolution process requires further explanation/amplification from the applicant to show how it complies with BMV policy.
13. LCC also wished to query the quantification of 'permanent' loss of agricultural land (4.6 ha, part of which is BMV), which appears to be very low. The Council raised the matter of 'temporary' use versus 'permanent' use insofar as it relates to this development, and questioning whether it is reasonable to conclude that a 60-year development timeframe is 'temporary'. LCC also queried whether the exclusion of areas that will be covered by infrastructure (hardstandings, access roads, compounds, BESS, substations, etc), again, for the duration of the development, can reasonably be described as 'temporary'. In LCC's experience, this categorisation is at variance to how other projects have approached this same matter.
14. In respect of the comment raised by NKDC relating to significance of effects under the Institute of Environmental Management and Assessment (IEMA) criteria, LCC are in agreement with the position taken by NKDC. LCC consider that the applicant's assertion that the '*low magnitude withdrawal of land from agricultural production may be interpreted as a minor adverse effect, which is not significant*' (reference ES Chapter 12 paragraph 12.7.44 (AS-016)) is incorrect. LCC's understanding of IEMA guidance is that the combination of low (or Minor) magnitude effect and High sensitivity (Grade 3a land) results in 'Moderate' impacts, which are classed as 'Significant'. Whilst the applicant provided commentary in response to this point at the Hearing, LCC remain of the view that the effects on Grade 3a land should be classed as 'significant'. This comment extends to the consideration of cumulative effects also.
15. The final point in this section that LCC wished to raise was in respect of the reasonable likelihood of grazing taking place beneath solar panels. In LCC's experience, the presence of grazing beneath panels is entirely dependent upon the availability of a willing grazier, and

this is not always guaranteed, therefore the Council would like this matter to be explored further with the applicant.

16. Under agenda item 3.4, in respect of cultural heritage, LCC raised the following concerns. With regard to the group value of historic farmsteads, Lincolnshire's rural landscape is characterised by historic farmsteads that form a coherent heritage network. Their collective significance is not fully captured by assessing individual assets alone. Understanding this group value is therefore important for evaluating cumulative and setting impacts.
17. Recent NSIPs in similar contexts, including Springwell Solar Project and Beacon Fen Energy Park, have undertaken structured group value assessments using a framework developed in collaboration with LCC. In the Council's view, without such assessment, as is the case with this application, the examination lacks the same level of certainty applied to comparable schemes. The Council would be willing to work with the applicant to apply this approach, ensuring consistency with emerging practice and providing the Examining Authority with a more robust evidence base for its decision-making.
18. In regard to the methodological approach and study area, LCC stated that the Environmental Statement adopts a tiered approach to defining study areas for designated heritage assets. Whilst LCC understands the rationale, the Council's concern is that this approach may not fully capture potential impacts on above-ground heritage receptors, particularly in a rural context. To ensure a comprehensive assessment, the Council would recommend:
 - A single, consistent study area for all designated assets — with the precise extent (for example 3 km or 5 km) to be determined by the Examining Authority;
 - A schedule of all above-ground heritage assets within the study area, including distance from the Order Limits and listing grade.
19. LCC considers that, under the current tiered approach, the Council are reliant on the applicant's professional judgement as to what is included or excluded. A consistent study area and a clear schedule would provide greater transparency and certainty for the examination.
20. With regard to archaeological matters under agenda item 3.4, LCC stated that the Council considers the archaeological information incomplete. LCC would welcome sight of site-specific design impacts for the potential intensive ground impacts, including drainage, landscape, ecology, and engineering measures.
21. LCC stated that trenching evaluation demonstrates that archaeology survives here at a depth of 30 cm. Therefore, there are a range of developmental impacts for a solar scheme which have the potential to damage or destroy currently surviving, unknown archaeology without identification or recording.

22. LCC further stated that evaluation trenches are needed to target both geophysical results and also to ground-truth so-called “blank” areas, archaeologically sensitive areas have been identified on other solar NSIPs solely through trenching.
23. Fit for purpose mitigation must be informed by sufficient baseline evidence of the archaeological potential. Site-specific mitigation measures can then be deployed effectively in an appropriate and reasonable way. In the absence of such site-specific mitigation, the Council will just be agreeing with the applicant that there are various methods of archaeological mitigation available but not applying this information in any meaningful or concrete way to the scheme’s developmental impacts. LCC raised that in its current form, the applicant’s proposed embedded mitigation measures reads simply as a list of the range of potential mitigation responses available without site-specific reference to where they may be most appropriately applied.
24. LCC further stated that once the detailed design with the range of site-specific impacts have been provided, LCC can work with the Applicant’s archaeological consultant to identify areas which will require any further evaluation, then agreement of an appropriate mitigation strategy to deal with the impact of this proposed development on currently surviving archaeology across the DCO order limits can be discussed.
25. LCC stated that given some specific ground impacts for this scheme may not be known for some time, the Council and applicant are now looking at devising reasonable agreed evaluation and informed proportionate agreed mitigation tied into future commitment, so that when the development impacts are known they can be mitigated adequately. LCC will therefore be working towards that future commitment being included in an agreed overarching or framework WSI which will include an agreed Archaeological Management Plan and an Archaeological Clerk of Works for the lifetime of the scheme, including the decommissioning phase.
26. With regard to whether a solar scheme temporarily has less impact on archaeology than ploughing: there are a range of ground impacts across a solar scheme which would cause much greater (permanent) impacts than ploughing; the decommissioning impacts of the scheme such as removing piles are not known; ecological, habitat and landscape measures may also be removed affecting surviving archaeology, for example tree planting removal or large scale soil movement. There is also the question of what must be done to the soil to restore it to agricultural use following decommissioning. LCC noted that minimum tillage ploughing is a recognised archaeological mitigation measure: DEFRA’s Environmental Land Management (ELM) schemes offer payments for minimum till on historic and archaeological features.
27. Under agenda item 3.5 LCC made the following points. LCC has prepared an LIR which will be submitted at deadline 1, scheduled for 20 January 2026. The conclusion regarding transport is as follows.

28. “In summary, the methodology and assessment of traffic impact is generally agreed with the Council. It provides a reasonable estimate of construction traffic that would be associated with the development. The Local Highway Authority do not expect capacity issues on the highway network as result of this development, provided the mitigation measures included in Section 13.6 of APP-008 are undertaken and delivered. This would mostly be achieved through the Framework CTMP. The Framework CTMP provides sufficient details at this stage for all proposed access locations. It also outlines proposals for site working hours, HGV routes, security, compound parking, wheel washing, delivery management, and traffic monitoring. These elements must be detailed in the final CTMP and be monitored, controlled, and be enforceable to ensure highway safety and that traffic impacts align with the ES assessment. Overall, the transport impact will be neutral”.
29. Under agenda item 3.6 LCC made the following comments: LCC stated that they had been sharing resources with North Kesteven District Council on matters relating to ecology and BNG. LCC confirmed that they fully supported comments made in the Hearing by NKDC in relation to BNG.
30. LCC confirmed that they would be happy to meet with the Applicant's ecological consultants to address points requiring clarification and additional information. LCC stated that they had confidence that outstanding issues could be resolved during the course of the examination.

ISH2

31. Under agenda item 3.1 LCC expressed support for the comments already raised by North Kesteven District Council and stated that in light of the time available it would limit its points on DCO drafting to those areas where the Council had statutory responsibilities, noting that LCC’s position on DCO drafting is fully detailed in the Council’s LIR. LCC encouraged the ExA to give consideration as to whether a further hearing on DCO drafting would be required.
32. LCC raised concern regarding the definition of ‘maintain’ within the draft DCO, as currently worded, it would seem to appear to LCC that it wouldn't prevent the wholesale replacement over the lifetime of the development happening incrementally. LCC highlighted that significant concerns would be raised in its LIR about waste arising from the development and in particular its cumulative impact alongside other schemes, given the lack of existing waste facilities for recycling solar PV waste currently. Current data suggests that if all NSIP solar and TCPA solar schemes in Lincolnshire are approved and constructed, around 15 million PV panels could require recycling and disposal at decommissioning alone. Whilst this is a long term issue, LCC are increasingly concerned about the ongoing operational failure rates, and even a modest failure rate of 0.2% equates to 31,000 PV panels needing replacement each year.

33. LCC, as the Waste Planning Authority (WPA), has a statutory duty to plan for sustainable waste management, and this requires accurate data on future waste streams. We currently lack that information in relation to solar waste. Without this information, it is difficult to identify sites, safeguard facilities and support the transition to a circular economy. LCC requested that consideration is given to including a requirement to limit panel replacement over the lifetime of the development, but also to require annual reporting of replacement/wastage figures to the WPA. This approach was discussed during the Springwell Solar examination, and in that case, the ExA did propose a similar requirement as an amendment to the draft DCO, however, it was acknowledged that this application has not yet been determined. Further details are provided in LCC's LIR within section 19, specifically referenced in paragraph 19.14.
34. In respect of Street Articles 8 and 10, as currently drafted they would give the developer rights to undertake highway works without further approvals from LCC as the Highway Authority. LCC's concern is that at this stage, we do not have the technical and detailed design details that the Council would usually require to be approved under the Highway Act and provisions for a bond. LCC have highlighted this within Section 11, and the table included with Section 22 of its LIR, and made suggestions as to how this could be resolved to the satisfaction of the Highway Authority through the detail of the Construction Traffic Management Plan (CTMP).
35. Regarding Requirement 17 and the proposed permissive footpath route LCC commented that it would wish to see consideration given to making this a dedicated public right of way instead, which would allow it to be protected in perpetuity and provide a permanent betterment as an outcome of the proposal.
36. Under agenda item 3.2 Lincolnshire Fire and Rescue (LFR) provided an overview of the current *draft* National Fire Chiefs Council (NFCC) guidance, set within the context that the document is still awaiting formal national sign-off. Reference was also made to the existing *current* NFCC guidance, with confirmation that much of the content remains valid and applicable. However, it was emphasised that careful consideration is required to identify where specific details have been amended, updated, or expanded within the draft guidance. It was further highlighted that NFCC guidance is intended to set out minimum standards, and that individual fire and rescue services may apply additional or enhanced measures where local risk profiles require this.
37. LFR and LCC confirmed copies of the current and draft NFCC guidance would be submitted into the examination at deadline 1.
38. NFCC provides strategic direction and operational guidance in relation to firefighting tactics. It was noted that these tactics have evolved over time in response to emerging evidence, operational learning, and technological developments. Current NFCC direction generally promotes a defensive firefighting approach for incidents involving battery energy storage systems (BESS). This approach would typically involve the establishment of a

secure and sustainable water supply, maintaining firefighter safety, and focusing on limiting fire spread beyond the container of origin, rather than committing crews to internal firefighting operations.

39. LFR confirmed its commitment to working collaboratively with the Environment Agency (EA) in relation to the management of firefighting water runoff. This includes consideration of potential environmental contamination, anticipated volumes of water required for firefighting and cooling operations, and opportunities for containment, treatment, and potential re-use where appropriate. It was acknowledged that these factors will need to be further developed and refined as site-specific plans and designs progress.
40. It was explained that, while the underlying design philosophy for BESS sites is that any fire should be contained within the container of origin, a dispersed BESS layout is considered more manageable from an operational firefighting perspective than a centralised design. A dispersed model increases separation distances between containers, thereby reducing the likelihood of fire spread, thermal escalation, or domino effects. This approach also supports more effective defensive firefighting tactics and enhances overall site resilience in the event of a container failure or fire.

1 **Draft NFCC Grid Scale Energy Storage System Planning –**
2 **Guidance for Fire and Rescue Services.**
3 *July 2024 Revision.*

4 The guidance is produced by the National Fire Chiefs Council (NFCC) for the use of
5 Fire and Rescue Services (FRSs) and planners to support community and firefighter
6 safety. It is intended to be informative, and this guidance does not constitute formal
7 legal advice. All parties' legal duties remain those specified by law.

8 This guidance relates to Battery Energy Storage Systems (BESS) which are
9 deployed in open air environments with an energy capacity of 1 megawatt (MWh) or
10 greater using lithium variant batteries. The principles contained within this guidance
11 may also be relevant to other battery technologies, advice should however also be
12 sought from a competent person.

13 The way FRSs use the guidance will be adapted based on local context. Local
14 authority planning departments should, therefore, not use the guidance as a
15 mandatory set of recommendations. Instead, discussions with the local FRS should
16 take precedence.

17 **1. Introduction**

18 The UK has for many years generated electricity to the National Grid using
19 predominantly coal, gas and nuclear fired power stations. With the move to reducing
20 the amount of fossil fuels that are being used, 44% of our energy in the third quarter
21 of 2023 was generated using renewable forms of energy such as solar, hydro or
22 wind power¹. However, unlike traditionally fuelled power stations, renewable energy
23 sources such as wind and solar cannot simply be switched on to generate energy to
24 meet the peaks and troughs of demand on the National Grid. Therefore, to ensure a
25 stable grid and to cope with the fluctuations in demand, the energy needs to be
26 captured and stored. Large batteries are being deployed as energy storage devices
27 that can capture the energy in times of low demand and provide almost
28 instantaneous support the National Grid at times of high demand.

29 These grid scale BESS are currently categorised as infrastructure projects and
30 progress through the planning system, rather than via a Building Regulations (as
31 amended) consultation process from building control bodies, whom FRSs work
32 closely alongside.

33 In 2023, Planning Practice Guidance for Renewable Energy published on the
34 Gov.UK website was updated and encourages early discussion between developers
35 of BESS and planners as well as the local FRS.

36 NFCC recognises the need for BESS to support the UK Government strategic
37 objectives of energy independence and security whilst the country is transitioning to
38 an environment that is less reliant on fossil fuels.

39 However, the National Fire Chiefs Council hold concerns that there are no duties on
40 the bodies receiving comments to respond, or to demonstrate how any FRSs
41 concerns have been satisfied or addressed.

¹ [Energy Trends December 2023 \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)

42 In referring to this guidance, NFCC seek to support FRSs to ensure they are aware
43 of the location of all grid scale BESS in their area. This is to allow for effective
44 operational pre planning to take place ensuring that FRS requirements are
45 proportionate to the hazard and risk whilst not being overly burdensome to the
46 developer of the BESS installation. It is hoped that the guidance will promote
47 consistency of approach across FRS.

48 NFCC's expectation is that a comprehensive risk management process supported
49 with appropriate evidence will be undertaken by operators to identify hazards and
50 risks specific to the facility and develop, implement, maintain and review risk
51 controls. From this process a robust Risk Management Plan and Emergency
52 Response Plan should be developed in conjunction with the local FRS.

53 This guidance supersedes and seeks to build on the original guidance document that
54 was published in 2023 (Version 1). The guidance is based upon a range of
55 supporting materials including academic research, national and international
56 standards, case studies, and industry guidance (please refer to Bibliography). The
57 content of this document is the result of analysis of that supporting material with
58 subsequent professional judgement applied.

59 Every BESS installation will be different, and FRSs should not limit themselves to the
60 content of this guidance. Where deviation from this guidance is required, advice
61 must be sought from a competent person.

62 **2. Scope**

63 NFCC recognises that BESS may also be deployed to support industry where there
64 is not a National Grid connection, for example, where a site has their own methods
65 of generating energy and have a desire to store it. The principles of this guidance
66 may also be relevant to be used in such cases.

67 Likewise, the principles of the guidance document may be relevant to the
68 deployment of temporary mobile BESS units which are becoming more prevalent.

69 Domestic BESS is outside the scope of this guidance and a publicly available
70 standard (PAS 63100 (1)) has been published setting out good practice in this area.

71 Mobile and temporary BESS deployments are also outside the scope of this
72 document.

73 **3. Incident Event Database**

74 Whilst, at the time of publication, thermal events and incidents involving BESS in the
75 UK are relatively rare, there have been failures within BESS across the world.

76 A source of information is the [Electric Power Research Institute \(EPRI\) Failure Event
77 Database](#) that records Energy Storage Failure Events. ■

78 Further advice and guidance for FRSs can be obtained through contacting the NFCC
79 via our [website](#).

80 **4. Principles**

81 This guidance has been developed with the safety of the public and emergency
82 responders in mind. It is based on trying to help reduce the risk as far as reasonably

83 practicable, whilst recognising that ultimate responsibility for the safe design and
84 running of these facilities rests with the developer and operator.

85 The guidelines are a starting point and cannot cover every eventuality or type of
86 design.

87 In developing these guidelines, the hazards and risks from lithium variant batteries
88 identified in National Operational Guidance, have been considered.

89 The following principles should be considered by FRSs, when liaising with operators,
90 and form the basis of this guidance²:

- 91 1. Effective identification and management of hazards and risks specific to
92 the siting, infrastructure, layout, and operations at the facility.
- 93 2. Siting of renewable energy infrastructure so as to eliminate or reduce
94 hazards to emergency responders.
- 95 3. Safe access for emergency responders in and around the facility, including
96 to renewable energy and firefighting infrastructure.
- 97 4. Provision of adequate water supply and firefighting infrastructure to allow
98 safe and effective emergency response. This could include the provision of
99 water to allow for defensive firefighting to protect surrounding
100 infrastructure.
- 101 5. Vegetation sited and managed so as to avoid increased bushfire and
102 grassfire risk.
- 103 6. Prevention of fire ignition on-site.
- 104 7. Prevention of fire spread between site infrastructure (solar panel banks,
105 wind turbines, battery containers/enclosures).
- 106 8. Prevention of external fire impacting and igniting site infrastructure.
- 107 9. Provision of accurate and current information for emergency responders
108 during emergencies.
- 109 10. Effective emergency planning and management, specific to the site,
110 infrastructure and operations.

111

112

5. Fire and Rescue Service Organisational Requirements

113 FRSs can take measures to support the planning process ensuring that timely and
114 meaningful engagement between the FRS, local planners and developers can take
115 place, thus assisting operational pre-planning.

116 FRSs are encouraged to:

- 117 • Nominate a lead department within their organisation that will be the public
118 facing point of contact for BESS.
- 119 • Host a webpage on their FRS website setting out a point of contact details for
120 BESS engagement.
- 121 • Although FRSs are not a statutory consultee for planning, FRSs are
122 encouraged to establish and maintain working arrangements with colleagues
123 in local authority planning departments to facilitate efficient consultation with
124 regard to BESS.

² State of Victoria (County Fire Authority) (2022), Design Guidelines and Model Requirements: Renewable Energy Facilities, p.4

- 125 • Use this guidance as a document to raise hazard awareness and inform
126 discussions with developers.

127

128

129

6. Fire and Rescue Service Contact Details

130 A comprehensive list of all FRSs can be found on the Fire England website which
131 will assist developers in making contact with the relevant FRS of the proposed
132 scheme. [Find your service | Fire England](#)

133

7. Planning Approval Process

134 As BESS are classed as infrastructure projects, they progress via a planning
135 application route for approval. They are not dealt with by Building Regulations (as
136 amended) consultations (unless there are ancillary buildings on site which may be
137 covered) and as such the FRS are not a statutory consultee.

138 In August 2023, the Department for Levelling Up, Housing and Communities
139 (DLUHC) amended the [Planning Practice Guidance for Renewable Energy](#). As a
140 result of this revision, both planners and developers are encouraged to engage with
141 the local FRS and, as such, each FRS should encourage early dialogue regarding
142 BESS proposals.

143 Whilst FRSs are not a statutory consultee for planning, they do have a statutory
144 responsibility under the [Fire and Rescue Services Act 2004](#) for obtaining information
145 to assist with the extinguishing of fires and the protection of life and property in their
146 area. In addition, through engaging at the pre planning or planning stage, FRSs may
147 be able to influence the design and layout of the site.

148 It is expected that there will be a proliferation of BESS developments across the UK,
149 and FRSs may also seek to ensure they are aware of planned and operational
150 projects in their area. The Department for Energy Security and Net Zero (DESNZ)
151 maintain a database of [Renewable Energy Schemes](#) for this purpose.

152

8. Information Requirements

153 Grid scale BESS should form part of FRS planning in accordance with arrangements
154 required under section 7(2)(d) of the Fire and Rescue Services Act (2004). Incidents
155 involving BESS will require a hazardous materials response and as such site-specific
156 risk information (SSRI) should be gathered with the support of suitably trained
157 hazardous materials environmental protection trained officers (HMEPO) and made
158 available to crews.

159

9. System design, construction, testing and decommissioning

160 The design of BESS is moving away from the original designs that resembled large
161 shipping containers where maintenance staff had to enter the container to undertake
162 their work, such as in figures 1 and 2 below.



163

164

165

166

Figure 1. Image reproduced with permission of PNNL **Figure 2.** Image reproduced with the permission of PNNL

167

168

169

More modern designs feature a cabinet design with access to the system being achieved through the provision of doors on the outside of the BESS unit (figure 3), thereby negating the need to enter the unit.



170

171

Figure 3. Image Reproduced with the permission of PNNL

172

173

174

175

176

177

FRSs should seek to obtain as much information as possible at the earliest opportunity from the applicant / developer / designer / manufacturer etc., to allow an initial appraisal of the BESS to be made. It is the responsibility of those above to provide this information to the FRS (via the local authority planners in the first instance), with appropriate evidence provided to support any claims made on performance and with appropriate standards cited for installation.

178

179

Such information should also be made available to FRSs for inclusion in SSRI records.

180

181

Areas for discussion that the FRS may wish to clarify with the site developer at the pre application / engagement phase include:

Areas for discussion	Clarification questions
Thermal event / Deflagration	<ul style="list-style-type: none"> How will the proposed BESS perform in the event of a thermal event / deflagration and what proactive / reactive systems are proposed to mitigate this?

	<ul style="list-style-type: none"> • How will the thermal event be contained to the BESS of origin without the radiant heat to others? • How has the performance of the BESS in a thermal runaway event influenced site design?
Site plans	<ul style="list-style-type: none"> • What are the assumptions about active firefighting, within the emergency response plan and what measures are in place to reduce the scale of an incident? • Are the incident assumptions realistic? What is the role of the FRS at an incident? Are they realistic? What is the expectation of the FRS in terms of the fire strategy at a thermal event? • What is the provision for firefighting access to, around and within the site?
Water supply / Suppression systems	<ul style="list-style-type: none"> • What is the type, purpose and effect of any fire suppression system installed? • What is the purpose of the water supply provision on site? Boundary cooling / defensive firefighting or active suppression?
BESS design	<ul style="list-style-type: none"> • What is the size, quantity and capacity of each BESS unit? • Is the BESS design appropriate for the weather at the proposed location i.e. prevention of water ingress and impact of temperature range on cooling systems? • Does the applicant / developer have relevant competence and experience in the field of BESS design and deployment on the scale of the proposed development? • What are the arrangements for ongoing monitoring of the BESS and what is the response time for

	onsite technical assistance in the event of an incident?
Annunciation	<ul style="list-style-type: none"> • What remote annunciation panels are available for monitoring an event from the site? • What data is available from these remote annunciation panels?
Environmental receptors	<ul style="list-style-type: none"> • Please refer to Section 15 of this guidance.

182 Responses to these questions will assist in shaping several areas of the emergency
183 response plan.

184 Further, the Environment Agency has published [Fire Prevention Plans:](#)
185 [Environmental Permits Guidance](#) detailing what should be included in a fire
186 prevention plan, the fire prevention measures that must be put in place, a plan
187 template and examples of alternative measures.

188 **10. Battery Chemistry**

189 Battery Chemistry is a very specialist area of materials science and as such NFCC
190 are not an authoritative body to make comment other than to discuss the broad and
191 generally accepted principles which were published as part of the Frazer Nash
192 Report (Smart: Energy Storage & Flexibility Innovation. Health & Safety Guidance for
193 Grid Scale EESS, Jan 2024). The text relating to battery chemistry is reproduced
194 here with the permission of Department for Energy Security and Net Zero.

There are a range of battery chemistries available which suit different use cases, have a different maturity and which present different risks and safety profiles that are at varying states of maturity.

Lithium-Ion batteries make up the majority of the current grid-scale BESS global market share, due to their ideal characteristics of high energy density, high energy efficiency and a long-life cycle.

There are multiple variants of Lithium-Ion batteries, with Lithium Nickel Manganese Cobalt Oxide (NMC) and Lithium Iron Phosphate (LFP) the two main chemistries that dominate stationary lithium-ion energy storage projects. There are multiple trade-offs when selecting battery cell types, including power and energy density, availability, cost and safety. From a safety perspective, it is noted that LFP batteries typically have better thermal stability (lowering the probability of thermal runaway) than NMC batteries, but not removing it.

Smart: Energy Storage & Flexibility Innovation. Health & Safety Guidance for Grid Scale EESS, January 2024

195

196 Whilst there are different characteristics of lithium ion batteries (e.g. NMC, LFP and
197 other chemistry types) involved in a fire, the overall risks they present to firefighters
198 are similar. Specifically, they may all involve toxic, flammable and / or explosive
199 vapour clouds. They may also result in intense flaming combustion.

200 In 2023, the Research Institute of Sweden (RI.SE) published a report: Guidelines for
201 the fire protection of battery energy storage systems³. The report highlighted
202 examples of cause scenarios and possible consequences related to BESS. These
203 are listed below (in no particular order).

204 **Table 1. Summary of the cause scenarios and their associated possible**
205 **consequences⁴**

Cause Scenarios	Possible Consequences
Manufacturing or installation errors	High temperatures, fire, explosion, pressure build up, release of toxic gases, projectiles, electrical hazards, corrosive gases, chemical spill etc.
Damage to battery cells due to environmental effects (dust, humidity, salt water, lightning strikes etc.)	
Electrical faults such as overcharging or deep discharge, electrical arcs	
Ageing and lithium dendrite formation	
Mechanical Impact e.g. collision, ice from wind turbines	
External fire which spreads to the BESS	
Over / Under Temperatures	
Incidents caused by human factors during maintenance	
Vandalism, Cyber attacks	

206

207 11. Detection and monitoring

208 An effective and appropriate method of early detection of a fault within the batteries
209 should be in place, with immediate disconnection of the affected battery / batteries
210 remotely. This may be achieved through the provision of an effective battery
211 management system (BMS). Specific electrolyte vapour detection system are
212 available and may be helpful, but should not be relied on in isolation as a pre cursor
213 to a thermal event.

214 Detection systems should also be in place as part of the risk management process to
215 alert the operator of an event at the site.

216 Appropriate automatic detection such as smoke, gas or radiant heat detectors, as
217 well as continuous combustible gas monitoring within units should be provided in all
218 ESS. Gas detectors should alarm at the presence of flammable gas, shut down the
219 ESS, and cause the switch over to full exhaust of the ventilation system. Sensor
220 locations should be appropriate for the response times, and type of gas detected e.g.
221 hydrogen, carbon monoxide and other volatile organic compounds.

³ Gronland, Quant et al RISE Report 2023:117

⁴ Table 2 Page 15 Gronland, Quant et al RISE Report 2023:117

222 External audible and visual warning devices, as well as addressable identification at
223 control and indicating equipment, should be linked to:

- 224 1. Battery management system (when a thermal runaway event is identified)
225 2. Detection and suppression system activation

226 This will enable first responders to understand what the warning is in relation to,
227 aiding their decision-making and the formation of an incident plan.

228 **12. Suppression**

229 The type of suppression system should be dictated by the battery technology used
230 within the BESS. For example, gas should not be used to compensate for the lack of
231 availability and accessibility of water supplies at a particular site.

232 It is becoming increasingly common for BESS to be designed and manufactured
233 without any suppression system and maybe specifically designed so that a fire can
234 be contained within the BESS cabinet or enclosure. Even in cases where no water-
235 based suppression system is installed, local water sources may be needed for
236 exposure protection.

237 Where dry pipe or fire service inlets are provided for BESS enclosures, signage
238 denoting their presence should be fixed in a prominent position for the FRS to use. It
239 must also be acknowledged by all that where a dry pipe system is installed:

- 240 • FRS attendance is dependent on many factors, expectations on weight of
241 attendance and times will vary between FRS, this should be discussed
242 between the developer and the FRS in question.
- 243 • FRS inlets need to be positioned where operational crews are safe from the
244 effects of a BESS event, failure to do so may lead to the system being
245 unusable.
- 246 • There must be an appropriately sized water supply for the FRS to use in a
247 location that promotes expediency of supplying water.

248 **13. Suppression systems**

250 The primary role of a fire suppression system in a BESS is to prevent a fire in the
251 ancillary electrical equipment spreading to the battery modules. It may have a limited
252 effect to protect the BESS from an external fire spreading to it. All claims of
253 performance of suppression systems, need to be supported with appropriate
254 evidence for that specific use case.

255 The suppression system, regardless of type, will have little effect on a thermal event
256 within the battery cell. Any effectiveness they have will be in preventing cell to cell
257 propagation, rather than fully extinguishing a fire in the cell.

258 Where the developer proposes that suppression systems are not required in the
259 design, the FRS needs to be satisfied that alternative controls are in place to prevent
260 a fire or other thermal event in the BESS of origin, from propagating to adjacent
261 equipment.

262 **13.1 Inert Gaseous Suppression System**

263 Gaseous suppression systems have no cooling capability and given that thermal
264 runaway will continue in the absence of oxygen, they will not suppress thermal

265 runaway. Their use, however, has been effective in dealing with flaming combustion
266 within enclosed spaces, which may be more appropriate for some ancillary electrical
267 systems.

268 The design and selection of a gaseous suppression system should be specific to the
269 use of the BESS in question and designed by a competent person. Whilst a
270 suppression system may extinguish the flaming combustion within a BESS, it could
271 create a further complexity for firefighters in the form of a developing vapour cloud,
272 as occurred in the McMicken incident⁵.

273 **13.2 Water based suppression system**

274 Whilst water has a high cooling capability and therefore may be able to prevent
275 further cell to cell propagation and thermal runaway within a BESS, it is also
276 conductive and has caused additional damage and increased incident duration in
277 some cases.

278 Water based systems could be installed as either a wet pipe system with a dedicated
279 water supply, or alternatively, as a dry pipe system with a standard instantaneous
280 firefighting connection for the FRS to connect to from a distance.

281 Any calculations for sufficient water supply for an appropriate suppression system
282 will need to be completed by a competent person considering the appropriate risk
283 and duration of any fire.

284 **14. Explosion Control (Deflagration Protection)**

285 BESS containers should be fitted with explosion protection or deflagration venting
286 appropriate to the hazard and battery technology deployed. Designs should be
287 developed by competent persons, with design suitability able to be evidenced⁶.
288 Exhaust systems designed to prevent deflagration should keep the environment
289 below 25% of the lower explosive limit (LEL).

290 Flames and materials discharged as a result of any venting should be directed
291 outside to a safe location and should not contribute to any further fire propagation
292 beyond the unit involved or prevent further risk to persons. The likely path of any
293 vented gasses or materials should be identified in emergency response plans to
294 reduce the risk to responders.

295 Likewise, the position of any venting should take account of the likelihood of weather
296 related ingress of water, so as to minimise the risk of water damage during the
297 ordinary functioning of the BESS.

298 Consideration should also be given to leakage paths for explosive vapour via cable
299 trunks and routes to other structures which could result in a secondary remote
300 vapour cloud explosion⁷.

301 Explosion / deflagration strategies should be built into the emergency response plan
302 such that responders are aware of their presence and the impact of their actions on

⁵ Surprise, Arizona 2019

⁶ BS EN 16009:2011 Flameless Explosive Venting Devices; BS EN 14373:2021 Explosion Suppression Systems; BS EN 14797:2007 Explosion venting Devices.

⁷ Dahongmen Incident, Beijing, 2021.

303 these strategies⁸. For example, opening the door to a unit may negate the potential
304 effect of deflagration vents due to an alternative path of least resistance having been
305 created⁹.

306 Where emergency ventilation is used to mitigate an explosion hazard, the
307 isolation/disconnect for the ventilation system should be clearly marked to notify
308 personnel or first responders to not disconnect the power supply to the ventilation
309 system during an evolving incident¹⁰. The remaining unaffected cells need to
310 continue to be maintained within their operating temperature. The method of
311 explosion control system utilised should be based on an explosion study performed
312 by a qualified engineer.

313 **15. Site Location**

314 The choice of BESS site and the associated safety measures should account for the
315 impact that an incident on the site could have on the local environment. A plan
316 should be prepared to assist in discussions with developers and planners regarding
317 the suitability of a site location highlighting all sensitive receptors within a 1km radius
318 of the site to allow for appropriate emergency planning.

319 The [Fire Prevention Plans: Environmental Permits Guidance](#) provides examples of
320 sensitive receptors that may include:

- 321 • Schools, hospitals, nursing and care homes, residential areas, workplaces.
- 322 • Protected habitats, watercourses, groundwater, boreholes, wells and springs
323 supplying water for human consumption. Further habitat information can be
324 found on the DEFRA [MAGiC map website](#).
- 325 • Roads, railways, bus stations, pylons (on or immediately adjacent to the site
326 only), utilities, airports.

327 Any plans created should have a compass rose showing north and the prevailing
328 wind direction.

329 Whilst incidents involving BESS are relatively rare at the time of publication, the
330 impact of an incident could be protracted and may have an impact on business
331 continuity in the area adjacent to the BESS. Given that all fire safety principles and
332 design documents in the UK are predicated on the fact that an incident / fire will
333 occur i.e., one fire at one time; an assessment of the impact of an incident on the
334 surrounding area should be undertaken to consider the business continuity and
335 neighbourhood disruption. The assessment should be inextricably linked to the
336 battery technology type, the expected incident response from the FRS (controlled
337 burn or active firefighting) and the proximity of any significant transport infrastructure,
338 public buildings etc.

339 The assessment should identify that any incident may span a period of hours to days
340 in terms of duration and the disruption to the local and / or national economy.

⁸ UL FSRI (2020) Four Firefighters injured in Lithium- Ion Battery Energy Storage System Explosion- Arizona pp 47-49

⁹ <https://www.pnnl.gov/news-media/pnnl-invention-reduces-risk-battery-explosions>

¹⁰ NFPA (2023) Standard for the Installation of Stationary Energy Storage Systems, para G.1.4.3.3

341 Developers may also wish to commission an analysis of fire gas plume modelling
342 under different scenarios to help understand the impact on local communities from
343 prevailing wind etc. Such modelling, if undertaken, should be completed by a
344 competent person.

345 Local Resilience Forum (LRF) partners may wish to comment on the impact of the
346 assessment on the surrounding area to establish whether the outcome is tolerable to
347 the environment and the local economy including major transport infrastructure.

348 External factors also need to be considered including proximity of other BESS sites
349 and the risk to the site from surface water flooding or spread from wildfire.

350 **16. Access**

351 **16.1 Site Access**

352 Suitable facilities for safely accessing and egressing the site should be provided.
353 Designs should be developed in close liaison with the local FRS as specific
354 requirements may apply due to variations in vehicles and equipment.

355 In achieving adequate access for the FRS, firefighters should not have to enter the
356 BESS site and drive through a vapour / gas cloud to reach the scene of operation. It
357 is therefore preferable to have an alternative access point taking account of the likely
358 wind direction.

359 Whilst BESS progress for approval is via the planning route, there is an absence of
360 guidance regarding adequate access for the FRS.

361 However, the principles contained within Approved Document B in support of B5
362 may assist in providing a proportionate and adequate provision of access and
363 facilities for the FRS. It must, however, be acknowledged by all, the guidance
364 referenced below is for 'common building situations' which BESS are clearly not,
365 therefore it is cited only as potential broad principles.

366 Approved Document B¹¹, section 15 sets out a number of tables relating to access
367 routes and hardstanding areas that consider the dimensions of fire service vehicles.

368 Table 15.2 below provides an overview of access routes and hardstanding areas
369 which have given consideration to fire service vehicles dimensions.

370 **Table 15.2 from Approved Document B – Typical FRS vehicle access route** 371 **specification**

¹¹ [Approved Document B \(fire safety\) volume 2: Buildings other than dwellings, 2019 edition incorporating 2020 and 2022 amendments \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/101441/Approved_Document_B_fire_safety_volume_2_Buildings_other_than_dwellings_2019_edition_incorporating_2020_and_2022_amendments.pdf)

Table 15.2 Typical fire and rescue service vehicle access route specification

Appliance type	Minimum width of road between kerbs (m)	Minimum width of gateways (m)	Minimum turning circle between kerbs (m)	Minimum turning circle between walls (m)	Minimum clearance height (m)	Minimum carrying capacity (tonnes)
Pump	3.7	3.1	16.8	19.2	3.7	12.5
High reach	3.7	3.1	26.0	29.0	4.0	17.0

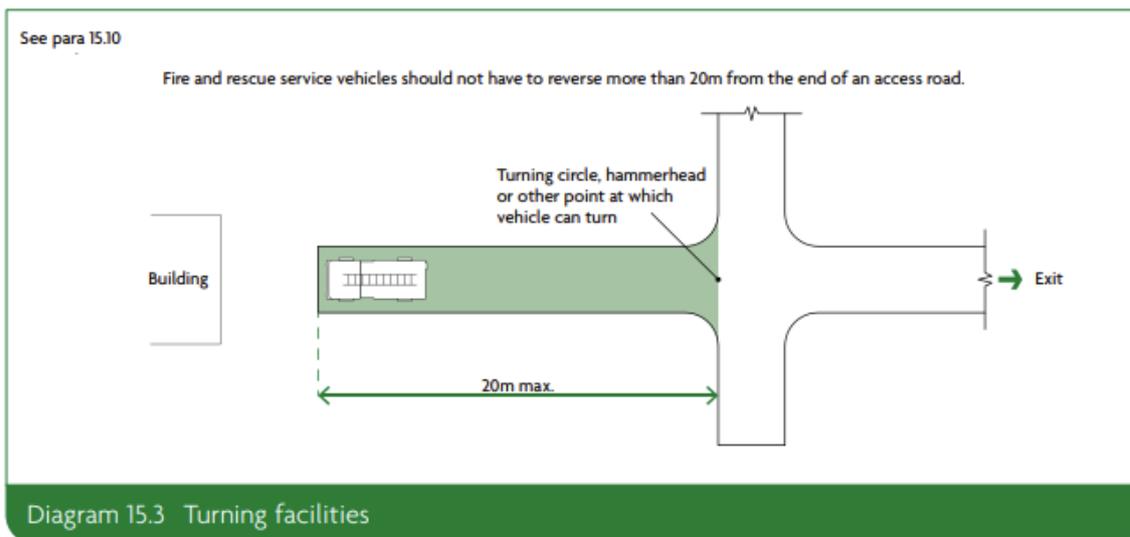
NOTES:

1. Fire appliances are not standardised. The building control body may, in consultation with the local fire and rescue service, use other dimensions.
2. The roadbase can be designed to 12.5 tonne capacity. Structures such as bridges should have the full 17-tonne capacity. The weight of high reach appliances is distributed over a number of axles, so infrequent use of a route designed to accommodate 12.5 tonnes should not cause damage.

372

373 Diagram 15.3 from Approved Document B provides a schematic demonstrating a
374 dead end situation.

375 **Diagram 15.3 Turning Facilities**



376

377 Fire Hydrants and connections to any dry pipe systems that are required to be
378 installed on the BESS site should be installed in accordance with BS 9990 (Non-
379 automatic firefighting systems in buildings - Code of Practice) (current edition) and
380 should be identified in accordance with BS 3251 Indicator Plates for Fire Hydrants
381 (current edition).

382 **17. Spacing between BESS**

383 NFCC does not support the vertical stacking of containers or units on top of each
384 other on the basis of the level of risk from the vertical fire spread between the BESS,
385 the fire loading and the difficulty in gaining access.

386 The emergency response plan should be predicated on the scenario of the fire will
387 not spread beyond the BESS container of origin. Fire and rescue operations should
388 be limited to boundary cooling of surrounding BESS and monitoring the BESS
389 involved in the thermal event.

390 This outcome can be achieved through a number of different routes including:

- 391 • Adequate separation between the BESS enclosures to ensure that the radiant
392 heat from a thermal event in one BESS will not trigger a secondary event.
- 393 • Provision of fire resistant materials that will prevent direct flame impingement
394 or radiated heat affecting adjacent BESS and allowing the incident to develop
395 beyond BESS of origin.

396 The provision of a suppression system to the BESS is unlikely to provide a
397 compensatory feature to allow reduced spacing between BESS.

398 In the event that the developer cannot demonstrate that a thermal event / fire can be
399 contained to the BESS of origin, then the developer should be referred to guidance
400 such as the separation distances within NFPA 855 (current edition - 2023). NFPA
401 855¹² states separation can be reduced to at least 3 feet or 0.914m between BESS if
402 tests such as UL 9540A shows propagation does not occur.

403 **17.1 Spacing to other buildings beyond perimeter of site**

404 Individual site designs will mean that distances between BESS units and occupied
405 buildings / site boundaries will vary. Proposed distances should take into account
406 risks including the impact of any vapour cloud and also any mitigation factors that
407 have been incorporated into the site design.

408 However, an initial minimum distance of 30m is proposed prior to any mitigation such
409 as blast walls. This distance is based upon the 100ft distance cited in NFPA 855 for
410 remote installations¹³.

411 **18 Site Conditions**

412 In addition to the risk of an incident occurring within the BESS, the site needs to be
413 maintained in order to prevent a fire spreading to the BESS or indeed fire loading, by
414 providing a 'bridge' or path between BESS units to transmit flaming or radiant heat.

415 It is important that no combustible material is adjacent to BESS units and that clear
416 access is maintained. Areas within 10 metres of BESS units should be kept clear of
417 combustible vegetation and all other vegetation within the curtilage of the site should
418 be kept in a condition such that it does not increase the risk of a fire on the site.

419 Areas with wildfire risk or vegetation that would result in a significant size fire should
420 be factored into the assessment. Additional separation distances should be factored
421 in to prevent a fire spreading to the BESS or increasing the ambient temperature
422 within the BESS above the tolerances of the safe working temperature.

423 **19 Water Supplies**

424 Pumping fire appliances in the UK typically have a water storage capacity of
425 approximately 1,800-2,000 litres of water which can be exhausted in under five
426 minutes per appliance. Therefore, to supplement the supply of water, the site needs
427 to be supplied with a water supply for FRS to utilise in the event of an emergency.

¹² NFPA 855. Standard for the Installation of Stationary Energy Storage Systems. (2023)

¹³ NFPA 855. Standard for the Installation of Stationary Energy Storage Systems. (2023)

428 There must be enough water available for firefighting to take place and to manage a
429 reasonable worst-case scenario. Depending on the site this could be water in
430 storage tanks, lagoons on site, access to hydrants or mains water supply.

431 The amount of water required will vary and will be dependent on a number of factors
432 including:

- 433 • The size of the incident to be dealt with e.g. 1 x BESS unit
- 434 • The principles of the emergency response plan and the expectation of the role
435 of the FRS (firefighting strategy).
- 436 • Access and facilities for firefighters on site
- 437 • BESS location and proximity to infrastructure or areas of population.
- 438 • The requirement to supplement any on site firefighting facility such as a dry
439 pipe sprinkler / deluge system.

440 Several manufacturers of BESS now advocate that should the BESS unit have a
441 thermal event and progress to thermal runaway, the BESS unit should be allowed to
442 consume itself i.e. burn itself out. Furthermore, an increasing number of
443 manufacturers of BESS suggest that applying firefighting jets to the BESS will have
444 limited affect and could prolong the duration of the thermal event unnecessarily. In
445 these instances, water fog or spray pattern branches should only be directed to
446 areas to ensure the incident does not spread to adjacent BESS.

447 If it can be confirmed that the recommended firefighting tactic for the BESS is to
448 defensively fire fight and boundary cool whilst allowing the BESS to consume itself,
449 this will reduce the water requirements, and thus the drainage / environmental
450 protection requirements significantly.

451 IP ratings of units should be known so that risks associated with boundary cooling
452 can be understood.

453 It is therefore imperative to enable the formation of the emergency response plan
454 that the manufacturer's instructions are followed to ensure that any incident is
455 brought to a swift and safe conclusion with minimal damage to the environment and
456 the local area.

457 Fire hydrants and connections to any dry pipe systems that are required to be
458 installed on the BESS site should installed in accordance with BS 9990 Non-
459 automatic firefighting systems in buildings code of practice (Current Edition) and
460 should be identified in accordance with BS 3251 Indicator Plates for Fire Hydrants
461 (Current Edition).

462 Fire Hydrants provided should achieve a flow rate of no less than 25 litres / second
463 at any hydrant on the site¹⁴. This figure is based on guidance produced by Water UK
464 and the Local Government Association. The flow rate for transportation has been
465 selected as the comparative value for flow rates, rather than that of a domestic
466 housing development or an industrial setting.

467 Where a flow of 25 litres / second cannot be achieved, it would be prudent to provide
468 an equivalent static supply of water on site that will provide for the same flow rate for
469 a duration of 120 minutes. This equates to approximately 180,000 litres of water.

¹⁴ Appendix 5 Guidelines on flow requirements for firefighting. National Guidance document Jan 2007 3rd
Edition [Microsoft Word - National guidance document on water for ffg FINAL.doc](#)

470 Consideration should be given, within the site design, to the management of water
471 run-off (e.g. drainage systems, interceptors, bunded lagoons).

472 Water supplies for any onsite suppression system will require to be sized
473 independently for the design fire size of the BESS by a competent fire engineer.

474 Any static water storage tanks designed to be used for firefighting must be located at
475 least 10 metres away from any BESS container / cabinet to allow for safe access
476 and usage. They must be clearly marked with appropriate signage. They must be
477 easily accessible to FRS vehicles and their siting should be considered as part of a
478 risk assessed approach that considers potential fire development / impacts. Outlets
479 and connections should be agreed with the local FRS. Any outlets and hard suction
480 points should be protected from mechanical damage (e.g. through use of bollards).

481 **20 Signage**

482 Signage should be installed in a suitable and visible location on the outside of BESS
483 units identifying the presence of a BESS system. Safety signage should be installed
484 in accordance with Health and Safety (Safety Signs and Signals) Regulations 1996.
485 Signage should also include details of:

- 486 • Relevant hazards posed.
- 487 • The type of technology associated with the BESS.
- 488 • Any suppression system fitted.
- 489 • 24/7 Emergency contact information signs on the exterior of a building or
490 enclosure should be sized such that at least one sign is legible at night at a
491 distance of 30 metres or from the site boundary, whichever is closer¹⁵.

492 Adherence to the Dangerous Substances (Notification and Marking of Sites)
493 Regulations 1990 (NAMOS) should be considered where the total quantity of
494 dangerous substances exceeds 25 tonnes.

495 **21 Emergency Response Plan**

496 To ensure the provision of risk information to the FRS, the site operator should
497 develop and share an emergency response plan with the local FRS point of contact.
498 There will be variance in the layout and design of each operator's emergency
499 response plan, but it should contain the following broad subject areas:

- 500 • How the FRS will be alerted.
- 501 • A facility description, including infrastructure details, operations, number of
502 personnel and operating hours.
- 503 • A site plan depicting key infrastructure: site access points and internal roads,
504 firefighting facilities (water tanks, pumps, booster systems, fire hydrants, fire
505 hose reels etc), drainage, and neighbouring properties.
- 506 • Details of the emergency response co-ordinator including the subject matter
507 expert for the site.
- 508 • Safe access to and within the facility for emergency vehicles and responders,
509 including to key site infrastructure and fire protection systems.
- 510 • Details and explanation of warning systems and alarms on site and locations
511 of alarm annunciators with alarm details (smoke, gas, temperature).

¹⁵ NFPA 855. Standard for the Installation of Stationary Energy Storage Systems. (2023)

- 512 • Hazards and potential risks at the facility and details of their proposed
- 513 management.
- 514 • The role of the FRS at incidents involving a fire, thermal event or fire
- 515 spreading to the site.
- 516 • Emergency shutoff or isolator locations.

517

518 **22 Site Plans and Maps**

519 In addition, site plans should be provided to the FRS that include:

- | | | | |
|-----|-----------------------------------|-----|------------------------------------|
| 520 | • The layout of buildings. | 548 | • Hydrants and water supplies. |
| 521 | • Any areas where hazardous and | 549 | • Areas of natural and unmade |
| 522 | flammable materials are stored | 550 | ground. |
| 523 | on site (location of gas | 551 | • Drainage runs, pollution control |
| 524 | cylinders, process areas, | 552 | features such as drain closure |
| 525 | chemicals, piles of combustible | 553 | valves, and fire water |
| 526 | wastes, oil and fuel tanks). | 554 | containment systems such as |
| 527 | • All permanent ignition sources | 555 | bunded or kerbed areas (this |
| 528 | on the site and show they are a | 556 | may be easier to show on a |
| 529 | minimum of 6m away from | 557 | separate drainage plan). |
| 530 | combustible and flammable | 558 | • Storage areas with pile |
| 531 | waste. | 559 | dimensions and fire walls |
| 532 | • Any areas where combustible | 560 | (where applicable) – this |
| 533 | waste is being treated or stored | 561 | includes wastes stored in a |
| 534 | including non-waste material. | 562 | building, bunker, or containers – |
| 535 | • All separation distances. | 563 | include indicative pile layouts |
| 536 | • Any areas where combustible | 564 | and ensure it is geographically |
| 537 | liquid wastes are being stored. | 565 | representative. |
| 538 | • Any area where depollution of | 566 | • The location of fixed plant or |
| 539 | ELVs takes place. | 567 | storage location of mobile plants |
| 540 | • Any area where crushing, | 568 | when not in use. |
| 541 | shredding, baling of metals or | 569 | • The location of spill kits. |
| 542 | ELVs takes place. | 570 | • The quarantine area. |
| 543 | • Main access routes for fire | 571 | • Anything site specific |
| 544 | engines and any alternative | 572 | considered needing to be |
| 545 | access. | 573 | added. |
| 546 | • Access points around the site | | |
| 547 | perimeter to assist firefighting. | 574 | |

575 There must have plans showing all sensitive receptors within a 1km radius of the site

576 that could be affected by a fire. Examples of sensitive receptors may include:

- 577 • Schools, hospitals, nursing and care homes, residential areas, workplaces.
- 578 • Protected habitats, watercourses, groundwater, boreholes, wells and springs
- 579 supplying water for human consumption – further habitat information can be found
- 580 on the Defra [MAGiC map website](#).
- 581 • Roads, railways, bus stations, pylons (on or immediately adjacent to the site only),
- 582 utilities, airports

583 Plans must have a compass rose showing north and the prevailing wind direction.

584 **23 Environmental impacts**

585 Suitable environmental protection measures should be provided. This should include
586 systems for containing and managing water runoff. System capability / capacity
587 should be based on anticipated water application rates, including the impact of water
588 based fixed suppression systems.

589 Sites located in flood zones should have details of flood protection or mitigation
590 measures.

591 **24 Recovery**

592 The operator should develop a post-incident recovery plan that addresses the
593 potential for re-ignition of ESS and de-energizing the system, as well as removal and
594 disposal of damaged equipment.

DRAFT

595 **25 Bibliography**

596

597 1. BSI - Electrical installations. Protection against fire of battery energy storage
598 systems for use in dwellings. Specification. 2024. PAS63100. [PAS 63100:2024 now](#)
599 [available - Wiring and the Regulations BS 7671 - IET EngX - IET EngX \(theiet.org\)](#)

600

601 2. Acts, UK Public General. Fire and Rescue Services Act 2004.
602 <https://www.legislation.gov.uk/ukpga/2004/21/contents>.

603 4. CFA's Design Guidelines and Model Requirements for Renewable Energy
604 Facilities v4 (2023). CFA. [Online] 4, 2023. [https://www.cfa.vic.gov.au/plan-](https://www.cfa.vic.gov.au/plan-prepare/building-planning-regulations/renewable-energy-fire-safety)
605 [prepare/building-planning-regulations/renewable-energy-fire-safety](https://www.cfa.vic.gov.au/plan-prepare/building-planning-regulations/renewable-energy-fire-safety).

606 5. Statistics, National. National Statistics: Energy Trends: December 2023.
607 [https://assets.publishing.service.gov.uk/media/6582da2d23b70a0013234cef/Energy](https://assets.publishing.service.gov.uk/media/6582da2d23b70a0013234cef/Energy_Trends_December_2023.pdf)
608 [Trends December 2023.pdf](https://assets.publishing.service.gov.uk/media/6582da2d23b70a0013234cef/Energy_Trends_December_2023.pdf).

609 6. The Building Regulations 2010; Fire Safety Approved Document B. 2019. [Fire](#)
610 [safety: Approved Document B - GOV.UK \(www.gov.uk\)](#)

611 7. Systems, Standard for the Installation of Stationary Energy Storage. *Energy*
612 *Storage NFPA 855: Improving Energy Storage System Safety*. 2024.
613 [NFPA855 Safety 240111.pdf \(cleanpower.org\)](#)

614 8. UK, Local Government Association and Water. *National guidance document on*
615 *the provision of water for fire fighting*. 2007 (Third Edition). pp. Appendix 5 (pages
616 37-38). [Microsoft Word - National guidance document on water for ffg FINAL.doc](#)

617 9. Grönlund O, Quant M, Rasmussen M, Willstrand O, Hynynen J. Guidelines for the
618 fire protection of battery energy storage systems. *RI.SE*. 2023.
619 <https://urn.kb.se/resolve?urn=urn:nbn:se:ri:diva-68770>.

620 10. Electric, China. Institute of energy storage and novel electric technology. 2021.

621 11. Four Firefighters Injured in Lithium-Ion Battery Energy Storage System Explosion
622 - Arizona. McKinnon, M B, DeCrane, S and Kerber, S. 2020, Firefighter Safety
623 Research Institute.

624 12. Frazer Nash. *Smart: Energy Storage & Flexibility Innovation. Health and Safety*
625 *Guidance for Grid Scale BESS 2024*. [Health and Safety Guidance for Grid Scale](#)
626 [Electrical Energy Storage Systems \(publishing.service.gov.uk\)](#)

627 13. BSI. Flameless explosion venting devices . *Standard*. 2011. BS EN 16009:2011.

628 14. Explosion Suppression Systems. *Standard*. 2021. BS EN 14373:2021.

629 15. Explosion venting devices. 2007. BS EN 14797.

630

631

632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653

26 Additional Resources

1. NIPV Report EU Energy Storage Systems Safety Conference 2023. Hessels. December 2023. [20231218-NIPV-Report-EU-Energy-Storage-Systems-Safety-Conference-2023.pdf](#)
2. American Clean Power Association Draft Emergency Response Plan. American Clean Power Association Draft Emergency Response Plan. [Energy Storage Emergency Response Template | ACP \(cleanpower.org\)](#)
3. FM Global (2017) Property Loss Prevention Data Sheets: Electrical Energy Storage Systems Data Sheet 5-33. [FM Global Loss Prevention Data Sheets – FM Global](#)

DRAFT



Grid Scale Battery Energy Storage System planning – Guidance for FRS

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

In the UK, approval for the majority of BESS installations takes place through the Local Authority planning process. Fire and Rescue Services (FRSs) may be engaged throughout the planning process, but this is not a statutory requirement. However, the National Fire Chiefs Council would encourage early engagement with the local FRS, continuing throughout the planning process.

The NFCC's expectation is that a comprehensive risk management process must be undertaken by operators to identify hazards and risks specific to the facility and develop, implement, maintain and review risk controls. From this process a robust Emergency Response Plan should be developed.

Given the rapidly developing nature of the technology, and ever evolving understanding of risks and mitigation measures, there is a need for guidance to support FRSs in providing consistent and evidence-based contributions to the planning process.

The guidance does not seek to provide a full specification or opinion on the entirety of a BESS system design. Instead, the aim is to limit the content to such matters that directly relate to facilitating a safe and effective response, by the fire and rescue service, to a fire or vapour cloud release involving a BESS installation. This includes factors such as facilities for the fire and rescue service, and design factors that contribute to reducing the escalation in the severity of an incident.

This guidance relates specifically to grid scale (typically 1 MW or larger) BESS in open air environments, using lithium-ion batteries.

The guidance is based upon a range of supporting materials including academic research, national and international standards, case studies, and industry guidance. The content of this document is the result of analysis of that supporting material with subsequent professional judgement applied. Every BESS installation will be different and fire and rescue services should not limit themselves to the content of this guidance. Particular reference has been made to the following:

- State of Victoria (County Fire Authority) (2022), *Design Guidelines and Model Requirements: Renewable Energy Facilities*
- FM Global (2017) *Property Loss Prevention Data Sheets: Electrical Energy Storage Systems Data Sheet 5-33*
- NFPA (2023) *Standard for the Installation of Stationary Energy Storage Systems*

Further advice and guidance can be obtained through the NFCC Alternative Fuels and Energy Systems lead officer.

This document contains guidance on:

1. Information requirements
2. System design, construction, testing and decommissioning
3. Detection and monitoring
4. Suppression systems
5. Site access
6. Water supplies
7. Emergency plans
8. Environmental impacts
9. Recovery

Principles

This guidance has been developed with the safety of the public and emergency responders in mind. It is based on trying to help reduce the risk as far as reasonably practicable, whilst recognising that ultimate responsibility for the safe design and running of these facilities rests with the operator.

The guidelines are a starting point and cannot cover every eventuality or type of design.

In developing these guidelines the hazards and risks from lithium-ion batteries, identified in National Operational Guidance, has been considered.

The following principles should be considered by Fire Services, when liaising with owners and operators, and form the basis of this guidance¹:

1. Effective identification and management of hazards and risks specific to the siting, infrastructure, layout, and operations at the facility.
2. Impact on surrounding communities, buildings, and infrastructure.
3. Siting of renewable energy infrastructure so as to eliminate or reduce hazards to emergency responders.
4. Safe access for emergency responders in and around the facility, including to energy storage infrastructure and firefighting infrastructure.

¹ State of Victoria (County Fire Authority) (2022), *Design Guidelines and Model Requirements: Renewable Energy Facilities*, p.4

5. Provision of adequate water supply and firefighting infrastructure to allow safe and effective emergency response.
6. Vegetation sited and managed so as to avoid increased bushfire and grassfire risk.
7. Prevention of fire ignition on-site.
8. Prevention of fire spread between site infrastructure (solar panel banks, wind turbines, battery containers/enclosures).
9. Prevention of external fire impacting and igniting site infrastructure.
10. Provision of accurate and current information for emergency responders during emergencies.
11. Effective emergency planning and management, specific to the site, infrastructure and operations.
12. Owner to have a comprehensive Emergency Response Plan, showing full understanding of hazards, risks, and consequences.

Information Requirements

Grid scale BESS should form part of FRS planning in accordance with arrangements required under section 7(2)(d) of the Fire and Rescue Services Act (2004). Site Specific Risk Information (SSRI) should be made available to crews in the form of an effective Emergency Response Plan.

Details of any site access arrangements, such as key codes, should be provided to the FRS.

System design, construction, testing and decommissioning

Information is required as early as possible from the applicant /developer/designer/manufacturer etc., to allow an initial appraisal of the BESS to be made. This information should be provided to the FRS (via the Local Authority Planners in the first instance), with appropriate evidence provided to support any claims made on performance, and with appropriate standards cited for installation.

Such information should also be made available to FRSs for inclusion in Site Specific Risk Information (SSRI) records.

System design and construction

Information required:

1. The battery chemistries being proposed (e.g. Lithium-ion Phosphate (LFP), Lithium Nickel Manganese Cobalt Oxide (NMC)). Because:
 - a. Battery chemistries will directly affect the heat released when a cell goes into thermal runaway²
 - b. Battery chemistries will influence vapour cloud formation.

² https://www.nasa.gov/sites/default/files/atoms/files/nabw20_fire_gas_char_studies_liion_cells_batt_djuarez-robles.pdf

- c. An understanding of the battery chemistry is useful when requesting scientific advice during an incident.
2. The battery form factor (e.g. cylindrical, pouch, prismatic)
3. Type of BESS e.g. container or cabinet
4. Number of BESS containers/cabinets
5. Size/capacity of each BESS unit (typically in MWh)
6. How the BESS units will be laid out relative to one another.
7. A diagram / plan of the site.
8. Evidence that site geography has been taken into account (e.g. prevailing wind conditions).
9. Access to, and within, the site for FRS assets
10. Details of any fire-resisting design features
11. Details of any:
 - a. Fire suppression systems
 - b. On site water supplies (e.g. hydrants, EWS etc)
 - c. Smoke or fire detection systems (including how these are communicated)
 - d. Gas and/or specific electrolyte vapour detection systems
 - e. Temperature management systems
 - f. Ventilation systems
 - g. Exhaust systems
 - h. Deflagration venting systems
12. Identification of any surrounding communities, sites, and infrastructure that may be impacted as a result of an incident.

Testing

Details of any evidence based testing of the system design should be requested, for example, results of UL 9540A testing.

Design

Design features should be made clear. These may include:

- Rack layout and setup
- Thermal barriers and insulation
- Container layout and access arrangements

Detection and monitoring

An effective and appropriate method of early detection of a fault within the batteries should be in place, with immediate disconnection of the affected battery/batteries. This may be achieved automatically through the provision of an effective Battery Management System (BMS) and/or a specific electrolyte vapour detection system.

Should thermal runaway conditions be detected then there should be the facility in place for the early alerting of emergency services.

Detection systems should also be in place for alerting to other fires that do not involve thermal runaway (for example, fires involving electrical wiring).

Continuous combustible gas monitoring within units should be provided. Gas detectors should alarm at the presence of flammable gas (yes/no), shut down the ESS, and cause the switchover to full exhaust of the ventilation system³. Sensor location should be appropriate for the type of gas detected e.g. hydrogen, carbon monoxide, volatile organic compounds.

External audible and visual warning devices (such as cabinet level strobing lights), as well as addressable identification at control and indicating equipment, should be to linked to:

1. Battery Management System (when a thermal runaway event is identified)
2. Detection and suppression system activation

This will enable first responders to understand what the warning is in relation to. This will aid in their decision-making.

Suppression systems

Suitable fixed suppression systems should be installed in units in order to help prevent or limit propagation between modules.

Where it is suggested that suppression systems are not required in the design, this choice should be supported by an evidence based justification and Emergency Response Plan that is designed with this approach in mind (for example, risk assessed controlled burn strategies, and external sprinkler systems).

Whilst gaseous suppression systems have been proposed previously, current research indicates the installation of water based suppression systems for fires involving cell modules is more effective.

The installation of gaseous suppression systems for electrical fires that do not involve cell modules may be appropriate but should be built into a wider suppression strategy.

FM Global cite the following reasons for not recommending gaseous protection systems⁴:

1. **Efficacy relative to the hazard.** As of 2019, there is no evidence that gaseous protection is effective in extinguishing or controlling a fire involving energy storage systems. Gaseous protection systems may inert or interrupt the chemical reaction of the fire, but only for the duration of the hold time. The hold time is generally ten minutes, not long enough to fully extinguish an ESS fire or to prevent thermal runaway from propagating to adjacent modules or racks.

³ FM Global (2017) *Property Loss Prevention Data Sheets: Electrical Energy Storage Systems*, para. 2.5.5.2

⁴ FM Global (2017) *Property Loss Prevention Data Sheets: Electrical Energy Storage Systems*, para. 3.3

2. **Cooling.** FM Global research has shown that cooling the surroundings is a critical factor to protecting the structure or surrounding occupancy because there is currently no way to extinguish an ESS fire with sprinklers. Gaseous protection systems do not provide cooling of the ESS or the surrounding occupancy.
3. **Limited Discharge.** FM Global research has shown that ESS fires can reignite hours after the initial event is believed to be extinguished. As gaseous protection systems can only be discharged once, the subsequent reignition would occur in an unprotected occupancy

The choice of a suppression system should be informed by liaison with a competent system designer who can relate the system choice to the risk identified and the duration of its required activation. Such a choice must be evidence based.⁵

Any calculations for sufficient water supply for an appropriate suppression system will need to be completed by a competent person considering the appropriate risk and duration of any fire.

Water run-off and potential impact on the environment, along with mitigation measures, should be considered and detailed in the Emergency Response Plan.

Lack of sufficient water supplies at a particular site location should not be considered as the basis for a suppression system choice. Such an approach could result in potentially ineffective and/or dangerous system designs.

Deflagration Prevention and Venting

BESS containers should be fitted with deflagration venting and explosion protection appropriate to the hazard. Designs should be developed by competent persons, with design suitability able to be evidenced.⁶ Exhaust systems designed to prevent deflagration should keep the environment below 25% of Lower Explosive Limit (LEL).

Flames and materials discharged as a result of any venting should be directed outside to a safe location and should not contribute to any further fire propagation beyond the unit involved or present further risk to persons. The likely path of any vented gasses or materials should be identified in Emergency Response Plans to reduce risk to responders.

Explosion/deflagration strategies should be built into the emergency plan such that responders are aware of their presence and the impact of their actions on these strategies.⁷

Where emergency ventilation is used to mitigate an explosion hazard, the disconnect for the ventilation system should be clearly marked to notify personnel or first responders to not disconnect the power supply to the ventilation system during an evolving incident.⁸

⁵ NFPA (2023) *Standard for the Installation of Stationary Energy Storage Systems*, para C.3

⁶ BS EN 16009:2011 *Flameless Explosion Venting Devices*; BS EN 14373:2021 *Explosion Suppression Systems*; BS EN 14797:2007 *Explosion Venting Devices*.

⁷ UL FRSI (2020) *Four Firefighters Injured in Lithium-ion Battery Energy Storage System Explosion – Arizona*, pp. 47-49

⁸ NFPA (2023) *Standard for the Installation of Stationary Energy Storage Systems*, para G.1.4.3.3

Access

Site access

Suitable facilities for safely accessing and egressing the site should be provided. Designs should be developed in close liaison with the local FRS as specific requirements may apply due to variations in vehicles and equipment.

This should include:

- At least 2 separate access points to the site to account for opposite wind conditions/direction.
- Roads/hard standing capable of accommodating fire service vehicles in all weather conditions. As such there should be no extremes of grade.
- A perimeter road or roads with passing places suitable for fire service vehicles.
- Road networks on sites must enable unobstructed access to all areas of the facility.
- Turning circles, passing places etc size to be advised by FRS depending on fleet.

Access between BESS units and unit spacing

In the event of a fire involving a BESS unit, one of the primary tactics employed will be to prevent further unit to unit fire spread. Suitable access for firefighters to operate unimpeded between units will therefore be required. This should allow for the laying and movement of hose lines and, as such, access should be free of restrictions and obstacles. The presence of High Voltage DC Electrical Systems is a risk and their location should be identified. Exclusion zones should be identified.

A standard minimum spacing between units of 6 metres is suggested⁹ unless suitable design features can be introduced to reduce that spacing. If reducing distances a clear, evidence based, case for the reduction should be shown.

Any reduction in this separation distance should be design based by a competent fire engineer. There should be consideration for the fire separation internally and the total realistic load of fire. Proposed distances should be based on radiant heat flux (output) as an ignition source.

The NFCC does not support the stacking of containers/units on top of one another on the basis of the level of risk in relation to fire loading, potential fire spread, and restrictions on access.

Distance from BESS units to occupied buildings & site boundaries

Individual site designs will mean that distances between BESS units and occupied buildings/site boundaries will vary. Proposed distances should take into account risk and mitigation factors. However, an initial minimum distance of 25 metres is proposed prior to any mitigation such as blast walls. Reduction of distances may be possible in areas of lower risk (e.g. rural settings). Where possible buildings should be located upwind.

⁹ FM Global (2017) *Property Loss Prevention Data Sheets: Electrical Energy Storage Systems*, para. 2.3.2.2

Site Conditions

Sites should be maintained in order that, in the event of fire, the risk of propagation between units is reduced. This will include ensuring that combustibles are not stored adjacent to units and access is clear and maintained. Areas within 10 metres of BESS units should be cleared of combustible vegetation and any other vegetation on site should be kept in a condition such that they do not increase the risk of fire on site. Areas with wildfire risk or vegetation that would result in significant size fires should be factored into this assessment and additional cleared distances maintained as required.

Water Supplies

Water supplies will depend on the size of the installation. In the majority of cases, initial firefighting intervention will focus on defensive firefighting measures to prevent fire spread to adjacent containers. As a result, proposals for water supplies on site should be developed following liaison with the local fire and rescue service taking into account the likely flow rates required to achieve tactical priorities. This should also take account of the ability of/anticipated time for the fire and rescue service to bring larger volumes of water to site (for example through the provision of High Volume Pumps).

IP ratings of units should be known so that risks associated with boundary cooling can be understood.

As a minimum, it is recommended that hydrant supplies for boundary cooling purposes should be located close to BESS containers (but considering safe access in the event of a fire) and should be capable of delivering no less than 1,900 litres per minute for at least 2 hours. Fire and rescue services may wish to increase this requirement dependant on location and their ability to bring supplementary supplies to site in a timely fashion.

Water supply for any automatic suppression system will be covered by the relevant standard/design depending on which system chosen as appropriate for the risk. For manual water, amounts should come from performance based requirement rather than a reference to a code, unless it can be proven that the code specifically covers BESS. Regarding water storage tanks, volumes will again need to be informed on a performance-based need. Isolation points should be identified.

Any static water storage tanks designed to be used for firefighting must be located at least 10 metres away from any BESS container/cabinet. They must be clearly marked with appropriate signage. They must be easily accessible to FRS vehicles and their siting should be considered as part of a risk assessed approach that considers potential fire development/impacts. Outlets and connections should be agreed with the local FRS. Any outlets and hard suction points should be protected from mechanical damage (e.g. through use of bollards).

Consideration should be given, within the site design, to the management of water run-off (e.g. drainage systems, interceptors, bunded lagoons etc).

Signage

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

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

Signs on the exterior of a building or enclosure should be sized such that at least one sign is legible at night at a distance of 30 metres or from the site boundary, whichever is closer¹⁰.

Adherence to the Dangerous Substances (Notification and Marking of Sites) Regulations 1990 (NAMOS) should be considered where the total quantity of dangerous substances exceeded 25 tonnes.

Emergency Plans

Site operators should develop emergency plans and share these with the Fire and Rescue Service. These include:

A Risk Management Plan should be developed by the operator, which provides advice in relation to potential emergency response implications including:

- The hazards and risks at and to the facility and their proposed management.
- Any safety issues for firefighters responding to emergencies at the facility.
- Safe access to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems.
- The adequacy of proposed fire detection and suppression systems (eg., water supply) on-site.
- Natural and built infrastructure and on-site processes that may impact or delay effective emergency response.

An Emergency Response Plan should be developed to facilitate effective and safe emergency response and should include:

- How the fire service will be alerted
- A facility description, including infrastructure details, operations, number of personnel, and operating hours.
- A site plan depicting key infrastructure: site access points and internal roads; firefighting facilities (water tanks, pumps, booster systems, fire hydrants, fire hose reels etc); drainage; and neighbouring properties.

¹⁰ NFPA (2023) *Standard for the Installation of Stationary Energy Storage Systems*, para G.1.4.2.1.1

- Details of emergency resources, including fire detection and suppression systems and equipment; gas detection; emergency eye-wash and shower facilities; spill containment systems and equipment; emergency warning systems; communication systems; personal protective equipment; first aid.
- Up-to-date contact details for facility personnel, and any relevant off-site personnel that could provide technical support during an emergency.
- A list of dangerous goods stored on site.
- Site evacuation procedures.
- Emergency procedures for all credible hazards and risks, including building, infrastructure and vehicle fire, grassfire and bushfire

Environmental impacts

Suitable environmental protection measures should be provided. This should include systems for containing and managing water runoff. System capability/capacity should be based on anticipated water application rates, including the impact of water based fixed suppression systems.

Sites located in flood zones should have details of flood protection or mitigation measures.

Recovery

The operator should develop a post-incident recovery plan that addresses the potential for reignition of ESS and de-energizing the system, as well as removal and disposal of damaged equipment.¹¹

¹¹ FM Global (2017) *Property Loss Prevention Data Sheets: Electrical Energy Storage Systems*, para. 2.8.2.3