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Appendix D

Enterprise BESS HCA

COFFMAN ENGINEERS

ENTERPRISE BATTERY ENERGY STORAGE SYSTEM PROJECT

Hazard Consequence Analysis

COFFMAN PROJECT NO. 253107

IFP SUBMITTAL

December 26, 2025

Prepared for: Enterprise BESS, LLC

HAZARD CONSEQUENCE ANALYSIS

FOR

ENTERPRISE BESS

Escondido, California

Project Number: 253107

Revision	Date	Description
A	10/15/2025	Issued for Review
B	12/05/2025	Issued for Permit
C	12/17/2025	Change to 2025 Code Cycle
D	12/26/2025	IFP Revision

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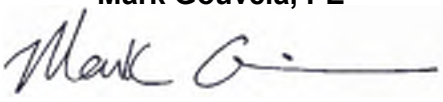

Principal, Fire Protection Engineering
406-582-1936

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APPENDICES

ABBREVIATIONS

BAU	Battery Array Unit
BCU	Battery Cluster Unit
BESS	Battery Energy Storage System
BMS	Battery Management System
BMU	Battery Management Unit
CATL	Contemporary Amperex Technology Company, Limited
CFC	California Fire Code
DC	Direct Current
EMS	Energy Management System
ESS	Energy Storage System
FACP	Fire Alarm Control Panel
FCC	Fire Command Center
FHSZ	Fire Hazard Severity Zone
FRS	First Responder Station
HMA	Hazard Mitigation Analysis
HVAC	Heating, Ventilation, and Air Conditioning
IDLH	Immediately Dangerous to Life and Health
kV	Kilovolt
LFL	Lower Flammability Limit
LPC	Local Plant Controller
LRA	Local Responsibility Area
MW	Megawatt
MWh	Megawatt-hour
MV	Medium Voltage
NEC	National Electric Code
PCS	Power Conversion System
PEL	Permissible Exposure Limits
SCADA	Supervisory Control and Data Acquisition
SCBA	Self-Contained Breathing Apparatus
UPS	Uninterruptible Power Supply

1 INTRODUCTION

This Hazard Consequence Analysis (HCA) is provided by Coffman Engineers, Inc. (Coffman) for the Enterprise Battery Energy Storage System (BESS) project located in Escondido, California. This document is to be used in conjunction with the Emergency Response Plan (ERP) so that the Operator and First Responders understand the practices and procedures to be followed to provide immediate and effective response to emergencies that may arise.

The purpose of this HCA is to identify the distance from the project site to the nearest sensitive receptors and identify and characterize the quantities and locations of hazardous chemicals that could be released during a thermal runaway and/or fire event. This HCA is based on the specific project system design including equipment specifications, location, and plume dispersion modeling using PHAST™ Version 8.9 software from DNV®.

Spill control and neutralization is not required as fire suppression using fire sprinkler systems interior to the Energy Storage System (ESS) enclosures is not the fire protection design approach for this site and spill control and neutralization is not required for lithium-ion battery installations per CFC §1207.6.2.

This HCA is being submitted to the California Energy Commission (CEC) for review and approval. The CEC is the entity responsible for licensing the BESS project including review (in consultation with the Escondido Fire Department) and approval of fire-related plans and design related to the BESS facility. The Escondido Fire Department is the Fire Marshal and is considered the AHJ for the purposes of Fire and Life Safety matters (e.g., emergency response planning and incident response). The life safety of personnel shall be the highest priority during any event.

2 PROJECT DESCRIPTION

2.1 Project Site

The Enterprise BESS yard will contain 24 SYL SU3794U3794KC enclosures (including augmentation) for an approximate total energy capacity of 52 MW / 52 MWh. The BESS yard portion is located within Escondido, California. The site will include enclosures manufactured by SYL Battery (a subsidiary of Risen Energy) containing lithium-ion battery technology.

The details of the BESS facility at the Enterprise BESS site are discussed in the Hazard Mitigation Analysis (HMA) in detail and summarized in this section. A vicinity map is provided in Figure 2.1(a). The site will include twenty-four (24) SYL SU3794U3794KC enclosures (including augmentation enclosures) installed over a footprint of approximately 0.83 acres. The project site will be provided with fire department access, transformers, and the necessary infrastructure for connection to the utility.

Figure 2.1(a) - Enterprise BESS Vicinity Map (North ↑)

2.2 Surrounding Area

The BESS yard is located in a mixed commercial and residential area within Escondido, California. The landscape is typical of the developed areas of Escondido Valley with vegetation categories being described as urban, coastal scrub, and mixed chaparral. The adjacent properties are zoned for Light Industrial (M-1), General Industrial (M-2), and Specific Plan (S-P) for residential, industrial, or commercial uses. The locations of additional occupancies, including schools and hospitals, are shown later in this section.

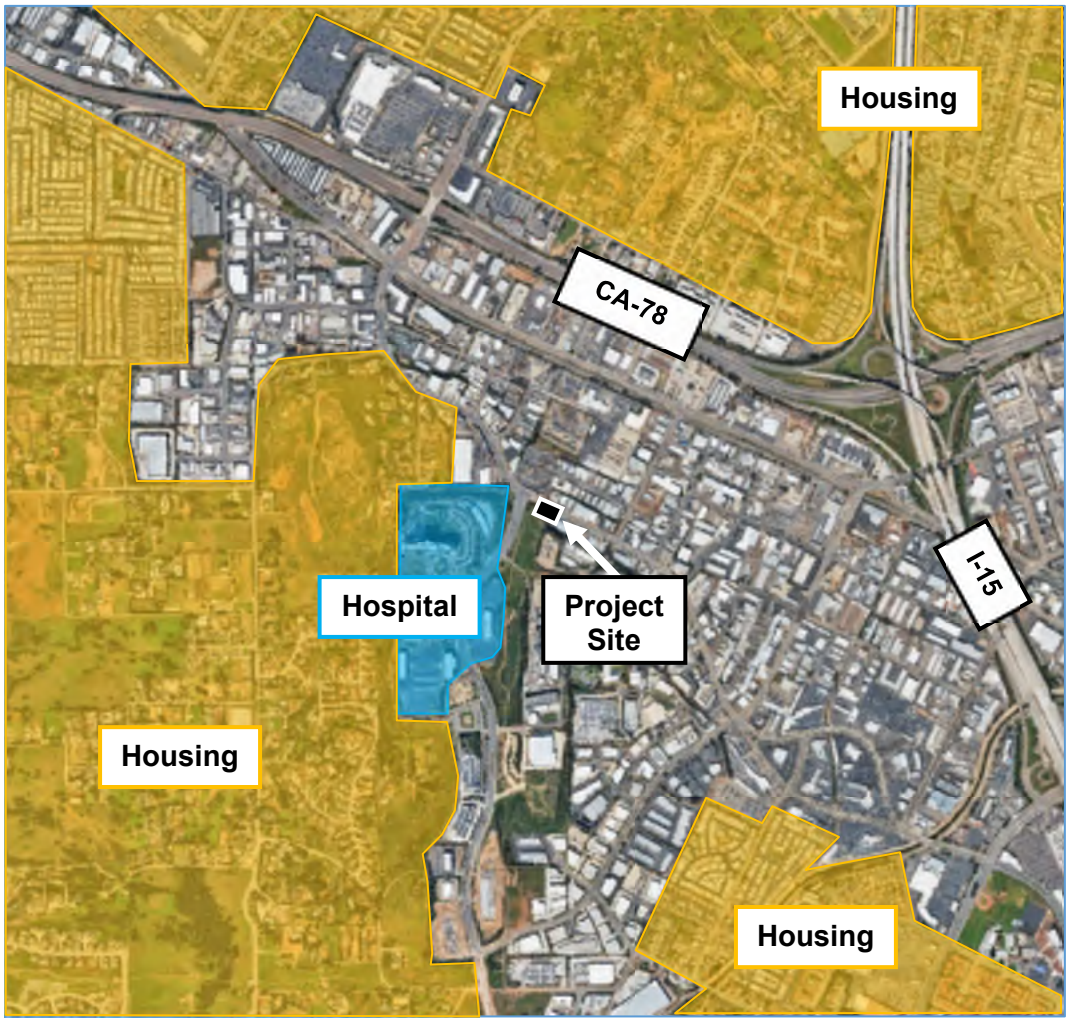

Figure 2.2(a) – Sensitive Receptors within 1 Mile of ESS Yard (North ↑)

The site is also located within a Moderate Fire Hazard Severity Zone (FHSZ) within a Local Responsibility Area (LRA) per California Department of Forestry and Fire Protection (CAL FIRE). However, this FHSZ designation does not trigger additional design requirements beyond the requirements of the adopted Fire Code.

Figure 2.2(b) – FHSZ Designation – Moderate FHSZ in LRA (North ↑)

Select nearby locations of sensitive receptors beyond one mile away from the site are provided below including approximate straight-line distances with compass headings. A zero-degree heading starts due to the North and rotates clockwise. Sensitive receptors are considered within this document as children, elderly, or others at a heightened risk of negative effects because of air pollutants.

2.2.1 Schools:

- Community Montessori / Dimensions Collaborative School / Element Education – 0.5 miles away Northeast at a 33-degree heading
- Edwin Markham Elementary School – 1.01 miles away Northwest at a 349-degree heading
- Rock Springs Elementary School – 1.07 miles away Southwest at a 34-degree heading
- Del Dios Academy of Arts and Sciences – 1.11 miles away Southeast at a 128-degree heading

2.2.2 Hospitals/Health Centers:

- Palomar Medical Center Escondido – 0.1 miles (550 feet) away West at a 254-degree heading
- Nordahl Medical Center – 0.79 miles away North at a 356-degree heading

2.2.3 Daycare Facilities:

- Candlelight Daycare – 1.74 miles away Southeast at a 145-degree heading
- Lara Family Childcare – 2.09 miles away West at a 282-degree heading

2.2.4 Residential Housing:

- There are concentrated housing areas in all directions around the project site, with the closest one being located 0.2 miles (1,050 feet) away

3 CODE STUDY

3.1 Applicable Codes

The applicable codes with regards to fire protection and life safety, with local amendments, are listed below.

- CFC, California Fire Code, (2025 Edition), as adopted by the City of Escondido
    - Including adoption of Fire Hazard Severity Zones (FHSZ)
- NFPA 72, National Fire Alarm and Signaling Code (2025 Edition)
- NFPA 70, National Electrical Code (NEC) (2023 Edition)
- NFPA 855, Standard for the Installation of Stationary Energy Storage Systems (2023 Edition)
- UL 9540, Standard for Energy Storage Systems and Equipment (2023 Edition)
- UL 9540A, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (2019 Edition)

4 SYSTEM EQUIPMENT

4.1 Main ESS Components

The following section provides a description of the SYL SU3794U3794KC (referred to in this document as “enclosure”) is 8-ft wide x 19.9-ft long x 9.5-ft tall. Enclosures are in groups of four, together with the ancillary equipment (e.g., transformers). See the figure below for an image of a SYL SU3794U3794KC enclosure. Figure 4.1(a) below provides a visual of the general arrangements. The ESS enclosures are organized in rows with fire department access roads as shown in Figure 4.1(b).

Figure 4.1(a) – SYL SU3794U3794KC Enclosure

Each enclosure is self-contained with its own integrated battery modules, battery management systems, thermal management systems, and explosion prevention system. A simplified arrangement of the Enterprise BESS facility for reference is shown below in Figure 4.1(b) with the Fire Command Center (FCC). Note that an FCC has the same function as a First Responder Station (FRS).

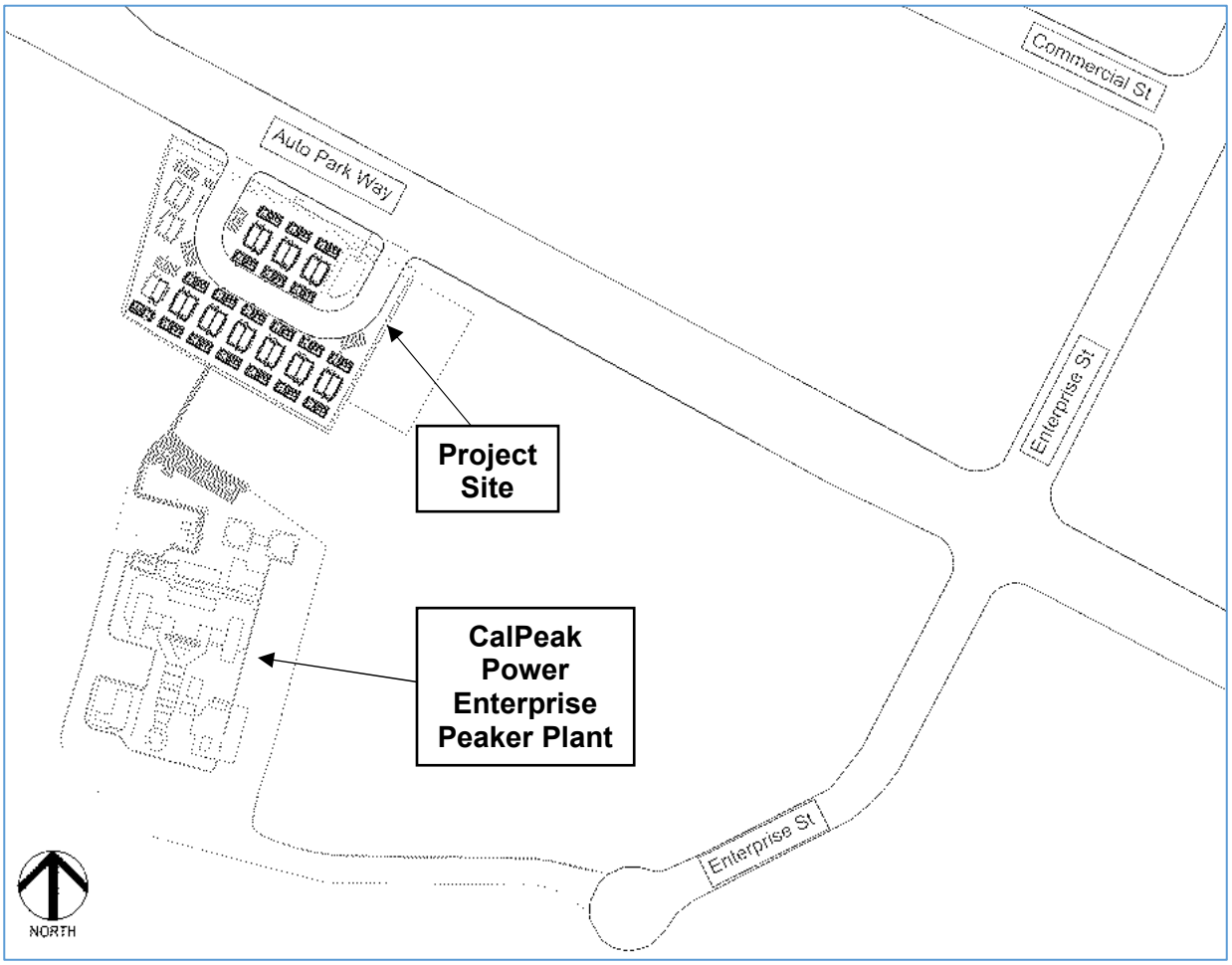

Figure 4.1(b) – Enterprise BESS Site Layout (North ↑)

4.2 Battery Arrangement and Quantities

The battery racks, shown in the figure below, are housed in the SYL SU3794U3794KC's enclosure (Figure 4.2). Each battery rack comprises eight (8) battery modules for a total of forty (40) modules per SYL SU3794U3794KC. In total, the Enterprise BESS facility will have a total of 1,160 battery modules housed within ESS enclosures on the site.

Figure 4.2 – View of single SYL SU3794U3794KC battery rack, containing 8 modules.

5 LARGE SCALE FIRE TESTING

5.1 UL 9540A Fire Test

This HCA has been prepared after reviewing the UL 9540A test result reports. The cell-level test is included in Appendix A of this report. Tests were conducted to the 4th edition of the UL 9540A test procedures. Key results of the UL 9540A testing are shown in the following sections.

5.1.1 Cell Level Test

The cell level test document that was referenced for this report was published by UL(Changzhou) Quality Technical Service Co., LTD, Dated 12/11/2023, Test Report No. 4790838636.1.

The cell test included the same test repeated 5 times with a separate cell each time. Each time, the single cell was forced into thermal runaway by inducing heat via a single film heater at a rate between 4°C/min and 7°C/min.

- On average, cell venting occurred at 156°C (312.8°F) and thermal runaway occurred at 232°C (449.6°F).
- Gas composition was analyzed showing the primary flammable gas constituents as hydrogen, methane and ethylene. The primary toxic gas was carbon monoxide.

5.1.2 Module Level Test

The module level test document that was referenced for this report was published by SGS-CEC New Energy Technology (Chongqing) Co., Ltd., Dated 07/30/2024, Report No. CQES240700055301.

The module test was conducted with 2 cells being forced into thermal runaway by inducing heat via 1 film heater between the 2 initiating cells.

- The report doesn't confirm the number of cells that went into thermal runaway, but the results appear similar to what was observed during the unit level test.
- Gas composition was analyzed showing the primary flammable gas constituents as hydrogen, methane and ethylene. The primary toxic gas was carbon monoxide.
- No flying debris, explosive discharge of gas, sparks or electrical arcs were observed during the test.

5.1.3 Unit Level Test

The unit level test document that was referenced for this report was published by SGS-CEC New Energy Technology (Chongqing) Co., Ltd., Dated 08/29/2024, Report No. CQES240800069201.

- The unit test was conducted with a single module being forced into thermal runaway with one (1) film heater used to simultaneously heat two (2) cells within the module. No fire suppression system was installed for any test.
- Thermal runaway of a single module occurred approximately 1 hour and 15 minutes after heater activation. At approximately 2 hours and 24 minutes temperature readings

inside the initiating module showed it had cooled to approximately the same temperature as when thermal runaway initiated. Cooling continued for the duration of the test.

- Thermal runaway propagated to one (1) non-induced cell within the initiating module, resulting in a total of three (3) cells in thermal runaway.
- The unit test results demonstrate that the thermal runaway event was limited to a single module within the initiating rack unit and there was no propagation to other modules within the initiating rack unit or any of the target rack units. There were no observations of a deflagration or explosive discharge of gases.
- The maximum external heat flux detected was 1.2 kW/m^2. This level of heat flux is below the level that can ignite combustibles.
    - For perspective on the effects of thermal radiation at various radiant heat flux values are provided below.
        - 1 kW/m^2 – Solar radiation (sunny day)
        - 10 kW/m^2 – Pain after 2 seconds of skin exposure (SFPE Handbook, 4th ed. Table 2-6.19, Perkins)
        - 29 kW/m^2 – Wood ignites spontaneously after prolonged exposure (Drysdale, 2005)
- The UL 9540A unit test demonstrates that the ESS enclosure design will limit a thermal runaway event from propagating outside of a single enclosure with a clearance distance of 100mm (0.4 inches) to adjacent units. This testing supports the proposed layout and back-to-back spacing of 6 inches of rack units at the site.
- Additional thermal runaway prevention will be provided via a Battery Management System (BMS) that monitors battery voltage, temperature, etc. to detect irregularities and disconnect power if needed. It is important to note that while the BMS may disconnect power it cannot discharge stored energy from the batteries.

6 FIRE PROTECTION FEATURES

6.1 Fire Suppression / Thermal Runaway Mitigation System

The failure of a battery module could lead to a thermal runaway event. UL 9540A testing has demonstrated that the failure and thermal runaway of one module is likely to be contained within the ESS enclosure. No fire suppression systems are provided inside the enclosure. If thermal runaway and cell venting occurs, the enclosure's exhaust ventilation system is expected to activate if LFL concentration above 10% is detected.

Each enclosure is equipped with smoke, heat, and combustible gas detectors to trigger a fire alarm in the event of fire or thermal runaway. The features are discussed in the Hazard Mitigation Analysis (HMA) for the project.

6.2 Smoke, Heat, and Gas Detection

Each SYL SU3794U3794KC ESS enclosure will contain smoke detectors, heat detectors, and combustible gas detectors. If respective detection criteria are reached within the enclosure, these detectors will send alarm signals to the enclosure's internal fire alarm panel, which will send a signal to the site FCC.

6.3 Explosion Protection

The explosion prevention system within the SYL SU3794U3794KC ESS enclosures employs an automatic approach that integrates gas detection devices, ventilation system, and operational safeguards:

- Gas Detection: Each enclosure houses two gas detectors specifically designed to detect flammable gases (e.g., H_2, hydrocarbons) typically released during lithium-ion battery thermal runaway. The detectors are calibrated to activate at a threshold of 10% LFL.
- Exhaust Ventilation (NFPA 69): Upon gas detection, one exhaust fan (697 cfm) activates to remove flammable gases from the enclosure.
- Operational Controls: Detection triggers several actions: alarms are sent, charging/discharging processes halt, off-gassing valves open, and exhaust ventilation activates.

6.4 Fire Alarm System/Fire Command Center

A networked site fire alarm panel and a Fire Command Center (FCC) are provided at the site entrance and connected to each remote fire alarm panel located throughout the site. The fire alarm panels monitor fire alarm devices within the ESS enclosures and interface with the FCC. These systems provide current information on active alarms and system telemetry to the responding fire department without approaching the battery enclosure.

The fire alarm system is monitored through a cellular connection and transmits supervisory, trouble and alarm signals to a constantly attended location.

6.5 Battery Management System

A Battery Management System (BMS) is provided for each SYL SU3794U3794KC enclosure. The total BMS system comprises three (3) components known as the Module Battery Management Unit (BMU), Battery Cluster Unit (BCU), and Battery Array Unit (BAU). Each BMU monitors one (1) module, which supplies enclosure level information to the BCU, and finally that information is processed within the BAU. Together, these components act as the BMS which monitors state of charge (SOC), temperature, and voltage to identify modules and cells that are not operating within acceptable ranges. The BMS can disconnect module clusters by switching the DC contactor from the BCU to cease charging/discharging. The BMS communicates with the Energy Management System (EMS) which may shut down the affected SYL SU3794U3794KC if needed and alert the Network Operator and SCADA monitors. The actions of the BMS system are not functionally tested in UL 9540A testing. For more information on the BMS, reference section 5.1.3 of the SYL SU3794U3794KC User Manual.

6.6 Signage

Approved signage shall indicate the type of lithium batteries in the enclosure, identify that the enclosure contains energized battery systems, and that the enclosure contains energized electrical circuits in accordance with CFC § 1207.4.8.

7 POTENTIALLY HAZARDOUS EMISSIONS

7.1 Characterization of Potential Hazards

The UL 9540A cell level test report identifies twenty-seven (27) hazardous substances captured during the thermal runaway that may have an impact on nearby receptors described earlier. These hazardous substances are: carbon monoxide, carbon dioxide, hydrogen, methane, ethylene, acetylene, ethane, propane, propene (propylene), isobutane, butane, isobutylene, 1-butene, trans-2-butene, cis-2-butene, pentane, trans-2-pentene, cis-2-pentene, 1,4-pentadiene, hexane, 1-hexene, benzene, 1-heptene, toluene, styrene, dimethyl carbonate and ethyl methyl carbonate.

The following describes the potential hazards, and potential effects from acute inhalation exposure: Acute Exposure Guideline Levels (AEGLs), Emergency Response Planning Guidelines (ERPGs), Temporary Emergency Exposure Limits (TEELs), Immediately Dangerous to Life and Health (IDLH), and Protective Action Criteria for Chemicals (PACs).

ERPGs are developed by the Emergency Response Planning committee of the American Industrial Hygiene Association (AIHA). AEGLs are developed by the National Academy of Sciences. TEELs are derived by the U.S. Department of Energy Subcommittee on Consequence Assessment and Protective Actions (SCAPA) according to a specific, standard methodology. IDLH limits are derived by the National Institute of Occupational Safety and Health (NIOSH). The public exposure guideline systems use a three-tier system to differentiate severity levels except for IDLH which has one level per substance. The tier levels for each system are described below as published by the EPA:

The AEGL values are defined as:

- AEGL-1 is the airborne concentration (expressed as parts per million [ppm] or milligrams per cubic meter [mg/m^3]) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.
- AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
- AEGL-3 is the airborne concentration, (expressed as ppm or mg/m^3), of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

The ERPG values are defined as follows:

- ERPG-1 is the maximum airborne concentration below which nearly all individuals could be exposed to for up to one hour without experiencing more than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.
- ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed to for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

- ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed to for up to one hour without experiencing or developing life-threatening health effects.

The TEEL values are defined as:

- TEEL-1 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, when exposed for more than one hour, could experience notable discomfort, irritation, or certain asymptomatic, non-sensory effects. However, these effects are not disabling and are transient and reversible upon cessation of exposure.
- TEEL-2 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, when exposed for more than one hour, could experience irreversible or other serious, long-lasting, adverse health effects or an impaired ability to escape.
- TEEL -3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, when exposed for more than one hour, could experience life-threatening adverse health effects or death.

The PACs dataset is a hierarchy-based system composed of the public exposure guideline systems. The PACs dataset prioritizes AEGLs (final or interim), followed by ERPGs, and lastly TEELs when determining values for levels of concern. The distance to toxic endpoints displayed in this report uses the PAC-2 values per EPA guidance to evaluate potential risk to nearby receptors or first responders.

The IDLH level is defined as:

- The airborne concentration (expressed as ppm or mg/m^3) from which a worker could escape without injury or irreversible health effects from an exposure in the event of the failure of respiratory protection equipment. The IDLH considered a maximum concentration above which only a highly reliable self-contained breathing apparatus (SCBA) providing maximum worker protection should be permitted.

The table below summarizes the individual values for each gas species measured in the UL 9540A cell level test.

Table 7.1 – Summary of Hazardous Thresholds

			EPA[1] (1 hour)			Cameo Chemicals[2] (NOAA)			U.S. Dept. of Energy[3]				NIOSH[4]
Gas Species	**Formula**	**CAS #**	**AEGL-1**	**AEGL-2**	**AEGL-3**	**ERPG**	**ERPG**	**ERPG**	**PAC-1**	**PAC-2**	**PAC-3**	**LFL %**	**IDLH**
Carbon Monoxide	CO_2	630-08-0	-	**83**	**330**	200	350	500	75	83	330	12.5	**1,200**
Carbon Dioxide	CO_2	124-38-9	-	-	-	-	-	-	30,000	40,000	50,000	-	40,000
Hydrogen	H_2	1333-74-0	-	-	-	-	-	-	65,000	230,000	400,000	**4**	-
Methane	CH_4	74-82-8	-	-	-	-	-	-	65,000	230,000	400,000	**5**	-
Ethylene (Ethene)	C_2H_4	74-85-1	-	-	-	-	-	-	600	6,600	40,000	**2.7**	-
Acetylene	C_2H_2	74-86-2	-	-	-	-	-	-	65,000	230,000	400,000	**2.5**	-
Ethane	C_2H_6	74-84-0	-	-	-	-	-	-	65,000	230,000	400,000	**3**	-
Propane	C_3H_8	74-98-6	5,500	17,000	33,000	-	-	-	5,500	17,000	33,000	**2.3**	2,100
Propylene (Propene)	C_3H_6	115-07-1	-	-	-	-	-	-	1,500	2,800	17,000	**2**	-
Isobutane	C_4H_{10}	75-28-5	-	-	-	-	-	-	5,500	17,000	53,000	**1.8**	-
Butane	C_4H_{10}	106-97-8	5,500	17,000	33,000	-	-	-	5,500	17,000	53,000	**1.9**	1,600
Isobutylene	C_4H_8	115-11-7	-	-	-	-	-	-	750	2,500	11,000	**1.8**	-
1-Butene	C_4H_8	106-98-9	-	-	-	-	-	-	750	2,900	17,000	**1.6**	-
trans-2-Butene	C_4H_8	624-64-6	-	-	-	-	-	-	750	2,400	14,000	**1.8**	-
cis-2-Butene	C_4H_8	590-18-1	-	-	-	-	-	-	750	2,200	13,000	**1.7**	-
Pentane	C_5H_{12}	109-66-0	-	-	-	-	-	-	3,000	33,000	200,000	**1.5**	1,500

[1] https://www.epa.gov/aegl/access-acute-exposure-guideline-levels-aegls-values
[2] https://cameochemicals.noaa.gov/search/simple
[3] https://emhub1.energy.gov/pacteel
[4] https://www.cdc.gov/niosh/idlh/intridl4.html

Gas Species	Formula	CAS #	AEGL-1	AEGL-2	AEGL-3	ERPG	ERPG	ERPG	PAC-1	PAC-2	PAC-3	LFL %	IDLH
trans-2-Pentene	C_5H_{10}	646-04-8	-	-	-	-	-	-	-	-	-	-	-
cis-2-Pentene	C_5H_{10}	627-20-3	-	-	-	-	-	-	-	-	-	-	-
1,4-Pentadiene	C_5H_8	591-93-5	-	-	-	-	-	-	-	-	-	-	-
Hexane	C_6H_{14}	110-54-3	-	2,900	8,600	-	-	-	400	2,900	8,600	**1.1**	1,100
1-Hexene	C_6H_{12}	592-41-6	-	-	-	-	500	5,000	150	500	5,000	**1.2**	-
Benzene	C_6H_6	71-43-2	52	800	4,000	50	150	1,000	52	800	4,000	**1.4**	500
1-Heptene	C_7H_{14}	592-76-7	-	-	-	-	-	-	130	1,400	8,700	**1**	-
Toluene	C_7H_8	108-88-3	67	560	3,700	50	300	1,000	67	560	3,700	**1.4**	500
Styrene	C_8H_8	100-42-5	20	130	1,100	50	250	1,000	20	130	1,100	**0.9**	700
Dimethyl Carbonate	$C_3H_60_3$	616-38-6	-	-	-	-	-	-	11	120	710	-	-
Ethyl Methyl Carbonate	$C_4H_8O_3$	623-53-0	-	-	-	-	-	-	-	-	-	-	-
Mixture Total	-	-	-	-	-	-	-	-	-	-	-	**7.45**	-

8 ESTIMATED THERMAL RUNAWAY EMISSIONS

A UL 9540A cell-level test was conducted by a cell being forced into thermal runaway by inducing heat via a film heater. The UL 9540A cell-level test captured the total volume of gas, in liters (L), vented during the thermal runaway event over a collection time which was analyzed to be approximately 15 minutes. The assumed release duration for a single cell was based on the UL 9540A cell-level test report by averaging the difference between cell venting time and thermal runaway time based upon the values within Attachment C of the UL 9540A cell-level test. This vent time is considered more conservative than the gas emission duration time within the NFPA 69 Analysis Report, which is 1128 seconds (18.8 minutes).

Although this estimation is based on the initiating time of thermal runaway and may not include its total duration, a shorter emissions duration of 15 minutes in the PHAST™ model is a more conservative approach than a longer duration. The gases recorded during the cell-level UL 9540A test are used in this report. These gases were collected in a fixed-volume vessel and include all pre-flaming gases released from a battery cell. The vented gases measured in the cell-level test do not indicate volume, only concentration in percentage.

During the UL 9540A unit-level test, thermal runaway was initiated in two cells and propagated to one (1) additional cell within the module, resulting in a total of three (3) cells in thermal runaway. The module-level test report does not confirm the total number of cells that experienced thermal runaway, but the results appear similar to what was observed during the unit level test.

For this analysis, the off-gas plume resulting from the thermal runaway of three (3) cells may be described as a “credible event” based on the unit-level test. A safety factor of two (2) would then be applied, resulting in a plume analysis “credible event” based upon six (6) cells in thermal runaway.

Emissions from all six (6) cells were modeled simultaneously rather than sequentially, which gives a more conservative result.

Table 8: Emission Release Rate	
Hazardous Gas Component	UL 9540A Gas Analysis (%)
Carbon Monoxide	13.453
Carbon Dioxide	27.205
Hydrogen	41.313
Methane	7.403
Ethene (Ethylene)	4.408
Ethane	1.235
Propene (Propylene)	1.297
Propane	0.734
Butene	1.085
Butane	0.193
Pentane	0.335
Hexane	0.147
Heptane	0.997
Toluene	0.013
Styrene	0.013
Total Cell Off-gas Volume	**211.7 L**
Credible Event Vent Volume	**1,270.2 L**
Credible Event Vent Mass	**1.272 kg**
Credible Event Mass Flow Rate*	**0.0848 kg/min**

*Note: * The emission rate was calculated for 6 cells with a conservative venting time of 15 minutes as described in Section 8.*

L = liters; min = minutes; kg = kilograms.

9 OFFSITE CONSEQUENCE ANALYSIS

An offsite consequence analysis was performed using emission rate estimates as described in Section 8 and the PHAST™ model as described in the sections below.

9.1 Methodology

The EPA's "Risk Management Program Guidance for Offsite Consequence Analysis" recommends conducting an offsite consequence analysis to represent release scenarios that are possible (although unlikely) to occur under a variety of weather and wind conditions to determine the distance to a toxic or flammable endpoint. Modeling assumptions and meteorological conditions that were used for conducting this offsite consequence analysis are described below. The offsite consequences analysis was conducted for ten (10) different weather scenarios based on the following assumed conditions:

- Specific conditions –
    - Wind speeds of 3.4 miles per hour (mph), 3.6 mph, 4.3 mph, 5.3 mph, and 13.4 mph were modeled based upon San Diego County's BESS Best Practice Study[5] and nearby ASHRAE weather data[6].
    - Atmospheric stability class F (Stable – night with moderate clouds and light/moderate wind) and class B (Unstable – as with A/B only less sunny or more windy).
    - Release temperature of 312.8 degrees Fahrenheit (°F) for toxic and flammable gas releases.
    - Relative humidity of 64%, 69%, and 75% based upon annual average, and monthly average high and low.
    - Height of release – 8 feet (approximate center of exhaust vent).
    - Surface roughness – PHAST™ default of "user defined" between "low crops" and "high crops"; as determined based on the density and height of obstructions.
    - No perimeter fence, barrier, or wall.

The first of the 10 weather scenarios within the model was based upon average weather conditions, with subsequent weather models changing one variable at a time. The subsequent 9 weather scenarios evaluated the effects of altering atmospheric stability class, temperature, wind speed, and humidity.

The PHAST™ model was set up to specify three toxic levels of concern, three flammable levels of concern, one heat flux level of concern, and three overpressure levels of concern. Modeling was conducted to identify maximum estimated distances to AEGL-2/PAC-2 at 1 hour, AEGL-3/PAC-3 at 1 hour, IDLH, LFL, 50% LFL, 25% LFL, 2.5 kW/m^2, 4.7 kW/m^2, 5 kW/m^2, 1.45 psi, 3 psi, and 4.35 psi. The gas cloud levels of concern were recorded from an elevation of 20 feet and below. This elevation was chosen as a worst-case gas cloud in the event of any unforeseen down drafts and includes the gases found up to approximately twice the height of the enclosure.

[5] https://engage.sandiegocounty.gov/bess-bestpracticestudy
[6] https://ashrae-meteo.info/v2.0/index.php

This was chosen as the hazards of flammable gases extend beyond exposure to the gases themselves, but the hazard of heat flux and overpressure in the event of ignition of the flammable gases.

Air toxics levels of concern were determined as described in section 7. Flammable levels of concern were based upon the lower flammable limit of the combined gas mixture or an individual gas. The gases analyzed were the collective gas mixture results from the UL 9540A cell-level test, carbon monoxide and hydrogen as these were determined to be the most concerning toxic and flammable gas mixture constituents. The heat flux level was based upon the NFPA 59A Table 19.8.4.2.1 threshold for “irreversible harm to persons outdoors without PPE”. Overpressure levels of concern were based on values from *Guidelines for Quantitative Risk Assessment*, “Purple Book”, 2005 that describe probabilities of fatalities from overpressure exposure indoors and outdoors to a vapor cloud explosion.

Table 9.1: Pressure Effects for a Vapor Cloud Explosion

Explosion Overpressure PSI (BARG)	Probability of Death	
	Indoor	Outdoor
> 4.35 (0.3)	100%	100%
> 3 (0.2)	-	50%
> 1.45 (0.1)	2.5%	0%

The offsite consequence analysis was conducted according to EPA’s “Risk Management Program Guidance for Offsite Consequence Analysis”. Plume analysis and exposure impacts were conducted using DNV®’s PHAST™ hazards modeling program. Based on the information from a chemical release, PHAST™ estimates how quickly the chemicals will escape from containment forming a hazardous gas cloud, and how that release rate may change over time. PHAST™ can then model how that hazardous gas cloud will travel downwind, including both neutrally buoyant and heavy gas dispersion.

Additionally, if the chemical release is flammable, PHAST™ can simulate multiple scenarios including pool fires, boiling liquid expanding vapor explosions, vapor cloud explosions, jet fires, and flammable gas clouds (where flash fires might occur). PHAST™ evaluates different types of hazards (depending on the release scenario) including toxicity, flammability, thermal radiation, and overpressure. PHAST™ produces a threat zone estimate, which shows the area where a particular hazard (such as toxicity, flammability, or thermal radiation) is predicted to exceed a specified level of concern at some time after the release begins. PHAST™ is able to determine a threat zone under different weather and wind scenarios.

10 OFFSITE CONSEQUENCE ANALYSIS

The release scenario was modeled using ASHRAE weather data from the McClellan-Palomar weather station located approximately 9 miles away from the Enterprise BESS site. The weather data represents average temperature and wind speed over a 22-year period from 1998-2019.

A toxic release from six (6) battery cells was the basis for the model runs with the potential for release of Carbon Monoxide, Carbon Dioxide, Hydrogen, Methane, Acetylene, Ethane, Ethene (Ethylene), Propane, Propene (Propylene), Butane, Pentane, Hexane, Heptene, Dimethyl carbonate, and Ethyl methyl carbonate. Note that Isobutylene, trans-2-Butene, cis-2-Butene, trans-2-Pentene, cis-2-Pentene, 1,4-Pentadiene, 1-Hexene, 1-Heptene, Dimethyl Carbonate, and Ethyl Methyl Carbonate are not material options within PHAST™. Many of these gases are hydrocarbon isomers and were all modeled as their common form. For example, Isobutylene, trans-2-Butene and cis-2-Butene were all modeled as 1-Butene due to all isomers having a simplified chemical formula of C_4H_8. Dimethyl Carbonate and Ethyl Methyl Carbonate were modeled as Heptane due to their relatively large molecular masses.

Various weather scenarios were modeled based upon local weather data from the McClellan-Palomar weather station located approximately 9 miles from the project site.

Graphical diagrams and data generated in PHAST™ are shown in the sections below. All measurements along the X-axis in the following graphs start at 0, the modeled gas release point.

10.1 Hydrogen

The modeled percentage LFL due to the emission of hydrogen during thermal runaway is shown in the diagrams and figures below. The categories are displayed in PPM based on the following colors in the legend:

- All contours show 25% LFL (10,000 ppm)

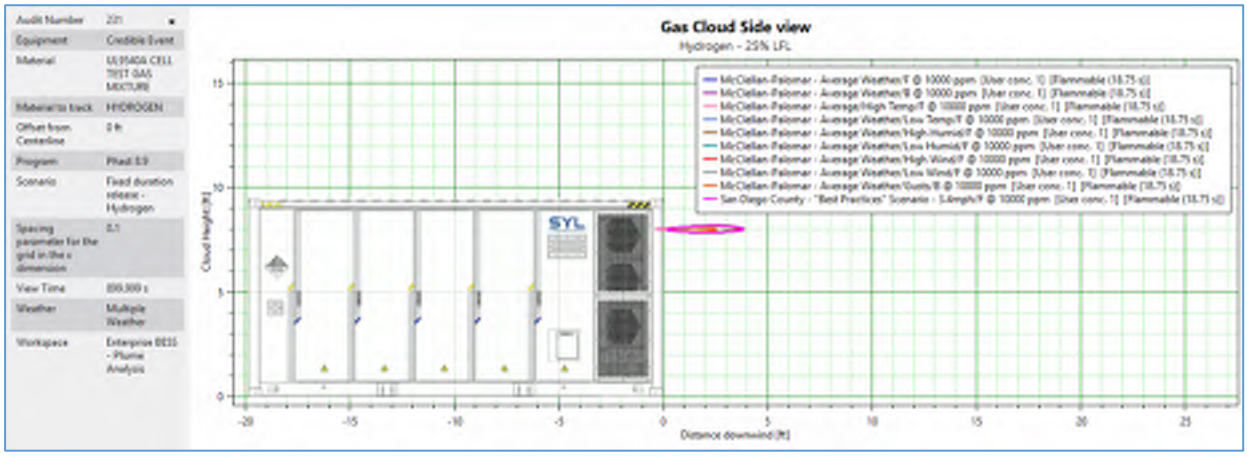

Figure 10.1(a) - Hydrogen - Gas Cloud Side View – 25% LFL with 15-minute vent duration

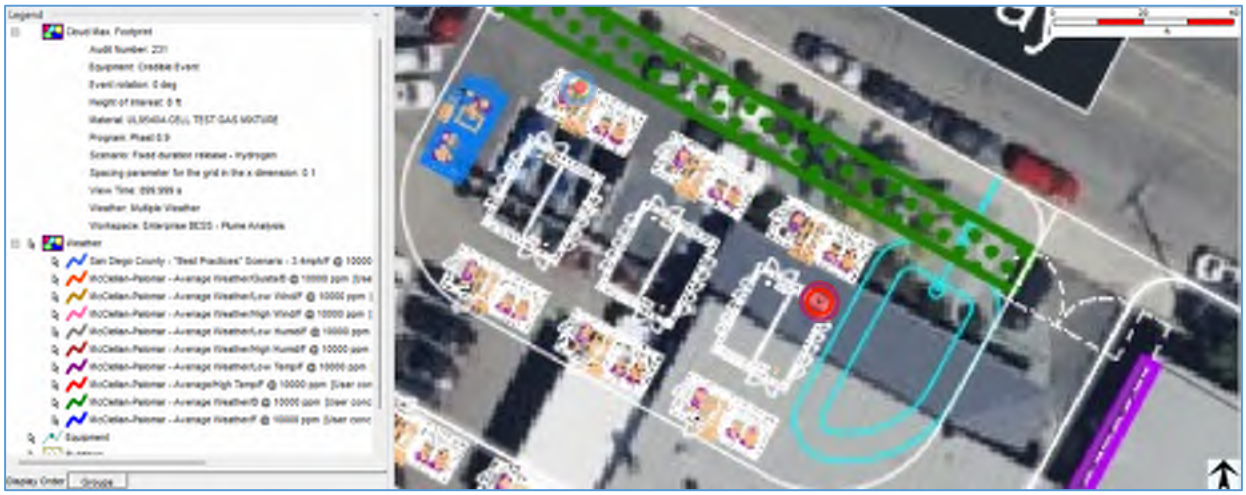

Figure 10.1(b) - Hydrogen - Gas Cloud Cross Section at 8-foot Elevation (Maximum cloud diameter below 20-feet) - LFL Concentration in PPM

10.2 Carbon Monoxide

The modeled carbon monoxide emissions due to emissions during thermal runaway is shown in the diagrams and figures below. The categories are displayed in PPM based on the following colors in the legend:

- All contours show AEGL-2 (1 hour) / PAC-2 levels of 83 ppm

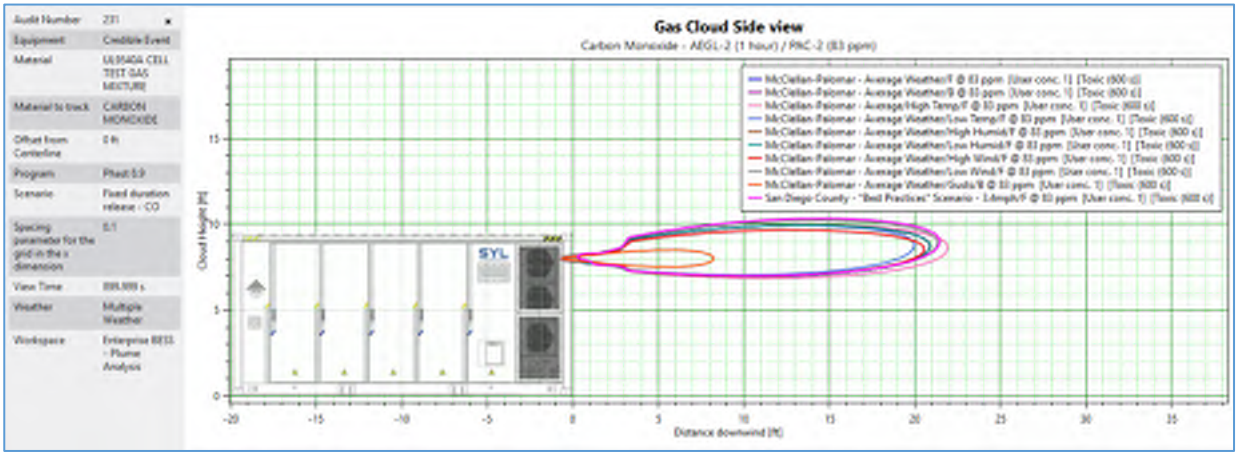

Figure 10.2(a) - Carbon Monoxide - Gas Cloud Side View – Concentration by PPM

Figure 10.2(b) – Carbon Monoxide - Gas Cloud Cross Section at 8-foot Elevation (Greatest extent below 20 feet) - Concentration in PPM

10.3 Hydrocarbons

The modeled hydrocarbons based in the UL 9540A testing due to emissions during thermal runaway is shown in the diagrams and figures below. The categories are displayed in PPM based on the following colors in the legend:

- All contours show 25% LFL (16,362.5 ppm)

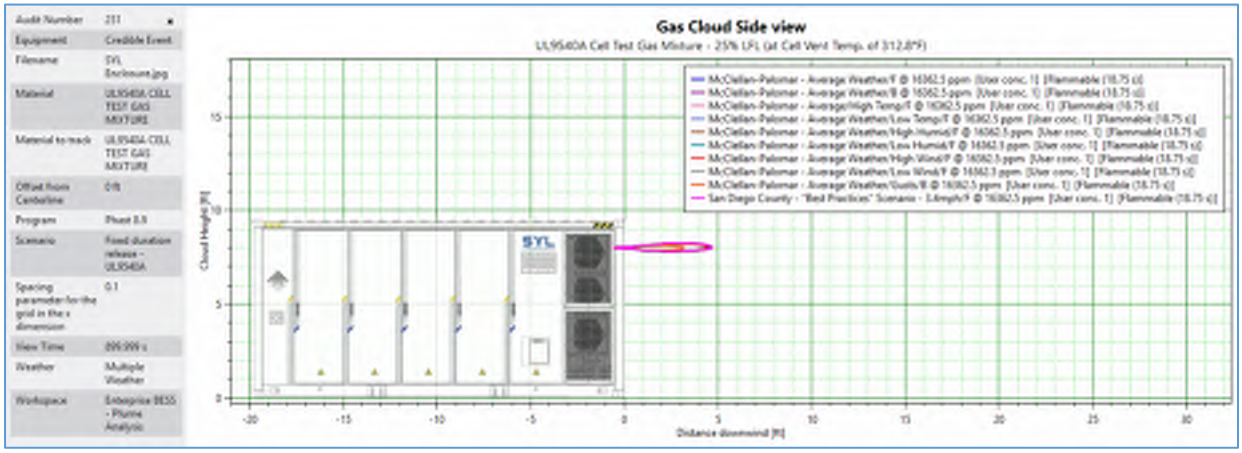

Figure 10.3(a) – UL 9540A Cell-level Hydrocarbon - Gas Cloud Side View Concentration by PPM

Figure 10.3(b) – UL 9540A Cell-level test Hydrocarbons - Gas Cloud Cross Section at 8-foot Elevation (Maximum cloud diameter below 20-feet) - Concentration in PPM

10.4 Radiation and Heat Flux

The modeled heat flux is based on the UL 9540A cell level testing emissions during thermal runaway and is shown in the diagrams and figures below.

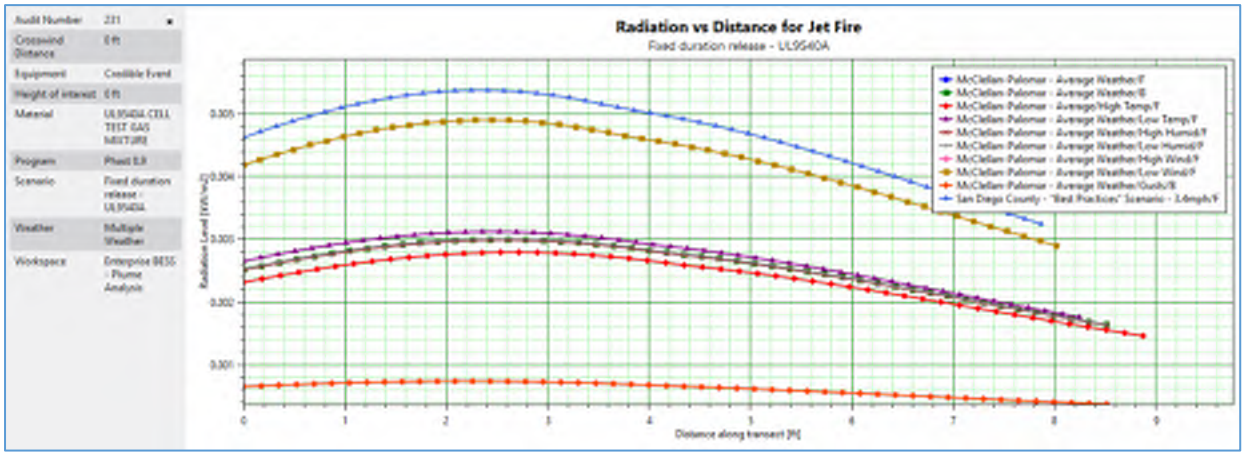

Figure 10.4(a) – UL 9540A Cell-level Test Gas Mixture - Jet Fire Heat Flux by Distance

Note that the model did not produce any contours that reached the 2.5 kW/m^2 threshold.

10.5 Explosion Effects

The modeled pressure effects are based on the UL 9540A cell level testing emissions during thermal runaway (multiplied by 6 for the number of cells in a SYL SU3794U3794KC credible thermal runaway event) and is shown in the diagrams and figures below. The categories are intended to be displayed in pounds per square inch (psi) based on the following colors in the legend:

- All contours show 1.45 psi

The model produced an overpressure event when a late ignition point was manually provided away from the gas release point. The late ignition point was input at 1-ft intervals, producing equivalent overpressure events at the 1-ft, 2-ft, and 3-ft ignition points. At 4-ft, the model failed to produce an overpressure event. The 3-ft ignition point is displayed in the following figures as it is the event that occurs furthest from the gas release point.

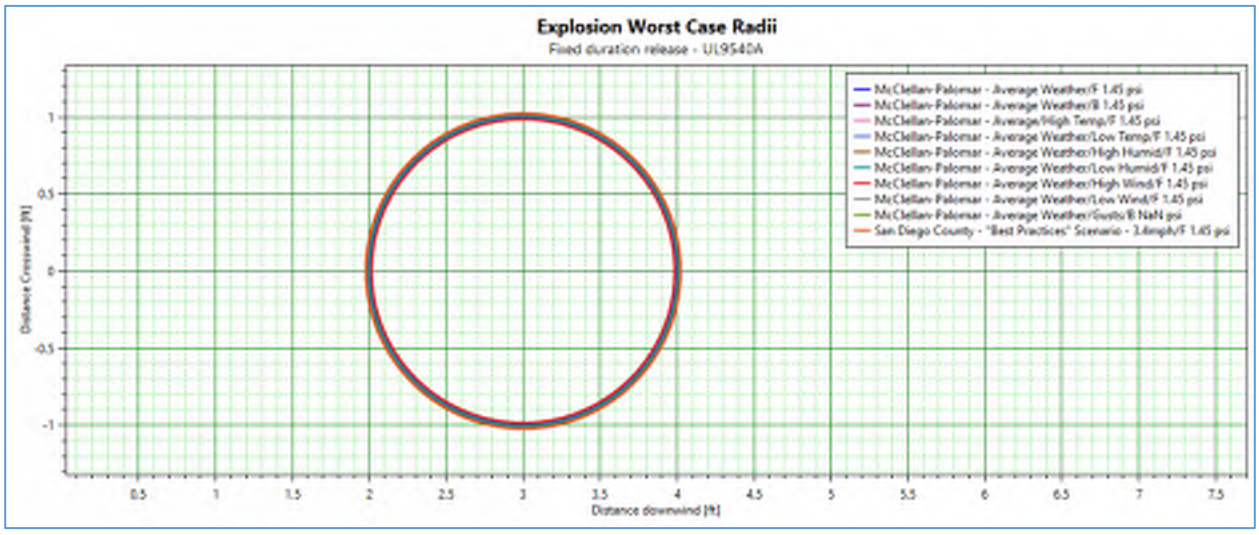

Figure 10.5(a) – UL 9540A Cell-level Test Gas Explosion - Pressure Effects

Figure 10.5(b) – UL 9540A Cell-level Test Gas Explosion – Pressure Effects (Large circles show 1.45 psi, 3 psi, and 4.35 psi effect zone contours. Small circles show overpressure event 3-ft offset from gas release point)

10.6 PHAST™ Analysis Effects Summary Table

Table 10.6: PHAST™ Analysis Results Table

#	Scenario	Gas Type	Release Type	Endpoint - Extent of Hazard at 20 ft Above Grade (ft)							
				100% LFL	50% LFL	25% LFL	IDLH	AEGL-3	AEGL-2	Heat Flux (2.5 kW/m²)	Over-pressure (1.45 psi)
1	Failure of 6 cells within SYL SU3794-U3794KC (15 Minutes)	UL 9540A Cell Test Gas Composition	Flammable	**2 ft**	**4 ft**	**5 ft**	N/A	N/A	N/A	**N/A**	**4 ft**
2		Hydrogen (H_2)	Flammable	**2 ft**	**3 ft**	**4 ft**	N/A	N/A	N/A	**N/A**	**4 ft**
3		Carbon Monoxide (CO)	Toxic	N/A	N/A	N/A	**7 ft**	**12 ft**	**22 ft**	N/A	N/A

The modeling analysis results are as follows:

- The maximum toxic endpoint distance of Carbon Monoxide's AEGL-2 / PAC-2 value would be 22 feet.
- The maximum distance to the flammable endpoint at 25% LFL would be 5 feet, based on the UL 9540A gas mixture.
- There is no heat flux endpoint distance as a heat flux of 2.5 kW/m² is never reached.
- An overpressure event did not develop within the model and a distance to the overpressure endpoint of 1.45 psi was never reached.

The results of the consequence analysis show that the maximum distance of these levels of concern is 22 feet based on Carbon Monoxide. The nearest receptor (ESS enclosure to site fence) is located approximately 32 feet away.

Below is an image with a hazard extent distance of 22 feet overlaid onto the site layout.

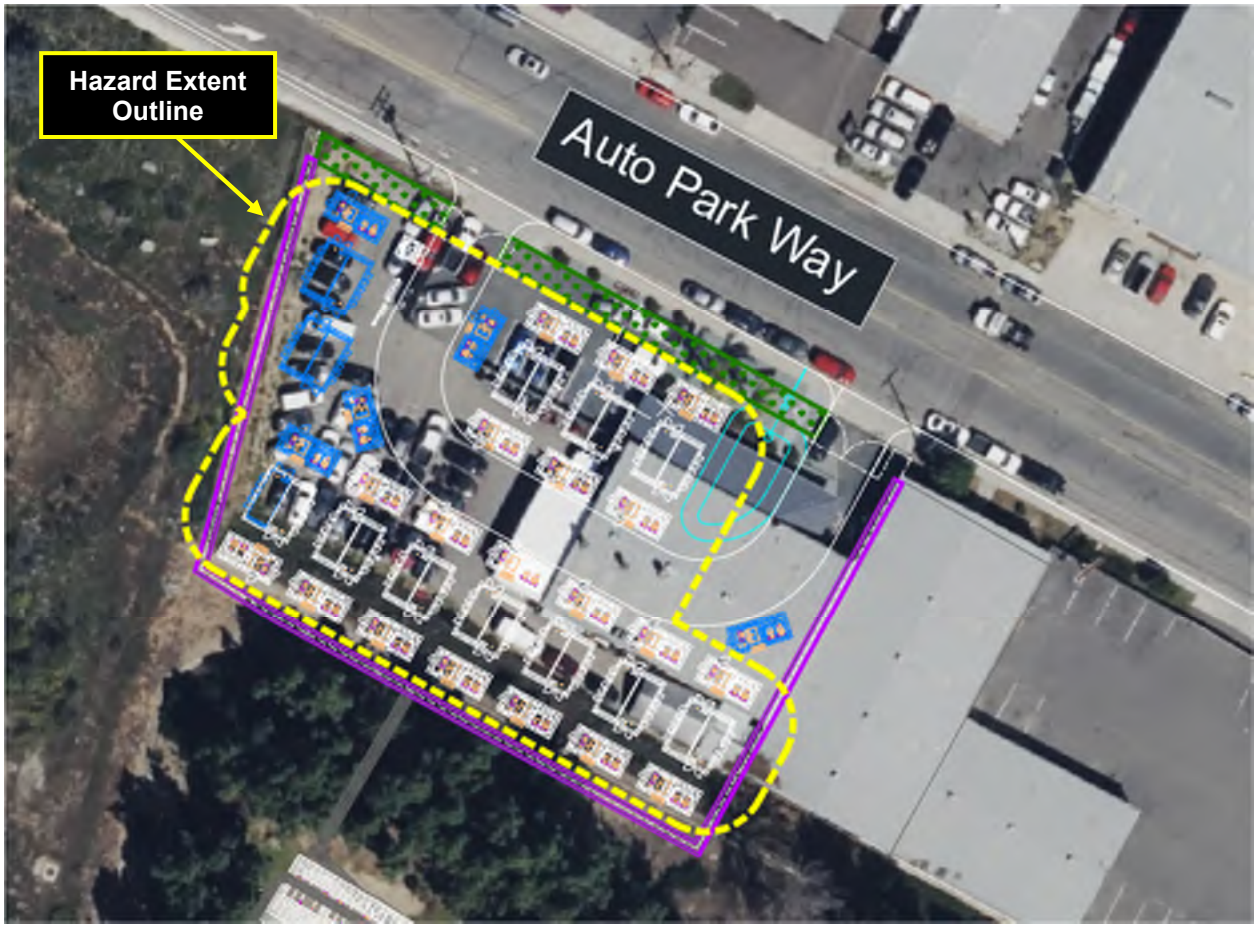

Figure 10.6 – Hazards Extent Overlay in yellow (North ↑)

11 SUMMARY

Coffman has provided this HCA for the Enterprise BESS site. The report was prepared based on modeling used the planned ESS enclosures and batteries planned to be implemented at the site, as well as the correct number of modules and potential toxins during a credible event. Modeling was accomplished with PHAST™ software, based on the information provided in the UL 9540A test reports, to identify and describe safety measures and fire risk mitigation measures, identify distance from the project site to the nearest sensitive receptors, and identify and characterize the quantities and locations of hazardous chemicals that could be released during a thermal runaway and/or fire event.

12 MAIN STUDY ASSUMPTIONS/REFERENCE MATERIAL

1. UL 9540A Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, December 9, 2019.
2. DNV GL, Considerations for ESS Fire Safety, February 9, 2017, https://www.nyserda.ny.gov/-/media/Project/Nyserda/files/Publications/Research/Energy-Storage/20170118-ConEd-NYSERDA-Battery-Testing-Report.pdf
3. National Fire Protection Association, Hazard Assessment of Lithium Ion Battery Energy Storage Systems, February 26, 2016, https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Hazardous-materials/RFFireHazardAssessmentLithiumIonBattery.ashx
4. Office of Response and Restoration, Public Exposure Guidelines, July 25, 2016, https://response.restoration.noaa.gov/oil-and-chemical-spills/chemical-spills/resources/public-exposure-guidelines.html
5. EPA, Risk Management Guidance for Offsite Consequence Analysis, March 2009, https://www.epa.gov/rmp/rmp-guidance-offsite-consequence-analysis
6. Guidelines for Quantitative Risk Assessment, “Purple Book”, 2005, International Atomic Energy Agency.

APPENDICES

Appendix A

CATL CBDC0 UL 9540A CELL LEVEL TEST RESULT

CELL TEST REPORT
UL 9540A
Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (AACD)

Project Number.....:	**4790838636.1**
Date of issue.....:	**2023.09.07 Amendment No.1: 2023.12.11**
Total number of pages.....:	**51**
UL Report Office .....:	**UL(Changzhou) Quality Technical Service Co., LTD**
Applicant's name.....:	**Contemporary Amperex Technology Co., Limited**
Address .....:	No 2 Xingang Road Zhangwan Town Jiaocheng District NingdeFujian 352100 China
Test specification:	4th Edition, Section 7, November 12, 2019
Standard.....:	UL 9540A, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
Test procedure .....:	7.1, 7.2, 7.3.1, 7.4, 7.6.1, 7.7
Non-standard test method .....:	N/A

General disclaimer:

The test results presented in this report relate only to the sample tested in the test configuration noted on the list of the attachments.

UL LLC did not select the sample(s), determine whether the sample(s) was representative of production samples, witness the production of the test sample(s), nor were we provided with information relative to the formulation or identification of component materials used in the test sample(s).

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Cell level information	
Model No .....:	CBDC0
Ratings (Vdc, Ah) .....:	3.2V, 285Ah
Chemistry of test item……:	Lithium Iron Phosphate
Original Equipment Manufacturer (OEM):	Contemporary Amperex Technology Co., Limited
Branding Manufacturer (if not OEM):	N/A
Was the cell certified? ……:	Yes
Standard test item certified to ……..:	UL 1973
Organization that certified test item …….:	MH62898
Average cell surface temperature at gas venting, °C:	156
Average surface temperature at thermal runaway, °C:	232
Gas Volume-:	211.7L
Lower flammability limit (LFL), % volume in air at the ambient temperature	7.45
Lower flammability limit (LFL), % volume in air at the venting temperature	6.545
Burning velocity (S_u) cm/s:	62.44
Maximum pressure (P_{max}) psig:	96.79

Cell Gas composition

Gas		Measured %
Carbon Monoxide	CO	13.453
Carbon Dioxide	CO_2	27.205
Hydrogen	H_2	41.313
Methane	CH_4	7.403
Acetylene	C_2H_2	0.101
Ethylene	C_2H_4	4.408
Ethane	C_2H_6	1.235
Propylene	C_3H_6	1.297
Propane	C_3H_8	0.734
-	C4 (Total)	1.296
-	C5 (Total)	0.335
-	C6 (Total)	0.147
1-Heptene	C7H14	0.025
Styrene	C8H8	0.013
Benzene	C_6H_6	0.049
Toluene	C_7H_8	0.013
Dimethyl Carbonate	$C_3H_6O_3$	0.917
Ethyl Methyl Carbonate	$C_4H_8O_3$	0.055
Total	-	100

Cell failure test method performed (summary of method and test clause):

☒ External heating using thin film with 4°C to 7°C thermal ramp.

☐ Nail Penetration

☐ Overcharge

☐ External short circuit (***X*** Ω *external resistance*)

☐ Flow Battery with 2 active electrolyte methods

☐ Flow Battery with 1 active electrolyte methods

☐ Others

Description of method used to fail cells if other than external thin film heater with thermal ramp, : N/A

Summary of testing:

Performance Criteria in accordance with Clause 7.7 and Figure 1.1:

[ ] Thermal runaway was not induced in the cell; and

[ ] The cell vent gas did not present a flammability hazard when mixed with any volume of air, as determined in accordance with ASTM E918 at both ambient and vent temperatures.

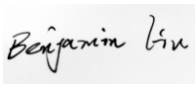
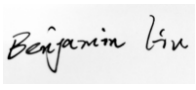
Necessity for a module level test

[X] The performance criteria of the cell level test as indicated in 7.7 of UL 9540A 4th edition has not been met, therefore a module level testing in accordance with UL 9540A will need to be conducted on a complete module employing this cell.

[ ] The performance criteria of the module level tests as indicated in 7.7 of UL 9540A 4th edition has been met, therefore a module level testing in accordance with UL 9540A need not be conducted.

Testing Laboratory information

Testing Laboratory and testing location(s):

Testing Laboratory:	UL(Changzhou) Quality Technical Service Co., LTD	
Testing location/ address ..... :	21 Longmen Rd, National High-Tech Industrial Development District, Wujin, Changzhou, Jiangsu, China	
Tested by (name, signature)..... :	Zhang Wei /Vic Zhang	
Witnessed by (for 3rd Party Lab Test Location) (name, signature) ..... :	N/A	N/A
Project Handler (name, signature)..... :	Arui Zhou	
Reviewer (name, signature) ……:	Benjamin Liu	
Amendment 1 Project Handler (name, signature) ..... :	Arui Zhou	
Amendment 1 Reviewer (name, signature) ……:	Benjamin Liu	

Gas Analysis Testing Laboratory :	UL(Changzhou) Quality Technical Service Co., LTD
Testing location/ address ..... :	21 Longmen Rd, National High-Tech Industrial Development District, Wujin, Changzhou, Jiangsu, China
Project Handler (name, signature)..... :	Arui Zhou
Reviewer (name, signature) ……..:	Albert He

List of Attachments (including a total number of pages in each attachment):

Attachment A: Cell Conditioning (Charge/discharge) Profiles - (*Pages **18** through **20***)

Attachment B: Cell Instrumentation Photos - (*Pages **21** through **21***)

Attachment C: Cell Temperature Profiles during testing - (*Pages **22** through **24***)

Attachment D: Cell Testing Photos - (*Pages **25** through **34***)

Attachment E: Cell vent gas test chamber photo and profile of chamber gas analysis (O_2 and Pressure) – (*Pages **35** through **35***)

Attachment F: Cell Gas Analysis Report - (*Pages **36** through **36***)

Attachment G-1~G4 for Amendment 1 report

Attachment G-1: Cell Conditioning (Charge/discharge) Profiles - (*Pages **39** through **40***)

Attachment G-2: Cell Instrumentation Photos - (*Pages **41** through **41***)

Attachment G-3: Cell Temperature Profiles during testing - (*Pages **42** through **43***)

Attachment G-4: Cell Testing Photos - (*Pages **44** through **51***)

Photo of cell/Stack:	
	
Figure 0-1	**Figure 0-2**

Test Item Charge/Discharge Specifications:	
• **Charge current, A:**	285
• **Charge Power, W**	912
• **Standard full charge voltage, Vdc:**	3.65
• **Charge temperature range, °C:**	0~60
• **End of charge voltage, V:**	3.65
• **Discharge current, A:**	285
• **Discharge Power, W**	912
• **End of discharge voltage, Vdc:**	2.5
• **Discharge temperature range, °C:**	-20~60

Test item particulars:	
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement .....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
- test object was completed per the requirement...:	C(Complete)
- test object was completed with modification……:	M(Modification)
Testing.....:	CBDC0
Date of receipt of test item .....:	2023-04-28, 2023-10-10
Date (s) of performance of tests.....:	2023-05-10~2023-05-13, 2023-10-20~2023-10-29

General remarks:
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a point is used as the decimal separator.**

Manufacturer's Declaration of samples submitted for test:	
The applicant for this report includes samples from more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided.....:	☒ **Yes** ☐ **Not applicable**
Name and address of factory (ies) ..... :	Factory_1: Guangdong Ruiqing Contemporary Amperex Technology Limited Factory_1 address: No.1 Shidai Street,High-tech Industrial Development Zone, Zhaoqing City，Guangdong Province Factory_2: Jiangxi Yichun Contemporary Amperex Technology Limited Factory_2 address: No. 1, Chunfeng Road, Yichun Economic and Technological Development Zone, Jiangxi Province Factory_3: Fuding Contemporary Amperex Technology Limited Factory_3 address: No. 1, Shidai Road, Xueqiao Village, Qianqi Town, Fuding City, 355200 Ningde City, Fujian Province, PEOPLE'S REPUBLIC OF CHINA

General product information and other remarks:

The tested cell is a Lithium-ion battery cell, Model CBDC0. Each cell has a capacity of 285 Ah and nominal voltage 3.2 Vdc.

The weight of cell is 5400g±300g.

The test samples were produced in Factory 1.

The test samples are figure 0-1 and figure 0-2.

Amendment 1 report:

The overall dimensions of cell were corrected from 71.6±0.8mm(Width) by 174.7±0.8mm(Length) by 207.3±0.8mm(Height) to the 71.55±0.8mm (depth) by 174.3±0.8 mm(width) by 207.3±0.8 mm(height).

The customer has changed the design of the top cover of the cell, figures 0-1 and 0-2 are the original design of the cell, 0-3 and 0-4 are the new designs.

Attachment G-1~G-4 is the supplementary test after the design change of the cell.

According to customer analysis, the above differences do not affect the test results.

UL 9540A, Edition 4,			
Clause	Requirement + Test	Result - Remark	Verdict

5.0	**CONSTRUCTION**		**Verdict**
5.1. 5.4	**Cell/Stack Construction**		—
5.1.1, 5.4.1	Generic Chemistry:	Lithium iron phosphate	—
	Electrolyte Chemistry:	LiPF6 with additives	—
	Flow Battery Electrolyte No. 1 Chemistry:	Not flow battery	—
	Max volume of system electrolyte No. 1, L:	Not flow battery	—
	Flow Battery Electrolyte No. 2 Chemistry:	Not flow battery	—
	Max volume of system electrolyte No. 2, L:	Not flow battery	—
	Separator Melt Temperature, °C:	Not used during test	—
	Format: Cylindrical /Prismatic /Pouch Flow Battery Stack	Prismatic	—
	Overall Dimensions, mm	174.3±0.8mm (depth) by 71.55±0.8mm (width) by 207.3±0.8mm (height)	—
	Cell Weight, g	5400±300g	—
5.1.2	Cell Certification:	Yes	—
	Standard Used for Cell Certification:	UL 1973	—
	Organization that Certified Cell:	MH62898	—
5.1.1, 5.4.1	Cell/Stack Ratings: • Nominal Voltage, Vdc •Nominal Capacity, Ah	3.2 285	— —
5.4.1	Flow Battery: No. of Cells per Stack:	Not flow battery	—
	Flow battery system manufacturer:	Not flow battery	—
	Flow battery system model:	Not flow battery	—
	Flow battery system ratings, Vdc, Ah:	Not flow battery	—
5.4.2	Flow battery system certified to UL 1973:	Not flow battery	—
	Organization that certified flow battery system:	Not flow battery	—
6.0	**PERFORMANCE**		**Verdict**
6.1	**General**		C
7.2	**Samples**		C

UL 9540A, Edition 4,			
Clause	Requirement + Test	Result - Remark	Verdict
7.2.1	Samples conditioned through charge discharge cycling a minimum of 2 cycles.	See Attachment A and Attachment G1 for profiles See Table 1 and Table G0-1 for specifications See also Table 2 and Table G0-2	C
7.2.2	100% SOC and stabilize from 1h to 8 h before testing		
7.2.3	Pouch Cells constrained per end use during testing.		N/A
7.3	**Determination of thermal runaway methodology**		C
7.3.1	**General**		C
7.3.1.1	Ambient indoor laboratory conditions: 25 ±5°C (77 ±9°F) ≤50 ±25% RH at the initiation of the test.	See Attachment C and Attachment G3 See Table 3 and Table G0-3	C
7.3.1.2	Heat the cell to thermal runaway by externally applied flexible film heaters	See Attachment B and Attachment G2	C
	Heater Dimension	Two heaters 152.4mm by 203.2 mm in size for each sample. Each side of the cells was instrumented with the heater	
	A surface heating rate of 4° C (7.2° F) to 7° C (12.6° F) per minute was applied to the cell.	See Attachment C, D, G1, G4 See Table 4 and Table G0-4	C
	Maximum surface end point temperature, °C	Not used, the cells are heated until the thermal runaway achieved According to the Certification Requirement Decision: Test Method for Evaluating Thermal Runaway Fire Propagation in Battery. Holding temperature was not utilized during the test and the cell was continuously heated until thermal runaway occurred	

UL 9540A, Edition 4,			
Clause	Requirement + Test	Result - Remark	Verdict
	The following method(s) was employed to cause thermal runaway: ☐ Mechanical (e.g. nail penetration); ☐ Electrical stress in the form of overcharging, ☐ Electrical stress in the form of over discharging ☐ Electrical stress in the form of external short-circuiting ☐ Use of alternate heating sources (e.g. oven). ☐ Other (explain)	Only external heating in the form of using flexible thin film heaters to cause thermal runaway	N/A
7.3.1.3	Detail of test method when using another cell abuse method to initiate thermal runaway	See Attachment E	N/A
7.3.1.4	Monobloc batteries such as a lead acid battery		N/A
7.3.1.5	Estimated surface temperature at which internal short circuiting within the cell will occur that could lead to a thermal runaway condition.	Not used, the cells are heated until the thermal runaway achieved According to the Certification Requirement Decision: Test Method for Evaluating Thermal Runaway Fire Propagation in Battery. Holding temperature was not utilized during the test and the cell was continuously heated until thermal runaway occurred	N/A
7.3.1.6	The cell was heated until thermal runaway has occurred.	Refer to Attachment C and Attachment G3	C
	Another external heating method was used to cause cell thermal runaway		N/A
7.3.1.7	The cell's exterior surface temperature was measured	See Attachment B and Attachment G2	C
7.3.1.8	The temperature at which the cell case vents due to internal pressure rise was documented.	See Table 4 and Table G0-4 See Attachment C, D, G3,G4	C
7.3.1.9	The temperature at the onset of thermal runaway was documented.	See Table 4 and Table G0-4 See Attachment C, D, G3, G4	C
	If cell venting occurs first, the cell was heated continuously until thermal runaway occurs.	See Attachment C and Attachment G3	C

UL 9540A, Edition 4,			
Clause	Requirement + Test	Result - Remark	Verdict
7.3.1.10	When using methods other than the heater method, the stresses were applied to the cell until thermal runaway occurs.		N/A
7.3.1.11	3 additional samples were tested using the same method and exhibited thermal runaway	See Table 3, 4 5, G0-3, G0-4 and G0-5 See Attachment C, D, G3, G4	C
7.4	**Cell vent gas composition test**		C
7.4.1	Cell vent gas was generated and captured by forcing a cell into thermal runaway with the methodology developed in 7.3, inside a pressure vessel	Size of pressure vessel used: 100L Refer to Attachment E	C
	The test was initiated with an initial condition of atmospheric pressure and less than 1% oxygen by volume.	Refer to Attachment E Atmospheric pressure (psig):0.17	C
		Oxygen concentration measured (% volume):0.17	
		Inert gas used: Nitrogen	
7.4.2	Cell vent gas composition was determined using Gas Chromatography (GC)	Refer to Table 8 Refer to Attachment F	C
	Hydrogen gas was measured	Refer to Table 8	C
	The initial atmospheric conditions prior to testing were noted.	Refer to Table 3 Refer to attachment C and F	C
7.4.3	The lower flammability limit of the cell vent gas was determined on samples of the synthetically replicated gas mixture in accordance with ASTM E918, testing at both ambient and cell vent temperatures.	Refer to Table 9 and 10	C
7.4.4	The gas burning velocity of the synthetically replicated cell vent gas was determined in accordance with the Method of Test for Burning Velocity Measurement of Flammable Gases Annex in ISO 817.	Refer to Table 9 and 10	C
7.4.5	P_{max} of the synthetically replicated cell vent gas was determined in accordance with EN 15967.	Refer to Table 9 and 10	C
7.6	**Cell Level Test Report Information**		C

UL 9540A, Edition 4,			
Clause	Requirement + Test	Result - Remark	Verdict
7.6.1	Minimum information provided in the report for items a) through m)		C
7.6.2	Minimum information of items a) through k) was provided in the report for flow battery		N/A
7.7	**Performance – cell level test**		C
7.7.1	a) Thermal runaway cannot be induced in the cell; and	Thermal runaway can be induced in the cell with external heater during the test	F
	b) The cell vent gas does not present a flammability hazard when mixed with any volume of air, at both ambient and vent temperatures.	As a result of gas analysis, the gas generated from the cell were identified flammable	F

Note: Table G0-1~G0-5 and Attachment G-1~G4 for amendment 1, Table 1~5 and Attachment A~F for original report.

UL 9540A, Edition 4,			
Clause	Requirement + Test	Result - Remark	Verdict

Table 1 – Specified conditioning parameters			
Charging:		Discharging	
Current, A	285	Current, A	285
Power (CP), W	912	Power (CP), W	912
Standard full charge voltage, Vdc	3.65	Voltage at start of discharge, Vdc	3.65
End of charge voltage, Vdc	3.65	End of discharge voltage, Vdc	2.5
Charging Test Ambient, °C	0~60	Discharging Test Ambient, °C	-20~60
Refer to Attachment A for charge/discharge profiles for each cell.			

Note: The charge and discharge cycle of the cell is carried out in accordance with 912W constant power.

Table 2 – Charge completion and cell test initiation times		
Cell Test Number	**Charge Completion Date and Time**	**Cell test Date and Time**
1	2023-05-18 08:43	2023-05-18 11:10
2	2023-05-18 12:14	2023-05-18 19:35
3	2023-05-19 06:04	2023-05-19 10:39
4	2023-05-20 12:00	2023-05-20 16:02
5	2023-05-25 10:38	2023-05-25 18:08

Table 3 - Test Initiation Details					
	Cell Test 1	**Cell Test 2**	**Cell Test 3**	**Cell Test 4**	**Cell Test 5**
Test Date	2023-05-18	2023-05-18	2023-05-19	2023-05-20	2023-05-25
Test Start Time	11:10	19:35	10:39	16:02	18:08
Initial Lab Temperature	25.9°C	25.9°C	24.4°C	25.0°C	24.6°C
Initial Relative Humidity	70.9%RH	70.9%RH	71.5%RH	61.9%RH	56.3%RH

Table 4 - Thermal Runaway Results					
	Cell Test 1	**Cell Test 2**	**Cell Test 3**	**Cell Test 4**	**Cell Test 5**
OCV at start of test, Vdc	3.355	3.349	3.351	3.340	3.340
Average Heating Rate, °C/min	4.5	4.5	4.6	4.5	4.5
Venting Time after the test start (hh:mm:ss)	0:34:44	0:35:14	0:35:00	0:35:46	0:35:54
Venting Temperature, °C	157	156	154	158	163
Thermal Runaway Time after the test start (hh:mm:ss)	0:54:20	0:54:06	0:54:22	0:55:04	0:53:11
Thermal Runaway Temperature, °C	231	227	233	237	229
Refer to Attachment C for surface temperature profiles during testing					

UL 9540A, Edition 4,			
Clause	Requirement + Test	Result - Remark	Verdict

Table 5 – Average Vent and Thermal Runaway Temperatures	
Average of Cell Vent Temperatures, °C	156
Average of Cell Thermal Runaway Temperatures, °C	232
#Averages of cell tests other than the gas analysis test	

Table 6 – Parameters Flow Battery
N/A

Table 7 – Results of Flammability Testing of Flow Battery Electrolyte
N/A

Table 8 – Results of Gas Analysis (Excluding O_2 and N_2)			
Gas		**Measured %**	**Component LFL[1]**
Carbon Monoxide	CO	13.453	10.9
Carbon Dioxide	CO_2	27.205	N/A
Hydrogen	H_2	41.313	4.0
Methane	CH_4	7.403	4.4
Acetylene	C_2H_2	0.101	2.3
Ethylene	C_2H_4	4.408	2.4
Ethane	C_2H_6	1.235	2.4
Propylene	C_3H_6	1.297	1.8
Propane	C_3H_8	0.734	1.7
-	C4 (Total)	1.296	N/A
-	C5 (Total)	0.335	N/A
-	C6 (Total)	0.147	N/A
1-Heptene	C7H14	0.025	N/A
Styrene	C8H8	0.013	1.1
Benzene	C_6H_6	0.049	1.2
Toluene	C_7H_8	0.013	1.0
Dimethyl Carbonate	$C_3H_6O_3$	0.917	N/A
Ethyl Methyl Carbonate	$C_4H_8O_3$	0.055	N/A
Total	-	100	-

[1] Extracted LFL values from ISO 10156-2017

UL 9540A, Edition 4,			
Clause	Requirement + Test	Result - Remark	Verdict

Table 9 – Gas composition excluding the constituents with boiling points higher than 60°C[2]			
Gas		**Measured %**	**Component LFL**
Carbon Monoxide	CO	13.619	10.9
Carbon Dioxide	CO_2	27.541	N/A
Hydrogen	H_2	41.823	4.0
Methane	CH_4	7.494	4.4
Acetylene	C_2H_2	0.102	2.3
Ethylene	C_2H_4	4.463	2.4
Ethane	C_2H_6	1.251	2.4
Propylene	C_3H_6	1.313	1.8
Propane	C_3H_8	0.743	1.7
Propadiene	C_3H_4	0.000	1.9
-	C_4 (Total)	1.312	N/A
-	C_5 (Total)	0.339	N/A
Total	-	100	-

[2] The constituents with a higher boiling point were excluded for the flammability characteristic analysis as these components will turn into a liquid state at room temperature and will not release from the gas bottle as a homogenous mixture.

UL 9540A, Edition 4,			
Clause	Requirement + Test	Result - Remark	Verdict

Table 10 – Properties of Vent Gas Analysis	
Lower Flammability limit at Ambient Temperature, 25°C (% vol in air)	7.45
Lower Flammability limit at Vent Temperature, [156°C] (% vol in air)	6.545
Burning Velocity Measurement, S_u cm/sec	62.44
Maximum Pressure P_{max}, psig	96.79

UL 9540A, Edition 4,			
Clause	Requirement + Test	Result - Remark	Verdict

	TABLE: Critical components information				
Object / part No.	**Manufacturer/ trademark**	**Type / model**	**Technical data**	**Standard**	**Mark(s) of conformity**
Cell Model	Contemporary Amperex Technology Co.,Limited	CBDC0	Nominal voltage：3.2V Rated capacity：285Ah	UL 1973	MH62898
Separator	Contemporary Amperex Technology Co.,Limited	SBM	Material: PE Size: LxWxT;(30542-36690mm) * (176-214mm) * (0.008-0.018mm) Separator melting temperature: 140±5°C	—	—
Electrolyte	Contemporary Amperex Technology Co.,Limited	ESN	Composition: LiPF6, DMC, EMC, EC, PC, DEC;	—	—
Case	Contemporary Amperex Technology Co.,Limited	PPA	Material: Al 3003 Minimum thickness: 0.6-0.7mm	—	—
Insulators/ location in cell	Contemporary Amperex Technology Co.,Limited	PTA PAP	Up-Plate Material: PP Down-Plate Material: PP	—	—
Vent	Contemporary Amperex Technology Co.,Limited	PTA	Size: (25.3-30.3) mm *(13.7-16.7) mm Pressure: 0.4Mpa~1.2Mpa	—	—

Attachment A: Cell Conditioning (Charge/discharge) Profiles - (*Pages **18** through **19***)
Note: The charge and discharge cycle of the cell is carried out in accordance with 912W constant power.

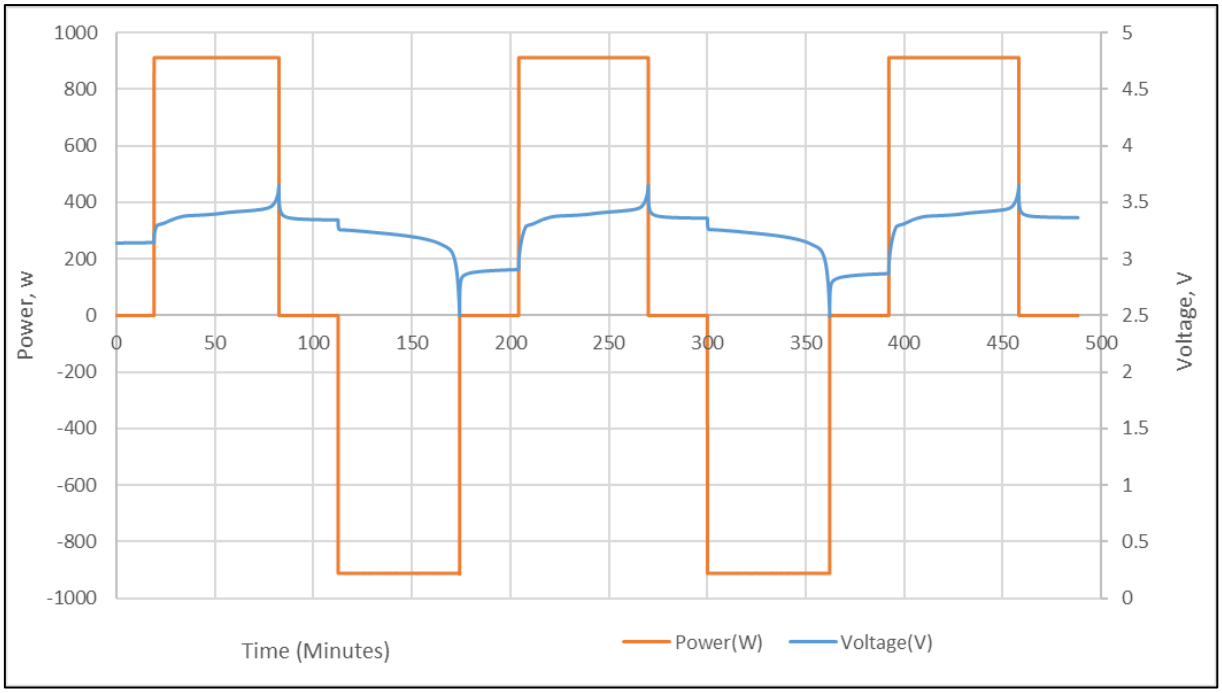


Figure 1: Cell 1 Conditioning (Charge/discharge) Profiles

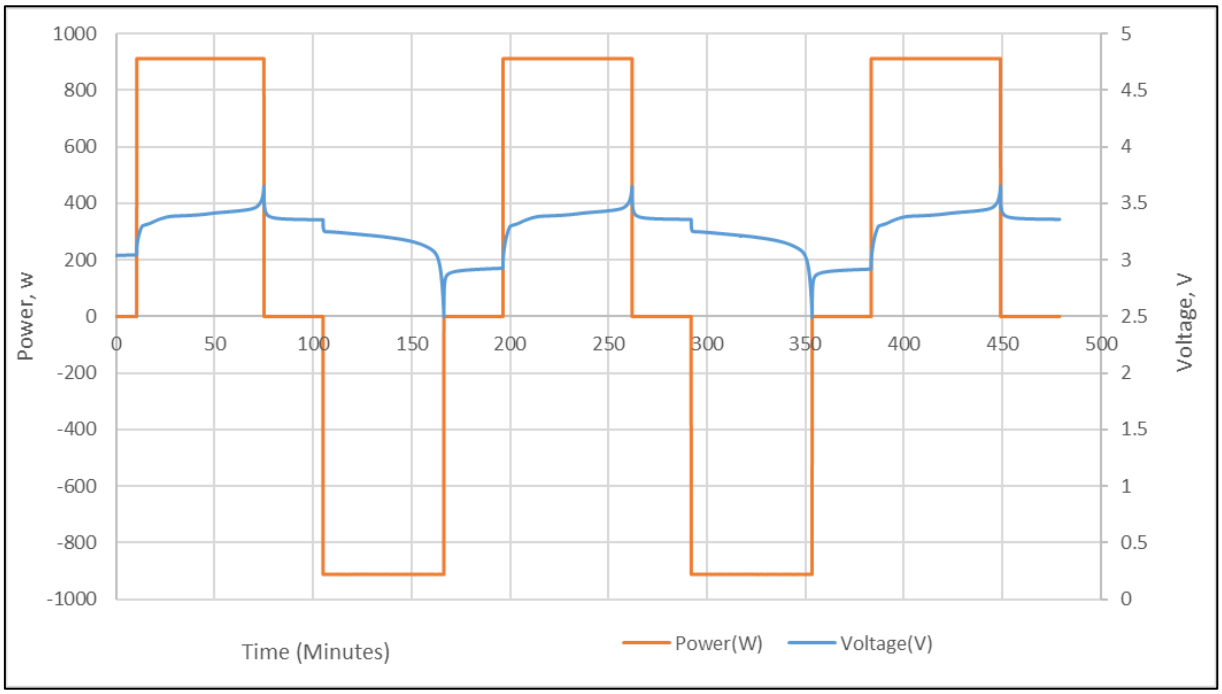


Figure 2: Cell 2 Conditioning (Charge/discharge) Profiles

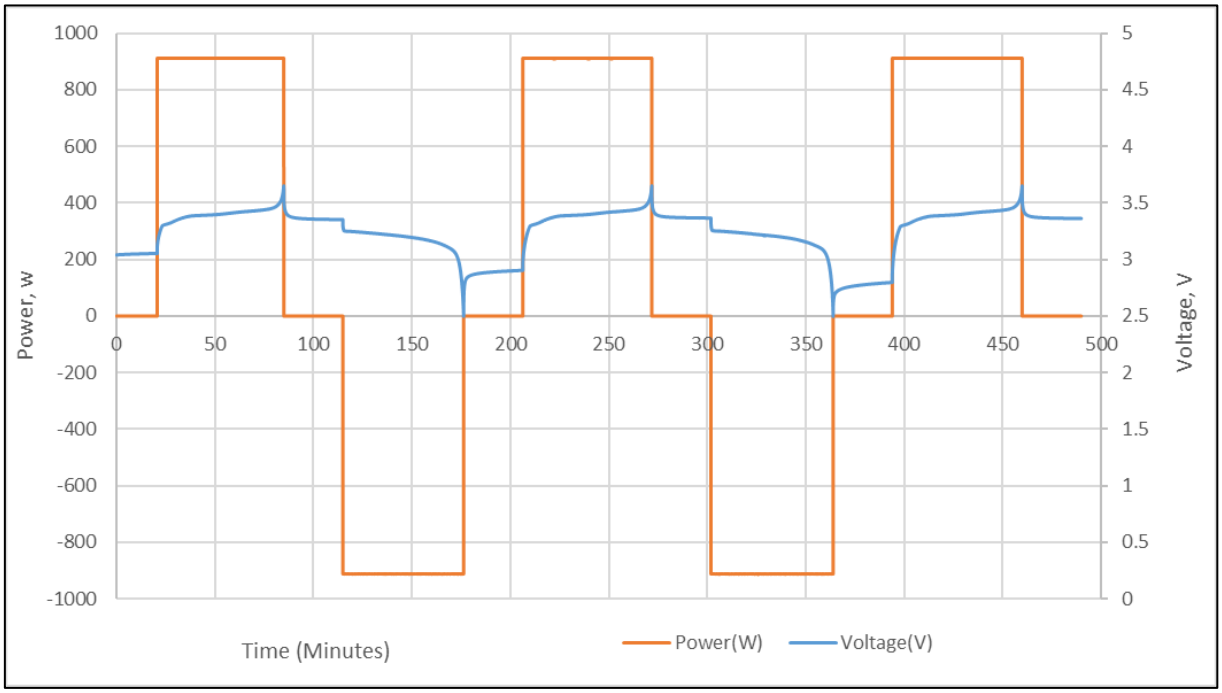


Figure 3: Cell 3 Conditioning (Charge/discharge) Profiles

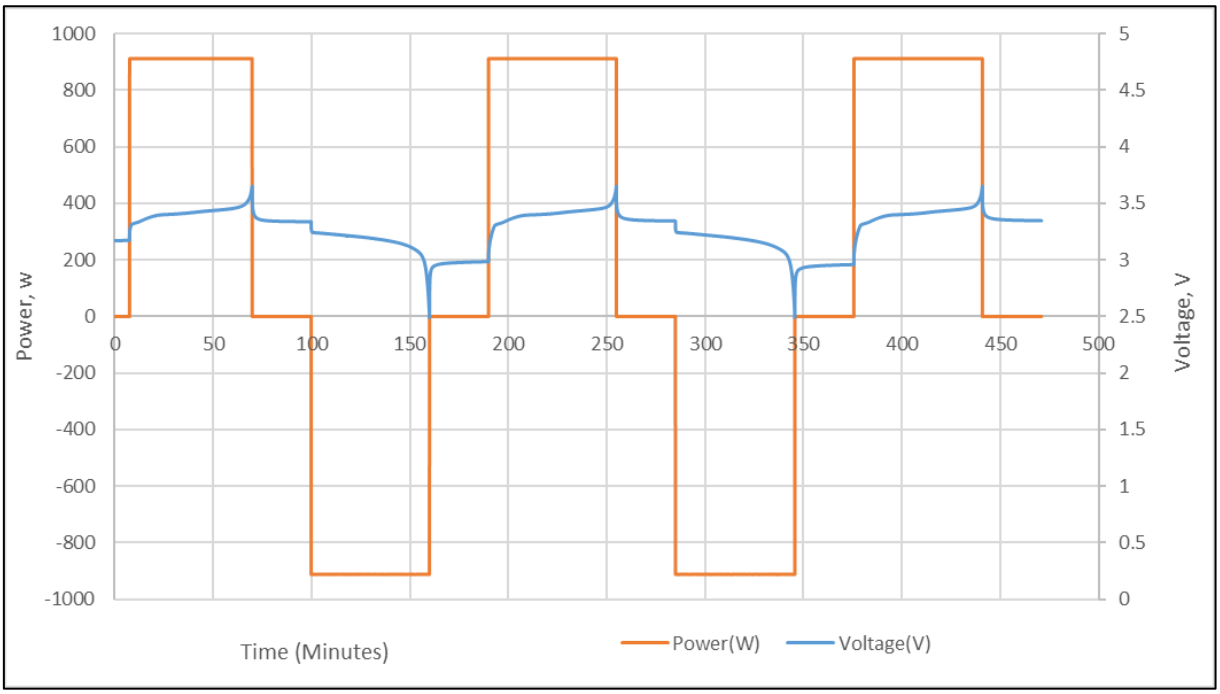


Figure 4: Cell 4 Conditioning (Charge/discharge) Profiles

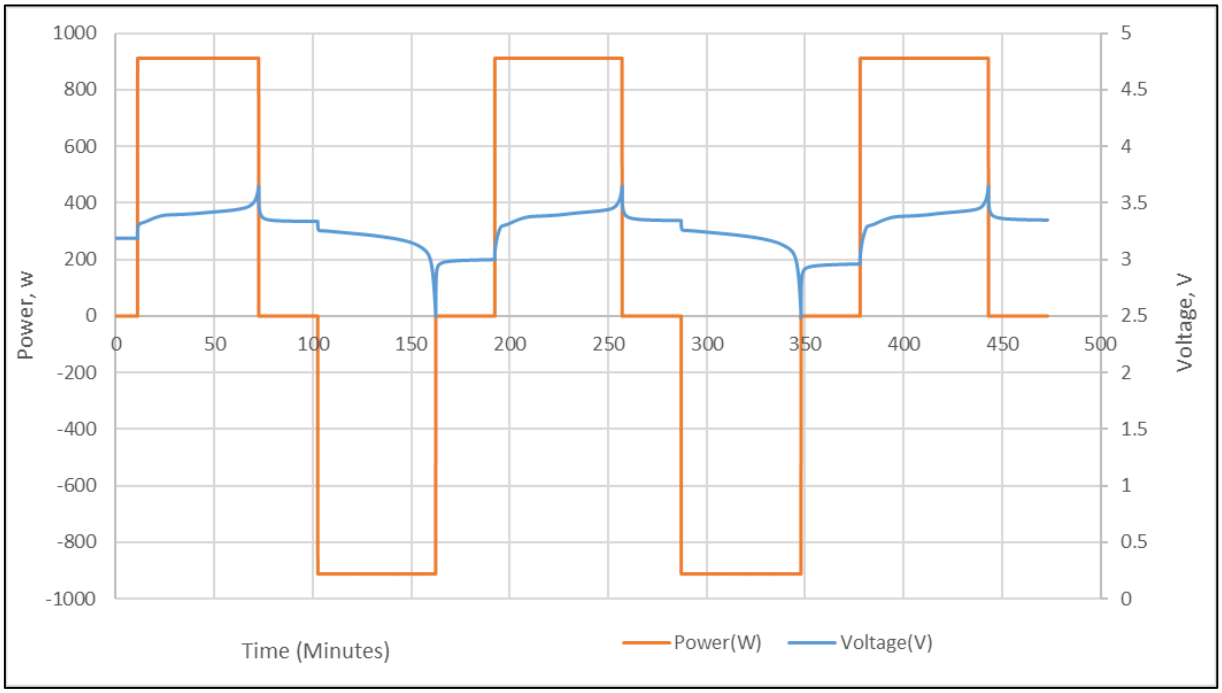
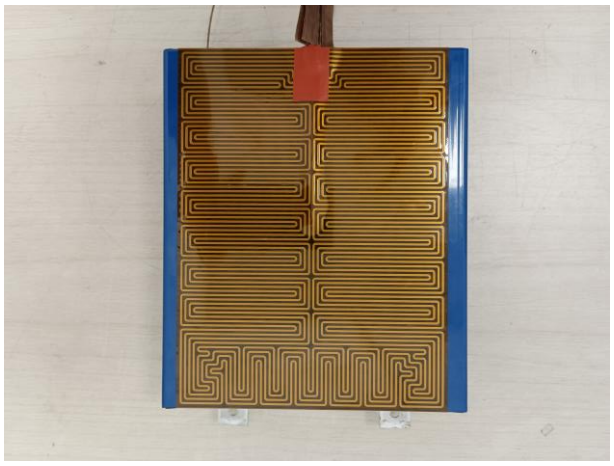
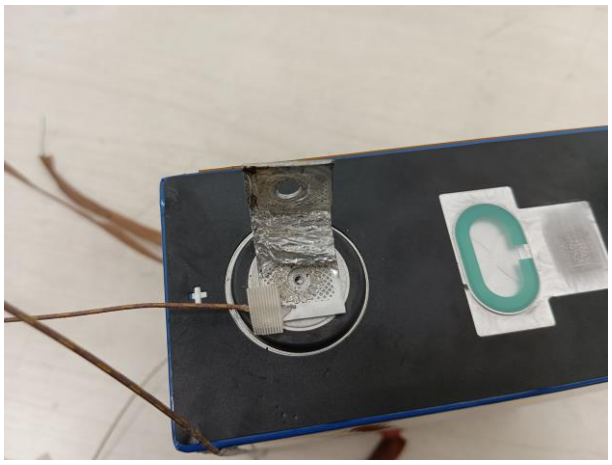
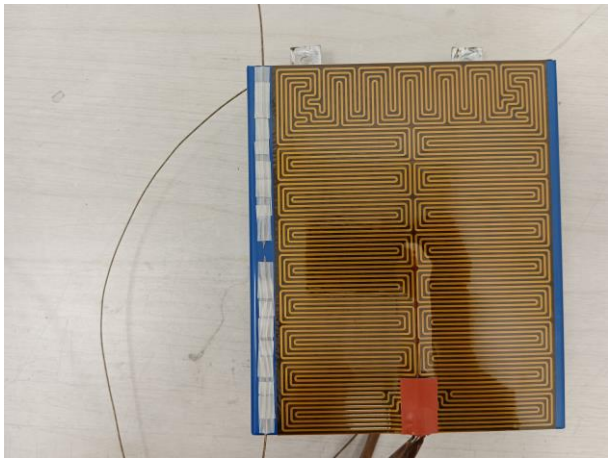


Figure 5: Cell 5 Conditioning (Charge/discharge) Profiles

Attachment B: Cell Instrumentation Photos - (*Pages **21** through **21***)







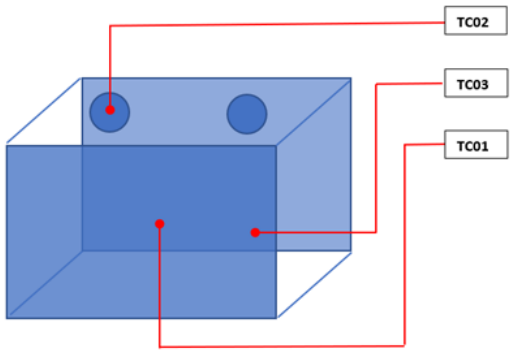


Figure 6: Sample Instrumentation Prior to Test
Note: heaters were placed on two sides of the cell after thermocouples were instrumented.
Note: TC01 between cell body and heater; TC02 on the cell positive; TC03 on the cell body not covered by heater; TC04 Ambient temperature; V1 cell voltage.

Attachment C: Cell Temperature Profiles during testing - (*Pages **22** through **24***)

Note: TC01 between cell body and heater; TC02 on the cell positive; TC03 on the cell body not covered by heater; TC04 Ambient temperature; V1 cell voltage.
TC01 was used to control the temperature at 4 to 7°C/min and TC03 temperatures were reported herein for the surface temperature at the onset of vent and thermal runaway.

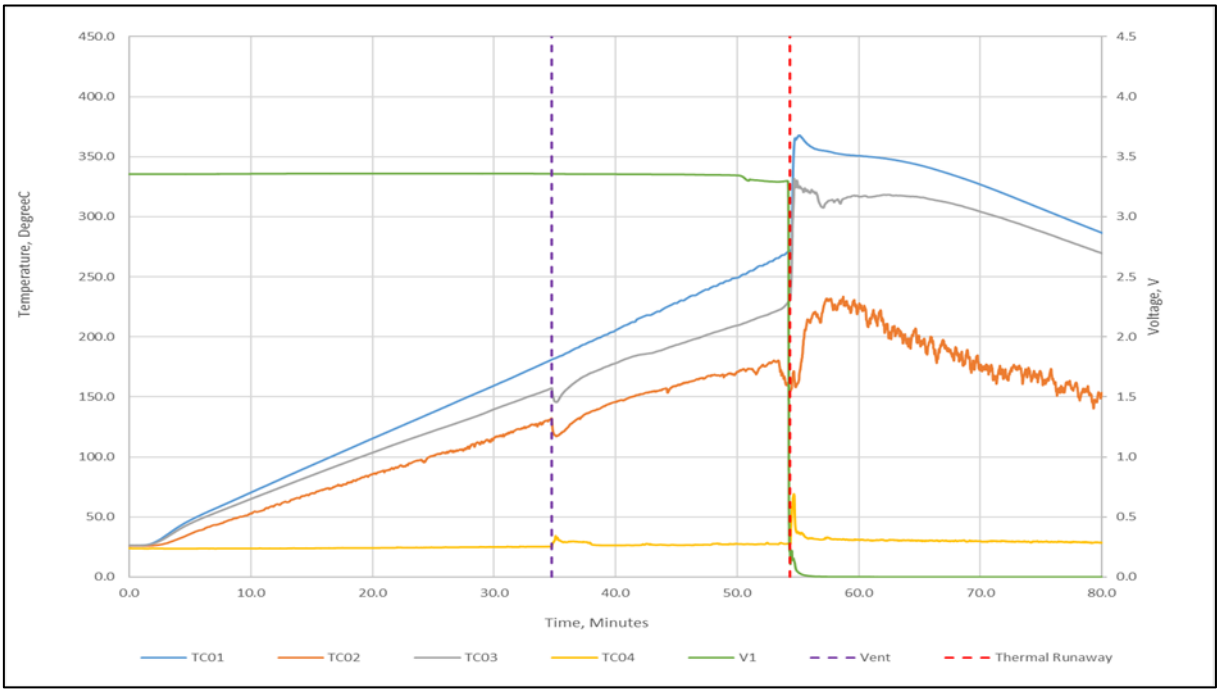


Figure 7: Cell 1 – External Heating 4.5°C per minute

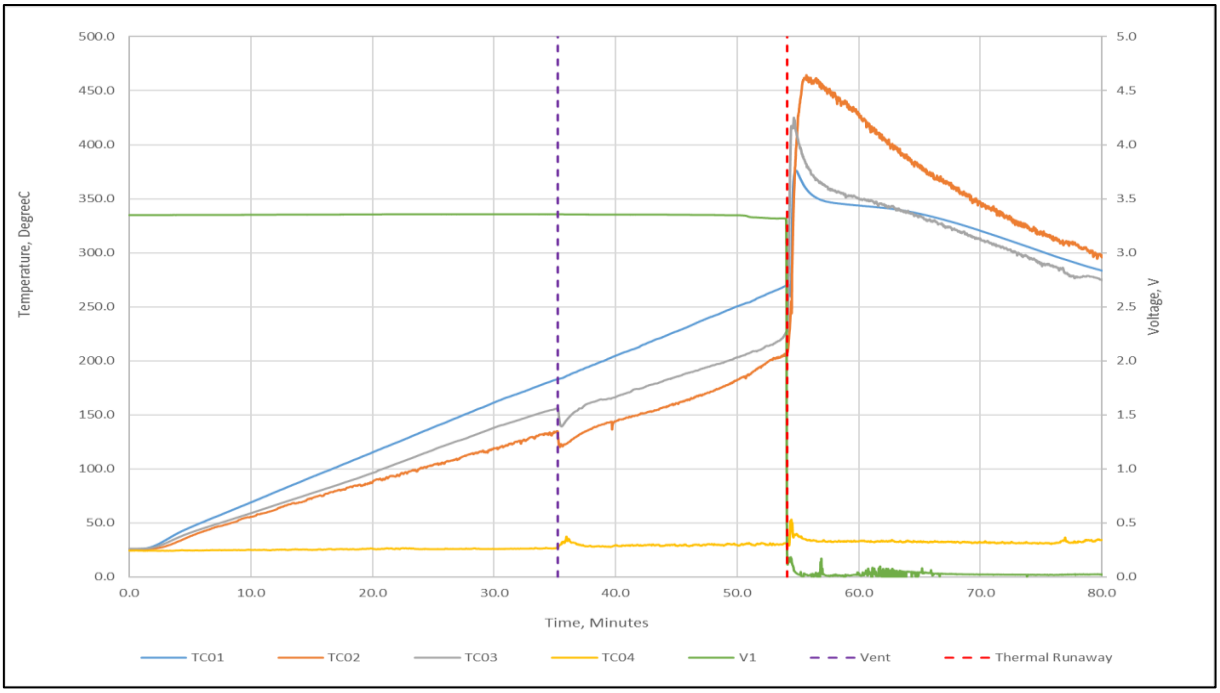


Figure 8: Cell 2 – External Heating 4.5°C per minute

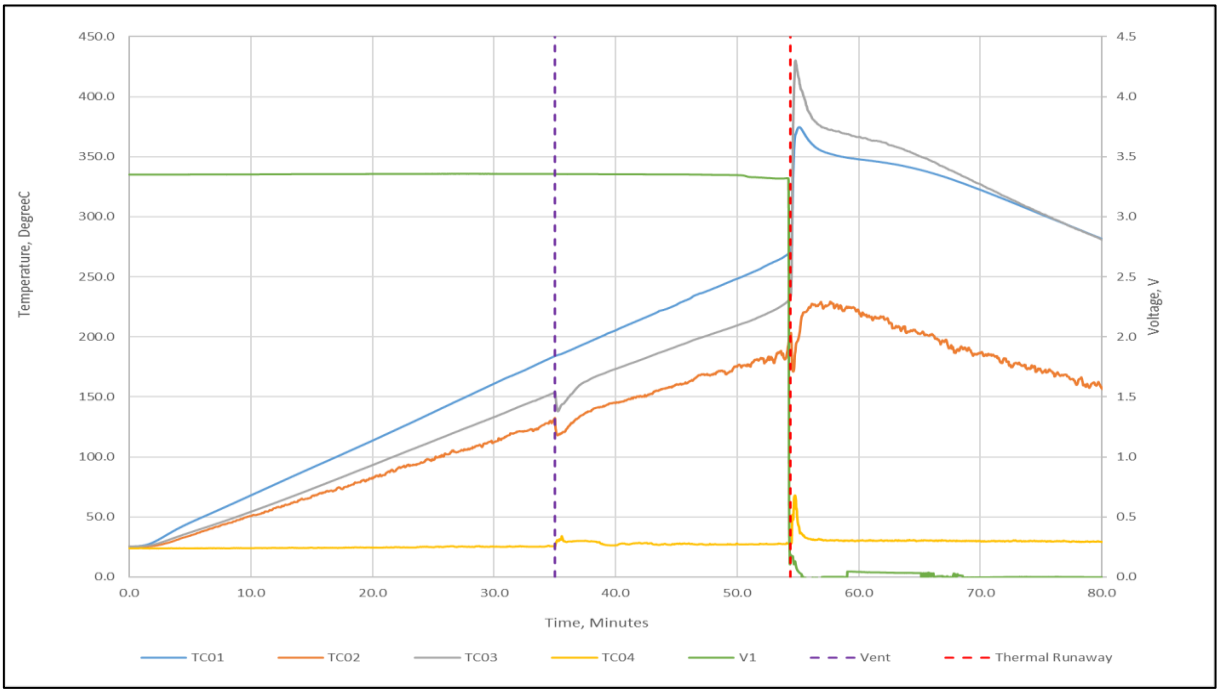


Figure 9: Cell 3 – External Heating 4.5°C per minute

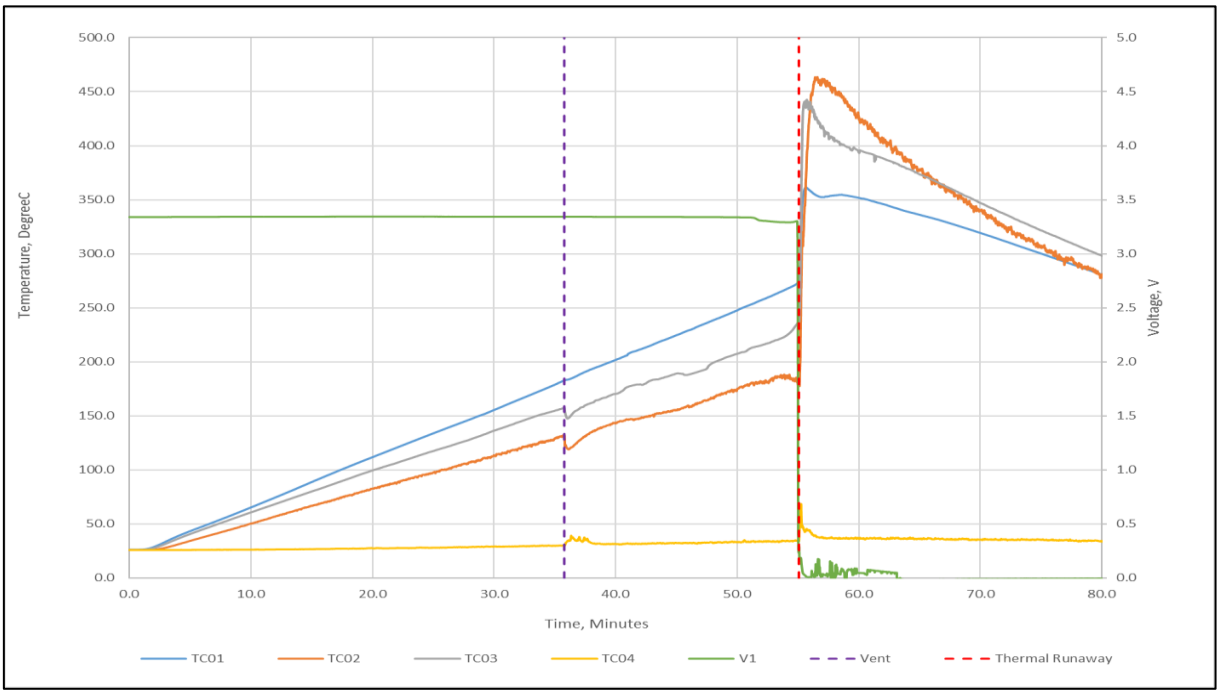


Figure 10: Cell 4 – External Heating 4.5°C per minute

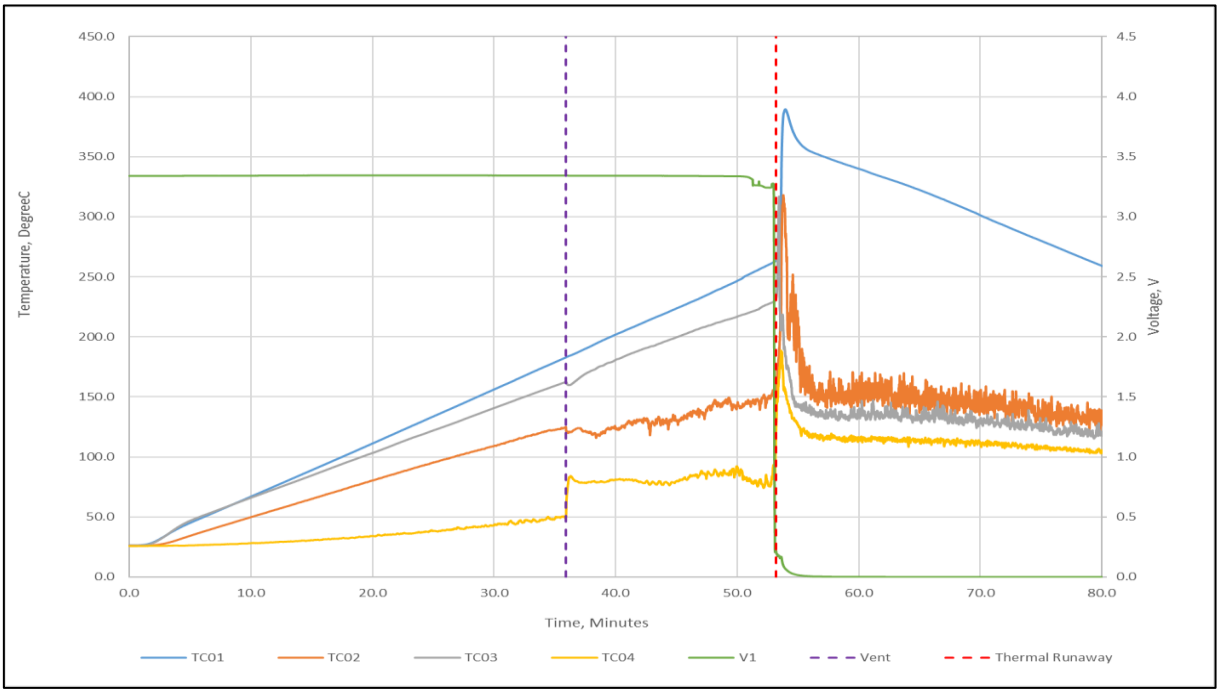
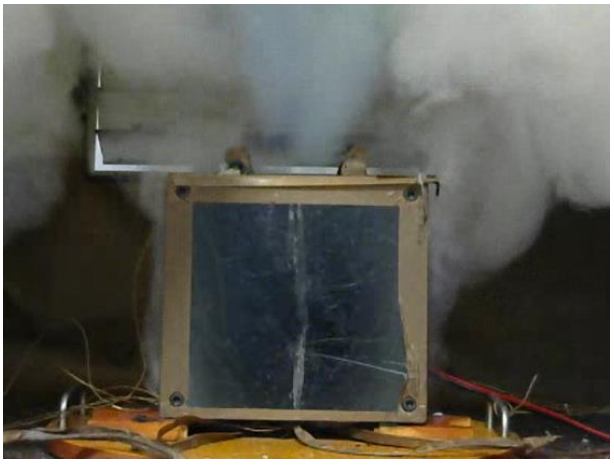


Figure 11: Cell 5 – External Heating 4.5°C per minute

Attachment D: Cell Testing Photos - (*Pages **25** through **34***)

Cell Sample 1 – below figure shows highlights of cell testing. Cell venting and thermal runaway were observed, however no evidence of fire. Figure on next page shows photos of cell after testing.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>(a) Test Start
[00:00]</td><td>(b) Cell Venting
[34:44]</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>(c) Thermal runaway behavior
[54:20]</td><td></td></tr>
<tr><td colspan="2">Figure 12: Highlights of Cell 1 Testing</td></tr>
</table>

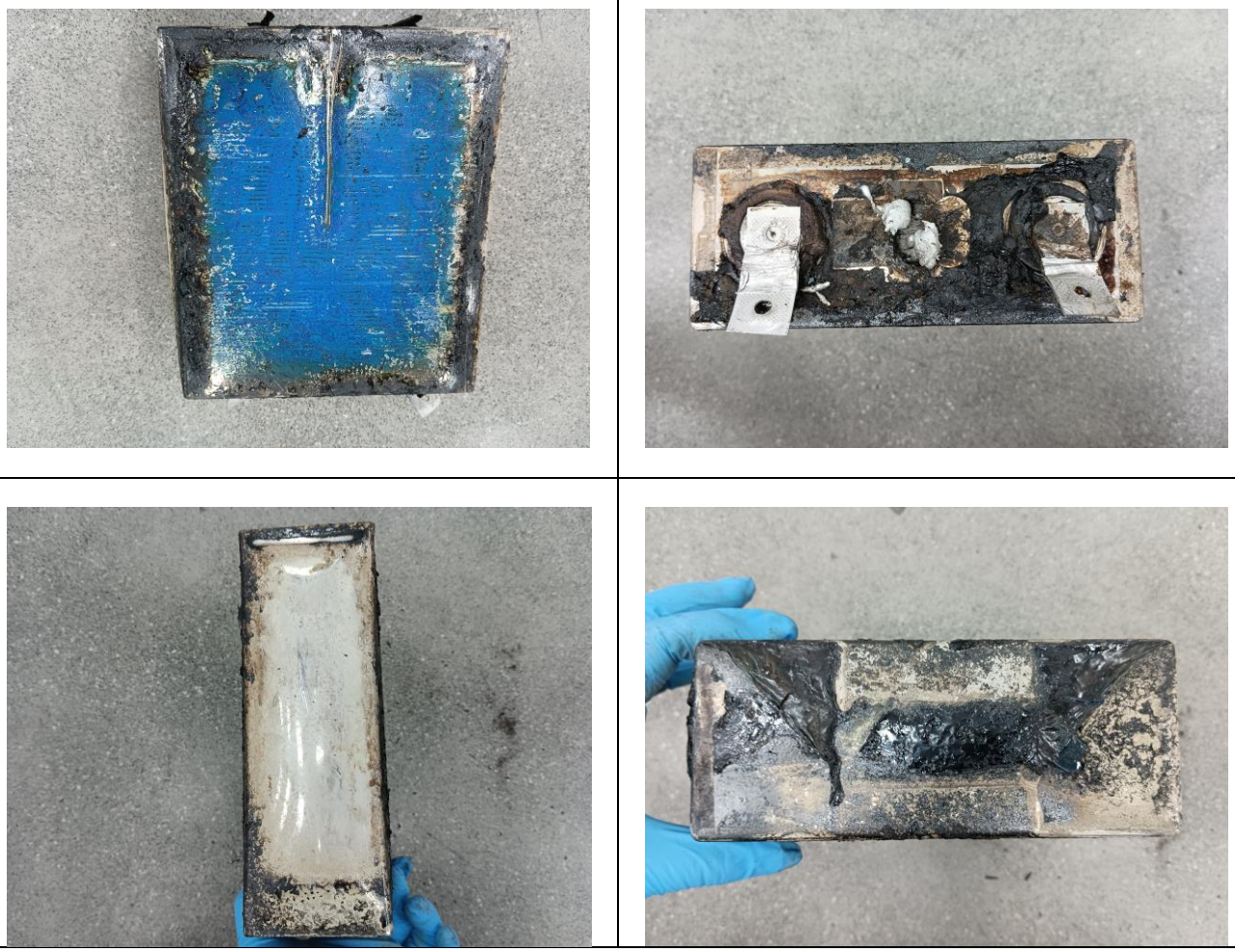


Figure 13: Sample 1 Post Test Photos

Cell Sample 2 – below figure shows highlights of cell testing. Cell venting and thermal runaway were observed, however no evidence of fire. Figure on next page shows photos of cell after testing.

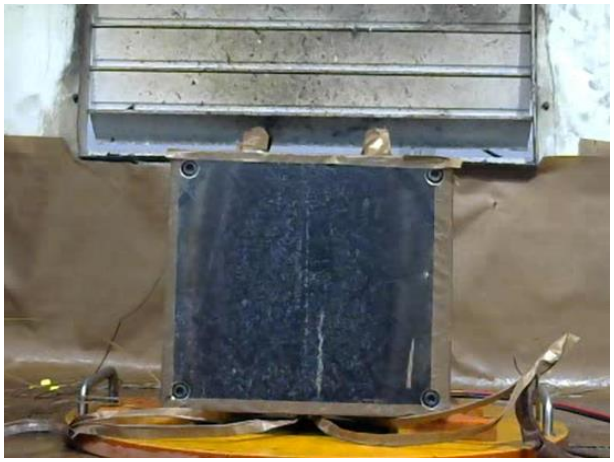
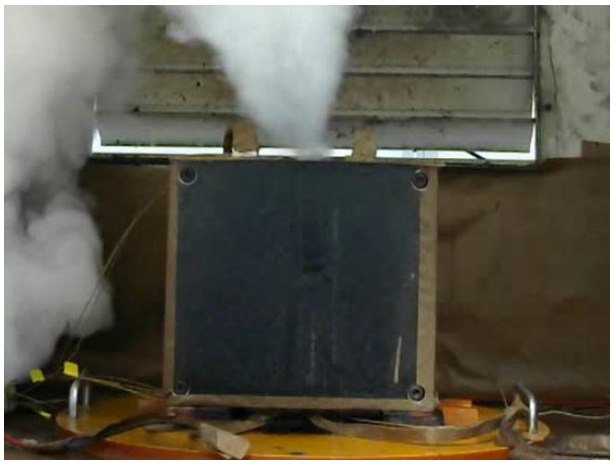
<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>(a) Test Start
[00:00]</td><td>(b) Cell Venting
[35:14]</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>(c) Thermal runaway behavior
[54:06]</td><td></td></tr>
<tr><td colspan="2">Figure 14: Highlights of Cell 2 Testing</td></tr>
</table>

Figure 15: Sample 2 Post Test Photos

Cell Sample 3 – below figure shows highlights of cell testing. Cell venting and thermal runaway were observed, however no evidence of fire. Figure on next page shows photos of cell after testing.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>(a) Test Start
[00:00]</td><td>(b) Cell Venting
[35:00]</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>(c) Thermal runaway behavior
[54:22]</td><td></td></tr>
<tr><td colspan="2">Figure 16: Highlights of Cell 3 Testing</td></tr>
</table>

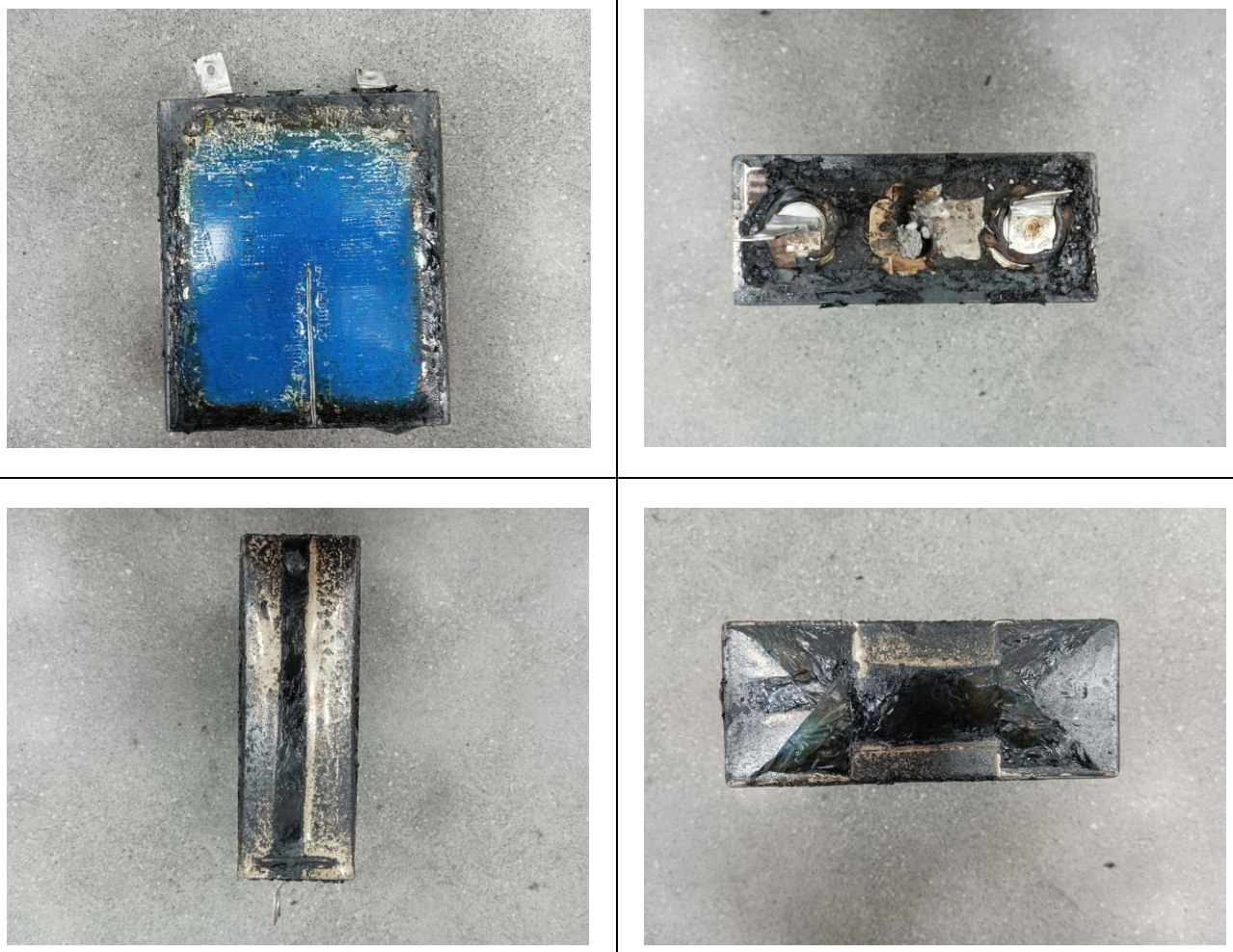


Figure 17: Sample 3 Post Test Photos

Cell Sample 4 – below figure shows highlights of cell testing. Cell venting and thermal runaway were observed, however no evidence of fire. Figure on next page shows photos of cell after testing.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>(a) Test Start
[00:00]</td><td>(b) Cell Venting
[35:46]</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>(c) Thermal runaway behavior
[55:04]</td><td></td></tr>
<tr><td colspan="2">Figure 18: Highlights of Cell 4 Testing</td></tr>
</table>

Figure 19 Sample 4 Post Test Photos

Cell Sample 5 – below figure shows highlights of cell testing. Cell venting and thermal runaway were observed, however no evidence of fire. Figure on next page shows photos of cell after testing.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>(a) Test Start
[00:00]</td><td>(b) Cell Venting
[35:54]</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>(c) Thermal runaway behavior
[53:11]</td><td></td></tr>
<tr><td colspan="2">Figure 20: Highlights of Cell 5 Testing</td></tr>
</table>

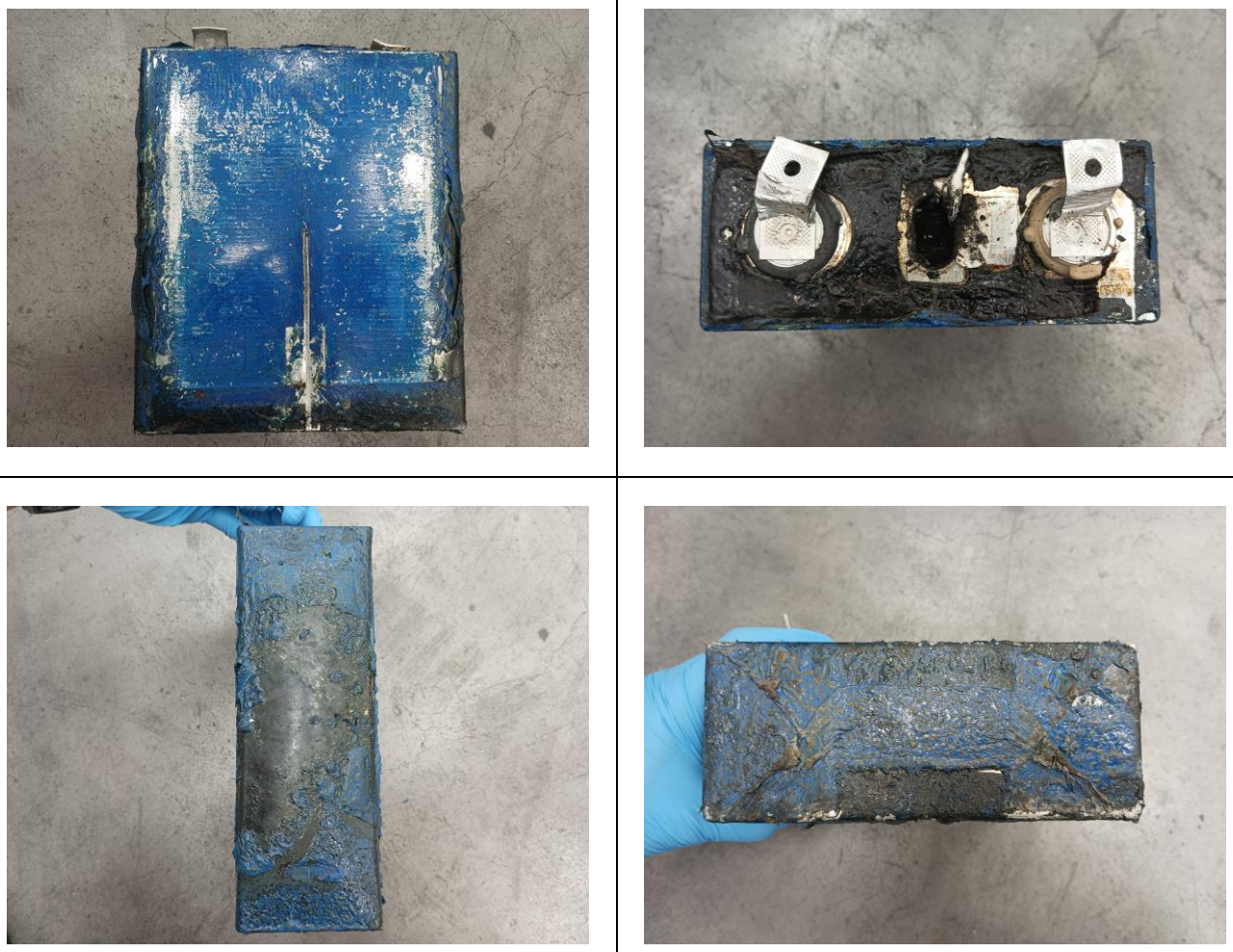


Figure 21: Sample 5 Post Test Photos

Attachment E: Cell vent gas test chamber photo and profile of chamber gas analysis (O2 and Pressure) - (Pages ***35*** through ***35***)

The gas composition test was conducted with the battery inserted into the battery gas composition test chamber and the chamber was sealed. The battery gas composition test chamber is a 100 L pressure vessel and is shown in figure below.

Prior to initiating thermal runaway, the chamber's atmosphere was purged until a condition of less than 1% oxygen by volume (actual 0.17%, with initial pressure 0.17psig).

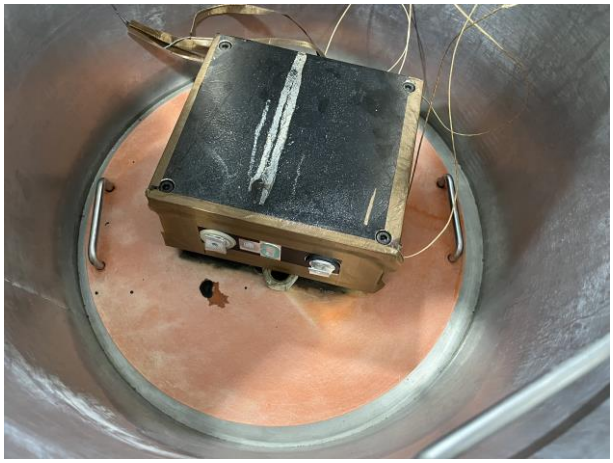


Figure 22: Sample 5 instrumented and inside gas test chamber

$\phi_{O2,\ chamber}$=	0.17	%

Pinitial,chamber=	0.17	psig

Figure 23: Profile of gas test chamber (O2 and Pressure)

Attachment F: Cell Gas Analysis Report - (Pages ***36*** through ***36***)

Table Re-normalized Gas Quantification, excluding N_2 and O_2, and unknown compounds.			
Item	**Measure**	**Chemical formula**	**Conc.(%)**
1	Carbon Monoxide	CO	13.453
2	Carbon Dioxide	CO_2	27.205
3	Hydrogen	H_2	41.313
4	Methane	CH_4	7.403
5	Ethylene	C_2H_4	4.408
6	Acetylene	C_2H_2	0.101
7	Ethane	C_2H_6	1.235
8	Propane	$CH_3CH_2CH_3$	0.734
9	Propylene	C_3H_6	1.297
10	Propadiene (Allene)	C_3H_4	0.000
11	Isobutane	$CH_3CH(CH_3)CH_3$	0.017
12	Butane	C_4H_{10}	0.193
13	Isobutylene	C_4H_8	0.522
14	1-Butene	C_4H_8	0.221
15	trans-2-Butene	C_4H_8	0.143
16	cis-2-Butene	C_4H_8	0.199
17	Pentane	C_5H_{12}	0.198
18	trans-2-Pentene	C_5H_{10}	0.061
19	cis-2-Pentene	C_5H_{10}	0.053
20	1,4-Pentadiene	C_5H_8	0.023
21	Hexane	C_6H_{14}	0.024
22	1-Hexene	C_6H_{12}	0.123
23	Benzene	C_6H_6	0.049
24	1-Heptene	C_7H_{14}	0.025
25	Toluene	C_7H_8	0.013
26	Styrene	C_8H_8	0.013
27	Dimethyl Carbonate	$C_3H_6O_3$	0.917
28	Ethyl Methyl Carbonate	$C_4H_8O_3$	0.055
29	Diethyl Carbonate	$C_5H_{10}O_3$	0.000
	Total	**Measurement result**	100.000

Amendment 1 report:

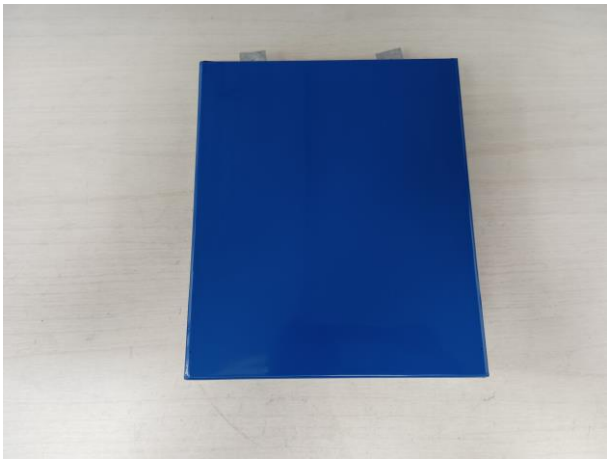
<table>
<tr><td colspan="2">Photo of cell/Stack:</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Figure 0-3</td><td>Figure 0-4</td></tr>
<tr><td>Test Item Charge/Discharge Specifications:</td><td></td></tr>
<tr><td>• Charge Power, W</td><td>912</td></tr>
<tr><td>• Standard full charge voltage, Vdc:</td><td>3.65</td></tr>
<tr><td>• Charge temperature range, °C:</td><td>0~60</td></tr>
<tr><td>• End of charge voltage, V:</td><td>3.65</td></tr>
<tr><td>• Discharge Power, W</td><td>912</td></tr>
<tr><td>• End of discharge voltage, Vdc:</td><td>2.5</td></tr>
<tr><td>• Discharge temperature range, °C:</td><td>-20~60</td></tr>
</table>

Table G0-1 – Specified conditioning parameters			
Charging:		Discharging	
Power (CP), W	912	Power (CP), W	912
Standard full charge voltage, Vdc	3.65	Voltage at start of discharge, Vdc	3.65
End of charge voltage, Vdc	3.65	End of discharge voltage, Vdc	2.5
Charging Test Ambient, °C	0~60	Discharging Test Ambient, °C	-20~60
Refer to Attachment A-1 for charge/discharge profiles for each cell.			

Table G0-2 – Charge completion and cell test initiation times		
Cell Test Number	**Charge Completion Date and Time**	**Cell test Date and Time**
6	2023-10-20 07:49	2023-10-20 10:42
7	2023-10-20 09:49	2023-10-20 14:40
8	2023-10-28 10:23	2023-10-28 15:41
9	2023-10-29 11:30	2023-10-29 15:00

Table G0-3 - Test Initiation Details				
	Cell Test 6	**Cell Test 7**	**Cell Test 8**	**Cell Test 9**
Test Date	2023-10-20	2023-10-20	2023-10-28	2023-10-29
Test Start Time	10:42	14:40	15:41	15:00
Initial Lab Temperature	25.7°C	25.7°C	25.3°C	26.0
Initial Relative Humidity	61.2%RH	61.2%RH	53.4%RH	51.5%RH

Table G0-4 - Thermal Runaway Results				
	Cell Test 6	**Cell Test 7**	**Cell Test 8**	**Cell Test 9**
OCV at start of test, Vdc	3.354	3.338	3.344	3.347
Average Heating Rate, °C/min	4.5	4.5	4.5	4.5
Venting Time after the test start (hh:mm:ss)	0:34:41	0:34:16	0:33:40	0:33:40
Venting Temperature, °C	161	150	156	152
Thermal Runaway Time after the test start (hh:mm:ss)	0:54:48	0:54:51	0:54:22	0:54:53
Thermal Runaway Temperature, °C	240	232	240	237

Table G0-5 – Average Vent and Thermal Runaway Temperatures	
Average of Cell Vent Temperatures, °C	155
Average of Cell Thermal Runaway Temperatures, °C	237
#Averages of cell tests other than the gas analysis test	

Attachment G-1: Cell Conditioning (Charge/discharge) Profiles - (*Pages**39** through **40***)

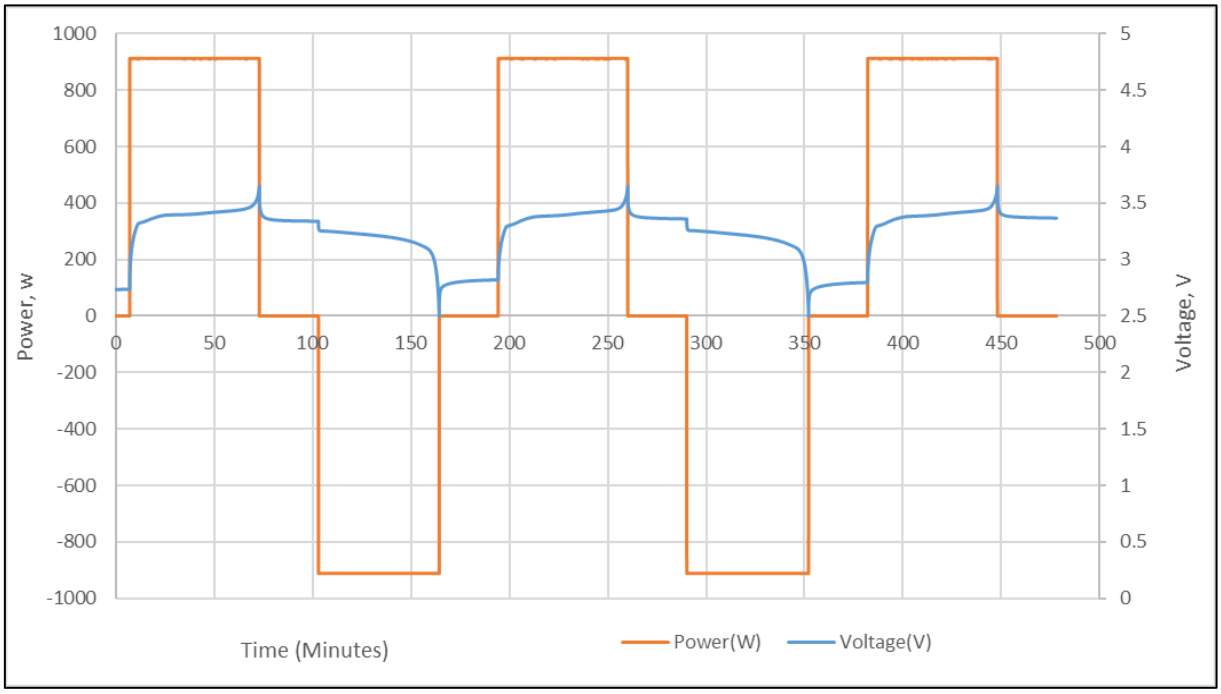


Figure 24: Cell 6 Conditioning (Charge/discharge) Profiles

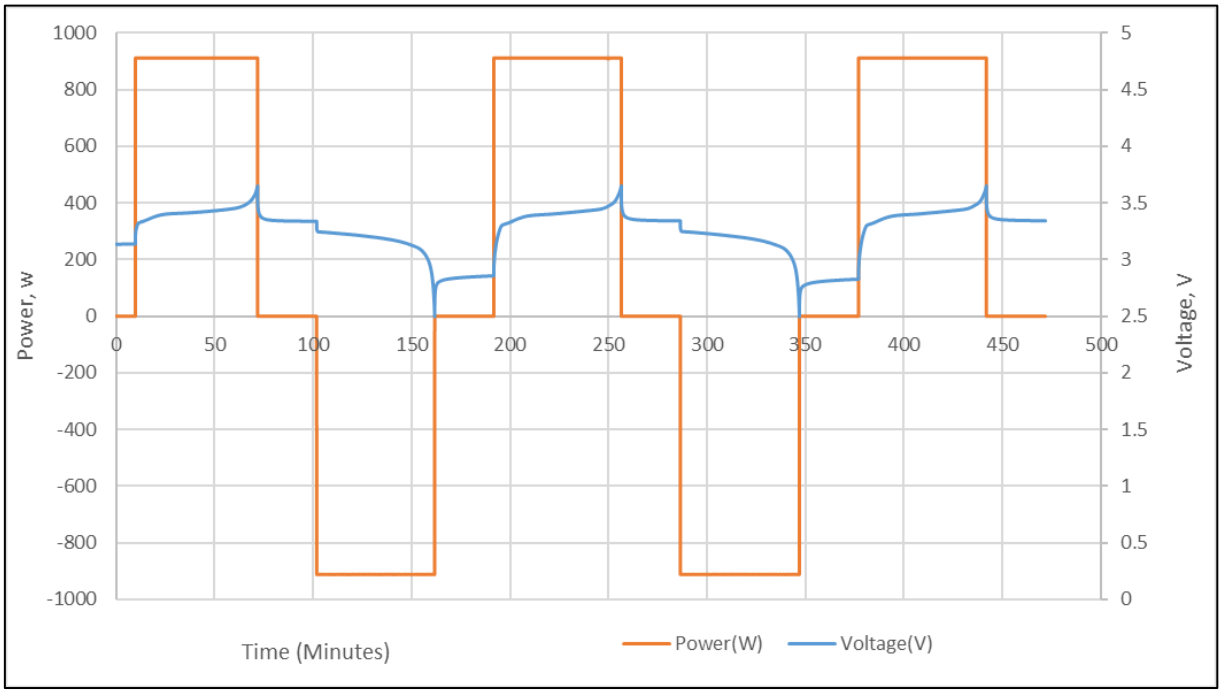


Figure 25: Cell 7 Conditioning (Charge/discharge) Profiles

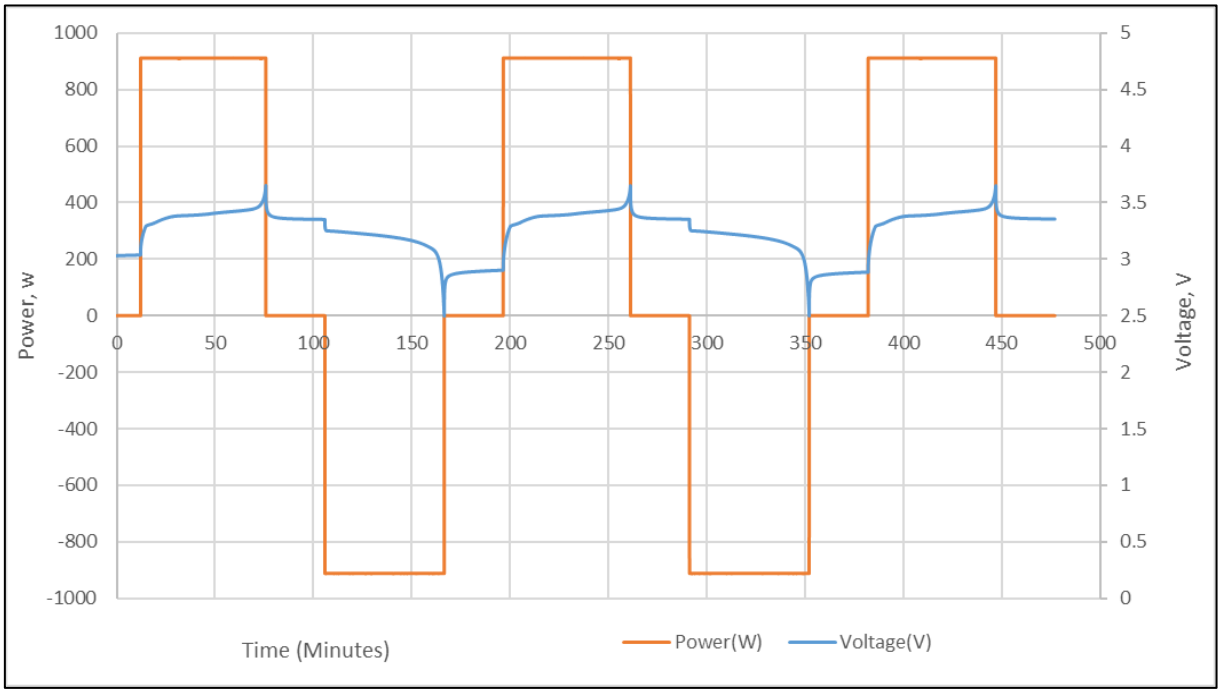


Figure 26: Cell 8 Conditioning (Charge/discharge) Profiles

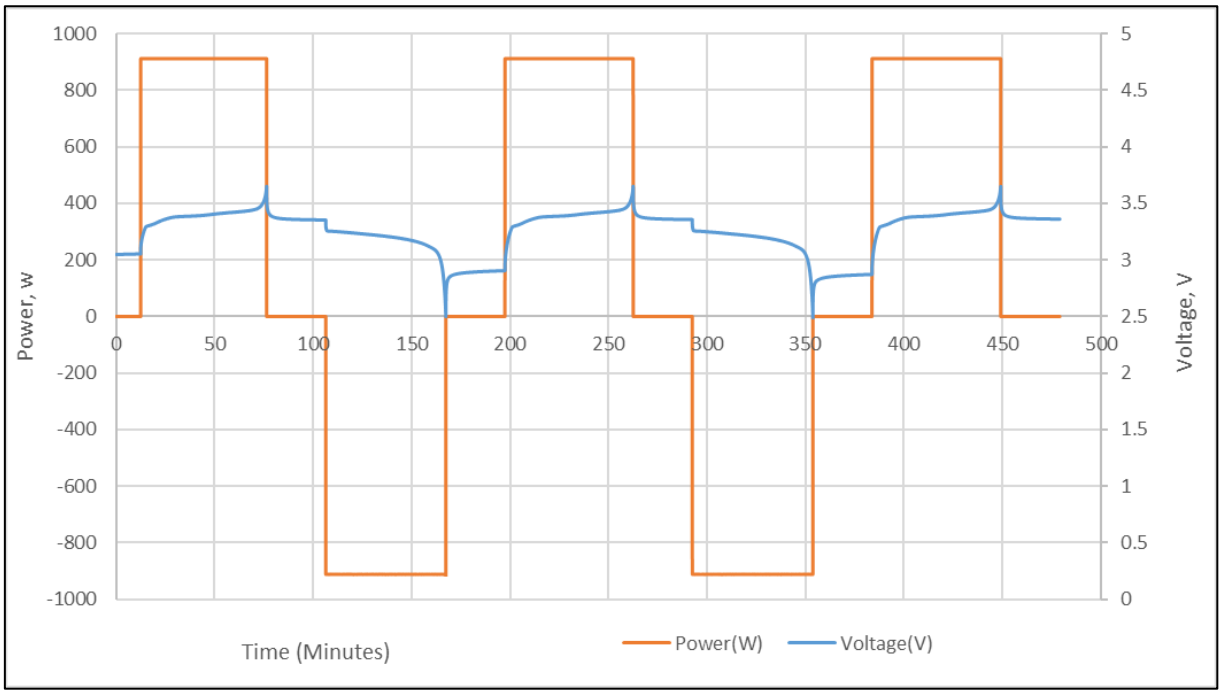
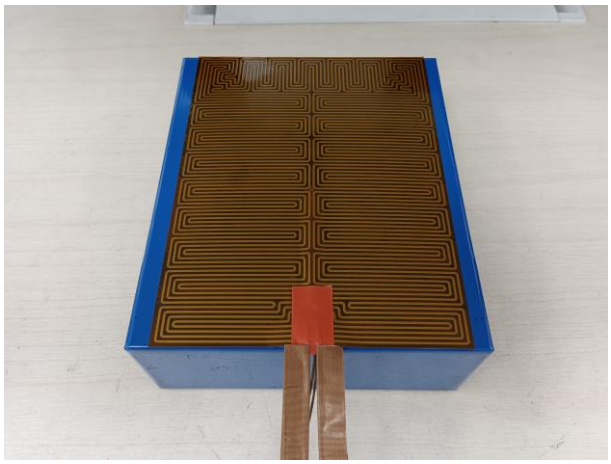
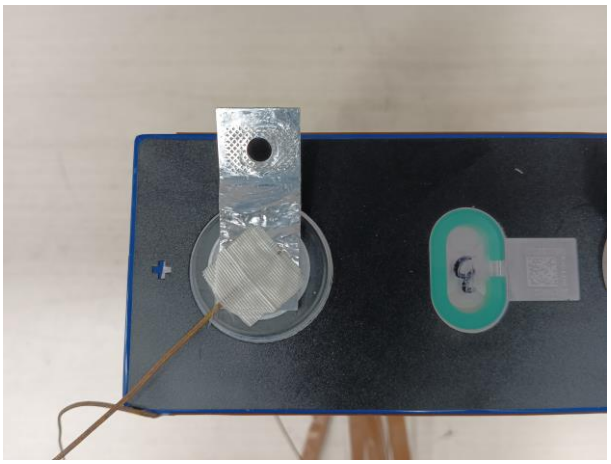
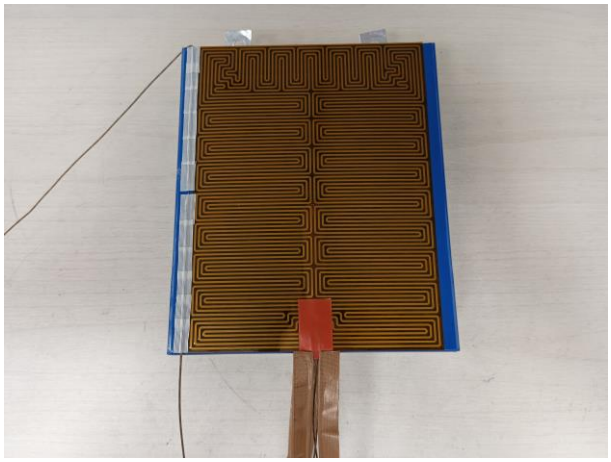


Figure 27: Cell 9 Conditioning (Charge/discharge) Profiles

Attachment G-2: Cell Instrumentation Photos - (*Pages **41** through **41***)







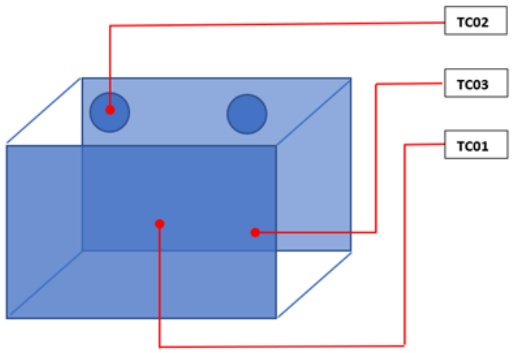


Figure 28: Sample Instrumentation Prior to Test
Note: heaters were placed on two sides of the cell after thermocouples were instrumented.
Note: TC01 between cell body and heater; TC02 on the cell positive; TC03 on the cell body not covered by heater; TC04 Ambient temperature; V1 cell voltage.

Attachment G-3: Cell Temperature Profiles during testing - (*Pages **42** through **43***)

Note: TC01 between cell body and heater; TC02 on the cell positive; TC03 on the cell body not covered by heater; TC04 Ambient temperature; V1 cell voltage.
TC01 was used to control the temperature at 4 to 7°C/min and TC03 temperatures were reported herein for the surface temperature at the onset of vent and thermal runaway.

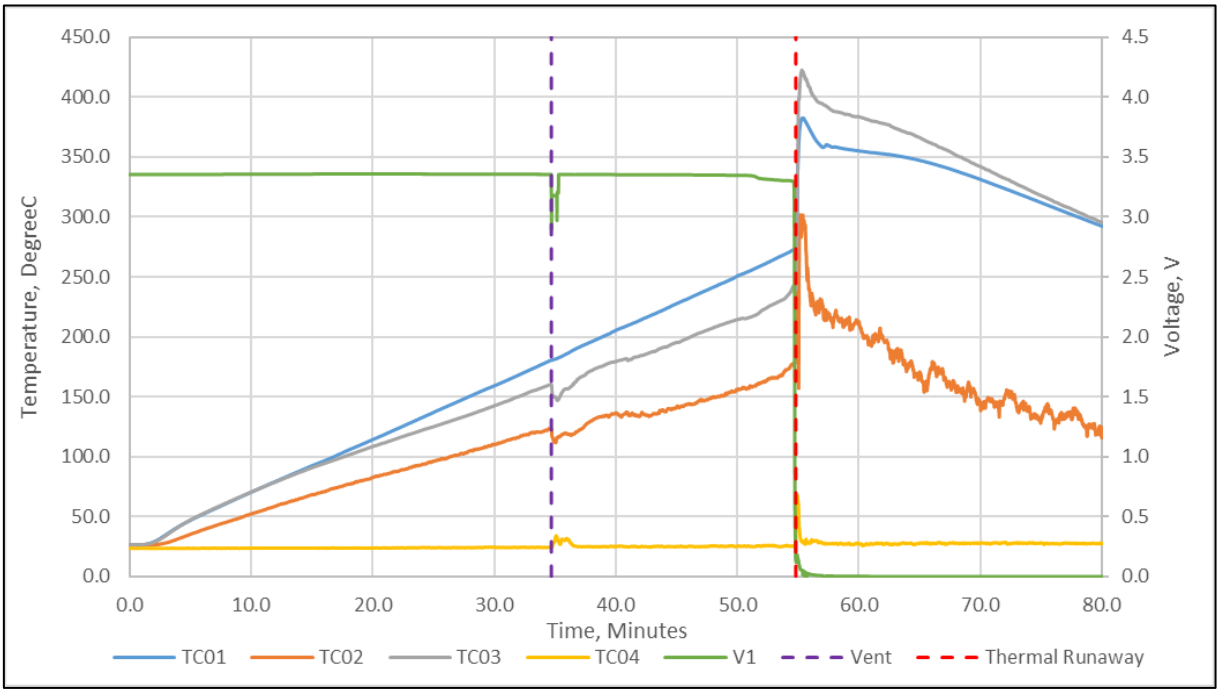


Figure 29: Cell 6 – External Heating 4.5°C per minute

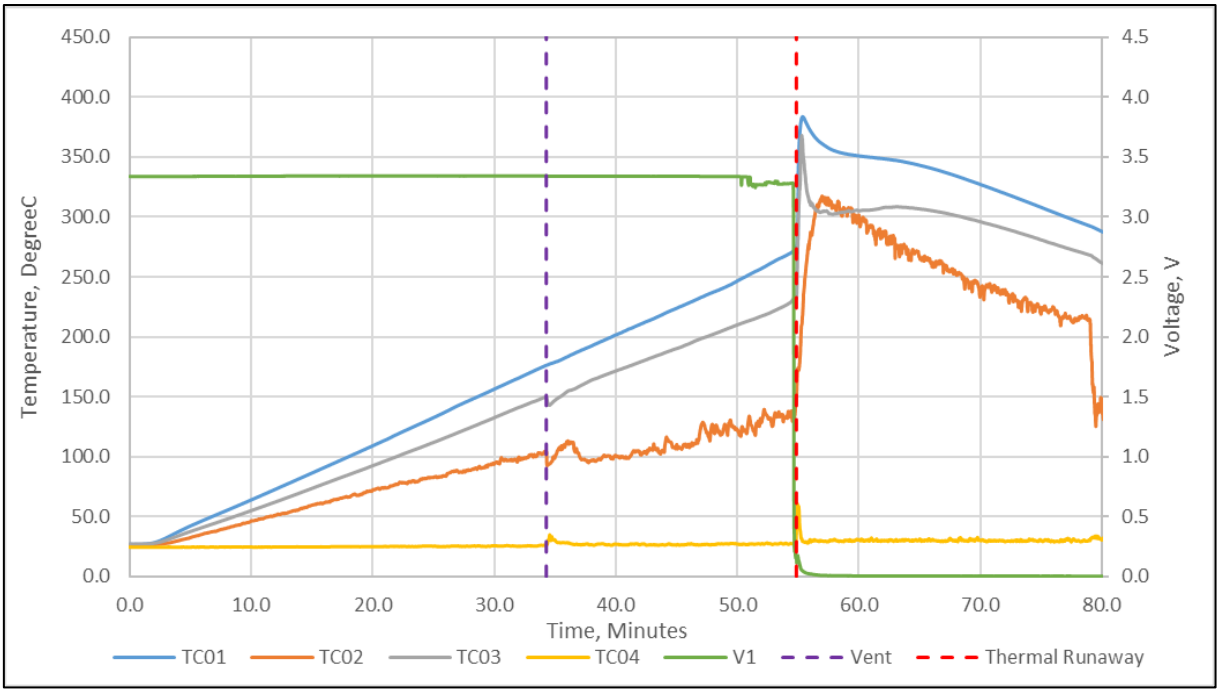


Figure 30: Cell 7 – External Heating 4.5°C per minute

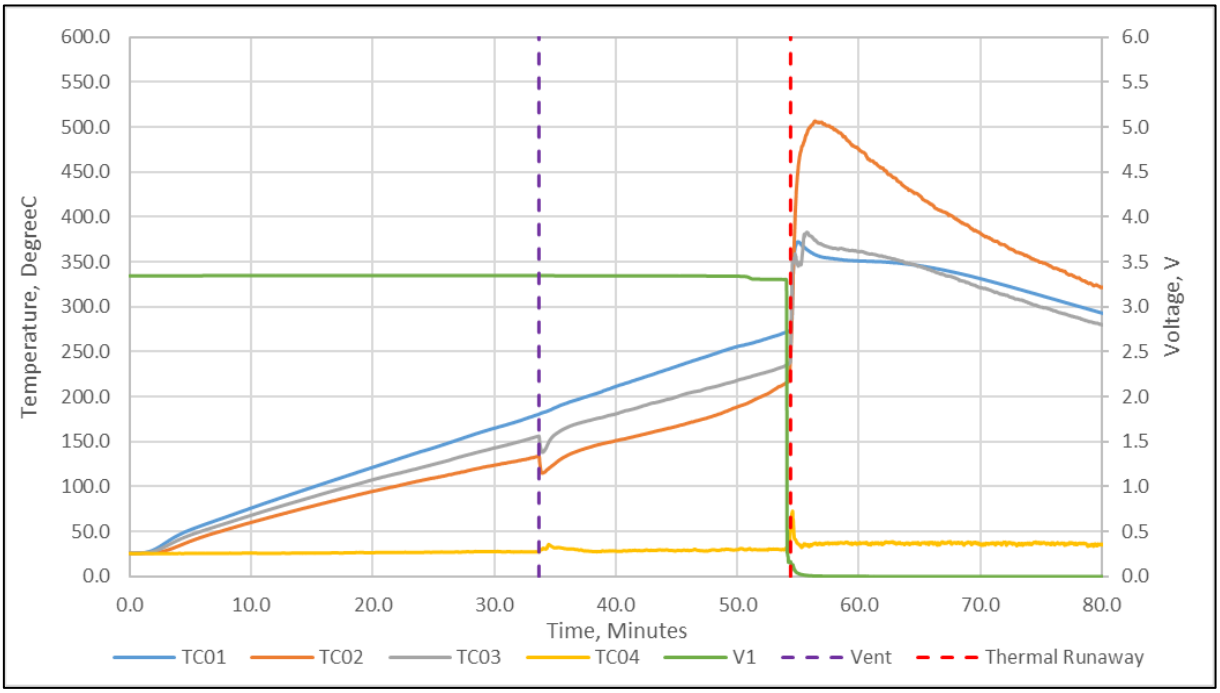


Figure 31: Cell 8 – External Heating 4.5°C per minute

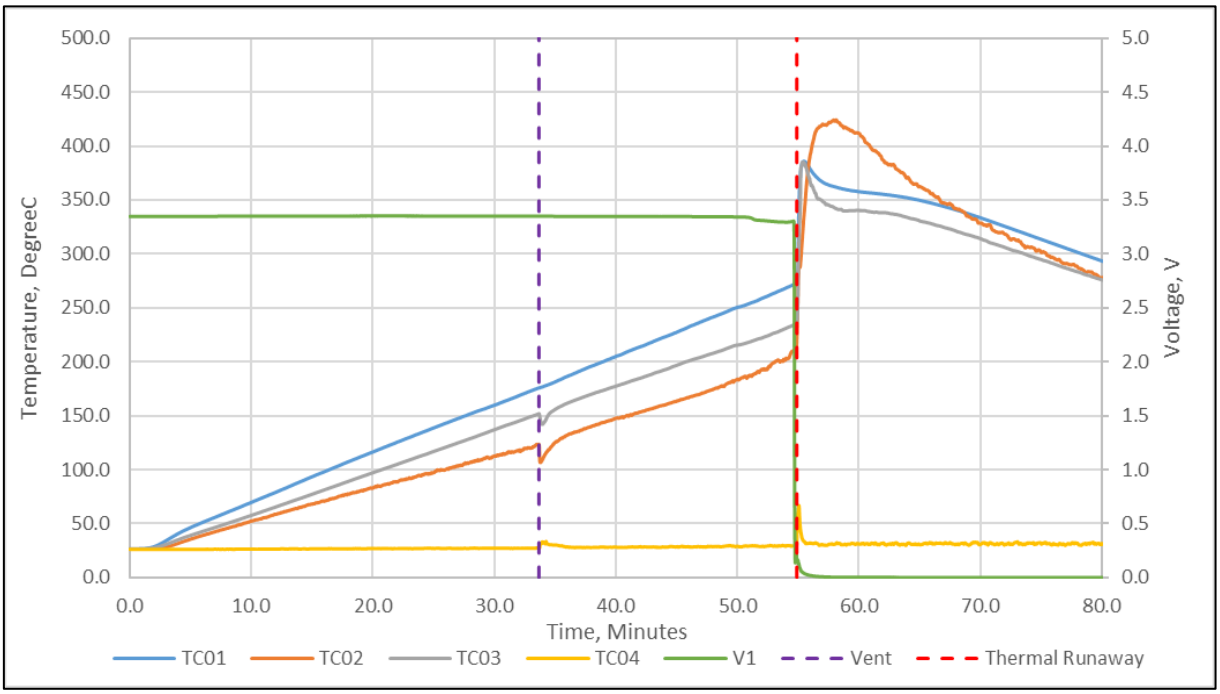
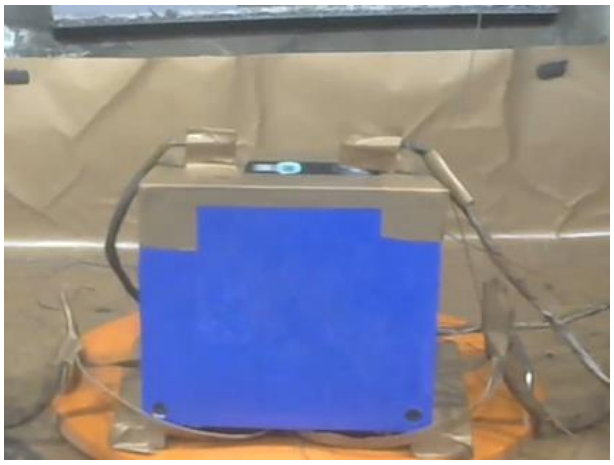
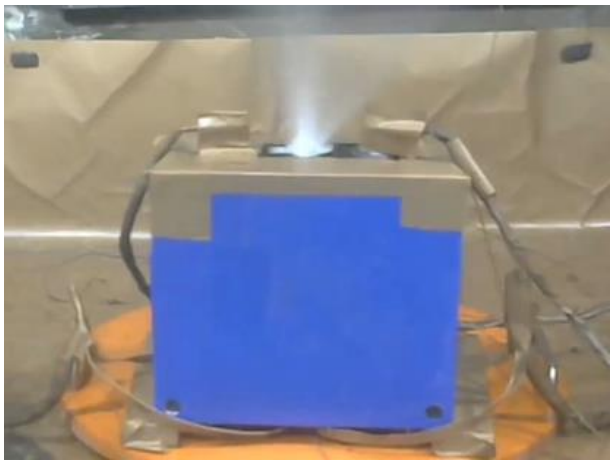


Figure 32: Cell 9 – External Heating 4.5°C per minute

Attachment G-4 Cell Testing Photos - (*Pages **44** through **51***)

Cell Sample 6 – below figure shows highlights of cell testing. Cell venting and thermal runaway were observed, however no evidence of fire. Figure on next page shows photos of cell after testing.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>(a) Test Start
[00:00]</td><td>(b) Cell Venting
[34:41]</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>(c) Thermal runaway behavior
[54:48]</td><td></td></tr>
<tr><td colspan="2">Figure 33: Highlights of Cell 6 Testing</td></tr>
</table>

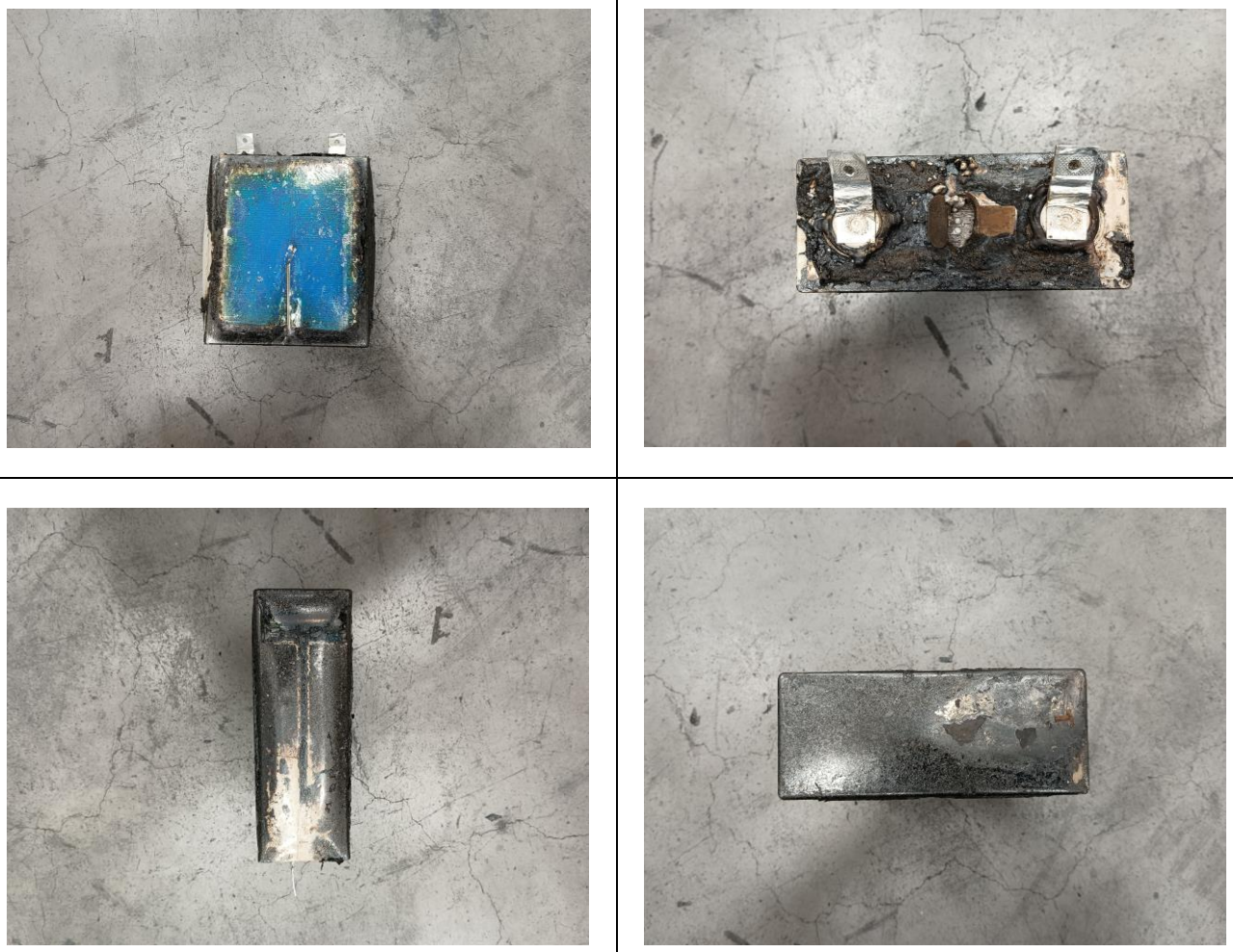
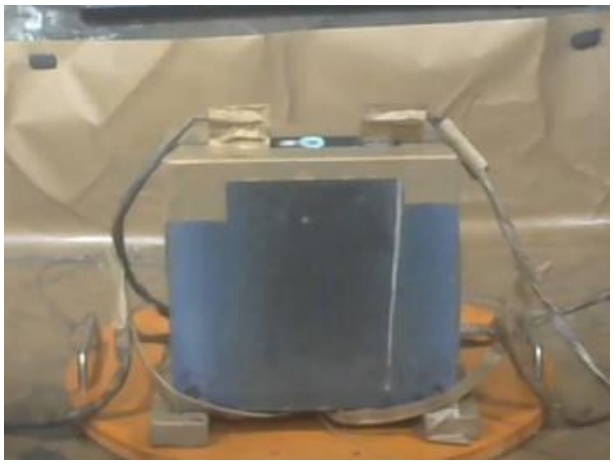


Figure 34: Sample Post Test Photos

Cell Sample 7 – below figure shows highlights of cell testing. Cell venting and thermal runaway were observed, however no evidence of fire. Figure on next page shows photos of cell after testing.

<table>
<tr><td>  </td><td>  </td></tr>
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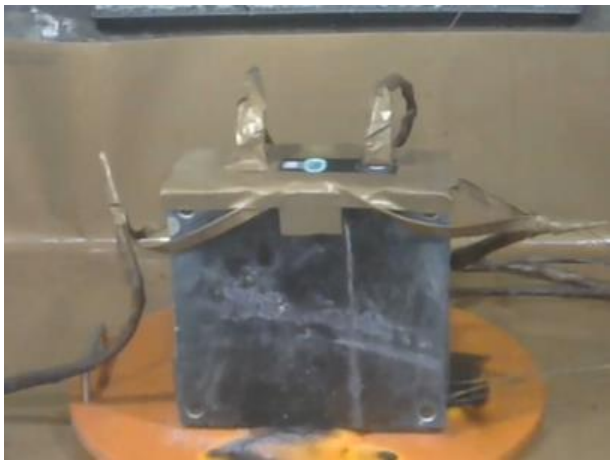
[34:16]</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>(c) Thermal runaway behavior
[54:51]</td><td></td></tr>
<tr><td colspan="2">Figure 35: Highlights of Cell 6 Testing</td></tr>
</table>

Figure 36: Sample Post Test Photos

Cell Sample 8 – below figure shows highlights of cell testing. Cell venting and thermal runaway were observed, however no evidence of fire. Figure on next page shows photos of cell after testing.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>(a) Test Start
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[33:40]</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>(c) Thermal runaway behavior
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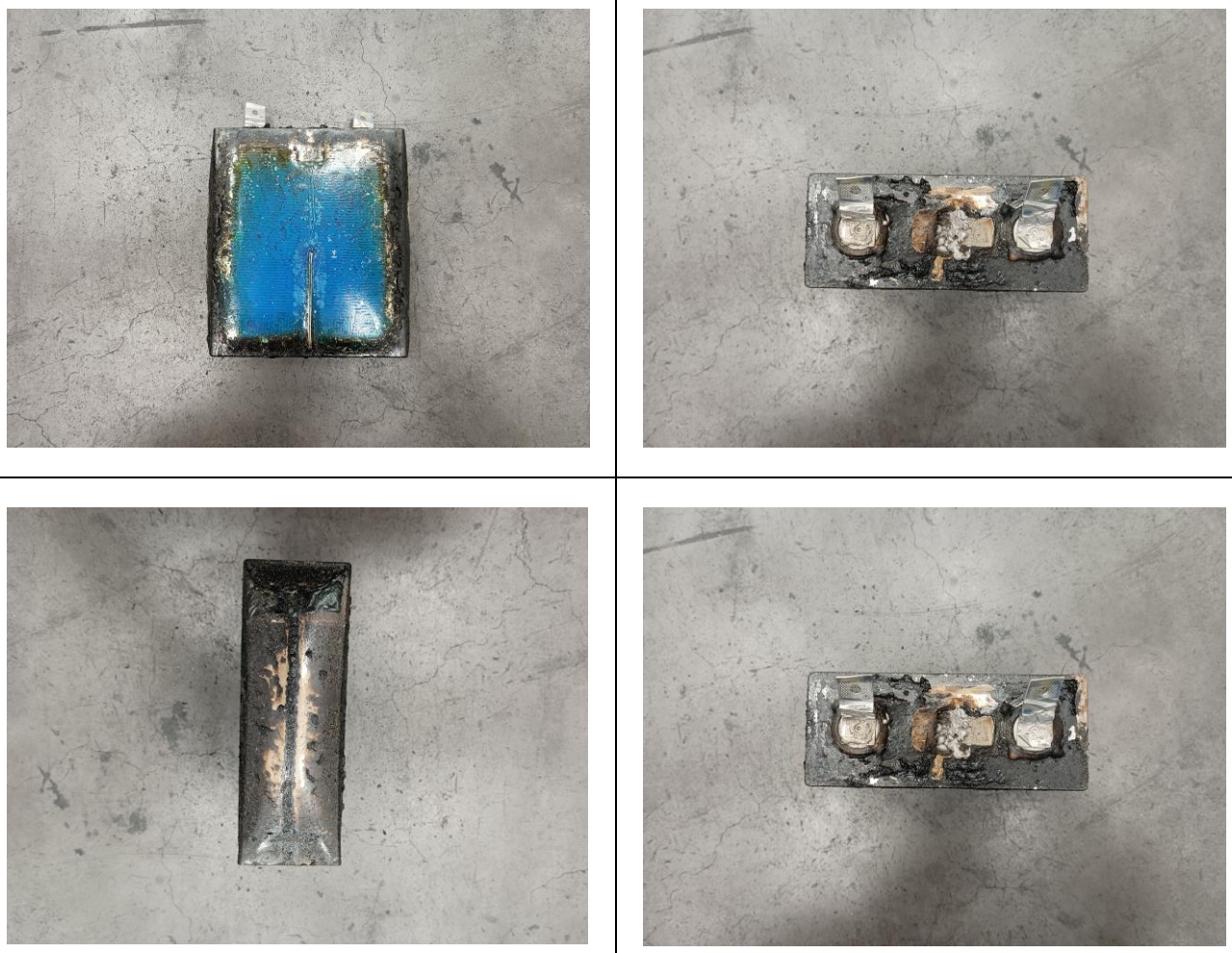


Figure 38: Sample Post Test Photos

Cell Sample 9 – below figure shows highlights of cell testing. Cell venting and thermal runaway were observed, however no evidence of fire. Figure on next page shows photos of cell after testing.

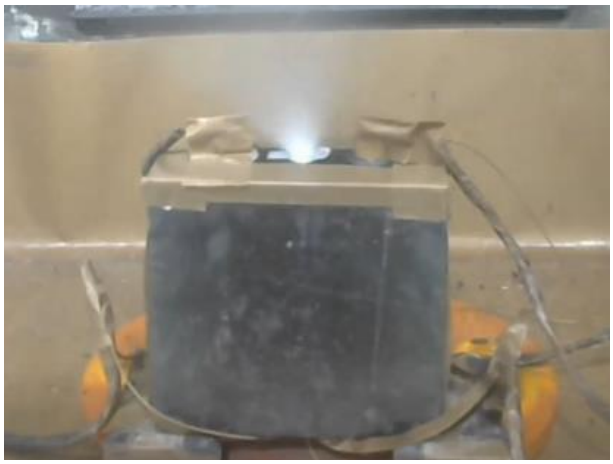
<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>(a) Test Start
[00:00]</td><td>(b) Cell Venting
[33:40]</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>(c) Thermal runaway behavior
[54:53]</td><td></td></tr>
<tr><td colspan="2">Figure 39: Highlights of Cell 6 Testing</td></tr>
</table>

Figure 40: Sample Post Test Photos

Appendix E

Enterprise BESS ERP

COFFMAN ENGINEERS

ENTERPRISE BATTERY ENERGY STORAGE SYSTEM PROJECT

Emergency Response Plan (ERP)

COFFMAN PROJECT NO. 253107

IFR SUBMITTAL

December 26, 2025

Prepared for: Enterprise BESS LLC

EMERGENCY RESPONSE PLAN

FOR

ENTERPRISE BESS

Escondido, California

Project Number: 253107

Revision	Date	Description
A	10/15/2025	Issued for Review
B	12/05/2025	Issue for Permit
C	12/17/2025	Change to 2025 Code Cycle
D	12/25/2025	IFP Revision

PREPARED BY:

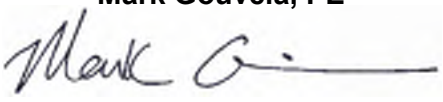
COFFMAN ENGINEERS, INC.

CONTACT:

Jake Reidelbach
Fire Protection Engineering
406-582-1936

&

Mark Gouveia, PE



Principal, Fire Protection Engineering
406-582-1936

IN THE EVENT OF A FIRE OR THERMAL RUNAWAY, FIRST CALL 911

TABLE OF CONTENTS

APPENDICES

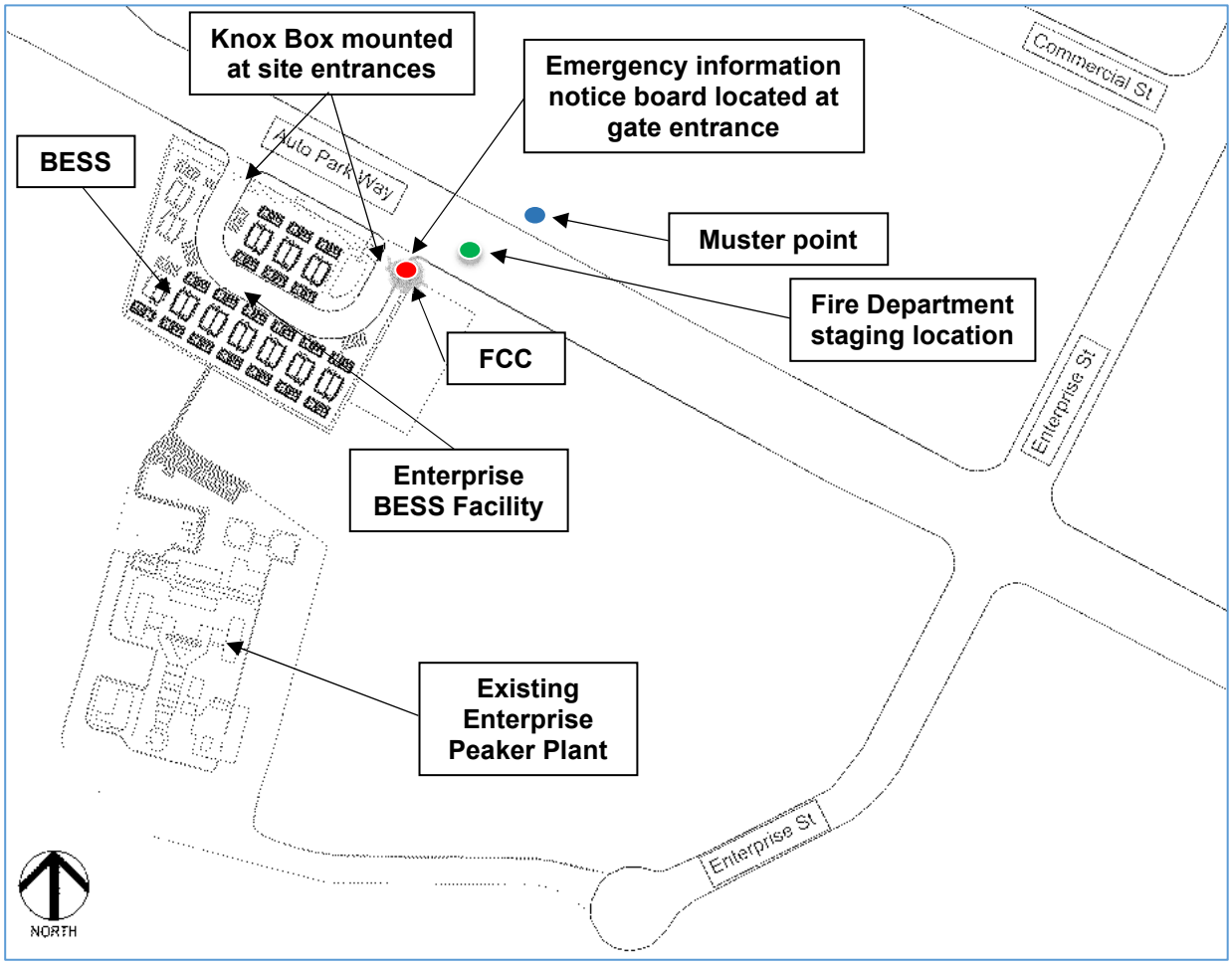
ABBREVIATIONS

AED	Automated External Defibrillator
AHJ	Authorities Having Jurisdiction
BESS	Battery Energy Storage System
BMS	Battery Management System
BOL	Beginning of Life
BOP	Balance of Plant
CFC	California Fire Code
EMS	Energy Management System
EOL	End of Life
ERP	Emergency Response Plan
ESS	Energy Storage System
FACP	Fire Alarm Control Panel
FCC	Fire Command Center
FM	Factory Mutual
LFP	Lithium Iron Phosphate
LPC	Local Plant Controller
MW	Megawatt
MWh	Megawatt-hour
NEC	National Electric Code
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
O&M	Operations & Maintenance
PCS	Power Conversion System
PPE	Personal Protective Equipment
ROC	Remote Operation Center
SCADA	Supervisory Control and Data Acquisition
SCBA	Self-Contained Breathing Apparatus
SDG&E	San Diego Gas & Electric
SME	Subject Matter Expert
SOC	State of Charge
UPS	Uninterruptible Power Supply

1 QUICK REFERENCE GUIDE

UNMANNED ESS FACILITY WITH REMOTE MONITORING

Staging Map



1. Key Site Information
   - Address: 2361 Auto Park Way, Escondido, CA 92029
   - Coordinates: 33.121727, -117.117625
   - Total Capacity: 52 MW/ 52MWh
   - Number of Enclosures: 24
   - Battery Chemistry: Lithium Iron Phosphate (LFP)

2. Abnormal Conditions - Page 18
   - Evacuate the area around the effected equipment
   - Report to the muster point and take head count

3. Emergency Contact List / Procedure – Page 11
   - For ANY emergency, call the Remote Operations Center (ROC) immediately
   - Tracy ROC:
     - Primary Emergency Number: 209.836.9987
     - Secondary number: 209.836.1605
     - ROC Manager number: 925.382.4421
   - Tracy ROC responsibilities:
     - Alert Enterprise BESS LLC if not already notified
     - Call emergency responders if necessary
     - Call Risen technical support
     - Arrange for on-site personnel if needed
   - Coordinate with Balance of Plant (BOP) provider for emergency response

4. Staging and Approach – Page 17 - 19
   - Stage at least 75 ft away from battery enclosures
   - Contact ROC for site entry consent and updates
   - Enter through the gate with Knox box access
   - Locate the Fire Command Center (FCC) just inside the main entrance

5. Hazard Assessment – Page 18 - 19
   - Check FCC display for enclosures in alarm
   - Assume toxic and flammable gases are present
   - Wear full PPE with SCBA and monitor for gases as required
   - Maintain 75 ft distance as explosive conditions could exist

6. Suppression Tactics – Page 19 - 20
   - Avoid direct suppression unless a life threat exists
   - Use water spray on adjacent structures to prevent spread
   - Apply water with a fog nozzle if deemed safe by the Incident Commander
   - Note: Foams, dry chemicals, and CO_2 are not effective

7. Enclosure Assessment – Page 23
   - Monitor BMS and FACP for internal conditions
   - Air monitor while approaching if approved by Incident Commander
   - Stay 75 ft clear if BMS/FACP is down and there is no ventilation
   - Possible explosive atmosphere even with ventilation
   - Continue monitoring for 24-48 hours post-event

8. Post-Fire Procedures – Page 15
   - Monitor nearby enclosures with detectors and BMS
   - Isolate unstable batteries until safe to decommission follow Risen recommendations
   - Maintain 75 ft exclusion zone after deflagration
   - Watch for toxic/flammable gases, re-ignition, and debris

2 INTRODUCTION

2.1 Purpose

This Emergency Response Plan (ERP) is provided by Coffman Engineers, Inc. (Coffman) for the Enterprise Battery Energy Storage System project located in Escondido, California. The following emergency response procedures are provided so that all fire service personnel understand the practices that are to be followed to prepare for and to provide immediate and effective responses to emergencies that may arise at the facility. The Energy Storage System (ESS) conditions will be remotely monitored by Enterprise BESS LLC (Operator), and service technicians will be on site periodically to maintain the enclosures. While this document is primarily intended for emergency responses to an operational BESS site, Appendix I has been included for emergency response considerations during the construction phase.

This ERP is being submitted to the California Energy Commission (CEC) for review and approval. The CEC is the entity responsible for licensing the BESS project including review (in consultation with the Escondido Fire Department) and approval of fire-related plans and design related to the BESS facility. The Escondido Fire Department is the Fire Marshal and is considered the AHJ for the purposes of Fire and Life Safety matters (e.g., emergency response planning and incident response). The life safety of personnel shall be the highest priority during any event.

2.2 Limitations

This plan does not imply, nor shall readers infer, that implementation of this plan will guarantee a perfect response will be practical or possible. No plan can shield individuals from all events.

Responders will attempt to coordinate the plan and response according to all applicable laws and standards.

Response to emergencies, events, or disasters shall only be undertaken to the level of the responders' training, Personal Protective Equipment (PPE), and resources available. There may be little to no warning to implement operational procedures during specific events.

The success or failure of all emergency plans depends upon effective training, continual (e.g., annual) review of this response plan, and execution of the response. Sites and operators shall comply with applicable codes, standards, and other requirements as appropriate locally, even if those codes, standards, and requirements contradict this plan.

Successful implementation of this plan depends on the timely identification of capabilities, available resources at the time of the incident, and a thorough information exchange between responding organizations and the facility or transporter.

This plan is unique and applicable to this specific site and equipment. It is not to be duplicated or used at any other site regardless of any assumed similarities between sites and equipment.

2.3 Facility Description

The Enterprise Battery Energy Storage System project is located at 2361 Auto Park Way, Escondido, CA 92029 with coordinates 33.121727, -117.117625.

Project Summary	
Engineering, Procurement and Construction	RavenVolt
Owner	Enterprise BESS LLC
Utility	San Diego Gas & Electric (SDG&E)
ESS Enclosure Type	Enclosure Type IP-55 SYL SU3794U3794KC
Number of ESS Enclosures	19 BOL (24 EOL)
Total Site Footprint	0.83 acres
Capacity	52 MW / 52 MWh

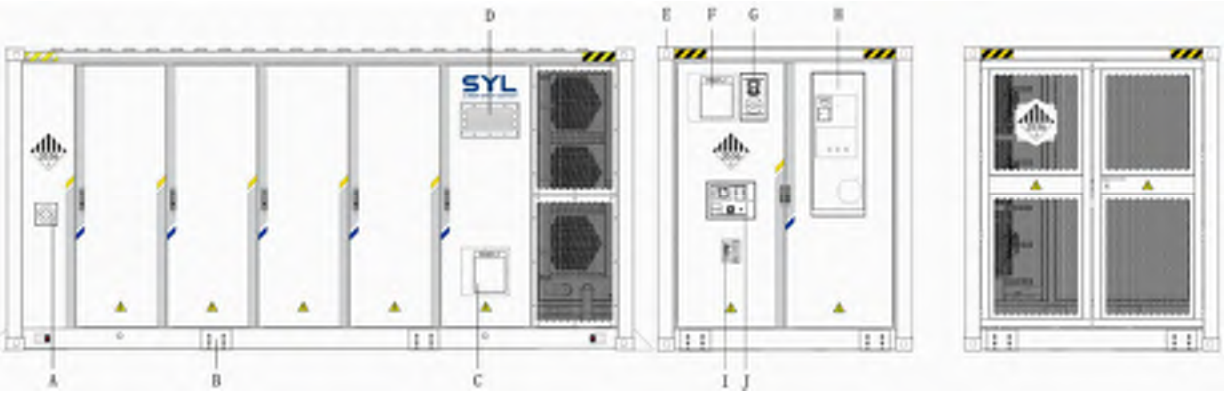


Figure 2.3 –SYL SU3794U3794KC Overview.

The project will utilize SYL SYLSU3794U3794KC energy storage system (ESS) enclosures, an on-site project substation, and associated on-site support facilities including inverters, collection lines, fencing, access roads, SCADA, and other ancillary equipment.

Below is a vicinity map (Figure 2.3.1) and a simplified map of the facility (Figure 2.3.2).

A Fire Command Center (FCC) will be provided at the site entrance near the first responder staging area. It will contain enclosures with power outlets, fire alarm indicator panel, floor and site plans, and printed copies of the ERP, safety data sheets, and any additional information deemed necessary by the Pre-incident planning sessions.

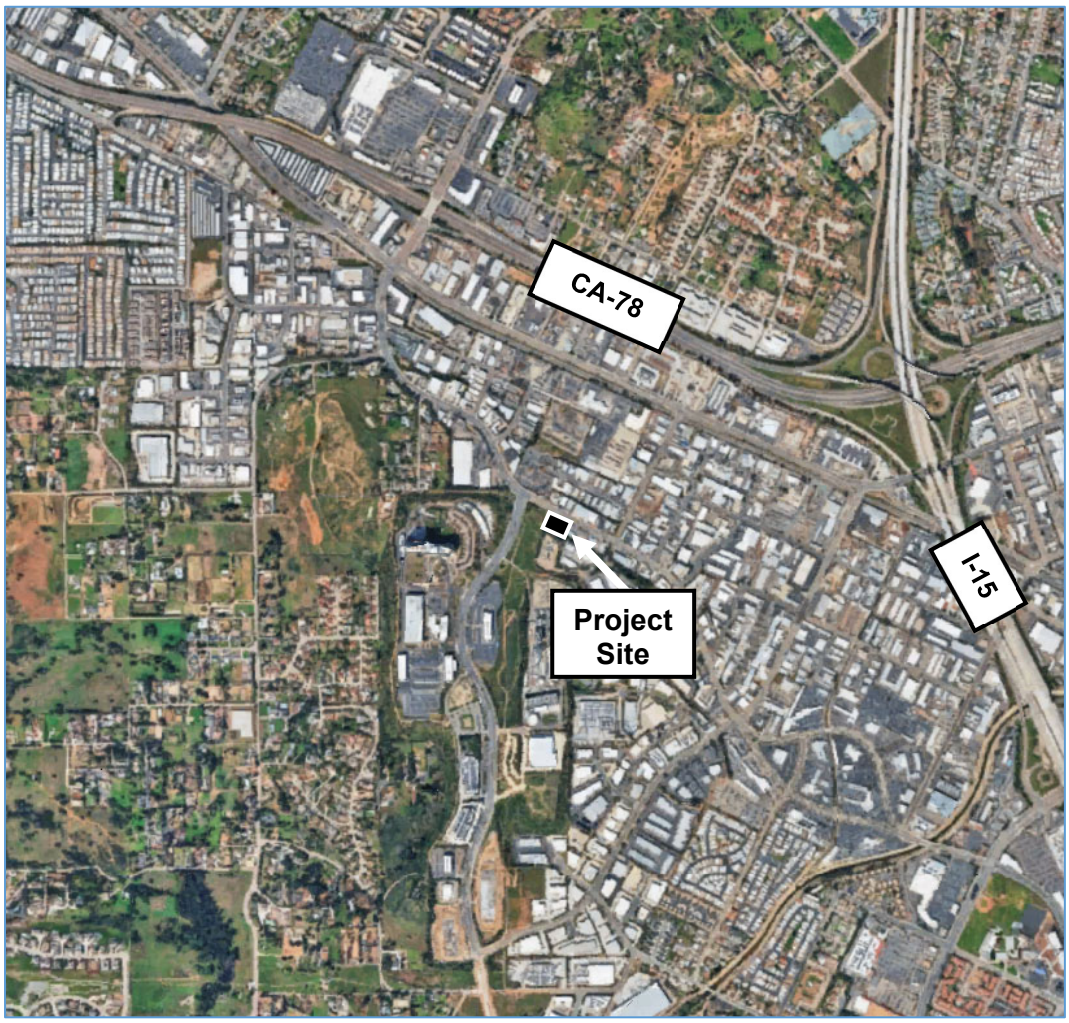


Figure 2.3.1 – Enterprise BESS Vicinity Map (North ↑)

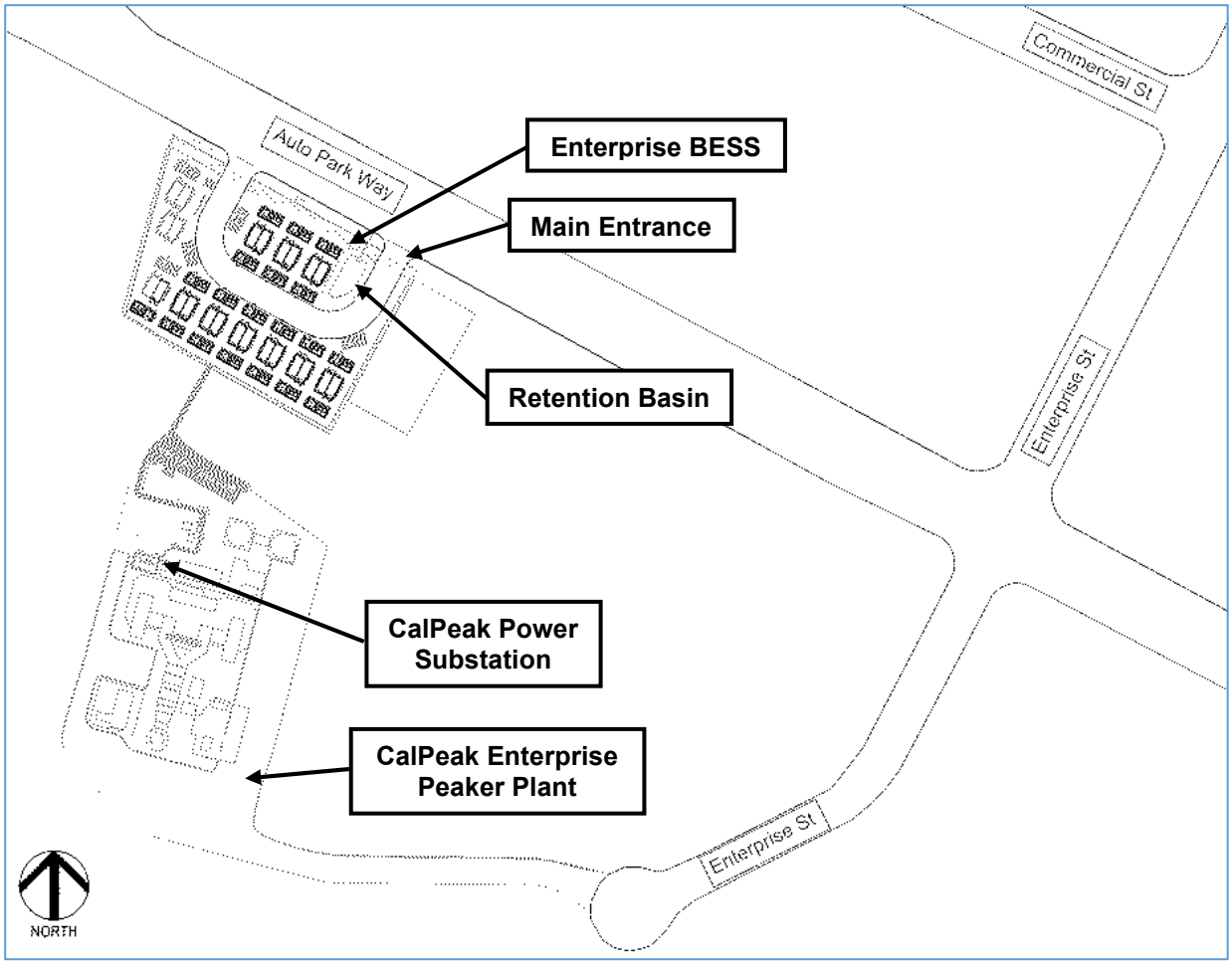


Figure 2.3.2 – Enterprise BESS Site Layout. (North ↑)

2.4 Plan Review and Revision

A review of this ERP shall be conducted and documented at a minimum on an annual basis. The plan shall be reviewed and amended whenever there is a:

- Change in facility design, construction, operation, or maintenance that affects emergency response planning,
- When outside resources are changed or modified,
- Change in ERP members,
- Updated documentation from SYL,
- Changes in the Escondido Fire Departments response plans.

The plan shall be reviewed and updated to reflect the changes that may affect this ERP when they occur and shall not be delayed until the annual review. This would include, but not be limited to, updating emergency contact information within Section 2.3.

2.5 Applicable Codes and Standards

The applicable codes with regards to fire protection and life safety, with local amendments, are listed below.

- CFC, California Fire Code, (2025 Edition), as adopted by the City of Escondido
    - Including adoption of Fire Hazard Severity Zones (FHSZ)
- NFPA 72, National Fire Alarm and Signaling Code (2025 Edition)
- NFPA 70, National Electrical Code (NEC) (2023 Edition)
- NFPA 855, Standard for the Installation of Stationary Energy Storage Systems (2023 Edition)
- UL 9540, Standard for Energy Storage Systems and Equipment (2020 Edition)
- UL 9540A, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (2019 Edition)

The following standards, not adopted by the CFC, are used as guidance:

- NFPA 855, Standard for the Installation of Stationary Energy Storage Systems (2026 Edition)
- Pre-incident planning per NFPA 1620, Standard for Pre-incident Planning (2020 Edition)

The referenced editions exceed the requirements of the existing guides and standards referenced in the 2025 CFC.

3 EMERGENCY RESPONSE MANAGEMENT

3.1 Overall Organization

Overall responsibility for this ERP lies with the Enterprise BESS Site Emergency Response Coordinator. The Emergency Response Coordinator, or their designee, is responsible for program implementation, including designating evacuation routes and employee assembly points, coordinating severe weather activities, communicating emergency response procedures to site personnel, contracting with emergency response organizations, and contractor coordination.

3.2 Roles and Responsibilities

Specific management personnel will assume leadership roles for emergency responses. Note that some of these responsibilities may be combined within the duties of single individuals. The following roles and responsibilities are defined herein and are referenced throughout the ERP.

All facility personnel have a responsibility to immediately report emergencies to the Lead Technician on duty or local emergency responder personnel when appropriate. There shall be no delay in reporting emergency events that require the local emergency responders. The Lead Technician will then notify the Emergency Response Coordinator and other key personnel of the situation using the Enterprise BESS emergency notification telephone list below.

Company Regional Manager: A Company Regional Manager is an individual not directly responsible for the day-to-day operation of the site, nor for the immediate response during or immediately after an emergency, but who does bear responsibility for post-event assessment and broader planning, recovery, and learning from experience. The Regional Manager will typically be responsible for ensuring incident records are maintained. Such a manager shall ensure that O&M Managers are providing safety training and that a safety-based culture is part of core operations across sites.

Emergency Response Contractor: An Emergency Response Contractor is an outside organization or individual who is contracted to undertake certain aspects of emergency response but is not otherwise responsible for the strategic coordination of response, nor is it part of the typical operation of a site. Care shall be taken that such contractors understand the broader picture of site safety and are aware of more comprehensive emergency response protocols (such as, but not limited to, the breadth of topics covered in this plan).

Emergency Response Coordinator: The Emergency Response Coordinator takes control of the emergency and any resources necessary until the emergency has been eliminated and the essential cleanup and restoration operations are complete. This person shall lead the incident reporting. The Emergency Response Coordinator is typically the O&M Manager; in her/his absence, the Lead Technician or other designated person shall assume this role. All personnel on-site shall know who the Emergency Response Coordinator on duty is during their time on site. Remote operators shall likewise know who the Emergency Response Coordinator is for any given shift.

The Emergency Coordinator or a designee will be responsible for notifying the appropriate regulatory agencies and, if necessary, the Emergency Response Contractor or mutual aid groups. A list of emergency contacts and agencies that may be notified in the event of an emergency is provided in this ERP. The incident will be documented and kept on file.

The Emergency Response Coordinator is also responsible for seeing that this plan is implemented and will appoint an adequate number of personnel to enforce the plan, ensure everyone is familiar with this plan, and act as a liaison with the local Fire Department(s).

The Emergency Response Coordinator will direct the following activities during an emergency:

1. Oversee the safety of all personnel.
2. Evaluate if operations in the affected area shall be shut down.
3. Take precautions to prevent or limit the spread of fire or explosions.
4. Isolate the affected area and provide directions for radio announcements.
5. Determine the source/cause of the emergency and evaluate the primary and secondary hazards to allow a full-scale, safe response.
6. Ensure that appropriate internal and external notifications are made.
7. Coordinate outside assistance from public or private organizations.
8. Implement other appropriate response provisions as necessary.
9. Determine evacuation routes for workers during an emergency.

The Emergency Response Coordinator shall be accredited in accordance with NFPA 70/70E and the National Electric Safety Code (NESC). If they are not, someone who is (e.g., the O&M Manager) must be present in emergencies to interface with electrical equipment above 50 volts.

Incident Commander: The Incident Commander is the on-scene ranking officer representing the fire department agency with incident jurisdiction. The Incident Commander authorizes incident objectives and strategies that collectively delineate a course of action. Incident Commander role shall not be designated to civilian organizations or owner operators.

O&M Manager: The Operations and Maintenance (O&M) Manager is the individual responsible for the normal operation and upkeep of the energy storage system on a day-to-day basis. This includes standard operating conditions and routine scheduled or responsive maintenance activities.

Lead Technician: A Lead Technician is an on- or off-site individual responsible for the operation of a site from a performance and technical perspective. Such responsibilities may lie with the O&M Manager or with a remote operator.

Site Manager: A Site Manager supervises the personnel for a site. The Site Manager is ultimately responsible for the implementation of the company's written procedures and practices.

Subject Matter Expert (SME): An individual and designated secondary contact with detailed working knowledge of the energy storage system and incident command systems. The Subject Matter Expert (SME) shall have ready access to information on the state of the system, status and meaning of alarms, etc. The SME's contact information must be available to the Emergency Response Coordinator and first responders, as well as others, via information on the emergency information notice board.

3.3 Emergency Contact Information

Contact	Address	Telephone Number
Emergency Fire/Police/Ambulance	N/A	911
Palomar Health Medical Center Escondido	2185 Citracado Parkwy, Escondido, CA 92029	Non-Emergency 442-281-5000

Emergency Call Centers	Telephone Number
Tracy Remote Operations Center (ROC)	Primary: 209-836-9987 Secondary: 209-836-1605
Risen Energy Security Operations Center (Reporting Emergencies)	400-101-8585
Risen Energy Technical Support	+86 400-101-8585

Emergency Services & Contractors	Telephone Number
California Governor's Office of Emergency Services (Cal OES)	916-845-8200
UC San Diego Health Regional Burn Center	619-543-6502
U.S. Pipeline & Hazardous Material Safety Administration help line	1-800-467-4922

3.4 ERP Summary Tactical Actions

The following summary actions are provided for storage and during operation:

- In case of an abnormal condition including:
  - Suspicious odor observed near the product,
  - Smoke or fire emanating from the product,
  - Severe physical impact on the product, or
  - An operational condition that is not consistent with normal operation.
- DO NOT APPROACH the ESS enclosure if an abnormal condition is suspected.
- Contact Risen Site Personnel or Risen Customer Support and describe the situation.
- The following immediate actions are recommended:
  - EVACUATE THE AREA AROUND THE EQUIPMENT
  - Notify the appropriate personnel which could include Site Operator, Risen, First Responders, Police, or the Utility.
  - Follow the Risen recommendations for shutting down or isolating the equipment.
  - Follow the instructions of Risen.
- DO NOT APPROACH THE ENCLOSURE UNTIL AHJ PROVIDES AN ALL CLEAR.
- Maintain the recommended minimum approach distances during the event:
  - First Responders and Firefighters – 75 feet is recommended in NFPA 855. Final determination to be made during the event, based on established field conditions.

3.5 Pre-Incident Planning

Pre-planning for emergencies is a crucial element of this plan. The following steps shall be taken in planning for emergencies at the site:

- The fire department and other first responders must receive a copy of this plan and participate in an on-site familiarization meeting.
- All emergency responder access points to the facility shall be identified.
- An emergency response information notice board must be maintained at a location readily visible and accessible to all personnel, identified in Appendix A, and contain key contacts for emergencies, a list of personnel certified in First Aid/CPR, and other notices as outlined in this document or as deemed appropriate by the Emergency Response Coordinator. Provision shall be made for non-English speaking workers on site.
- All road exits shall be established and posted on the emergency information notice board.
- An evacuation muster point diagram must be documented and posted on the emergency information notice board.
- Logs of on-site personnel for tracking headcounts during emergencies shall be maintained.
- All enclosures and property surrounded by fencing must be marked by signage that identifies specific hazards, as required by code.
- Site personnel must receive instruction to keep exits from the site clear.
- Safe approach distances must be established for equipment's different failure modes,

personnel must be trained in these distances, and such information must be communicated in writing to first responders during drills and other emergency response informational meetings. A safe distance of 75 feet from an enclosure is required wherever explosive conditions may be present, as further discussed in section 4.1.6 below.

- Safety Data Sheets provided by manufacturers shall, where relevant, be provided to first responders.
- Audible and visual (e.g., flashing lights) alarm systems shall be established that reflect specific on-site hazard analyses. Personnel shall be trained on the significance of different alarms and the corresponding actions. Descriptions of each alarm and corresponding actions shall be clearly posted on an emergency information notice board (location marked on the map in Appendix A).
- Complete periodic on-site training programs to identify emergency risks and protocols to follow in an emergency event.
- Review of OSHA requirements contained in 29 CFR 1910.38

3.6 Emergency Routes & Procedures

A Enterprise BESS site evacuation sheet shall be posted and employees shall be trained to know the exit location and be familiar with the muster point posted in the area indicated on the site map (Appendix B).

Depending upon the degree of emergency, weather, and site conditions, roadways, as designated on the site map (Appendix B), will be used for routes of evacuation.

In the event of an evacuation, all personnel will meet at the designated muster point, as shown in Appendix B, for further information. If the primary muster point is inaccessible or hazardous, personnel shall establish a secondary muster point and announce its location via radios and telephones as available and inform the emergency coordinator (if not present) by radio or phone. Employees shall then immediately contact their supervisor for further instructions.

When notified to evacuate, site personnel shall do so in a calm and orderly fashion, keeping the following instructions in mind:

- Walk, don’t run. Help others who need assistance as long as doing so does not put you at greater risk.
- Stay upwind, upstream, and uphill whenever possible.
- Watch for other traffic and equipment on access roads and roadways.
- Be aware of ice/snow and loose gravel conditions.
- Drive safely.

Any person with a disability (mobility, hearing, sight, etc.) who requires assistance to evacuate is responsible for prearranging with someone in their immediate work area to assist them in the event of an emergency. Anyone knowing of a person with a disability or injury who was not able to evacuate will report this fact immediately to their supervisor. This information shall be communicated to emergency responders immediately upon their arrival if the disabled person has not been evacuated.

Once an evacuation is complete, the Emergency Response Coordinator or Lead Technician shall account for all personnel. This accountability information shall be communicated to the emergency responders immediately upon their arrival. When a person is unaccounted for, the following information shall be communicated to the emergency responders:

- Name of the individual
- Disabled or not disabled
- Work location
- Last known location

Responder access points shall be kept unobstructed so first responders will be able to continue their operations when responding to emergencies within the site.

3.7 Communications

Timely and efficient communications are essential to deal with an emergency response situation. The Emergency Response Coordinator is the central point of contact for all involved in an emergency response, including first responders and Subject Matter Experts (SMEs). The following processes shall be observed during emergency communications:

- Employees using radios/phones shall yield to individuals who are the most directly involved in an emergency response activity, i.e., emergency response takes priority over all other communication on the company network.
- Emergency transmissions shall be clearly announced using signal words such as ‘urgent’ or ‘mayday.’ These signal words give priority to the radio transmitter to proceed with their message.
- If emergency radio/phone communications are interrupted or unclear, employees shall proceed to the muster point identified in Appendix B.
- All hand-held radios/phones shall be recharged daily with backup batteries ready for use.
- Radios shall be inspected daily for functionality, and a radio check shall be transmitted to confirm that both the transmission and receiving functions work. If a radio is not working properly, then the employee shall notify the lead technician and make arrangements for some other form of communication while working. Radios that are not working properly shall be placed out of service and labeled appropriately so they will not be used by another employee.
- Provision shall be made for non-English speaking workers on site.

3.8 Personal Protective Equipment

Full firefighter protective gear shall be worn in any response to a fire or explosion event or if there is any indication that a fire or thermal runaway may be present. This shall include but not be limited to proper turnout gear (coat, pants, boots, and gloves), helmet, fire hood, and a Self-Contained Breathing Apparatus (SCBA). All NFPA compliant PPE equipment shall be worn in accordance with local fire department policy.

3.9 Emergency Response Operations

Any firefighting or rescue operations shall be performed by trained professionals upon their arrival. An Incident Commander shall be identified, and they will coordinate smoke and fire

boundaries as well as Hot, Warm, and Cold zones for the scene as required. No employee is required or permitted to place themself in harm's way in order to facilitate extinguishment, evacuation, or rescue.

3.10 Post Emergency Fire Department Procedures

The Incident Commander, in consultation with the O&M Manager, SME, and fire department, shall make the final determination regarding when the scene is safe for release. The Incident Commander shall decide when it is appropriate to remove the fire and smoke scene boundaries and safety zones. In some circumstances, the scene may need to be safeguarded for investigators to examine the event's failures. If the event was caused by a criminal act, the O&M manager should be guided by law enforcement for direction.

3.11 Post-Emergency Incident Reporting Procedures

Following any emergency described in this plan and in compliance with facility permits and other County and State requirements, an incident report must be prepared by the Emergency Response Coordinator and transmitted to the appropriate individuals and agencies after review by the Company Regional Manager.

The Emergency Response Coordinator shall compile all documentation and perform a post-emergency investigation. Immediate performance of this activity will aid in determining the exact circumstances and cause of the incident. Issues to be resolved include:

- Causes of the incident.
- Effectiveness of the emergency response plan.
- Need for amendments to the response plan.
- Need for additional training programs.

4 FIRE OR THERMAL RUNAWAY INCIDENTS

4.1 Conditions Associated with Lithium-Ion Battery Storage

Electrical, vehicle, or other fires not directly involving Lithium-ion batteries shall be managed and controlled using typical firefighting and response efforts. In addition, efforts shall be made to limit fire and heat impacts to the battery storage enclosures.

Lithium-ion battery storage systems present a unique challenge for firefighters.

A battery energy storage system does not have a single point of disconnect. Disconnects will de-energize select parts of the system; however, batteries will remain energized. Stranded electrical energy in fire-damaged storage batteries and other ESS has the potential for reignition long after initial extinguishment.

Proper response to electrochemical ESS thermal runaway is automated within the enclosure, but additional site actions may be required for control or for other fires and may include the following procedures and steps:

- System isolation and shutdown
- Hazard confinement
- Fire suppression

The following hazards may be encountered when fighting fires in lithium-ion battery energy storage systems:

- Electrical enclosures and batteries may not allow water intrusion from the high-pressure stream of a fire hose.
- Shock hazard due to direct contact with energized components.
- Smoke and toxic gases
- Thermal runaway
- Explosion hazard

While the site fire alarm system utilizes an offsite 24/7 monitoring station that will alert the fire department in case of emergency, the exact conditions of each monitoring point on the fire alarm system will only be viewable at the Fire Command Center (FCC) located near the north entrance to the battery energy storage facility. This will allow the responding fire department to know which enclosure (s) is/are in alarm.

4.1.1 Thermal Runaway

Fires in electrochemical ESS are often a result of a process called thermal runaway, which results in a dynamic temperature increase. Initial signs of thermal runaway include pressure increase at the cell level, temperature increase, and off-gassing. As the process continues, additional signs might include vent gas ignition, exploding cells, projectile release, heat propagation, and flame propagation. As the failure cascades, responders shall also be prepared for toxic and potentially explosive gas release. Responders shall treat them as highly dangerous and use their entire suite of PPE and breathing apparatus when responding.

Thermal runaway can be detected by monitoring temperature and gas levels in and around a battery. The Battery Management System (BMS) monitors battery cell temperature, voltage, current, and dry contact switching value in real time but is external to the fire alarm system. Sensors within the battery enclosures monitor the batteries for high temperatures, smoke, and for toxic and flammable off-gassing. The activation of the gas, smoke, or heat sensors indicates the high probability of a thermal runaway. It sends an alarm signal to the associated FACP and subsequently to the site FCC and the remote monitoring center. Each FACP has a display that will show alarms from its local ESS group. The FCC display will show alarms from the entire site.

Rescue personnel shall keep their distance unless actively rescuing a person if batteries are in a thermal runaway condition.

The ESS enclosures are under the control of a site Energy Management System (EMS) or Local Plant Controller (LPC), which in turn communicates with an off-site fleet controller, SCADA operations center, or other third-party dispatch and monitoring entity. The ESS enclosure alarms will be forwarded to the remote operations, and remote operations or staff personnel on the site can shut down the ESS enclosure(s) remotely if determined necessary.

Note that a system shutdown will not de-energize the battery bank or guarantee that a fault or thermal runaway event has been stopped. Responders and staff shall not approach the ESS enclosure or attempt to open the ESS enclosure until deemed safe.

On-site personnel witnessing an emergency shall not assume that automated alarms have reached the Local Plant Controller or Emergency Management System or that such alarms have been passed on to remote operations. Such personnel are advised to call 911 and contact remote operations directly, in addition to other key stakeholders described herein.

4.1.2 Non-Firefighter Response to Fire Event

In the event of a pre-alarm incipient stage (beginning, small) fire where audible and visual alarms may not be activated, employees shall notify adjacent individuals of this situation and exit the area. Signs of a fire may include:

- Acrid burning smell – sweets smells (e.g., Juicyfruit) or solvent smells (e.g., nail polish have been commonly reported)
- Excessively hot access door handles or outer surfaces
- Unusual sounds indicating electrical arcing or combusting materials – (e.g., hissing and popping)
- Smoke emanating from the battery enclosure
- Other abnormal events

In the event of a more significant fire that has triggered audible or visual fire alarms, employees shall still notify adjacent individuals of this situation and exit the area.

Contractors, maintenance staff, or visitors shall immediately exit the area upon notification of an emergency condition and proceed to the designated muster point. Only employees trained in the use of fire extinguishers or other manual fire suppression systems shall attempt to use them. Employees are not expected or authorized to respond to fires beyond the incipient stage. The

fire department shall be immediately notified by dialing 911 when any unintended fire has taken place. Site management shall also be immediately notified of any emergency.

For a fire, uncontrolled heating, or off-gassing event occurring related to a Battery Enclosure:

1. Evacuate the ESS enclosure area immediately
2. Call 911
    a. Site Name: Enterprise BESS
    b. Address: 2361 Auto Park Way, Escondido, CA 92029 with coordinates 33.121727, -117.117625
3. Make sure the immediate area of the fire is clear of personnel.
4. Account for all employees, contractors, and visitors who were working in the immediate area of the fire. If any personnel are unaccounted for from the immediate fire area, issue a communication throughout the facility to attempt to locate the person(s) missing.
5. Contact the O&M Manager and Emergency Response Coordinator immediately.
6. Remove obstructions that might impede response to the scene.
7. Station available personnel at road intersections to stop traffic flow into the fire scene.
8. Proceed to the designated muster point for a headcount. If on-site, the Emergency Response Coordinator will do the headcount and relay information/instructions.
9. If encountering heavy smoke, stay low and breathe through a handkerchief or other fabric. Move away from the area.
10. Assist anyone needing help leaving the area so long as doing so does not put the assistor at additional risk.
11. Do not leave the designated muster point until advised to do so. If risk requires evacuation of the muster point, a secondary muster point must be established, and that fact must be announced via radios and alarms as available. The secondary muster point shall be outside the property boundary and at least 75 ft away from ESS enclosures.
12. The Emergency Response Coordinator will issue an “all clear” only when the fire department informs them that it is safe to do so.
13. The ESS enclosure is not to be accessed until the O&M Manager or designated Emergency Response Coordinator gives authorization.

The ESS enclosures are under the control of a site Emergency Management System (EMS) or Local Plant Controller (LPC), which in turn communicates with an offsite fleet controller, SCADA operations center, or other third-party dispatch and monitoring entity. The ESS enclosure alarms will be forwarded to the remote operations and remote operations, or staff personnel on the site, can shut down the ESS enclosure(s) remotely if determined necessary. Note that a system shutdown will not de-energize the battery bank or guarantee that a fault or thermal runaway event has been stopped. Nobody shall approach the ESS enclosure or attempt to open the ESS enclosure until deemed safe.

On-site personnel witnessing an emergency shall not assume that automated alarms have reached the Local Plant Controller or Emergency Management System or that such alarms have been passed on to remote operations. Such personnel, in addition to other critical

stakeholders described herein, are advised to call 911 and contact remote operations directly.

4.1.3 Firefighter Response to Fire Event

Considerations for firefighter response:

1. Address: 2361 Auto Park Way, Escondido, CA 92029 with coordinates 33.121727, -117.117625
2. There is a Knox box located at the site's main entrance.
3. Make operator contact for consent to enter site and updated information regarding the current situation. If the operator gives consent to enter site, follow BESS firefighting training procedures.
4. An approved Incident Command Station (ICC) and Fire Alarm Panel are provided at the designated site entrance.
5. Information on which enclosures(s) is/are in alarm may be found on the Incident Command Station (ICC) which is located just within the site entrance to the left as you enter.
6. Recommended staging location is at least 75-ft away from the nearest battery enclosure. See section 3.4.
7. Existing fire hydrants on Auto Park way will be available for fire department use.
8. Toxic and flammable gases may be present but not be detected. Assume they are present. Wear PPE including a self-contained breathing apparatus and monitor the site for toxic and flammable gases.
9. Follow Section 4.1.4 for Recommended Suppression.
10. The Emergency Response Coordinator will issue an "all clear" only when the fire department informs them that it is safe to do so.
11. The ESS enclosure is not to be accessed until the O&M Manager or designated Emergency Response Coordinator gives authorization.

4.1.4 Recommended Suppression

In the absence of a justified reason to enter the site or pass the minimum approach distance (i.e. entrapment of personnel), it is advised that first responders and emergency personnel DO NOT TAKE DIRECT ACTION to suppress the fire, enter the ESS enclosure, or enter the site.

A manual fire alarm activation is provided at the FCC at the main entrance.

If deemed appropriate and safe to do so by the Incident Commander, water can be applied to the Risen ESS enclosure exterior and adjacent structures to prevent fire spread. Existing fire hydrants on Auto Park way will be available for fire department use.

Water spray has been deemed safe as an agent for use on high-voltage systems and should only be applied by trained professionals.

The possibility of current leakage back to the nozzle, and ultimately the fire fighter, is insignificant based on testing data published in the Fire Protection Research Foundation report "Best Practices for Emergency Response to Incidents Involving Electric Vehicles Battery Hazards: A Report on Full-Scale Testing Results."

The following methods identified in the report are not recommended:

- Fire-fighting foams are not considered to be effective for these chemistries (lithium-ion batteries) because they lack the ability to cool sufficiently and can conduct electricity.
- Fire-fighting dry chemical powders will not cool the thermal runaway event / battery components.
- Carbon dioxide and inert gas suppressing agents will also eliminate visible flame but will likely not provide sufficient cooling to interrupt the thermal runaway process.

In accordance with Section 1.4 of this document, this section shall be reviewed annually and updated appropriately as fire protection technology changes.

4.1.5 Risen ESS Enclosure Fire Protection System Summary

The ESS enclosures located at Enterprise BESS site **will** have the following characteristics:

- Thermal runaway management
- Mechanical ventilation system
- Automatic fire detection system
- Gas detection systems
- Clean agent (Novec 1230 or FM-200) fire suppression
- Interior fire sprinkler system with FDC on ESS enclosure (Factory installed, but not used)

The ESS enclosures located at Enterprise BESS site **will not** have the following characteristics:

- Dry chemical fire suppression

4.1.6 Explosion Control

The Risen lithium-Ion batteries may release detectable levels of flammable gases such as Hydrogen (H_2) and other hydrocarbons in the event of thermal runaway, fire or when exposed to high temperatures. In the event that flammable gases are detected, the enclosure exhaust ventilation system is designed to exhaust the gases. An alarm signal will be transmitted to the

main fire alarm panel identifying the enclosure and that flammable gas has been detected. The exhaust ventilation system will continue after detected gas concentrations within the enclosure have been reduced until manually reset.

A minimum of seventy-five feet (75') should be maintained between individuals and the incident enclosure whenever explosive conditions may be present as indicated by the enclosure and site fire alarm control panels. Staging of personnel and equipment shall be on the angles of the enclosure to stay out of the blast pressure wave as much as possible, as well as the blast radius of any doors or other potential projectiles.

Only attempt to extinguish fire if imminent threat to life safety exists. Lithium batteries off-gas when heated or when subjected to electrical or physical damage. These gases can accumulate inside the enclosure at levels well above the Lower Explosive Limit (LEL). Extreme caution shall be taken prior to any attempts to open any compartments or access panels on the system as the introduction of fresh air may bring atmospheric condition back into the explosion range and result in an explosion if a fire or another ignition source is present.

Gas monitoring must be continuously conducted at all times near the Fire Command Center to warn of potential atmospheric risks.

4.1.7 Toxic Gas Release

The Risen lithium-Ion batteries may release detectable levels of toxic gases including carbon monoxide (CO), carbon dioxide, hydrogen, methane, ethylene, and small traces of other gases in the event of fire or high temperatures. The Site Controller monitors the module and cell temperatures and will provide an alert through the SCADA system prior to the thermal runaway. This alert will be transmitted to the EMS, and Local Plant Controller.

Personnel shall remain clear of the enclosure and at no point approach during an off-gassing event unless there is imminent threat to life safety at which only properly trained and equipped personnel may approach. This approach shall be with full firefighter protective gear to include self-contained breathing apparatus (SCBA). Entry in this situation shall be at the sole discretion of the Incident Commander.

The pressure relief vents are located at the top front of the cabinet. Any approach to the front of the cabinet may pose a potential risk of exposure to the byproducts of combustion. Chemicals released from the batteries during a fire or explosion will be in a gaseous form and primarily pose an explosion hazard. However, as water may be used in extinguishing flames, these gases can become acids which may cause skin irritation.

The thermal management system utilizes an ethylene glycol coolant and R134a refrigerant for the HVAC system. These chemicals have the potential to leak in an event. R134a can become combustible in air with strong ignition sources. Under certain circumstances these chemicals can pose a health risk in sufficient quantities. Refer to the Safety Data Sheets provided by Risen for more information on the coolant and refrigerant.

4.1.8 Assessing when it is safe to approach or open the enclosure.

Batteries remain energized even if all the contacts, breakers, and switches have been opened. Toxic or flammable gas may be present inside the enclosure. Visual observation of the exterior

may not provide any information on the conditions within. The Incident Commander, with support from First Responders and Operations Manager, shall remotely monitor data and information from the battery management system (BMS) and the Fire Alarm Panel to assess the conditions internal to the enclosure.

If the Site Controller and fire alarm panel are reporting, the following information should be available:

1. Alarm status of smoke detectors and heat detectors
2. Gas Alarm
3. BMS can provide internal temperature and location information if thermal runaway has occurred as well as elevated temperature information for cells that may be at risk of entering thermal runaway

If the exhaust ventilation system is operational and exhausts gases from the enclosure, it is unlikely that flammable gas concentrations within the enclosure are above the LEL, based on a credible event.

Under certain conditions the thermal management system may continue to operate. If the conditions inside the enclosure have caused the thermal management system and BMS to cease reporting to the Site Controller, then extreme caution shall be utilized including maintaining a safe distance and **NOT** opening the enclosure. It is recommended that first responders stay clear of the enclosure and allow the enclosure to burn itself out.

Defensive firefighting is recommended only to prevent spread to nearby enclosures or equipment if the Incident Commander determines this is a possibility. Allow the battery packs to cool down while maintaining contact with the Equipment Manufacturer. This may take up to 48 hours or longer based on the severity of the incident. Monitor the SCADA telemetry and ESS enclosure with a thermal imaging camera.

Monitoring for the presence of smoke (which precedes or coincides with thermal runaway) and remote monitoring of the exterior temperature of the enclosure may provide information about the risk of fire or explosion. Maintaining a safe distance, air monitoring and a fire watch for 48 hours after temperatures drop and no smoke has been observed may be required to ensure it is safe to approach or open the enclosure. If the fire department or any other highly trained personnel has deemed the enclosures safe to open, then they may do so as long as they are confident that no risk to life exists.

When the ESS enclosures are finally opened to vent the area out, the enclosure doors shall remain open until the decommission phase. Stranded energy in ESS still poses a risk that can continue to exist for hours, days, and even weeks following an emergency event of a damaged battery. Reference Decommissioning/Stranded Energy Plan for more information.

The fire department can deem the ESS thermal runaway event safe, to turn back over to the owner, once the following criteria are met:

1. Visible smoke and gas concentrations have shown to be actively decreasing
2. Toxic gas levels are within PAC-2 measured 25 feet away from the ESS event
    a. Carbon Monoxide - 83 ppm
3. Surface temperatures of all the ESS modules within the enclosure are around 200ºF
4. Final determination will be based on municipal Fire Department policies

5 MEDICAL EMERGENCY

5.1 Medical Emergency Response Procedures

If an employee is injured, or an accident has occurred on-site and first aid is not enough treatment for the emergency, 911 must be called. The call to 911 can be made by phone by any available site personnel. The caller must state to the dispatch that they are at the Enterprise BESS facility. A second notification will be made to the O&M Building to inform others of the situation.

Employees with first aid/CPR training are identified on the emergency information notice board, and employees shall be aware of who on staff is so certified. At all times when the site is staffed, at least one first aid-certified member of staff shall be present. The location of first aid kits and automated external defibrillators (AEDs), if present, shall be identified by appropriate signage and indicated on the map in Appendix A. All employees shall designate a personal emergency contact, which shall be kept on file.

The following procedures apply for serious medical injuries such as loss of consciousness, heart attack, bone fractures, neck trauma, or severe burns.

1. If life-threatening, call 911.
2. Notify Operations and Safety Managers.
3. Provide name, exact location, number of injured persons, and a brief description of the incident.
4. On-site personnel shall meet emergency medical responders at the site entrance and direct them to the location of the incident.
5. Do not leave or move the injured unless directed to by Safety Managers or emergency medical responders.
6. Administer first aid if necessary.
7. The site manager shall inform the employee’s personal emergency contact.
8. Document incidents and keep them on file.

Note that emergency response procedures are ultimately the responsibility of the Incident Commander.

5.1.1 Attending an Incident

When attending an incident, the following procedures apply:

1. Clear a path to the injured person for Operations and Safety Managers and assign personnel to assist with signaling emergency medical responders to the location of the incident.
2. Identify the location of the Project Site entrance nearest to the incident and notify emergency medical responders.
3. Operations and Safety Managers shall meet emergency medical responders at the site entrance.

4. Direct and accompany emergency medical responders to the location of the incident.
5. Follow all directions of emergency medical responders.
6. Contact management personnel and subcontractors.
7. Document incidents and keep them on file.

5.1.2 Medical Facilities

The nearest medical facility and emergency room to the project site is Palomar Health Medical Center Escondido at 2185 Citracado Parkwy, Escondido, CA 92029. Directions from the site entrance:

1. Head northwest on Auto Park Way
    - 472 ft (30 seconds)
2. Turn left onto Citracado Parkwy
    - 0.2 miles (1 minute)
3. Turn right into the Medical Center
    - 0.1 miles (30 seconds)

5.2 Non-Emergency Safety Procedures

5.2.1 Notification of Minor Incident

In the event a safety incident occurs where emergency response is not required (first aid treatment, near miss, etc.), work is to be stopped immediately and reported to the Emergency Response Coordinator and Lead Technician. Risk will be reassessed, adequate controls implemented, and the situation made safe before resuming the task. The event will be documented and kept on file.

5.2.2 Heat Related Illnesses

When the temperature exceeds 95 degrees Fahrenheit (35 degrees Celsius) or is expected to be so during the course of a shift or work project, the O&M Manager will hold short staff meetings to review the weather report; reinforce heat illness prevention with all workers; and provide reminders to drink water frequently, to be on the lookout for signs and symptoms of heat illness, and inform them that shade can be made available upon request.

Employees shall have free access to potable drinking water provided and located as close as practicable to the areas where employees are working. Where drinking water is not plumbed or otherwise continuously supplied, it shall be provided in sufficient quantity at the beginning of the work shift to provide one quart per employee per hour for drinking for the entire shift. Employers may begin the shift with smaller quantities of water if they have effective procedures for replenishment during the shift as needed to allow employees to drink one quart or more per hour. The frequent drinking of water shall be encouraged.

Heat-Related Illness	Signs	Actions
Heat Stroke	• High body temperature (103˚F or higher) • Hot, red, dry, or damp skin • Fast, strong pulse • Headache • Dizziness • Nausea • Confusion • Losing consciousness (passing out)	• **Call 911 right away. Heat stroke is a medical emergency** • Move the person to a cooler place • Help lower the person's temperature with cool clothes or a cool bath • Do not give the person anything to drink
Heat Exhaustion	• Heavy sweating • Cold, pale, and clammy skin • Fast, weak pulse • Nausea or vomiting • Muscle cramps • Tiredness or weakness • Dizziness • Headache • Fainting (passing out)	• Move to a cool place • Loosen your clothes • Put cool, wet clothes on your body or take a cool bath • Sip water **Get medical help right away if:** • You are throwing up • Your symptoms get worse • Your symptoms last longer than 1 hour
Heat Cramps	• Heavy sweating during intense exercise • Muscle pain or spasms	• Stop physical activity and move to a cool place • Drink water or a sports drink • Wait for cramps to go away before you do any more physical activity **Get medical help right away if:** • Cramps last longer than 1 hour • You're on a low-sodium diet • You have heart problems
Sunburn	• Painful, red, and warm skin • Blisters on the skin	• Stay out of the sun until your sunburn heals • Put cool clothes on sunburned areas or take a cool bath • Put moisturizing lotion on sunburned areas • Do not break blisters
Heat Rash	• Red clusters of small blisters that look like pimples on the skin (usually on the neck, chest, groin, or in elbow creases)	• Stay in a cool, dry place • Keep the rash dry • Use powder (like baby powder) to soothe the rash

6 SECURITY INCIDENTS

Security incidents at an ESS facility can potentially compromise the safety systems and lead to hazardous conditions. In line with CFC Section 1207.4.9, the ESS installation is equipped with security measures to prevent unauthorized access. Any security breach should be treated as a potential safety risk to the ESS.

6.1 Bomb Threat

6.1.1 Response Plan

The purpose of this plan is to give direction to all site personnel in the event the Enterprise BESS site is a target of an actual or threatened bomb assault/attack.

Anyone receiving a bomb threat shall:

1. Treat the caller with courtesy and respect. Complete the Bomb Threat Report (Appendix D). Use this sheet as a reference while talking with the caller making the threat.
2. Attempt to obtain as much information as possible. See the “Bomb Threat Checklist” (Appendix E).
3. Immediately notify the Enterprise BESS site Emergency Coordinator by phone. Stop all radio transmissions from this point on until cleared by the Emergency Coordinator or other competent authority. Radio transmissions can activate electronic detonating or timing devices.

The Emergency Response Coordinator will immediately notify 911. The Emergency Response Coordinator shall:

1. Evaluate the threat and determine the appropriate course of action to take.
2. Notify law enforcement and ambulance.
3. Evacuate the facility as necessary.
4. Coordinate evacuation of any part of the surrounding community with local authorities as needed.
5. Coordinate the search of the site with the proper authorities.

6.1.2 Suspicious Items

If any suspicious item(s) are found, they are not to be touched. Barrier tape will be used to mark the area where the suspicious item(s) are by extending a continuous line of tape beginning immediately in front of the suspicious item(s) and extending to just outside the room exit. This will help guide local authorities to the suspicious item.

The Emergency Response Coordinator will be responsible for communicating the "All Clear" message once the threat has passed or is no longer present.

6.2 Chemical/Biological Agent Threat

The procedures described previously for a bomb threat shall be used for a chemical or biological agent threat.

Any person who is exhibiting signs and symptoms from a chemical or biological agent shall be isolated from other workers and be prepared for transport by emergency medical services.

6.3 Sabotage or Vandalism

Anyone detecting any act or threat of any act of sabotage or vandalism will immediately notify the Emergency Response Coordinator. The Emergency Response Coordinator will evaluate the situation and decide what actions to take. The following options shall be considered and implemented:

1. Notification of 911.
2. Corrective action as required, providing that no person will risk injury.
3. Evacuation of the facility.

6.4 Active Shooter

In an active shooter situation, employees shall:

1. Quickly determine what actions to take to protect life: Options include run, hide, and fight (described in the Ready.gov site). Use best judgment based on the specific circumstances of the incident. Getting away from the shooter(s) is the top priority. Call 911 when in a safe location and warn/prevent individuals from entering an area where an active shooter may be if possible.
2. When encountering responding police, remain calm and follow all instructions from the officers. Officers may shout commands and push individuals to the ground for their safety as well as their own. When law enforcement personnel arrive at the scene, personnel shall be aware of the following:
    - Follow all official instructions from the police
    - Remain calm, think, and resist the urge to panic
    - Immediately raise hands and spread fingers
    - Keep hands visible at all times
    - Put down any items
    - Avoid making sudden or quick movements toward officers
    - Do not point, scream, or yell
    - Do not ask for help from the officers when evacuating
    - Proceed in the direction advised by the officers
    - Provide all relevant information to police

7 ENVIRONMENTAL HAZARDS

7.1 Flooding and Flash Floods

Flash flooding is a result of heavy localized rainfall, such as that from slow-moving, intense thunderstorms. Flash floods often result from small creeks and streams overflowing during heavy rain. These floods often become raging torrents of water that rip through riverbeds and canyons, sweeping everything with them. Flash flooding can occur within 30 minutes to 6 hours of a heavy rain event. In hilly terrain, flash floods can strike with little to no advanced warning. Distant rain may be channeled into gullies and ravines, causing flash flooding in minutes. In the event of a flash flood, the following procedures shall apply:

1. During Periods of Thunderstorms:
    - Always remain alert to heavy rains in your immediate area or upstream from your location. It does not have to be raining at your location for flash flooding to occur.
    - Avoid all topographic depressions that may act as a channel or receptacle for flood water.
    - If you are in a vehicle and are positioned in a dry stream or riverbed, move the vehicle to high ground or abandon the vehicle and seek high ground. If you are already in the stream of water, stay with the vehicle and get on top of the roof.
    - Wait for the flood waters to subside before moving from the area.
    - Be aware of possible lightning.
2. Once the Flashflood has Stopped:
    - Report to the management of the designated area.
    - Attend to any injured, but do not move them unless they are in an unsafe area. Moving them may cause further injury.
    - Management will contact those who are outside by radio.
    - Call 911 to report any injuries, fires, or to receive any other emergency aid.
    - The designated on-site Incident Commander will contact those who are outside by radio or phone.
3. After all are Accounted For:
    - Management will evaluate the extent of the damage and decide whether or not to evacuate the site.
    - Check water and electrical lines, buildings, transformers, containers, inverters, etc. for damage.
    - Do not approach downed power lines. Call local utility CalPeak Power to notify.
    - The Incident Commander will contact senior management and provide a status report.

7.2 High Winds and Dust Storms

Upon the issuance of high wind warnings:

- Take cover in a safe location. Lie down alongside walls.
- If inside, stay inside. If outside, find a secure object that you can attach yourself to. Seek cover alongside building foundations or in trenches. Cover your head and face with your arms, and keep your legs tightly together.
- Remain in place until the high winds subside to a safe speed. Move only when it is safe to do so. Call for help if you cannot move,

- Report to management or muster area for roll call.
- If any person is missing, a search will be made to determine their location and condition only if it is safe to do so.
- Attend to any injuries, but do not move unless they are in an unsafe area.
- Call 911 for emergency assistance.

7.3 Earthquakes

Earthquakes may strike with little to no warning. Earthquakes may result in a lack of basic necessities and loss of life, road and bridge damage, and collapse of buildings or destabilization of the base of buildings. Be aware that some earthquakes may be foreshocks and precursors to a more significant subsequent earthquake. Many earthquakes are also accompanied by aftershocks after the main event has occurred.

1. Earthquake Preparedness:
    - All employees must be trained in the earthquake procedure and evacuation plan.
    - The escape routes must be posted if required by the Emergency Response Coordinator.
    - Safety meetings and drills on earthquake preparedness must be held at least annually.
2. At the Onset of an Earthquake:
    - Drop to the ground, cover your head, and hold on to a sturdy object if available.
    - If outside, quickly find an area clear of possible falling objects.
    - Remain in a safe area until all movement has stopped.
3. When the Earthquake has stopped:
    - Report to the safest, closest designated area
    - Attend to any injured persons. Only move them if they are in an unsafe area. Moving them may cause further injury.
    - The designated on-site Incident Commander will contact those who are outside by radio or phone.
    - Be aware that there may be aftershocks that may be large enough to do additional damage to structures that were weakened during the original quake.
4. After all are Accounted For:
    - Management will evaluate the extent of the damage and decide whether or not to evacuate the site.
    - Check water and electrical lines, buildings, transformers, containers, inverters, etc. for damage.
    - Do not approach downed power lines. Call SDG&E to notify.
    - Visually inspect battery equipment and fire alarm equipment for damage.
    - Call the monitoring station and ensure all readings are normal.
    - The Incident Commander will contact senior management and provide a status report.

7.4 Lightning

In the event of an approaching lightning storm within 30 miles of the site, the following procedures will apply.

1. Notify the O&M Manager and all on-site employees.
2. Stop work safely and head to staging and laydown yards in vehicles.
3. Remain at staging and laydown yards and get updates on weather conditions.

At the Onset of Lightning:

1. If you are inside, stay inside. Avoid contact with any conductive objects. Stay clear of electrical power sources. Stay off of landlines.
2. If you are outside, get inside a vehicle if available. If no shelter is available, get on the ground.
3. If you are caught in an open area, act quickly to find adequate shelter. The most important action is to remove yourself from danger. Crouching or getting low to the ground can reduce your chances of being struck but does not remove you from danger.
4. If you are caught outside with no safe shelter nearby, the following actions may reduce your risk:
    - Immediately get off elevated areas such as hills, mountain ridges, or peaks.
    - Never lie flat on the ground. Crouch down in a ball-like position with your head tucked and hands over your ears so that you are down low with minimal contact with the ground.
    - Never shelter under an isolated tree.
    - Never use a cliff or rocky overhang for shelter.
    - Immediately get out of and away from any body of water.
    - Stay away from objects that conduct electricity (barbed wire fences, power lines, etc.)

APPENDICES

Appendix A

MAP OF SITE

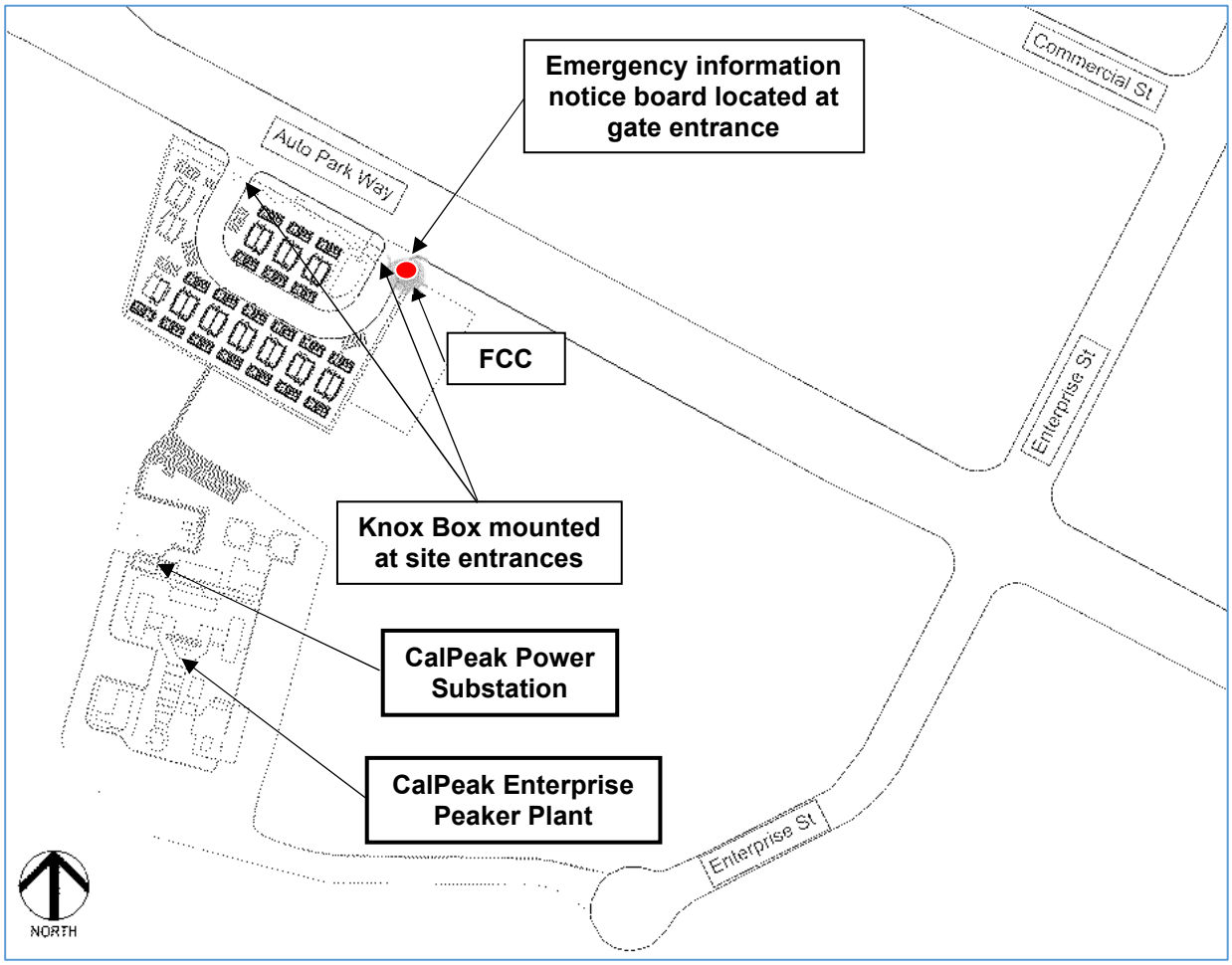


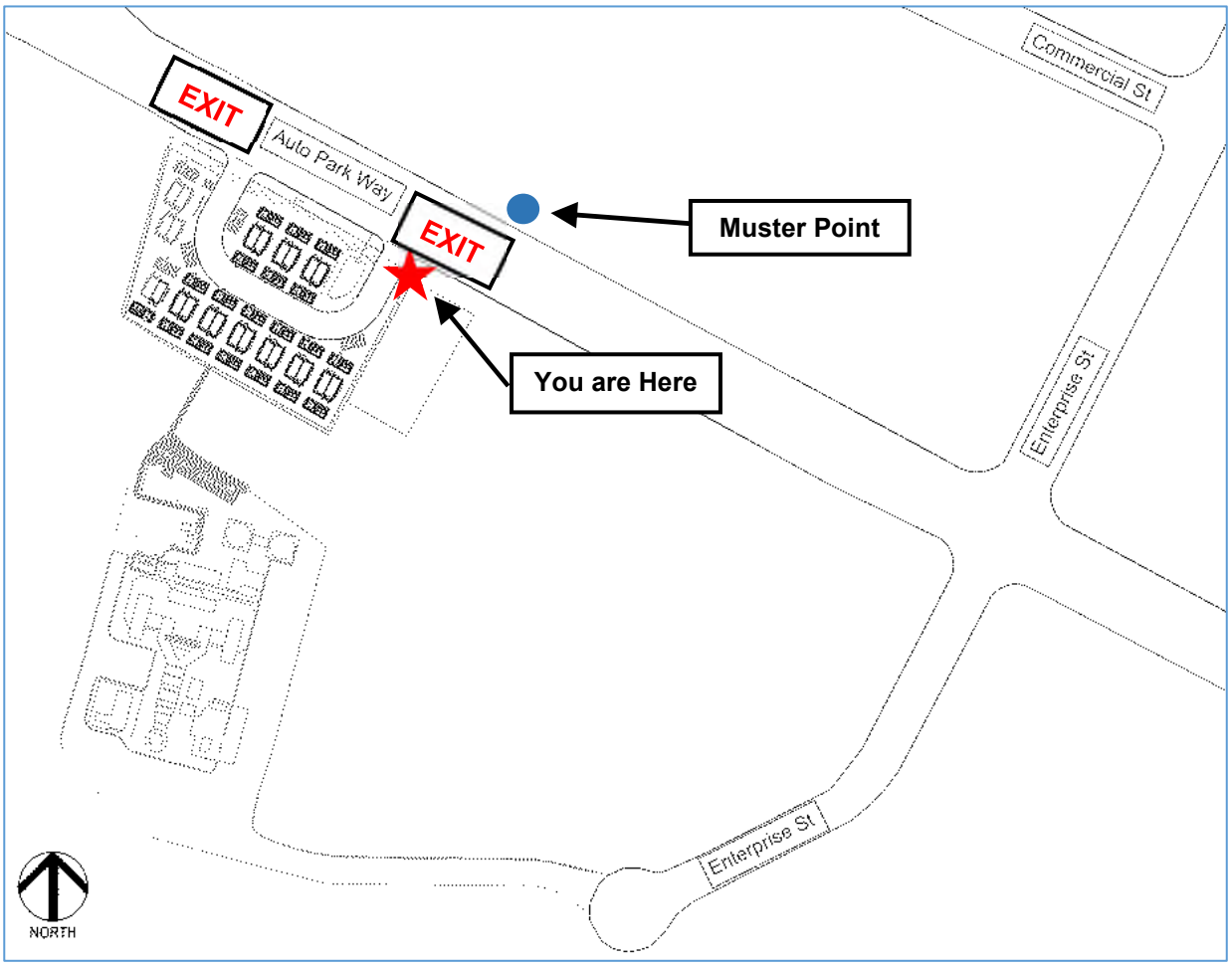
Figure A – Enterprise BESS Site Map (North ↑)

Appendix B
EMERGENCY RESPONSE MAP

Emergency Response Map

Site Name: Enterprise Battery Energy Storage System
Site Address: 2361 Auto Park Way, Escondido, CA 92029

Fire/Police/Ambulance: 911
Tracy ROC Emergency Number: 209-836-9987
Cal OES: 916-845-8200



Emergency Response Plan Located within the Fire Command Center Cabinet

Personnel shall stay at the muster point until the fire department arrives

Figure B – Proposed Emergency Response Map (North ↑)

Appendix C
INCIDENT REPORT FORM

HAZARDOUS MATERIALS INCIDENT REPORT

INITIAL CONTACT INFORMATION

(Check one): _____ REPORTED/ACTUAL INCIDENT __ DRILL/EXERCISE

1. Date/Time of Notification: _____ Report received by: _____
2. Reported by (name & phone number or radio call signs): _____
   _____
3. Company/agency and position (if applicable): _____
4. Incident address/descriptive location: _____
   _____
   _____
5. Agencies at the scene: _____
   _____
6. Known damage/casualties (do not provide names over unsecured communications): _____
   _____
   _____

CHEMICAL INFORMATION

7. Nature of emergency: (check all that apply)
   ___ Leak ___ Explosion ___ Spill ___ Fire ___ Derailment ___ Other
   Description: _____
   _____
   _____
   _____
8. Name of material(s) released/placard number(s): _____
9. Release of materials:
   _____ Has ended _____ Is continuing. Estimated release rate & duration: _____
10. Estimated amount of material which has been released: _____
11. Estimated amount of material which may be released: _____

12. Media into which the release occurred: _____ air _____ ground _____ water
13. Plume characteristics:
    a. Direction (Compass direction of plume):_____ c. Color: _____
    b. Height of plume: _____ d. Odor:_____
14. Characteristics of material (color, smell, liquid, gaseous, solid, etc) _____
15. Present status of material (solid, liquid, and gas):_____
16. Apparently responsible party or parties: _____

ENVIRONMENTAL CONDITIONS

17. Current weather conditions at incident site:
    Wind From:_____ Wind Speed (mph):_____ Temperature (F): _____
    Humidity (%): _____ Precipitation: _____ Visibility: _____
18. Forecast:_____
19. Terrain conditions:_____

HAZARD INFORMATION

(From ERP, MSDS, CHEMTREC, or facility)

20. Potential hazards:_____
21. Potential health effects:_____
22. Safety recommendations:_____
23. Recommended evacuation distance: _____

IMPACT DATA

24. Estimated areas/ populations at risk:_____

25. Special facilities at risk: _____

_____

26. Other facilities with HAZMAT in area of incident: _____

_____

PROTECTIVE ACTION DECISIONS

27. Tools used for formulating protective actions

_____ a. Recommendations by facility operator/responsible party

_____ b. *Emergency Response Plan*

_____ c. Material Safety Data Sheet

_____ d. Recommendations by CHEMTREC

_____ e. Results of incident modeling (CAMEO or similar software)

_____ f. Other: _____

28. Protective action recommendations:

____ Evacuation ____Shelter-In-Place ____Combination ____No Action

____ Other _____

Time Actions Implemented

_____

_____

_____

29. Evacuation Routes Recommended: _____

_____

EXTERNAL NOTIFICATIONS

30. Notification made to:

_____ National Response Center (Federal Spill Reporting) 1-800-424-8802

_____ CHEMTREC (Hazardous Materials Information) 1-800-424-9300

_____ State Emergency Response Commission

_____ SERC written follow-up forms

31. Other Information: _____

_____

Source: Washington State Emergency Response Commission. Local Emergency Planning Committee (LEPC) Hazardous Materials Emergency Response Plan TEMPLATE. September 2011. http://www.ecy.wa.gov/epcra

Appendix D
BOMB THREAT REPORT

*** * * KEEP CALLER ON THE LINE AS LONG AS POSSIBLE! * * ***

Exact words of caller:

_____

_____

Questions to ask the caller:

1. When is the bomb going to explode? _____
2. Where is the bomb right now? _____
3. What kind of bomb is it? _____
4. What does the bomb look like? _____
5. Why did you set the bomb? _____
6. Where are you calling from? _____
7. What is your name? _____

Try to determine the following

IDENTITY: • male • female • adult • juvenile (age? _____)

VOICE: • loud • high-pitched • deep • raspy • pleasant

• disguised • broken Other: _____

ACCENT: • local • not local • foreign • regional _____

RACE: • Caucasian • Black • Hispanic • Asian

Other: _____

SPEECH: • educated • average • illiterate • obscene

Other: _____

MANNER: • calm • angry • rational • irrational • coherent

• incoherent • deliberate • self-righteous • laughing • intoxicated

BACKGROUND NOISES:

- office machines
- factory machines
- bedlam
- trains
- quiet
- voices
- mixed sounds
- airplanes
- music
- traffic
- party

Other: _____

If the voice is familiar to you, who did it sound like? _____

Additional Information: _____

_____

Date____/____/____ Time: _____:_____ a.m./p.m. Received by: ___

Appendix E
BOMB THREAT CHECKLIST

Mail Threat:
_____1. Handle documents as little as possible to preserve fingerprints. _____2. Hand deliver immediately to O&M Manager.
Phone Threat:
_____1. Complete Bomb Threat Form. _____2. Deliver completed form to O&M Manager. _____3. Notify Supervisor immediately.
O&M Manager:
_____1. Gather all information regarding threat. _____2. Decide upon course of action. _____3. Coordinate searches with proper authorities.
Suspicious Objects:
_____1. DO NOT TOUCH OR ATTEMPT TO MOVE! _____2. Notify Police—911.
Evacuation:
_____1. Announce over public address system, give location where to assemble. Do not use the radio. _____2. Enlist volunteers to remain and shut down site.
Re-entry:
_____1. Determined based on: _____a. "All-clear" given by bomb disposal unit. _____b. O&M Manager's judgment that danger is passed. _____2. Full report prepared.

Appendix F

CHEMICAL/BIOLOGICAL AGENT THREAT REPORT

*****KEEP CALLER ON THE LINE AS LONG AS POSSIBLE*****

Exact words of caller:

_____

_____

Questions to ask the caller:

1. What chemical or biological agent is it? _____
2. When is the agent going to be released? _____
   (date) (time)
3. Where is it right now? _____
   (Building) (Floor) (Room)
4. Who put it there? _____
5. What does it look like? _____
6. What will cause it to spread? _____
7. What will trigger it? _____
8. Where did you get the agent? _____
9. Why are you doing this? _____
10. What is your name? _____
11. What is your telephone number and address? _____

Try to determine the following

IDENTITY: • male • female • adult • juvenile (age? _____)

VOICE: • loud • high-pitched • deep • raspy • pleasant

• disguised • broken Other: _____

ACCENT: • local • not local • foreign • regional: _____

RACE: • Caucasian • Black • Hispanic • Asian

Other: _____

SPEECH: • educated • average • illiterate • obscene

Other: _____

MANNER: • calm • angry • rational • irrational • coherent

• incoherent • deliberate • self-righteous • laughing • intoxicated

BACKGROUND NOISES:

• office machines • factory machines • bedlam • trains • quiet

• voices • mixed sounds • airplanes • music • traffic

• party Other: _____

If the voice is familiar to you, who did it sound like? _____

Additional Information: _____

_____

Date____/____/_____ Time: _____:_____ a.m./p.m. Received by: ___

Appendix G

CHEMICAL/BIOLOGICAL AGENT THREAT CHECKLIST

Mail Threat:

_____ 1. Handle documents as little as possible to preserve fingerprints.

_____ 2. Hand-deliver immediately to O&M Manager.

Telephone Threat:

_____ 1. Complete the Chemical/Biological Threat Report form.

_____ 2. Deliver completed form to O&M Manager immediately.

O&M Manager:

_____ 1. Gather all information regarding threat.

_____ 2. Decide upon course of action.

Searches:

_____ 1. Comprehensive---To be conducted by trained law enforcement personnel only.

Suspicious Objects:

_____ 1. Do not touch or attempt to move.

_____ 2. Notify police.

Evacuation:

_____ 1. Make a site-wide announcement and give location where to assemble.

_____ 2. Enlist volunteers to remain and shut down site.

Re-entry:

_____ 1. Determined based on:

_____ a. "All-Clear" given by competent authority.

_____ b. O&M Manager's judgment that danger has passed.

_____ 2. Full report prepared.

Appendix H
SAFETY DATA SHEETS

Solstice® 513A

10668670

SECTION 1. IDENTIFICATION

Product name	:	Solstice® 513A
Number	:	000000022892
Product Use Description	:	Refrigerant
Manufacturer or supplier's details	:	Honeywell International Inc. 115 Tabor Road Morris Plains, NJ 07950-2546
For more information call	:	800-522-8001 +1-973-455-6300(Monday-Friday, 9:00am-5:00pm)
In case of emergency call	:	**Medical: 1-800-498-5701 or +1-303-389-1414**
	:	**Transportation (CHEMTREC): 1-800-424-9300 or +1-703-527-3887**
	:	
	:	(24 hours/day, 7 days/week)

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Form	:	Liquefied gas
Color	:	clear colourless
Odor	:	slight ether-like

Classification of the substance or mixture

Classification of the substance or mixture	:	Gases under pressure, Liquefied gas Simple Asphyxiant

GHS Label elements, including precautionary statements

Symbol(s) :

Signal word : Warning

Hazard statements : Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements : **Storage:**
Protect from sunlight. Store in a well-ventilated place.

Hazards not otherwise classified : May cause cardiac arrhythmia.
May cause frostbite.
May cause eye and skin irritation.

Carcinogenicity

No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP, IARC, or OSHA.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical nature : Mixture

Chemical name	CAS-No.	Concentration
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	56.00 %
1,1,1,2-Tetrafluoroethane	811-97-2	44.00 %

SECTION 4. FIRST AID MEASURES

Inhalation : Move to fresh air. If breathing is irregular or stopped, administer artificial respiration. Use oxygen as required, provided a qualified operator is present. Call a physician. Do

not give drugs from adrenaline-ephedrine group.

Skin contact	:	After contact with skin, wash immediately with plenty of water. If there is evidence of frostbite, bathe (do not rub) with lukewarm (not hot) water. If water is not available, cover with a clean, soft cloth or similar covering. If symptoms persist, call a physician.
Eye contact	:	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In case of frostbite water should be lukewarm, not hot. If symptoms persist, call a physician.
Ingestion	:	Unlikely route of exposure. As this product is a gas, refer to the inhalation section. Do not induce vomiting without medical advice. Call a physician immediately.

Notes to physician

Indication of immediate medical attention and special treatment needed, if necessary	:	Because of the possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should be used with special caution and only in situations of emergency life support. Treatment of overexposure should be directed at the control of symptoms and the clinical conditions. Treat frost-bitten areas as needed.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	The product is not flammable. Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Specific hazards during firefighting	:	Contents under pressure. This product is not flammable at ambient temperatures and atmospheric pressure. However, this material can ignite when mixed with air under pressure and exposed to strong ignition sources. Container may rupture on heating. Cool closed containers exposed to fire with water spray. Do not allow run-off from fire fighting to enter drains or water courses. Vapours are heavier than air and can cause suffocation by

reducing oxygen available for breathing.
In case of fire hazardous decomposition products may be produced such as:
Hydrogen halides
Hydrogen fluoride
Carbon monoxide
Carbon dioxide (CO2)
Carbonyl halides

Special protective equipment for firefighters	:	In the event of fire and/or explosion do not breathe fumes. Wear self-contained breathing apparatus and protective suit. No unprotected exposed skin areas.
Further information	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Immediately evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Wear personal protective equipment. Unprotected persons must be kept away. Remove all sources of ignition. Avoid skin contact with leaking liquid (danger of frostbite). Ventilate the area. After release, disperses into the air. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Avoid accumulation of vapours in low areas. Unprotected personnel should not return until air has been tested and determined safe. Ensure that the oxygen content is >= 19.5%.
Environmental precautions	:	Prevent further leakage or spillage if safe to do so. The product evaporates readily.
Methods and materials for containment and cleaning up	:	Ventilate the area.

SECTION 7. HANDLING AND STORAGE

Handling

Precautions for safe handling	:	Handle with care. Avoid inhalation of vapour or mist. Do not get in eyes, on skin, or on clothing. Wear personal protective equipment. Use only in well-ventilated areas. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C. Follow all standard safety precautions for handling and use of compressed gas cylinders. Use authorized cylinders only. Protect cylinders from physical damage. Do not puncture or drop cylinders, expose them to open flame or excessive heat. Do not pierce or burn, even after use. Do not spray on a naked flame or any incandescent material. Do not remove screw cap until immediately ready for use. Always replace cap after use.
Advice on protection against fire and explosion	:	The product is not flammable. Can form a combustible mixture with air at pressures above atmospheric pressure.

Storage

Conditions for safe storage, including any incompatibilities	:	Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use. Keep containers tightly closed in a dry, cool and well-ventilated place. Storage rooms must be properly ventilated. Ensure adequate ventilation, especially in confined areas. Protect cylinders from physical damage.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Protective measures	:	Do not breathe vapour. Avoid contact with skin, eyes and clothing.

Ensure that eyewash stations and safety showers are close to the workstation location.

Engineering measures : General room ventilation is adequate for storage and handling. Perform filling operations only at stations with exhaust ventilation facilities.

Eye protection : Wear as appropriate:
Safety glasses with side-shields
If splashes are likely to occur, wear:
Goggles or face shield, giving complete protection to eyes

Hand protection : Leather gloves
In case of contact through splashing:
Protective gloves
Neoprene gloves
Polyvinyl alcohol or nitrile- butyl-rubber gloves

Skin and body protection : Avoid skin contact with leaking liquid (danger of frostbite).
Wear cold insulating gloves/ face shield/ eye protection.

Respiratory protection : In case of insufficient ventilation, wear suitable respiratory equipment.
Wear a positive-pressure supplied-air respirator.
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.
For rescue and maintenance work in storage tanks use self-contained breathing apparatus.

Hygiene measures : Handle in accordance with good industrial hygiene and safety practice.
Ensure adequate ventilation, especially in confined areas.
Avoid contact with skin, eyes and clothing.
Remove and wash contaminated clothing before re-use.
Keep working clothes separately.

Exposure Guidelines

Components	CAS-No.	Value	Control parameters	Update	Basis
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	TWA : Time weighted average	(500 ppm)	2009	WEEL:US. OARS. WEELs Workplace Environmental Exposure Level Guide, as amended

2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	TWA : Time weighted average	(500 ppm)	03 15 2010	Honeywell:Limit established by Honeywell International Inc.
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	STEL : Short term exposure limit	(1,500 ppm)	03 15 2010	Honeywell:Limit established by Honeywell International Inc.
1,1,1,2-Tetrafluoroethane	811-97-2	TWA : Time weighted average	(1,000 ppm)		Honeywell:Limit established by Honeywell International Inc.
1,1,1,2-Tetrafluoroethane	811-97-2	TWA : Time weighted average	4,240 mg/m3 (1,000 ppm)	2007	WEEL:US. OARS. WEELs Workplace Environmental Exposure Level Guide, as amended

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state	:	Liquefied gas
Color	:	clear colourless
Odor	:	slight ether-like
Odor threshold	:	Note: No data available
pH	:	Note: Not applicable
Melting point/range	:	Note: No data available
Boiling point/boiling range	:	-29.2 °C

Flash point	:	Note: Not applicable
Flammability	:	The product is not flammable.
Lower explosion limit	:	Note: None
Upper explosion limit	:	Note: None
Vapor pressure	:	0.637 MPa at 21.1 °C(70.0 °F)
Vapor density	:	3.83 Note: (Air = 1.0)
Density	:	1.15 g/cm3 at 21.1 °C
Water solubility	:	Note: No data available
Partition coefficient: n-octanol/water	:	Note: No data available
Ignition temperature	:	Note: No data available
Auto-ignition temperature	:	> 750 °C
Decomposition temperature	:	> 250 °C Note: To avoid thermal decomposition, do not overheat.
Viscosity, dynamic	:	Note: No data available
Viscosity, kinematic	:	Note: No data available

SECTION 10. STABILITY AND REACTIVITY

Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	Hazardous polymerisation does not occur.
Conditions to avoid	:	Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C. Decomposes under high temperature. Some risk may be expected of corrosive and toxic decomposition products. Can form a combustible mixture with air at pressures above atmospheric pressure. Do not mix with oxygen or air above atmospheric pressure.
Incompatible materials	:	Potassium Calcium Powdered metals Finely divided aluminium Finely divided magnesium Zinc
Hazardous decomposition products	:	Halogenated compounds Hydrogen fluoride Carbonyl halides Carbon oxides

SECTION 11. TOXICOLOGICAL INFORMATION

Acute inhalation toxicity

2,3,3,3-Tetrafluoroprop-1-ene	:	LC50: > 400000 ppm Exposure time: 4 h Species: Rat Method: OECD Test Guideline 403
1,1,1,2-Tetrafluoroethane	:	LC50: > 500000 ppm Exposure time: 4 h Species: Rat

Skin irritation	:	Note: Not applicable study technically not feasible
Eye irritation	:	Note: Not applicable study technically not feasible
Sensitisation		
2,3,3,3-Tetrafluoroprop-1-ene	:	Dermal Note: Not applicable, as this product is a gas. study technically not feasible
1,1,1,2-Tetrafluoroethane	:	Cardiac sensitization Species: dogs Note: No-observed-effect level 50 000 ppm Lowest observed effect level 75 000 ppm
Repeated dose toxicity		
2,3,3,3-Tetrafluoroprop-1-ene	:	Species: Rat Application Route: Inhalation Exposure time: (2 Weeks) No-observed-effect level: 50000 ppm Method: OECD Test Guideline 412 Species: Rat Application Route: Inhalation Exposure time: (4 Weeks) NOAEL (No observed adverse effect level): 50000 ppm Method: OECD Test Guideline 412 Species: Rat Application Route: Inhalation Exposure time: (13 Weeks) NOAEL (No observed adverse effect level): 50000 ppm Method: OECD Test Guideline 413 Species: Rabbit, male Application Route: Inhalation Exposure time: (28 d) No-observed-effect level: 500 ppm Method: OECD Test Guideline 412 There are no observed toxicological effects, which result in

classification as a specific target organ toxicant.

Species: Rabbit, female
Application Route: Inhalation
Exposure time: (28 d)
No-observed-effect level: 1000 ppm
Method: OECD Test Guideline 412
There are no observed toxicological effects, which result in classification as a specific target organ toxicant.

Species: Mini-pig
Application Route: Inhalation
Exposure time: (28 d)
NOAEL (No observed adverse effect level): 10000 ppm
highest exposure tested

1,1,1,2-Tetrafluoroethane : Species: Rat
NOEL: 40000 ppm

Genotoxicity in vitro

2,3,3,3-Tetrafluoroprop-1-ene : Test Method: Ames test
Result: 20% and higher, positive in TA 100 and e. coli WP2 uvrA, negative in TA98, TA100, and TA1535.
Method: OECD Test Guideline 471

1,1,1,2-Tetrafluoroethane : Note: In vitro tests did not show mutagenic effects

: Test Method: Chromosome aberration test in vitro
Cell type: Human lymphocytes
Result: negative
Method: OECD Test Guideline 473
Note: Dose 760,000 ppm

Genotoxicity in vivo

2,3,3,3-Tetrafluoroprop-1-ene : Species: Mouse
Cell type: Micronucleus
Dose: up to 200,000 ppm (4 hour)
Method: OECD Test Guideline 474
Result: negative

: Test Method: Unscheduled DNA synthesis
Dose: up to 50,000 ppm (4 weeks)

Method: OECD Test Guideline 486
Result: negative

: Species: Rat
Cell type: Micronucleus
Dose: up to 50,000 ppm (4 weeks)
Method: OECD Test Guideline 474
Result: negative

Carcinogenicity
2,3,3,3-Tetrafluoroprop-1-ene : Species: Rat
Note: Not classified as a human carcinogen. Substance not expected to be a carcinogen based on available data.

Further information : Note: Rapid evaporation of the liquid may cause frostbite. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Handle in accordance with good industrial hygiene and safety practice.

SECTION 12. ECOLOGICAL INFORMATION

Toxicity to fish
2,3,3,3-Tetrafluoroprop-1-ene : LC50: > 197 mg/l
Exposure time: 96 h
Species: Cyprinus carpio (Carp)
Method: OECD Test Guideline 203
Note: No demonstrable toxic effect in saturated solution.

Toxicity to daphnia and other aquatic invertebrates
2,3,3,3-Tetrafluoroprop-1-ene : EC50: > 83 mg/l
Exposure time: 48 h
Species: Daphnia magna (Water flea)
Method: OECD Test Guideline 202

Toxicity to algae

2,3,3,3-Tetrafluoroprop-1-ene	:	EC50: > 100 mg/l Species: Scenedesmus capricornutum (fresh water algae) Method: OECD Test Guideline 201
Bioaccumulation 2,3,3,3-Tetrafluoroprop-1-ene	:	Note: Due to the distribution coefficient n-octanol/water, accumulation in organisms is not expected.
Biodegradability 2,3,3,3-Tetrafluoroprop-1-ene	:	Result: Not readily biodegradable. Method: OECD Test Guideline 301F

Further information on ecology

Ecotoxicology Assessment

Results of PBT assessment
This substance is not considered to be persistent, bioaccumulating and toxic (PBT)., This substance is not considered to be very persistent and very bioaccumulating (vPvB).

Additional ecological information	:	Accumulation in aquatic organisms is unlikely. This product is subject to U.S. Environmental Protection Agency Clean Air Act Regulations at 40 CFR Part 82. This product contains greenhouse gases which may contribute to global warming. Do NOT vent to the atmosphere. To comply with provisions of the U.S. Clean Air Act, any residual must be recovered.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods	:	Observe all Federal, State, and Local Environmental regulations.
Note	:	This product is subject to U.S. Environmental Protection Agency Clean Air Act Regulations Section 608 in 40 CFR Part 82 regarding refrigerant recycling.

SECTION 14. TRANSPORT INFORMATION

DOT	UN/ID No.	:	UN 3163
	Proper shipping name	:	LIQUEFIED GAS, N.O.S.

			(R-1234yf, 1,1,1,2-Tetrafluoroethane)
	Class		2.2
	Packing group		
	Hazard Labels		2.2
IATA	UN/ID No.	:	UN 3163
	Description of the goods	:	LIQUEFIED GAS, N.O.S. (R-1234yf, 1,1,1,2-Tetrafluoroethane)
	Class	:	2.2
	Hazard Labels	:	2.2
	Packing instruction (cargo aircraft)	:	200
	Packing instruction (passenger aircraft)	:	200
IMDG	UN/ID No.	:	UN 3163
	Description of the goods	:	LIQUEFIED GAS, N.O.S. (R-1234yf, 1,1,1,2-TETRAFLUOROETHANE)
	Class	:	2.2
	Hazard Labels	:	2.2
	EmS Number	:	F-C, S-V
	Marine pollutant	:	no

SECTION 15. REGULATORY INFORMATION

Inventories

US. Toxic Substances Control Act	:	On TSCA Inventory
Australia. Inventory of Industrial Chemicals (AIIC), as amended	:	On the inventory, or in compliance with the inventory
Canada. Canadian Environmental Protection Act (CEPA). Domestic Substances List (DSL)	:	All components of this product are on the Canadian DSL
Japan. Kashin-Hou Law List	:	On the inventory, or in compliance with the inventory

Korea. Existing Chemicals Inventory (KECI)	:	On the inventory, or in compliance with the inventory
Philippines. Inventory of Chemicals and Chemical Substances (PICCS)	:	Not in compliance with the inventory
China. Inventory of Existing Chemical Substances (IECSC)	:	On the inventory, or in compliance with the inventory, or has been registered as new substance
New Zealand. Inventory of Chemicals (NZIoC), as published by ERMA New Zealand	:	Not in compliance with the inventory
Taiwan Chemical Substance Inventory (TCSI)	:	On the inventory, or in compliance with the inventory
TSCA 12B	:	US. Toxic Substances Control Act (TSCA) Section 12(b) Export Notification (40 CFR 707, Subpt D)
		2,3,3,3-Tetrafluoroprop-1-ene 754-12-1

National regulatory information

US. Toxic Substances Control Act (TSCA) Section 5(a)(2) Final Significant New Use Rules (SNURs) (40 CFR 721, Subpt E)	:	
	:	Issued.
	:	2,3,3,3-Tetrafluoroprop-1-ene 754-12-1
SARA 302 Components	:	No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.
SARA 313 Components	:	This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.
SARA 311/312 Hazards	:	Sudden Release of Pressure Hazard Acute Health Hazard

California Prop. 65 : This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

SECTION 16. OTHER INFORMATION

		HMIS III	NFPA
Health hazard	:	1	2
Flammability	:	1	1
Physical Hazard	:	0	
Instability	:		0

Hazard rating and rating systems (e.g. HMIS® III, NFPA): This information is intended solely for the use of individuals trained in the particular system.

Further information

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. Final determination of suitability of any material is the sole responsibility of the user. This information should not constitute a guarantee for any specific product properties.

Changes since the last version are highlighted in the margin. This version replaces all previous versions.
Previous Issue Date: 05/08/2018
Prepared by Honeywell Performance Materials and Technologies Product Stewardship Group

Design Report of Safety Data Sheet

(SDS)

Sample Name: FIRE EXTINGUISHERS（WITH COMPRESSED OR LIQUEFIED GAS）

Type/Model: /

Entrust Unit: WANZHEN FIRE TECHNOLOGY（GUANGDONG）CO.,LTD

Audited by: DAVE

Edited by: NICOK

（Stamp）

Unit: Guangfen Testing Institute (Guangzhou) Quality Inspection Co., Ltd.（GFQT）

Add : Room 101, 1st Floor, Building 2, Jinke Industrial Park, No. 1 Xinji Avenue, Nancun Town, Panyu District, Guangzhou

Tel : 020-66624679 Web : www.gflad.com

SAFETY DATA SHEET
FIRE EXTINGUISHERS (WITH COMPRESSED OR LIQUEFIED GAS)
***According to GHS (Tenth Revised Edition)**

SDS

Section 1 Identification of the chemical and supplier

◆ **Product identifier**	
Product Name	FIRE EXTINGUISHERS (WITH COMPRESSED OR LIQUEFIED GAS)
Product Model	-
CAS No.	Not applicable
EC No.	Not applicable
Molecular Formula	Not applicable
◆ **Relevant identified uses of the substance or mixture and uses advised against**	
Relevant identified uses	Fire extinguishing agent
Uses advised against	Please consult the manufacturer.
◆ **Details of the supplier of the Safety Data Sheet**	
Applicant Name	Wanzhen Fire Technology（Guangdong）Co.,Ltd
Applicant Address	Room 116, huichuang space, TCL culture industrial park, no.69, guangpu west road, Huangpu district,Guangzhou, Guangdong, China
Applicant Telephone	+86-20-29866567
Applicant Fax	-
Applicant E-mail	tsd@wanzn.com
Supplier Name	SIEX 2001 S.L.
Supplier Address	C/Merindad de Montija nº6, Burgos, 09001 Burgos (Spain)
Supplier Telephone	-
Supplier Fax	-
Supplier E-mail	-
◆ **Emergency phone number**	
Emergency phone number	+86-20-29866567

Section 2 Hazards identification

Hazard class and label elements of the product according to GHS(the nine revised edition)

◆ **Hazard classification according to GHS**	
Gases under pressure	Compressed gas

Hazardous to the aquatic environment, long-term (Chronic)	Category 3
◆ **GHS Label elements**	
Hazard pictograms	
Signal word	**Warning**
◆ **Hazard statements**	
H280	Contains gas under pressure; may explode if heated
H412	Harmful to aquatic life with long lasting effects.
◆ **Precautionary statements**	
▲ **Prevention**	
P273	Avoid release to the environment.
▲ **Response**	
P301 + P317	IF SWALLOWED: Get medical help.
▲ **Storage**	
P410+P403	Protect from sunlight. Store in a well ventilated place.
▲ **Disposal**	
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.
◆ **Hazard description**	
▲ **Physical and chemical hazards**	
Physical and chemical hazards	It contains high-pressure compressed gas, which may crack and explode in case of heat.
▲ **Health hazards**	
Inhaled	Harmful to health or cause respiratory discomfort.
Ingestion	Abdominal Pain, Vomiting
Skin Contact	Frostbite possible.
Eye	Redness, pain, tears.
▲ **Environmental hazards**	
Environmental hazards	Please refer to 12th chapter of SDS.

Section 3 Composition/information on ingredients

◆ **Substance / mixture**

☐**Substance** ☑**mixture**

Component	Cas No.	EC No.	Concentration (weight percent，%)
1,1,1,2,2,4,5,5,5-nonafluoro-4-(trifluoromethyl)-3-pentanone	756-13-8	231-545-4	70-100
Nitrogen	7727-37-9	231-545-4	2.5-10

Section 4 First aid measures

◆ **Description of first aid measures**

General advice	Immediate medical attention is required. Show this safety data sheet (SDS) to the doctor in attendance.
Eye contact	Check and remove any contact lenses, occasionally lifting the upper and lower eyelids, and immediately flush the eyes with water until the residue clears. Provide a convenient eyewash device and a quick and safe shower without rubbing your eyes. If irritation symptoms occur or persist, consult an ophthalmologist.
Skin contact	Remove contaminated clothing and shoes. Wash it off with mild soap and plenty of water. Seek medical attention if irritation symptoms occur or continue to develop. If you have frostbite, seek medical attention.
Ingestion	Rinse mouth with water. If the material has been swallowed and the person is conscious, drink a small amount of water. Water can be dangerous if the person is feeling unwell and vomiting. Do not induce vomiting unless instructed by a medical professional. If vomiting occurs, the head should be kept low so that vomiting cannot enter the lungs. If adverse health effects persist or are severe, seek medical attention and do not orally feed any food to the unconscious person.
Inhalation	Get out of the scene quickly to fresh air, keep the airway open. Rest where you breathe comfortably. If breathing is difficult, oxygen should be given by trained personnel. If symptoms persist or seriously affect health, seek immediate medical attention.
Protecting of first-aiders	Ensure that medical personnel are aware of the substance involved. Take precautions to protect themselves and prevent spread of contamination.

◆ **Most important symptoms/effects, acute and delayed**

1 The most important known symptoms and effects are as described in Parts 2 and/or 11.

◆ **Indication of any immediate medical attention and special treatment needed**

1	Treat symptomatically.
2	Symptoms may be delayed.

Section 5 Firefighting measures

◆	**Extinguishing media**
	Not applicable
◆	**Specific hazards arising from the substance or mixture**
1	May expansion or decompose explosively when heated or involved in fire.
◆	**Special protective equipment and precautions for fire-fighters**
1	As in any fire, wear self-contained breathing apparatus (MSHA/NIOSH approved or equivalent) and full protective gear.
2	Fight fire from a safe distance, with adequate cover.
3	Prevent fire extinguishing water from contaminating surface water or theground water system.

Section 6 Accidental release measures

◆	**Personal precautions, protective equipment and emergency procedures**
1	Do not take any action involving any personal risk or without proper training.
2	Entry of unnecessary and unprotected persons is strictly prohibited.
3	Do not touch or cross spilled material to avoid slipping.
4	Avoid inhalation of vapors/gases.
5	Ensure adequate ventilation. Wear proper breathing apparatus when ventilation is poor.
6	Emergency personnel will be equipped with appropriate personal protective equipment (PPE) (see Section 8).
◆	**Environmental precautions**
1	Prevent further leakage or spillage if safe to do so.
2	Discharge into the environment must be avoided.
◆	**Methods and materials for containment and cleaning up**
1	Small leakage: if there is no danger, stop the leakage and remove the container from the leakage area. If possible, proper ventilation should be used to diffuse and prevent accumulation. Large leakage: if there is no danger, stop the leakage and remove the container from the leakage area. Approaching the leak from upwind, spray the liquid nitrogen to accelerate evaporation, but do not make the water gun to the liquid nitrogen. If possible, the residual or leaked gas will be sent to the washing tower or the fume hood connected to the tower by an exhaust fan. Air leakage containers should be properly handled, repaired, tested before use. Containment and collection of leaking liquids with non-combustible absorbers such as sand, earth, vermiculite, diatomite.
2	Contaminated adsorbents can be just as hazardous as spilled products.
3	Adhered or collected material should be promptly disposed of, in accordance with appropriate laws and regulations.

Section 7 Handling and storage	
◆	**Precautions for safe handling**
1	Wear appropriate personal protective equipment (see Part 8)
2	Eating, drinking and smoking are prohibited where materials are handled, stored and processed.
3	Workers should wash their hands and faces before eating or smoking. Avoid contact with eyes and inhalation of gas.
4	Provide suitable exhaust equipment. Operate in a well-ventilated place.
5	Observe good hygiene procedures and practices.
6	Handling should be light, to prevent damage to the packaging and containers.
7	General fire protection measures. Keep away from heat sources, open flames and hot surfaces.
8	Clean thoroughly after operation.
9	Individuals with a history of skin allergies should not be employed in any work related to this product.
10	Equipped with corresponding varieties and quantities of fire equipment and leakage emergency treatment equipment.
◆	**Conditions for safe storage, including any incompatibilities**
1	Store in accordance with local regulations. Store in a dry, cool and well-ventilated place. Keep container tightly sealed until use.
2	Avoid direct sunlight. Keep away from high temperatures and open flames, from incompatible materials (see Section 10), food and feed.
3	Equipped with corresponding varieties and quantities of fire equipment and leakage emergency treatment equipment.
4	Keep away from children and pets.

Section 8 Exposure controls/personal protection	
◆	**Control parameters**
▲	**Occupational Exposure limit values**
	No information available
▲	**Biological limit values**
	No information available
▲	**Monitoring methods**
1	EN 14042 Workplace atmospheres. Guide for the application and use of procedures for the assessment of exposure to chemical and biological agents.
2	GBZ/T 160.1~GBZ/T 160.81-2004 Determination of toxic substances in workplace air (Series standard)
▲	**Engineering controls**
1	Ensure adequate ventilation, especially in confined areas.

2	Ensure that eyewash stations and safety showers are close to the workstation location.
3	Set up emergency evacuation channels and necessary risk relief areas.
4	Operate in accordance with good industrial hygiene and safety regulations.

▲ **Personal protection equipment**

General requirement	
Eye protection	Wear safety glasses when there is potential eye contact.
Hand protection	Use protective gloves. Check whether the protective gloves are normal before each use Choosing the right glove depends not only on the material, but also on the quality of the material, which varies from manufacturer to manufacturer.
Respiratory protection	If the concentration of vapor/gas exceeds the occupational exposure limit or symptoms such as irritation occur, use a full-cover multifunctional respirator.
Skin and body protection	Wear regular work clothes and boots.

Section 9 Physical and chemical properties

◆ **Physical and chemical properties**

Appearance	Red barrels contain colorless liquids and gases
Odor	Odorless
pH	No information available/Not applicable
Melting point/freezing point(℃)	-108
Initial boiling point and boiling range(℃)	49
Flash point(Closed cup,℃)	No information available/Not applicable
Evaporation rate	No information available/Not applicable
Flammability	Not flammable
Upper/lower explosive limits[%(v/v)]	No information available/Not applicable
Vapor pressure(KPa)	No information available/Not applicable
Vapor density(Air＝1)	No information available/Not applicable
Relative density(Water=1)	No information available/Not applicable
Solubility(mg/L)	not soluble in water
n-octanol/water partition coefficient:	No information available/Not applicable
Auto-ignition temperature(℃)	No information available/Not applicable

Decomposition temperature(℃)	No information available/Not applicable
Viscosity(mm2/s)	No information available/Not applicable
Particle characteristics	No information available/Not applicable
Explosive properties	Not explosive
Oxidizing properties	Not oxidizing

Section 10 Stability and reactivity

◆ **Stability and reactivity**

Reactivity	Stable under proper operation and storage conditions.
Chemical stability	The substance is chemically stable.
Conditions to avoid	Incompatible material, mechanical impact, direct sunlight, high temperature and flame.
Incompatible materials	Strong oxidizing agent.
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11 Toxicological information

◆ **Acute toxicity**

No information Available

◆ **Carcinogenicity**

Component	IARC	NTP
1,1,1,2,2,4,5,5,5-nonafluoro-4-(trifluoromethyl)-3-pentanone	Not Listed	Not Listed
Nitrogen	Not Listed	Not Listed

◆ **Others**

Skin corrosion/irritation	Based on available data, the classification criteria are not met
Serious eye damage/irritation	Based on available data, the classification criteria are not met
Skin sensitization	Based on available data, the classification criteria are not met
Respiratory sensitization	Based on available data, the classification criteria are not met
Reproductive toxicity	Based on available data, the classification criteria are not met
STOT-single exposure	Based on available data, the classification criteria are not met
STOT-repeated exposure	Based on available data, the classification criteria are not met
Aspiration hazard	Based on available data, the classification criteria are not met
Germ cell mutagenicity	Based on available data, the classification criteria are not met

Reproductivetoxicity(additional)	Based on available data, the classification criteria are not met

Section 12 Ecological information

◆	**Acute aquatic toxicity**
	Based on available data, the classification criteria are not met
◆	**Chronic aquatic toxicity**
	Harmful to aquatic life with long lasting effects (Category 3)
◆	**Persistence and degradability**
	No information available
◆	**Bioaccumulative potential**
	No information available
◆	**Mobility in soil**
	No information available
◆	**Results of PBT and vPvB assessment**

Component	Results of PBT and vPvB assessment (according to (EC) No 1907/2006)
1,1,1,2,2,4,5,5,5-nonafluoro-4-(trifluoromethyl)-3-pentanone	not PBT/vPvB
Nitrogen	not PBT/vPvB

Section 13 Disposal considerations

Waste chemicals	Refer to state, local, and national regulations for proper handling. Avoid or reduce waste production whenever possible. It is recommended to transfer to a suitable container and arrange for collection and disposal by a professional waste disposal company.
Contaminated packaging	Containers may still present chemical hazard when empty. Keep away from hot and ignition source of fire. Return to supplier for recycling if possible.
Disposal recommendations	Refer to section waste chemicals and contaminated packaging.

Section 14 Transport information

◆	**Transport rules**
	According to IATA DGR 64rd Edition for transportation, IMO International Maritime Dangerous Goods Code (Amendment 40-20), European Agreement Concerning the International Carriage of Dangerous Goods by Road. The products are subject to IATA DGR, IMDG and ADR/RID.
◆	**Label(s) required**

Transporting Label	

◆ **Road transport (UN-ADR)**

UN Number	UN1044
UN Proper shipping Name	Fire extinguisher containing compressed or liquefied gas
Transport hazard class	2.2
Transport subsidiary hazard class	None
Packing group	Not applicable
Special provisions for transportation	225|594

◆ **(ICAO-IATA/DGR)**

UN Number	UN1044
UN Proper shipping Name	Fire extinguisher containing compressed or liquefied gas
Transport hazard class	2.2
Transport subsidiary hazard class	None
Packing group	225|594
Special provisions for transportation	A19

◆ **(IMDG-CODE)**

UN Number	UN1044
UN Proper shipping Name	Fire extinguisher containing compressed or liquefied gas
Transport hazard class	2.2
Transport subsidiary hazard class	None
Packing group	225|594
Special provisions for transportation	A19
Marine pollutant(Yes/No)	No

Section 15 Regulatory information

◆ **International list of chemicals**

CAS No.	EC Inventory	TSCA	DSL	IECSC	NZIoC	PICCS	KECI	AICS	ENCS
756-13-8	×	√	√	√	√	×	√	√	√
7727-37-9	√	√	√	√	√	√	√	√	×

【EC inventory】European Inventory of Existing Commercial Chemical Substances
【TSCA】United States Toxic Substances Control Act Inventory
【DSL】Canadian Domestic Substances List
【IECSC】China Inventory of Existing Chemical Substances
【NZIoC】New Zealand Inventory of Chemicals
【PICCS】Philippines Inventory of Chemicals and Chemical Substances
【KECI】Existing and Evaluated Chemical Substances
【AICS】Australia Inventory of Chemical Substances (AIICS)
【ENCS】Japan Inventory of Existing & New Chemical Substances
Note :
"√" Indicates that the substance included in the regulations
"×" That no data or included in the regulations

Section 16 Additional Information

Information on revision

Creation Date	2024/01/01
Revision Date	2024/01/02 (Explanation: This report is valid until the implementation of the eleventh revised version of the United Nations GHS.)
Reason for revision	-

References

【1】IPCS:The International Chemical Safety Cards (ICSC) ,website: http://www.ilo.org/dyn/icsc/showcard.home.
【2】IARC，website: http://www.iarc.fr/.
【3】OECD: The Global Portal to Information on Chemical Substances, website: http://www.echemportal.org/echemportal/index?pageID=0&request_locale=en。
【4】CAMEO Chemicals, website: http://cameochemicals.noaa.gov/search/simple.
【5】NLM:ChemIDplus, website: http://chem.sis.nlm.nih.gov/chemidplus/chemidlite.jsp.
【6】EPA: Integrated Risk Information System, website: http://cfpub.epa.gov/iris/.
【7】U.S. Department of Transportation:ERG, website: http://www.phmsa.dot.gov/hazmat/library/erg.
【8】Germany GESTIS-database on hazard substance, website: http://gestis-en.itrust.de/.

Abbreviations and acronyms

CAS	Chemical Abstracts Service	UN	The United Nations
PC-STEL	Short term exposure limit	OECD	Organization for Economic Co-operation and Development
PC-TWA	Time Weighted Average	IMDG	International Maritime Dangerous Goods
MAC	Maximum Allowable Concentration	IARC	International Agency for Research on Cancer
DNEL	Derived No Effect Level	ICAO	ICAO-International Civil Aviation Organization
PNEC	Predicted No Effect Concentration	IATA	International Air Transportation Association
NOEC	No Observed Effect Concentration	ACGIH	American Conference of Governmental Industrial Hygienists

LC_{50}	Lethal Concentration 50%	NFPA	National Fire Protection Association
LD_{50}	Lethal Dose 50%	NTP	National Toxicology Program
EC_{50}	Effective Concentration 50%	PBT	Persistent, Bioaccumulative, Toxic
ECX	Effective Concentration X%	vPvB	vPvB -High very Persistent, High very Bioaccumulative
P_{OW}	Partition coefficient Octanol:Water	CMR	Carcinogens, mutagens or substances toxic to reproduction
BCF BCF	Bioconcentration factor (BCF)	RPE	Respiratory Protective Equipment
ED	Endocrine disruptors	-	-

◆ Disclaimer

This Safety Data Sheet (SDS) The data included was derived from international authoritative database and provided by the enterprise. Other information was based on the present state of our knowledge. We try to ensure the correctness of all information. However, due to the diversity of information sources and the limitations of our knowledge, this document is only for user’ s reference. Users should make their independent judgment of suitability of this information for their particular purposes. We do not assume responsibility for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the product， This report may not be published as an advertisement without the approval of the GFQT. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is illegal and the offender may be prosecuted to the fullest extent of the law.In case of any different meanings from the language used in the report， the Chinese version is applicable.

Appendix I
CONSIDERATIONS DURING CONSTRUCTION

ROLES AND RESPONSIBILITIES DURING CONSTRUCTION

During construction the key change from the ERP is that the General Contractor will be the Emergency Response Coordinator. The Emergency Response Coordinator takes control of the emergency and any resources necessary until the emergency has been eliminated and the necessary cleanup and/or restoration are complete. This person shall lead the incident reporting. All personnel on site shall know who the Emergency Response Coordinator on-duty is during their time on site. Remote operators shall likewise know who the Emergency Response Coordinator is for any given shift.

The Emergency Coordinator or a designee will be responsible for notifying the appropriate regulatory agencies and, if necessary, the Emergency Response Contractor or mutual aid groups. A list of emergency contacts and agencies that may be notified in the event of an emergency is provided in the ERP. The incident will be documented and kept on file.

The Emergency Response Coordinator is also responsible for seeing that this plan is implemented and will appoint an adequate number of personnel to enforce the plan, assure everyone is familiar with this plan and act as a liaison with the local Fire Department(s).

GENERAL CONTRACTOR EMERGENCY ACTION PLAN

The General Contractor shall prepare an emergency action plan per OSHA standard 1926.35. This plan should address the following items:

- Types and locations of hazardous materials (refer to Safety Data Sheets)
- Potentially dangerous operations or conditions
- Chemical storage sites
- Remote job sites
- Workplace communication systems
- Employee work shifts
- Means of egress
- Evacuation routes and means to maintain routes in all ground and weather conditions
- Fixed and portable fire extinguishing systems
- Employee alarm systems
- Protection of visitors and members of the public
- Adverse weather conditions

BESS STORAGE RECOMMENDATIONS

During the process of construction and commissioning, any BESS enclosures that are to be stored between arrival and installation shall be stored following the guidance of NFPA 855 – Standard for the Installation of Stationary Energy Storage Systems – 2023 Edition as stated in the following subsections.

It is important to note that the following storage guidance from NFPA 855 is intended for batteries. The BESS enclosures that will be on-site are not batteries themselves but contain battery cells within. The enclosures have gone through full-scale UL 9540A testing as operational units. However, in the construction phase of the project, the enclosures are not yet operational and there are safety features of each enclosure that may not yet be activated including smoke, heat and gas detection and exhaust ventilation. For these reasons, Coffman recommends these enclosures be regarded as batteries while on-site but not operational for Section 4 of this document, following the methodology of NFPA 855 - 2023 Edition - Chapter 14 - Storage of Used or Off-Specification Batteries.

No temporary buildings or transportation containers will be used for this site. Information below on such arrangements is used to further guide construction management crews if any storage configurations change on-site.

The placement of an ESS enclosure in its final location is not considered storage if commissioning and safety features are operational within 3-months of setting.

Per NFPA 241 §5.3.3, any non-storage temporary structures used during the construction process shall be equipped with a minimum of one fire extinguisher suitable for all classes of fires that are expected inside the structure. The extinguisher(s) shall be located so that travel distance to an extinguisher does not exceed 50ft within the structure.

Outdoor Storage Locations

The planned storage arrangement for this project is directly outside so the storage areas or “piles” shall comply with the following:

1. Be limited to 200 ft^2 in area and separated from other piles by 10 ft.
2. Be separated by a minimum 20 ft from:
    a. Lot lines
    b. Public ways
    c. Buildings
    d. Other storage
    e. Hazardous materials
    f. Other exposure hazards
3. Be permitted to have a 3 ft clearance from exposures where a 3-hour freestanding fire barrier, suitable for exterior use, and extending 15 ft above and extending 15 ft beyond the physical boundary of the pile is provided to protect the exposure.

Indoor Storage Locations

While it is not anticipated that any batteries or ESS will be stored inside during construction and commissioning, the following information is provided for reference should this change.

If stored in a **room or space**, the room or space shall:

1. Be classified as an industrial high-hazard occupancy.
2. Be separated from the remainder of the building areas by fire barriers with a 3-hour fire resistance rating and with horizontal assemblies with a 3-hour fire resistance rating constructed in accordance with the local building code.
3. Be provided with a fire alarm system activated by a radiant-energy detection system with occupant notification installed in accordance with NFPA 72 – National Fire Alarm Code.
4. Be provided with an automatic sprinkler system designed and installed in accordance with NFPA 13 – Standard for the Installation of Sprinkler Systems.
5. Be equipped with an explosion protection system in accordance with NFPA 68 or 69.

These fire incident detection and mitigation measures shall be documented in a Fire Incident Prevention and Mitigation Plan to be provided to the AHJ for review and approval.

Storage Precautions

In accordance with the Risen transportation and storage guidelines, should the ESS enclosures or battery cells require storage for extended periods of time, the following is advised:

1. Long-term storage of batteries is not recommended and causes irreversible capacity loss. After 12 months of storage at the recommended temperature (less than or equal to 95ºF) the typical irreversible capacity loss is 3 to 6 percent.
2. Recommended battery storage ambient humidity of less than 60%.
3. Recommended battery stored between 30%-50% State-of-Charge (SOC). During storage, all external power-consuming devices must be disconnected. Perform regular inspections. Maintain detailed inspection records and promptly address any abnormal conditions.
4. Store in a dry, clean, and well-ventilated warehouse to prevent dust and moisture ingress and ensure no short circuits.
5. Avoid contact with corrosive organic solvents or gases to prevent battery corrosion and rust.
6. Avoid direct sunlight.
7. During storage, if any questions arise, contact the after-sales service for consultation and handling at +86 400-101-8585, or essmkt@risenstorage.com
8. Storage facilities should be compliant with the appropriate local fire code requirements.

DAMAGE TO BESS EQUIPMENT DURING CONSTRUCTION

Battery Cells

Should a battery cell be damaged during handling, storage, or transportation reference section 4.1.8 of the ERP for assessing if it is safe to approach the enclosure.

Fire Alarm / BMS Systems

Any ESS enclosure that has a non-functional Fire Alarm or Battery Management System (BMS) shall be shut down immediately.

Note that a system shutdown will result in electrical isolation of the battery strings and cessation of battery charging or discharging. A system shutdown will not de-energize the battery bank, nor will it guarantee that a fault or thermal runaway vent has stopped. Do not open the ESS enclosure until deemed safe to do so by an individual qualified to direct such decision.

COMMISSIONING

Prior to starting any commissioning, the commissioning plan, documentation requirements, and design verification checklist shall be finalized by all interested parties. In addition to Risen procedures, the following site considerations shall be implemented:

Fire Command Center (FCC)

The overall site Fire Command Center (FCC) shall be operational prior to commissioning of individual ESS fire alarm panels. Individual ESS enclosure fire alarm systems shall be operational prior to energization of that ESS enclosure. See Appendix A for location.

Fire Water Access

Existing fire hydrants on Auto Park way will be available during construction. The ESS enclosures were tested in accordance with UL 9540A without the use of water and demonstrated that unit-to-unit propagation does not occur.

Fire Access Roads

For any ESS being commissioned, the fire access road to the equipment shall be clear with an unobstructed width of at least 24-ft and unobstructed vertical clearance to the sky (or 13’-6” vertical clearance to protected tree species adjacent to access roads), so that responding fire department equipment can access the location of the ESS. See Appendix A for location.