



FIRE & RISK
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BESS ERP

Emergency Response Plan – Rev0



Prepared for: Blue Wave Energy

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TABLE OF CONTENTS

1 GENERAL INFORMATION	4
1.1 Scope	4
1.2 Purpose	4
1.3 Site Owner	4
1.4 Location.....	4
1.5 Emergency Contact	4
2 SITE OVERVIEW	6
2.1 General Site Overview.....	6
2.2 Energy Storage System Site Overview	6
3 MITIGATION.....	8
3.1 Battery Cabinet Equipment Overview.....	8
3.2 Fire Protection Overview	8
3.2.1 Site Access	8
3.2.2 Fire Alarm and Detection System.....	8
3.2.3 Fire Protection Water Supply.....	8
3.3 Explosion Control and Prevention Systems	8
3.4 Battery Management System.....	10
3.5 Emergency Stop	10
3.6 Power Conversion System.....	10
4 PREPAREDNESS	11
4.1 Chemical Hazards	11
4.1.1 Cell Vent Gas	11
4.1.2 Hydrogen	11
4.1.3 Carbon Monoxide	11
4.1.4 Transformer Dielectric Fluid.....	12
4.1.5 Refrigerant	12
4.2 Electrical Hazards	12
4.3 Thermal Runaway and Fire Hazards	13
4.4 Explosion Hazard.....	13
4.5 Recommended PPE	13
4.6 BESS Subject Matter Expert.....	13
5 RESPONSE	15
5.1 Tactics.....	15
5.1.1 Life Safety	15

5.1.2 Community Air Monitoring	15
5.1.3 Exclusion Zone	16
5.1.4 Alarms Monitoring	16
5.1.5 Isolation of Trouble Equipment.....	16
5.1.6 Condition Monitoring	16
5.1.7 Exposure Assessment	16
5.1.8 Exposure Protection	17
5.2 Incident Stabilization	17
5.2.1 Under Control	17
5.3 Inverter Failure	17
5.4 Transformer Fire	17
6 RECOVERY	18
7 REVISION SHEET.....	19

TABLE OF FIGURES

FIGURE 1 EXAMPLE SITE OVERVIEW	6
FIGURE 2 EXAMPLE EQUIPMENT ARRANGEMENT.....	7
FIGURE 3 EXPLOSION PREVENTION SYSTEM	9
FIGURE 4 EXPLOSION CONTROL SYSTEM.....	9
FIGURE 5 GENERAL 100' EXCLUSION ZONE	16

TABLE OF TABLES

TABLE 1 EMERGENCY SERVICES CONTACT INFORMATION	5
TABLE 2 BMS FUNCTIONS.....	10
TABLE 3 HYDROGEN CHARACTERISTICS	11
TABLE 4 CARBON MONOXIDE CHARACTERISTICS	11
TABLE 5 REFRIGERANT CHARACTERISTICS	12



1 GENERAL INFORMATION

1.1 Scope

This document is a product-agnostic emergency response plan (ERP) intended to be used for initial documentation of a typical battery energy storage system (BESS) facility. This product-agnostic ERP provides a general overview of a typical facility and site design, along with a description of typical equipment and safety features found at most BESS facilities. Basic response recommendations are also provided for potential BESS facility failure scenarios.

Important Note

This product-agnostic ERP is not based on any specific battery product or any specific BESS facility. It is meant to be informational in nature to provide the type of content typically included in an BESS facility ERP. It should not be utilized for an operating BESS facility. Any use or reuse of this document for an operating BESS facility is not authorized. Once a BESS facility has been approved and designed, a site-specific ERP should be developed to include the product and site specific design details.

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1.2 Purpose

This product-agnostic ERP is intended to provide basic information to BESS subject matter experts (SMEs) and fire department personnel about potential hazards at BESS facilities as an initial document submission for permit application purposes. This information is general in nature and does not reflect specific hazards or a finalized site design, which will be provided in a future site-specific ERP.

1.3 Site Owner

Site Owner: BlueWave Energy

Headquarters Address: 116 Huntington Ave, Suite 601, Boston, MA 02116

Headquarters Telephone: 617.209.3122

1.4 Location

Site address and coordinates should be provided in this section.

1.5 Emergency Contact

The remote operations center (ROC) can be reached at **XXX.XXX.XXXX** for any emergency that may occur at the BESS facility.

The local 911 dispatch center can be reached for non-emergencies at **XXX.XXX.XXXX**.



Table 1 Emergency Services Contact Information

Emergency Services Agency	Address
<i>All Emergencies</i>	<i>Call 911</i>
Local Fire Department	Fire Department Address
Local Police Department	Police Department Address
Local Hospital	Hospital Address

The non-emergency line for Northampton Dispatch (for Worthington Fire Rescue Department) is:
413-586-1508 (recorded emergency line)
413-587-5700 (unrecorded business line)

HAZMAT Dispatch - Tier 1: 1-877-385-0822

Massachusetts Emergency Management Agency (MEMA) Emergency Dispatch: 508-820-2000

Bureau of Forest Fire Control - District 10: 413-253-1798

MA Dept of Environmental Protection (DEP) Emergency Response: 888-304-1133

Worthington Fire-Rescue Department: 51 Huntington Road, Worthington, MA 01098

Worthington Police Department: 51 Huntington Road, Worthington, MA 01098

Worthington Highway Department (DPW): 64 Huntington Road, Worthington, MA 01098

Hospitals:

Cooley Dickinson Hospital: 30 Locust Street, Northampton, MA 01060

Berkshire Medical Center: 725 North Street, Pittsfield, MA 01201

Noble Hospital: 115 WestSilver Street, Westfield, MA 01085

Baystate Medical Center: 759 Chestnut Street, Springfield, MA 01199



2 SITE OVERVIEW

2.1 General Site Overview

The proposed BESS facility location should be described in this section. A description of the size, location, and surrounding area of the facility will be provided to detail the surrounding area for the fire department. A site overview diagram would be provided in Figure 1.

A specific BESS product has not yet been chosen for the facility. However, the proposed equipment will be compliant with NFPA 855 as it relates to safety features and equipment listings. BESS facilities are normally unstaffed and are monitored by an ROC.

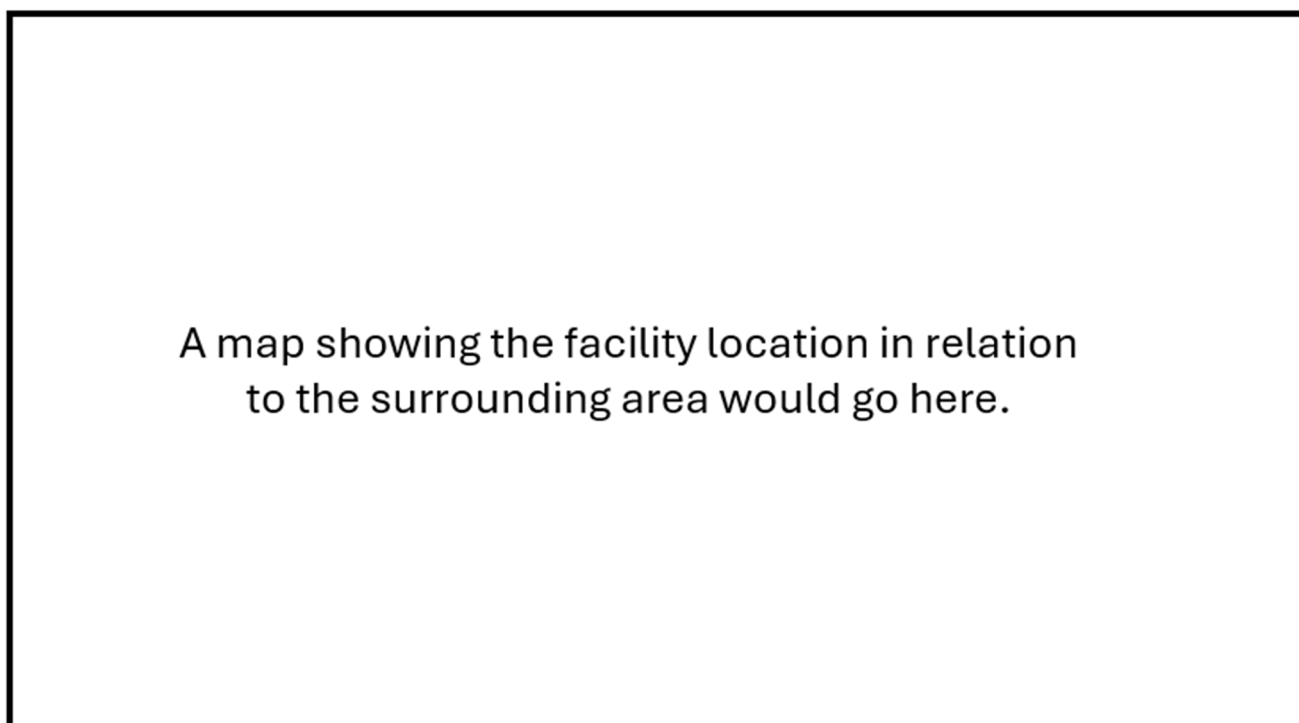


Figure 1 Example Site Overview

2.2 Energy Storage System Site Overview

The preliminary design for the facility has not yet been completed. An example equipment arrangement is shown in Figure 2. Typically, BESS cabinets are divided up into blocks. Each block is generally made up of a number of BESS cabinets and a power conversion system (PCS). Each PCS contains inverters, transformers, and disconnects. BESS cabinets produce DC voltage, which is sent to the inverters for conversion to AC voltage. The transformers step up the AC voltage for distribution to a substation or other point of interconnection (POI) with the grid, where it is distributed to end users.

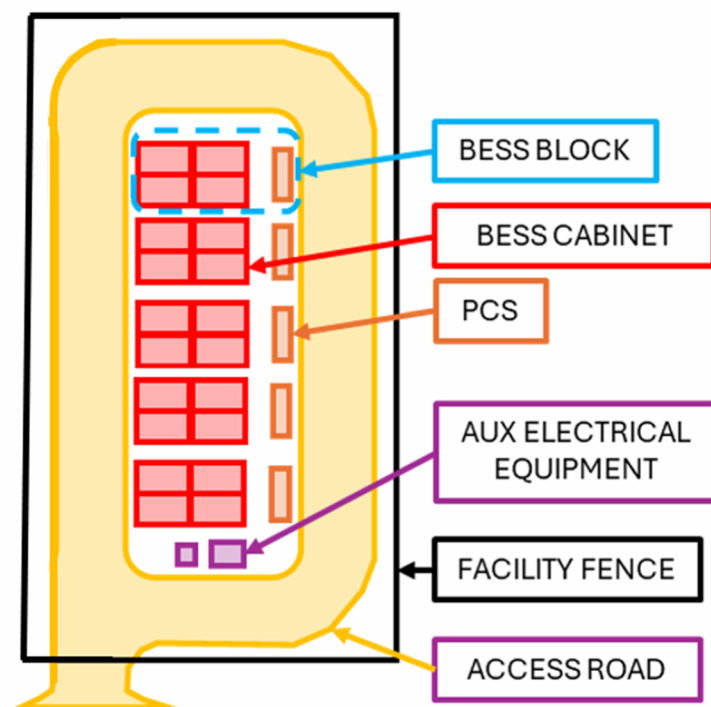


Figure 2 Example Equipment Arrangement



3 MITIGATION

3.1 Battery Cabinet Equipment Overview

The smallest component of a BESS is a cell. Lithium-ion style batteries with **lithium iron phosphate (LFP) chemistry are expected to be used**. Cells are combined into modules which are combined into racks. Cabinets contain multiple racks and additional protection, monitoring, and isolation features powered by on-site auxiliary power. Generally, every battery cabinet is rated to withstand outdoor environmental conditions.

3.2 Fire Protection Overview

3.2.1 Site Access

Entrance locations to the site are typically noted. Facility driving surfaces that will be provided are generally shown and labeled in Figure 2.

3.2.2 Fire Alarm and Detection System

Fire alarm and detection systems are typically required for BESS facilities. Depending on the BESS product, there will be internal smoke, heat, and/or gas detectors to detect thermal runaway conditions within each BESS cabinet, or there will be an external stand-alone infrared (IR) flame detection system. Internal detection systems can utilize Fire Alarm Control Panels (FACPs) within each BESS cabinet or a site-level FACP to aggregate alarms for the site. External IR detection systems will report to a central FACP. In either case, the central FACP will have a horn strobe for local notification of alarms, a manual pull station for manual activation of the alarm **and will also report to a 24/7 remote monitoring station that will alert first responders to an incident. All site fire alarm systems will be designed for compliance with NFPA 72.**

3.2.3 Fire Protection Water Supply

If a fire protection water supply for the facility is provided, it will be noted in this section. **If a fire protection water supply is not provided, alternatives will be discussed, such as a fire department tanker shuttle or relay pumping operation that can be set up to provide water to the site from an established drafting source or water supply system. This water shall be used for the intermittent cooling of exposures to prevent propagation should this risk exist, not for offensive firefighting of fires involving battery cabinets.**

3.3 Explosion Control and Prevention Systems

All utility-scale BESS are required to contain an explosion control or prevention system. Many contain both types of systems. Explosion prevention systems are designed to stop an explosion before it starts. They work by using a combustible gas detection system to monitor the air inside the battery enclosure. If flammable gases are detected, the system activates a powered ventilation system, which includes air intakes, exhausts, and fans, as shown in Figure 3. The goal is to rapidly purge the enclosure with fresh air, keeping the concentration of any explosive gas mixture below 25% of its lower flammability limit (LFL). This ensures the atmosphere is never rich



enough to ignite. **The entire system is typically monitored by an FACP**, which can be located at the cabinet or site level.

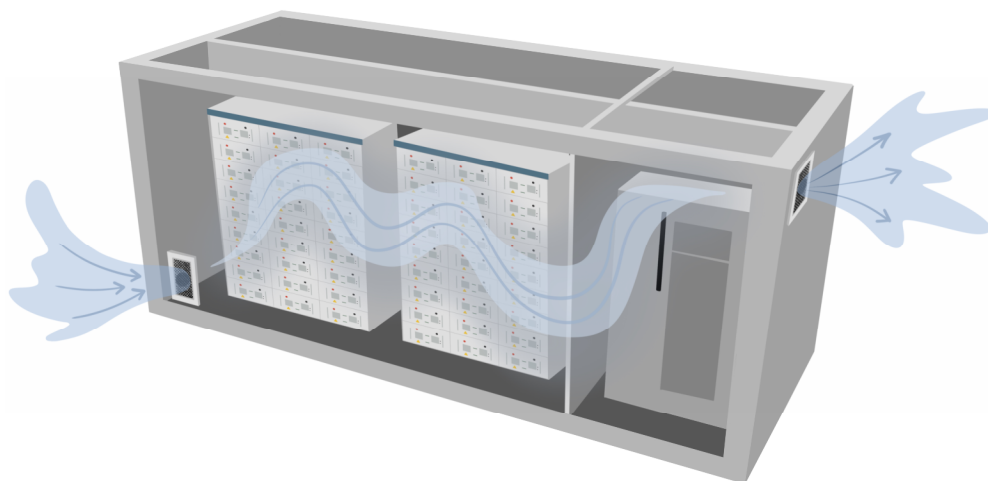


Figure 3 Explosion Prevention System

An explosion control system uses passive deflagration panels, which are essentially engineered weak points in a BESS enclosure. These panels are designed to burst open at a specific, low pressure. When a rapid pressure increase from a thermal runaway event occurs, the panels vent the pressure and flames in a controlled way, as shown in Figure 4. This action prevents the pressure from building up to a dangerous level, which could otherwise cause the entire BESS unit to fail, leading to catastrophic damage and a much greater risk to nearby personnel.

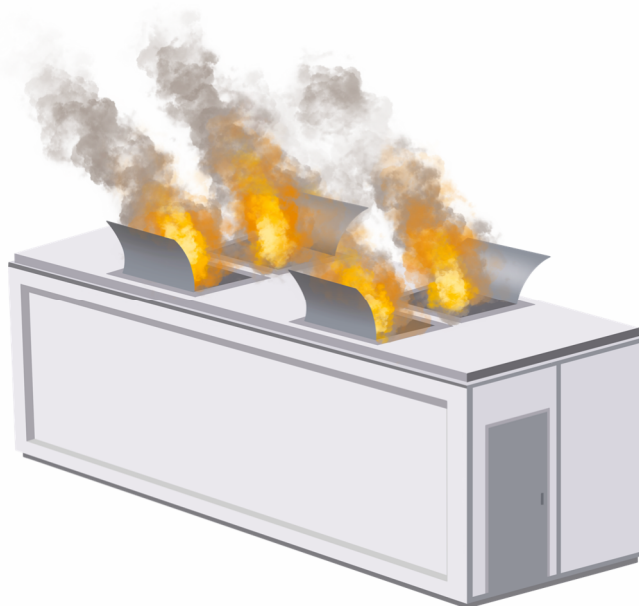


Figure 4 Explosion Control System



3.4 Battery Management System

The battery management system (BMS) monitors, protects, and manages the BESS, ensuring battery health parameters are maintained for efficient and continual operation.

Table 2 BMS Functions

Function	Description
Monitoring	The BMS continuously monitors key parameters such as voltage, current, temperature, and state of charge (SOC).
Protection	The BMS protects the battery from over-charging, over-discharging, over-current, over-temperature, and short circuits by isolating batteries that exceed predetermined operating parameters.
Balancing	The BMS helps to equalize the SOC across all cells.
Thermal Management	The BMS regulates the battery temperature by controlling heating or cooling systems, keeping the battery within the predetermined temperature range.
Power Control	The BMS regulates the power in and out of the batteries.
Communication	The BMS remotely communicates the status of monitored parameters and autonomously performed functions.

3.5 Emergency Stop

Some, but not all, BESS products and PCS are equipped with physical emergency stop (E-stop) buttons. Most BESS products are equipped with remote or virtual E-stop functionality. The operation of a BESS E-stop isolates the BESS cabinet. Though isolated, the BESS batteries still maintain their SOC. The operation of a PCS E-Stop isolates the PCS from the BESS and the grid. Operation of a site E-stop isolates the site from the grid. Never approach a trouble cabinet or PCS for manual activation of the E-Stop. Electrical switching at the site will be limited to facility personnel.

3.6 Power Conversion System

A PCS typically contains inverters, a medium voltage (MV) step-up transformer, and a system disconnect switch. The PCS inverter converts DC energy from the batteries to AC. Power is then routed through the MV step-up transformer where voltage is stepped up for interconnection with the grid.



4 PREPAREDNESS

4.1 Chemical Hazards

4.1.1 Cell Vent Gas

During a failure event, battery cells produce toxic gases that have the potential to be harmful to site personnel and first responders. If the failure spreads to other BESS components, it can produce additional toxic gases similar to those released during the combustion of ordinary manufactured products. Although outdoor BESS cabinets are not occupiable, site personnel and first responders can still be exposed to these toxic gases while operating near a BESS during a failure or fire event. In the event of a gas release, these toxic gases are expected to be diluted by the entrainment of outside air. Fire department personnel should wear the appropriate personal protective equipment (PPE), as outlined in Section 4.5.

4.1.2 Hydrogen

When the temperature of a cell reaches the venting stage, the primary hazard is the production of hydrogen gas (H₂). The gas is odorless, colorless, and requires internal sensors or external meters for detection. H₂ is flammable and lighter than air.

Table 3 Hydrogen Characteristics

Characteristic	Description/Value
Appearance	Colorless Gas
Odor	Odorless
LFL	4%
UFL	76%
Auto Ignition	500°C/932°F
25% LFL	1% or 10,000 ppm
Vapor Density	0.69 (Air = 1)

4.1.3 Carbon Monoxide

Carbon monoxide (CO) is an odorless, colorless gas, and requires internal sensors or external meters for detection. CO is produced during incomplete combustion and/or cell failure.

Table 4 Carbon Monoxide Characteristics

Characteristic	Description/Value
Appearance	Colorless Gas
Odor	Odorless
LFL	12.5 %



Characteristic	Description/Value
UFL	74.2%
Auto Ignition	607°C (1125°F)
25% LFL	3.125% or 31,250 ppm
Vapor Density	0.97 (Air = 1)

4.1.4 Transformer Dielectric Fluid

Dielectric fluid is used to insulate and cool site transformers such as PCS transformers and auxiliary power transformers. During a transformer failure, arcing and sustained fire can lead to heat retention in the windings and metal cabinet of the transformer, making this a persistent fire.

4.1.5 Refrigerant

Refrigerant is commonly used within the BESS thermal management system. Refrigerants are nonflammable under normal operating conditions. However, refrigerants are pressurized and can become combustible when mixed with air at elevated temperatures and pressures. Refrigerants can also release toxic by-products as a result of heating and decomposition. In high concentrations, refrigerants can also become an asphyxiation hazard.

Table 5 Refrigerant Characteristics

Characteristic	Description
Appearance	Colorless Liquid
Odor	Faintly Sweet

4.2 Electrical Hazards

Shielded electrical hazards at the BESS facility include battery cabinets, inverters and transformers. Outer covers around the equipment eliminate casual contact and locks prevent access to energized areas.

Unshielded electrical hazards at the facility include exposed bus within a substation or overhead electrical connections to the surrounding grid. OSHA regulations require a minimum standoff distance of 10 feet from equipment and power lines. The minimum clearance should be increased by 4 inches for every 10kV over 50kV.

BESS products contain batteries that are ALWAYS energized and present an electrical hazard even when disconnected from an electrical source. The operation of breakers or E-Stops will serve to isolate trouble equipment. However, the operation of these devices will not remove stranded energy. Class C electrical hazards constantly exist at BESS facilities.

NFPA 1970 structural firefighting ensemble is not rated for arc flash hazards. Maintain a 10-foot standoff distance from any open doors on BESS cabinets.

E-field detectors are commonly used to identify potential AC hazards. These devices do not have the ability to detect DC voltage from battery cabinets. Do not use E-field detectors within a BESS facility.



4.3 Thermal Runaway and Fire Hazards

Thermal runaway occurs when an electrochemical battery cell's temperature increases at an accelerating rate in an uncontrollable fashion sufficient to result in damage to the cell. The thermal runaway progresses when the cell's generation of heat is at a higher rate than the heat it can dissipate.

During thermal runaway, flammable gas and heat is produced. Failure may spread to adjacent cells or modules and the gas may ignite. Due to the high pressure at which these gases vent and the lack of a listed suppression agent, no attempt should be made to suppress this fire.

4.4 Explosion Hazard

The failure of a cell will begin with the venting stage; this is the pre-cursor to thermal runaway. Accumulation of flammable gases within a confined space, such as a BESS cabinet, can lead to an explosive atmosphere where the gas concentration falls within its upper and lower flammability limits. An explosion can occur when cell vent gases accumulate and contact a competent ignition source. While safety features are present to decrease the risk of an explosion, always assume that they are non-operational. Maintain an exclusion zone from the trouble equipment for the duration of the incident.

4.5 Recommended PPE

The recommended PPE is NFPA 1970 structural firefighting gear and the use of a self-contained breathing apparatus (SCBA) when exposed to respiratory hazards. **All chemicals associated with the failure of BESS equipment and ancillary electrical components present dermal and respiratory hazards.**

The PPE recommendation is for emergency response operations and life safety. PPE recommendations for the post-fire removal of damaged modules will be defined by conditions found at the time of decommissioning. In addition, structural firefighting ensembles are not designed to provide protection from arc flash hazards.

4.6 BESS Subject Matter Expert

Typically, a BESS SME is a person or group familiar with the BESS product, the site layout and equipment, installation guides and manuals, the BMS architecture, passive and active protection systems, notification sequencing, and this product-agnostic ERP.

The BESS SME, equipment owner, and site operator play a critical role in guiding fire department personnel responding to a BESS emergency by coordinating the following:

- Ensuring security of the site and limiting access to only authorized personnel.
- Ensuring accountability of non-fire department personnel inside the facility.
- Ensuring authorized personnel have PPE that is appropriate to their assigned role/task.
- Reviewing and interpreting BMS data including SOC, state of health (SOH), temperature, and status of equipment.
- Locating and isolating trouble equipment.
- Ensuring an exclusion zone has been established around the trouble equipment.



- Expanding exclusion zone in the event additional battery cabinets sustain alarms or direct fire impingement.
- Evaluating the status of the explosion control and prevention system (if applicable).
- Identifying need for exposure protection.
- Leading post-incident operations.
- Administering decommissioning plan.



5 RESPONSE

5.1 Tactics

DO NOT FORCE ENTRY

Fire department personnel should not encroach within 100 feet of the facility fence line until the trouble battery cabinet has been identified.

Upon arrival, fire department incident command should contact the ROC at XXX.XXX.XXXX to obtain preliminary information including the following:

- Accountability
 - Were any personnel present at the site?
 - If personnel are present, what is the status of their accountability?
- Location of Equipment in Alarm
 - What is the type and location of the trouble equipment in alarm?
- Alarm Type
 - What type of alarm has generated the initial response and have any other alarms been received that would suggest conditions are deteriorating?
- Equipment Status
 - Has trouble equipment been isolated autonomously or manually?
- Explosion Control and Prevention Systems
 - What is the status of the explosion control and prevention system?

5.1.1 Life Safety

BESS facilities are normally not staffed and are observed and controlled remotely. However, facility personnel may be on-site periodically for inspection, testing and maintenance of equipment. Accountability shall be confirmed with the ROC.

Obvious line of sight rescues is the priority for responding fire department personnel. Fire department personnel shall not enter the facility for recovery operations.

Unescorted Rescue Considerations:

- Personnel located >100 feet from the battery cabinet in alarm
 - Outside explosion risk zone
- Personnel located <100 feet from battery cabinet in alarm
 - Inside explosion risk zone
- Personnel located near battery cabinet with door open
 - Possible equipment contact – shock or electrocution risk.

5.1.2 Community Air Monitoring

Utilizing a four- or five-gas meter, establish air monitoring 100 feet downwind from the facility fence line to



evaluate gas dispersion from failed equipment. Visually observe smoke plume to ensure it is not encroaching on exposure structures. If metering equipment detects abnormal levels, consider evacuating affected areas.

5.1.3 Exclusion Zone

Once the trouble equipment is identified, establish a 100-foot exclusion zone. Expand the exclusion zone if failure conditions spread to adjacent equipment.



Figure 5 General 100' Exclusion Zone

5.1.4 Alarms Monitoring

Monitor input alarms from the FACP and the BMS for the trouble equipment. Receipt of additional alarms can indicate deteriorating conditions within the trouble equipment. A review of the BMS can indicate the possible origin location and further impacted internal equipment.

First responder dispatch will be notified in advance of any planned drills conducted on-site.

5.1.5 Isolation of Trouble Equipment

Confirm trouble equipment has been autonomously isolated. If recommended by the BESS SME, remotely isolate adjacent equipment.

Fire Department personnel should never operate equipment or controls within the site. The BESS SME will coordinate all operational requests.

Never approach a trouble cabinet for manual activation of the E-Stop.

5.1.6 Condition Monitoring

From outside the exclusion zone, visually and audibly monitor the conditions of the trouble cabinet. Look for the presence of white gas, smoke, fire, and damage to the cabinet. Even if there are no visible or audible indications of failure, hazards to responding fire department personnel may still be present.

5.1.7 Exposure Assessment

Assess the adjacent equipment to determine if exposure protection is necessary. Evaluate the following:

- Are there any heat and/or cell temperature alarms in adjacent equipment?



- Expand exclusion zone if adjacent equipment becomes involved.
- Based on **thermal imaging camera readings**, is there any increase in temperature on adjacent equipment?
 - If temperatures reach 50% of the average cell vent temperature as determined by UL9540A testing, see Section 5.1.8
- Is there any direct flame impingement on adjacent equipment?

5.1.8 Exposure Protection

Exposure protection should be considered if conditions warrant or if **recommended by the BESS SME. While maintaining the exclusion zone, establish a continuous water supply. From outside the exclusion zone, using a rain down method, apply water in a fog pattern to cool the exposure equipment. Do not use a solid or straight stream to ensure fire department personnel safety and limit water intrusion into uninvolved equipment.**

5.2 Incident Stabilization

5.2.1 Under Control

The incident may be considered under control when:

- Fire is contained to the equipment involved with no exposure concerns
- No new alarms have been generated
- The volume of fire or gas has decreased

Once the incident has been placed under control, establish continuous fire-watch for the facility through decommissioning.

5.3 Inverter Failure

Inverter failures do not typically result in a fire, rather they manifest as an arc flash. Inverter fires can be fought using agents rated for **Class C hazards**, as they are classified as Class C fires until power is disconnected. Once disconnected from the electrical source, an inverter fire can be treated as a Class A fire and is limited to isolated pockets of burning insulation.

5.4 Transformer Fire

Following a transformer fire, the presence of sustained arcing is a sign that the fault condition has not cleared. This will present with a blue flame or electrical arc and may be a precursor to a catastrophic failure of the transformer. **Transformer fires are classified as Class B and C fires until power is disconnected. Once the electrical source is removed, the transformer fire can then be reclassified as a solely Class B fire (insulating oil). CO2 is the recommended agent for transformer fires. If the fire is unresponsive to extinguishment efforts, the unit should be allowed to burn off and consume dielectric fluid until the fire self-extinguishes.**



6 RECOVERY

Recovery focuses on equipment assessments for determining repair, replacement, or restoration as part of the facility owner/operator's recovery plan. **Implementation of the recovery plan is the responsibility of the facility owner/operator and should be overseen by the BESS SME. Fire department involvement in the recovery plan is at the discretion of the BESS SME and the facility owner/operator.**

Typical facility recovery plans can include:

- Facility fire watch
- Post-incident equipment assessment including:
 - Grid connectivity
 - BMS status
 - Fire alarm status
 - Fire suppression status
 - Explosion control status
- Lock out/Tag out
- Decommissioning
- Installation of new equipment
- Recommissioning



7 REVISION SHEET

Date	Revision	Reason for Issue	Developed By	Reviewed By	Approved By
03/10/2026	Rev0	Initial ERP	TH	KL	AFB