Battery Energy Storage System

Emergency Response Plan Guide

Prepared by Fire Risk Alliance for NY-BEST

December 15, 2023

Introduction:

Fire Risk & Alliance (FRA) developed this emergency response plan (ERP) guide to assist Battery Energy Storage System (BESS) project developers, owners, and operators in preparing for potential emergencies and addressing the concerns of emergency responders and members of the fire services. Each section of the Guide addresses specific issues important to emergency responders and fire department members. Guidance contained herein was prepared by a diverse group of FRA staff team members with extensive experience in the fire services, industrial Class C firefighting, fire engineering and research & development.

Disclaimer:

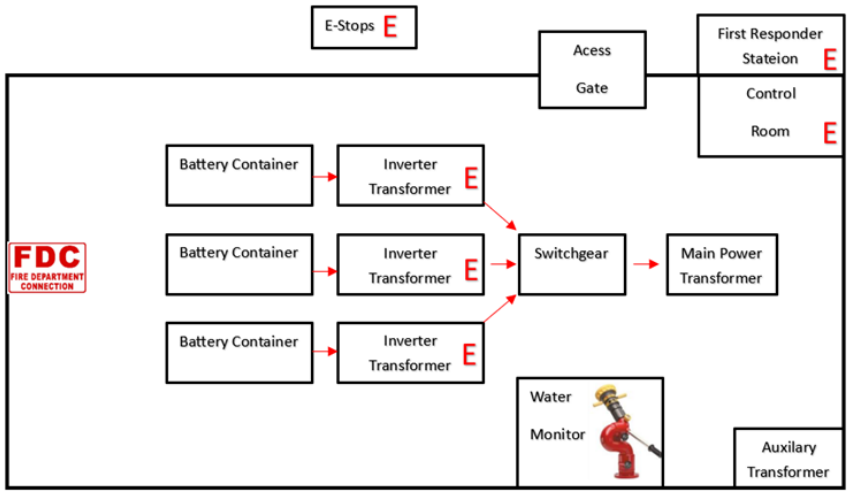
This ERP guide is intended to be a useful tool in standardizing the information necessary to ensure informed decisions are made in the event of a BESS fire or emergency event. This guide, however, remains a suggestion in terms of the information to be covered in an ERP. All ERPs should be specific to the site, the specific BESS and should cover all available failure-related hazards. ERPs should be developed with the local fire services and industry experts in order to ensure safety and positive outcomes for the actions employed. NY-BEST and FRA assume no responsibility or liability for the use of this ERP guide.

Recommended ERP Sections and Content

Section 1: Energy Storage System Overview

- Facility Overview: Provide an overview of the facility in terms of size and surrounding area. The overview should address the following questions: Is there a viable water supply? If so, how many and what are their locations? What are the means of access and egress for the site and the facility. Does the facility border a major transportation artery or residential housing and is it low or high density? Are there sensitive locations within ½ mile such as schools, hospitals, or other care facilities? Is the facility in a flood zone and does it border environmentally sensitive areas? If a Community Risk Assessment (CRA) had been performed, include any relevant information such as impact of equipment failure and plume modeling overview.
    - An annotated aerial map should be used as a reference along with a general equipment arrangement drawing as supporting figures.

Figure 1 General Equipment Arrangement



- Site Design: Describe the equipment in terms of the manufacturer(s), along with specific model(s) and quantities. Provide a high-level summary of safety features, risk mitigation tools and designs to enhance continuity of operations, such as back-up generation.
    - Most manufacturers will have pictures on their websites of the equipment, such as containers and MVSkids to illustrate the type of equipment used in the design.

- Battery Information: Reports such as UL9540a and the Hazard Mitigation Analysis (HMA) should be used to provide details on the cell type, chemistry, fire behavior, explosion data along with critical temperatures and module specification in terms of weight and size for disposal.

Section 2: General Information

Site Owner/Operator: Provide information in regard to the BESS site owner and operator. Provide links to relevant websites for local personnel to help familiarize them with the company.

Key Contact Information: Provide a list of personnel that may be called upon to support an emergency at the facility. The list should capture emergency phone numbers and addresses for police, fire, EMS, local hospitals, battery subject matter experts (SME), decommissioning vendors, as well as any personnel who may be required for electrical switching at the site. It should be noted that local/regional emergency control centers may be called upon to contact various local emergency services representatives during an incident. This is typically done through dialing 911, however please note this will only summon emergency responders local to the geographic area and should be confirmed as to specific service coverage.

ERP Scope: A well-defined scope should be included in the ERP so there is a clear expectation of what the document will cover. For example, BESS co-located with a substation, or other energy sources such as solar, should clearly address the full site and not simply the BESS. Without proper guidance, emergency responders may fail to recognize all the potential hazards and may act inappropriately.

Note: *We recommend that topics such as bomb search, active shooter and cybersecurity reside in a separate document(s) independent of the ERP and should be guided by Security and IT professionals.*

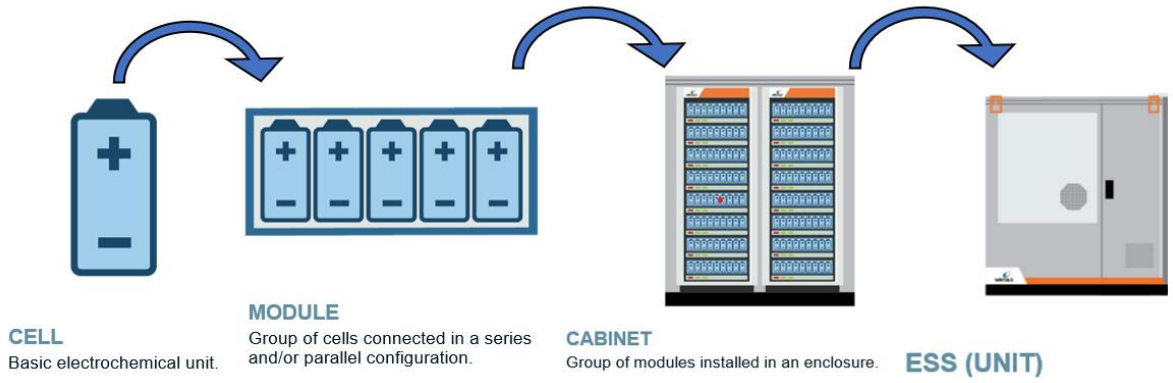
ERP Purpose: The purpose of the ERP document should be to cover every reasonable scenario that may bring members of the fire services to the facility. The ERP should provide the potential hazards and response tactics associated with each of these scenarios. We caution against reliance on ERPs that provide only a high-level overview of the facility, along with very generalized guidance. This approach does not provide the necessary information that will allow the fire services and Chief Officers the ability to make informed decisions to mitigate and resolve the situation.

Section 3: Definitions

The ERP may be read by a very wide group of stakeholders with varying degrees of knowledge on battery energy storage systems (BESS). As such, the definitions section should provide a thorough, but not overly technical explanation of the equipment found at a BESS along with accompanying illustrations for each.

Again, the development of this section should be from the viewpoint that the reader may be seeing this information for the very first time.

Figure 2 Linear Overview of BESS System

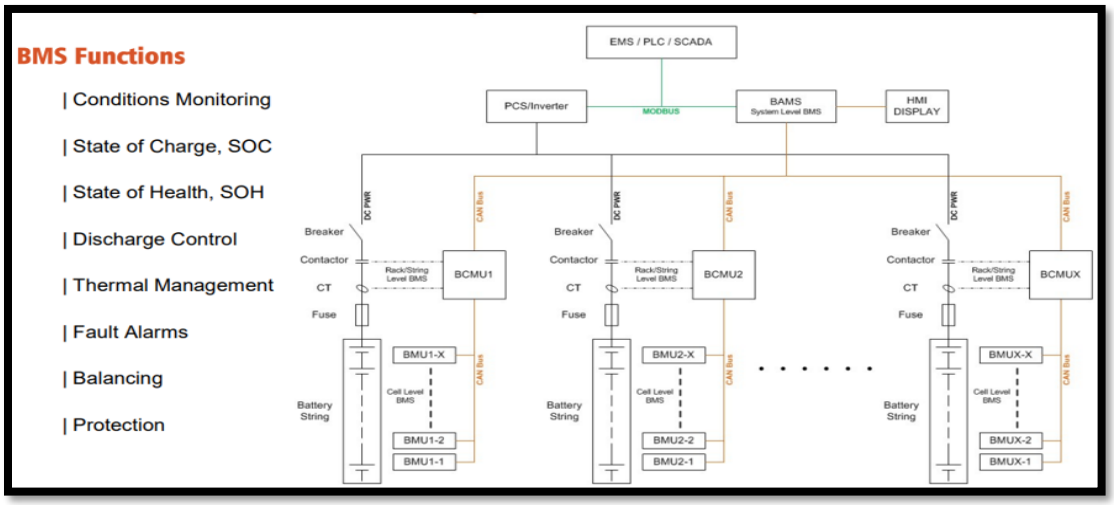


Section 4: Battery Management System

Given that the primary readers of the ERP will likely be members of the fire services, it may be useful to employ an analogy to explain the battery management system or BMS and its importance. For example, upon arrival at a typical large residential or commercial facility fire or emergency, the Chief Officer of the fire services will locate the fire alarm control panel (FACP) which will allow them to begin their basic scene size-up. This provides insight into the type of alarm, location and how much of the facility may be involved. At a BESS incident, the BMS provide a similar function as the FACP. Importantly, the appearance of a BESS facility on a normal day with no emergencies/alarms may be no different than its appearance during the initial stages of an emergency. The BESS containers may shield the view of the condition which generated the alarm. Therefore, data in the BMS must be leveraged to make informed decisions. Typically, Chief Officer conducts a physical 360 size-up of the facility. At a BESS facility, most of the important data will come from the BMS.

The BESS SME will play a critical role in interpreting the BMS data and conveying it to the Chief Officer to support tactical considerations. Notably, conditions internal to the BESS container may interrupt the reporting of these various data points used to make informed decisions. Accordingly, responders actions will then be driven by an analysis of what is observed. Guidance should also be sought from the manufacturer of the BESS on the contingency plans for loss of data during emergency conditions. ***Note:*** *The BESS SME is someone designated and trained by the facility owner/operator, is available immediately by phone and is expected to arrive on site in a reasonable amount of time (less than two hours in NYC per NYC code).*

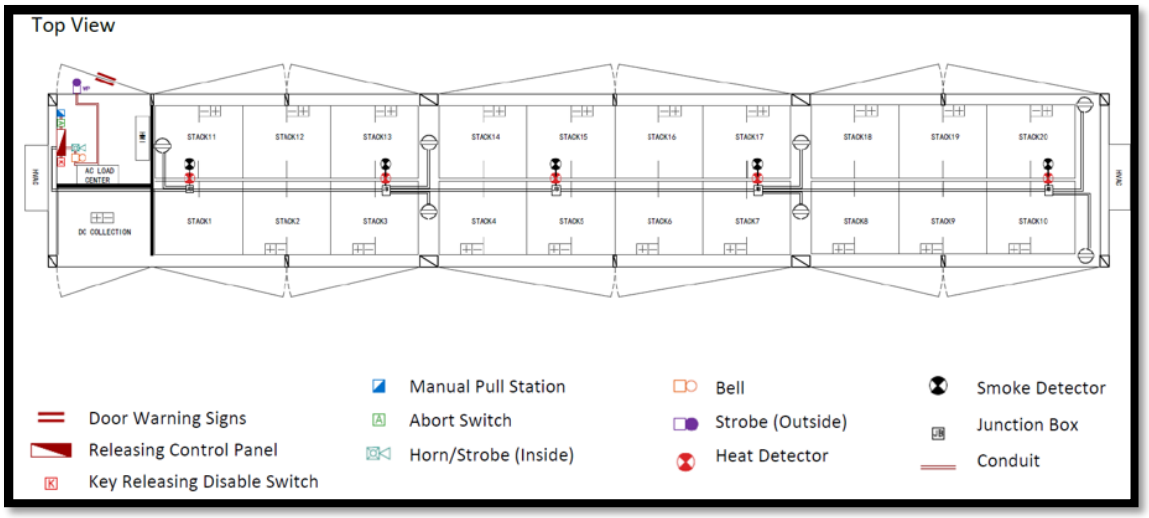
Figure 3 BMS Architecture



Section 5: Detection & Suppression

In this section details should be provided on what type of detection and suppression has been installed and where these devices are located. In this discussion, time should be taken to illustrate detection thresholds and what the alarm sequence initiates. As an example, once Hydrogen is detected at 10% of the Lower Flammability limit (LFL), the BMS initiates the Emergency Stop (E-Stop) to isolate the BESS container, activates the NFPA 69 explosion control system and notifies central station through the FACP. If aerosols or clean agents are being used, it should be clearly explained that there are NO Listed Agents for the suppression of lithium-ion fires. If there is an option to dispense water within the battery enclosure there must be established triggers such as a fully involved container for an extended period of time. The application of water is usually not a first tactic but a last resort. The decision to dispense water should be made jointly between the Chief Officer and Battery SME.

Figure 4 Detection and Suppression System Overview



Section 6: Hazards

In this section the following hazards should be discussed:

- Chemical: What chemical hazards can the first responders be exposed to during normal conditions and as a result of equipment failure? The appropriate PPE should be covered for each of the aforementioned hazards.

- Electrical: Electrical sources less than 345,000 volts do not make a sound so the ERP must explain where the electrical hazards can be found. Are these shielded electrical sources that do not permit casual contact or are they unshielded sources that require a safe standoff distance based on the voltage present? The ERP should identify potential hazards/risks if fire services enters the facility with tools. Tools may be conductive and may allow fire service members to breach locked areas that pose electrical hazards. Finally, ERP must reinforce that E-Stops do NOT remove stranded energy.

- Explosion: Provide an overview of the conditions that may cause an explosion, methods of detection, mitigation tools such as NFPA 68 deflagration venting and NFPA 69 explosion control systems, apparatus staging and safe operating corridors.

Section 7: Notification Matrix

A notification matrix should be developed to outline who and how personnel will be contacted. Notification triggers should also be developed to ensure the appropriate level of response to a given potential emergency and the ERP must define the people who should be notified, as well as those who will respond and their contact information.

Section 8: Command & Control

When operating at an emergency the National Incident Management System (NIMS) should be utilized. Every City, State and Federal partner has been trained in this doctrine which makes this a universal language. As such, each organization operating under the umbrella of the Incident Command System will all have the same roles and overall responsibilities as noted in Figure 5 below. The facility representative, which may be senior management or the BESS SME, will lead their organization but will not serve as the Incident Commander in charge of the event. This role is assumed by the lead agency, which in this case will typically be the fire services. However, in the case of more complex incidents a Unified Command approach may be used to manage the event. Unified Command is comprised of major stakeholders such as the fire services, law enforcement (site security / traffic control), environmental or Health Dept and the facility representative. All decisions in terms of operational tactics and even press releases are made jointly. An example of the Unified Command Structure has been provided as Figure 6.

Emergency Management Institute - National Incident Management System (NIMS) (fema.gov)

Figure 5 ICS Roles and Responsibilities

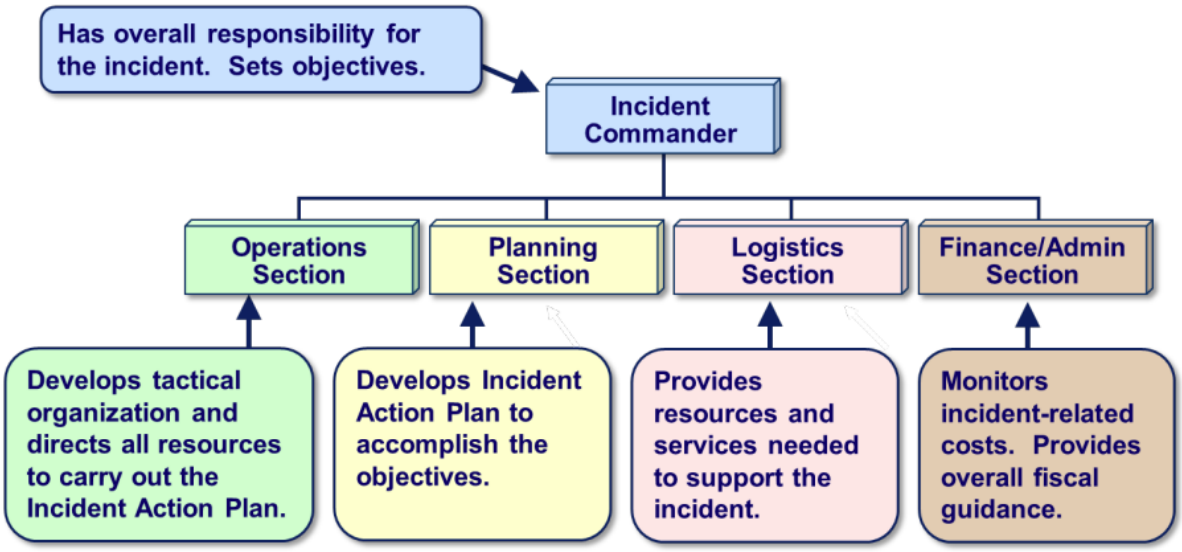
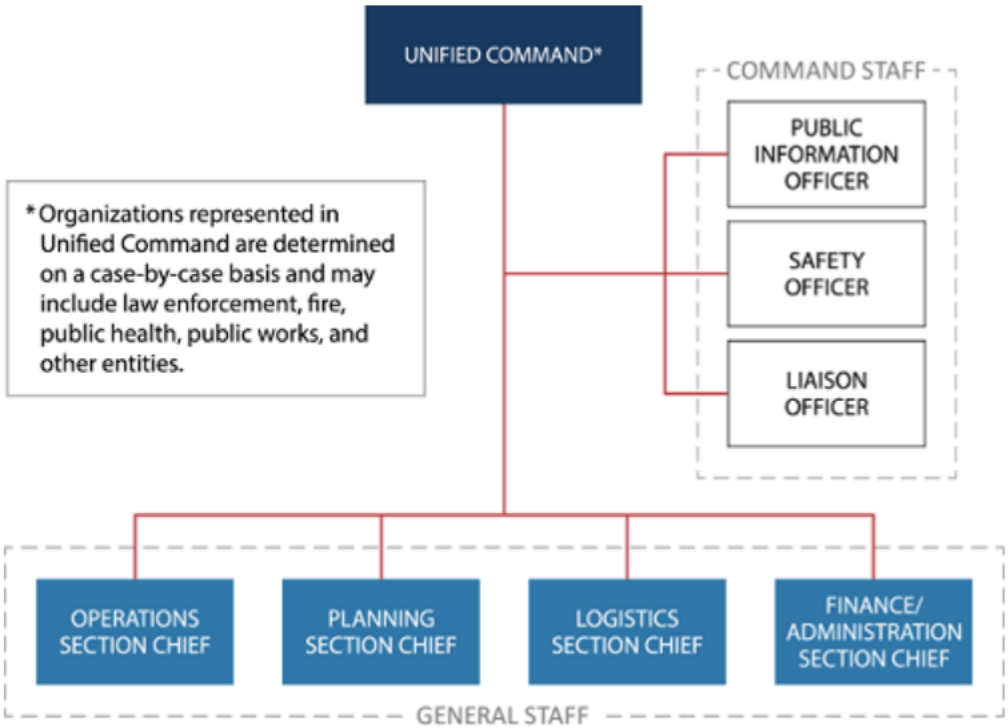


Figure 6 Unified Command Structure



Section 9: Response Tactics

In this section every reasonable means of BESS failure should be identified and accompanied by the hazards and appropriate response tactics for each scenario. Given the likelihood that energized electrical equipment will be present, the ERP must consider what agents are safe for Class C hazards along with the safe standoff distance for use. Conditions may occur where a BESS container becomes fully involved in fire. Under these conditions water may be applied for what is referred to as exposure protection. However, the ERP must consider that these streams may enter the container breached by fire and contact energized equipment. Without very defined answers to these questions non-intervention may be the safest option. ***Note:*** *If water is considered as an option for exposure control or suppression, it must be from a potable water source. Drafting is not an option for energized electrical facilities. Clearly salt water is highly conductive; however, fresh water sources may have high mineral contents that enhance conductivity.*

This section should also outline mitigation tactics that must be employed by the facility operator. There should be a clear understanding between the facility operator and the fire services that all equipment will be operated by facility personnel for safety. The fire department should also be dissuaded from operating E-Stops. Trouble equipment will be isolated closest to the source of the problem.

Section 9 Response Tactics should be developed into a shorter guide for use during an incident. Most ERPs can be 40 or 50 pages, so a quick reference guide for each failure scenario is highly valuable in the case of an incident.

Note: *If the BESS facility is co-located with a substation the hazards associated with large scale transformer fires and the failure of SF6 breakers must be covered.*

Section 10: Post Incident Operations

Post Incident Operations should be a set of defined tasks that will enable Incident or Unified Command to determine if conditions have stabilized and the incident may be placed under control. These tasks will eventually be used to inform how and when to open the impacted container doors. Post Incident Operations should transition into administering a Decommissioning Plan. NFPA 855 provides an outline for decommissioning plan requirements. However, one of the key elements is identifying qualified recycling facilities and understanding their requirements for shipping. Some facilities will accept undamaged modules with a full State of Charge (SOC) and others will require 30% or less SOC which can significantly delay operations. These facilities can also provide guidance on DOT compliant packaging for shipping damaged modules. Commissioning and Decommissioning Plans should be developed in parallel to ensure preparation for any potential failure scenario.

Section 11: Training

Training should be conducted for members of the fire services prior to batteries and BESS equipment arriving on location. Training and familiarization tours on the systems, hazards and response tactics associated with BESS facilities should be provided annually. The Emergency Response Plan (ERP) serves as the platform for the training program and includes the following:

- System Overview
- Equipment
- Battery Management System
- Detection & Suppression
- Emergency System Shutdown
- Hazards
- Suppression Agents & Exposure Control
- Response Tactics
- Post-Fire Operations

Section 12: Exercises

NFPA 855 requires “Drills” to be conducted. The United States Coast Guard has developed a practical exercise concept. Over a three-year cycle, exercises should grow in complexity and be evaluated to ensure the Emergency Response Plan can be executed as written. Exercises may be tabletop, functional or full-scale and should follow the FEMA/HSEEP doctrine (see link below). An After-Action Review should be conducted for each exercise along with a Corrective Action Plan as applicable.

- **Plan Cycle 1:** Cycle 1 exercises should be basic in nature and consider the reasonable conditions that may cause the fire services to respond to the facility.
- **Plan Cycle 2:** Cycle 2 will begin to evaluate more complex equipment failures where facility personnel will collaborate with members of the first response community to mitigate and contain the event.
- **Plan Cycle 3:** Cycle 3 will postulate the most complex scenario that can impact major system components, utility neighbors, and the environment.

Homeland Security Exercise and Evaluation Program | FEMA.gov