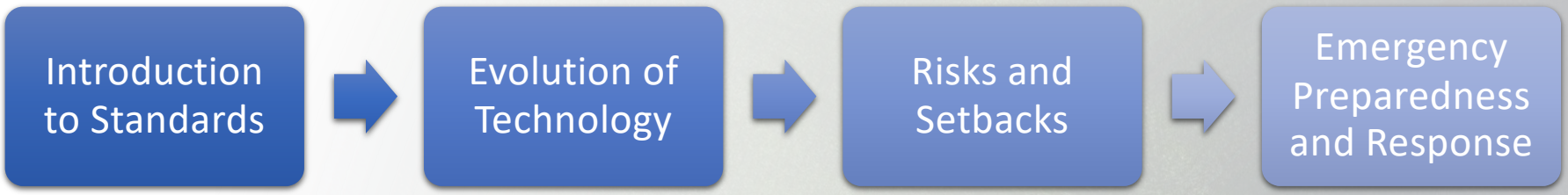
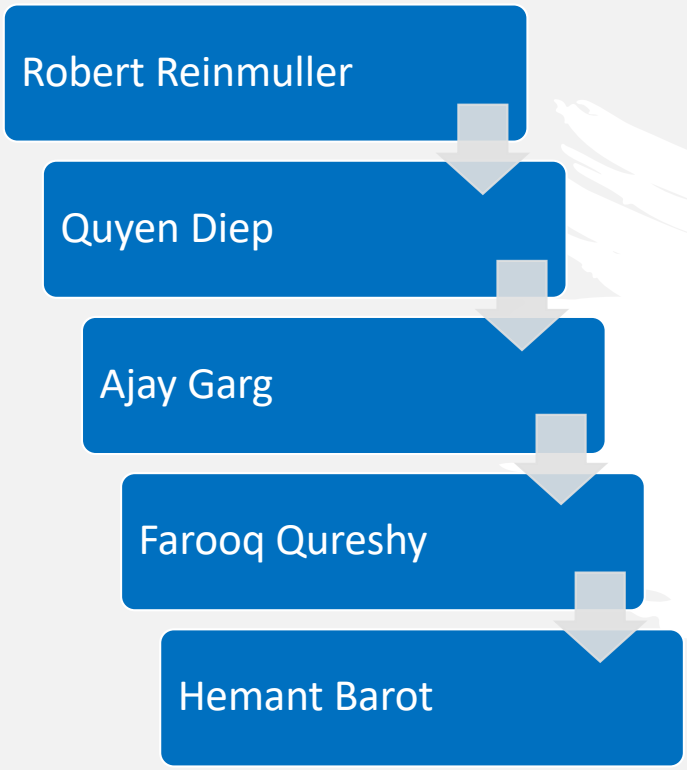
Safety Standards for BESS Interconnection

Presented by

Hydro One & Fire & Risk Alliance

Agenda


Introduction to Standards
Evolution of Technology
Risks and Setbacks
Emergency Preparedness and Response



hydro one

Team

Team

- Anthony Natale
- Derek Post
- Noah Ryder
- Jeffrey Reetz

FIRE & RISK ALLIANCE

Anthony Natale

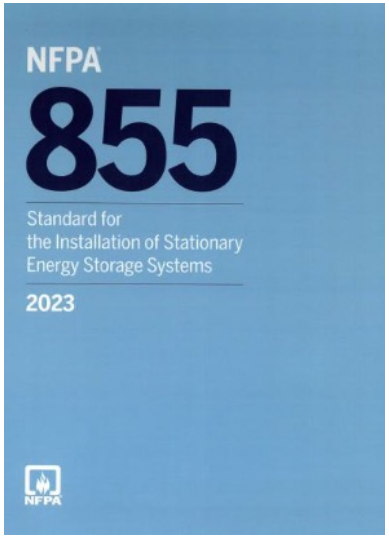
- **CERTIFICATIONS:**
  - Fire Instructor I, II - ProBoard Certified New York State
  - Incident Command System Instructor FEMA Cert E-449
  - Incident Command System 100, 200, 300, 400, 700 & 800a
  - All Hazards Liaison Officer – FEMA Certification
  - Incident Management Level 3 New Jersey DFS
  - HazMat On-Scene Incident Commander New Jersey DFS
  - Hazardous Material Technician II (120 hr.) FDNY
  - Firefighter 1 New Jersey DFS
  - Advanced Exterior Industrial Brigade - NFPA 1081 Texas A&M
  - Interior Structural Industrial Brigade NFPA - 1081 Texas A&M
  - Refrigeration Operating Engineer FDNY
  - Underground Storage Tank System Operator NYS DEC
  - NFPA 18 Technical Committee
  - NFPA 855 Technical Committee

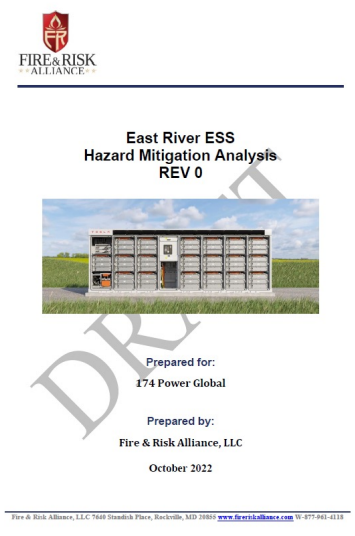
Overview

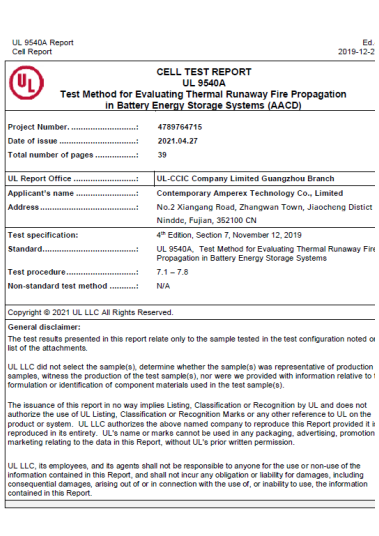
Section 1

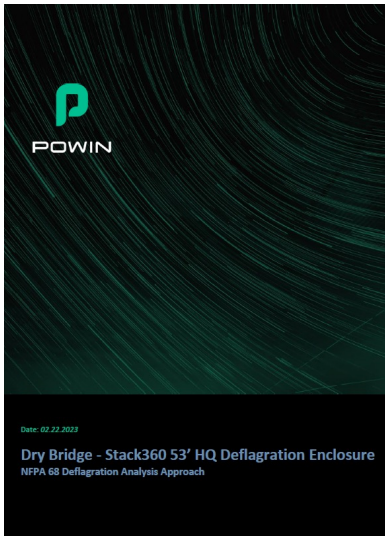
Introduction

Develop Fire Protection & Risk Assessment Standard



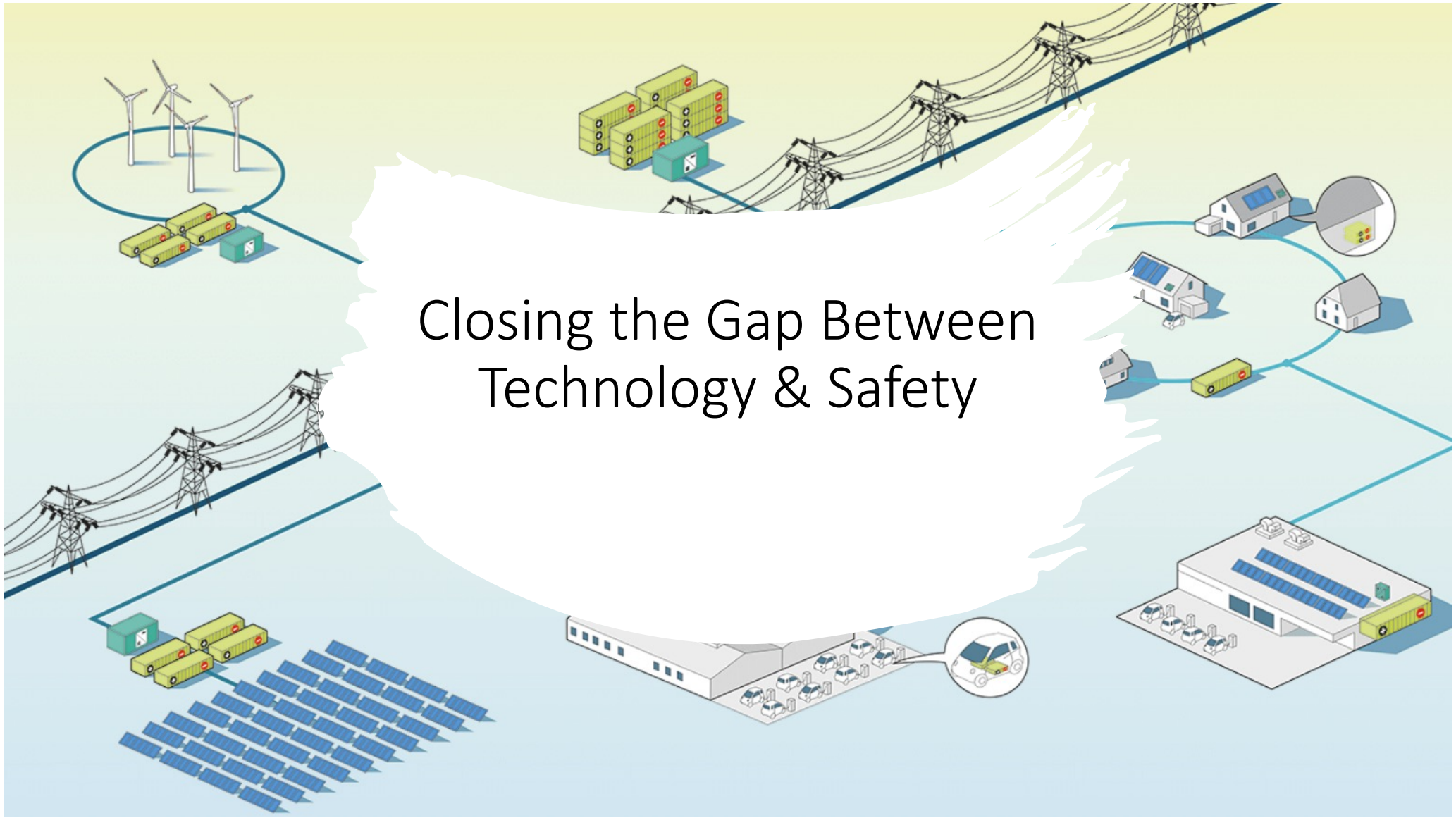







Introduction
Purpose
Applicable Codes and Standards
Community Risk Assessment
Minimum Design Documentation
BESS Classification and Spatial Separation
Fire Protection System Requirements
Explosion Mitigation Requirements
Commissioning Plan
Operations and Maintenance Plan
Decommissioning Plan
Emergency Response Plan

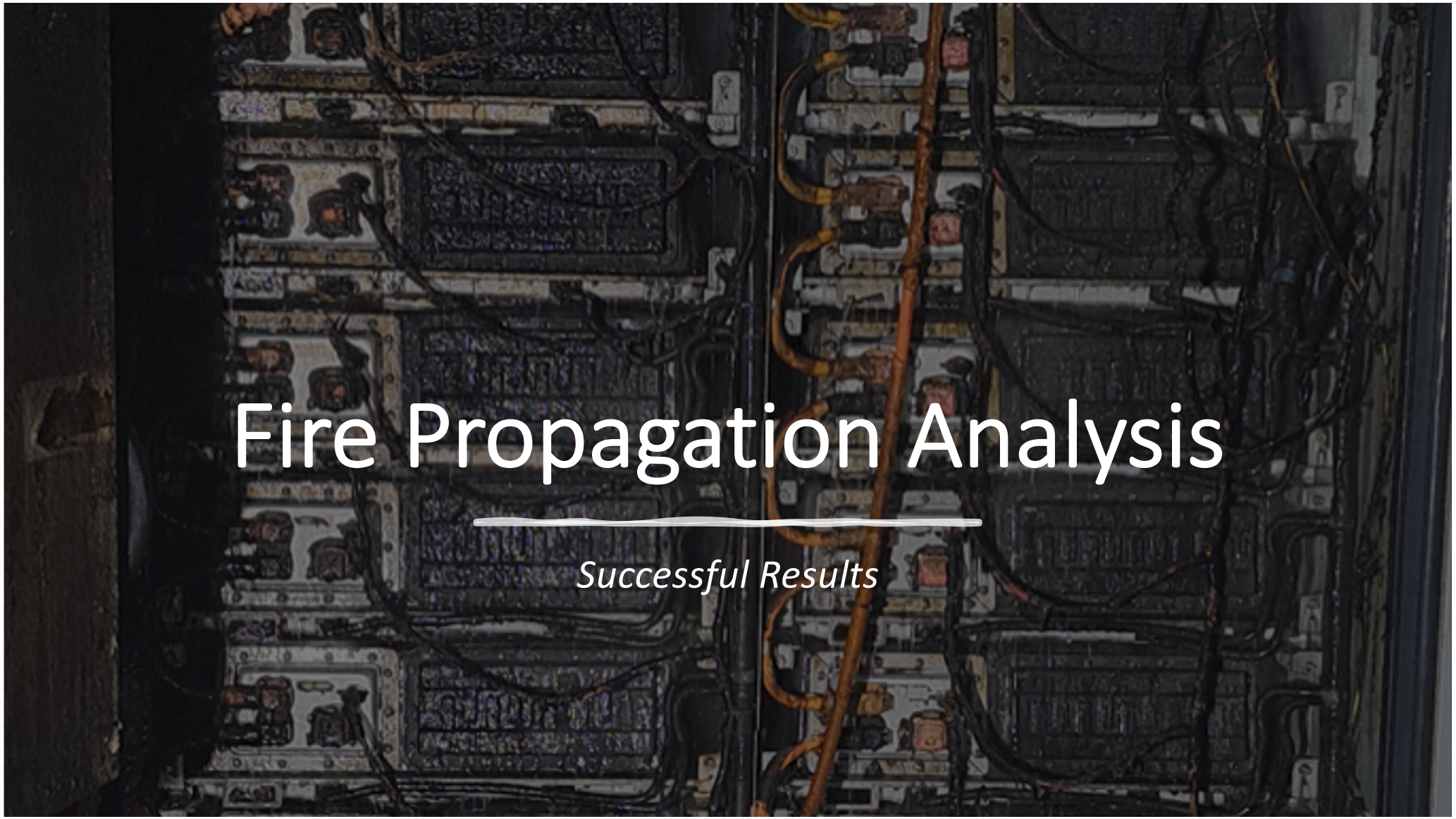

Interconnection Safety Standard


Closing the Gap Between
Technology & Safety

No Risk to Transmission Assets from BESS Failure

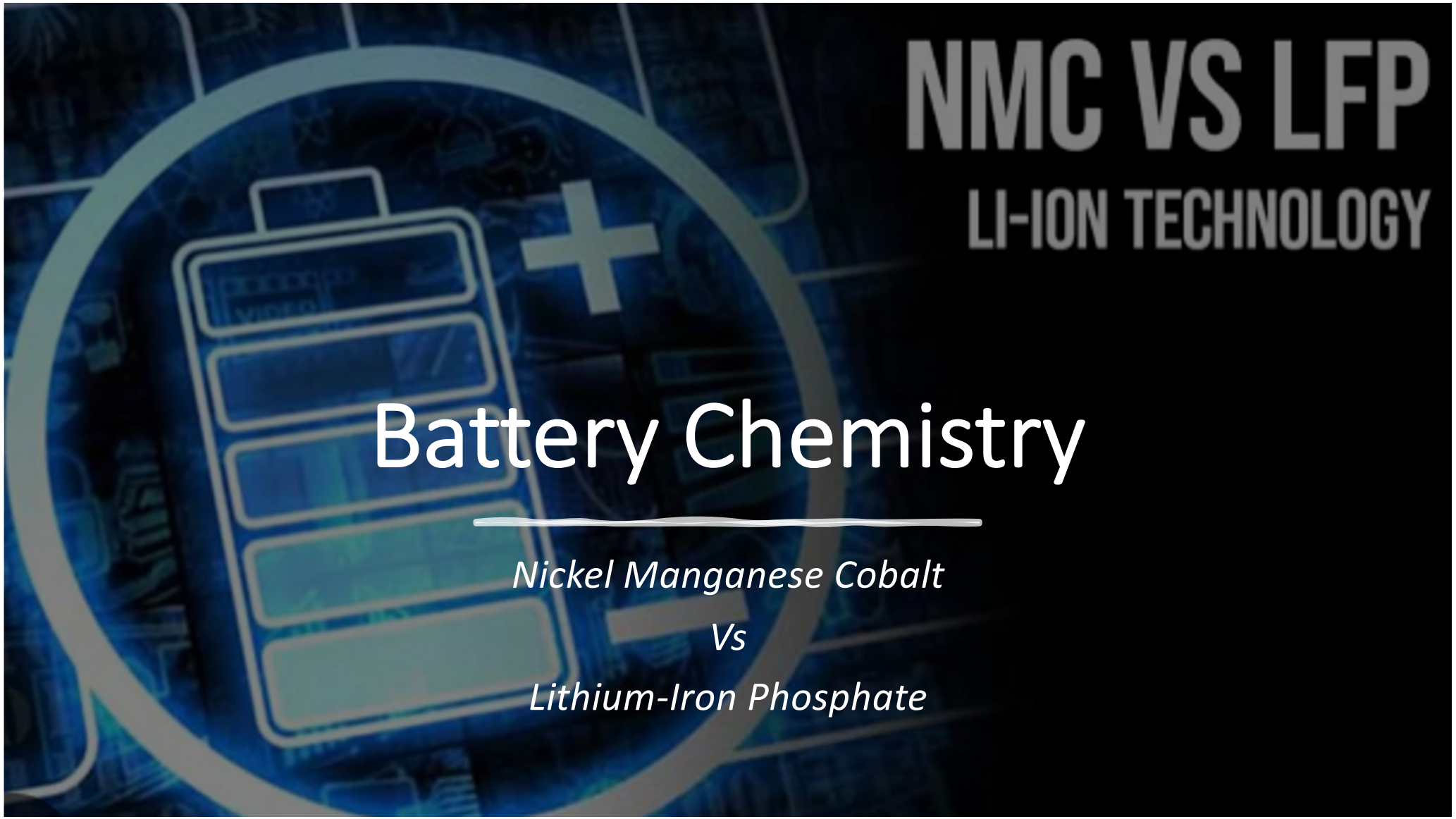
Requirements

Section 2



Fire Propagation Analysis

Successful Results



Battery Chemistry

Nickel Manganese Cobalt

Vs

Lithium-Iron Phosphate

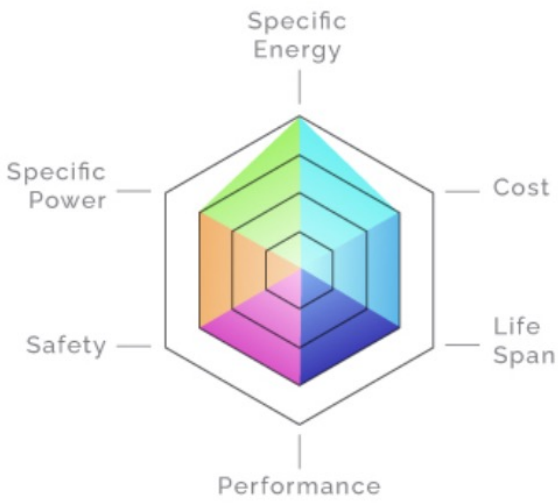

Manageable Hazards
NMC
LFP
GASOLINE
DIESEL

Nickel Manganese Cobalt (NMC)

Nickel Manganese Cobalt (NMC)

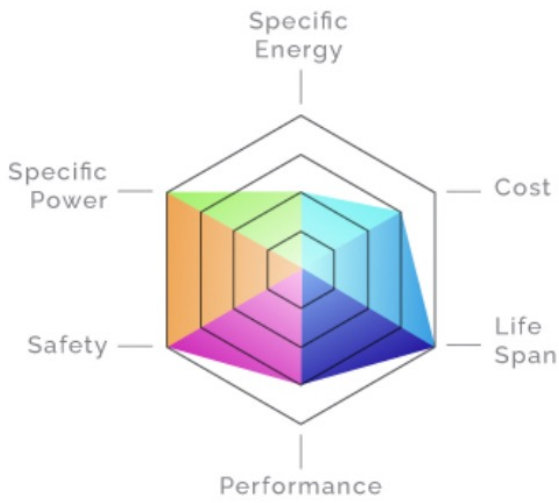
LITHIUM NICKEL MANGANESE COBALT OXIDE

NMC



LITHIUM IRON PHOSPHATE

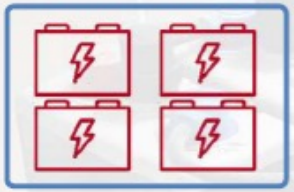
LFP



UL 9540A Test Hierarchy

Cell Level Test

- Whether cell can exhibit thermal runaway
- Thermal runaway characteristics
- Gas composition (flammability)



Module Level Test

- Propensity for propagation of thermal runaway
- Heat and gas release rates (severity/duration)
- Flaming/deflagration hazards

Unit Level Test

- Evaluation of fire spread
- Heat and gas release rates (severity/duration)
- Deflagration hazards
- Re-ignition hazards

Installation Level Test

- Effectiveness of fire protection system(s)
- Heat and gas release rates (severity/duration)
- Deflagration hazards
- Re-ignition hazards

Module Test

No Fire Propagation Beyond the Module

Hazard Mitigation Analysis (HMA)

FIRE & RISK ALLIANCE

STRATA CLEAN ENERGY

Hazard Mitigation Analysis for Outside Ground Mounted Battery Energy Storage Systems:
Dry Bridge BESS Facility, Chesterfield County, Virginia

DRAFT REPORT | REV0 | June 8, 2023

Explosion Mitigation

APS, Surprise AZ - April 19th, 2019

No Provisions for NFPA 68/69 Compliance

NFPA 68

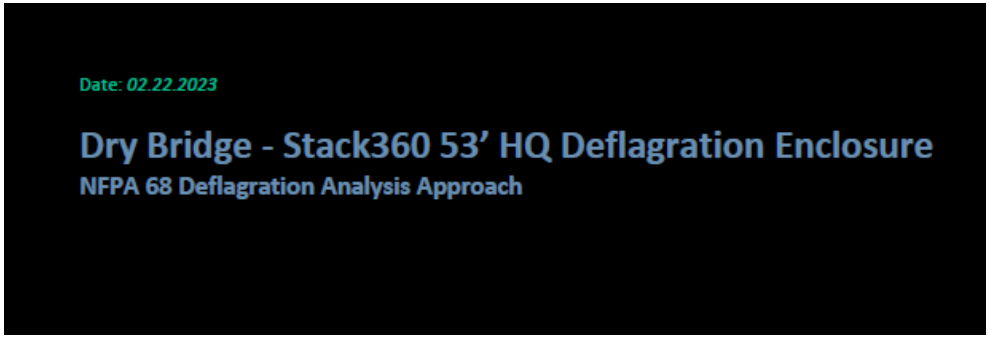

LS
LS
LS
NFPA 69

NFPA 68 or NFPA 69 Analysis

Powin Stack 360 53-ft Dual-Duct Roof C1D1 Exhaust Fan Explosion Prevention Analysis

Powin Stack 360 53-ft Dual-Duct Roof C1D1 Exhaust Fan Explosion Prevention Analysis

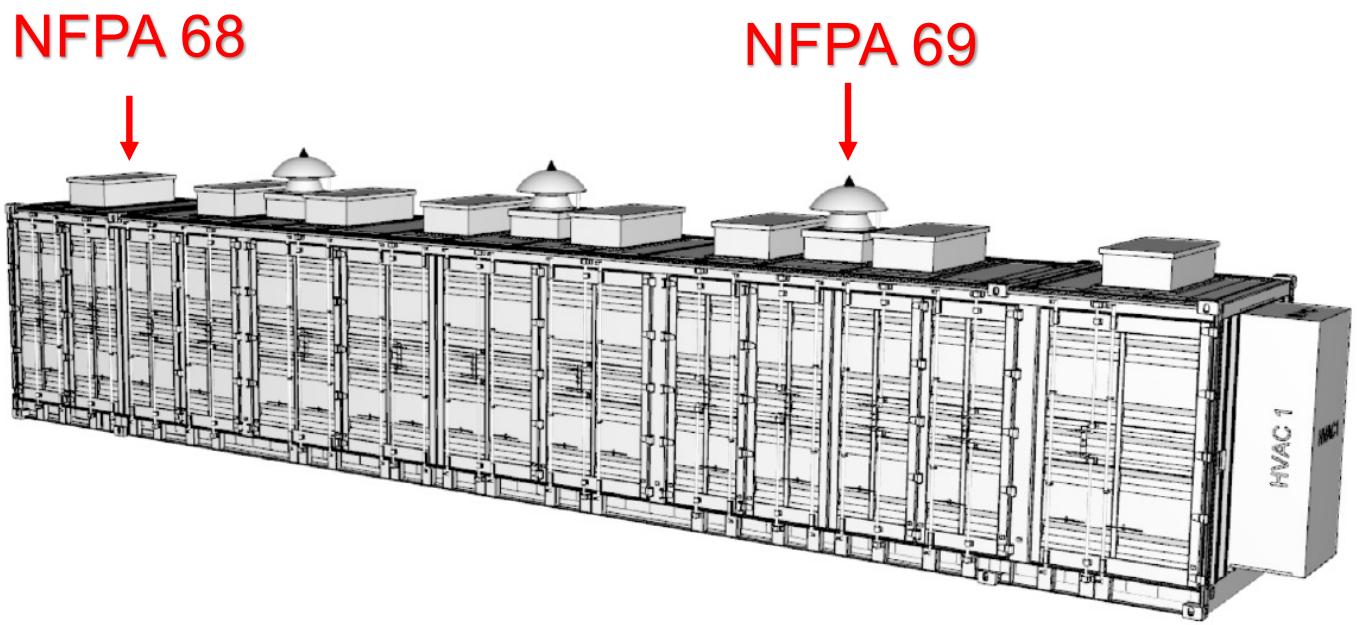
SUPPORTS NFPA 69 ANALYSIS



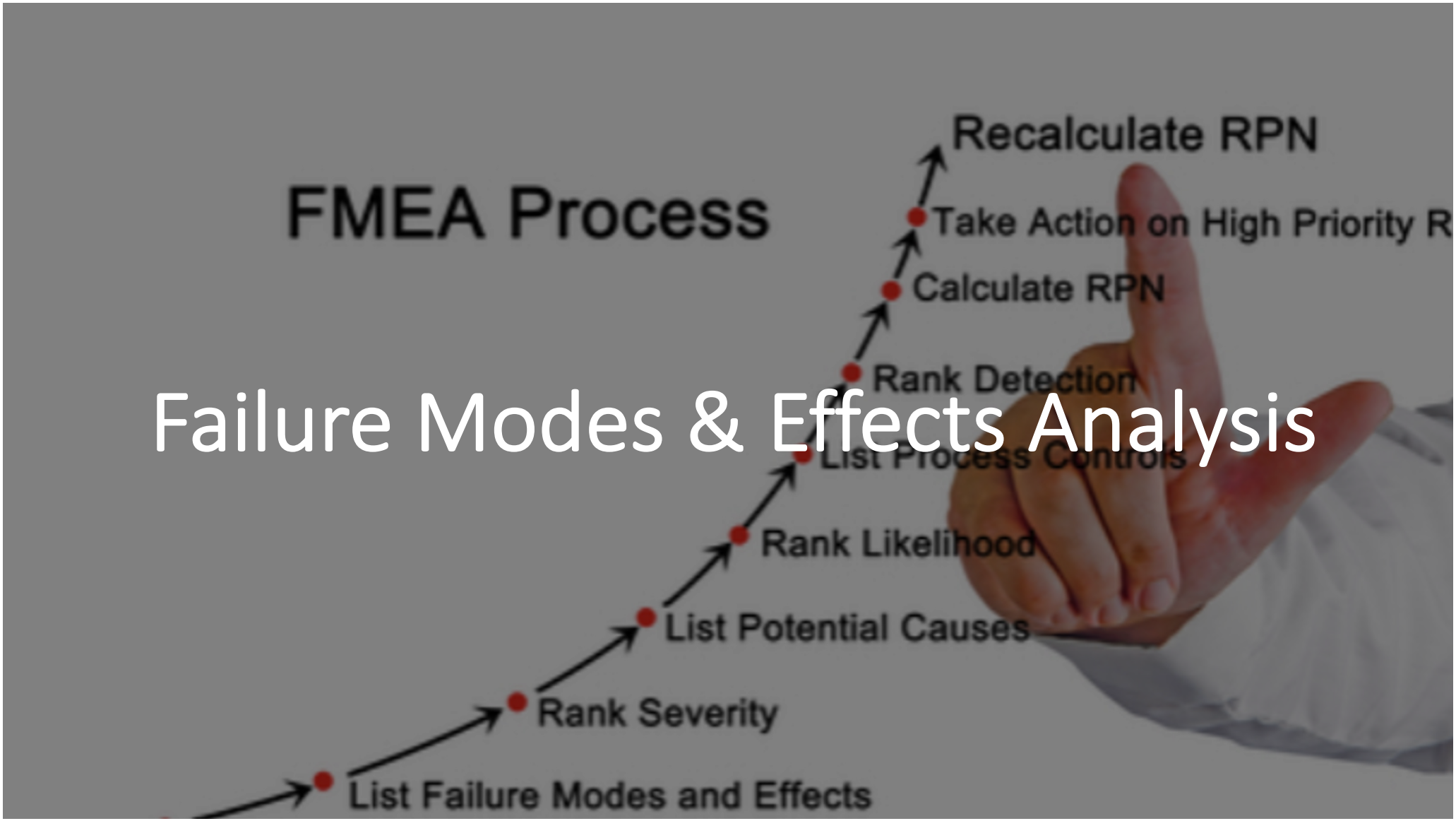
Number of Cells Required to Reach LFL

Event Description	*Number of Cells involved*	*Failure Mode*	*Average gas release rate (g/s)*	*Total Duration (min.)*	*Assumptions*
Single module failure	9	Cell overheating or power surge affecting one module	1.65	14.5	Propagation to all cells in one module

NFPA 855 Requires 1 Explosion Control Method




Tesla Explosion Control
22 Roof Vents w/ 12 Sparkers



Failure Modes & Effects Analysis

Fire Risk Assessment

Community Risk Assessment

FIRE & RISK ALLIANCE

WÄRTSILÄ

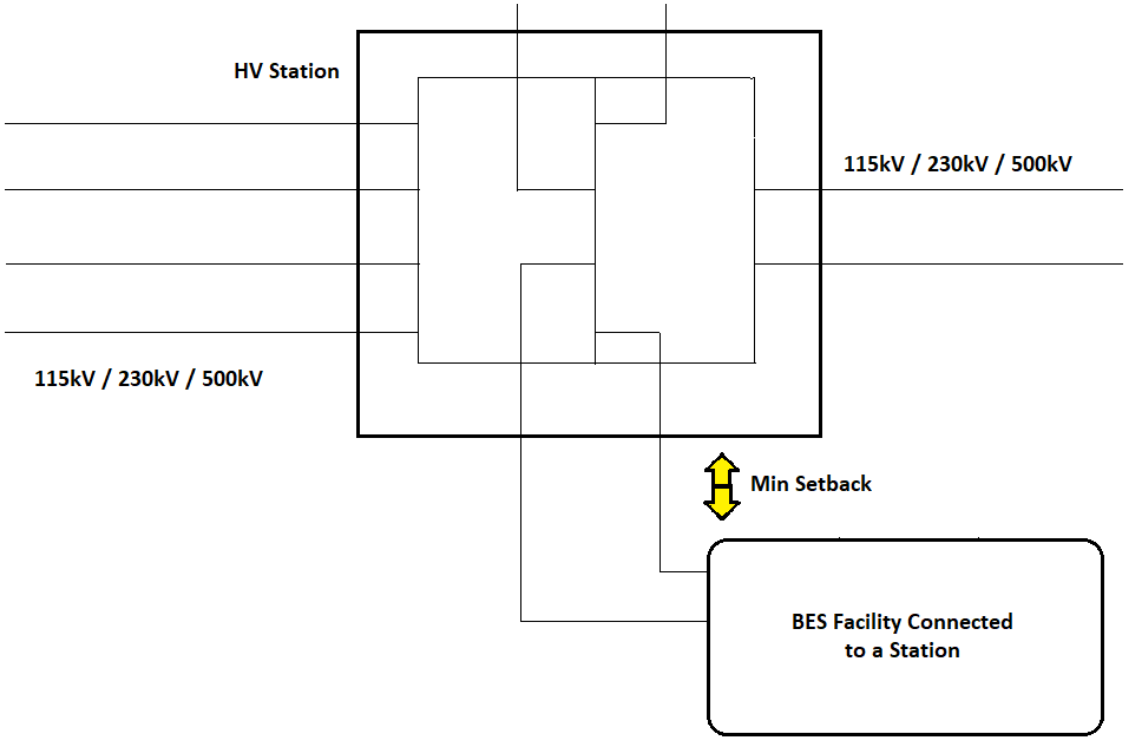
WÄRTSILÄ Quantum Cube

Fire Safety Assessment for Outdoor Ground Mounted Battery Energy Storage Systems: Moccasin Pointe, La Porte, TX

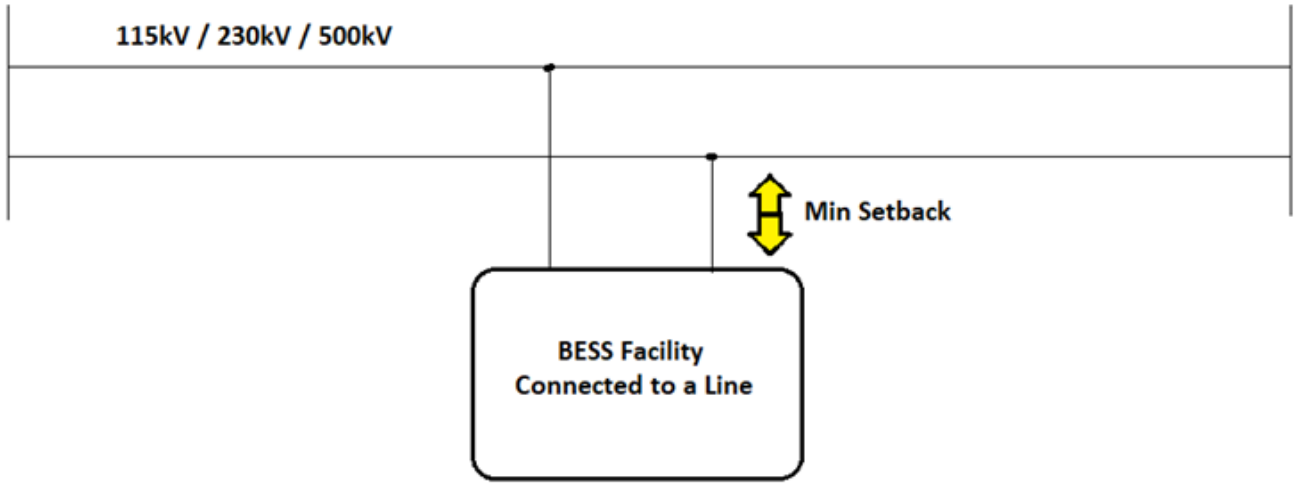
REV3 | April 14, 2023


Required Setbacks

Substation Setback



Transmission Corridor Setback



Setback Table

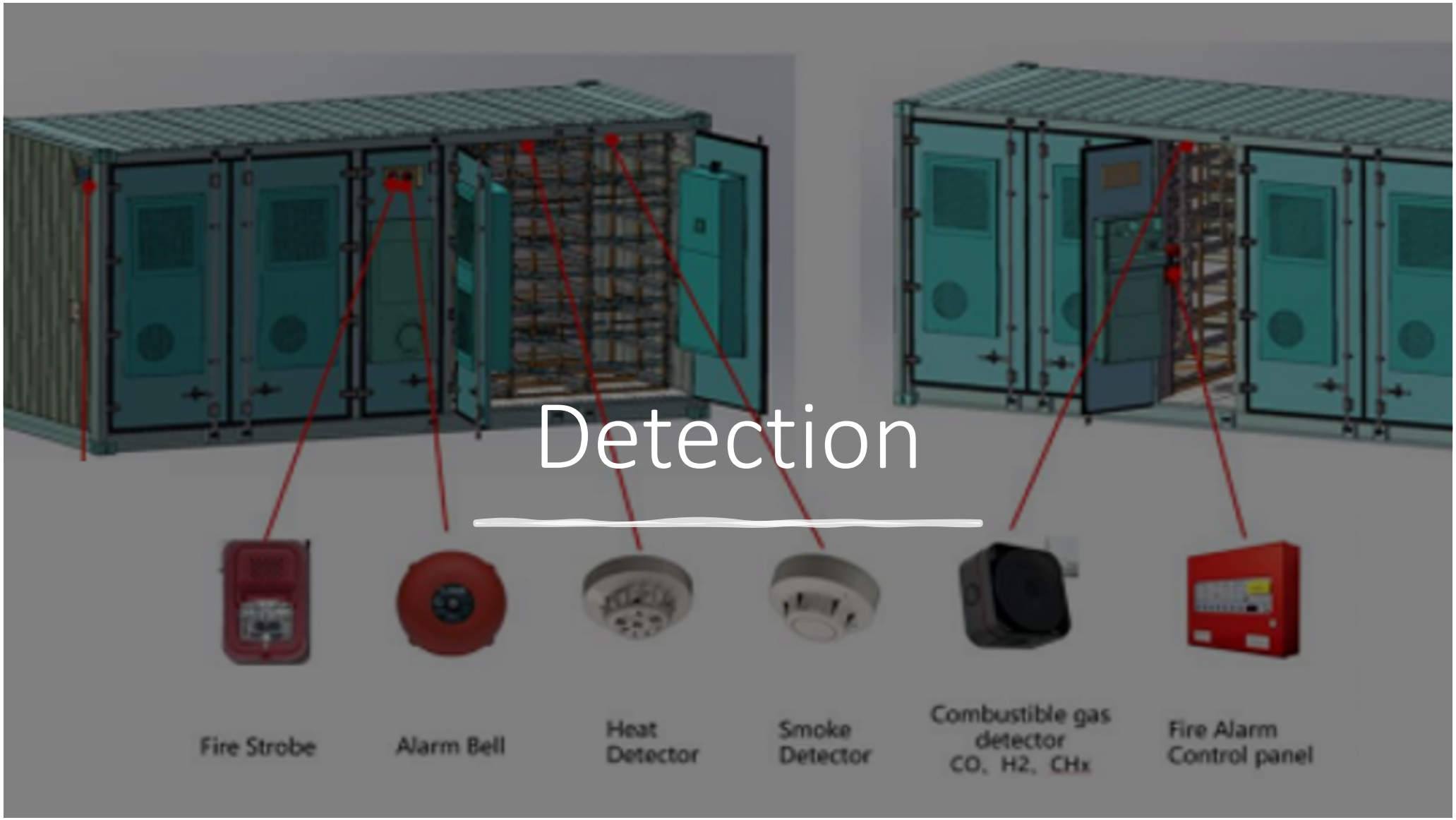
Item #	Hydro One Facilities	Hydro One Setback Distance[1,2]
1	Hydro One – 500 kV Right of Way (ROW)	150 meters
2	Hydro One – 230 kV ROW	100 meters
3	Hydro One – 115kV ROW	60 meters
4	Hydro One – 500 kV Substation	300 meters
5	Hydro One – 230 kV Switching Substation	200 meters
6	Hydro One 115kV Switching Substation or Hydro One 230kV & 115kV step down Substation	120 meters

1. All distances are from the edge of right of way or Hydro One station property line.
2. For proponents that have acquired property rights or own the BESS property prior to January 1, 2023, and cannot meet the above distances, the layout must be discussed with Hydro One for assessment and approval.

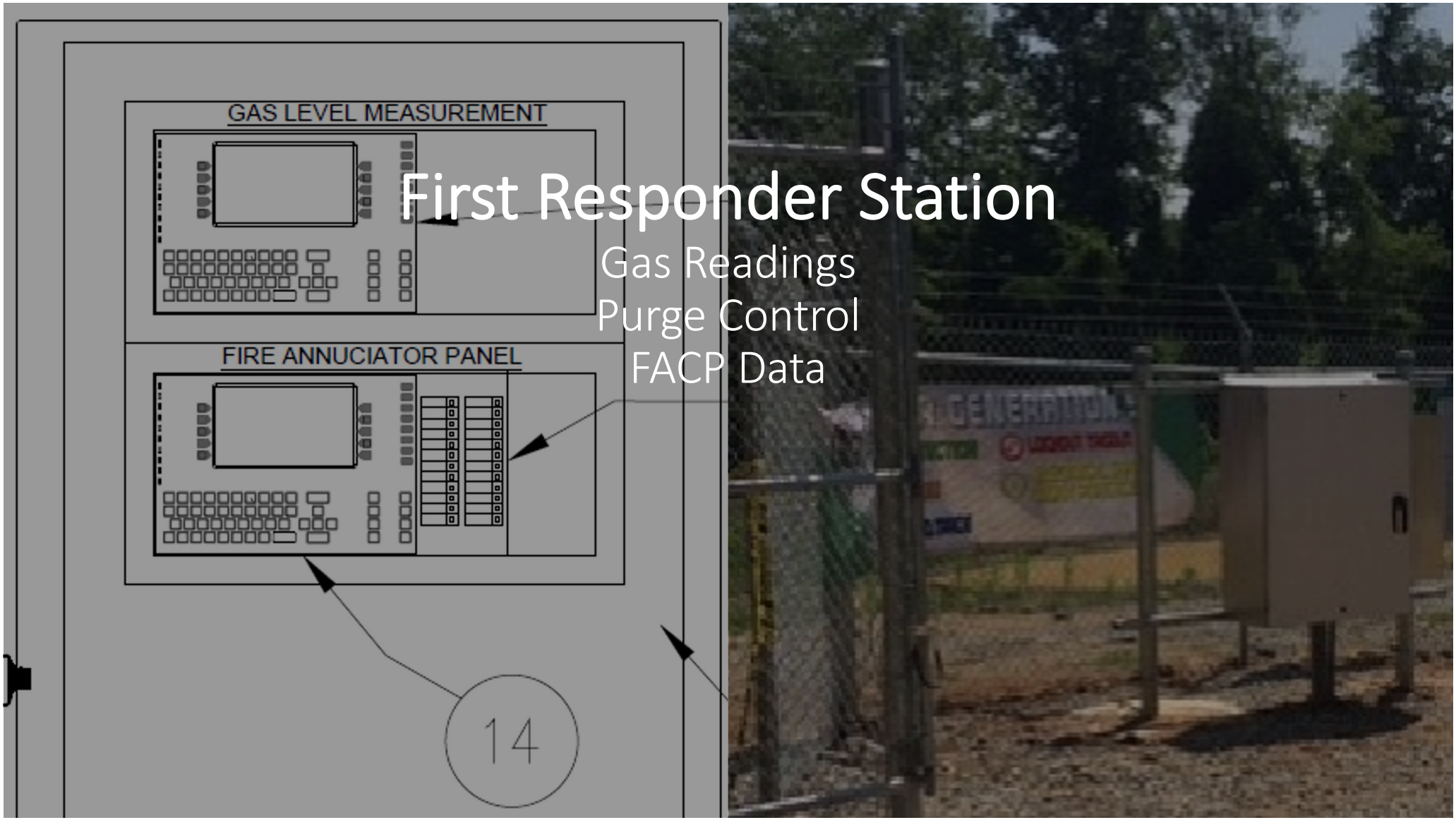
Assessments

Required Assessments	Up to 250m from Lines ROW	Up to 400m from Stations Property Line
• Hazard Mitigation Analysis (HMA) ○ Code Review ○ UL 9540 Listing ○ UL 9540A Test Report ○ Fault Condition Assessment	Required	Required
• Fire Risk Assessment (FRA) ○ Community Risk Assessment ○ Air/Gas Dispersion Study	Required	Required
• Fire Protection Design Documentation ○ Passive Fire Protection System ○ Active Fire Protection Systems	Required	Required
• Commissioning Plan	Required	Required
• Emergency Response Plan	Required	Required

Detection


Fire Strobe
Alarm Bell
Heat Detector
Smoke Detector
Combustible gas detector CO、H2、CHx
Fire Alarm Control panel

FACP to Central Station Monitoring



First Responder Station

Gas Readings
Purge Control
FACP Data


Fire Suppression
Changing Tactics

Why Do We Extinguish Fires ?

Life Safety & Preservation of Property


What They Think
&
What Actually Happened
Home › Future Tech › Electric Vehicles
TESLA'S CAR CRASH NEEDED 32,000 GALLONS OF WATER TO PUT OUT THE FIRE

Thermal Runaway

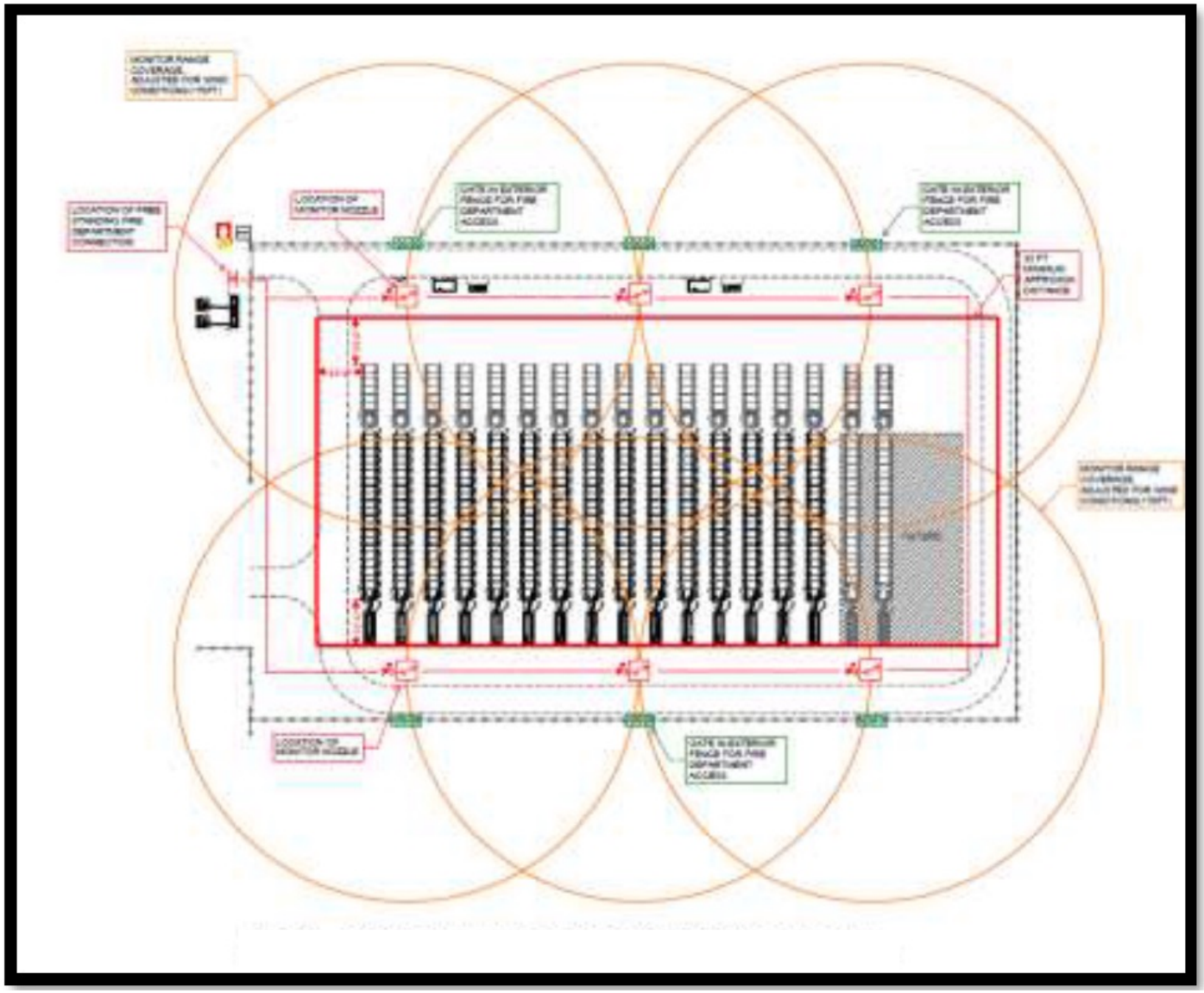
Vent Pressure 100 psi

Single Failure Loss


Spatial Seperation
NFPA 855 3’
FM Global 20’
Utility Standard 25’

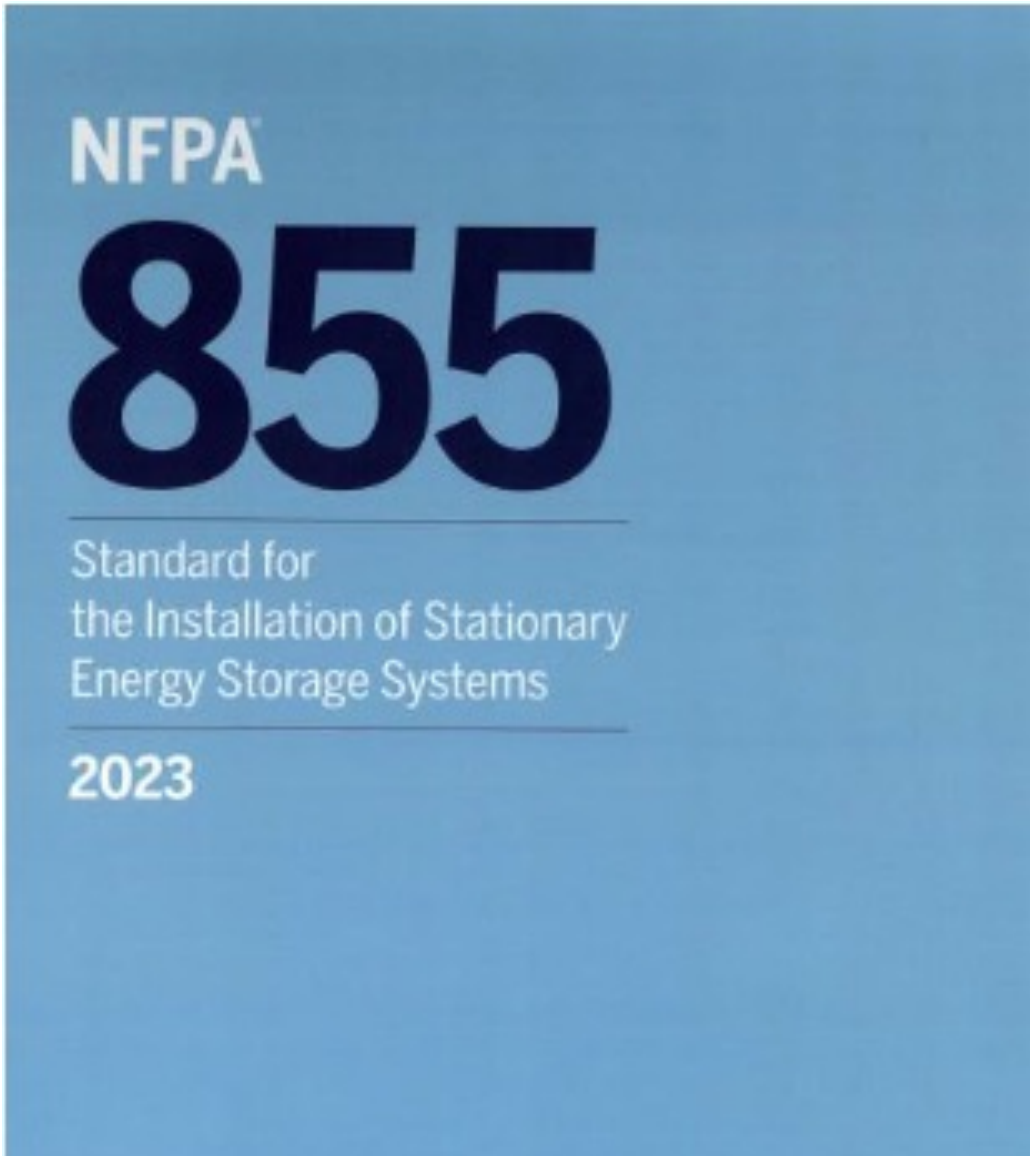
Do Not Install MVSkid Between Containers

Exposure Control




Vegetation Management

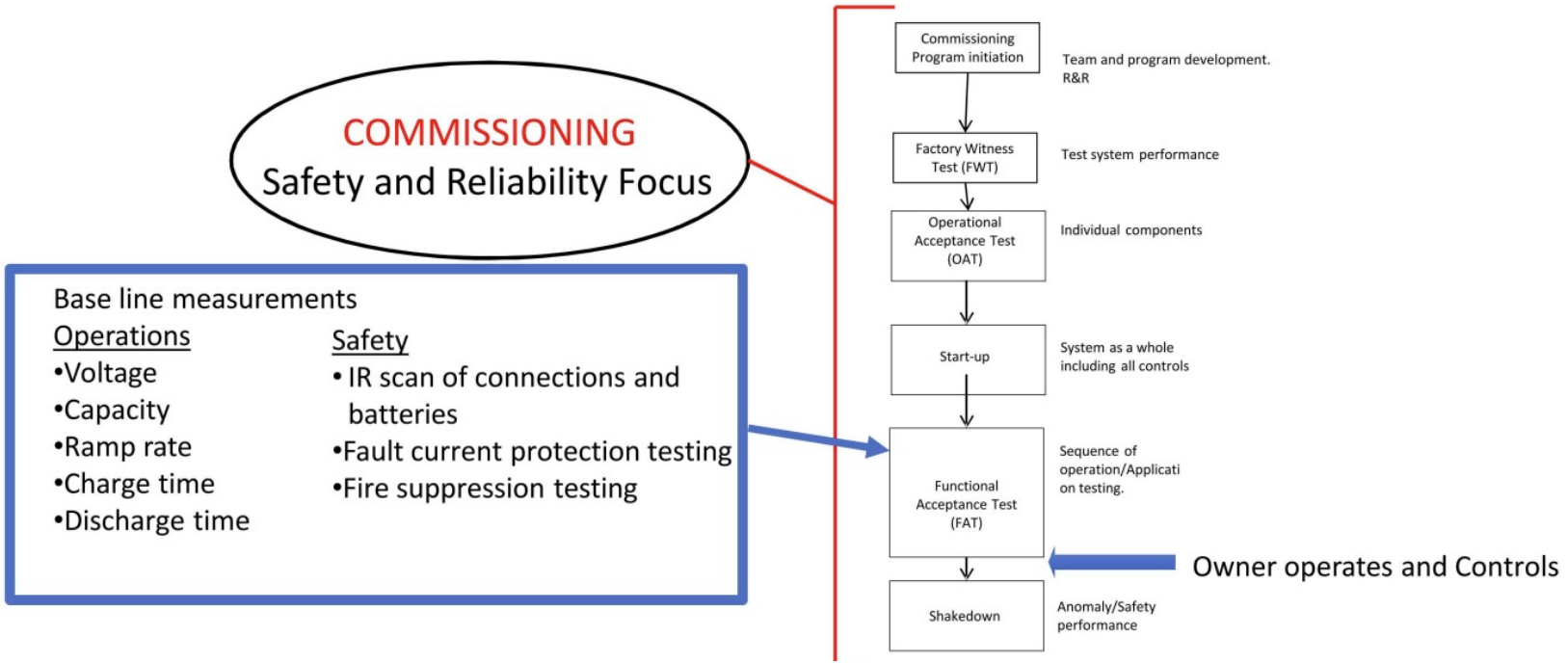
Required Plans



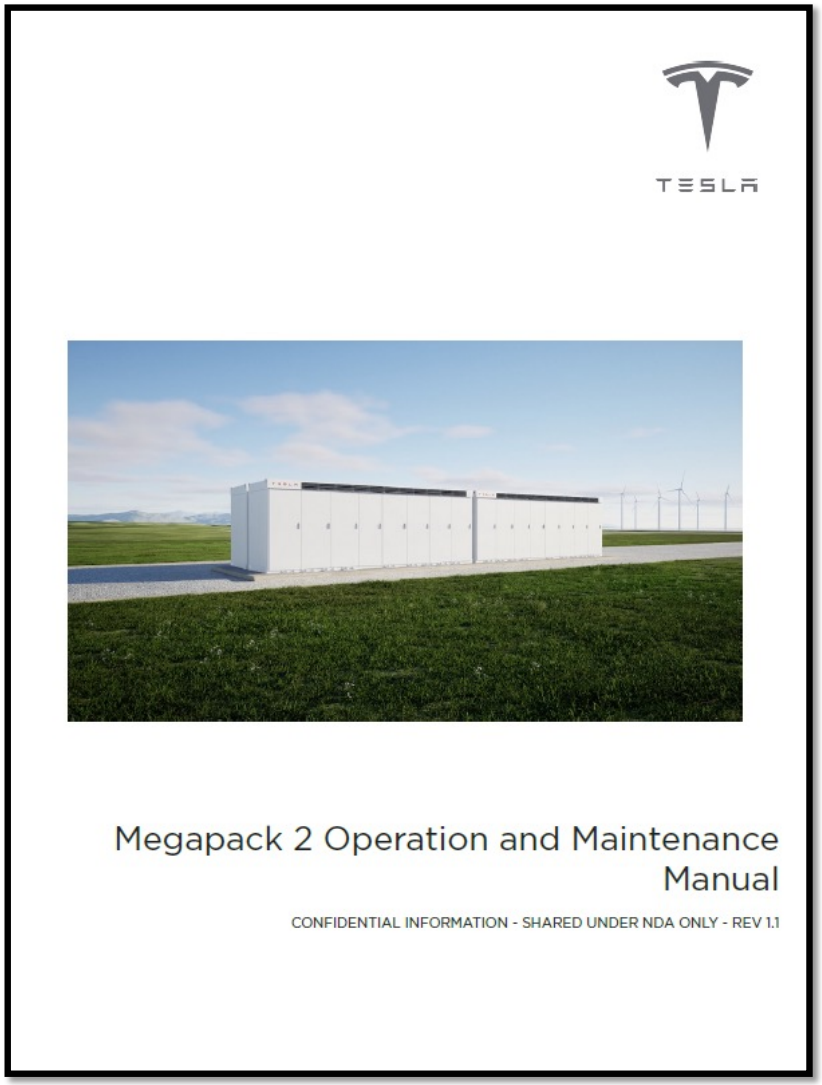
Commissioning Plan

15

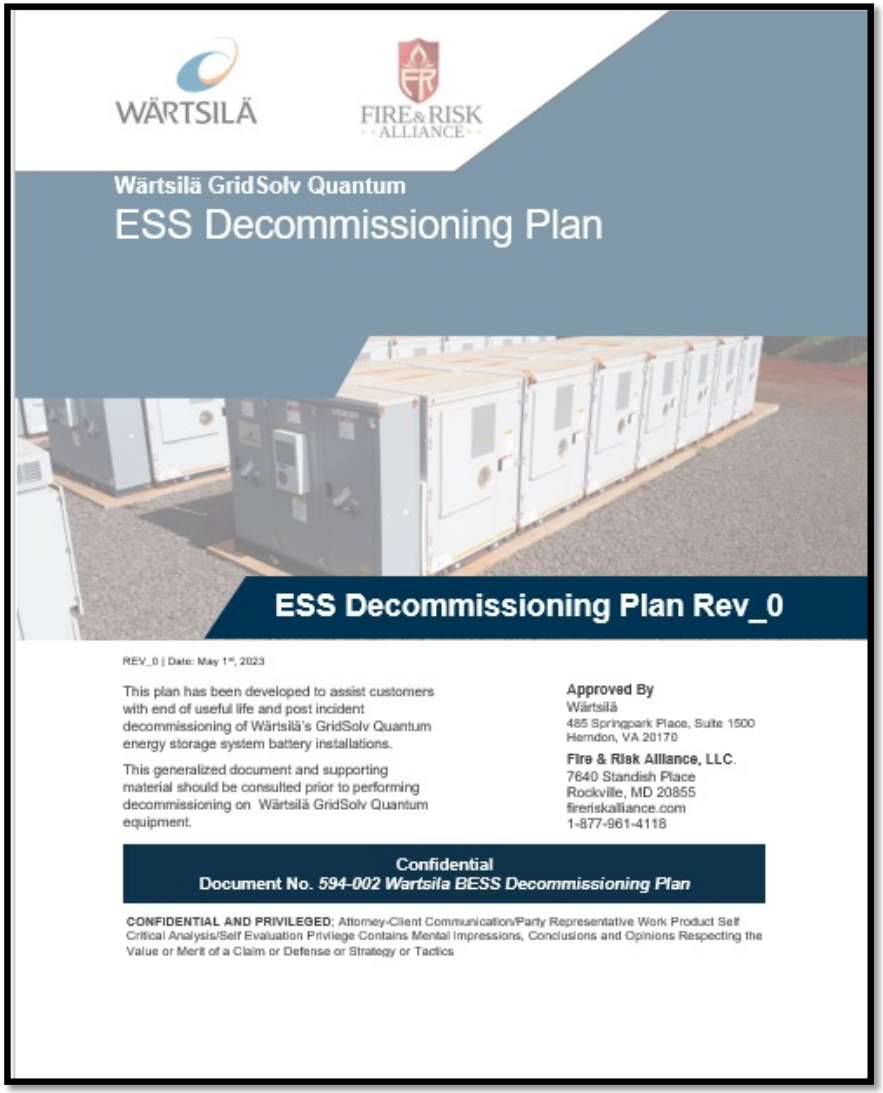
Commissioning / Testing Process details



Operations & Maintenance Plan



Decommissioning Plan



WÄRTSILÄ

FIRE & RISK ALLIANCE

Wärtsilä GridSolv Quantum

ESS Decommissioning Plan

ESS Decommissioning Plan Rev_0

REV_0 | Date: May 1st, 2023

This plan has been developed to assist customers with end of useful life and post incident decommissioning of Wärtsilä's GridSolv Quantum energy storage system battery installations.

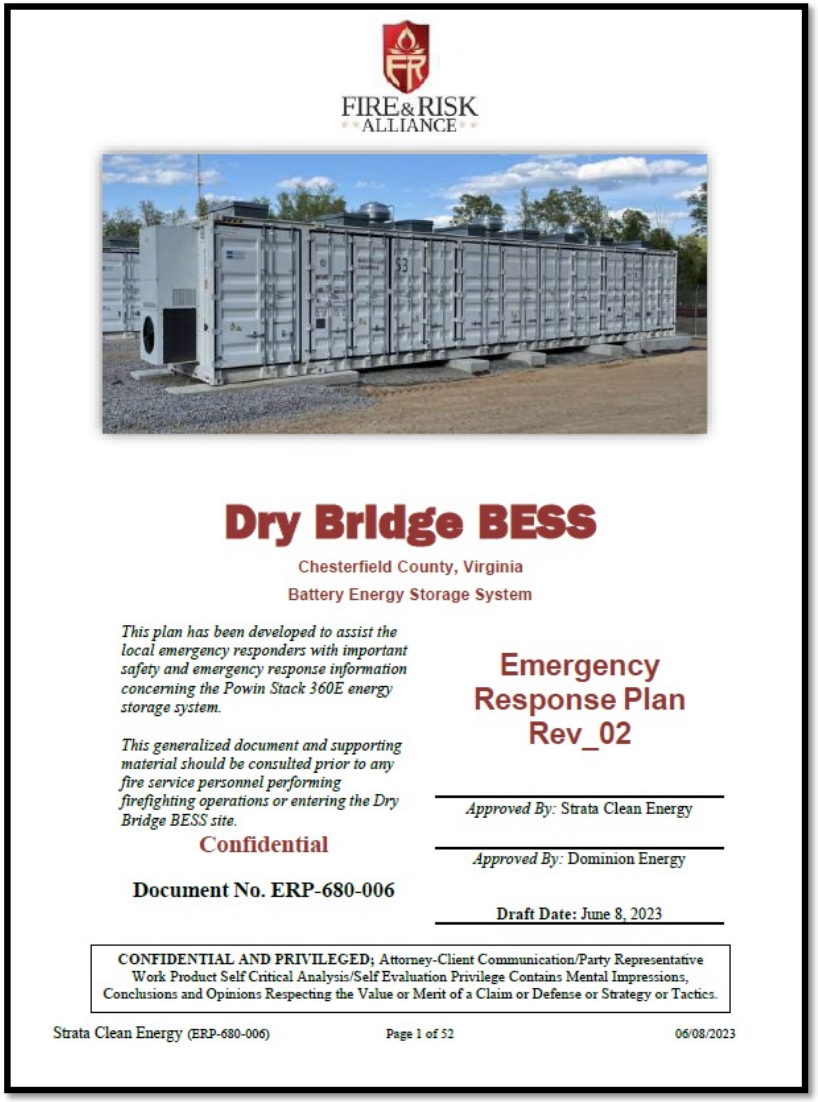
This generalized document and supporting material should be consulted prior to performing decommissioning on Wärtsilä GridSolv Quantum equipment.

Approved By
Wärtsilä
485 Springpark Place, Suite 1500
Herndon, VA 20170

Fire & Risk Alliance, LLC.
7640 Standish Place
Rockville, MD 20855
fireriskalliance.com
1-877-961-4118

Confidential
Document No. *594-002 Wartsila BESS Decommissioning Plan*

Emergency Response Plan



FIRE&RISK ALLIANCE

Dry Bridge BESS

Chesterfield County, Virginia

Battery Energy Storage System

This plan has been developed to assist the local emergency responders with important safety and emergency response information concerning the Powin Stack 360E energy storage system.

This generalized document and supporting material should be consulted prior to any fire service personnel performing firefighting operations or entering the Dry Bridge BESS site.

Confidential

Document No. ERP-680-006

Emergency Response Plan Rev_02

Approved By: Strata Clean Energy

Approved By: Dominion Energy

Draft Date: June 8, 2023

CONFIDENTIAL AND PRIVILEGED; Attorney-Client Communication/Party Representative Work Product Self Critical Analysis/Self Evaluation Privilege Contains Mental Impressions, Conclusions and Opinions Respecting the Value or Merit of a Claim or Defense or Strategy or Tactics.

Fire Department Training

Hazards & Response Tactics for BESS Emergencies


Familirarization Tours

Design Documentation

- Recommended documents to be submitted to Hydro One:
- Hazard Mitigation Analysis (HMA)
  - Code Review
  - UL 9540 Listing
  - UL 9540A Test Reports
  - Fault Condition Assessment
- Fire Risk Assessment (FRA)
  - Community Risk Assessment
  - Air/Gas Dispersion Study
- Fire Protection Design Documentation
  - Passive Fire Protection Systems
  - Active Fire Protection Systems
- Commissioning Plan
- Emergency Response Plan
- Signed and Sealed Document Assembly- Self Certification Document

Next Steps

Hydro One will post the Fire Protection Risk and Response Standard (FPRRAS) on the Transmission Connected Generator page by 21st July 2023.

Your comments are expected before 4th August 2023

For any questions or comments, please email us with a Subject Line "BESS Setback Enquiry" to:
largeaccounts@hydroone.com

Questions