GBEP Appendix B – Summary (WR3) Fire Risks in Large Scale BESS
Applicant Response to Roy Clegg Submission.
Written Representation (WR3) on Fire Risks in Large Scale BESS

Questions REP-089	Applicants Response	Response from Roy Clegg
1. Written Representation (WR3) on Fire Risks in Large Scale BESS 2. Fire Risks in Large Scale BESS 3. A BESS carries a risk of "thermal runaway", more commonly known as "battery fire", where overheating in a single cell can spread to neighbours within a container leading to further energy release. These are not strictly fires in that no oxygen is required, which of course means that conventional methods of fire control are unlikely to succeed. 4. "They represent an electrochemical discharge between chemical components that are self-reactive. They do not require air or oxygen at all to proceed." 5. A BESS fire can result in the release of toxic and inflammable gases and chemicals: 6. "They evolve toxic gases such as Hydrogen Fluoride (HF) and highly inflammable gases including Hydrogen (H2), Methane (CH4), Ethylene (C2H4) and Carbon Monoxide (CO). These in turn may cause further explosions or fires upon ignition. The chemical energy then released can be up to 20 times the stored electrochemical energy." 7. But once a fire is underway in a container the only possible response is to allow it to continue to burn, continually apply water to stop it spreading and wait for it to burn out. 8. Risk of Critical Event and Fire. 9. Whilst this is new technology the effect of a critical event and fire is becoming understood. With a handful of sites in the UK there has been one BESS fire in Liverpool and many fires worldwide it is leading to the conclusion that the probability of a BESS Critical Event is significant and real. 10. Despite the experience of BESS fires and known toxins, the current legislation to control the choice and operation of BESS in the UK can best be described as "light touch". 11. There is no minimum distance from homes for the location of a BESS which in theory could be placed next to accommodation. 12. A fire, near a residential area in a Liverpool suburb in September 2020, threatened to engulf the area in a toxic plume of gas, while debris was blasted up to 75ft away. Efforts to put out the blaze were hampered after water hydrants proved 'inadequate', the report by Merseyside Fire & Rescue Service found. The fire 59 hours to extinguish was caused by an explosion at the controversial mega-battery site. 13. The Liverpool BESS fire, using the same NEC system as built in Northern Ireland at Mullavilly and Drumkee BESS's was theoretically protected by a suppression system that failed to activate and would not have had any effect anyway, as	1 to 17. No response required. 18. The Applicant has brought in Dr Paul Christensen from Newcastle University to advise on the latest worldwide safety protocols associated with Lithium-Ion technology, along with the Lincolnshire Fire and Rescue Service to advise on design and a safety management plan and to provide the emergency services with relevant information if requested. This will be refreshed prior to construction to ensure the highest safety standards are incorporated in the design and ensure minimal impact on the environment. The Applicant has had a virtual meeting with Lincolnshire's Fire and Rescue team and this engagement will continue throughout the development, construction, and operation of the Scheme. The detailed design phase of individual BESS sites will consider the lifecycle of the battery system from installation to decommissioning. At the detailed design stage, risk assessment tools will be utilised together with detailed consequence modelling to provide a comprehensive site operations and emergency response safety audit. The battery system mitigation measures adopted in a final Battery Fire Safety Management Plan, will reflect the latest BESS safety codes and standards applicable at that stage. Mitigation measures will be discussed and coordinated with LFRS. A Failure Modes and Effects Analysis (FMEA) of the BESS (BS EN IEC 60812) will be conducted to lay the foundation for predictive maintenance requirements and compliment the fault indicator capabilities of the BMS data analytics system Comprehensive Hazard Mitigation Analysis (HMA) will be conducted by a BESS specialist independent Fire Protection Engineer following NFPA 855 (2023) guidelines and recommendations. Additional risk assessments likely to be conducted at the detailed design stage are Fire Risk Analysis (FRA), Explosion Risk Analysis (ERA), Hazard and Operability Analysis (HAZOP). Comprehensive BESS 3rd Party risk	1. It is noted that the applicant has chosen not to respond to the points raised in 1 – 17. 18. In the applicants Environmental Statement 1.2.8. it is noted that the Fire Suppression system to be used is the Novec1230 extinguishment system. it will be useful to note that in the Liverpool BESS, fire was theoretically protected by a suppression system that failed to activate and would not have had any effect anyway, as the investigator states: Although there was a fire suppression system in the container, the speed of propagation indicated that this hadn't activated. The McMicken explosion was an object lesson in this. The installed "clean agent" system operated correctly, as designed, on detection of a hot fault in the cabin. There was no malfunction in the fire suppression system, but it was completely useless because the fire was not a conventional fuel-air fire, it was a thermal runaway event. Only water will serve in thermal runaway. Indeed, in the McMicken explosion the "Novec 1230" clean agent arguably contributed to the explosion by creating a stratified atmosphere with an air/Novec 1230 mixture at the bottom and inflammable gases accumulating at the cabin top. Is the applicant still confident about using a suppression system? The applicant has listed what appears to be a significant and comprehensive list of items that may; will; be required; or assessed at some later stage. Will the ExA put aside the items identified so that when the applicant is ready and able to provide meaningful information comments can be made?

the investigator states: Although there was a fire suppression system in the container, the speed of propagation indicated that this hadn't activated. 14. It was thought that activation of the suppression system would have had little or no effect on the resultant fire/explosion. 15. In the town of Suprise, Arizona, a recent grid - scale battery system installed caught fire and an explosion injured four fire service personnel. Large flames were reported flames of 50 -75 feet being fed by flammable liquids coming from the cabinets. 16. Professor Sir David Melville CBE, BSc, PhD, CPhys, FInstP, Sen Mem IEEE(USA) of The Faversham Society and recognised as one of the leading experts on Solar Farms and BESS notes that: 17. There is however guidance for the Insurance industry in the form of a Technical Guidance from Allianz Risk Consultancy entitled Battery Energy Storage Systems (BESS) Using Liion Batteries and quoted extensively from this detailed publication which concluding that 'BESS using lithium -ion batteries are susceptible to thermal runaway and have been involved in several serious fires in the last few years. The document recognises the lack of guidelines and highlights current knowledge gaps; describes the loss experience due to BESS fires in Hawaii, Arizona, Wisconsin and Belgium; describes the hazards; and makes detailed recommendation for the planning of BESS in relation to: Fire and Rescue Services; Construction and Location; Material, Equipment and Design; Ventilation and Temperature Control; Gas and Smoke Detection; Fire Protection and Water Supply; and Maintenance. 18. We respectively ask that the risks associated with the deployment of large-scale BESS, must be addressed in order to avoid the issues clearly highlighted by the Deputy Fire Safety Commissioner of the London Fire Brigade when he said: 19. "If we know some things could fail catastrophically or it could have those effects," he said, "it's going to be a difficult day if one of us is standing there in court saying we knew about it but we didn't do anything."	analysis is sometimes automatically provided by Tier one BESS manufacturers and / or BESS integrators. If the BESS system supplied differs from the specification considered for risk assessments and consequence modelling, then a full safety audit must be repeated for the new BESS system specification. These studies must be completed and signed off before construction commences. On an annual basis an independent fire risk assessment is carried out. Insulation monitoring and arc fault monitoring will detect low grade faults before they are close to a fire risk. There is a fusing and protection at string level, string combiner box level, inverter level, switchgear level and substation level that will cascade in depending on the original location of the fault causing the fire. Equipment is built to contain a fire, especially the inverters and the substation. If a fire was to occur for example at an inverter, the fire will be contained to this specific inverter. The site boundaries and inter-row spaces provide a natural fire gap for containment of fire. There is a separation between combustible material and non-combustible material. Fire retardant cables are used. Regular testing and groundskeeping also help to minimise the likelihood of a fire. The Applicant has embedded mitigation within the Scheme design and has included an Outline Battery Fire Safety Management Plan in its DCO application [APP-222/7.1]. This outline plan sets out how the Scheme proposes to mitigate and manage the potential fire risk posed by the BESS. 19. No response required.	**BESS Failure Event Database**  Click and enlarge the display to read the Database, which is a public resource for documenting publicly available data on battery energy storage failure events from around the world. Showing 65 failure events from the about 2010 which also includes significant failures in transporting and storage of Lithium-ion batteries. 19. No response required.