

Reviewer: _____ Case # _____
Fee Rcv'd: _____ Rcpt # _____
Date & Time Rcv'd: _____
Pre-App Meeting: _____

LAND USE AMENDMENT APPLICATION

Board of Supervisors of Louisa County, Virginia

The following information shall be typed or printed and completed in full. Attach additional pages where necessary.

1. IDENTIFICATION OF REQUEST:

- A: REZONING: From _____ () to _____ ()
- B: CONDITIONAL USE: Battery Energy Storage or a Major Utility designation to be
sited on an Agriculture zoned property.
- C: TEMPORARY CONDITIONAL USE: _____
- D: VARIANCE: _____
- E: PROFFER AMENDMENT: _____
- F: COMP PLAN AMENDMENT: _____
- G: COMP PLAN REVIEW FOR CONFORMANCE: Battery Energy Storage projects are required
by the state to include a Comprehensive Plan Compliance check.
- H: SPECIAL EXCEPTION: _____

2. APPLICANT, PROPERTY OWNER, AGENT

- A. NAME OF APPLICANT: Ava Energy Center, LLC
If a corporation, name of agent: Chris Meyer
- B: MAILING ADDRESS: _____

Telephone # _____
- C: NAME OF PRESENT OWNER OF PROPERTY ON WHICH THIS REQUEST WILL OCCUR:
Betsye and Calvert Compton and Nancy and Brady Pleasants & Cherry Family LTD Partnership
- D: MAILING ADDRESS: _____ & _____

Telephone # _____

If the applicant is not the owner of the property in question, explain: Ava Energy Center, LLC and the Cherry Family & Compton/Pleasants families are under an option agreement, which is attached as requested.

A copy of pending contract or option agreement shall be attached hereto and made a part of this application.

Enclosure 1

E. NAME OF PERSON TO BE NOTIFIED IN ADDITION TO THE APPLICANT AND/OR PROPERTY OWNER: _____

F. ADDRESS: _____
Telephone #: _____

3. **LOCATION OF PROPERTY** (Assistance will be given in obtaining the following information upon request).

A. VOTING DISTRICT Patrick Henry B. TAX MAP # 40
C. SUBDIVISION NAME - _____ D. LOT/PARCEL # 40 116 & 40 114
E. PROPERTY LOCATION Harris Creek Road

F. IS PARCEL UNDER LAND USE TAXATION PROGRAM? xxx YES _____ NO _____

4. **EXPLAIN FULLY THE PROPOSED USE, TYPE OF DEVELOPMENT, OPERATION PROGRAM, ETC., AND THE REASON OF THIS REQUEST:**

Ava Energy Center is a battery energy storage project that will connect to the County's electrical transmission infrastructure. The project is essential for a resilient and economical electrical service to the County residences and businesses. See attached for more info.

(Attach applicable plans, renderings, elevations, photographs.)

5. **STATE HOW THIS REQUEST WILL NOT BE MATERIALLY DETRIMENTAL TO ADJACENT PROPERTY, THE SURROUNDING NEIGHBORHOOD OR THE COUNTY IN GENERAL. INCLUDE, WHERE APPLICABLE, INFORMATION CONCERNING: USE OF PUBLIC UTILITIES; EFFECT OF REQUEST ON PUBLIC SCHOOLS; EFFECT ON TRAFFIC--INCLUDE MEANS OF ACCESS TO THE NEAREST PUBLIC ROAD; EFFECT ON EXISTING AND FUTURE AREA DEVELOPMENT, ETC.**

Ava Energy Center is designed to not be seen, heard, nor interacted with in any manner by the public nor neighboring parcels. It will have setbacks from property lines that includes a minimum of 100ft+ setbacks and visual buffering. Post construction, it will not generate any significant traffic, create students for schools, nor have any impacts on other public infrastructure.

6. **EXPLAIN ANY EXISTING USE PERMIT, SPECIAL EXCEPTION, (Prior) CONDITIONAL USE PERMIT, TEMPORARY CONDITIONAL USE PERMIT OR VARIANCE PREVIOUSLY GRANTED ON THE PARCEL IN QUESTION:**

The properties are not entitled with any other permits or variances.

Enclosure 1

7. INDICATE THE FOLLOWING WITH RESPECT TO THE SUBJECT PARCEL:

- A. EXISTING LAND USE(S): Ag (haying), timber, and energy infrastructure
- B. EXISTING STRUCTURE(S): abandoned home and storage sheds
- C. EXISTING ZONING: Ag⁻²
- D. ACREAGE OF REQUEST: 50.15 + 42.27 = 92.42
- E. UTILITIES: No public utilities are needed
(Intended use, example: public water and/or sewer; individual well and/or septic tank; other source.)
- F. IS THIS PROJECT IN OR NEAR A PINE PLANTATION? Yes
- G. IS THIS PROJECT IN AN AG/FORESTAL DISTRICT? No

8. IF REQUESTING A VARIANCE, EXPLAIN THE UNIQUE PHYSICAL HARDSHIP OR EXTRAORDINARY SITUATION THAT IS THE JUSTIFICATION FOR THE VARIANCE:

9. GIVE COMPLETE NAMES AND ADDRESSES (INCLUDING ZIP CODES) OF ALL OWNERS ADJACENT, ACROSS THE ROAD OR HIGHWAY FACING THE PROPERTY AND ACROSS ANY RAILROAD RIGHT-OF-WAY, CREEK, OR RIVER FROM SUCH PROPERTY, EVEN IF SUCH PROPERTY LIES IN ANOTHER COUNTY OR TOWN. (THIS INFORMATION MUST BE OBTAINED BY THE APPLICANT).

- * PROPERTY OWNER'S NAME: Dominion Energy Virginia
MAILING ADDRESS: _____

TAX MAP # 40 115
SUBDIVISION NAME _____ LOT/PARCEL# 40 115
ACREAGE 8.36 ZONING A2
- * PROPERTY OWNER'S NAME: Colonial Pipeline
MAILING ADDRESS: _____

TAX MAP # 40 117
SUBDIVISION NAME _____ LOT/PARCEL# 40 117
ACREAGE 9.68 ZONING A1
- * PROPERTY OWNER'S NAME: Boyd Cash LLC
MAILING ADDRESS: _____

TAX MAP # 40 119

Enclosure 1

SUBDIVISION NAME: _____ LOT/PARCEL# 40 119
ACREAGE 34.75 ZONING A2
* PROPERTY OWNER'S NAME: Boyd Cash LLC
MAILING ADDRESS: _____

TAX MAP # 40 120
SUBDIVISION NAME: _____ LOT/PARCEL# 40 120
ACREAGE 69.89 ZONING A2
* PROPERTY OWNER'S NAME: Boyd Cash LLC
MAILING ADDRESS: _____

TAX MAP # 40 15 3
SUBDIVISION NAME: _____ LOT/PARCEL# 40 15 3
ACREAGE 5.74 ZONING A2
* PROPERTY OWNER'S NAME: Everette Anderson
MAILING ADDRESS: _____

TAX MAP # 40 113
SUBDIVISION NAME: _____ LOT/PARCEL# 40 113
ACREAGE 7 ZONING A1
* PROPERTY OWNER'S NAME: Katherine Johnson
MAILING ADDRESS: _____

TAX MAP # 40 21 1
SUBDIVISION NAME: _____ LOT/PARCEL# 40 21 1
ACREAGE 2.861 ZONING A2
* PROPERTY OWNER'S NAME: Keith Roots
MAILING ADDRESS: _____

TAX MAP # 40 49
SUBDIVISION NAME: _____ LOT/PARCEL# 40 49
ACREAGE 55.93 ZONING A1
* PROPERTY OWNER'S NAME: Boyd Cash LLC

TAX MAP # 40 41
SUBDIVISION NAME: _____ LOT/PARCEL# 40 41
ACREAGE 32.33 ZONING A2
* PROPERTY OWNER'S NAME: Mildred Baird

Enclosure 1

TAX MAP # 40 27 1
SUBDIVISION NAME: Harris Creek Estate LOT/PARCEL# 40 27 1
ACREAGE 1.57 ZONING A2
* PROPERTY OWNER'S NAME: Melissa Lonce

TAX MAP # 40 27 5
SUBDIVISION NAME: Harris Creek Estate LOT/PARCEL# 40 27 5
ACREAGE 1.71 ZONING A2
* PROPERTY OWNER'S NAME: John Wilderson
MAILING ADDRESS:

TAX MAP # 40 27 6
SUBDIVISION NAME: LOT/PARCEL# 40 27 6
ACREAGE 1.73 ZONING A2
* PROPERTY OWNER'S NAME: Brenda and Alan Winner
MAILING ADDRESS:

TAX MAP # 40 27 10
SUBDIVISION NAME: Harris Creek Estates LOT/PARCEL# 40 27 10
ACREAGE 1.83 ZONING A2
* PROPERTY OWNER'S NAME: Justin and Portia Bullock

TAX MAP # 40 27 11
SUBDIVISION NAME: Harris Creek Estates LOT/PARCEL# 40 27 11
ACREAGE 3.01 ZONING A2
* PROPERTY OWNER'S NAME: Donald Taylor
MAILING ADDRESS:

TAX MAP # 40 27 12
SUBDIVISION NAME: Harris Creek Estates LOT/PARCEL# 40 27 12
ACREAGE 1.85 ZONING A2
* PROPERTY OWNER'S NAME: Gerald Turney
MAILING ADDRESS:

TAX MAP # 40 27 13
SUBDIVISION NAME: Harris Creek Estates LOT/PARCEL# 40 27 13
ACREAGE 2.03 ZONING A2
* PROPERTY OWNER'S NAME: Unknown

Enclosure 1

MAILING ADDRESS: unknown
TAX MAP # 40 10 A
SUBDIVISION NAME: _____ LOT/PARCEL# 40 10 A
ACREAGE appr 1.2 ZONING 2A?
* PROPERTY OWNER'S NAME: Sean Gose
MAILING ADDRESS: _____
TAX MAP # 40 11 B
SUBDIVISION NAME: _____ LOT/PARCEL# 40 11 B
ACREAGE 20.27 ZONING A2

**10. HERewith IS DEPOSITED THE FEE REQUIRED. CHECKS OR MONEY ORDERS
MADE PAYABLE TO TREASURER, COUNTY OF LOUISA.**

A. REZONING	Tiered System
B. CONDITIONAL USE PERMIT	Tiered System
C. TEMPORARY CONDITIONAL USE PERMIT	\$325.00*
Temporary Housing*	
Extension or Amendment*	
Other*	
D. VARIANCE	\$1,250.00*
E. PROFFER AMENDMENT	\$1,500.00*
F. COMP PLAN AMENDMENT	\$650.00*

*IN ADDITION TO THE STANDARD FEE, AN ADDITIONAL \$75.00 WILL BE CHARGED FOR EACH REQUEST AS A DEPOSIT ON A ZONING SIGN AND WILL BE REFUNDED UPON THE RETURN OF THE SIGN BY THE APPLICANT ONCE THE REQUEST HAS BEEN ACTED UPON.

*THERE WILL BE A \$25.00 FEE CHARGED PER ADJACENT/ADJOINING PROPERTY OWNER FOR NOTIFICATION AND ADVERTISEMENT. THERE WILL ALSO BE A RE-ADVERTISEMENT FEE EACH TIME AN APPLICATION IS DELAYED OR POSTPONED AT THE REQUEST OF THE APPLICANT OR NECESSARY DUE TO SOME FAILURE TO ACT ON THE PART OF THE APPLICANT, PLUS A \$25.00 FEE CHARGED PER ADJACENT/ADJOINING PROPERTY OWNER FOR RENOTIFICATION.

*THERE IS AN ADDITIONAL CHARGE FOR PUBLIC NOTICE ADVERTISEMENT.

Enclosure 1

11. ENCLOSED WITH THIS APPLICATION IS A SITE PLAN OR TENTATIVE PLAN.

Yes

12. ENCLOSED WITH THIS APPLICATION IS THE APPROPRIATE COUNTY TAX MAP WITH THE PROPERTY MARKED AND A SURVEYED PLAT OF THE ENTIRE PARCEL.

Yes

13. I/WE HEREBY CERTIFY THAT TO THE BEST OF MY/OUR KNOWLEDGE ALL OF THE ABOVE STATEMENTS AND THE STATEMENTS CONTAINED IN ANY EXHIBITS TRANSMITTED ARE TRUE AND THAT THE ADJACENT PROPERTY OWNERS LIST HERewith ARE THE OWNERS OF RECORD AS OF THE DATE OF APPLICATION.

Enclosure 1

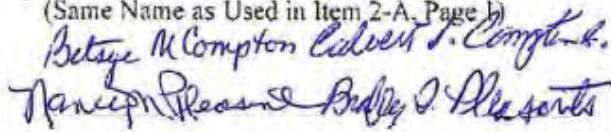
NOTE: INCOMPLETE APPLICATIONS WILL NOT BE ACCEPTED. ANY REQUEST WHICH REQUIRES PLANS MUST BE ACCOMPANIED BY THOSE PLANS AT THE TIME OF SUBMISSION OF THE APPLICATION.

DATE: August 13th, 2026.


SIGNATURE OF APPLICANT

AVA ENERGY CENTER
APPLICANT'S NAME

(Same Name as Used in Item 2-A, Page 1)



SIGNATURE OF OWNER

(Same Name as Used in Item 2-C, Page 1)

(Typed or Printed)

BETSY M. COMPTON CARVER T. L. COMPTON SR.
NANCY PLEASANTS BRADLEY I. PLEASANTS

OWNER'S NAME

(Typed or Printed)


SIGNATURE OF AGENT

(Name of Person Other Than, but Acting for the Applicant. Responsible for this Application)

Tyler B. Cline
AGENT'S NAME

(Typed or Printed)

NOTICE TO TEMPORARY CONDITIONAL USE PERMIT APPLICANTS

In accordance with Section 86-91, of the Louisa County Zoning Ordinance, any Temporary Conditional Use Permit granted shall be considered canceled if the applicant does not avail himself/herself of the privilege within ninety (90) days from the date of issuance of the Temporary Conditional Use Permit.

Enclosure 1

NOTE: INCOMPLETE APPLICATIONS WILL NOT BE ACCEPTED. ANY REQUEST WHICH REQUIRES PLANS MUST BE ACCOMPANIED BY THOSE PLANS AT THE TIME OF SUBMISSION OF THE APPLICATION.

DATE: August 13th, 2026.

SIGNATURE OF APPLICANT

(Same Name as Used in Item 2-A, Page 1)

SIGNATURE OF OWNER

(Same Name as Used in Item 2-C, Page 1)

APPLICANT'S NAME

(Typed or Printed)

OWNER'S NAME

(Typed or Printed)

SIGNATURE OF AGENT

(Name of Person Other Than, but Acting for the Applicant, Responsible for this Application)

AGENT'S NAME

(Typed or Printed)

NOTICE TO TEMPORARY CONDITIONAL USE PERMIT APPLICANTS

In accordance with Section 86-91, of the Louisa County Zoning Ordinance, any Temporary Conditional Use Permit granted shall be considered canceled if the applicant does not avail himself/herself of the privilege within ninety (90) days from the date of issuance of the Temporary Conditional Use Permit.



COUNTY OF LOUISA

COMMUNITY DEVELOPMENT

1 WOOLFOLK AVENUE, STE 201 • LOUISA, VIRGINIA • 23093 • www.louisacounty.gov • (540) 967-3430

Conditional Use & Rezoning Fee Worksheet

Property Address	Harris Creek Road
Tax Map ID	40 116 & 40 114

The effects of proposed conditional use permit or rezoning applications – whether related to land size, building space, use type, or operational factors – can increase the time and effort required by staff to review and evaluate the project. Larger properties, more complex building designs, higher customer volumes, and greater numbers of employees all require additional staff time to review and process the project application. To account for the totality of the application review, a tiered fee structure has been created, which adjusts the base fee using specific characteristics of the proposed application according to the following factors.

Use this worksheet to calculate applicable project fees.

Conditional Use & Rezoning Fees		
Description	Fee	Applicable Fee to Project
Base Fee	Applies to all projects.	\$750
Total Site Acres		
0 – 2.5 total acres	No additional fee	
2.6 - 10 total acres	+\$50	
10.1 - 25 total acres	+\$100	
25+ total acres	+\$250	\$250
Disturbed Acres		
<1 acre	No additional fee	
1.1 – 2.5 acres	+\$50	
2.6 - 10 acres	+\$100	
10+ acres	+\$250	\$250



Enclosure 1 COMMUNITY DEVELOPMENT

Total Building Square Footage		
0 - 5,000 sq. ft.	No additional fee	
5,001 - 10,000 sq. ft.	+\$50	
10,001 - 20,000 sq. ft.	+\$100	
20,001+ sq. ft.	+\$250	\$250
Finished Square Footage		
0 - 2,500 sq. ft.	No additional fee	
2,501 - 5,000 sq. ft.	+\$50	
5,001 - 10,000 sq. ft.	+\$100	
10,001+ sq. ft.	+\$250	\$250
Residential		
Personal Use Only	-\$1,000	
Residential Development	+\$1,000	
Commercial, Business Size		
Fewer than 50 customers/ clients onsite per day	No additional fee	\$0
50-200 customers/ clients onsite per day	+\$100	
More than 200 customers/ clients onsite per day	+\$250	
Commercial, Number of Employees		
0 - 10 employees	No additional fee	\$0
11 - 50 employees	+\$50	
51 - 100 employees	+\$100	
101+ employees	+\$250	
Total Fees		\$1750

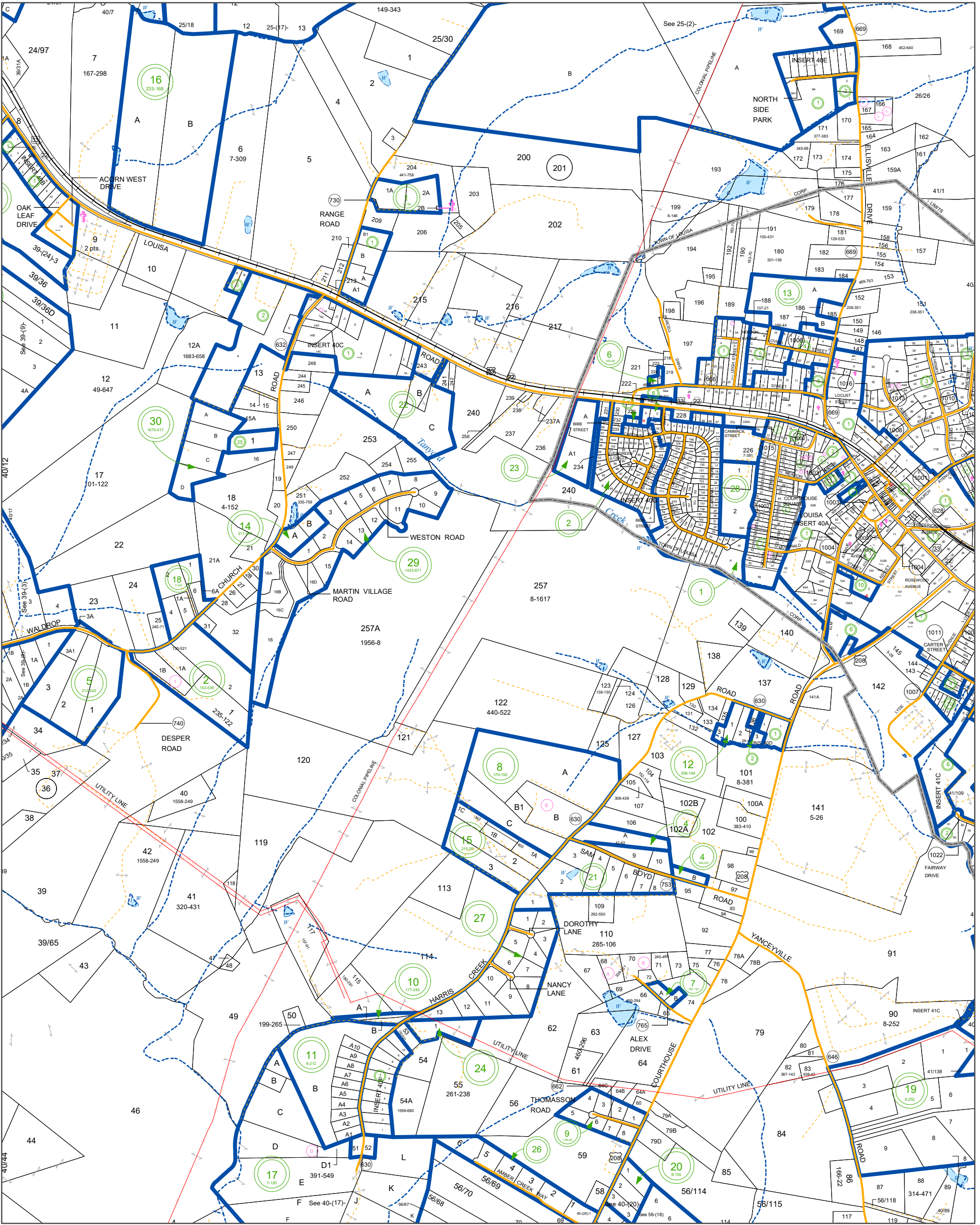
Enclosure 1

Louisa County Community Development Department staff provides a Public Facilities evaluation in staff reports as a result of the Board of Supervisors adoption on February 20, 2024 of a Public Facilities Appendix added to the 2040 Comprehensive Plan. Please review the Public Facilities Appendix located on the Comprehensive Plan webpage and update your application as needed to address anticipated impacts to Public Facilities as listed below. If an impact is expected, you need to provide mitigation in your application. Contact information for the organizations responsible for these public facilities is included in the list below. Please contact Chris Coon Deputy County Administrator at (540) 967-3409, if you have any questions.

The following are the public facilities that impacts must be addressed in an application

- * Fire & EMS
- * Law Enforcement
- * Parks and Recreation
- * Schools
- * Solid Waste
- * Administration

LOUISA COUNTY



0 600 1,200 2,400 3,600 4,800 Feet

SECTION 40

LOUISA DISTRICT

24	25	26
39	40	41
55	56	57

MATCHING SHEETS



Date: Thursday, January 23, 2025

SPECIAL POWER OF ATTORNEY AFFIDAVIT

COMMONWEALTH OF VIRGINIA
COUNTY OF LOUISA

This 30th day of march, 2026, I,
Billy Pleasants, the owner of
Tax Map # 40 116 (describe land by tax map number) make,
 constitute, and appoint Ava Energy Center, LLC, my
 true and lawful attorney-in-fact, and in my name, place and stead giving unto said
a limited liability company full power and authority to do and perform
 all acts and make all representation necessary, without any limitation whatsoever, to
 make Application for said Rezoning or Conditional Use Permit Application. This includes the
 authority to execute and amend proffers or conditions.

The right, powers, and authority of said attorney-in-fact herein granted shall commence and be
 in full force and effect on March 20, 2026, and shall remain in full force
 and effect thereafter until actual notice, by certified mail, return receipt requested is received by
 the Community Development Department of Louisa County stating that the terms of this
 power have been revoked or modified.

Given under our hands this 30th day of march, 2026.

Billy Pleasants

Owner/Contract Purchaser/Authorized Agent (Circle One)

COMMONWEALTH OF Virginia
 CITY/COUNTY OF Louisa, to wit:

The foregoing instrument was acknowledged before me by
Billy Pleasants, the Owner of
 said property, this 30th day of march, 2026

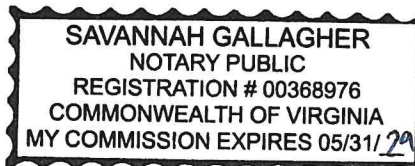
My commission expires:

Savannah Gallagher

Notary Public

00368976

Registration Number



OFFICE USE ONLY

File/Case Number : _____ Date Accepted: _____, 20____

SPECIAL POWER OF ATTORNEY AFFIDAVIT

COMMONWEALTH OF VIRGINIA
COUNTY OF LOUISA

This 30th day of March, 2026, I,
Nancy Pleasants, the owner of
Tax Map # 40 116 (describe land by tax map number) make,
 constitute, and appoint Ava Energy Center, LLC, my
 true and lawful attorney-in-fact, and in my name, place and stead giving unto said
a limited liability company full power and authority to do and perform
 all acts and make all representation necessary, without any limitation whatsoever, to
 make Application for said Rezoning or Conditional Use Permit Application. This includes the
 authority to execute and amend proffers or conditions.

The right, powers, and authority of said attorney-in-fact herein granted shall commence and be
 in full force and effect on March 20, 2026, and shall remain in full force
 and effect thereafter until actual notice, by certified mail, return receipt requested is received by
 the Community Development Department of Louisa County stating that the terms of this
 power have been revoked or modified.

Given under our hands this 30th day of March, 2026.

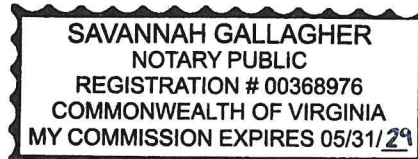
Nancy Pleasants
 Owner/Contract Purchaser/Authorized Agent (Circle One)

COMMONWEALTH OF Virginia
 CITY/COUNTY OF Louisa, to wit:

The foregoing instrument was acknowledged before me by
Nancy Pleasants, the Owner of
 said property, this 30th day of March, 2026.

My commission expires:

Savannah Gallagher Notary Public
00368976 Registration Number



OFFICE USE ONLY

File/Case Number : _____ Date Accepted: _____, 20____

SPECIAL POWER OF ATTORNEY AFFIDAVIT

COMMONWEALTH OF VIRGINIA
COUNTY OF LOUISA

This 30th day of March, 2026, I,
Calvert Compton, the owner of
Tax Map #46 116 (describe land by tax map number) make,
 constitute, and appoint Ava Energy Center, LLC, my
 true and lawful attorney-in-fact, and in my name, place and stead giving unto said
a limited liability company full power and authority to do and perform
 all acts and make all representation necessary, without any limitation whatsoever, to
 make Application for said Rezoning or Conditional Use Permit Application. This includes the
 authority to execute and amend proffers or conditions.

The right, powers, and authority of said attorney-in-fact herein granted shall commence and be
 in full force and effect on March 20, 2026, and shall remain in full force
 and effect thereafter until actual notice, by certified mail, return receipt requested is received by
 the Community Development Department of Louisa County stating that the terms of this
 power have been revoked or modified.

Given under our hands this 30th day of March, 2026.

Calvert H. Compton Jr.

Owner/Contract Purchaser/Authorized Agent (Circle One)

COMMONWEALTH OF Virginia
 CITY/COUNTY OF LOUISA, to wit:

The foregoing instrument was acknowledged before me by
Calvert Compton, the Owner of
 said property, this 30th day of March, 2026.

My commission expires:

Savannah Gallagher

Notary Public

00368976

Registration Number

SAVANNAH GALLAGHER
 NOTARY PUBLIC
 REGISTRATION # 00368976
 COMMONWEALTH OF VIRGINIA
 MY COMMISSION EXPIRES 05/31/29

OFFICE USE ONLY

File/Case Number : _____ Date Accepted: _____, 20____

SPECIAL POWER OF ATTORNEY AFFIDAVIT

COMMONWEALTH OF VIRGINIA
COUNTY OF LOUISA

This 30th day of March, 2026, I,
Betsy M. Compton, the owner of
Tax Map # 40 116 (describe land by tax map number) make,
 constitute, and appoint Ava Energy Center, LLC, my
 true and lawful attorney-in-fact, and in my name, place and stead giving unto said
a limited liability company full power and authority to do and perform
 all acts and make all representation necessary, without any limitation whatsoever, to
 make Application for said Rezoning or Conditional Use Permit Application. This includes the
 authority to execute and amend proffers or conditions.

The right, powers, and authority of said attorney-in-fact herein granted shall commence and be
 in full force and effect on March 20, 2026, and shall remain in full force
 and effect thereafter until actual notice, by certified mail, return receipt requested is received by
 the Community Development Department of Louisa County stating that the terms of this
 power have been revoked or modified.

Given under our hands this 30th day of March, 2026.

Betsy M. Compton

Owner/Contract Purchaser/Authorized Agent (Circle One)

COMMONWEALTH OF Virginia
 CITY/COUNTY OF Louisa, to wit:

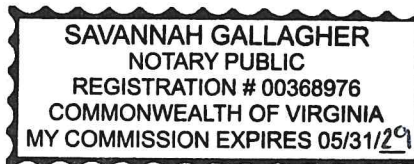
The foregoing instrument was acknowledged before me by

Betsy Compton, the Owner of
 said property, this 30th day of March, 2026.

My commission expires:

Savannah Gallagher Notary Public

00368976 Registration Number



OFFICE USE ONLY

File/Case Number : _____ Date Accepted: _____, 20____

SPECIAL POWER OF ATTORNEY AFFIDAVIT

COMMONWEALTH OF VIRGINIA
COUNTY OF LOUISA

This 13th day of August, 2026, I,
Jerome Facchina, the owner of
tax parcel ID# 40 114 (describe land by tax map number) make,
 constitute, and appoint Ava Energy Center, LLC, my
 true and lawful attorney-in-fact, and in my name, place and stead giving unto said
a limited liability company full power and authority to do and perform
 all acts and make all representation necessary, without any limitation whatsoever, to
 make Application for said Rezoning or Conditional Use Permit Application. This includes the
 authority to execute and amend proffers or conditions.

The right, powers, and authority of said attorney-in-fact herein granted shall commence and be
 in full force and effect on August 11th, 2026, and shall remain in full force
 and effect thereafter until actual notice, by certified mail, return receipt requested is received by
 the Community Development Department of Louisa County stating that the terms of this
 power have been revoked or modified.

Given under our hands this 13th day of August, 2026.



Owner/Contract Purchaser/Authorized Agent (Circle One)

COMMONWEALTH OF Virginia
 CITY/COUNTY OF Henrico, to wit:

The foregoing instrument was acknowledged before me by
Jerome Taylor Facchina, the Owner of
 said property, this 13th day of August, 2026.

My commission expires:

 Notary Public

00411429 Registration Number

CAMERON JAMES
 NOTARY PUBLIC
 REG. #00411429
 COMMONWEALTH OF VIRGINIA
 MY COMMISSION EXPIRES OCTOBER 31, 2030

OFFICE USE ONLY

File/Case Number : _____ Date Accepted: _____, 20____



Conditional Use Permit Application and 2232 Comprehensive Plan Compliance Check

Ava Energy Center
Louisa County VA

Louisa County
c/o Tom Egeland
1 Woolfolk Ave
Louisa, VA 23093

Submission Date: August 19th, 2026

Applicant & Owner Information

Ava Energy Center LLC
c/o: East Point Energy, LLC
310 4th St. NE, 3rd Floor
Charlottesville, VA 22902

Ava Energy Center LLC's Point of Contact

Chris Meyer
Project Developer
434-227-5549
cmeyer@eastpointenergy.com

Company Background

Ava Energy Center, LLC is a wholly owned subsidiary of East Point Energy, LLC. East Point Energy develops, builds, owns, and operates grid-scale energy storage projects. As an Equinor company and independent power producer, our team is currently developing gigawatts of energy storage projects throughout the country to build a clean, resilient, and affordable electric grid for the future.

East Point successfully developed the first utility scale battery energy storage project in Virginia for Rappahannock Electric Cooperative as well as the largest project operational project in the state, Dry Bridge Energy Center, now operated by Dominion.

East Point's nimble team is comprised of hard-working, strategic problem solvers who are passionate about sustainability. We are technology and contractor agnostic, allowing us to find the best solution for each project. The firm's executive team founded East Point in 2018, bringing decades of combined energy development experience. Success for East Point is measured by delivering affordable energy storage solutions that benefit the grid, communities, and our environment.

Project Details

Introduction

East Point is excited to present the Planning Commission with a Conditional Use Permit application for the Ava Energy Center. The project is a proposed battery energy storage system (BESS) that will connect to Dominion electrical infrastructure adjacent to Harris Creek Road and be situated near a pump station for the Colonial Pipeline. Once connected, the system will be capable of charging from and discharging to the electrical grid to provide a variety of benefits. These include, but are not limited to, realizing the full value and cost savings of renewable energy built across the state of Virginia and increasing the reliability and resilience of the electrical grid. This development will help to implement the County's Comprehensive Plan by: helping to ensure the County's residents and businesses a more reliable electricity grid, indirectly contributing to lower electricity rates, and increasing the tax base.

The sections below highlight details of the potential project and our planned conformity to all Louisa County rules and ordinances.

Table 1

Current Property Owners	Compton and Pleasants families & Cherry Family Ltd Partnership
Property Addresses	Off of Harris Creek Road
Properties Coordinates	36°43'31.46"N 76°18'27.43"W
Parcel IDs	40 116 & 40 114
Properties Zoning	A1
Properties Acreage combined	92.42 (50.15 + 42.27)
Project Acreage or Limit of Disturbance	~25 acres limits of disturbance ~10 acres inside project fence

Property & Topography

The project will be located on approximately 92.4 acres on two parcels west of Harris Creek Road. Dominion transmission lines, a Dominion substation, and a Colonial Pipeline pump station are located on the site's S/SW border. The properties are crossed by a Dominion high-voltage transmission line in their southern portion and by the Colonial Pipeline through on one parcel's western side. One parcel is already being utilized to transport and host energy infrastructure while the other's current use is for a pine timber plantation. Table 1, above, contains additional information on the properties.

Battery energy storage projects require relatively flat terrain for development. Portions of the project site will require grading and East Point will ensure the appropriate erosion control and stormwater management measures required by the state and Louisa County are taken as the property is graded. Additionally, East Point's engineering team will study any necessary stormwater treatment and discharge. Priority will be placed on site design to minimize storm water runoff and treatment on site.

Figure 1: Proposed project parcels shown



Preliminary Site Plans

Figure 2 shows our preliminary site plan for the storage system we hope to build. We have established 200MW as a maximum size for the project and any need for downsizing will be determined after interconnection studies are complete. High fencing and vegetative screening of the project area is included. This site plan is preliminary and generally represents where battery containers and associated equipment would be located. This area will be further refined once an interconnection agreement is signed and a project size is finalized. The battery enclosures will have a height at or below 12 feet.

Project access will be achieved with an access road through parcel 10 114 from Harris Creek Road and entrance per VDOT standards. The stormwater management facilities for the project will be designed and permitted in accordance with Virginia DEQ and Louisa County requirements. No permanent wastewater discharge is proposed.

[illegible]

The directly adjacent surrounding properties include a mix of uses with the primary being agriculture in nature. There is a parcel owned by the Colonial Pipeline company to the SW that includes a substation, transmission lines, pipelines, stormwater pond, and a pumping station. To the S, there is a Dominion substation and transmission lines. To the E/SE across Harris Creek Road are A-2 zoned properties of 1.5-2 acres sizing roughly usually with a detached single family home. On the project's northern boundary it nearly encompasses an ag zoned parcel (40 113) of roughly 8.85 acres with a single family detached home. The remaining properties to the N, NW, and W are Ag zoned and contain a mix of natural, secondary forest and pine plantation. Looking further west is the Belcher solar project.

The proposed Ava Energy Center would disturb approximately 25 acres including its stormwater, access road, and site for the batteries and electrical gear. The project will boast a capacity of up to 200MW/800 MWh, which is sufficient to supply electricity to approximately 100,000 homes for 4 hours or the majority of Louisa County and its businesses sans any data centers.

The facility will consist of enclosed battery storage containers, associated electrical equipment, a small, unmanned operations/maintenance building, internal gravel access drives, security fencing, and landscaping buffers. There will be a project substation that includes the necessary transmission infrastructure to interconnect the batteries with the existing electrical grid. The facility will operate unmanned on a continuous basis, though battery monitoring systems (BMS) will provide twenty-four hours a day, seven days a week (24/7) monitoring, with routine maintenance occurring periodically on site. A "knock" box and fire control panel will be installed at the entrance to the facility to provide access to fire and rescue personnel in addition to a safe muster location with necessary communication equipment and fire safety information portal.

Screening & Landscaping

East Point prioritizes being a good neighbor to adjacent parcels and its project's security and thus, having the project not be seen nor heard is our goal. Maintaining the existing forest is prioritized when considering the minimum 100ft of vegetative screen around the project. Where the existing vegetative screen is not present, East Point commits to planting native and evergreen trees (non-fire prone pine) and shrubs to ensure a proper vegetative screen. Such addition should at a minimum meet the County's solar buffering guidance (Sec. 86-532 a9) that would have staggered evergreens ten feet apart and on 15 ft center, at least 5ft at planting, and expected to grow to a minimum of 20ft within 10yrs. Some portions of the project are adjacent to the existing Colonial Pipeline and while we cannot plant vegetation in the Pipeline's Right of Way, we will make additive plantings around it. Screening to the west of the Dominion distribution electricity line Right of Way along Harris Creek Road would maintain 100ft even if that particular parcel were to be logged prior to the project's start of construction. The screening of the project aligns with East Point's operational goal of keeping the project safe and secure from the public's view and consciousness.

East Point Energy does propose placing the majority of the approximately 42 acre parcel (PIN# 40 114) adjacent to Harris Creek road and remainder of host parcel (PIN# 40 116) into a conservation easement to address neighborhood concerns about additional development for housing, data centers, or another BESS project.

Operation, Safety, & Environment

East Point is battery technology and chemistry technology agnostic with a safety first priority. After completing the interconnection study with the transmission grid operator, we will select the safest and best battery technology for the project site. For the Ava Energy Center, we anticipate the use of lithium-ion Iron Phosphate (LFP) battery technology and chemistry. This is a common technology used in smartphones and computers, medical devices, and many other sophisticated technologies we interact with daily. The system will be remotely monitored 24/7 – 365 days a year and will require frequent if not daily maintenance visits from trained staff. East Point acknowledges the very limited risks

associated with lithium-ion LFP BESS and will ensure local, state, and federal safety requirements are followed and that local responders are well-trained and equipped to handle any kind of response to a system malfunction.

East Point's parent company, Equinor, is an "all of the above" energy provider that includes decades of oil and gas energy development of some of the most challenging environments in the world (North sea oil/gas exploration). Over those decades of operations, it refined its safety Standard Operating Procedures to ensure human safety and environmental sustainability through purposeful planning including layers of checks, controls, and processes to reduce the potential of an incident in the first place and if something were to happen, that any human and environmental impacts are minimized as much as possible.

Specifically for Ava Energy Center, East Point proposed utilizing the National Fire Protection Alliance 855 code that provides specific safety requirements for Battery Energy System. That includes specific guidance UL code, factory testing, and quality control requirements for the battery equipment, the creation of the Emergency Response Plan, training timing and frequency on the Plan, fire water requirements, site design including setbacks and access road widths, auxiliary backup power and communications requirements, and the commissioning and inspection timing.

Please see Attachment A for an example of an Emergency Response Plan, Attachment B for a Hazard Mitigation Analysis, and Attachment C for a review of Potential Impacts of Fires at BESS facilities.

Security for the project will be provided through multiple layers including screening vegetation around the site's perimeter, a security fence or wall, 24/7 video monitoring, motion sensing lighting that is dark sky compliant, and a Remote Operations Center (ROC) that monitors the project perimeter and enclosures for any potential incidents. The first layer of security is the vegetative screening that helps ensure the public in general is not aware of the project in the first place.

This project will have no emissions into the environment around Louisa County as lithium-ion is a non-emitting technology. The project will produce a sound similar in magnitude to what is created by the neighboring substation and pipeline pumping station and commits to a sound level below the County ordinance of 55dba at the parcel boundaries.

Public Facility Impacts

Fire and EMS – Ava Energy Center should not have any significant impacts on Louisa County Fire and EMS other than minimal time for trainings as desired. Annual trainings on the Emergency Response Plan would be coordinated with the Fire operations team and paid for by East Point. If a fire emergency were to occur on the site, there are no adjacent buildings that would require protection and with no employees working on the site, there

would be no need for any life saving activity. If the Fire and EMS teams deem additional equipment may be necessary, East Point is amenable to including such equipment expense in the Siting Agreement.

Law Enforcement – Ava Energy Center should not require law enforcement responses nor protection.

Parks and Recreation – Ava Energy Center will not generate any new visitors to Parks and Recreation facilities.

Schools – Ava Energy Center will not generate any new students for Louisa County Schools. East Point does prioritize supporting K-12 STEM education with its annual community support grants where projects are located.

Solid Waste – Ava Energy Center will not generate any regular waste from its operations after construction. The recycling and decommissioning of the batteries and electrical equipment will be done through specialized and licensed facilities outside of Louisa County.

Administration – Ava Energy Center will require some review of its property tax submissions by the Commissioner of Revenue, but the project once operational should not require supervision by the County's administration.

Conclusion

In summary, East Point Energy is respectfully requesting a Conditional Use Permit allowing the development of Ava Energy Center, a battery energy storage system, with a capacity of up to 200MW, on A-1 zoned land. This project will help to increase the reliability and resiliency of the local electricity grid, indirectly lower electricity rates, and provide tax revenue to Louisa County with little to no impact on local resources such as schools and roads. This application is an indication of our confidence in this project, but not a guarantee that it will be built. Additional electrical studies need to be completed before the decision to move forward will be made.

2232 Comprehensive Plan Compliance Review

East Point Energy does believe Ava Energy Center complies or does not conflict with Louisa County's Comprehensive Plan. Below East Point reviews the Ava Energy Center project against relevant goals of the County's most recent Comprehensive Plan:

- Goal 1: Preserve and protect our rural heritage and natural resources:* Ava Energy Center does not negatively impact any rural heritage resources nor natural resources. It will comply with all state Department of Environmental Quality requirements in regards to Threatened and Endangered Species, Stormwater runoff, and pollution (project is non-polluting) rules. It will utilize existing tree cover where possible as a buffer and is not located adjacent to any rural heritage or important natural resources such as the water shed for county drinking water. It is not adjacent to a road that would impact the viewshed of the rural heritage of an adjacent property.
- *Goal 3: Safeguard historic resources:* Ava Energy Center's initial Critical Issues Analysis did not identify any cultural resources of relevance. East Point will conduct a Cultural Resource assessment to ensure its land disturbance does not impact any significant historic resource that might be located on the property. If any historic resources would be identified, project adjustment will be taken in order to preserve the resource.
 - *Goal 4: Maintain community characteristics:* The Ava Energy will not negatively impact any community characteristic in as much it is sited adjacent to existing energy infrastructure and will not be seen nor heard by the community. The screening and noise conditions proposed will ensure no impacts to the community characteristics.
 - *Goal 5: Ensure compatibility between land uses:* Adjacent properties to the project are zoned ag and are either hosting energy infrastructure already or being utilized as natural or planted forest. The battery energy storage use case is compatible with existing energy infrastructure use while also not having a negative impact on the other parcel's forestry use. Land not used for the BESS is proposed to be placed into conservation easements.
 - *Goal 6: Manage growth by concentrating development activity:* Ava Energy Center is concentrating vital energy infrastructure adjacent to existing and energy infrastructure. The project will also be limited to the limits of disturbance in the Conditional Use Permit, which is not the dozens or hundreds of acres like the data centers or solar array projects.
 - *Goal 7: Encourage high quality development:* The Ava Energy Center will meet the most recent safety and design standards by requiring the National Fire Protection Alliance 855 code, which is specific to battery energy storage projects. All storm water and other relevant environmental standards will be required and met. Additionally, all quality of life considerations of potential noise impacts for example will be conditioned to ensure compliance with the County's ordinances.

- *Goal 8: Maximize returns on the investment of public resources:* No public financial nor physical resources will be used in this project's development, construction, nor operations. It is not requesting a subsidy in any manner and rather will be turning a property currently receiving a land use subsidy for agriculture purposes into a very, very high source of tax revenue vis-a-vis the acreage it occupies when considering real and personal property valuation increases. Any potential impact on fire and rescue resources from an equipment perspective should be addressed in the project's Siting Agreement.

Conclusion

East Point Energy believes the Ava Energy Center project does fit into and comply with the County's Comprehensive Plan. The project will not cause adverse impact to the County's natural resources, historic resources, nor visual rural nature because it will not be seen, will follow all state and local requirements regarding protection of said resources, and is situated adjacent to existing energy infrastructure. Additionally, the project will generate exponentially more in tax revenue from the property while not requiring any public resources.

East Point Energy Statement of Qualifications

Ava Energy Center, LLC is a wholly owned subsidiary of East Point Energy, LLC. East Point Energy develops, builds, owns, and operates grid-scale energy storage projects. As an Equinor company and independent power producer, our team is currently developing gigawatts of energy storage projects throughout the country to build a clean, resilient, and affordable electric grid for the future.

East Point successfully developed the first utility scale Battery Energy Storage project in Virginia for Rappahannock Electric Cooperative as well as the largest project operational project in the state, Dry Bridge Energy Center, now operated by Dominion.

East Point's nimble team is comprised of hard-working, strategic problem solvers who are passionate about sustainability. We are technology and contractor agnostic, allowing us to find the best solution for each project. The firm's executive team founded East Point in 2018, bringing decades of combined energy development experience. Success for East Point is measured by delivering affordable energy storage solutions that benefit the grid, communities, and our environment.

East Point at a Glance

- 3.7 GW energy storage projects actively under development
- Management team has developed over 1.8 GW (\$1.5B) of operating Distributed Energy Resources around the country
- Developed 88 MWh of projects that are now operated by leading electrical utilities in the Commonwealth of VA

Utility Experience



Supply Chain Partners



Key Team Members

EXECUTIVE TEAM	
Andrew Foukal <i>CEO</i>	Andrew Foukal is the CEO and co-founder of East Point Energy, a leading energy storage independent power producer based in the United States. Since launching the company in 2018, Andrew has been responsible for shaping its strategic direction, overseeing execution, and building a high-performing team. Andrew brings over a decade and a half of experience in utility-scale energy development to East Point. Prior to founding the company, he held senior roles at HelioSage Energy and Coronal Energy, where he led teams responsible for developing and executing gigawatts of solar projects across the United States. He holds a Bachelor of Science in Physics from Bates College and a Master's in Materials Science and Engineering from the University of Virginia.
Tyler Cline <i>CDO</i>	As CDO, Tyler is responsible for overseeing the development of East Point Energy's front-of-the-meter, standalone energy storage projects throughout the United States. Tyler has a background in utility-scale, renewable energy origination and project development. Tyler began his career in renewable energy with Coronal Energy, where he facilitated the development of utility-scale solar and solar-plus storage projects throughout the United States. Following the acquisition of Coronal by Ørsted, Tyler shifted his focus to origination, securing long-term revenue opportunities for Ørsted's onshore wind and solar portfolio in the United States. Prior to his career in clean energy, Tyler spent several years in the United States Army as an infantry officer. Tyler holds a BS in Civil Engineering from the United States Military Academy at West Point and an MBA from the University of North Carolina at Chapel Hill's Kenan-Flagler Business School.
Matt Cousins <i>CFO</i>	As CFO, Matt is responsible for the Finance & Control, Business Development, and Asset Management teams at East Point Energy. Matt has a

	background in utility-scale, energy storage acquisition, business development, and finance. Matt began his career in renewable energy with Dominion Energy, where he led the acquisition of the company's first utility-scale energy storage projects. Following his time at Dominion, Matt led the US-based electric utility business development strategy for Wartsila's energy storage EPC and integration services business. Prior to his career in clean energy, Matt advised M&A clients at Harris Williams across energy, power, and infrastructure end markets and spent over eleven years flying MH-60S helicopters in the US Navy. Matt holds a BS in Systems Engineering from the United States Naval Academy, an MBA from The College of William & Mary, and an MS in Accounting from the University of Connecticut.
Christie Borton <i>General Counsel</i>	As General Counsel for East Point Energy, Christie is responsible for supporting the company's legal needs and managing and mentoring the internal legal team. Prior to joining East Point, Christie practiced law in Birmingham, Alabama for nearly fifteen years with the law firm Maynard Nexsen PC. Christie began her legal career in the bankruptcy and loan workout area, where she developed both litigation and transactional skills, but quickly found that her passion was helping clients achieve their goals through closing transactions and she gradually shifted into a fully transactional practice. After returning to Maynard Nexsen, Christie focused her practice entirely on representing clients in the commercial real estate space, and developed extensive experience handling a wide range of complex transactions across the country. Christie holds a BA in Philosophy and Japanese from Dartmouth College and a JD from the University of Virginia.

ADDITIONAL MEMBERS OF PROJECT TEAM	
Maggie Howe <i>VP of Project Development</i>	Maggie manages and mentors East Point's team of Project Developers, in addition to leading campaigns for several key East Coast markets. Prior to joining East Point, Maggie worked as a contractor for the EPA, where she supported oil spill prevention and response programs. For several years, she also ran an environmentally focused summer camp in Brevard, NC, serving over 1200 children each season. Maggie holds a BS in Science, Technology, and International Affairs, focusing on environmental and energy policy, from Georgetown University's School of Foreign Service, as well as an MBA from the University of North Carolina's Kenan Flagler School of Business.
Chris Meyer <i>Project Development Manager</i>	As a Project Developer, Chris supports East Point Energy's existing campaigns and engages in new market research. Prior to joining the team, Chris founded and ran an organization focusing on sustainable silvo agriculture in Panama; advocated in UN climate change negotiations for the Environmental Defense Fund; and led a non-profit working on residential energy efficiency, electrification, and rooftop solar installations in Virginia.

	Chris holds an MA in International Relations from Johns Hopkins University's School of Advanced International Studies (SAIS) and a BBA in Finance from the University of Portland.
Tom DeAngelis <i>Senior Development Engineer</i>	Tom focuses on the engineering, design, interconnection, permitting, and technical risk assessment of East Point Energy's energy storage projects. Tom served as the lead development engineer for East Point's Dry Bridge Energy Center, which was sold to Dominion Energy in 2021, as well as Yadkins Energy Center, which was sold to Aypa Power in 2022. Prior to joining East Point Energy, Tom worked with Integrated Environmental Solutions in Dublin, Ireland where he helped buildings achieve LEED certification. Tom holds a BS in Mechanical Engineering from the University of Virginia.

Representative Energy Storage Projects

East Point Owned Projects

Sunset Ridge Energy Center Battery Storage Project

System Size: 10 MWac | 20 MWh

Location: ERCOT

Current Status: Operational

Citrus Flatts Energy Center Battery Storage Project

System Size: 100 MWac | 200 MWh

Location: ERCOT

Current Status: Operational

Railroad Energy Center Battery Storage Project

System Size: 20 MWac | 40 MWh

Location: PJM

Current Status: Under construction

Evergreen Energy Center Battery Storage Project

System Size: 20 MWac | 40 MWh

Location: PJM

Current Status: Operational

Reid Energy Center Battery Storage Project

System Size: 20 MWac | 40 MWh

Location: PJM

Current Status: Under construction

Bethlehem Energy Center Battery Storage Project

System Size: 20 MWac | 40 MWh

Location: PJM

Current Status: Under construction

Commercial Operation: 2026 (expected)

East Point Developed Projects

Dry Bridge Energy Center Battery Storage Project

System Size: 20 MWac | 80 MWh

Owner: Dominion Energy Virginia

Location: Chesterfield County, Virginia (PJM)

Brokenburg Battery Energy Storage System

System Size: 2MWac | 8MWHac

Owner: Rappahannock Electric Cooperative

Location: Spotsylvania, Virginia (PJM)

Shands Energy Center Battery Storage Project

System Size: 15.7 MWac | 62.8 MWh

Owner: Dominion Energy Virginia

Location: PJM

Yadkins Energy Center Battery Storage Project

System Size: 100 MWac | 400 MWh

Owner: Aypa Power

Location: Chesapeake, Virginia (PJM)

Knightdale Energy Center Battery Storage Project

System Size: 100 MWac | 400 MWh

Owner: Undisclosed Investor-Owned Utility

Location: SERC

Proposed Proffered Conditions

1. Stormwater Management Monitoring and Maintenance

The Applicant shall be responsible for the ongoing inspection, monitoring, and maintenance of all stormwater management facilities associated with the project. Inspections shall occur in accordance with applicable federal, state, and local requirements and additionally following significant or impactful weather events to ensure that erosion and sediment control measures and stormwater facilities are functioning as designed.

If deficiencies or failures are identified, the Applicant shall take timely corrective action to restore stormwater and erosion and sediment control measures to proper working condition in compliance with approved plans and permits.

2. Responsibility for Erosion and Sediment Control Compliance

The Applicant shall be solely responsible for ensuring continued compliance with all approved erosion and sediment control (E&S) plans, stormwater permits, and related regulatory requirements throughout construction and operation of the facility.

Any erosion, sedimentation, or stormwater-related issues identified during inspections or by regulatory authorities shall be promptly addressed by the Applicant at its sole expense, including the implementation of corrective or supplemental measures as necessary to maintain compliance.

3. Emergency Response Planning Coordination

Prior to commencement of operations, the Applicant shall develop a site-specific Emergency Response Plan (ERP) and Hazard Mitigation Analysis (HMA) for the Battery Energy Storage System (BESS) facility in coordination with Louisa County Fire and Rescue and other applicable emergency response agencies. The ERP should be approved as part of the Site Plan approval process.

The ERP shall include, at a minimum, site access information, emergency contact procedures, incident notification protocols, system safety features, fire response strategy, and general response considerations applicable to battery energy storage systems.

The Applicant shall offer training and familiarization sessions for local emergency responders prior to commissioning of the facility and periodically thereafter during the life of the project. The ERP shall be updated as necessary to reflect material changes to the facility or applicable safety standards.

4. Sound

Operation of the Battery Energy Storage System (BESS) facility shall comply with the following sound limits: sound levels generated by the facility shall not exceed 55 dBA, measured at the adjacent parcel boundary

A sound study shall be presented as part of the Site Plan review. A sound study shall be performed once operational and its results submitted to the County to demonstrate compliance.

If the sound study demonstrates non-compliance, the operator shall take reasonable corrective actions, which may include operational adjustments, equipment modifications, or installation of sound attenuation measures, to achieve compliance with this condition.

5. Environmental Monitoring Following Fire Event

In the event of a confirmed fire involving one or more Battery Energy Storage System (BESS) units that requires response by the local fire department, the operator shall conduct post-incident environmental monitoring to evaluate potential impacts to air, soil, surface water, and groundwater, as applicable, in the vicinity of the affected equipment.

Monitoring shall be conducted by a qualified environmental professional and may include sampling and analysis of airborne particulates, combustion byproducts, soil, and water for constituents commonly associated with lithium-ion battery incidents. Monitoring shall be coordinated with the appropriate state or local regulatory agencies, as applicable.

A summary report of the monitoring results shall be provided to the County within a reasonable timeframe following completion of sampling. If monitoring identifies contaminant concentrations exceeding applicable state or federal regulatory standards, the operator shall coordinate with the appropriate regulatory agencies to implement any required remediation or corrective actions.

7. Decommissioning and Financial Assurance

Enclosure 1

Prior to commencement of operations, the operator shall submit a decommissioning plan prepared by a qualified professional describing the removal of all above-ground equipment, foundations, and associated infrastructure related to the BESS facility and the restoration of the site to a stable condition.

The operator shall provide financial assurance, following the fifteenth (15th) anniversary of the project's commercial operation date, in the form of a surety bond, letter of credit, or parent company guarantee to ensure completion of decommissioning activities. The amount of the financial assurance shall be based on a third-party estimate of the cost to decommission the facility, net of any salvage value, and shall be reviewed and updated periodically to reflect changes in decommissioning costs.

Decommissioning shall occur if the facility is permanently abandoned or ceases operations for a continuous period of twelve (12) months, unless otherwise approved by the County.

8. Adherence to NFPA 855

The project shall adhere to the latest NFPA 855 code when finalizing design and presenting its site plan to ensure fire and safety concerns are adequately addressed.

9. Baseline well and soil testing

Prior to commencement of operations, neighboring parcels within .75 mile of a BESS enclosure shall be offered well and soil testing to measure for any potential contaminant identified in the projects' Hazard Mitigation Analysis in order to provide both the developer and neighboring property owners a baseline of measurement against a potential emergency event. Test results shall be shared with respective property owners and the County's Fire and Rescue and Community Development departments. The testing offer shall be delivered within 30 days of the project's land disturbance permit issuance and through at least two mailings to the mailing address on the property's respective tax ID file and a notification in a local publication.

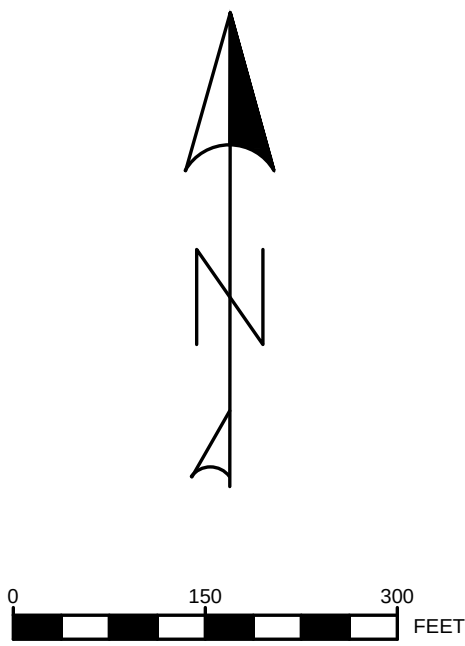
10. Remaining portion of property post-project development to be placed into conservation easement

Prior to Site Plan approval, the remaining portions of the project's parcels (40 116 & 40 114) not being utilized for easements, access, stormwater, and the project's BESS limits of disturbance shall be placed into a conservation easement.



GENERAL NOTES

1. THIS DRAWING IS A PRELIMINARY DESIGN - NOT FOR CONSTRUCTION.
2. ALL DIMENSIONS SPECIFIED HERE ARE FOR REFERENCE ONLY, DO NOT SCALE THIS DRAWING.
3. EQUIPMENT TYPE, QUANTITY, AND LOCATION IS REPRESENTATIVE ONLY AND MAY CHANGE BASED ON AVAILABILITY AND FINAL DESIGN.
4. ALL EQUIPMENT IS A MINIMUM OF 100' FROM THE PROPERTY LINE.
5. PROPERTY BOUNDARIES ARE APPROXIMATE AND BASED ON PUBLICLY AVAILABLE DATA. BOUNDARIES WILL BE UPDATED UPON COMPLETION OF FIELD SURVEY.
6. BUFFER COLORS:
 - 6.1. GREEN - EXISTING BUFFER IS SUFFICIENT
 - 6.2. YELLOW - VEGETATIVE BUFFER NOT REQUIRED DUE TO UTILITY ROW OR ACCESS ROAD.
 - 6.3. RED - ADDITIONAL PLANTING NECESSARY



DATE	08/05/2026
BY	TD
PAGE	1



AVA ENERGY CENTER
BATTERY ENERGY STORAGE SYSTEM
HARRIS CREEK ROAD, LOUISA VA 23093

PROJECT CAPACITY: 200 MW / 800 MWh
INTERCONNECTION VOLTAGE: 230 kV

PRELIMINARY CONCEPT PLAN

PRELIMINARY

NOT FOR
CONSTRUCTION



FIRE & RISK
★★ ALLIANCE ★★

Evergreen Energy Center

BESS

Emergency Response Plan



Prepared for East Point Energy

April 18, 2025

Rev 0

The distribution of this document to third parties is prohibited without written approval from Fire & Risk Alliance, LLC.

OVERVIEW

This document is an Emergency Response Plan (ERP) for the Evergreen Energy Center (Evergreen EC) battery energy storage system (BESS) facility located at 20831 Evergreen Mills Road in the city of Leesburg, Virginia. The Evergreen EC BESS is anticipated to include 10 Hithium Infinity Block Gen 2 (Hithium) BESS cabinets with a capacity of 20MW/40MWh, along with 5 power conversion system skids. There is also space allotted for two augmentation Hithium BESS cabinets and an additional PCS skid in the future. The Hithium cabinet is a fully integrated BESS consisting of battery modules, power electronics, control systems, a battery management system, a thermal management system, and an explosion prevention system all pre-assembled within a single, non-occupiable cabinet. It is meant for outdoor installations, mounted to the ground, for commercial, industrial, and utility applications.

The ERP provides an overview of the facility including details about site equipment, detection equipment, and safety features. It also provides information on potential hazards and the response strategies needed to address emergencies at the facility. The purpose of this ERP is to provide guidance to BESS subject matter experts (SMEs) and the members of the fire service on emergencies that can reasonably occur at the facility.

The scope of services performed during this analysis may not adequately address the needs of other users of this document, and any re-use of this ERP or its conclusions presented herein are at the sole risk of the user. The recommendations formulated during this assessment are based on observations and information available at the time of the analysis, which has been provided to FRA by others. No guarantee or warranty as to future performance of any reviewed condition is expressed or implied.



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TABLE OF CONTENTS

1 GENERAL INFORMATION	1
1.1 Scope	1
1.2 Purpose	1
1.3 Site Owner	1
1.4 Site Location	1
1.5 Battery Energy Storage System Manufacturer	1
1.6 Emergency Contact	1
1.7 First Responder Contact Information	2
2 ENERGY STORAGE SYSTEM INFORMATION	3
2.1 Site Overview	3
2.2 Energy Storage System Site Design	3
3 GLOSSARY OF TERMS.....	7
3.1 Battery Management System/Battery Management Unit	7
3.2 Critical Temperatures	8
3.3 Cell.....	8
3.4 Module	9
3.5 Rack	10
3.6 Lithium BESS Cabinet	10
3.7 Control Panel Compartment	11
3.8 Thermal Management Unit	11
3.9 Power Conversion System Skid	11
3.10 Auxiliary Power Transformer	12
3.11 Emergency Stop	12
3.12 Stranded Energy	13
3.13 Cell Venting.....	13
3.14 Thermal Runaway	14
3.15 Explosion Control	14
3.16 Alternating Current / Direct Current	14
3.17 Subject Matter Expert.....	14
4 BATTERY MANAGEMENT UNIT	15
5 FIRE DEPARTMENT INFORMATION.....	16
5.1 First Responder Station.....	16
5.2 Knox Box	16
5.3 Apparatus Access	16
5.4 Fire Alarm Control Panel	16
5.4.1 Detection System	16

5.4.2 Gas Detection and Ventilation.....	17
5.5 Alarm Annunciation	18
5.6 Suppression Systems	18
5.7 Water Supply.....	18
6 HAZARDS	20
6.1 Chemical	20
6.1.1 Lithium Iron Phosphate Cells	20
6.1.2 Hydrogen	22
6.1.3 R-134a Refrigerant.....	22
6.1.4 Transformer Oil	23
6.1.5 Carbon Monoxide	23
6.1.6 Recommended PPE.....	24
6.2 Electrical	24
6.3 Explosion	26
7 NOTIFICATIONS	27
7.1 Notification Flow	27
8 UNIFIED COMMAND	28
8.1 Subject Matter Expert	28
8.2 Unified Command Structure	29
8.3 Incident Command Structure	29
9 RESPONSE TACTICS.....	31
9.1 Personal Protective Equipment (PPE).....	31
9.2 On Arrival	31
9.3 Initial Status Briefing.....	31
9.4 Size-Up	31
9.5 Response Scenarios	36
9.5.1 Cell Failure	36
9.5.2 Fully Involved Battery Enclosure	37
9.5.3 Inverter/Transformer Failure	38
10 POST INCIDENT OPERATIONS	39
10.1 Personal Protective Equipment	39
10.2 Under Control	39
10.2.1 Roof Breached.....	39
10.2.2 Roof Intact/Data Points Available	39
10.2.3 Roof Intact/No Data Points Available	40
10.3 Lock Out/Tag Out.....	40

11 TRAINING	41
--------------------------	-----------

12 REVISION SHEET	42
--------------------------------	-----------

TABLE OF FIGURES

Figure 1 Site Aerial View	3
Figure 2 Site Layout	4
Figure 3 Battery Enclosure Overview	5
Figure 4 Control Panel	6
Figure 5 LFP Battery Cell	8
Figure 6 LFP Battery Module	9
Figure 7 Rack	10
Figure 8 Enclosure Configuration	11
Figure 9 PCS Skid	12
Figure 10 Typical Auxiliary Power Transformer	12
Figure 11 E-Stop Location	13
Figure 12 Cell Venting	13
Figure 13 Thermal Runaway	14
Figure 14 BMS Capabilities	15
Figure 15 Automatic Fire Detection System	17
Figure 16 Gas Detection System	17
Figure 17 Municipal Fire Hydrant Locations	19
Figure 18 LFP SDS Hazard Information	22
Figure 19 R-134a SDS Data	23
Figure 20 E-Field Detectors & AC/DC Illustration	25
Figure 21 Unified Command Structure	29
Figure 22 Incident Command Structure	30
Figure 23 Exclusion Zone Interior Container	33
Figure 24 Exclusion Zone Exterior Container	33
Figure 25 Safe Staging for Exposure Control	35

TABLE OF TABLES

Table 1 Critical Temperatures	8
Table 2 Cell Level Information	8
Table 3 Module Level Information.....	9
Table 4 UL 9540A Cell Gas Analysis	21
Table 5 Hydrogen Characteristics	22
Table 6 Typical Transformer Oil Characteristics	23
Table 7 Carbon Monoxide Characteristics	23
Table 8 OSHA Effects of Current on the Human Body	25
Table 9 Notification Matrix	27
Table 10 CDC IDLH Limit Values	32
Table 11 Class C Water Application Distance	34



1 GENERAL INFORMATION

1.1 Scope

This document is an ERP for the Evergreen EC BESS facility, located in Leesburg, Virginia, operated by East Point Energy. The ERP provides an overview of the site electrical equipment, detection equipment safety features, and the hazards found at the site. The ERP also provides response tactics necessary to mitigate potential emergencies at the facility.

1.2 Purpose

The purpose of this ERP is to provide guidance to BESS SMEs and the members of the fire service on emergencies that can reasonably occur at the facility. Guidance contained herein will allow these groups to operate within a unified command setting to develop strategies that ensure safety and mitigate risk during an operational response to an energy storage system emergency.

1.3 Site Owner

East Point Energy:

310 4th Street NE, 3rd Floor

Charlottesville, VA 22902

HQ Telephone: 512.375.4052

1.4 Site Location

Evergreen Energy Center:

20831 Evergreen Mills Road

Leesburg, VA 20175

1.5 Battery Energy Storage System Manufacturer

Hithium Infinity Block Gen 2, 3.2v – 314Ah Lithium Iron Phosphate (LFP) cells

1.6 Emergency Contact

The East Point Energy Remote Operations Center (ROC) can be reached 24/7 regarding any emergencies that occur at the Evergreen EC BESS.



1.7 First Responder Contact Information

First Responder Agency	Address	Phone
<i>All Emergencies</i>	<i>Statewide</i>	<i>911</i>
Leesburg Volunteer Fire Department	61 Plaza St NE, Leesburg, VA	571.258.3720
Loudon County Volunteer Rescue Squad	143 Catoclin Circle SE, Leesburg, VA	703.777.7185
Loudon County Sheriff's Office	25216 Loudon County Pkwy, Chantilly, VA	517.257.3200
Inova Loudon Hospital	44045 Riverside Pkwy, Leesburg, VA	703.858.6040



2 ENERGY STORAGE SYSTEM INFORMATION

2.1 Site Overview

The proposed Evergreen EC BESS facility is located at 20831 Evergreen Mills Road in Leesburg, Virginia. The area around the facility is mostly suburban. The north side of the site is predominantly bordered by residential properties. The east side of the facility is bordered by Evergreen Mills Road, with privately owned land and residential properties further east. The south side of the facility is bordered by an existing electrical substation and the Loudoun County solid waste management facility. The west side of the site is immediately bordered by power company easements for transmission lines, with residential properties further west. The closest residence to the facility is approximately 250 ft to the north of the nearest proposed BESS unit. There are two schools located near the facility, which are each approximately ½ mile from the facility, with one located to the northeast and the other to the southeast. Based upon UL 9540A test results, emergencies within the BESS facility are expected to be confined to the facility.



Figure 1 Site Aerial View

2.2 Energy Storage System Site Design

The Evergreen EC BESS facility will include 10 Hithium BESS containers. The Hithium BESS is a fully integrated BESS with battery modules, power electronics, controls systems, battery management system (BMS), thermal management system (TMS), smoke, heat, and combustible gas detection and notification system, and explosion prevention system that is all pre-assembled within a single container. The Hithium BESS is meant for



outdoor, ground mounted installations. The container is an IP 55 rated enclosure that protects the BESS inside. Every enclosure is also equipped with a liquid cooling unit and a control panel. The control panel contains the fire alarm control panel (FACP), which monitors and controls the detection and ventilation systems.

Every rack within the enclosure is equipped with a high voltage box (HV box), which contains the cluster battery management unit (CBMU) and a disconnect switch for isolation of modules within the rack. The CBMU communicates with the system battery management unit (SBMU) located in the enclosure control panel.

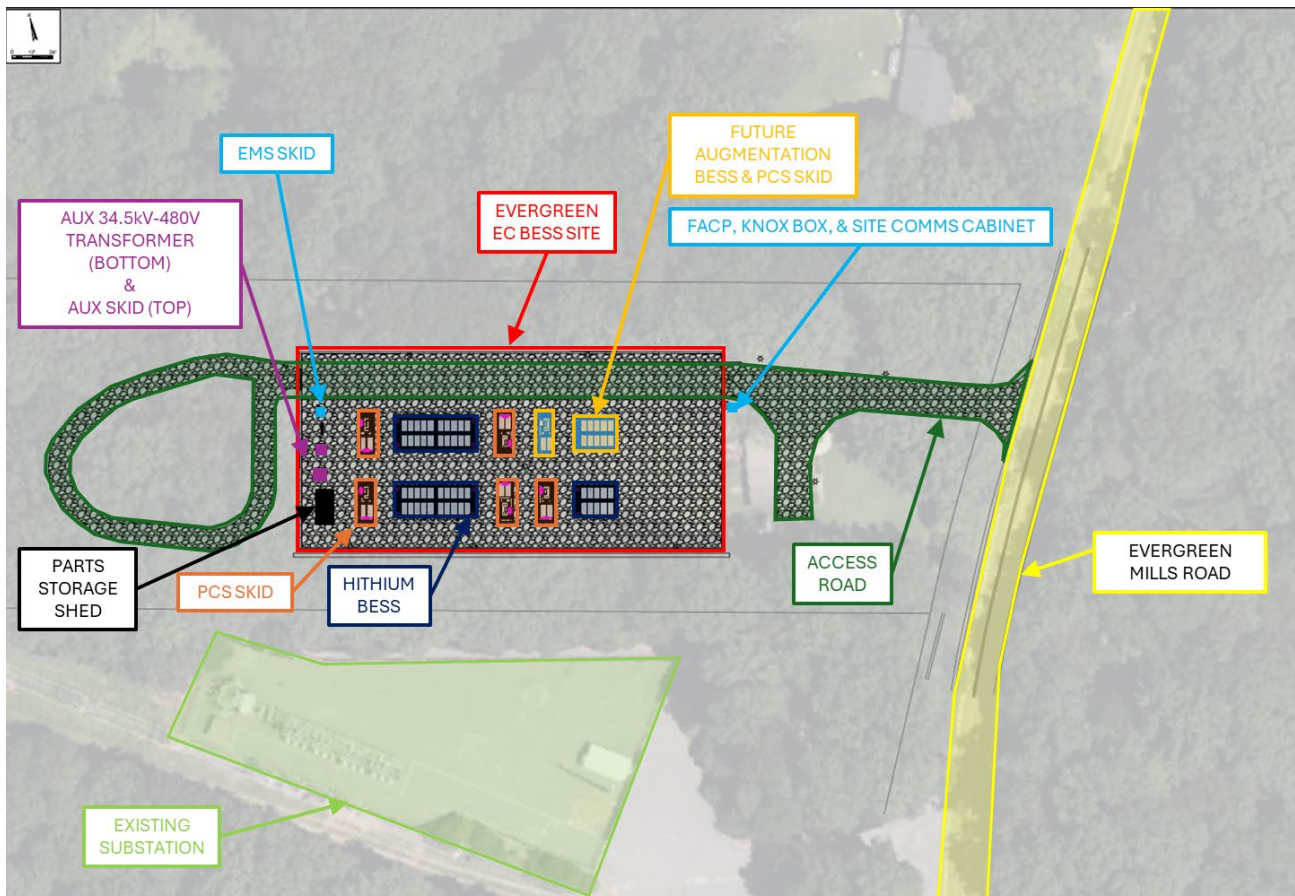


Figure 2 Site Layout

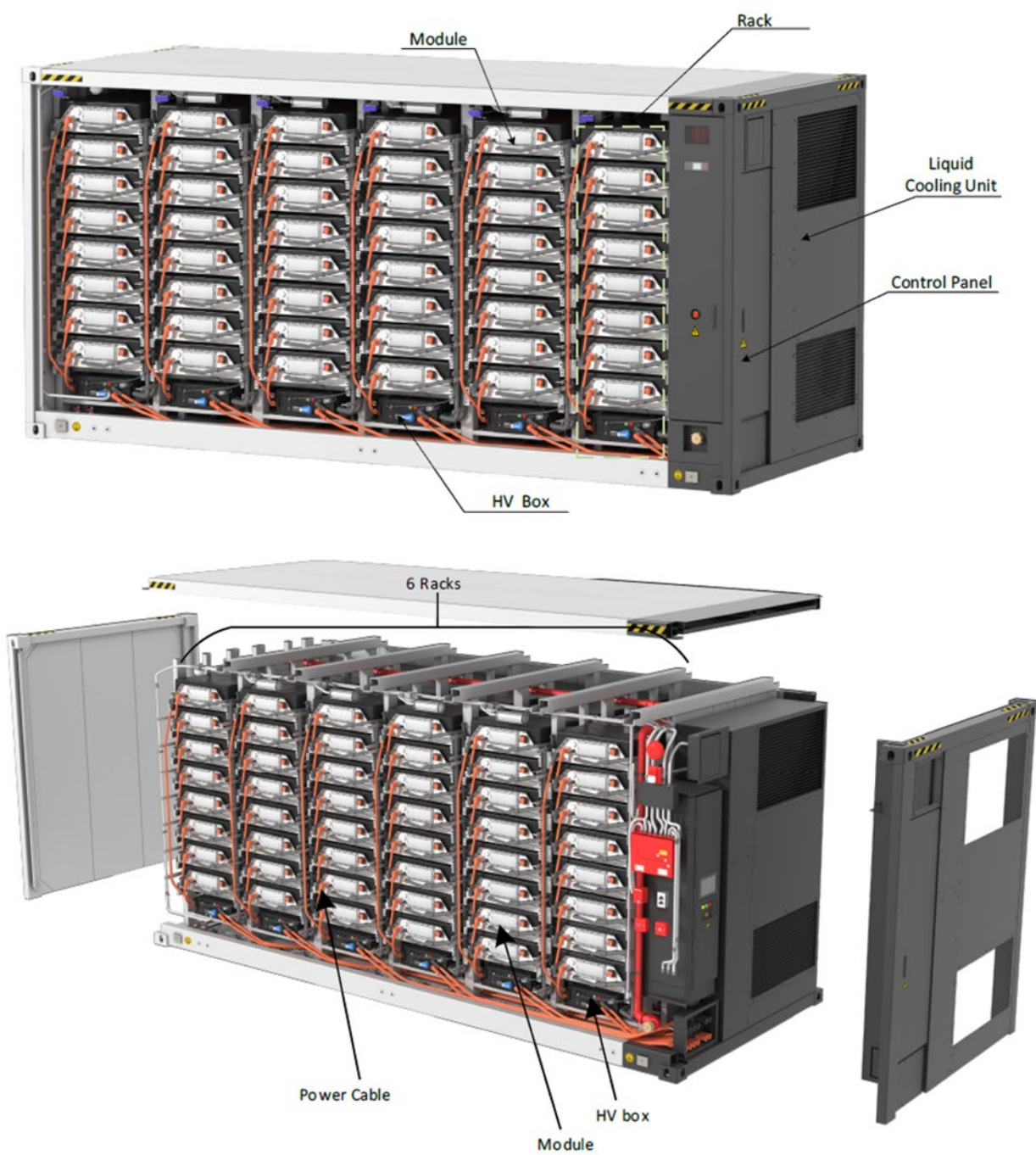


Figure 3 Battery Enclosure Overview

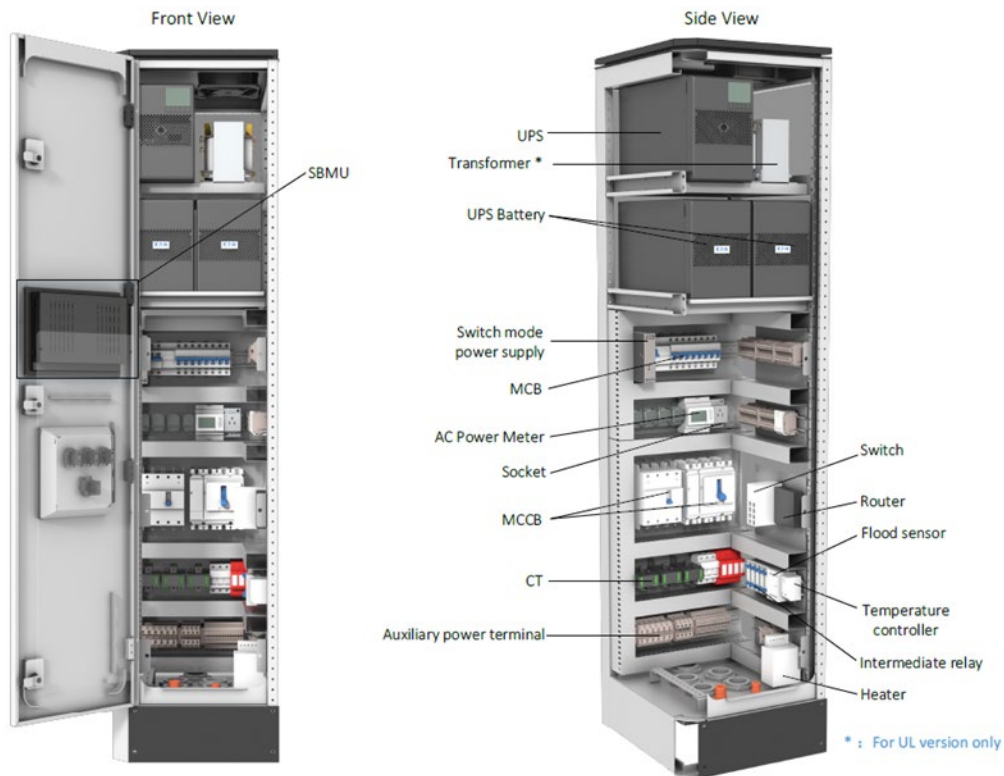


Figure 4 Control Panel



3 GLOSSARY OF TERMS

3.1 Battery Management System/Battery Management Unit

The BMS, otherwise known as the battery management unit (BMU) is an electronic system that monitors, controls, and optimizes the charging, discharging, temperature, and other factors influencing the performance and state of cells within a module. It is used to monitor and maintain the health and capacity of a battery. The BMU also has the ability to control the disconnection of the module(s) from the system in the event of abnormal conditions.

The Hithium BESS is provided with a module-level BMU (MBMU), CBMU, and SBMU that can identify possible risks to the battery system by monitoring battery cell temperatures and voltage. The BMU is intended to prevent the risk of thermal runaway by preventing the risks of over-charge, over-discharge, over-temperature, and over-current. It provides thermal runaway risk protection by safely disconnecting the batteries in case of fault conditions. The BMU can be regarded as three levels:

- MBMU
 - The MBMU collects cell data inside the battery module and transmits cell voltage and temperature data to the CBMU.
- CBMU
 - The CBMU receives voltage and temperature data from the MBMU. The CBMU provides rack level isolation.
- SBMU
 - The SBMU Maintains operation and management of the entire battery system within the container. The SBMU communicates to the energy storage management system (ESMS) via ethernet communication. The SBMU provides string level isolation by triggering all rack level isolation commands to each CBMU.



3.2 Critical Temperatures

Table 1 Critical Temperatures

Thermal Operating Range	Celsius	Fahrenheit
Normal Operating Range	-30°C / 45°C	-22°F / 113°F
Average Testing Critical Temperature: Venting (flammable electrolyte)	203.7°C	398.7°F
Average Testing Critical Temperature: Thermal Runaway	295.7°C	564.26°F

3.3 Cell

A cell is the smallest anatomy of the battery assembly. As the basic functional electromechanical unit of a battery, the cell contains an assembly of electrodes, electrolyte, separators, container, and terminals. It is a source of electrical energy by direct conversion of chemical energy. Each cell in the Hithium BESS is manufactured by Xiamen Hithium Energy Storage Technology Co. Ltd., model number LFP71173207, has a nominal capacity of 314 Ah, a nominal voltage of 3.2 Vdc, and is composed of LFP (LiFePO_4) chemistry. The cell is prismatic in geometry, certified to UL 1973, and a UL 9540A cell-level test was completed.

Table 2 Cell Level Information

Cell Level Information	
Manufacturer:	Xiamen Hithium Energy Storage Technology Co. Ltd.
Model Number:	LFP71173207
Chemistry:	Lithium Iron Phosphate (LFP)
Physical Configuration:	Prismatic
Dimensions (W x D x H):	174.7 mm x 71.7 mm x 207.1 mm (6.9 in x 2.8 in x 8.2 in)
Weight:	5,600 g (12.3 lb)
Rated Capacity (Ah):	314
Nominal Voltage (v):	3.2
Compliance with UL 1973:	Yes



Figure 5 LFP Battery Cell



3.4 Module

A module is a subassembly which is a component of a BESS that consists of a group of cells, connected either in a series and/or parallel configuration, along with protective devices and monitoring circuitry. Each Hithium BESS module is manufactured by Xiamen Hithium Energy Storage Technology Co. Ltd., model number LM010401-A, and contains 52 cells in series and 2 strings within a module that are in parallel. Every 4th row is separated by a barrier. During UL 9540A testing, thermal runaway propagation from module to module was not observed.

Table 3 Module Level Information

Module Level Information	
Manufacturer:	Xiamen Hithium Energy Storage Technology Co. Ltd.
Model Number:	LM010401-A
Dimensions (W x D x H):	800 mm x 2183 mm x 243 mm (2.6 ft x 7.2 ft x 0.8 ft)
Weight:	667 kg (1,470 lb)
Configuration:	2P52S
Cooling Method:	Liquid Cooling
Rated Capacity (Ah):	628
Nominal Voltage (Vdc):	166.4
Compliance with UL 1973:	No

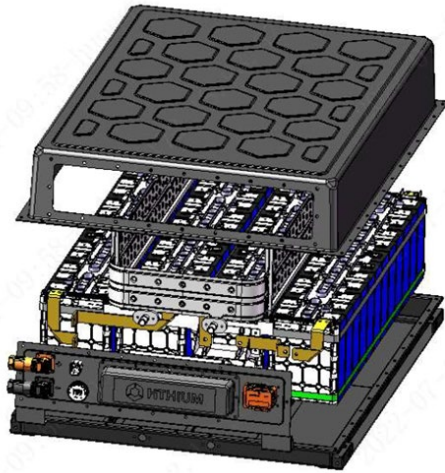


Figure 6 LFP Battery Module



3.5 Rack

A rack is an arrangement of modules. Each rack in the Hithium BESS contains 8 modules connected in series and a HV Box. The HV Box houses the rack BMU and electrical units to manage and control the rack. Each Hithium BESS rack, model number LC083502, is rated at a nominal capacity of 628 Ah and 1331.2 V. Each rack measures nominally 3 ft wide x 6 ft deep x 9 ft tall.

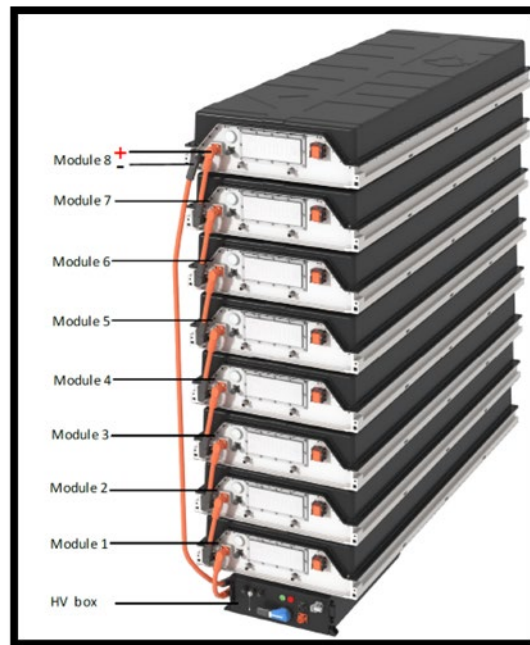


Figure 7 Rack

3.6 Hithium BESS Cabinet

The Hithium BESS enclosure is a rigid steel enclosure designed to house the batteries, associated controllers, and appurtenances. The container supports the safe operation of the BESS through its exterior rigid housing structure that helps to protect the batteries from mechanical damage and weather conditions. The Hithium BESS is nominally 8 ft wide x 9.5 ft tall x 20 ft long and is intended for outdoor, ground mounted installations, with an IP-55 rating. The Hithium enclosure used includes battery racks, electrical controls, fire alarm devices, an explosion prevention system, a TMS, and string BMU. The Hithium BESS also includes a control panel compartment that is integrated inside the enclosure. The control panel provides auxiliary power, master communication, and fire alarm control to the enclosure.



Figure 8 Enclosure Configuration

3.7 Control Panel Compartment

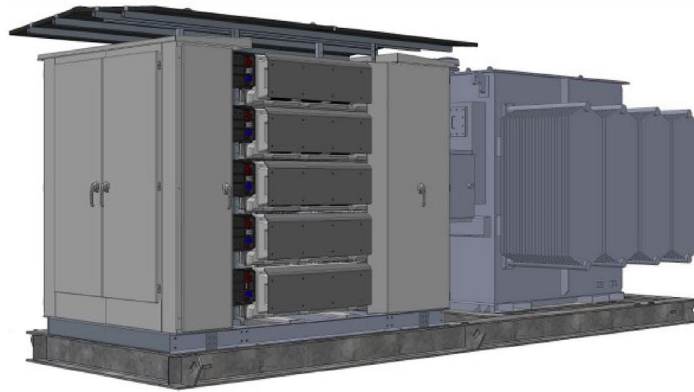
The control panel compartment is integrated inside the BESS Container. The control panel contains the auxiliary power supply, master communication, SBMU, fire alarm power supply, and fire alarm modules and devices. The exterior of the control panel compartment includes local fire alarm notification appliances, and the emergency stop button.

3.8 Thermal Management Unit

The thermal management unit is composed of a chiller system with a liquid cooling system using 50/50 water and glycol mixture. The thermal management system is monitored by the SBMU.

3.9 Power Conversion System Skid

The power conversion system (PCS) skid contains an inverter, medium voltage transformer, and disconnect switch to island the battery block. The inverter transforms direct current (DC) to alternating current (AC) and the medium voltage transformer ramps up the voltage received from the battery enclosure to 34.5 kV for grid compatibility. The transformer is cooled and insulated using transformer oil.

*Figure 9 PCS Skid*

3.10 Auxiliary Power Transformer

These units provide basic light and power to the site and are supplied by the local grid. These units support critical operations, such as the FACP, BMU, TMS, and the explosion prevention system.

*Figure 10 Typical Auxiliary Power Transformer*

3.11 Emergency Stop

Emergency stops (E-stops) are designed to stop the charging and discharging of system batteries. The operation of an E-stop will NOT remove the stranded energy hazard from cells or modules. The E-stop is located on the exterior of the control panel compartment for each Hithium BESS. Though the E-stop is provided for manual deactivation means, the ROC should be contacted for confirmation of automatic E-stop activation. Personnel should not approach a trouble cabinet for manual depression of the E-stop button.

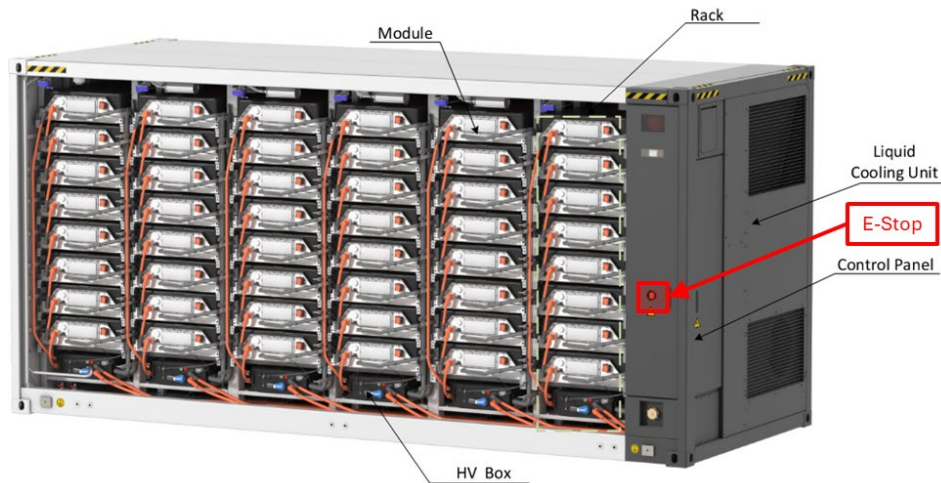


Figure 11 E-Stop Location

3.12 Stranded Energy

During an emergency at a BESS facility, E-Stops may be operated to stop charging and discharging of modules. However, the E-Stop feature does not discharge the electrical potential remaining in the cells/modules, known as stranded energy. Batteries must be discharged over time to remove their electrical potential.

3.13 Cell Venting

In this initial stage of failure, a flammable electrolyte vents from the module in gaseous state. During UL 9540A testing, the average temperature where cell venting began was 203.7°C (398.7°F). Gas venting is often a precursor of thermal runaway.



Figure 12 Cell Venting



3.14 Thermal Runaway

The incident when an electromechanical cell's temperature increases at an accelerating rate in an uncontrollable fashion sufficient to result in damage to the cell. The thermal runaway progresses when the cell's generation of heat is at a higher rate than the heat it can dissipate. During UL 9540A testing, the average temperature where thermal runaway began was 295.7°C (564.3°F).



Figure 13 Thermal Runaway

3.15 Explosion Control

The Hithium BESS container is equipped with an NFPA 69 mechanical ventilation explosion control system that activates upon detection of combustible gas at 10% LEL. While operational, the system is designed to maintain the average flammable gas concentration below 25% LEL, minimizing the potential for a deflagration to occur. It consists of gas detection, an explosion proof 820 cfm exhaust fan (outlet), and a make-up air louver.

3.16 Alternating Current / Direct Current

Energy produced by the cells can be categorized as DC. During electrical emergencies, the fire service traditionally uses non-contact voltage testers to identify energized equipment. Non-contact voltage detectors cannot detect the presence of DC and should never be used.

3.17 Subject Matter Expert

NFPA 855 requires the facility owner/operator to designate and train staff to respond 24/7 within a timely manner to investigate all BESS incidents. They will serve as the site SME and work closely with the fire services to investigate and mitigate conditions while ensuring the safety of fire service members operating at the scene.

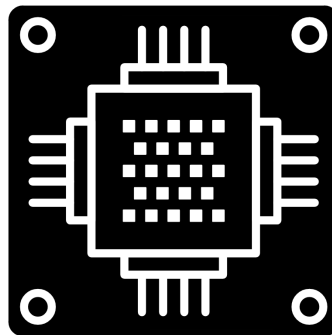
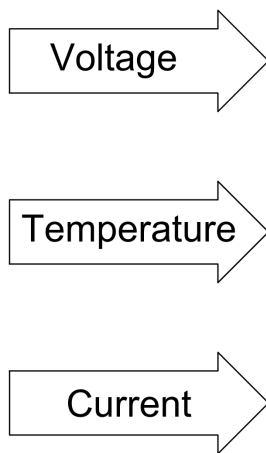


4 BATTERY MANAGEMENT UNIT

The Hithium BESS has an integrated BMU/BMS that tracks the performance, voltage, current, and state of charge of the cells (among many other datapoints). The BMU is a layered system, that exists at multiple levels including the MBMU, CBMU, and SBMU. The BMU can identify possible risks to the battery system by monitoring battery cell temperatures and voltage. The BMU is engineered to react to faulty conditions in an autonomous manner, with safeguards built into the firmware.

The BMU also interfaces with the FACP. When the FACP receives an alarm, such as gas, heat or smoke, this notification is routed to the BMU which autonomously isolates the trouble battery enclosure.

Input from Battery



BMS

Output to Application

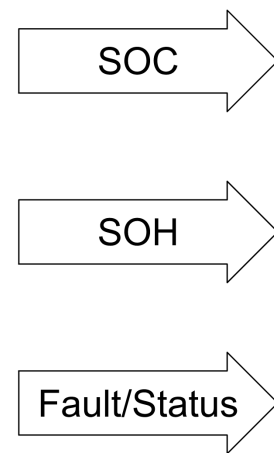


Figure 14 BMS Capabilities



5 FIRE DEPARTMENT INFORMATION

5.1 First Responder Station

The site will have a first responder station (FRS) located at the main entrance. The FACP will be located at the FRS. The FACP will be capable of showing smoke, gas, and heat alarms, as well as activation of the explosion control system. The FRS will also display fault conditions on critical equipment such as the gas detectors, the explosion control system, and the TMS. The site communications cabinet will also be located at the FRS.

5.2 Knox Box

A Knox box will be installed at the main entrance to the facility. BESS facilities are operated remotely. The presence of on-site personnel is limited to system maintenance or alarm investigations. Any equipment that has failed cannot be saved. Unescorted access must be limited to life safety in the event the ROC confirms that maintenance staff cannot be reached. With no life safety hazard, entry should only be made to the site once the BESS SME has arrived.

5.3 Apparatus Access

The main entry to the facility is from an access road off Evergreen Mills Road. The private access road is a greater than 20-foot-wide, predominantly gravel, drive lane that leads into the facility. All areas of the BESS facility are within 150 ft of an access road.

5.4 Fire Alarm Control Panel

The FACP monitors and controls the detection, notification, and ventilation systems for the BESS enclosures. The FACP is supplied with a secondary power source that provides 24 hours of standby power or 2 hours of alarm. All FACP alarms will be routed to the East Point Energy ROC, which will execute the notification matrix outlined in Section 7 of this document. The FACP also interfaces with the BMS to isolate trouble equipment autonomously. The FACP will be located at the main entrance to the facility.

5.4.1 Detection System

Each enclosure is equipped with two smoke detectors, two heat detectors and two combustible gas detectors. Detectors activate the enclosure's notification appliance and relay a signal to the site FACP via a relay module.

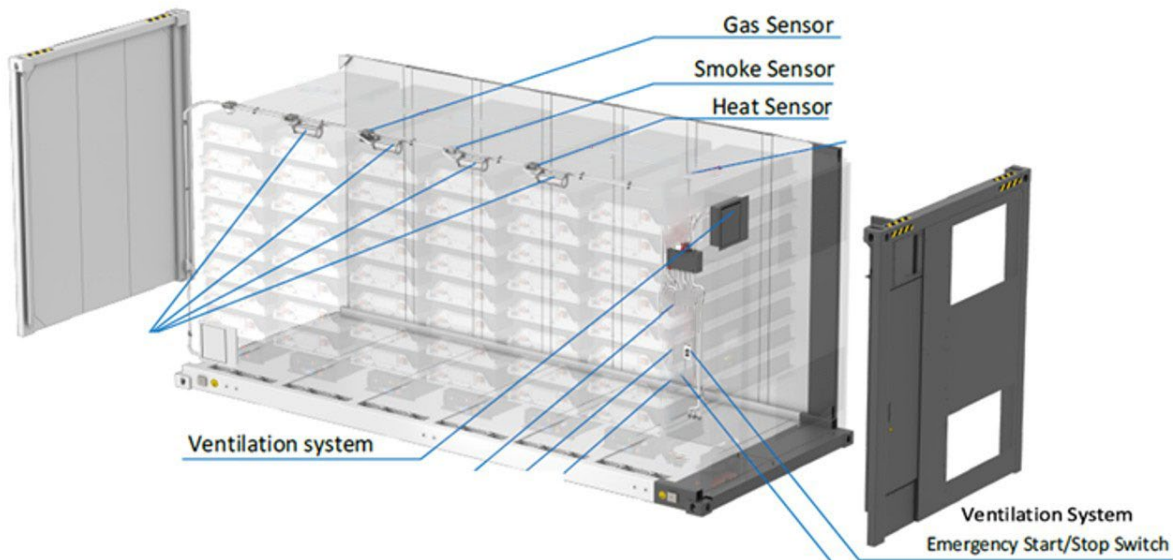


Figure 15 Automatic Fire Detection System

5.4.2 Gas Detection and Ventilation

Each enclosure is equipped with two combustible gas detectors and an exhaust system. During a cell venting or thermal runaway condition, flammable gas will be emitted within the enclosure. Once 10% of the LFL is observed at a combustible gas detector, the explosion prevention system will be activated, the battery container will be isolated via the BMU, and the FACP will provide notification to the ROC. The ventilation system can also be activated or deactivated manually by the ventilation system emergency start/stop button, which is located on the outside of the cabinet.

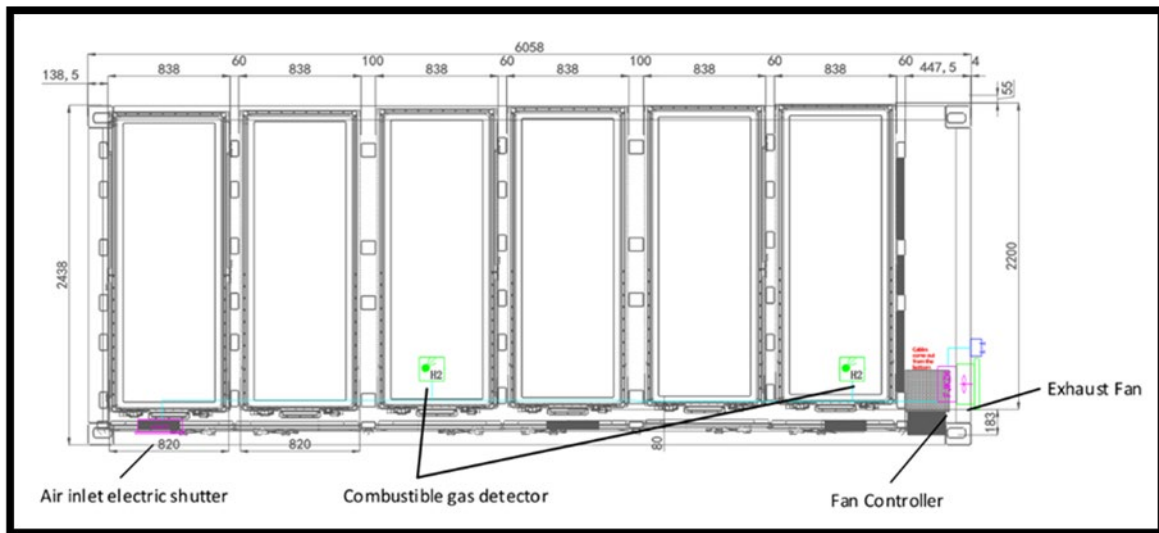


Figure 16 Gas Detection System



5.5 Alarm Annunciation

Alarms received at the FACP will generate audio and visual alarms on the exterior of the enclosure to alert staff and first responders to the troubled equipment's location. The FACP will annunciate alarms to the ROC. The ROC has output responsibilities upon alarm receipt, as shown in Section 7. Notification devices such as horn strobes are powered by their own power supply from the enclosure.

5.6 Suppression Systems

The Lithium BESS is not equipped with any automatic or manual suppression systems.

Suppression of Lithium-Ion Battery Fires: During failure, gases can vent from the cells and modules at over 100 psi, preventing extinguishing agents from reaching the fuel source. Additionally, the batteries are enclosed in an IP rated steel structure, housed in racks, modules, and hermetically sealed cells. Thus, delivery of suppression agents and water to the fuel source is impractical. As a result, the best practice is to allow the event to progress to its natural conclusion and to provide defensive measures to ensure that an event does not propagate to a neighboring enclosure. As such, no intervention is recommended to extinguish a lithium-ion battery fire. Once the state of charge has been fully discharged, the fire will self-extinguish.

5.7 Water Supply

There is existing area water infrastructure near the site in the form of municipal fire hydrants. The closest municipal fire hydrant is located across Evergreen Mills Road, just south of the site. Existing municipal fire hydrant locations are circled in red in Figure 17 below.

Typical BESS firefighting response procedures and tactics do not recommend offensive firefighting to manually suppress a BESS fire. If manual defensive firefighting tactics are used, water is considered the preferred agent for managing lithium-ion battery fires, suppressing nearby combustibles, cooling nearby exposures, and controlling smoke.

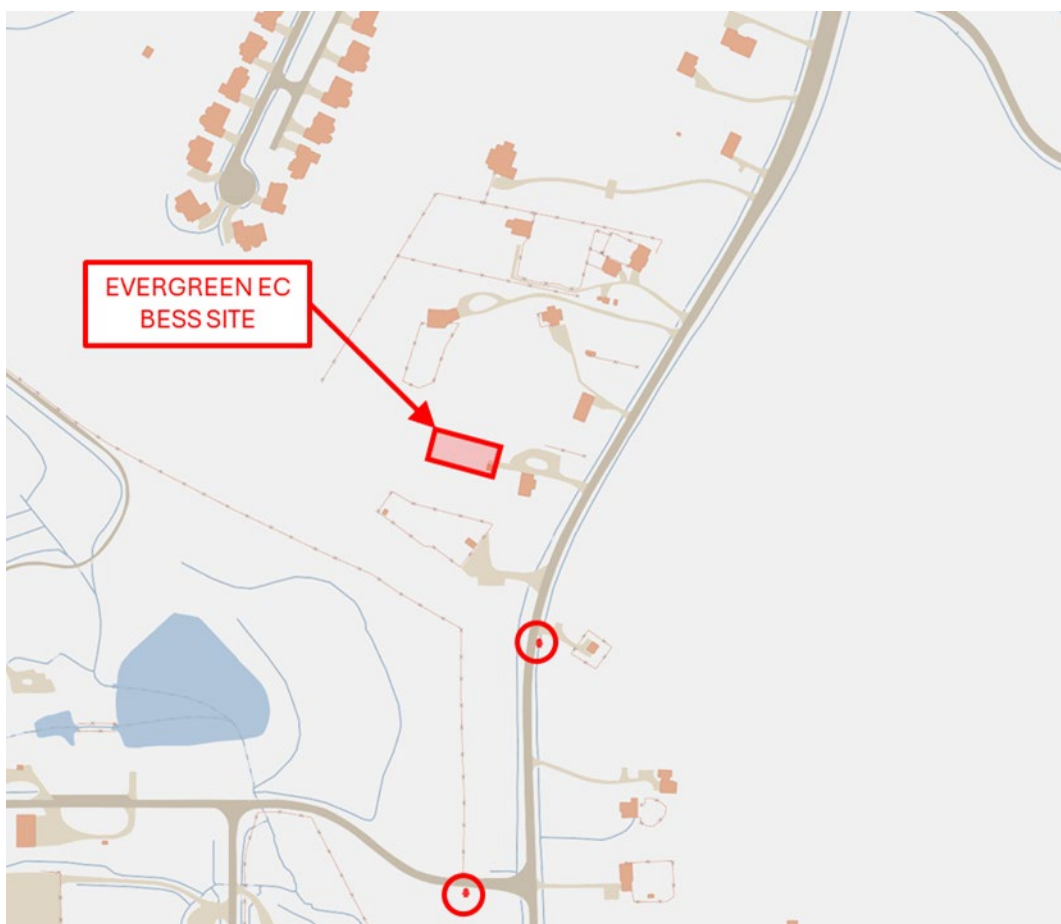


Figure 17 Municipal Fire Hydrant Locations



6 HAZARDS

The following hazards are covered in this section:

- Chemical
- Electrical
- Arc Flash
- Explosion

6.1 Chemical

This section outlines the predominant chemicals hazards along with the recommended personal protective equipment when responding to a BESS facility event.

- LFP Cells
- Hydrogen
- R-134a
- Transformer Oil
- Carbon Monoxide

6.1.1 Lithium Iron Phosphate Cells

Toxicity: LFP cell gases are evaluated during UL 9540A fire testing to identify the production of immediately dangerous to life and health (IDLH) conditions. Carbon monoxide (CO) and carbon dioxide (CO₂) were the only target IDLH gases identified. The risk from CO and CO₂ under this situation does not pose a health hazard since the battery container cannot be occupied. In addition, CO and CO₂ are simply managed through administrative controls such as staging upwind and PPE such as a self-contained breathing apparatus (SCBA) to manage the respiratory hazard.

Note: There are no dermal hazards posed by CO or CO₂.



Table 4 UL 9540A Cell Gas Analysis

Gas		Measured %
Carbon Monoxide	CO	14.507
Carbon Dioxide	CO ₂	23.000
Hydrogen	H ₂	45.167
Methane	CH ₄	4.868
Acetylene	C ₂ H ₂	0.148
Ethylene	C ₂ H ₄	1.804
Ethane	C ₂ H ₆	0.805
Propadiene (Allene)	C ₃ H ₄	0.006
Propylene	C ₃ H ₆	2.256
Propane	C ₃ H ₈	1.379
-	C4 (Total)	2.029
-	C5 (Total)	0.447
-	C6 (Total)	0.021
1-Heptene	C ₇ H ₁₄	0.004
Benzene	C ₆ H ₆	0.018
Toluene	C ₇ H ₈	0.001
Dimethyl Carbonate	C ₃ H ₆ O ₃	3.340
Ethyl Methyl Carbonate	C ₄ H ₈ O ₃	0.198
Total	-	100.000

UL 9540A Data: Cells are outfitted with a vent that ejects flammable electrolyte during elevated thermal conditions. This safety feature manages the risk of internal pressurization. LFP batteries are more stable than other battery chemistries, are less likely to undergo thermal runaway, and are generally not susceptible to violent failures of the outer shell. During testing, propagation beyond the module level was not observed.

Hazards of Vented Electrolyte: Cell vent gas composition will depend upon several factors, including cell composition, cell SOC, and the cause of cell venting. Vent gases may include volatile organic compounds (VOCs) such as alkyl-carbonates, methane, ethylene, ethane, hydrogen, carbon dioxide, carbon monoxide, and soot. Vented gases may irritate the eyes, skin, and throat. Cell vent gases are typically hot. Vent gas temperatures leaving the cells may exceed 600°C/1,110°F. Contact with hot gases can cause thermal burns. Vented electrolyte is flammable and may ignite on contact with a competent ignition source such as an open flame, spark, or a sufficiently heated surface. Vented electrolyte may also ignite on contact with cells undergoing thermal runaway.

Hazards of Leaked Electrolyte: Leaked electrolyte solution is flammable, corrosive, and irritating to the eyes and skin. If a liquid is observed that is a suspected electrolyte, ventilate the area and avoid contact with the liquid until a positive identification can be made and sufficient protective equipment can be obtained (eye, skin, and respiratory protection). Chemical classifier strips can be used to identify the spilled liquid. Electrolyte will contain petroleum, organic solvent and fluoride compounds.



Label Elements

Hazard Images:

**Signal word:** Danger**Hazard Statements:**

H317 May cause allergic skin reaction.

H370 Causes damage to organs (digestive system).

H335 May cause respiratory irritation.

Label Elements

Hazard Images:

**Signal word:** Danger**Hazard Statements:**

H261 In contact with water releases flammable gas.

H372 Causes damage to organs through prolonged or repeated exposure (Lung).

H413 May cause long lasting harmful effects to aquatic life.

Figure 18 LFP SDS Hazard Information

6.1.2 Hydrogen

During cell venting, the primary hazard is the production of H_2 . H_2 is odorless, colorless, and requires internal sensors or external meters for detection. H_2 is extremely flammable and is lighter than air.

Table 5 Hydrogen Characteristics

Appearance	Colorless Gas
Odor	Odorless
LFL	4 %
UEL	76 %
Auto Ignition	500°C / 932°F
25% LFL	1%
25% LFL (ppm)	10,000 ppm
Vapor Density	0.07 (Air = 1)

6.1.3 R-134a Refrigerant

The thermal management system utilizes R-134a refrigerant. R-134a is a colorless, volatile liquid with a faint, sweet-ish odor. R-134a is non-flammable, but overexposure can lead to dizziness and loss of concentration. The risk from R-134a under this situation does not pose a health hazard since the BESS cabinet is installed outdoors, in the open ambient air, and it cannot be occupied. If a release is suspected, it can be simply managed through administrative controls, such as staging upwind from the distressed BESS, utilizing engineering controls, such as donning the appropriate PPE including SCBA to manage the respiratory hazard. Thermal decomposition of R-134a can result in the production of hazardous by-products outlined in Figure 19.



HAZARDS IDENTIFICATION

CLASSIFICATION:	Gases under pressure, Liquefied Gas
SIGNAL WORD:	WARNING
HAZARD STATEMENT:	Contains gas under pressure, may explode if heated
SYMBOL:	Gas Cylinder
PRECAUTIONARY STATEMENT:	STORAGE: Protect from sunlight, store in a well ventilated place



EMERGENCY OVERVIEW: Colorless, volatile liquid with ethereal and faint sweetish odor. Non-flammable material. Overexposure may cause dizziness and loss of concentration. At higher levels, CNS depression and cardiac arrhythmia may result from exposure. Vapors displace air and can cause asphyxiation in confined spaces. At higher temperatures, (>250°C), decomposition products may include Hydrofluoric Acid (HF) and carbonyl halides.

Figure 19 R-134a SDS Data

6.1.4 Transformer Oil

Transformer oil is used to insulate and cool the step-up and auxiliary power transformer. During the failure of a transformer, elevated temperature arcing, coupled with fire conditions, causes heat retention in the windings and metal cabinet of the transformer. This condition keeps oil above its autoignition point making transformer fires persistent in nature.

Table 6 Typical Transformer Oil Characteristics

Appearance	Clear Yellow Mineral Oil
Odor	Vegetable oil
Flash Point	310°C / 590°F
Auto Ignition	401°C / 753°F
Specific Gravity	0.92 (1= water)
PCB	No
Oil Capacity	932 Gallons

6.1.5 Carbon Monoxide

CO is an odorless, colorless flammable gas formed by the incomplete combustion of fuels. The failure and subsequent arcing or burning of electrical components and cables can readily produce CO.

Table 7 Carbon Monoxide Characteristics

Appearance	Colorless Gas
Odor	Odorless
LFL	12.5 %
UEL	74.2%
Auto Ignition	607°C (1125°F)
25% LFL	3.125%
25% LFL (ppm)	31,250 ppm
Vapor Density	0.97 (Air = 1)



6.1.6 Recommended PPE

All chemicals associated with the failure of BESS equipment and ancillary electrical components present dermal and respiratory hazards. The failure of a BESS or electrical components can produce smoke and liquid runoff during fire suppression operations. NFPA 1971 structural firefighting gear and use of an SCBA is recommended.

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

6.2 Electrical

Shielded Conductors: Basic equipment at a BESS, such as battery cabinets, inverters, and step-up transformers, have electrical conductors housed within that are shielded from contact by the exterior enclosure. Shielding eliminates the potential for casual contact or the need to maintain safe standoff distances.

Unshielded Conductors: The use of unshielded or exposed conductors in a BESS facility is limited to the overhead electrical service connecting the facility to the surrounding grid or dedicated substation.

Required Safe Standoff Distance: OSHA (29 CFR 1910.333) requires a safe standoff distance of 10 feet from exposed energized conductors 50,000 V or less to prevent casual contact. OSHA also requires an additional 4 in. of clearance for each 10,000 volt increment over 50 kV.

Stranded Energy: ESS products contain lithium-ion batteries that are ALWAYS energized and present an electrical hazard even when disconnected from an electrical source. Voltages of up to 1,500 DC can be present within the battery containers. This may pose a shock or electrocution risk if the outer cabinet of the battery container has been damaged during installation, from inadvertent contact with transportation equipment, or from equipment failure. Even when disconnected, powered off, or in a discharged condition, a substantial electrical charge is possible within the batteries, which can cause injury or death if mishandled.

Electrical Current Effect: Current, the flow of electricity, is measured in amperage. Table 8 below outlines OSHA guidelines on the effects of current on the human body. Between 1 and 4 amps is likely to cause a cardiac condition leading to death. The smallest breaker in most residential homes is 15 amps. Inadvertent contact with conductors can create conditions resulting in shock or electrocution.



Table 8 OSHA Effects of Current on the Human Body

Current	Reaction
Below 1 Milliamp	Generally not perceptible
1 Milliamp	Faint Tingle
5 Milliamps	Slight shock felt. Not painful but disturbing. Average individual can let go. Strong involuntary reactions can lead to other injuries
6 to 25 Milliamps (women)	Painful shocks. Loss of muscle control.
9 to 30 Milliamps (men)	The freezing current or "let go" range. If extensor muscles are excited by shock, the person may be thrown away from the power source. Individuals cannot let go. Strong involuntary reactions can lead to other injuries
50 to 150 Milliamps	Extreme pain, respiratory arrest, severe muscle reactions. Death is possible.
1.0 to 4.3 Amps	Rhythmic pumping action of the heart ceases. Muscular contraction and nerve damage occur; death is likely.
10 Amps	Cardiac arrest, severe burns, death is probable.

Shock & Electrocution: Shock is an injury from inadvertent contact with an electrically energized object. Electrocution results in death from contact with an energized conductor. Several factors affect whether an incident results in a shock or electrocution, including how well the victim was grounded, the path the current flows through the body, and the duration of exposure.

Non-Contact Voltage Tester: E-field detectors are commonly used in the fire services to identify energized equipment and objects. These devices are only capable of identifying equipment and objects energized by AC wave form. To assess a surface for the presence of DC, a traditional meter with a ground reference will be required.

Note: Do not use a non-contact voltage detector at a BESS without guidance from a BESS SME.

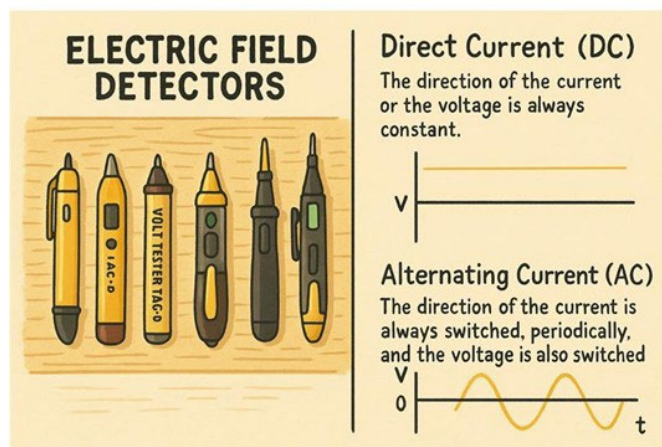


Figure 20 E-Field Detectors & AC/DC Illustration



Equipment NOT Normally Energized: In a post fire scenario, protective shielding or insulation on equipment that is not normally energized, such as cabinets, racks, and modules, may become energized. DC stray voltage testing should be conducted on such components until stray voltage from stranded energy can be safely ruled out.

6.3 Explosion

Flammable Gas: During the venting stage, H_2 is the prevalent flammable gas. When H_2 is detected at 10% of the LEL (4000 PPM), an alarm is sent to the BMU, and the ventilation system is activated. The ventilation stays active until the gas concentrations are below the safety threshold and the fan has operated for at least 5 minutes.

NFPA 69 Explosion Prevention System: The Hithium BESS enclosure is equipped with an NFPA 69 mechanical ventilation explosion control system designed to maintain the flammable gas concentration below 25% LFL, thereby minimizing the deflagration potential. It consists of gas detection, an explosion proof 820 cfm exhaust fan (outlet), and a make-up air louver.

Note: During an incident personnel should maintain a minimum of 100 feet from the trouble battery container doors.



7 NOTIFICATIONS

7.1 Notification Flow

The following notification matrix will define the scalable response posture to alarms received by the BMS and/or FACP.

Table 9 Notification Matrix

FACP Notifies	ROC Notifies
ROC	911
	BESS SME
	O&M
	Decommissioning Vendor



8 UNIFIED COMMAND

8.1 Subject Matter Expert

The BESS SME will guide fire service chief officers through a scene size-up, allowing them to better understand the hazards and develop the appropriate response tactics. The SME will fall under the unified command structure where they will collaborate with members of the fire services to bring the incident under control. The SME will be responsible for coordinating the following:

- Ensure security of the site and limit access to only authorized personnel
- Ensure accountability of non-fire department personnel inside the facility through use of written or electronic logs
- Ensure that authorized personnel have PPE that is appropriate to their assigned role/task
- Notify the chief officer of the fire services if plume conditions have impacted neighboring residential and commercial areas to support decision making in terms of seal in place or evacuation orders.
- Review and interpret BMS data, such as SOC, SOH, and temperature along with service status of equipment
 - Focus should be on identifying conditions that would suggest conditions are deteriorating.
- Locate & isolate trouble equipment
 - Trouble equipment should be islanded from the facility grid where it is safe to do so
 - Do not engage in manual switching operations that would require access into the exclusion zone
- Ensure a 100 ft. exclusion zone has been established around the trouble battery cabinet
- Review the FACP and BMU for any alarms and assist with interoperating what the alarms mean
- Identify any internal exposures that may need to be protected.
 - The decision to engage in intervention tactics is influenced by heat alarms and/or BMS cell temperature alarms in adjacent cabinets
 - If the facade of an adjacent cabinets reaches 50% of the average cell vent temperature (199°F) or is exposed to direct fire impingement.
- Conduct post-incident operations
- Administering the decommissioning plan



8.2 Unified Command Structure

Sample Unified Command Structure: Low frequency, high hazard incidents, such as a BESS emergency will not be managed by one individual incident commander. The command structure will include all the stakeholders necessary to mitigate risk and ensure the safety of first responders.

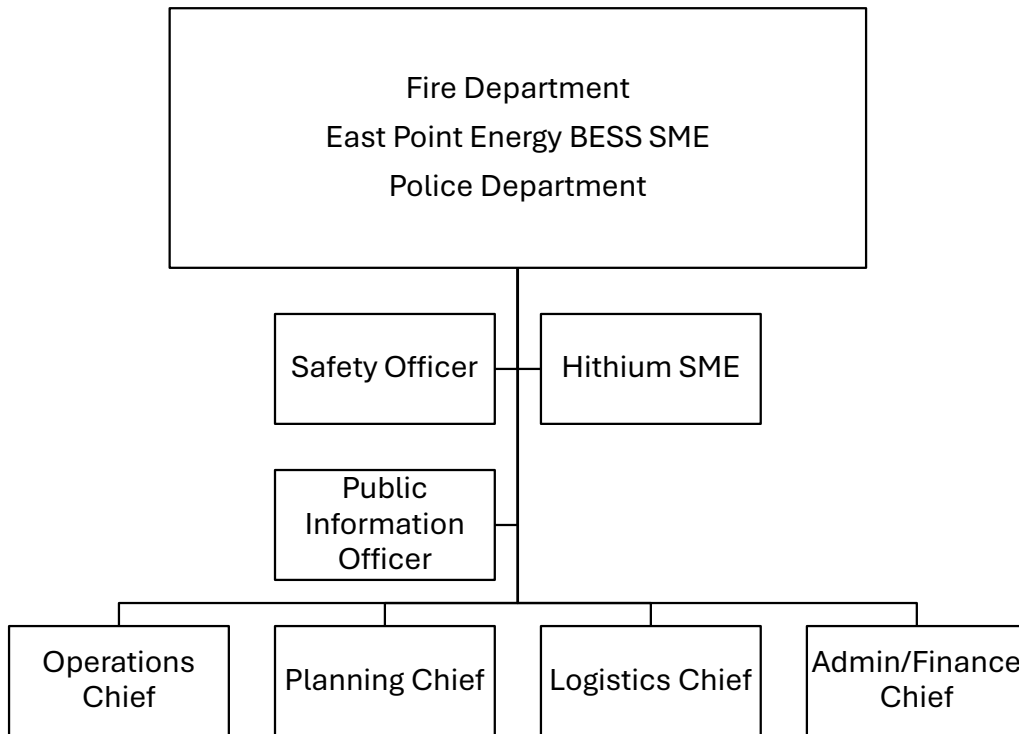


Figure 21 Unified Command Structure

8.3 Incident Command Structure

Below is an example of the command structure that may be used by the owner to manage the incident through the decommissioning phase. This is a malleable concept that can be scaled to meet the operational needs of the response.

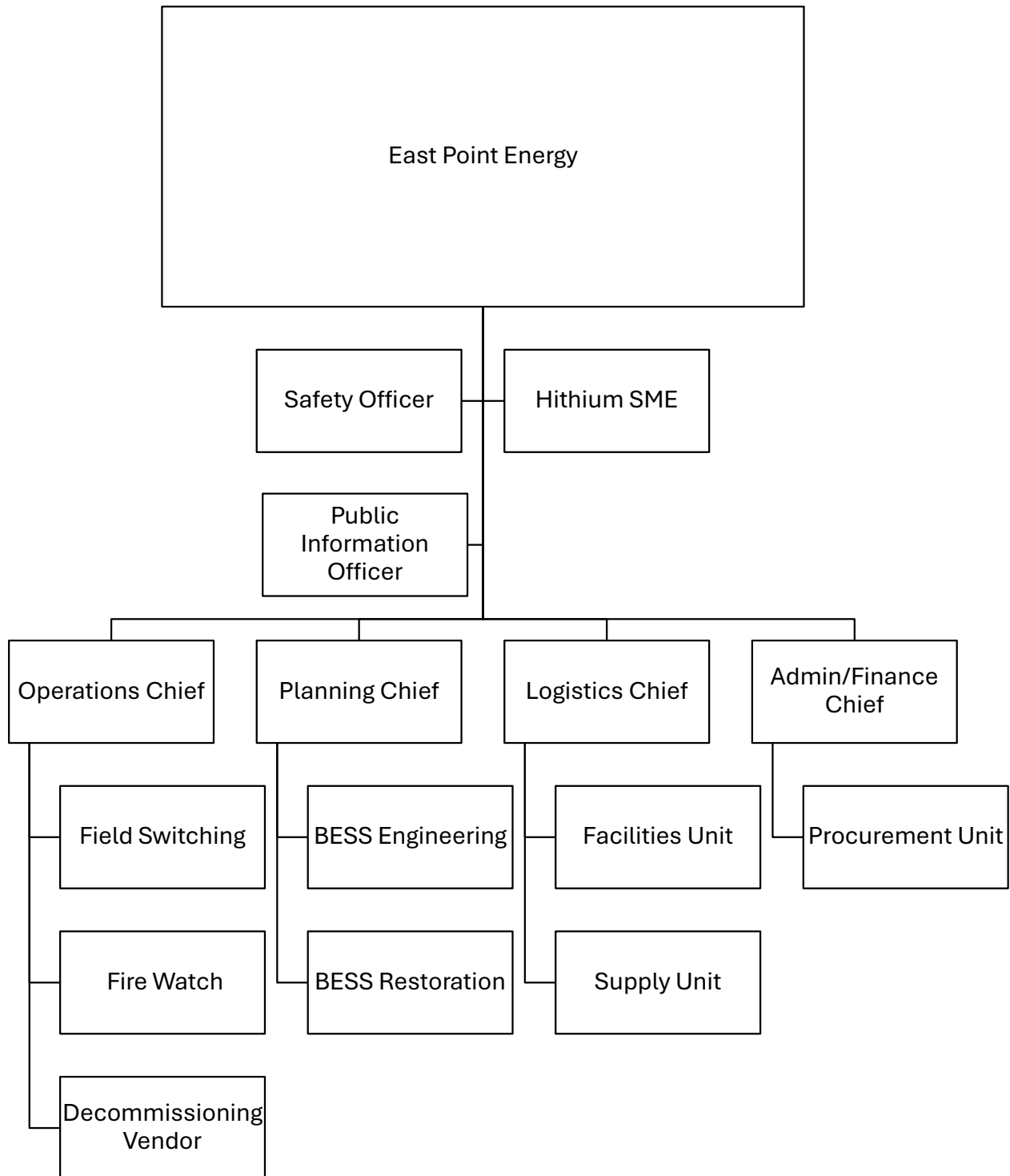


Figure 22 Incident Command Structure



9 RESPONSE TACTICS

9.1 Personal Protective Equipment (PPE)

Electrical Switching: OSHA requires a hazard assessment under 29 CFR 1910.269 to identify flame resistive (FR) clothing and insulated PPE required to conduct switching operations.

Fire Operations: Fire services personnel engaged in operations that can expose members to heat, flame, flammable gas, and chemical hazards shall use NFPA 1971 structural firefighting equipment and an SCBA.

9.2 On Arrival

DO NOT FORCE ENTRY

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

9.3 Initial Status Briefing

Upon arrival, the fire officer shall contact the 24/7 ROC to obtain a status briefing covering at a minimum the following:

- Accountability
 - Were there any personnel on site and have they all been accounted for? This will ensure there is no unnecessary entry by the fire services.
- Location of Equipment in Alarm
 - Can active smoke, fire or purge vent operation be seen without entering the site? If these active conditions are observed, monitor alarms on exposure battery cabinets to determine if asset protection will be required.
- Alarm Type
 - What type of alarm has generated the initial response and has any other alarm been received that would suggest conditions are deteriorating?
- Isolation of Trouble Equipment
 - Has the trouble equipment has been isolated from the facility grid?

9.4 Size-Up

BESS SME: On arrival, collaborate with officers from the fire services to conduct a size-up which is a basic assessment to develop the appropriate response tactics. There are eight tasks to evaluate. This will allow chief officers to make an informed decision in terms of the response posture.



1. **Community Air Monitoring:** During an active fire scenario, consideration may be given to conducting air monitoring to ensure safety and address community concerns. The properties of the gases generated during fire conditions indicate that they will rise vertically and dissipate. However, it is recommended based on wind direction that air monitoring for gases identified in UL 9540A testing be conducted to determine if a seal in place or an evacuation order is appropriate. Table 10 illustrates IDLH concentrations for substances identified in the cell vent gas during testing. Field sampling should focus on the presence of those gases to determine the need for public displacement.

Table 10 CDC IDLH Limit Values

Gas Name	Chemical Structure	IDLH (PPM)
Carbon Monoxide	CO	1,200
Carbon Dioxide	CO ₂	40,000
Hydrogen	H ₂	N/A
Methane	CH ₄	N/A
Acetylene	C ₂ H ₂	N/A
Ethylene	C ₂ H ₄	N/A
Ethane	C ₂ H ₆	N/A
Propene	C ₃ H ₆	N/A
Propane	C ₃ H ₈	2,100
-	C ₄ (Total)	N/A
-	C ₅ (Total)	N/A
-	C ₆ (Total)	N/A
1-Heptene	C ₇ H ₁₄	N/A
Benzene	C ₆ H ₆	500
Toluene	C ₇ H ₈	500
Dimethyl Carbonate	C ₃ H ₆ O ₃	N/A
Ethyl Methyl Carbonate	C ₄ H ₈ O ₃	N/A

2. **FACP:** What alarms are present in the trouble battery container?
3. **Explosion Prevention System:** The presence of an H₂ alarm and a corresponding alarm for cell temperature in the BMS would suggest a cell failure and the release of the flammable electrolyte in the form of H₂. The flammable electrolyte appears as a dense white vapor cloud. The absence of this may suggest that the explosion prevention system is not operating to design criteria and there is an increased risk for deflagration to occur. Members of the fire service shall remain 100-feet or more from the trouble battery cabinet out of direct line of site to guard against projectiles.
4. **Battery Management Unit:** The BMU shall be reviewed to determine the following information:

Rise in Temperature: If additional cells or modules around the trouble module begin to show signs of increased temperature, propagation may be occurring.



Status of Trouble Electrical Equipment: Trouble equipment should be autonomously isolated by the BMS at the module, rack, or container level, and should be verified through the BMS.

Current Detection Alarms: Have any additional alarms been generated after arriving at the facility? If so, do they suggest there may be an active fire condition in terms of smoke and/or heat detection?

5. **Locate & Isolate Trouble Equipment:** Ensure that E-Stops have been operated and, if safe to do so, open disconnect switches that would island trouble equipment from the facility grid.
6. **Exclusion Zone:** Establish an exclusion zone of 100 feet from the doors of the troubled BESS container using caution tape to manage the safety of personnel if an explosion should occur. While BESS containers have been outfitted with an explosion control measure, assume this system will fail and the doors on the BESS container will become projectiles.

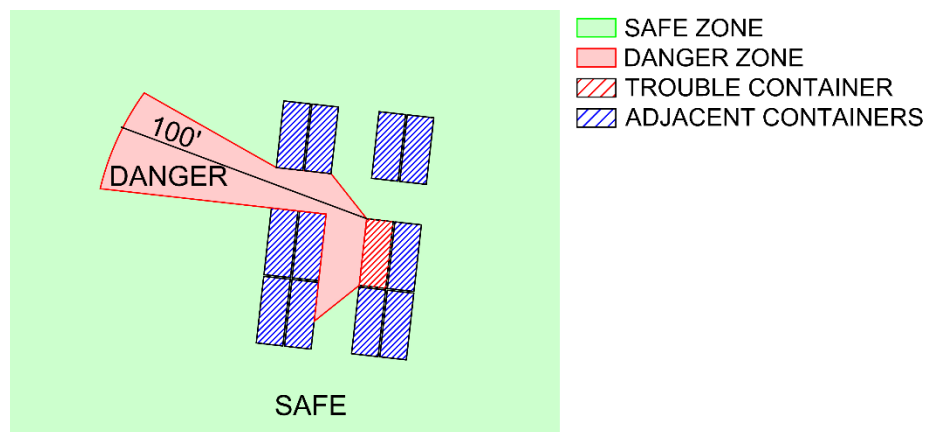


Figure 23 Exclusion Zone Interior Container



Figure 24 Exclusion Zone Exterior Container

7. **Smoke/Fire Conditions:** Identify if smoke or fire conditions have extended from the failed equipment. Non-intervention is generally recommended unless it appears conditions are extending to adjacent equipment. Begin monitoring adjacent battery cabinets for BMS and FACP alarms.
8. **Exposures:** An exposure assessment will determine if intervention is appropriate for asset protection. Evaluate the following risks:



- BMS Alarms: Cell temperature rise or alarms will be an indication that intervention will be necessary for asset protection.
- Thermal Imaging Assessment: Battery containers adjacent to a fully involved container should be monitored with a thermal imaging camera. If a container reaches 50% of the average cell vent temperature, 199°F, intervention should be considered.
- Direct Fire Impingement: During UL 9540A unit-level testing, propagation from unit to unit was not observed. If wind influenced fire conditions place adjacent containers at risk, intervention for asset protection may be recommended.

Water Use in a Class C Environment: During the application of water streams for exposure protection, the potential exists to contact energized electrical components in the trouble cabinet. Table 11 below should be followed for the application of water on or near energized electrical equipment. The safe standoff distance for asset protection will be driven by the risk of explosion not the electrical hazard. The position of the apparatus or appliances to provide asset protection will be outside the exclusion zone, far exceeding the required 25 feet. Water should not be applied directly to the container using a straight stream, a rain down effect will be more useful in providing cooling and protect a larger portion of the asset.

Table 11 Class C Water Application Distance

Agent	Voltage	Spray Pattern	Pressure	Min Distance
Potable Water	< 50 kV	30-Degree Fog	100psi	25 feet

Safe Staging: The application of water for exposure control should be made from outside of the exclusion zone.

Note: If alarms are received in the battery container being protected the exclusion zone should be expanded to include the doors on this battery container.

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

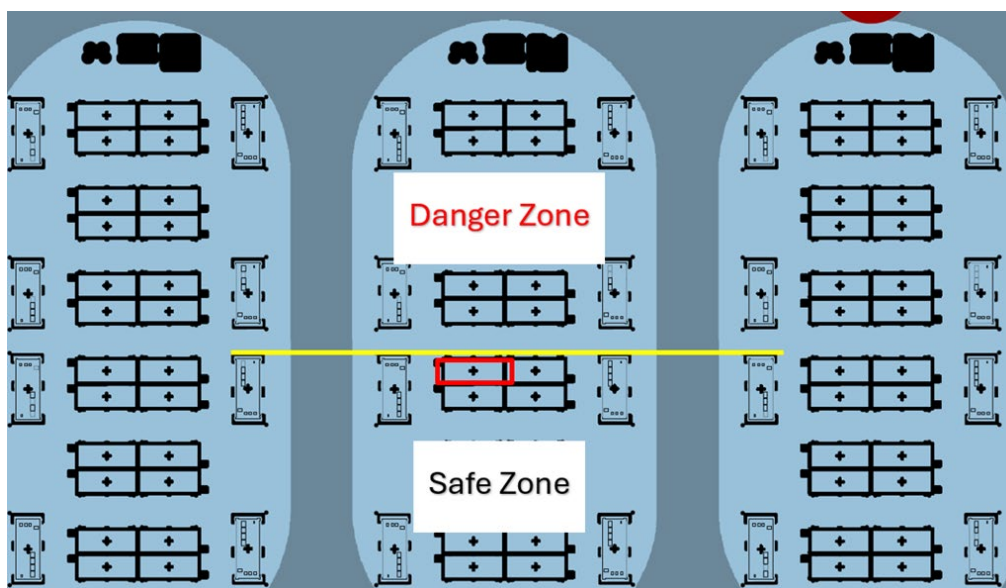


Figure 25 Safe Staging for Exposure Control

9.5 Response Scenarios

9.5.1 Cell Failure

	Cell Failure Response Matrix
Hazards	The potential for a fire exists when a cell enters thermal runaway impinging adjacent cells within the module. The temperature of vent gas can exceed 600°C/1,100°F causing thermal burns. In addition, vent gas is extremely flammable and, given its low LFL, can be quickly ignited if the gas encounters a competent ignition source. In addition, the accumulation of flammable gas in an enclosed space, such as the battery containers, presents a risk for an explosion. During a cell failure, personnel and fire service members must maintain a 100-foot clearance from the doors on the Hithium BESS container.
Alarm	The battery cabinet contains H ₂ detectors. The failure of a cell will generate a BMS alarm which will isolate the trouble equipment. These conditions will be received through alarms remotely at the ROC. The ROC will dispatch the BESS SME. Flammable H ₂ gas present in a cell failure will be detected by the detection system and will be discharged from the battery cabinet through the vent fans. Heat and smoke will be detected by the detection system and an alarm will be generated at the FACP and transmitted to the central station for 911 notification.
Fire Classification	This will be considered a Class C fire. Even after the battery cabinet has been isolated, stranded energy remains in the cells/modules and associated cables.
Switching	Upon receipt of an H ₂ alarm, the trouble battery enclosure should be isolated autonomously through the BMS. This can be verified through SCADA without approaching the battery enclosure. If this cannot be validated, the PCS connected to the battery block should be isolated using an E-stop as a conservative tactic. The ROC should be contacted for confirmation of automatic E-stop activation. Personnel should not approach a trouble cabinet for manual depression of the E-stop button.
Exposure Control	None unless fire conditions have extended from the battery container.
Assessment	Review the BMS to determine if propagation is occurring or if the failure is contained to one module. If conditions appear to have stabilized, move to under control step. ACTIVE FIRE: If a fire were to occur, non-intervention is recommended given the fact that there are no listed suppression agents capable of stopping thermal runaway. Batteries should be allowed to consume themselves until they reach a zero SOC. For active fire conditions, proceed to Section 9.5.2.
Under Control	Follow guidance in Section 10 for placing the event under control.
Suppression	During the decommissioning phase, any remaining pockets of fire may be extinguished with dry-chemical agent or Purple-K or CO ₂ .
Safe Standoff Distance	There is no required standoff distance for leakage current when using the prescribed agents. Standoff distance is driven by the potential for arc flash. - Personnel wearing arc flash protection: Apply agent from no closer than 5 feet. - Personnel wearing NFPA 1971 structural firefighting ensemble: 10 feet.



9.5.2 Fully Involved Battery Enclosure

	Fully Involved Battery Enclosure Response Matrix
Hazards	The main hazard associated with a fully involved container is the potential for propagation to adjacent containers. During UL 9540A testing, propagation was not observed beyond the module level. However, wind conditions may lead to failure propagation. Radiant heat may cause the failure of cells/modules in adjacent containers presenting the potential for an explosion. Monitor all adjacent containers. If failure spreads, expand exclusion zone to include the additional containers.
Alarm	Once a container becomes fully involved in fire there will be no reliable data points such as FACP or BMU alarms.
Fire Classification	This will be considered a Class C fire. Even after the battery container has been isolated, stranded energy remains in the cells, modules, and associated cables.
Switching	Isolate the entire battery block associated with the PCS along with any other battery enclosures that have generated alarms or sustained direct fire impingement.
Exposure Control	During extreme wind conditions, the adjacent battery containers should be evaluated to determine if exposure control is warranted. Water should only be applied intermittently as directed by the BESS SME. The BESS SME will only recommend exposure cooling if: BMS alarm for excessive temperature received in adjacent battery container(s) The exterior temperature of adjacent battery container(s) exceeds 50% of the average vent temperature (199°F) of the cells.
Assessment	ACTIVE FIRE: There are no listed agents capable of suppressing a lithium-ion fire or interrupting thermal runaway. Cells should be allowed to consume themselves until they reach a ZERO SOC. At this point there is no fuel left to support fire conditions. While observing non-intervention strategies on the fully involved container, conditions on the surrounding Lithium BESS containers must be closely monitored for alarms, specifically anything related to temperature. If failure extends to adjacent containers, extend the exclusion zone. Consideration may also be given to the preemptive isolation of surrounding containers as a conservative measure.
Under Control	Follow guidance in Section 10 for placing the event under control.
Suppression	During the decommissioning phase, any remaining pockets of fire may be extinguished with dry-chemical agent or Purple-K or CO ₂ .
Safe Standoff Distance	There is no required standoff distance for leakage current when using the prescribed agents. Standoff distance is driven by the potential for arc flash. - Personnel wearing arc flash protection: Apply agent from no closer than 5 feet. - Personnel wearing NFPA 1971 structural firefighting ensemble: 10 feet.



9.5.3 Inverter/Transformer Failure

	Inverter/Transformer Failure Response Matrix
Hazards	Inverter Failure: The failure of a cable or electrical component within the inverter can result in a fire. Transformer Failure: The site may contain oil insulated step-up transformers. The elevated temperature arc resulting from the failure causes heat to be retained in the windings and metal enclosure of the transformer, keeping the oil above its autoignition temperature and making transformer fires inherently persistent.
Alarms	The failure of the transformer or the inverter will result in a trip of the collector circuit and isolate the battery cabinets in the transformer block. These conditions will be received through alarms remotely at the ROC. The ROC will dispatch the Battery SME.
Fire Classification	Inverter: Class C fire until the unit is confirmed deenergized, then the incident can be classified as Class A. Transformer: Fires are considered Class B/C fires until the electrical source has been removed. Never attempt to suppress an energized electrical fire.
Switching	Depress the E-stop on the battery containers associated with the battery block and open the disconnect switches to island the PCS from the battery containers. Open the load disconnect switch on the high side of the transformer.
Exposure Control	None required. If the incident management team believes exposure control is appropriate, follow Section 9.5.2.
Assessment	Inverter: Once the inverter fails it will be automatically isolated from the system. Once the energy source is removed, minor pockets of fire may exist from insulation materials. These fires can be suppressed with a gaseous suppression agent. Transformer: CO₂ is the recommended agent for transformer fires. The use of other gaseous agents, such as dry-chemical and Purple-K, have no cooling value. A transformer fire may be unresponsive to these agents. The use of foam-based products is not advised. The transformer cannot be salvaged after a failure event. If the fire is unresponsive to the recommended agent, the unit should be allowed to burn off and consume the insulating oil. The use of foam will result in environmental impact with no value added.
Suppression	Inverter: Fire conditions will be limited to burning insulation. The use of dry-chemical or Purple-K is recommended for extinguishing isolated pockets of fire. Transformer: CO₂ is the recommended agent. CO₂ has a Class C listing and is rated to 100kV.
Standoff Distance	Do not touch any of the equipment until it has been deenergized and isolated. At that time approach is limited to fire tolerance.



10 POST INCIDENT OPERATIONS

10.1 Personal Protective Equipment

Fire services personnel should remain in NFPA 1971 structural firefighting gear. A 100-foot exclusion zone should be maintained at all times. Facility personnel should don the appropriate PPE for arc flash hazards associated with potential stranded energy conditions until a post-fire assessment has been completed. If cells are at a zero SOC, PPE may be downgraded.

10.2 Under Control

The fire department has three strategic objectives at a fire, life safety, incident stabilization and property conservation. Once these objectives have been achieved the incident can be placed under control. Section 10 describes similar strategies for placing a BESS emergency under control. Each step focuses on personnel safety; favorable results in these steps indicate incident stabilization which allows the process to advance toward decommissioning. A final assessment will be completed utilizing thermal imaging and air monitoring to ensure there is no active fire or thermal runaway conditions. This step validates that the incident is contained to the trouble cabinet with no potential for extension into neighboring cabinets thus achieving the final objective of property conservation.

Note: Fire department personnel must remain cognizant of the hazards posed by stray voltage and the potential for an explosion. The failure associated with batteries can be broken down into three scenarios. Select the guidance that is applicable to the existing conditions. Begin the assessments outlined in Section 10.2 once there is no active fire for a period to 24-hours.

10.2.1 Roof Breached

Existing Conditions: The roof of the battery cabinet is breached from fire conditions. This will alleviate the accumulation of any flammable gases within the space. The properties of the target gases that present the primary risk to responders is H₂ and CO. These gases are lighter than air and would escape the breached roof, thus removing/reducing the explosion risk.

24-Hour Safety Stand-Down: Assign a fire watch to observe and record hourly thermal readings over the breached roof for the 24-hour safety assessment period. The average vent temperature of cells is 318°F. A thermal imaging camera should be used to assess the thermal column above the breached sections of the roof to determine the temperature of any existing vent gases. Evaluate conditions until vent gases are sustained below 199°F (50% of the average vent temperature) for a period to 12 hours. If conditions comply with guidance in Section 10.2.1 proceed to Section 10.3.

10.2.2 Roof Intact/Data Points Available

Existing Conditions: BMS shows no signs of propagation. No active or additional FACP alarms.

48-Hour Safety Stand-Down: Assign a fire watch for a 48-hour period to observe and record hourly thermal readings over the trouble container. The ROC will be required to observe and record all trouble alarms generated by the trouble battery cabinet once the safety stand-down period commences.



- Firewatch: The fire watch should focus thermal imaging readings on the thermal roof where the umbrella and over-pressure vents reside. The time that the safety stand-down begins (day/night) will influence baseline temperature readings. In response there should be no observed readings above 199°F for the duration of the stand-down. Temperatures above 199°F or a sustained rise in temperature shall be reported immediately to the BESS SME.
- ROC: No additional alarms should be received over the course of the stand-down. Any additional alarms received will be relayed to East Point Energy for guidance and will result in a restart of the 48-hour safety stand-down period.
- Upon conclusion of the 48-hour safety stand-down, data from the fire watch and ROC will be reviewed by the BESS SME. If conditions comply with guidance in this section, proceed to Section 10.3.

10.2.3 Roof Intact/No Data Points Available

Existing Conditions: The container roof is still intact and the BMS is not reporting.

1-Week Safety Stand-Down: Assign a fire watch for a one-week period to observe and record hourly thermal readings over the trouble container. The ROC will be required to observe conditions on the trouble battery cabinet in the event that BMS reporting reoccurs.

- Firewatch: The fire watch should focus thermal imaging readings on the thermal roof where the umbrella and over-pressure vents reside. The time that the safety stand-down begins (day/night) will influence baseline temperature readings. In response there should be no observed readings above 199°F for the duration of the stand-down. Temperatures above 199°F or a sustained rise in temperature shall be reported immediately to the BESS SME.
- Upon conclusion of the one-week safety stand-down, data from the fire watch and ROC will be reviewed by the BESS SME. If conditions comply with guidance in this section, proceed to Section 10.3.

10.3 Lock Out/Tag Out

Once emergency conditions have concluded, prior to accessing the trouble battery container or removing any modules, E-Stops and disconnects associated with the trouble array shall be locked or tagged out as required by OSHA 29 CFR 1910.147. Once completed, a transition should be made to the decommissioning phase.



11 TRAINING

Training shall be conducted for members of the first response community prior to commissioning the facility. Training and familiarization tours on the hazards and response tactics associated with BESS facilities should be provided annually. The following topics should be covered in the training program:

- Energy Storage System Concept
- Site Overview & Exposures
- Equipment & Definitions
- Battery Management System
- Detection & Suppression
- Emergency System Shutdown
- Hazards
 - Chemical
 - Electrical
 - Arc Flash
 - Explosion
- Response Tactics
 - Size Up
 - Safe Standoff Distances
 - Suppression & Exposure Control
 - Cable Fire
 - Module Venting/Fire
 - Fully Involved Cabinet Fire
 - Inverter/Transformer Fire
- Post-Incident Operations



12 REVISION SHEET

Rev. No.	Date	Written By	Reviewed By	Approved By	Notes
Rev 0	04/18/2025	TJH	CSF	DBP	Final

Hazard Mitigation Analysis for Outside Ground Mounted Battery Energy Storage Systems: Evergreen Energy Center BESS Facility, Leesburg, Virginia

Final Report | Rev0 | April 18, 2025



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Enclosure 1

Date	Revision	Reason for Issue	Developed By	Checked By	Approved by
04/18/2025	Rev 0	Final	TJH	MHK	DBP

Revision Control Sheet

Revision	Section	Change Noted

EXECUTIVE SUMMARY

Fire and Risk Alliance, LLC (FRA) conducted an installation level code review and a hazard mitigation analysis (HMA) for the Evergreen Energy Center (Evergreen EC) battery energy storage system (BESS) facility in accordance with the requirements of the 2021 Virginia Statewide Fire Prevention Code (SFPC). Virginia has adopted the 2021 International Fire Code with amendments. NFPA 855, 2023 edition, has also been referenced, as it is considered an industry best-practice. The analysis evaluates the Hithium Infinity Block Generation 2 (Hithium) battery energy storage system (BESS) intended for installation at the Evergreen EC facility in Leesburg, Virginia. The Hithium BESS is a pre-assembled, non-walk-in (NWI) style lithium-ion BESS container. The Evergreen EC BESS facility has a total site capacity of 20 MW/ 40 MWh.

This HMA is intended to be used as a tool by the Authority Having Jurisdiction (AHJ) to assist in their review of the Evergreen EC BESS. This analysis includes a review of the Evergreen EC BESS facility site plan, the Hithium BESS, its construction, design, fire safety features, listings, certifications, UL 9540A fire test data, and preliminary failure mode and effects analysis (FMEA).

Based on a review of the Hithium BESS and the facility site plan, the Evergreen EC BESS site design can meet SFPC installation level requirements for an outdoor, NWI style BESS when it is installed in accordance with the manufacturer's instructions, its listing, and the approved drawings. However, the following items need to be addressed to ensure compliance:

- A disconnecting means or placards must be provided at the site per SFPC §1207.4.1.
- Signage must be provided at the site per SFPC §1207.4.8.
- An approved fire alarm system shall be provided, acceptable to the AHJ.
- It is recommended that the NFPA 69 explosion control system is verified for performance
- Provide an approved water supply system and fire department access, acceptable to the AHJ.

In addition, the Hithium BESS installation at the Evergreen EC BESS facility meets the HMA approval criteria outlined in the NFPA 855 §4.4.3, as follows:

1. *Fires will be contained within unoccupied ESS rooms for the minimum duration of the fire resistance rating specified in NFPA 855 §9.6.4.*

The Evergreen EC BESS meets this requirement. The Hithium BESS is installed outdoors, not within an unoccupied ESS room. However, it should be noted that the Hithium BESS has a number of protection schemes in place to inhibit fire from spreading from one container to another. As demonstrated in UL 9540A unit level testing, thermal runaway was contained to a single module within the Hithium container. Although this requirement applies to unoccupied ESS rooms (and not an outdoor installation), the Evergreen EC BESS still meets the intent of the requirement by containing a thermal runaway event to a single Hithium container.

2. *Fires and products of combustion will not prevent occupants from evacuating to a safe location.*

The Evergreen EC BESS meets this requirement. The Hithium BESS is installed outdoors, in a remote location, and not within an occupied work center (or any other room). Also,

the closest building is a residential house, which is 250 ft away. As such, fire and products of combustion do not pose a significant risk to prevent egress from nearby locations.

3. *Deflagration hazards will be addressed by an explosion control or other system.*

The Hithium BESS contains an explosion prevention exhaust system that is activated upon 10% LFL H₂ gas detection. The exhaust system is designed in accordance with NFPA 69 and is intended to prevent the accumulation of flammable gases inside the container and reduce risks from deflagrations and explosions. TUV Rheinland performed modeling using FLame Acceleration Simulator computational fluid dynamics (FLACS-CFD) software to analyze the capabilities of the system. The study considered a three-cell failure scenario using gas composition data obtained from the UL 9540A cell level test. The analysis concluded that, for the scenario and assumptions modeled, the exhaust system is capable of maintaining an average combustible gas concentration below 25% LFL. Note, that if the gas release scenario differs from the design basis, such as a larger release volume or smaller free air volume, the hazard may not be addressed with the current exhaust system configuration. FLACS-CFD cannot simulate fan pressure curves. It is recommended that an airflow test be conducted during commissioning to ensure fan performance meets or exceeds the FLACS-CFD analysis and to validate that correct airflow is measured.

The Hithium BESS is equipped with fire detection and notification. These systems can detect and notify local site personnel, should anyone be in the area, of a thermal event so that they can evacuate to a safe location. Additional mitigation measures include emergency response procedures and training that will advise site personnel and first responders to stand at a safe distance, upwind from a distressed Hithium BESS container.

In summary, the Hithium BESS installation at the Evergreen EC BESS facility meets the Hazard Mitigation Analysis approval criteria laid out in NFPA 855, as outlined above.

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
1.1	Applicable Codes and Standards	1
1.2	Reference Materials	2
2.0	REPORT DEFINITIONS	3
3.0	EVERGREEN EC BESS FACILITY ARRANGEMENT	5
4.0	HITHIUM BESS SYSTEM INFORMATION.....	7
4.1	BESS Cell	7
4.2	BESS Module.....	7
4.3	BESS Rack.....	8
4.4	BESS Container	9
4.4.1	Control Panel Compartment	10
4.4.2	Thermal Management Unit.....	10
4.4.3	BMU (BMS)	10
4.4.4	Electrical Fault Protection Devices.....	11
4.4.5	Fire and Gas Detection.....	11
4.4.6	Explosion Control	11
5.0	EVERGREEN EC BESS SITE CODE ANALYSIS – VIRGINIA SFPC.....	13
5.1	All ESS Installations	13
5.1.1	Electrical Disconnects.....	13
5.1.2	Enclosures	13
5.1.3	Working Clearances.....	13
5.1.4	Vehicle Impact Protection.....	14
5.1.5	Combustible Storage.....	14
5.1.6	Toxic and Highly Toxic Gas.....	14
5.1.7	Signage.....	14
5.1.8	Security of Installations	14
5.1.9	Listings.....	15
5.1.10	Energy Storage Management System (ESMS).....	15
5.2	Outdoor ESS Classification	15
5.2.1	Clearance to Exposures and Setbacks.....	16

5.2.2	Fire Suppression Systems	16
5.2.3	Maximum Allowable Quantities.....	17
5.2.4	Maximum Enclosure Size	17
5.2.5	Means of Egress.....	17
5.2.6	Size and Separation.....	17
5.2.7	Fire Detection System.....	17
5.2.8	Vegetation Control.....	18
5.3	Technology Specific Requirements – Lithium-Ion ESS.....	18
5.3.1	Explosion Control	18
5.3.2	Thermal Runaway	19
5.4	All Facilities.....	19
5.4.1	Fire Apparatus Access Roads	19
5.4.2	Key Boxes.....	20
5.4.3	Fire Protection Water Supply.....	20
6.0	EVERGREEN EC BESS PLANS AND TRAINING.....	21
6.1	Commissioning, Operation, Decommissioning, and ITM	21
6.2	Emergency Response/Operations Plan	21
6.3	Emergency Response Training	22
7.0	HAZARD MITIGATION ANALYSIS	23
7.1	UL 9540A Test Method.....	23
7.2	UL 9540A Cell Level Verification Testing	23
7.2.1	Cell Tests 1 Through 5.....	24
7.2.2	Cell Test 1	24
7.3	UL 9540A Module Level Verification Testing	26
7.4	UL 9540A Unit Level Verification Testing.....	27
7.5	Off Gassing IDLH and Explosion Hazard Analysis	29
7.5.1	Hydrogen Explosion Hazard.....	30
7.5.2	Carbon Monoxide Explosion Hazard.....	30
7.5.3	Total Vent Gas Explosion Hazard	31
7.5.4	Carbon Monoxide IDLH.....	31
7.5.5	Explosion Prevention	31
7.6	Failure Modes and Effects Analysis	31

7.6.1	Thermal Runaway	32
7.6.2	Failure of an Energy Management System	32
7.6.3	Failure of Ventilation or Exhaust System	33
7.6.4	Voltage Surges on the Primary Electric Supply	33
7.6.5	Short Circuit on the Load Side of Battery Storage System	33
7.6.6	Failure of Fire Detection and Suppression System	33
7.6.7	Failure of Explosion Control System	34
7.6.8	Failure of Spill Control and Neutralization	34
7.7	HMA Approval Criteria	34
8.0	RECOMMENDATIONS	36
9.0	CONCLUSIONS	38
10.0	LIMITATIONS	39

TABLE OF FIGURES AND TABLES

Figure 1. Evergreen EC BESS Facility Overall Site Plan	5
Figure 2. BESS Cell.....	7
Figure 3. BESS Module	8
Figure 4. BESS Rack	9
Figure 5. BESS Container.....	10
Figure 6. Thermocouple, Film Heater, and Steel Plant Positions.....	24
Figure 7. Battery Gas Composition Test Chamber.....	25
Figure 8. Module Level Test Thermocouple and Heater Positions	26
Figure 9. Unit Level Test Configuration.....	27
Figure 10. Unit Level Test Module Arrangement	28
Figure 11. Unit Level Test Thermocouple and Heater Positions Within Initiating Module M02	29
Table 1. SFPC Remote Outdoor BESS Installation Requirements.....	16
Table 2. Key Results from Cell Tests 1 Through 5	24
Table 3. Cell Test 1 Vent Gas Composition During Thermal Runaway	25
Table 4. Cell Test 1 Vent Gas Flammability Properties	26
Table 5. Hydrogen Off Gassing Volume Needed to Reach LFL.....	30
Table 6. Carbon Monoxide Off Gassing Volume Needed to Reach LFL	30
Table 7. Total Off Gassing Volume Needed to Reach LFL	31
Table 8. Carbon Monoxide Volume Needed to Reach the IDLH Threshold	31

1.0 INTRODUCTION

Fire and Risk Alliance, LLC (FRA) conducted an installation level code review and a hazard mitigation analysis (HMA) for the Evergreen EC BESS facility in accordance with the requirements of the 2021 Virginia Statewide Fire Prevention Code (SFPC). Virginia has adopted the 2021 International Fire Code, with amendments. NFPA 855, 2023 edition, has also been referenced, as it is considered an industry best-practice. The analysis evaluates the Hithium Infinity Block Generation 2 (Hithium) battery energy storage system (BESS) intended for installation at the Evergreen EC facility in Leesburg, Virginia. The Hithium BESS is a pre-assembled, non-walk-in (NWI) style lithium-ion BESS container. The Evergreen EC BESS facility has a total site capacity of 20 MW/ 40 MWh.

This HMA is intended to be used as a tool by the Authority Having Jurisdiction (AHJ) to assist in their review of the Evergreen EC BESS. This analysis includes a review of the Evergreen EC BESS facility site plan, the Hithium BESS, its construction, design, fire safety features, listings, certifications, UL 9540A fire test data, and high level failure mode and effects analysis (FMEA).

1.1 Applicable Codes and Standards

The minimum codes and standards that apply to this project include:

Commonwealth of Virginia

- Virginia Statewide Fire Prevention Code, based on the 2021 International Fire Code, with local amendments (SFPC).

National Fire Protection Association (NFPA)

- NFPA 69, *Standard on Explosion Prevention Systems* – 2019 Edition
- NFPA 70, *National Electrical Code* – 2020 Edition
- NFPA 855, *Standard for the Installation of Stationary Energy Storage Systems*, 2023 Edition

Underwriters Laboratories (UL)

- UL 1973, *Batteries for Use in Stationary and Motive Auxiliary Power Applications* – 2022 Edition
- UL 9540, *Energy Storage Systems and Equipment* – 2023 3rd Edition
- UL 9540A, *Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems* – 2019 4th Edition

1.2 Reference Materials

The following reference materials were reviewed as part of this analysis:

- Renvolt East Point Energy Evergreen Preliminary Site Plan, Dated 2024.12.17
- UL 9540A Cell Level Test Report #CN23F118 001, TÜV Rheinland (Shenzhen) Co., Ltd, Dated 2023.12.06
- UL 9540A Module Level Test Report #CN23XXY9 003, TÜV Rheinland (Shenzhen) Co., Ltd, Dated 2024.05.11
- UL 9540A Rack Level Test Report #CN244DBX 001, TÜV Rheinland (Shenzhen) Co., Ltd, Dated 2024.04.26
- Hithium User Manual, V2.5, Dated 2024.09.24
- Hithium Operations and Maintenance Manual, V1.0, Dated 2024.08.29
- Hithium_TI_ESS Container Venting Area Calculation_20230925_V1.0, Calculation Sheet for Mechanical Exhaust Ventilation, Dated 2023.08.01
- Fire Protection Device and Equipment Product Data and UL Listing
- Hithium TR ESS Container 5015kWh_NFPA 69 Test Report, TUV Rheinland, Report #CN24Q0JQ 001, Dated 2024.04.11
- Evergreen EC BESS Draft Emergency Response Plan Rev 0, Dated 2025.04.03
- UL 9540 Listing Certificate, Date of Issue 2024.05.31
- UL 1973 Listing Certificate, Date of Issue 2024.06.20

2.0 REPORT DEFINITIONS

Battery Energy Storage System (BESS): Stationary equipment that receives electrical energy and then utilizes batteries to store that energy to supply electrical energy at some future time. The BESS, at a minimum, consists of one or more modules, a power conditioning system (PCS), battery management system (BMS) and balance of plant components.

Battery Management System (BMS): A system that monitors, controls, and optimizes the performance of an individual or multiple battery modules.

Cell: The basic functional electrochemical unit containing an assembly of electrodes, electrolyte, separators, container, and terminals. It is a source of electrical energy by direct conversion of chemical energy.

Combustible: Readily or easily ignitable material. Specific definitions vary depending on material: dust, fibers, liquids, etc.

Combustible Liquid, Class II: Liquids having a closed cup flash point at or above 100 degrees F, and below 140 degrees F.

Emergency Alarm System: A system to provide indication and warning of emergency situations involving hazardous materials.

Energy Storage Management System / Energy Management System (ESMS/EMS): A system that monitors, controls, and optimizes the performance and safety of an energy storage system.

Energy Storage Systems (ESS): One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

Energy Storage System Cabinet: An enclosure containing components of the energy storage system where personnel cannot enter the enclosure other than reaching into access components for maintenance purposes.

Fire Resistance: That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases, or flames under conditions of use.

Fire-Resistance Rating: The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests prescribed in Section 703 of the International Building Code.

Flammable Gas: A material which is a gas at 68° F (20° C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure [a material that has a boiling point of 68° F (20° C) or less at 14.7 psia (101 kPa) which:

1. Is ignitable at 14.7 psia (101 kPa) when in a mixture of 13 percent or less by volume with air; or
2. Has a flammable range at 14.7 psia (101 kPa) with air of at least 12 percent, regardless of the lower limit.

The limits specified shall be determined at 14.7 psi (101 kPa) of pressure and a temperature of 68° F (20° C) in accordance with ASTM E681.

Lithium-ion battery: A storage battery with lithium ions serving as the charge carriers of the battery. The electrolyte is a polymer mixture of carbonates with an inorganic salt and can be in a liquid or a gelled polymer form. Lithiated metal oxide is typically a cathode and forms of carbon or graphite typically form the anode.

Module: A subassembly that is a component of a BESS that consists of a group of cells or electrochemical capacitors connected together either in a series and/or parallel configuration (sometimes referred to as a block) with or without protective devices and monitoring circuitry.

Stationary Energy Storage System: An energy storage system that is permanently installed as fixed equipment.

Thermal runaway: The incident when an electrochemical cell's temperature increases at an accelerating rate in an uncontrollable fashion sufficient to result in damage to the cell. The thermal runaway progresses when the cell's generation of heat is at a higher rate than the heat it can dissipate. This may lead to fire, explosion and gas and smoke evolution.

Unit: A frame, rack, or enclosure that consists of a functional BESS, which includes components and subassemblies such as cells, modules, battery management systems, ventilation devices and other ancillary equipment.

3.0 EVERGREEN EC BESS FACILITY ARRANGEMENT

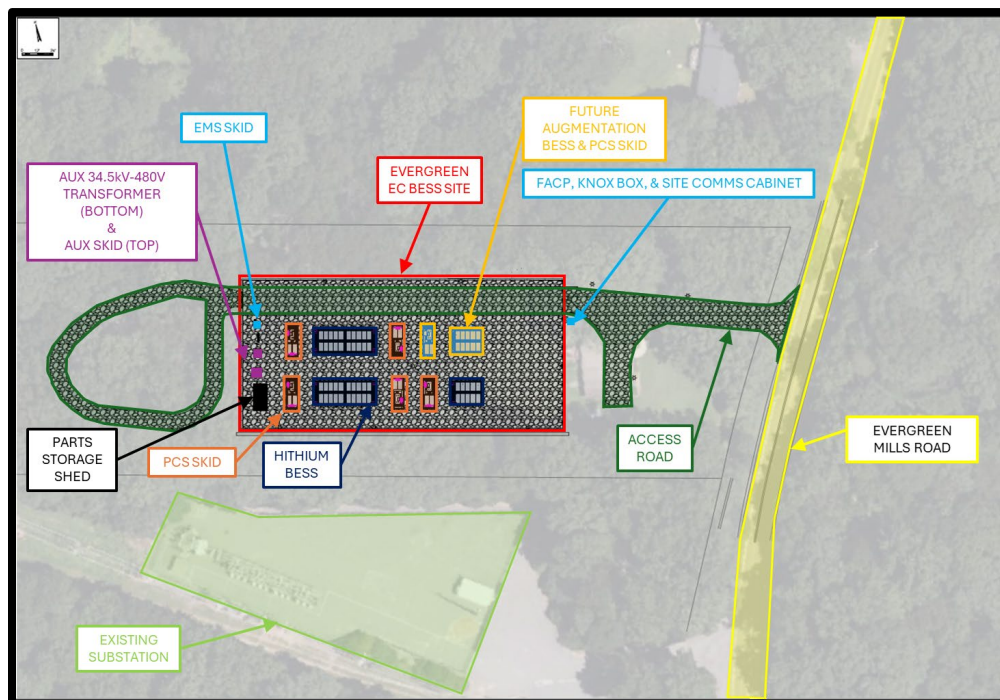


Figure 1. Evergreen EC BESS Facility Overall Site Plan

The 20 MW/40 MWh Evergreen EC BESS facility is located off Evergreen Mills Road in Leesburg, Virginia. The BESS facility uses the Hithium BESS, a pre-assembled, NWI style lithium-ion BESS container with an energy capacity of 5,015 kWh. The Evergreen EC BESS facility, illustrated in Figure 1, includes 10 Hithium BESS containers.

The BESS facility includes power conversion systems (PCS), a piece of equipment that provides an inverter, transformer, and switchgear in a single skid, each connected to between two to four Hithium BESS. Auxiliary transformers are provided to supply auxiliary power loads to Hithium BESS containers.

The Hithium BESS is equipped with two smoke detectors, two combustible gas detectors, and two heat detectors. Explosion protection is provided by an explosion prevention exhaust system that is activated upon 10% LFL combustible gas detection. Site fire alarm control panel(s) (FACP) will be installed at the first responder station (FRS) located at the main gate for the monitoring and control of the fire alarm devices for the BESS. The FACP will be capable of annunciating smoke, gas, and heat alarms along with the activation of the explosion control system.

The preliminary site design does not illustrate any proposed fire protection water supply. This will need to be reviewed prior to AHJ approval.

The Hithium BESS container is provided with a battery management system (BMS) that can identify possible risks to the battery system by monitoring battery cell temperature, voltage, and current, and provide system shutdown and isolation capability. The BMS is monitored by the energy storage management system (ESMS), which provides remote monitoring and system

shutdown capability. The BMS function is intended to mitigate the risk of thermal runaway by preventing the risks of over-charge, over-discharge, over-temperature, and over-current.

4.0 HITHIUM BESS SYSTEM INFORMATION

The Hithium is a fully integrated BESS with battery modules, power electronics, control systems, BMS, thermal management system (TMS), fire detection and notification system, and explosion control system all pre-assembled within a single container. It is meant for outdoor installations, mounted to the ground.

4.1 BESS Cell

The BESS cell is the smallest anatomy of the battery assembly, Figure 2. The cell model number is LFP71173207 and is rated for 314 Ah capacity, 3.2 V, and 1.00 kWh. It is UL 1973 listed and is composed of lithium iron phosphate (LFP) chemistry. Each cell measures 6.9 in x 8.2 in x 2.8 in (174.7 mm x 207.1 mm x 71.7 mm).

TÜV Rheinland (Shenzhen) Co., Ltd, performed standardized cell level UL9540A testing and a UL9540A report^A was provided.

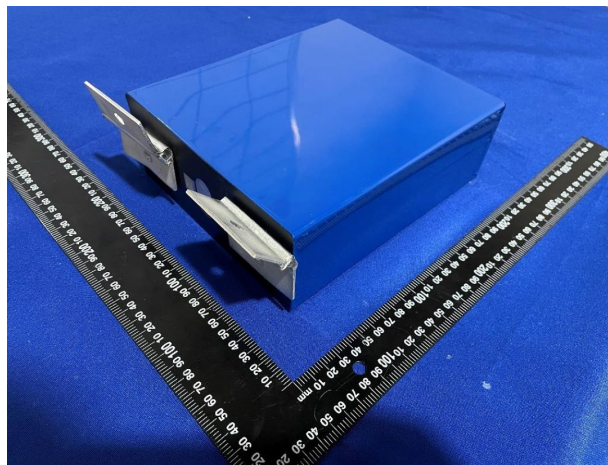


Figure 2. BESS Cell

This cell is manufactured for use in the Hithium BESS and is intended to be part of the module assembly. Passive safety features include material reliability and manufacturing processes. Known hazards of the cell during normal operation consist of either electrical, thermal, or mechanical failures, which could result in gas release, flaming electrical fluid, electrical shorting, thermal heating, and/or thermal runaway.

4.2 BESS Module

The BESS module is the second smallest level of the BESS anatomy, Figure 3. The module model number is LM010401-A and contains 104 cells in a 2P52S configuration. It is constructed with a metal base with a non-metallic plastic cover. The modules are rated for 628 Ah capacity, 166.4 V,

^A TÜV Rheinland Report # CN23F118 001, TÜV Rheinland (Shenzhen) Co., Ltd, Dated 2023.12.06

and 104.5 kWh. Each module measures 2.6 ft wide x 7.2 ft deep x 0.8 ft tall (800 mm x 2,184 mm x 243 mm).

TÜV Rheinland (Shenzhen) Co., Ltd, performed standardized module level UL9540A testing and a UL9540A report^B was provided.

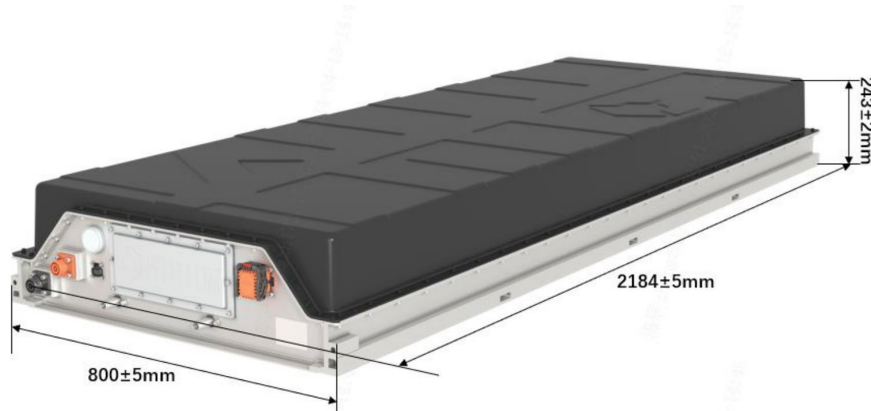


Figure 3. BESS Module

This module is manufactured for use in the Hithium BESS and is intended to be part of the unit-level assembly. The module assembly supports safe operation through its material insulation and internal cooling. Passive safety features include the pressure vent located on the front face, material reliability and manufactured assembly process. The module itself does not have any active emergency functions for disconnection from the charging source or discharging stored potential energy.

Known hazards of the module during normal operation consist of electrical, thermal, or mechanical failures, which could result in gas release, flaming electrical fluid, electrical shorting, thermal heating, and thermal runaway.

4.3 BESS Rack

The rack (or unit) is the third level of BESS anatomy, Figure 4. The rack model number is LC083502, containing 8 modules per rack. The racks are rated for 628 Ah capacity, 1,331.2 V, and 836 kWh. Each rack measures 3.1 ft wide x 6.2 ft deep x 9.43 ft tall (946 mm x 1,890 mm x 2,874 mm) and is composed of 8 modules with an HV box on the bottom of the rack. The HV box includes the cluster battery management unit (CBMU) and circuits to manage and control each rack. The CBMU is also referred to as rack BMU or rack level BMS.

TÜV Rheinland (Shenzhen) Co., Ltd, performed standardized rack level UL9540A testing and a UL9540A report^C was provided.

^B TÜV Rheinland Report # CN23XXY9 003, TÜV Rheinland (Shenzhen) Co., Ltd, Dated 2024.05.11

^C TÜV Rheinland Report # CN244DBX 001, TÜV Rheinland (Shenzhen) Co., Ltd, Dated 2024.04.26



Figure 4. BESS Rack

4.4 BESS Container

The container is the final and largest level of the BESS, Figure 5. The Hithium BESS container is a rigid steel enclosure designed to house the batteries, associated controllers, and appurtenances. The container supports the safe operation of the BESS through its exterior rigid housing structure that helps to protect the batteries from mechanical damage and weather conditions. It is 8 ft wide x 9.5 ft tall x 19.9 ft long (2,438 mm x 2,896 mm x 6,058 mm) and is intended for outdoor, ground mounted installations, with an IP-55 rating. The Hithium includes battery racks, electrical controls, fire alarm devices, an emergency ventilation system designed in accordance with NFPA 69, a thermal management system, and string BMU (string level BMS).

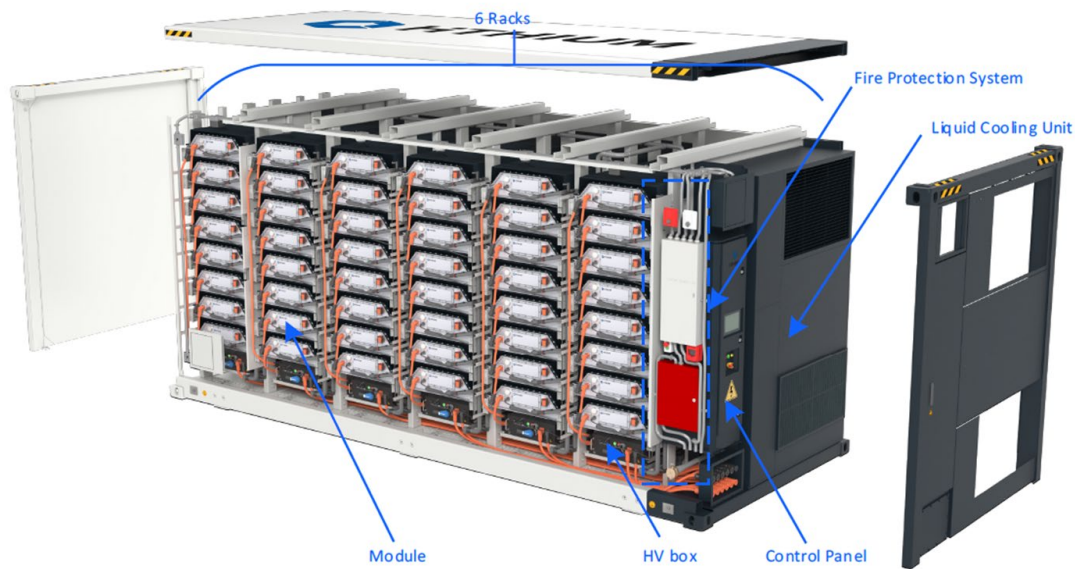


Figure 5. BESS Container

4.4.1 Control Panel Compartment

The control panel compartment is integrated inside the BESS Container. The control panel has the function of auxiliary power supply, master communication, SBMU, fire alarm power supply, and fire alarm modules and devices. The exterior of the control panel compartment includes local fire alarm annunciation and the emergency stop button. The emergency stop disconnects the auxiliary stop and rack isolation.

4.4.2 Thermal Management Unit

The thermal management unit (TMU) is composed of a chiller system with a liquid cooling system using 50/50 water and glycol mixture. The TMU is monitored by the SBMU.

4.4.3 BMU (BMS)

The Hithium BESS is provided with MBMU (module level BMS), CBMU (rack level BMS) and SBMU (string level BMS), that can identify possible risks to the battery system by monitoring battery cell temperatures and voltage. The BMU function is intended to prevent the risk of thermal runaway by preventing the risks of overcharge, over-discharge, over-temperature, and overcurrent. It provides thermal runaway risk protection by safely disconnecting the batteries in case of fault conditions. The BMU can be regarded as three levels:

- Module Battery Management Unit (MBMU)
 - The MBMU collects cell data inside the battery module and transmits cell voltage and temperature data to the CBMU.
- Cluster Battery Management Unit (CBMU)
 - The CBMU receives voltage and temperature data from the MBMU. The CBMU provides rack level isolation.

- String Battery Management Unit (SBMU)
 - Maintains operation and management of the entire battery system within the container. The SBMU communicates to the ESMS via ethernet communication. The SBMU provides string level isolation by triggering all rack level isolation commands to each CBMU.

4.4.4 Electrical Fault Protection Devices

The Hithium BESS is equipped with layers of electrical fault protection devices designed to protect the battery cells from abnormal electrical conditions. These include:

- DC Fuse: The main circuit is protected against overcurrent using DC fuses.
- DC Relay: For each rack, the switching on and off of the rack circuit is managed via the DC Relay, which is controlled by the CBMU (cluster BMU, also referred to as Rack BMU).
- Manual Service Disconnect: During assembly, maintenance, and transportation, the disconnect at each rack can cut off the high-voltage connection to protect personnel from electrical shock injuries.

4.4.5 Fire and Gas Detection

The Hithium BESS is equipped with two smoke detectors, two combustible gas detectors, calibrated to hydrogen (H₂) target gas, and two heat detectors. Explosion protection is provided by an explosion prevention exhaust system that is activated upon 10% LFL combustible gas detection. The site FACP will be located at the main entrance to the facility for the monitoring and control of the fire alarm devices for the BESS site.

4.4.6 Explosion Control

The Hithium BESS container is equipped with a combustible gas concentration reduction system (explosion control system) designed to maintain the flammable gas concentration below 25% LEL, thereby minimizing the deflagration potential. It consists of gas detection, an explosion proof 820 cfm exhaust fan (outlet), and a make-up air louver. The explosion prevention exhaust system is activated upon 10% LFL H₂ gas detection. The exhaust system is designed in accordance with NFPA 69. TUV Rheinland performed modeling using FLame Acceleration Simulator computational fluid dynamics (FLACS-CFD) software to analyze the capabilities of the system. The study considered a three-cell failure scenario using gas composition data obtained from the UL 9540A cell level test. The analysis concluded that, for the scenario and assumptions modeled, the exhaust system is capable of maintaining an average combustible gas concentration below 25% LFL. Note, if the gas release scenario differs from the design basis, such as a larger release volume or smaller free air volume, the hazard may not be addressed with the current exhaust system configuration. FLACS-CFD cannot simulate fan pressure curves. It is recommended that an airflow test be conducted during commissioning to ensure fan performance meets or exceeds the FLACS-CFD analysis and to validate that correct airflow is measured.

The Hithium BESS is equipped with fire detection and notification. These systems can detect and notify local site personnel, should anyone be in the area, of a thermal event so that they can evacuate to a safe location. Additional mitigation measures include emergency response procedures and training that will advise site personnel and first responders to stand at a safe

distance, upwind from a distressed Hithium BESS container. Once the explosion control system activates, it should not shut down until checked by site personnel. It should not automatically shut down, even if the gas detector resets.

5.0 EVERGREEN EC BESS SITE CODE ANALYSIS – VIRGINIA SFPC

The 2021 Edition of the International Fire Code is adopted in Virginia as the Statewide Fire Prevention Code (SFPC). Compliance with SFPC §1207, Electrical Energy Storage Systems, is required when a lithium-ion BESS installation has an energy capacity greater than 20 kWh [SFPC §1207.1.1 and Table 1207.1.1]. Since the Evergreen EC BESS includes the installation of Hithium containers (energy capacity 5,015 kWh each), compliance with SFPC §1207 is required. As such, the below site design code analysis was performed analyzing the Evergreen EC BESS site design to §1207 of the SFPC. Note, this code analysis applies only to site design elements of the Evergreen EC BESS pertaining to fire and life safety. Other aspects of the site design, including the electrical or structural design/installation, are outside the scope of this review.

5.1 All ESS Installations

SFPC §1207.1 through §1207.6.5 applies to all ESS installations: indoors, outdoors, stationary, or mobile. SFPC §1207.8 applies to all outdoor ESS installations. Only the fire and life safety general installation requirements applicable to outdoor, NWI style BESS installations are summarized in the following sections. Requirements unrelated to fire and life safety or pertaining to other types of BESS installations, such as indoor, are not discussed. These include occupied work centers [SFPC §1207.4.10] and walk-in units [SFPC §1207.4.12].

5.1.1 Electrical Disconnects

SFPC §1207.4.1 requires placards or directories to be installed at the location of the main electrical service disconnecting means indicating the location of stationary storage battery system disconnecting means in accordance with NFPA 70 when the ESS disconnecting means is not within sight of the main electrical service disconnecting means. Based on a review of the Hithium and the site plan, it is capable of being installed in compliance with the electrical disconnect requirement. To ensure compliance, a disconnecting means or placards must be provided at the site per SFPC §1207.4.1.

5.1.2 Enclosures

NFPA 855 §4.6.12.1 requires enclosures of ESS to be of noncombustible construction. NFPA 855 §4.6.12.2 requires that ESS electrical circuitry be located within weatherproof enclosures suitable for the type of exposure required by NFPA 70. The Hithium consists of a noncombustible steel enclosure with an IP-55 ingress rating.

5.1.3 Working Clearances

SFPC §1207.4.2 requires access and working space to be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment in accordance with NFPA 70 and the manufacturer's instructions. The Hithium User Manual identifies working clearances of 9.8 ft to the side aisles and 11.5 ft to the front aisles. The Evergreen EC BESS site design complies with these clearances.

5.1.4 Vehicle Impact Protection

SFPC §1207.4.5 requires energy storage systems that may be subject to impact by a motor vehicle to be provided with vehicle impact protection in accordance with Section 312. Based on a review of the site plan, the Hithium containers are not being installed in an area that is subject to vehicle impact (i.e. there are no public roads near the facility). As such, the Evergreen EC BESS site design complies with the SFPC vehicle impact protection requirements.

5.1.5 Combustible Storage

SFPC §1207.4.6 does not permit combustible materials not related to Evergreen EC BESS to be stored in ESS rooms, areas or walk-in units. The Hithium is an NWI style BESS that is not occupiable, with all internal components accessible via exterior doors. It does not have free open space within the container to store additional combustible materials. As such, the Evergreen EC BESS site design complies with the SFPC combustible storage requirement.

5.1.6 Toxic and Highly Toxic Gas

SFPC §1207.4.7 requires ESS that have the potential to release toxic and highly toxic gas during charging, discharging and normal use conditions to be provided with hazardous exhaust systems that are operated and maintained. The Hithium utilizes listed lithium-ion cells that do not vent toxic or highly toxic gases (or any gases) during charging, discharging, or normal use conditions. Therefore, no hazardous exhaust system is required for the Hithium container. As such, the Evergreen EC BESS site design complies with the toxic and highly toxic gas requirements.

5.1.7 Signage

SFPC §1207.4.8 requires approved signs to be provided on or adjacent to all entry doors for ESS rooms or areas and on enclosures of ESS cabinets and walk-in units located outdoors. The signage must include the following or equivalent:

1. “ENERGY STORAGE SYSTEM,” “BATTERY STORAGE SYSTEM,” “CAPACITOR ENERGY STORAGE SYSTEM,” or the equivalent.
2. The identification of the electrochemical ESS technology present.
3. “ENERGIZED ELECTRICAL CIRCUITS.”
4. Where water-reactive electrochemical ESS are present, the signage shall include “APPLY NO WATER.”
5. Current contact information, including phone number, for personnel authorized to service the equipment and for fire mitigation personnel required by Section 1207.1.6.1.

Based on a review of the Hithium BESS and the site plan, it is capable of being installed in compliance with the signage requirement. To ensure compliance, signage must be provided at the site per SFPC §1207.4.8.

5.1.8 Security of Installations

SFPC §1207.4.9 requires rooms, areas, and walk-in units in which electrochemical ESS are located to be secured against unauthorized entry and safeguarded in an approved manner. Based on a review of the site plan, a security fence is provided around the perimeter of the Evergreen EC BESS that guards against unauthorized entry to the site.

5.1.9 Listings

SFPC §1207.3.1 requires ESS to be listed in accordance with UL 9540. The Hithium BESS is listed with UL 9540. As such, the Evergreen EC BESS complies with the SFPC listing requirement.

SFPC §1207.3.2 requires inverters and the ESMS to be covered as part of the UL 9540 listing or they must be listed separately. SFPC §1207.3.3 requires inverters to be listed and labeled according to UL 1741. Only inverters listed and labeled for utility-interactive system use and identified as interactive are allowed to operate in parallel with the electric utility power system to supply power to common loads.

5.1.10 Energy Storage Management System (ESMS)

SFPC §1207.3.4 requires ESS to be provided with an approved energy storage management system that monitors and balances cell voltages, currents, and temperatures within the manufacturer's specifications. The Hithium is provided with a BMS that monitors battery cell temperatures, voltages, currents, and the switching of each rack. As such, the Evergreen EC BESS site design complies with the SFPC ESMS requirement.

5.2 Outdoor ESS Classification

SFPC §1207.8 requires stationary storage battery systems located outdoors to comply with Sections 1207.8.1 through 1207.8.3 in addition to all other applicable requirements of §1207.8. Since the Hithium BESS is a NWI style container, it is classified by the SFPC as an outdoor BESS installation and not a battery storage room. SFPC Section 1207.8 site design requirements applicable to outdoor, NWI style BESS installations (such as the Evergreen EC BESS), are summarized below in Table 1. Each requirement is further discussed in detail in the following sections. Note, for outdoor BESS installations, SFPC provides code requirements based on the proximity and location of the BESS equipment from adjacent exposures. The two outdoor installation classifications are as follows:

- **Remote locations** – BESS located more than 100 ft from buildings, lot lines that can be built upon, public ways, stored combustible materials, hazardous materials, high-piled stock, and other exposure hazards not associated with electrical grid infrastructure.
- **Locations near exposures** – BESS locations that do not comply with remote outdoor location requirements.

Based on review of the site plan provided, the Evergreen EC BESS is located greater than 100 ft from the lot lines and other exposure hazards. As such, the Evergreen EC BESS will be considered a remote installation for this analysis.

Table 1. SFPC Remote Outdoor BESS Installation Requirements

Requirement	Compliance Required	SFPC Code Reference
All Installations	Yes	§1207.4
Clearance to Exposures	Yes	§1207.8.3
Fire Suppression Systems	Yes ^a	§1207.5.5
Maximum Allowable Quantities	No	§1207.5.2
Maximum Enclosure Size	Yes	§1207.5.6
Means of Egress Separation	Yes	§1207.5.8
Size and Separation	No	§1207.5.1
Smoke and Automatic Fire Detection Systems	Yes	§1207.5.4
Vegetation Control	Yes	§1207.5.7
Technology Specific Requirements – Lithium-Ion BESS		
Explosion Control	Yes	§1207.6.3
Thermal Runaway Protection	Yes	§1207.6.5
All ESS Installations		
Fire Apparatus Access Roads	Yes	§503
Key Boxes	Yes	§506
Fire Protection Water Supply	Yes	§507

a. Where approved by the fire code official, fire suppression systems are permitted to be omitted.

5.2.1 Clearance to Exposures and Setbacks

SFPC §1207.8.3 requires ESS located outdoors to be separated by a minimum of 10 ft (3,048 mm) from lot lines, public ways, buildings, stored combustible materials, hazardous materials, high-piled stock, and other exposure hazards. The site plan depicts no buildings, stored combustible materials, hazardous materials, high-piled stock, and other exposure hazards within 10 ft of the Hithium containers. As such, the Evergreen EC BESS site design complies with the clearance to exposures requirement of the SFPC.

5.2.2 Fire Suppression Systems

SFPC §1207.5.5 requires rooms and areas within buildings and walk-in units containing electrochemical ESS to be protected by an automatic fire suppression system. The Hithium BESS is a non-occupiable enclosure that is installed outdoors, not within rooms or buildings. Therefore, the Hithium BESS containers at the Evergreen EC BESS do not require fire-extinguishing systems.

5.2.3 Maximum Allowable Quantities

SFPC §1207.5.2 only requires the maximum allowable quantity threshold limit from the applicable building code to be met for fire areas within rooms, areas, and walk-in units containing ESS. The Hithium BESS is a non-occupiable enclosure that is installed outdoors, not within rooms or buildings. As such, the Evergreen EC BESS site design complies with the SFPC maximum allowable quantities requirement.

5.2.4 Maximum Enclosure Size

SFPC §1207.5.6 limits outdoor walk-in units housing ESS to a maximum size of 53 ft x 8 ft x 9.5 ft high, not including bolt-on HVAC and related equipment. The Hithium BESS is a NWI style BESS that is installed outdoors. As such, the Hithium BESS is not required to comply with the maximum enclosure size requirement. However, the Hithium BESS still complies with this requirement, as its dimensions are 8 ft x 9.5 ft x 19.9 ft. As such, the Evergreen EC BESS meets the maximum enclosure size requirement.

5.2.5 Means of Egress

SFPC §1207.5.8 requires ESS located outdoors to be separated from any means of egress as required by the fire code official to ensure safe egress under fire conditions. There are no buildings depicted on the site plan that are closer than 30 ft to the nearest Hithium BESS container. As such, the Evergreen EC BESS site design complies with the means of egress requirements.

5.2.6 Size and Separation

SFPC §1207.5.1 requires the configuration and size of ESS groups to be in accordance with the applicable building code. Remote outdoor BESS are not required to be separated into groups. As such, the Evergreen EC BESS site design complies with the SFPC size and separation requirement.

It should be noted, the Hithium BESS installation at Evergreen EC BESS will have larger capacities and smaller separation distances than what is specified for indoor BESS. However, the SFPC also permits the size and separation at Evergreen EC BESS based on the UL 9540A large scale fire testing performed on the Hithium BESS in accordance with UL 9540A (see Section 7.0). The UL 9540A test demonstrated that thermal runaway does not propagate from module-to-module within the Hithium or to adjacent racks. As such, although not required for a remote outdoor BESS installation, the UL 9540A testing supports the current design configuration (size and separation) for the Evergreen EC BESS.

5.2.7 Fire Detection System

SFPC §1207.5.4 requires an approved automatic smoke detection system or radiant energy-sensing fire detection system complying with Chapter 9 to be installed in rooms, indoor areas and walk-in units containing electrochemical ESS. Alarm signals from detection systems shall be transmitted to a central station, proprietary or remote station service in accordance with NFPA 72, or where approved to a constantly attended location.

NFPA 855 §9.6.1 clarifies this requirement by requiring that all areas containing ESS systems located within buildings or structures be provided with smoke detectors or radiant energy detection. As such all ESS must be provided with a fire detection system.

The Hithium BESS is equipped with a smoke and fire detection system consisting of heat detectors, smoke detectors, horn/strobes (fire alarm and amber gas alarm signals), control modules, monitor modules, and a manual pull station. It is anticipated that these devices will be monitored by the site-FACP located at the main entrance to the facility. To ensure compliance, alarm signals from the detection systems must be transmitted to a supervising station in accordance with SFPC §1207.5.4.

5.2.8 Vegetation Control

SFPC §1207.5.7 requires areas within 10 feet on each side of outdoor ESS to be cleared of combustible vegetation and other combustible growth. Based on the site plan, the Evergreen EC BESS will be installed on concrete pads, surrounded by gravel and access roads and will not have any combustible vegetation within 10 ft of any container. As such, the Evergreen EC BESS meets the vegetation control requirements.

5.3 Technology Specific Requirements – Lithium-Ion ESS

5.3.1 Explosion Control

SFPC §1207.6 requires explosion control for rooms, areas, or walk-in units containing lithium-ion BESS to comply with §1207.6 and the applicable building code. Such areas shall be provided with explosion (deflagration) venting or explosion (deflagration) prevention systems in accordance with NFPA 68 or NFPA 69. The Hithium BESS container is equipped with a combustible gas concentration reduction system (explosion control system) designed to maintain the flammable gas concentration below 25% LEL, thereby minimizing the deflagration potential. It consists of gas detection, an explosion proof 820 CFM exhaust fan (outlet), and a make-up air louver. Each BESS container is provided with UPS backup for the ventilation system sized for 2 hours of standby. The Hithium contains an explosion prevention exhaust system that is activated upon 10% LFL H₂ gas detection. The exhaust system is designed in accordance with NFPA 69. TUV Rheinland performed modeling using FLame Acceleration Simulator computational fluid dynamics (FLACS-CFD) software to analyze the capabilities of the system. The study considered a three-cell failure scenario using gas composition data obtained from the UL 9540A cell level test. The analysis concluded that, for the scenario and assumptions modeled, the exhaust system is capable of maintaining an average combustible gas concentration below 25% LFL. Note, if the gas release scenario differs from the design basis, such as a larger release volume or smaller free air volume, the hazard may not be addressed with the current exhaust system configuration. FLACS-CFD cannot simulate fan pressure curves. It is recommended that an airflow test be conducted during commissioning to ensure fan performance meets or exceeds the FLACS-CFD analysis and to validate that correct airflow is measured.

The Hithium BESS is equipped with fire detection and notification. These systems can detect and notify local site personnel, should anyone be in the area, of a thermal event so that they can evacuate to a safe location. Additional mitigation measures include emergency response procedures and training that will advise site personnel and first responders to stand at a safe distance, upwind from a distressed Hithium container.

5.3.2 Thermal Runaway

SFPC §1207.6.5 requires lithium-ion batteries to be provided with a listed device or other approved method to prevent, detect and minimize the impact of thermal runaway. The thermal runaway protection is permitted to be part of a battery management system that has been evaluated with the battery as part of the evaluation to UL 9540. The Hithium is provided with a BMS that monitors battery cell temperatures, voltages, currents, and the switching of each rack. As such, the Evergreen EC BESS site design complies with thermal runaway requirements.

5.4 All Facilities

The Evergreen EC BESS is required to comply with the SFPC Sections 503, 506, and 507 to ensure first responder safety in the event that fire protection measures are ever needed on site. A discussion is required to determine appropriate site access and fire protection water supply needs, as they will ultimately need to be approved by the AHJ.

5.4.1 Fire Apparatus Access Roads

SFPC §503.1 requires fire apparatus access roads to be provided for every facility, building or portion of a building hereafter constructed or moved into or within the jurisdiction. Fire apparatus access roads must meet the requirements of SFPC §503 as follows:

1. Fire apparatus access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the first story of the building is located not more than 150 feet (46 m) from fire apparatus access roads as measured by an approved route around the exterior of the building or facility [SFPC §503.1.1].
2. Fire apparatus access roads shall have an unobstructed width of not less than 20 feet (6.1 m) and an unobstructed vertical clearance of not less than 13 ft. 6 in. (4.1 m) [SFPC §503.2.1].
3. Fire apparatus access roads shall be designed and maintained to support the imposed loads of fire apparatus and shall be provided with an all-weather driving surface [SFPC §503.2.3].
4. The turning radius of a fire apparatus access road shall be as approved by the AHJ [SFPC §503.2.4].
5. Dead-end fire apparatus access roads in excess of 150 feet (46 m) in length shall be provided with approved provisions for the fire apparatus to turn around [SFPC §503.2.5].
6. The gradient for a fire apparatus access road shall not exceed the design limitations of the fire apparatus of the fire department and shall be subject to approval by the AHJ [SFPC §503.2.7].

Based on the site plan provided, 20-foot-wide internal fire department access roads are provided, and all portions of the facility are within 150 ft of the access roads. All other requirements noted above must be confirmed for acceptability by the AHJ when site plans are finalized.

5.4.2 Key Boxes

SFPC §506.1 permits the AHJ to require a key box to be installed in an approved location when an area is restricted. The key box must be of an approved type in accordance with UL 1037 and must contain keys to gain access. The site plan denotes that a Knox Box will be provided at the first responder station near the main entrance to the facility. As such, the Evergreen EC BESS complies with the SFPC key box requirement.

5.4.3 Fire Protection Water Supply

SFPC §507.1 requires an approved water supply capable of supplying the required water flow for fire protection to be provided to premises on which facilities, buildings, or portions of buildings are hereafter constructed or moved into within the jurisdiction. NFPA 855 §4.9.4.2 does allow NFPA 1142 requirements to apply where no permanent adequate and reliable water supply exists for firefighting purposes.

Typical BESS firefighting response procedures and tactics do not recommend offensive firefighting to manually suppress a BESS fire. In addition, UL 9540A unit level fire testing (see Section 7.0) demonstrated that a fire will not spread from module-to-module within the Lithium rack or to adjacent Lithium racks. If manual firefighting tactics are used, water is considered the preferred agent for managing lithium-ion battery fires, suppressing nearby combustibles, cooling nearby exposures, and controlling smoke. Other fire suppression methods, such as gaseous agents (CO₂, Halon), dry chemical suppressants, or foams, are not listed for the application and are ineffective.

There is existing area water infrastructure in the form of municipal fire hydrants adjacent to the site. The closest municipal fire hydrant is across Evergreen Mills Road to the south of the site.

If additional onsite fire protection water supply is requested by the fire department or AHJ, an onsite firewater storage tank or a well tap to the area aquifer could be coordinated and provided. If supplemental fire water is required, final approval is to be accepted by the AHJ.

For discussion purposes, a fire protection water storage tank containing ~30,000 gallons would be able to supply a single handline flowing 250 gpm for a two-hour duration.

6.0 EVERGREEN EC BESS PLANS AND TRAINING

A new BESS installation typically requires a number of plans to be developed for a site prior to energizing the batteries. These documents are developed during construction or after substantial completion of the facility, such that they include site specific details that would not be available prior (such as during the design phase of the project).

6.1 Commissioning, Operation, Decommissioning, and ITM

SFPC §1207.2 requires commissioning, decommissioning, and inspection, testing, and maintenance (ITM) requirements for the BESS installations. It states that the operation, inspection, testing, and maintenance are to be followed per the manufacturer's instructions and directions.

A commissioning plan is to be developed for the integration of the new BESS equipment into the electrical utility grid. The commissioning documentation is to capture the commissioning roles and responsibilities, list of equipment, conditions, BESS operation compliance, fire protection feature compliance and operability, etc. [SFPC §1207.2.1]. An operation and maintenance manual is to be developed and provided to both the Owner, or their authorized agent, and the BESS operator before the BESS is put into operation [SFPC §1207.2.2]. A decommissioning plan is to be developed to provide the organization, documentation requirements, contingencies, and methods and tools necessary to indicate how the safety systems, BESS, and components will be decommissioned and removed from the site [SFPC §1207.2.3]. In addition, all fire protection systems must be designed, installed, commissioned, inspected, tested, and maintained as required by the SFPC and their respective NFPA standard [SFPC Chapter 9].

Commissioning, operation/maintenance, and decommissioning plans will be developed for the Evergreen EC BESS facility. FRA recommends all commissioning, operations and maintenance, and decommissioning plans should be finalized prior to energizing the Evergreen EC BESS.

6.2 Emergency Response/Operations Plan

An emergency response plan (ERP) is typically developed to be readily available at the Evergreen EC BESS for use by facility operations and maintenance personnel. The ERP is a living document that should be updated when conditions change that affect the response considerations and procedure changes. At a minimum, the ERP shall include the following: procedures for safe operational shutdown, inspection testing and maintenance, Evergreen EC BESS response procedures, fire response procedures, safety data sheets, emergency contact information, AHJ operations and response procedures. The ERP should be shared with and approved by the local AHJ/fire responders prior to commercial operation of the Evergreen EC BESS.

An Evergreen EC BESS ERP has been developed for the Evergreen EC BESS. As identified above, the ERP includes information and procedures for responding to the site during a thermal event or power outage where the Hithium fire safety systems may not be functional, such as the explosion control systems. When responding during these events, FRA recommends that all site personnel and first responders remain at a safe distance, upwind from a distressed Hithium container, as designated in the Evergreen EC BESS ERP, to ensure they are not momentarily exposed to dangerous conditions. In addition, FRA recommends that the ERP be finalized and approved prior to energizing the Evergreen EC BESS.

6.3 Emergency Response Training

FRA recommends that all site personnel and emergency response personnel, who could be responsible for responding to an Evergreen EC BESS emergency, be trained on the ERP prior to energizing the Evergreen EC BESS such that any foreseeable hazards associated with the outdoor ESS units can be effectively addressed. This typically includes having all personnel responsible for the operation, maintenance, repair, servicing, and response of the ESS to be trained in the procedures included in the ERP. In addition, refresher training should be provided as appropriate, typically annually, if requested by the AHJ.

7.0 HAZARD MITIGATION ANALYSIS

This HMA is being prepared using the guidance provided by the SFPC. The HMA evaluates the findings of the UL 9540A cell, module, and unit level testing pertaining to thermal runaway and off-gassing. A high-level FMEA has been performed to assess the adequacy of planned mitigating provisions. A product level FMEA has not been provided for incorporation into this analysis.

7.1 UL 9540A Test Method

UL 9540A is the Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems.

Initially, the cells are tested to determine if further testing is required. Module level testing is required if the following observations are recorded:

- Thermal runaway is induced in the cell; and,
- Composition of vent gases exceed 25% of the LFL for flammable gases.

Module level testing examines the module design, heat release rate, gas generation, external debris, and flying debris hazards. Unit level testing is required if the following observations are recorded:

- Module design is unable to contain thermal runaway; and,
- Cell vent gas is flammable.

Unit level testing assesses the BESS design of the unit, heat release rate, gas generation and composition, deflagration and flying debris hazards, BESS and wall surface temperatures, heat flux at the target walls, and reignition. Installation level testing is required if the following observations are recorded during unit level testing:

- Flaming is observed outside the initiating BESS unit;
- Surface temperature of the modules in the adjacent BESS unit exceeds the temperature at which cell level gas venting occurred;
- Surface temperatures of wall surfaces increase more than 175 °F (79.4 °C) from ambient; and,
- Explosion hazards are recorded.

UL 9540A cell, module, and rack level testing was conducted for the Hithium BESS.

7.2 UL 9540A Cell Level Verification Testing

The UL 9540A cell level tests were conducted in five separate tests, all of which were conducted under similar parameters. All tests were conducted with a single battery cell. External film heater rated 220VAC/429 W was used to induce the cell thermal runaway.

The sample cell and heater were clamped together by two steel plates to simulate the constraint in the BESS module to prevent excessive swelling during the test. The thermocouples (type K, 24AWG) were located below the heater and were used to measure vent and thermal runaway onset temperature. An AC power supply controller was used to control the voltage supply to the heater

to maintain a 4°C/min to 7°C/min heating rate. Once thermal runaway was observed, the heaters were immediately de-energized. Figure 6 shows the cell test setup.



Figure 6. Thermocouple, Film Heater, and Steel Plant Positions

7.2.1 Cell Tests 1 Through 5

The cell tests were conducted to replicate the cells to be installed in the BESS equipment. The flexible film heaters were used to heat the cell at a rate of 4°C to 7°C per minute to a final average temperature of 295.7°C until thermal runaway was observed.

Tests 1 through 5 produced similar results in terms of time to smoke venting and thermal runaway. No ignition of the vent gas occurred during testing. Table 2 outlines the key events of each test.

Table 2. Key Results from Cell Tests 1 Through 5

Description	Test Sample Number				
	#1	#2	#3	#4	#5
Ambient conditions at the initiation of the test	26.1°C 51% R.H.	27.9°C 51% R.H.	26.1°C 52% R.H.	27.9°C 50% R.H.	26.1°C 51% R.H.
Open circuit voltage before test (V)	3.35	3.37	3.36	3.35	3.35
Cell vent temperature (°C)	231.4	201.8	200.7	208.5	203.6
Thermal runaway onset temperature (°C)	328.8	306.3	283.5	291.4	301.6
Average cell vent temperature (°C)	203.7				
Average thermal runaway onset temperature (°C)	295.7				

7.2.2 Cell Test 1

Test 1 used the same film heater setup as tests 2 through 5 but was placed into a sealed battery gas composition chamber. The battery gas composition chamber can be seen in Figure 7.



Figure 7. Battery Gas Composition Test Chamber

Test 1 was heated using the same method as tests 2 through 5. The gas composition produced during the test is shown in Table 3. Cell vent gas flammability properties are shown in Table 4.

Table 3. Cell Test 1 Vent Gas Composition During Thermal Runaway

Gas Component	Cell Gas Analysis	
	%	Liters
CH ₄	3.671	4.7723
C ₂ H ₆	0.548	0.7124
C ₂ H ₄	1.389	1.8057
C ₃ H ₈	0.18	0.234
C ₃ H ₆	0.745	0.9685
n- C ₄ H ₁₀	0.068	0.0884
n- C ₄ H ₈	0.22	0.286
n- C ₅ H ₁₂	0.076	0.0988
iso- C ₅ H ₁₂	0.112	0.1456
n- C ₅ H ₁₀	0.053	0.0689
CO	16.202	21.0626
CO ₂	26.861	34.9193
H ₂	49.875	64.8375
Totals	100	130

Table 4. Cell Test 1 Vent Gas Flammability Properties

Vent Gas Information and Flammability Properties	
Average cell surface temperature at gas venting	203.7°C
Average cell surface temperature at thermal runaway	295.7°C
LFL, % volume in air at the ambient temperature	8.1%
LFL, % volume in air at 200°C	6.5%

7.3 UL 9540A Module Level Verification Testing

The module utilizes a 2P52S cell configuration. The modules were tested by inducing thermal runaway in one cell of a module. Cell #1-10 was used as an initiating cell and induced thermal runaway in a similar method used for the cell level testing. The module level test demonstrated that the thermal runaway propagated into one adjacent cell, Cell #1-9. The module assembly cell layout, heater location, and thermocouple positions are shown in Figure 8.



Figure 8. Module Level Test Thermocouple and Heater Positions

The module level test concluded that cell to cell propagation occurred. A total of 2 cells were damaged during the test; thermal runaway was induced in Cell #1-10 and thermal runaway propagated to Cell #1-9. No external flaming or flying debris was observed.

7.4 UL 9540A Unit Level Verification Testing

Unit level testing was conducted for the racks to be installed in the Hithium BESS. The Hithium BESS containers are equipped with active protection systems such as a liquid cooling system and BMS, however, these features were disabled and not used or evaluated during the test. Similarly, an active fire suppression system was not used during the unit level testing. Testing consisted of two units. The unit level testing was done using a representative rack, but not in the installed enclosure.

Three instrumented wall sections (IWS) were constructed to form two right angles. The IWSs were constructed with 5/8 in (16 mm) gypsum wall boards painted flat black. Each IWS was equipped with an array of 11 thermocouples at 5.98in (152 mm) intervals for the full height and heat flux gauges, as shown in Figure 9.

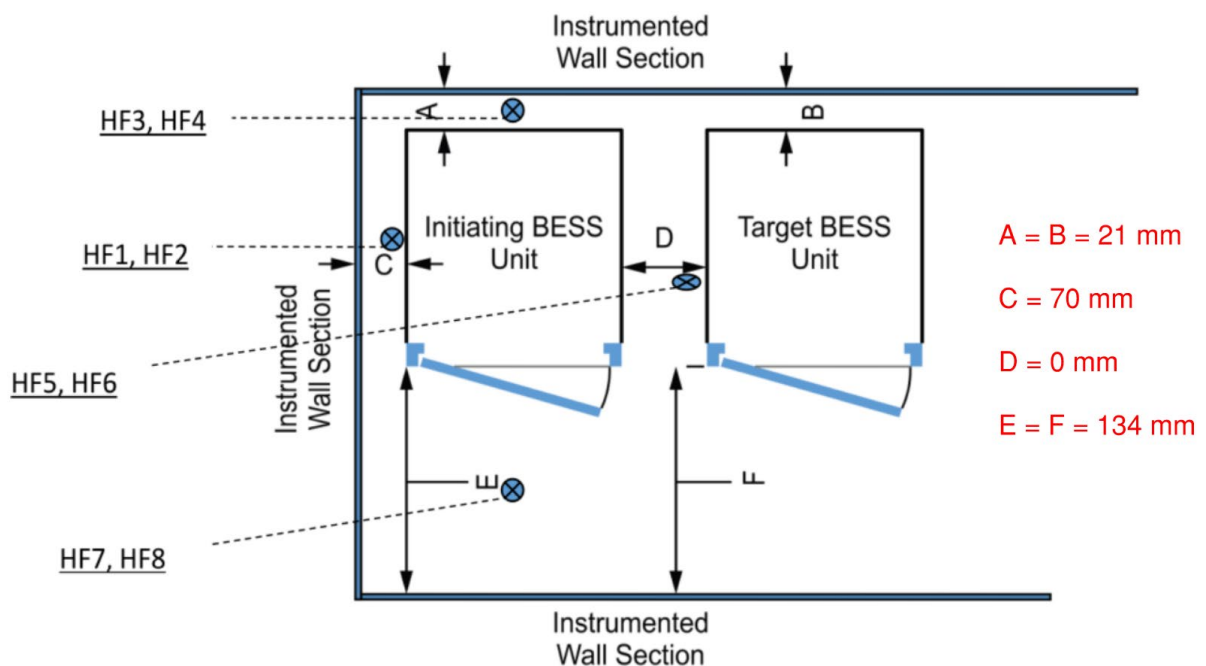


Figure 9. Unit Level Test Configuration

The location of the initiating module 02 was selected to enable the thermal stress to be transmitted to the adjacent modules 01 and 03, and to target unit 01 module 02. The position of the initiating module is shown in Figure 10. The initiating module was equipped with flexible film heaters and thermocouples similar to the module level test, Figure 11.

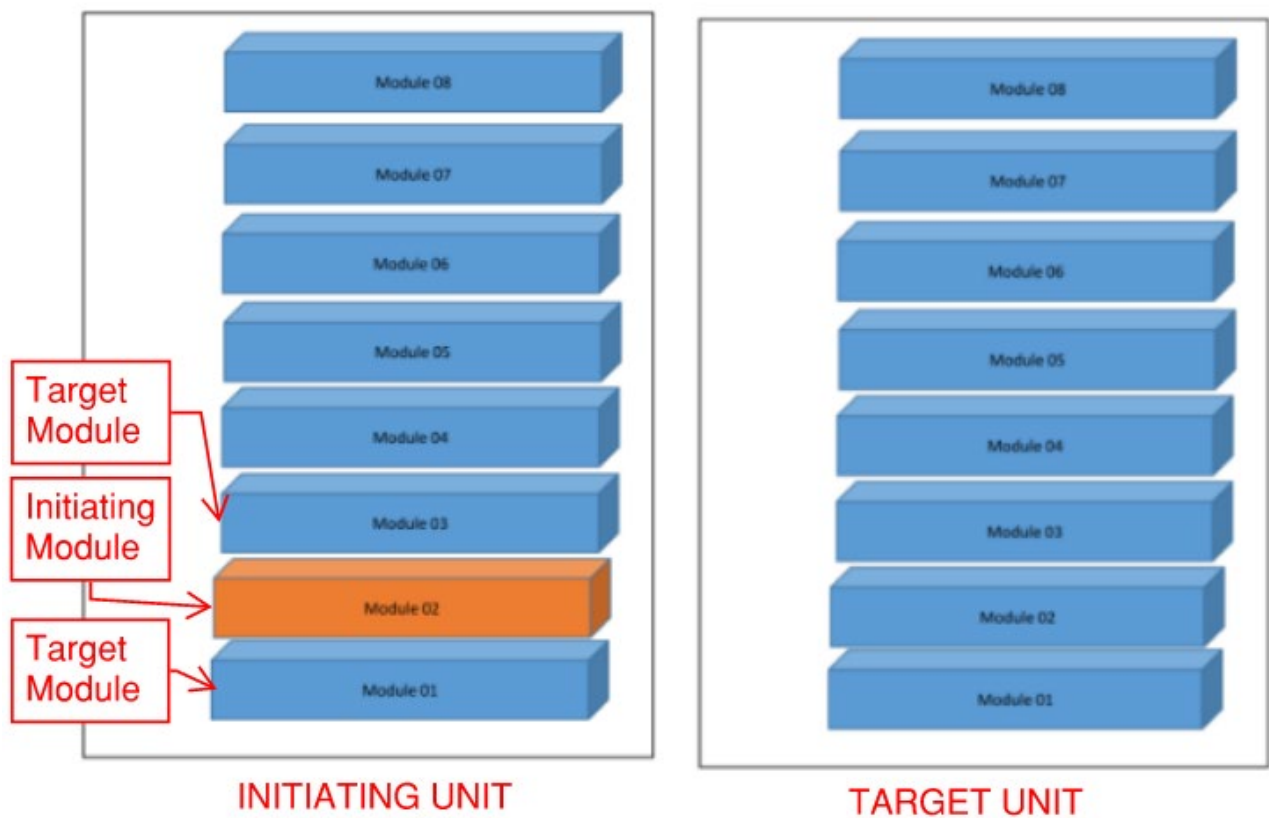


Figure 10. Unit Level Test Module Arrangement

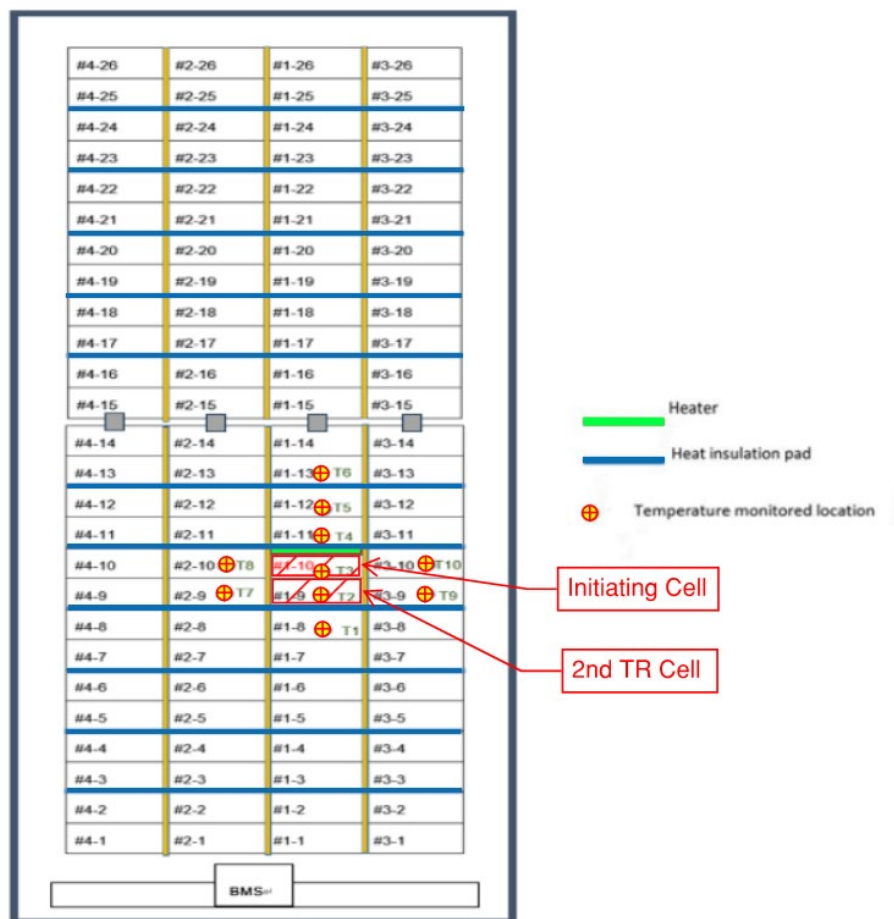


Figure 11. Unit Level Test Thermocouple and Heater Positions Within Initiating Module M02

The initiating cell #1-10 was heated until it entered thermal runaway. Thermal runaway propagation was induced in one adjacent cell. The test concluded with a total of 2 cells damaged, and no further thermal runaway propagation was observed.

The temperature measured by the IWS thermocouple array was below 17.3°C and remained relatively constant for the duration of the test. The heat flux measurement taken at IWS measured below 1.3 kW/m² test maximum. Surface temperatures of modules within the target units adjacent to the initiating units was 13.9°C, which is below the cell venting temperature of 203.7°C. The unit level test concluded with no observation of external flaming, flying debris, explosive discharge, and electrical arcs. The damage did not extend past the initiating modules, and the temperature rise on the surface of adjacent modules was below those necessary for the onset of thermal runaway, indicating the successful completion of the UL 9540A test series.

7.5 Off Gassing IDLH and Explosion Hazard Analysis

The cells generated flammable gases during thermal runaway as recorded in the cell level and module level tests. Gas generation and composition during the cell level and unit level testing was

not measured. The analysis provided in this section of the report is based on the recorded level of the gases in the cell level test as a bounding (worst-case) off-gassing scenario.

The total gases vented from the cell have an LFL of 6.5% in the air at 200°C as determined per the testing method outlined in the UL 9540A cell level test. The total gas volume collected from the cell level test was 4.59 ft³ (0.130 m³).

The BESS container interior measurements are 17.8 ft x 7.64 ft x 8.7 ft (5.450 m x 2.326 m x 2.654 m) with an approximate volume of 1,188 ft³ (33.64 m³). Each module measures 2.6 ft x 7.2 ft x 0.8 ft (0.800 m x 2.184 m x 0.243 m) with an approximate volume of 15 ft³ (0.42 m³).

It is anticipated that 6 racks, each with 8 modules of equivalent volume, will be used for Hithium BESS, resulting in a total approximate volume of 719.7 ft³ (20.38 m³). The electrical compartment has measurements of 1.64 ft x 7.63 ft x 8.7 ft (0.5 m x 2.326 m x 2.654 m) with an estimated volume of 109 ft³ (3.08 m³).

An approximate volume 297 ft³ (8.41 m³), or 25 percent of the total container volume, is assumed for ancillary equipment such as cables and coolant piping. Therefore, the interior free air volume inside the Hithium BESS is estimated to be 62.4 ft³ (1.76 m³).

7.5.1 Hydrogen Explosion Hazard

Hydrogen gas (H₂) has an LFL of 4% in air. The cell level test generated 2.29 ft³ (0.064 m³) of H₂. Table 5 provides a summary of the cell gas release in the BESS unit that would need to off gas to reach the LFL of H₂.

Table 5. Hydrogen Off Gassing Volume Needed to Reach LFL

Interior Air Volume (ft ³ / m ³)	Volume of H ₂ Required for LFL (ft ³ / m ³)	No. of Cells Required for LFL
62.4 / 1.76	2.49 / 0.071	1.09

The LFL for H₂, which requires 1.09 cells, can be approached by off gassing from thermal runaway conditions within a single cell and risks due to explosions are present if off gases are not vented.

7.5.2 Carbon Monoxide Explosion Hazard

Carbon Monoxide (CO) gas has an LFL of 12.5% in air. The cell level test generated 0.744 ft³ (0.021 m³) of CO. Table 6 provides a summary of the cell gas released in the BESS unit that would need to off gas to reach the LFL of CO.

Table 6. Carbon Monoxide Off Gassing Volume Needed to Reach LFL

Interior Air Volume (ft ³ / m ³)	Volume of CO Required for LFL (ft ³ / m ³)	No. of Cells Required for LFL
62.4 / 1.76	7.8 / 0.221	10.487

The LFL for CO data shows a margin of safety, however explosion risks are present if the battery failure gases are not vented.

7.5.3 Total Vent Gas Explosion Hazard

The total vent gas produced has an LFL of 6.5%. The cell level test generated 4.59 ft³ (0.13 m³) of total gas. Table 7 provides a summary of the cell gas release in the BESS unit that would need to off gas to reach the LFL of the total vent gas.

Table 7. Total Off Gassing Volume Needed to Reach LFL

Interior Air Volume (ft ³ / m ³)	Volume of Vent Gas Required for LFL (ft ³ / m ³)	No. of Cells Required for LFL
62.4 / 1.76	4.056 / 0.1144	0.88

The LFL for total vent gas can be reached by off gassing from thermal runaway conditions within a single cell.

7.5.4 Carbon Monoxide IDLH

The IDLH level for CO is listed at 1,200 parts per million. This corresponds to a 0.12% IDLH. A cell generated 0.744 ft³ (0.021 m³) of CO gas during thermal runaway.

Table 8. Carbon Monoxide Volume Needed to Reach the IDLH Threshold

Interior Air Volume (ft ³ / m ³)	Volume of CO Required for IDLH (ft ³ / m ³)	No. of Cells Required for IDLH
62.4 / 1.76	0.075 / 0.002	0.101

The IDLH level for carbon monoxide gas can be reached by off gassing from thermal runaway conditions within a single cell. However, the BESS unit is installed outdoors and is non-occupiable. Meaning it cannot be occupied by personnel or entered by first responders. Therefore, the IDLH hazard is not applicable to this installation. However, FRA recommends that proper PPE be worn by first responders when approaching a distressed Hithium container when responding to a BESS emergency.

7.5.5 Explosion Prevention

The UL 9540A 4th edition unit test demonstrates that the thermal runaway is limited to the initiating module and module-to-module propagation does not occur. The LFL calculations presented in this section indicated that there is no margin of safety to reach LFL without an additional level of protection. In the event of H₂ gas event, the LFL may be reached by off gassing conditions within a single cell. To mitigate the risk of explosion, the BESS container is equipped with an exhaust system to reduce the flammable gas concentrations.

7.6 Failure Modes and Effects Analysis

SFPC §1207.1.4 allows an FMEA or other approved HMA to be approved by the fire code official. The HMA methodology that is provided in NFPA 855 §4.4.2.1 is recommended for use as an approved methodology, as the SFPC does not specify what failure modes need to be analyzed.

NFPA 855 requires the evaluation of the consequences of the following failure modes. Note that only single failure modes shall be considered:

1. A thermal runaway or mechanical failure condition in a single ESS unit.
2. Failure of an energy storage management system or protection system that is not covered by the product listing failure modes and effects analysis (FMEA).
3. Failure of a required protection system including, but not limited to, ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, fire suppression, or gas detection.

The consequences of each of these for the Hithium BESS are discussed in detail below.

7.6.1 Thermal Runaway

Thermal runaway occurs when a cell's temperature increases at an accelerating rate in an uncontrollable fashion sufficient to result in damage to the cell. The thermal runaway progresses when the generation of heat is at a higher rate than the rate at which the heat can dissipate. This may lead to venting (off-gassing and smoke evolution) or a fire/explosion. The primary potential cause for a thermal runaway is cell overtemperature, overcharge, and over-discharge. Other potential causes include manufacturing defects (presence of contaminant), damage during handling, electrical faults, and low temperature charging.

Mitigation features in place include the BMU (BMS), which has layers of protection that work autonomously to identify abnormal cell conditions and react to reduce the likelihood of thermal runaway. The BMS is considered a reliable means of preventing thermal runaway and SFPC permits thermal runaway protection to be part of the BMU that has been evaluated to UL 1973.

Further mitigating features include rigorous quality controls in cell manufacturing and the Hithium assembly process, as well as commissioning tests performed prior to operation. Should thermal runaway occur in one cell, it should be noted that the battery module is designed to contain that failure. As demonstrated in UL 9540A unit level testing, the thermal runaway of one cell only propagated to one adjacent cell. Thermal runaway was contained within a single module and did not propagate into adjacent modules, nor did thermal runaway propagate from the initiating unit into adjacent units. No flaming, flying debris, or deflagrations were observed during the test. These test results demonstrated that in the unlikely event of a cell undergoing thermal runaway, it will not propagate throughout the module and unit.

7.6.2 Failure of an Energy Management System

The BMU identifies risks to the battery system by monitoring key cell properties, such as cell temperature, voltage, current and dry contact switching value in real time. If abnormal cell conditions exist, the BMU signals this alarm condition and autonomously isolates the affected racks.

However, in the event of a BMU failure, these thermal runaway protections may not be functional. With the exception of an overcharge condition, the failure of the BMU by itself is unlikely to cause a fire unless there is prolonged operation of the Hithium in this fault condition and/or additional failures within the battery system subsequently occur. Overcharging is a direct effect of a failure

in the BMU software logic that allows continuous operation (i.e., continuous charging) that could lead to cell failure and thermal runaway.

Mitigations in place include the battery module design and construction. Should thermal runaway occur in one cell, as described above, the battery module is designed to contain that failure. As demonstrated in UL 9540A unit level testing, thermal runaway was contained within a single module and did not propagate into adjacent modules, nor did thermal runaway propagate from the initiating unit into adjacent units. No flaming, flying debris, or deflagrations were observed during the test. These test results demonstrated that in the unlikely event of a BMU failure leading to a cell thermal runaway scenario, it is not likely to propagate throughout the module and unit. Furthermore, the provided fire and gas detection system acts independently of the BMU and provides another layer of detection and notification of abnormal events.

7.6.3 Failure of Ventilation or Exhaust System

The Hithium has a TMS that includes a heating and cooling system. As an additional review, the TMS should maintain safe operating temperatures for the cells during normal operation.

Mitigation features in place include the BMU, which monitors the TMS and has layers of protection that work autonomously to identify abnormal cell conditions and react to reduce the likelihood of thermal runaway. The BMS is considered a reliable means of preventing thermal runaway.

7.6.4 Voltage Surges on the Primary Electric Supply

The Hithium BESS incorporates multiple passive and active safety mechanisms designed to mitigate voltage surges on the primary electric supply (see Section 4.4.4, Electrical Fault Protection Devices). Key components include DC fuses and DC relays, which provide overvoltage protection. The main circuit is safeguarded against overcurrent by DC fuses, shielding the equipment from significant voltage surges. The DC relay, controlled by the CBMU, manages the switching of the racks. If a substantial voltage is detected, the DC fuse will trip. For other voltage anomalies, the CBMU can deactivate the rack.

7.6.5 Short Circuit on the Load Side of Battery Storage System

The Hithium is equipped with layers of electrical fault protection devices designed to protect the battery cells from abnormal electrical conditions. These include DC fuses, relays, and manual disconnects. In the event of a short circuit leading to thermal runaway conditions, the UL 9540A test results, BMU protection, and fire alarm and gas detection system monitoring provide layered protection.

7.6.6 Failure of Fire Detection and Suppression System

The Hithium is provided with a fire alarm system that includes two smoke detectors, two gas detectors, and a local visible/audible notification appliance. Potential causes of failure include manufacturing defects in the devices, incorrect installation, a loss of auxiliary power, and/or failure to properly inspect, test, and maintain the system.

Mitigation features in place include redundant smoke and gas detectors, a backup power supply, the BMU, and proper design, installation, commissioning, inspection, testing, and maintenance.

Specifically, Hithium BESS is provided with two smoke detectors and two gas detectors. Should one fail to operate as intended, additional devices within the container are capable of detecting and signaling the site-FACPs. In addition, to address a power loss, the fire alarm and gas detection systems will be equipped with backup batteries sufficiently sized to provide standby and alarm power, as required by NFPA 72.

The BMU and fire alarm systems provide separate protection. As such, the failure of the fire alarm system does not affect the BMU and, in the event that the fire alarm system fails, the BMU would still be operational and capable of detecting and signaling the abnormal condition. Lastly, proper fire alarm system design, installation, commissioning, inspection, testing, and maintenance in accordance with NFPA 72 will ensure the system is operating and functioning as intended.

The Hithium BESS is not equipped with a water or aerosol-based fire suppression system. Therefore, failure modes associated with fire suppression systems do not apply to the Evergreen EC BESS.

7.6.7 Failure of Explosion Control System

The Hithium BESS is equipped with a combustible gas concentration reduction (explosion control) system that is designed in accordance with NFPA 69. The system consists of gas detection, an explosion proof 820 cfm exhaust fan (outlet), and a make-up air louver. The explosion prevention exhaust system is activated upon 10% LFL H₂ gas detection.

Depending on the conditions of release, flammable gases released during a thermal runaway event may present an explosion or fire hazard. An explosion hazard exists when sufficient flammable gases are released in the absence of an ignition source and build-up within the container. A fire hazard exists when the flammable gases are released in the presence of an ignition source or self-ignite. It should be noted, the fire hazard and explosion hazard are not mutually exclusive, and both may exist at different time periods throughout a propagating thermal runaway event. A failure or loss of power related to the explosion control system components may lead to accumulation of combustible gas and deflagration in the presence of an ignition source. This failure condition is mitigated by regular inspection, testing, and maintenance and backup power for the fire alarm system and explosion control system.

In addition, the Evergreen EC BESS ERP will instruct all site personnel and first responders to maintain a safe distance, upwind from a distressed Hithium container. This distance should be based on local conditions on the day of the fire such that they are not momentarily exposed to gases, heat, flames, overpressures, or projectiles.

7.6.8 Failure of Spill Control and Neutralization

The Hithium LFP cells do not require spill control or neutralization.

7.7 HMA Approval Criteria

Based on the above analysis, the Hithium BESS installation at the Evergreen EC BESS facility meets the HMA approval criteria outlined in NFPA 855 §4.4.3, as follows:

- 1. Fires will be contained within unoccupied ESS rooms for the minimum duration of the fire resistance rating specified in NFPA 855 §9.6.4.*

The Evergreen EC BESS meets this requirement. The Hithium BESS is installed outdoors, not within an unoccupied ESS room. However, it should be noted that the Hithium BESS has a number of protection schemes in place to inhibit fire from spreading from one container to another. As demonstrated in UL 9540A unit level testing, thermal runaway was contained to a single module within the Hithium container. Although this requirement applies to unoccupied ESS rooms (and not an outdoor installation), the Evergreen EC BESS still meets the intent of the requirement by containing a thermal runaway event to a single Hithium container.

2. *Fires and products of combustion will not prevent occupants from evacuating to a safe location.*

The Evergreen EC BESS meets this requirement. The Hithium BESS is installed outdoors, in a remote location and not within an occupied work center (or any other room). Also, the closest building is a residential house, which is 590ft away. As such, fire and products of combustion do not pose a significant risk to prevent egress from nearby locations.

3. *Deflagration hazards will be addressed by an explosion control or other system.*

The Hithium BESS contains an explosion prevention exhaust system that is activated upon 10% LFL H₂ gas detection. The exhaust system is designed in accordance with NFPA 69 and is intended to prevent the accumulation of flammable gases inside the container and reduce risks from deflagrations and explosions. TUV Rheinland performed modeling using FLAME Acceleration Simulator computational fluid dynamics (FLACS-CFD) software to analyze the capabilities of the system. The study considered a three-cell failure scenario using gas composition data obtained from the UL 9540A cell level test. The analysis concluded that, for the scenario and assumptions modeled, the exhaust system is capable of maintaining an average combustible gas concentration below 25% LFL. Note, that if the gas release scenario differs from the design basis, such as a larger release volume or smaller free air volume, the hazard may not be addressed with the current exhaust system configuration. FLACS-CFD cannot simulate fan pressure curves. It is recommended that an airflow test be conducted during commissioning to ensure fan performance meets or exceeds the FLACS-CFD analysis and to validate that correct airflow is measured.

The Hithium BESS is equipped with fire detection and notification. These systems can detect and notify local site personnel, should anyone be in the area, of a thermal event so that they can evacuate to a safe location. Additional mitigation measures include emergency response procedures and training that will advise site personnel and first responders to stand at a safe distance, upwind from a distressed Hithium BESS container.

8.0 RECOMMENDATIONS

Throughout the report, FRA provided several recommendations related to the Evergreen EC BESS installation and emergency response to mitigate the hazards of a fire event. These recommendations are based on our review of the available materials, our background, experience, and training, the analyses performed to date described above, common industry best practices for responding to a thermal event involving lithium-ion BESS, as well as from FRA's experience with lithium-ion battery hazards, BESS hazards, and previous BESS fires. These recommendations do not provide opinions or conclusions meant to address specific circumstances or all possible scenarios of an emergency. As with all emergency events, emergency response actions should be evaluated and performed based on real-time fire conditions, observations, and data (i.e., BESS data points, air quality measurements, smoke production, wind direction/speed, fire intensity, proximity of flames to adjacent electrical equipment and structures) during the actual emergency. Below is a summarized list of the recommendations provided throughout the report:

1. **Site Design:** As the site design is finalized, FRA recommends that the following be addressed to ensure compliance with the SFPC:
 - A disconnecting means or placards must be provided at the site per SFPC §1207.4.1.
 - Signage must be provided at the site per SFPC §1207.4.8.
 - An approved fire alarm system shall be provided, acceptable to the AHJ.
 - It is recommended that the NFPA 69 explosion control system is verified for performance
 - Provide an approved water supply system and fire department access, acceptable to the AHJ.
2. **Plans:** FRA recommends that prior to energizing the Evergreen EC BESS, commissioning, decommissioning, operations and maintenance, and emergency operations plans be developed.
3. **Emergency Response Training:** FRA recommends that all site personnel and emergency response personnel who could be responsible for responding to an Evergreen EC BESS emergency, be trained on the ERP before energizing the Evergreen EC BESS. Annual refresher training should be provided, as appropriate, if requested by the AHJ.
4. **Fire Protection Systems:** FRA recommends that all fire protection systems (such as the fire alarm system and explosion control system) be designed, installed, commissioned, inspected, tested, and maintained as required by the SFPC and their respective NFPA standards. The NFPA 69 system, once activated, should latch and require manual resetting of the fire alarm before it can be turned off. As part of commissioning, it is recommended that the NFPA 69 system airflow be checked and data collected by a calibrated capture hood. The NFPA 69 system should be inspected, tested, and maintained in accordance with NFPA 69 as approved by the AHJ.

5. **Minimum Approach Distance (MAD):** When responding to a battery emergency, FRA recommends that all site personnel and first responders remain at a safe distance, upwind from a distressed Hithium container, as designated in the Evergreen EC BESS ERP, to ensure they are not momentarily exposed to dangerous conditions. In addition, site personnel and first responders should not approach the front of distressed Hithium containers and all first responders should wear proper PPE when approaching a distressed Hithium container during a battery emergency.

9.0 CONCLUSIONS

Based on a review of the Hithium BESS and the facility site plan, the Evergreen EC BESS site design can meet the SFPC installation level requirements for an outdoor, NWI style BESS when it is installed in accordance with the manufacturer's instructions, its listing, and the approved drawings. However, the following items need to be addressed to ensure compliance:

- A disconnecting means or placards must be provided at the site per SFPC §1207.4.1.
- Signage must be provided at the site per SFPC §1207.4.8.
- An approved fire alarm system shall be provided, acceptable to the AHJ.
- It is recommended that the NFPA 69 explosion control system is verified for performance
- Provide an approved water supply system and fire department access, acceptable to the AHJ.

In addition, the Hithium BESS installation at the Evergreen EC BESS facility meets the HMA approval criteria outlined in the NFPA 855 §4.4.3, as follows:

1. Fires will be contained to a single Hithium BESS container as demonstrated through UL 9540A unit level testing.
2. Fires and products of combustion will be detected in time to allow personnel to safely evacuate via the internal fire detection system and internal sensors of the Hithium BESS.
3. Deflagration hazards are addressed by an NFPA 69 explosion prevention system.

In summary, the Hithium BESS installation at the Evergreen EC BESS facility meets the Hazard Mitigation Analysis approval criteria laid out in NFPA 855, as outlined above.

10.0 LIMITATIONS

At the request of East Point Energy, FRA performed an HMA for the Evergreen EC BESS facility in accordance with the requirements of the 2021 Edition of the Virginia Statewide Fire Prevention Code. The analysis evaluates the Hithium BESS, which is a pre-assembled, NWI style lithium-ion BESS container. The Evergreen EC BESS facility has a total site capacity of 20 MW/ 40 MWh. The scope of services performed during this analysis may not adequately address the needs of other users of this report, and any re-use of this report or its conclusions presented herein are at the sole risk of the user. The opinions and comments formulated during this assessment are based on observations and information available at the time of the analysis, which has been provided to FRA by others. No guarantee or warranty as to future performance of any reviewed condition is expressed or implied.

Summary of Battery Energy Storage Fire Incidents & Contamination Findings

Battery Energy Storage (BESS) projects have evolved extensively over the last 10 years in designs and standards for safety. Fire codes such as National Fire Protection Association's (NFPA) 855 are now available specifically for BESS projects and are updated every 3 years by fire safety experts to reflect the evolution of battery chemistry, technology, and lessons learned from safety incidents.

One of the key lessons learned in recent years from safety incidents for BESS project design is the importance of containerized units that cannot be entered by people. Specifically, BESS enclosures are not put inside buildings with roofs, but instead, they are installed outdoors on fixed pads or pilings on a gravel covered site.

That safety evolution combined with now purpose-built enclosures with fire ratings, venting, and advanced monitoring and alarm systems, has led to a near zeroing of major safety incidents. In the rare instance when a BESS fire does occur, they are constrained to a 1 or 2 BESS enclosures, are relatively easy to manage by first responders, and property damage is limited to a very small portion of the project.

These rare incidents are now monitored from the beginning with air monitoring set up as first responders arrive (or soon after), and soil and water contamination testing being completed during and immediately afterward. The air, soil, and water contamination testing by trained 3rd parties or government entities have shown no threats to human health, nor the land or nature adjacent to the project/fire incident.

Below are brief descriptions of BESS safety incidents and links to relevant incident response materials and contamination testing results. A complete set of BESS safety incidents [can be found at this database that tracks global incidents](#).

[Elkhorn, CA 2022](#) – Root cause event summary of a first-generation Tesla Megapack fire incident in CA. Includes review of BESS fire safety protocols and proposes new best practices that were integrated into new BESS fire safety guidance and codes. [No air contamination was found](#).

[New York incidents summer 2023](#) – Review of 3 BESS fires in NY during the summer of 2023. NY state agencies did a thorough review of all incidents concluded [no harmful levels of toxins found in testing of air, soil and water samples](#).

[Escondido, CA 2024](#) – An urban incident with [extensive air testing](#) and [water testing](#) did not show any threat to human health or contamination.

[Moss Landing, CA Jan 2025](#) – Probably largest BESS fire to date of a project built in an old turbine warehouse structure. While the fire was relatively large, no [soil](#), [air](#), and/or [water](#) contamination was found during the incident nor in the post incident sampling.