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NAVIGATING FIRE PROTECTION FOR THE LITHIUM-ION ERA
SPRINKLER DESIGN FOR BATTERY SYSTEMS: APPLYING NFPA 855 AND NFPA 13
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ESRG
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Energy Safety Response Group (ESRG)
Roles:
Chief Operating Officer, ESRG
Lead business strategy, oversee business operations, business development, and thought leadership for the organization.
Fire Protection Research Foundation, NFPA
Led the energy transition research portfolio and supported fire protection systems (suppression/detection/electrical) research efforts.
Heritage Fire Protection, Inc.
Sprinkler contractor – project management, engineering, design and account management.
Fire Protection Engineer: BS/MS in Fire Protection Engineering
SFPE Handbook of Fire Protection Engineering Deputy Editor, and author of "Automatic Sprinkler System Design Considerations and Calculations" Chapter
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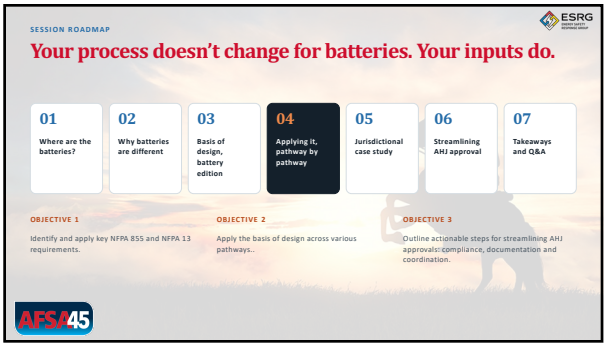
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SESSION ROADMAP
Your process doesn't change for batteries. Your inputs do.
01 Where are the batteries?
02 Why batteries are different
03 Basis of design, battery edition
04 Applying it, pathway by pathway
05 Jurisdictional case study
06 Streamlining AHJ approval
07 Takeaways and Q&A
OBJECTIVE 1
Identify and apply key NFPA 855 and NFPA 13 requirements.
OBJECTIVE 2
Apply the basis of design across various pathways..
OBJECTIVE 3
Outline actionable steps for streamlining AHJ approvals: compliance, documentation and coordination.
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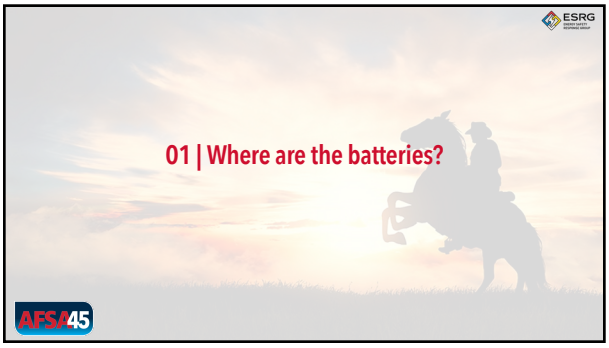
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01 | Where are the batteries?
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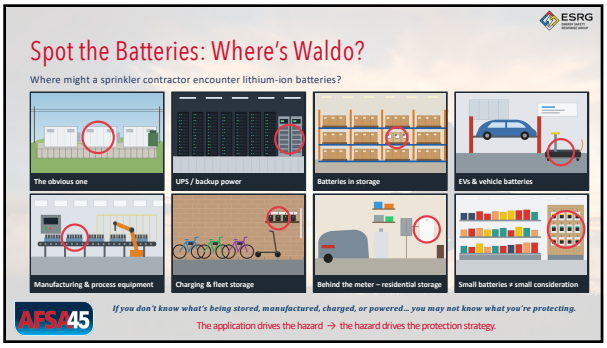
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Spot the Batteries: Where's Waldo?
Where might a sprinkler contractor encounter lithium-ion batteries?
The obvious one
UPS / backup power
Batteries in storage
EVs & vehicle batteries
Manufacturing & process equipment
Charging & fleet storage
Behind the meter – residential storage
Small batteries ≠ small consideration
If you don't know what's being stored, manufactured, charged, or powered... you may not know what you're protecting.
The application drives the hazard → the hazard drives the protection strategy.
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Different Risk Landscapes
BESS in NYC application
BESS in Remote Environment
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Battery Terminology
Cells
Modules
Units/Racks
BOS
ESS Installations
Residential (kWh)
Commercial (kWh – MWh)
Utility-Scale (MWh – GWh)
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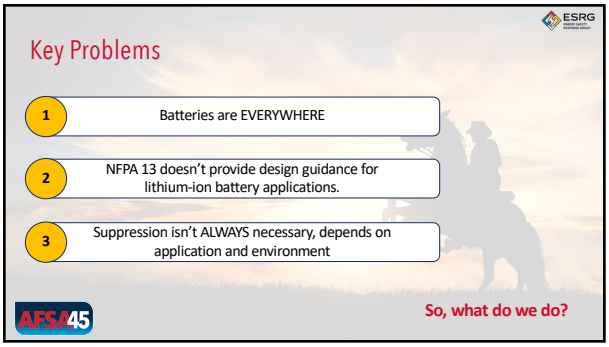
Key Problems
1 Batteries are EVERYWHERE
2 NFPA 13 doesn't provide design guidance for lithium-ion battery applications.
3 Suppression isn't ALWAYS necessary, depends on application and environment
So, what do we do?
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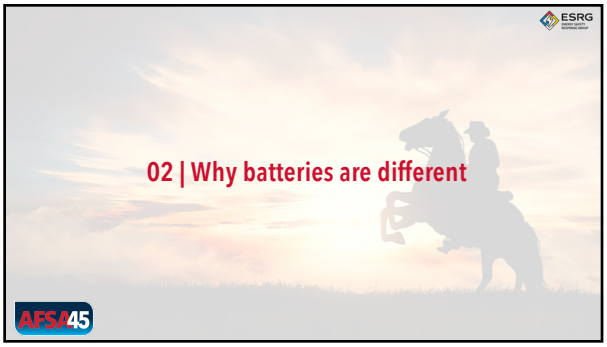
02 | Why batteries are different
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Thermal Runaway in a Lithium Ion Battery
This…
Is Happening…
Inside this…
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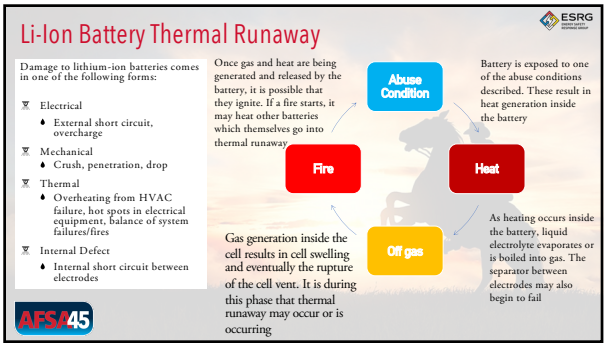
Li-Ion Battery Thermal Runaway
Damage to lithium-ion batteries comes in one of the following forms:
Electrical
External short circuit, overcharge
Mechanical
Crush, penetration, drop
Thermal
Overheating from HVAC failure, hot spots in electrical equipment, balance of system failures/fires
Internal Defect
Internal short circuit between electrodes
Once gas and heat are being generated and released by the battery, it is possible that they ignite. If a fire starts, it may heat other batteries which themselves go into thermal runaway
Abuse Condition
Fire
Heat
Off gas
Battery is exposed to one of the abuse conditions described. These result in heat generation inside the battery
As heating occurs inside the battery, liquid electrolyte evaporates or is boiled into gas. The separator between electrodes may also begin to fail
Gas generation inside the cell results in cell swelling and eventually the rupture of the cell vent. It is during this phase that thermal runaway may occur or is occurring
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FIRE AND EXPLOSION HAZARD

Li-ion Batteries present both a fire and explosion hazard – simultaneously

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Li-ion's Biggest Concern – Off-gas

- Off-gas is one of the biggest concerns with li-ion batteries
- During thermal runaway, gas production becomes immense, producing several liters of gas per Ah capacity of the cell. Total gas produced thus depends on:
  - Chemistry,
  - Form factor,
  - Failure mode,
  - Environment (O2 level)
  - Cell size

A large format LFP battery, after venting for several minutes, finally goes into thermal runaway

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Oftentimes the gases ignite…

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Impact of Size + Capacity | Variability in Concentration

Smaller Capacity; Older Design

Larger Capacity; Newer Design

despite controls, no battery fire is the same

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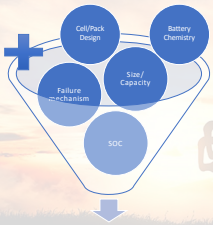
Variables Impacting Fire Behavior



Fire/Gas Behavior

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Chemistry Debate – Impacting Hazard Class

Debate over whether the chemistry type should impact hazard classification: NMC (higher hazard) than LFP (lower hazard)

NMC — nickel manganese cobalt

- Unstable around 160°C (320°F); burns as hot as 800°C (1,472°F).
- A violent 10–30 second ejection of gas, liquid and burning solids through the cell vent — fuel, oxygen and ignition source arriving together.
- Denser, so a smaller footprint for the same megawatt-hours.

LFP — lithium iron phosphate

- Stable to roughly 230°C (446°F); runaway near 620°C (1,148°F).
- Less intense flame, but testing to date shows it produces far more gas — including hydrogen — when it fails.
- Roughly half the field failures ESRG worked in a recent twelve-month period were LFP, mostly from commissioning, human factors and electrical issues.

ESRG's position: do not protect differently based on chemistry.
The difference is closer to gasoline versus diesel than to safe versus unsafe.

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UNIQUE ASPECT OF LITHIUM ION BATTERIES

Every battery fire is unique.
Countless variables that impact fire behavior.

Hazard or commodity class for LIBs still doesn't exist, prescriptively.

Large Scale Fire Testing

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Water and Batteries

What happens when water is applied, when it's appropriate, and when it's not

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WHY BATTERIES ARE DIFFERENT

Sprinklers control and cool.

They don't stop thermal runaway inside a module.

What water does well

Cools adjacent racks and structure,
Delays or prevents rack-to-rack spread,
Protects the building.

What water/ceiling sprinklers can't do

Reach cells inside a module/ rack,
Halt a cell already in runaway,
Manage explosion risk,
Prevent reignition hours later.

Where is it appropriate to use them for batteries?

Starts with your goal for protection.

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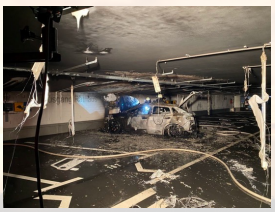
Sprinklers in Parking Garages

- Where sprinklers are present in parking structures, fire spread has been limited and fires generally contained, regardless of vehicle type – ICE or EV.
- Research also confirms EV fires are manageable with overhead sprinkler protection. More details forthcoming on debate between OH2 and EH1.



Marienplatz parking garage originating vehicle and surrounding fire scene. (Source: Feuerwehr Ravensburg)

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Sprinklers protecting batteries in storage

- Research from FM and the Fire Protection Research Foundation shows batteries in standard packaging in storage behaves more like an ordinary combustibles fire than a battery fire – if it is caught early before there is significant involvement from the batteries

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Dedicated Use BESS Buildings – with Sprinkler Protection

- Dedicated-use BESS building. Repurposed turbine hall was 300 MW; 1200 MWh
  - Total site capacity ~750 MW
- Largest BESS fire to date. Investigation still underway
- Designed prior to release of NFPA 855
- Suppression
  - In-rack thermal runaway management system (TRMS)
  - Ceiling level sprinkler protection
- Resulted in structural collapse.

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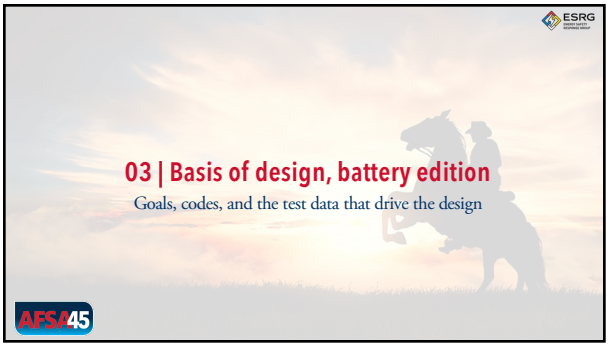

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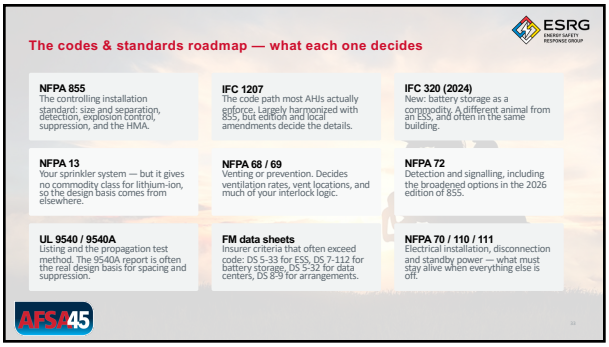

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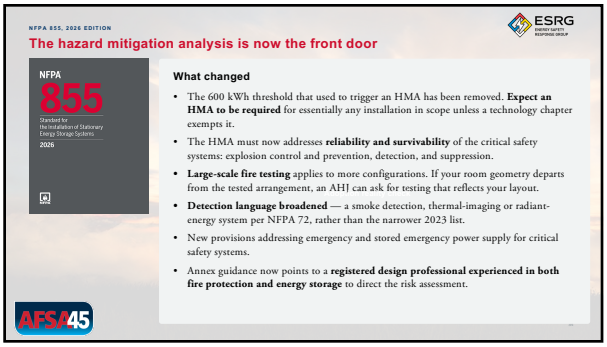

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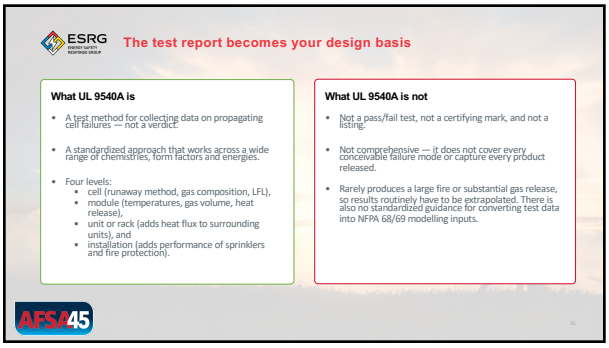

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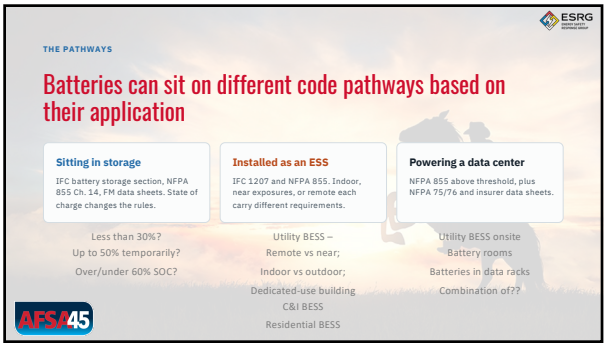

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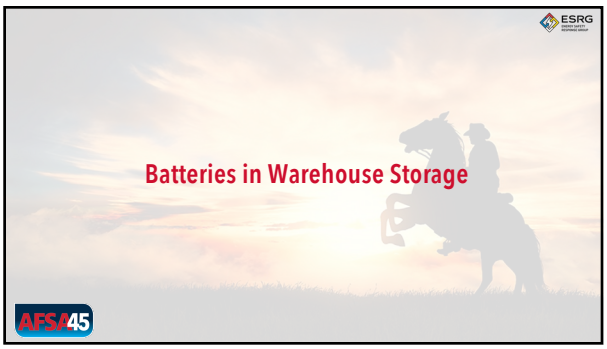

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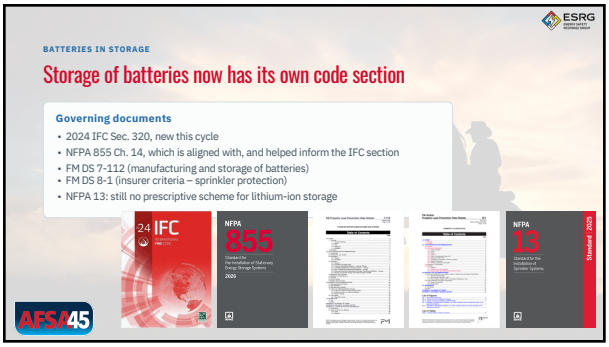

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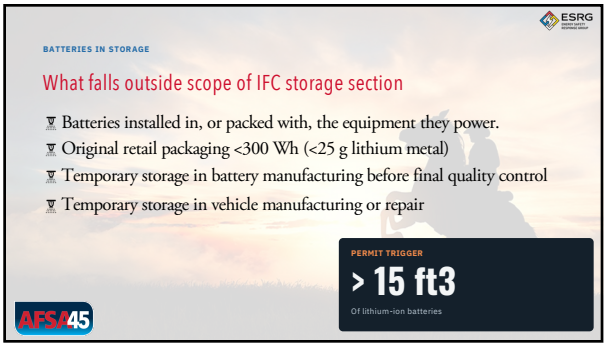

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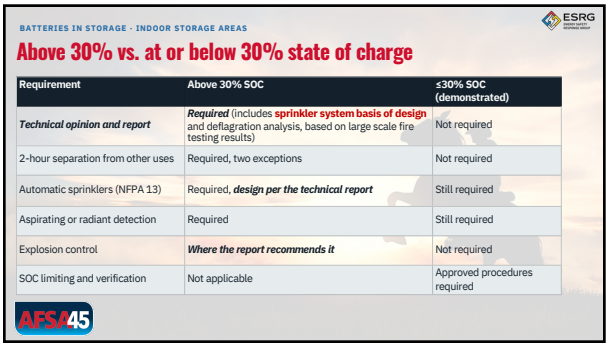

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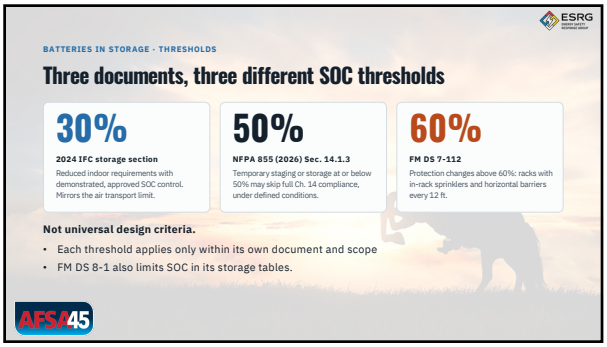

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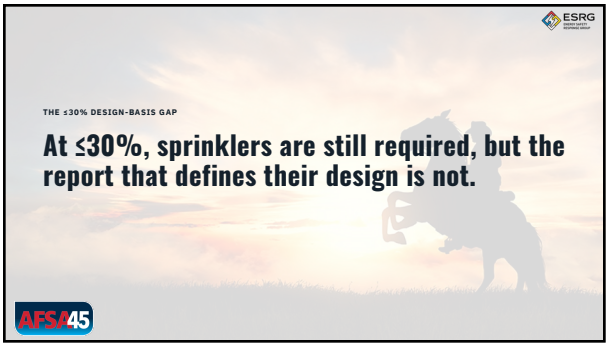

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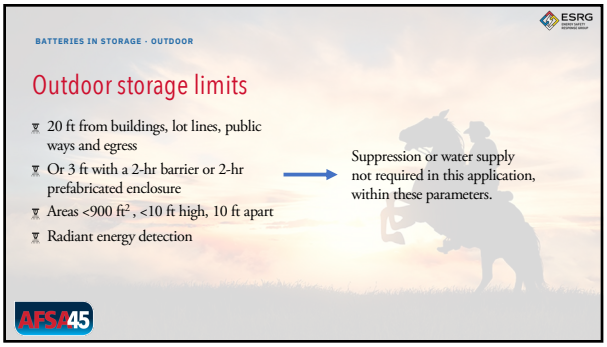

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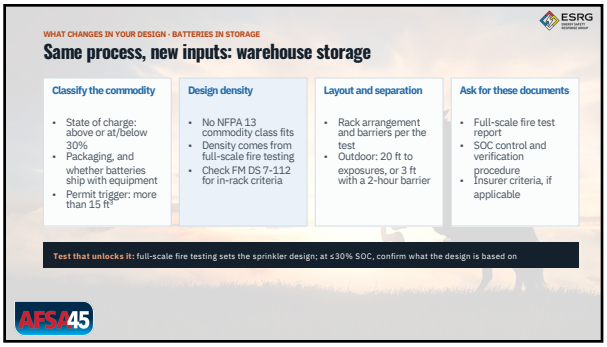

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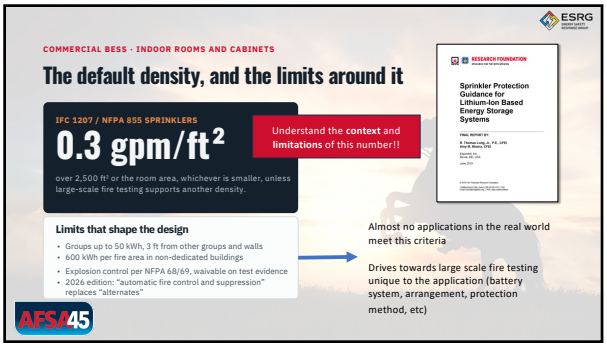

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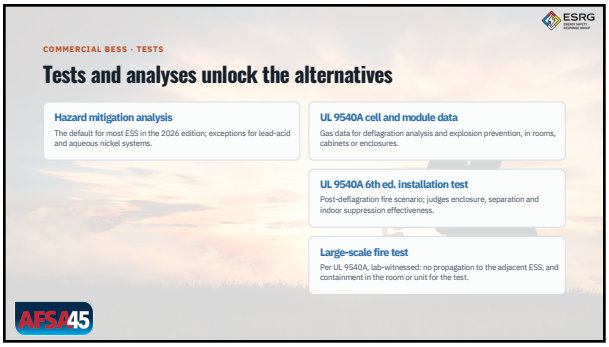

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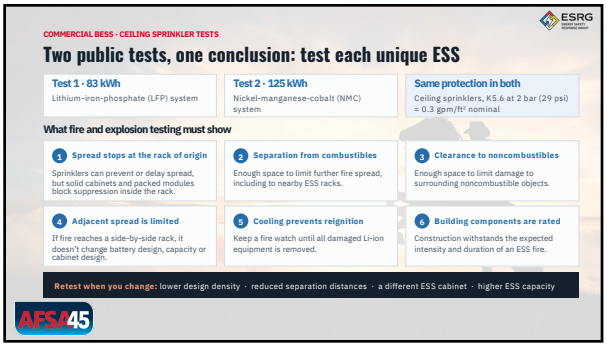

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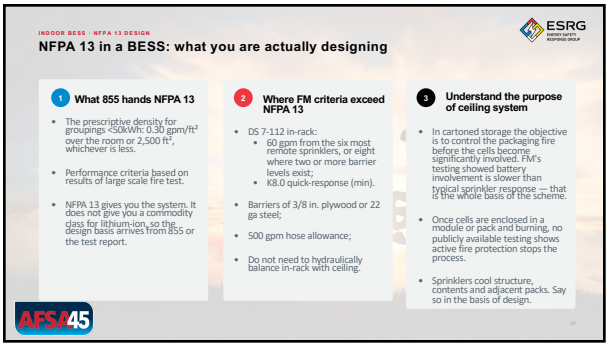

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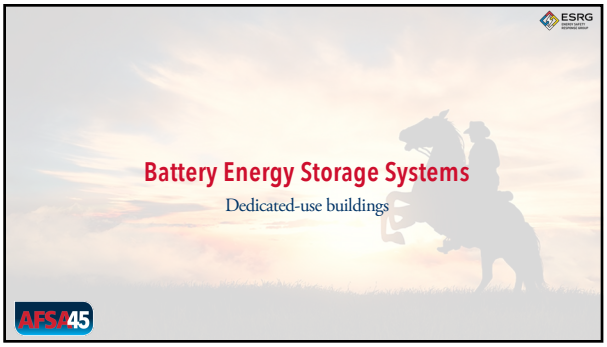

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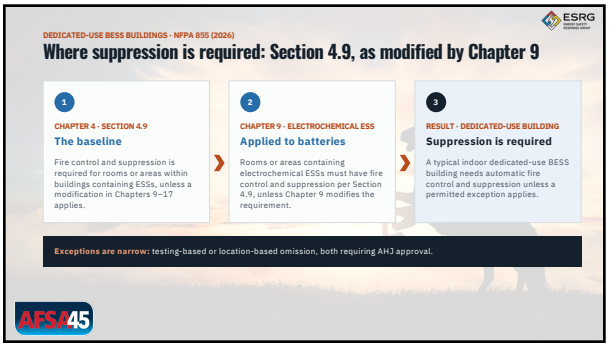

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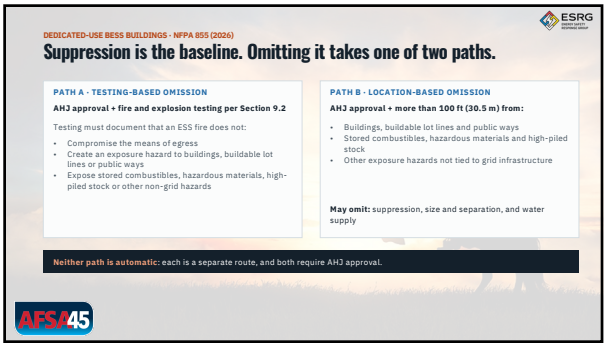

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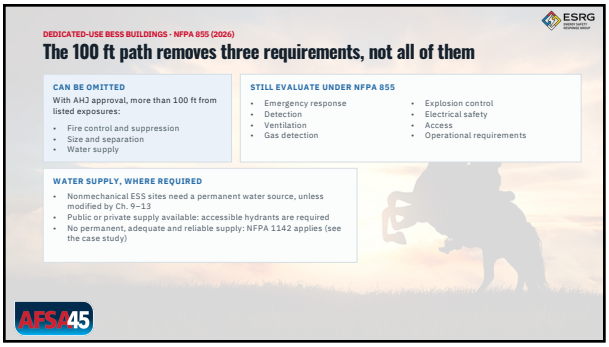

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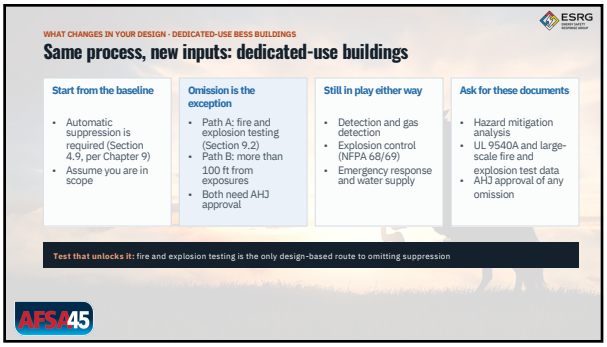

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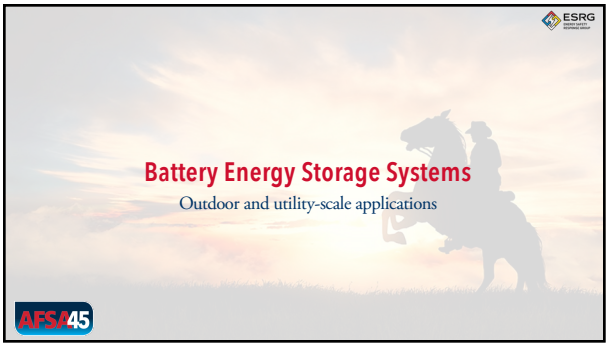

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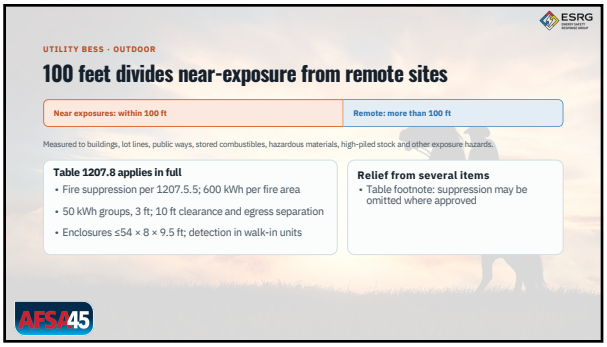

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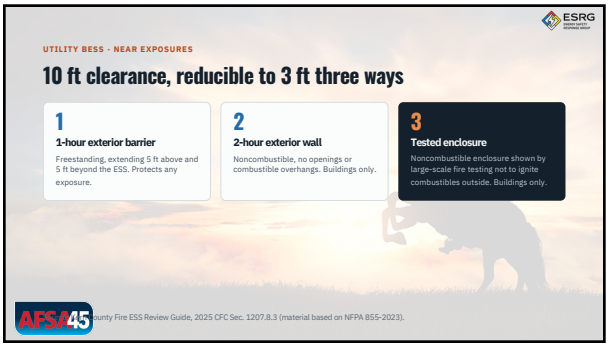

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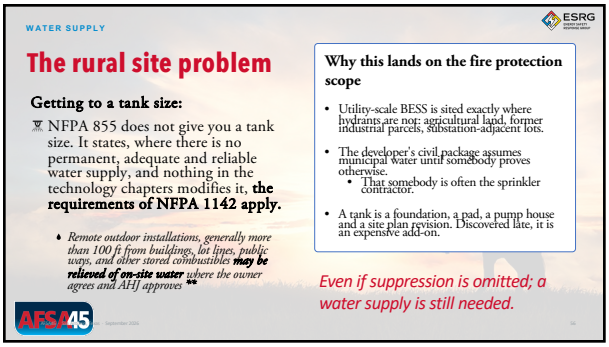

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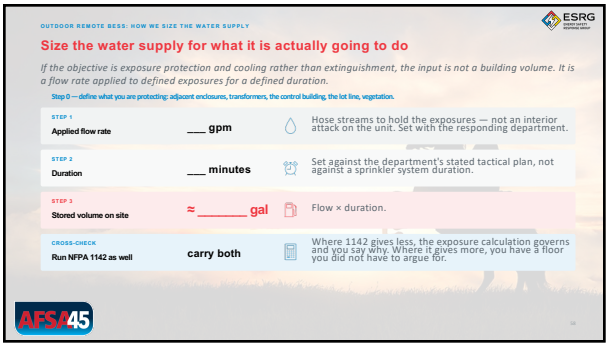

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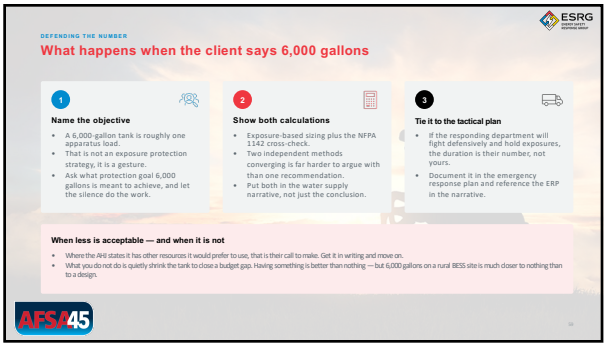

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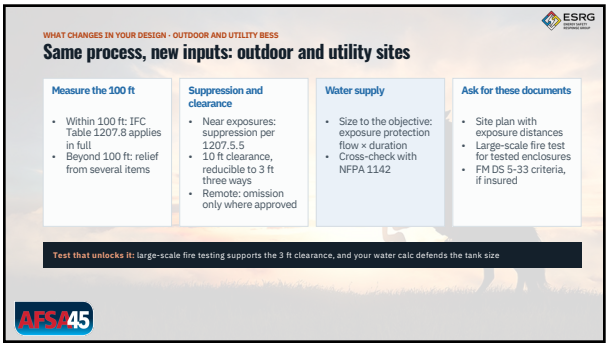

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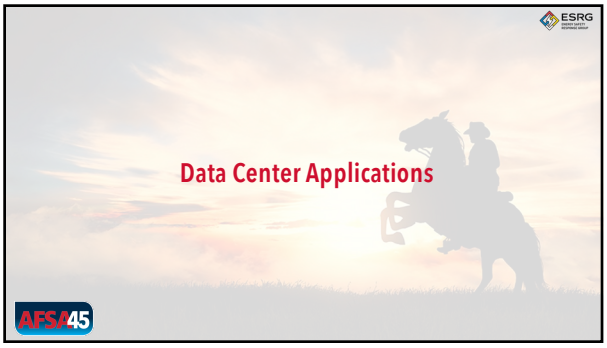

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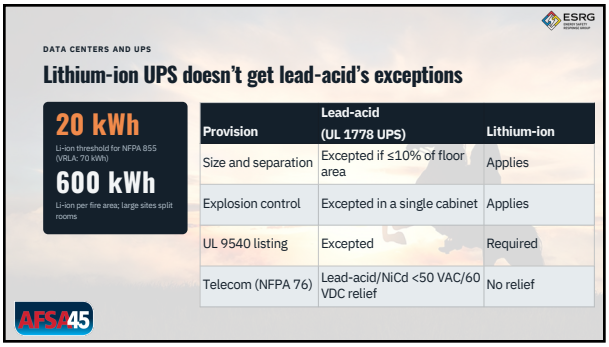

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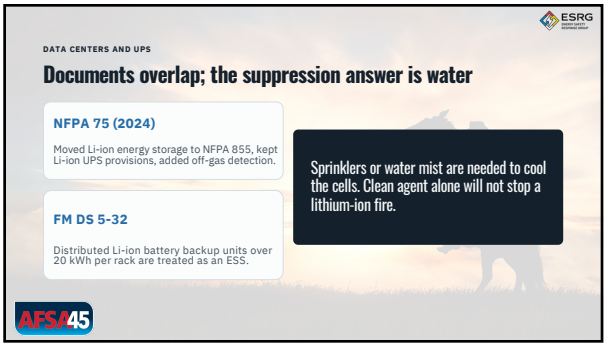

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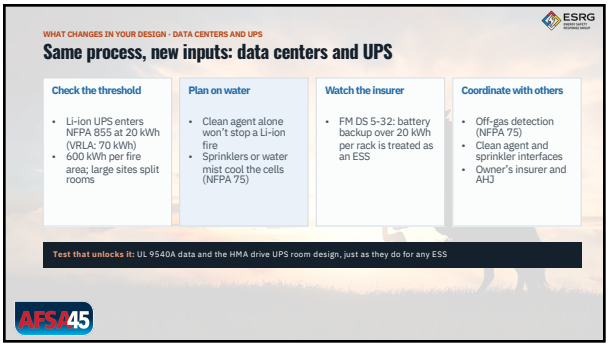

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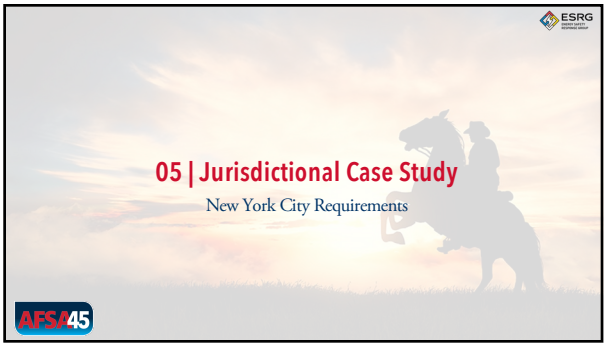

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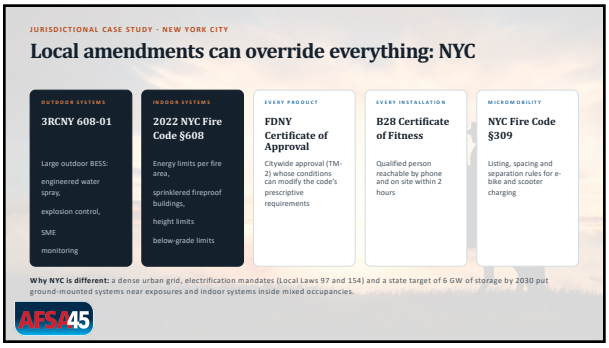

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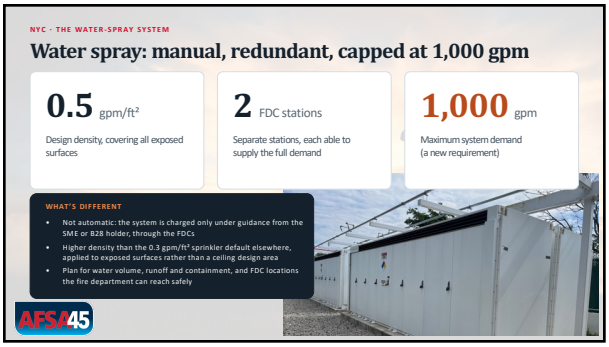

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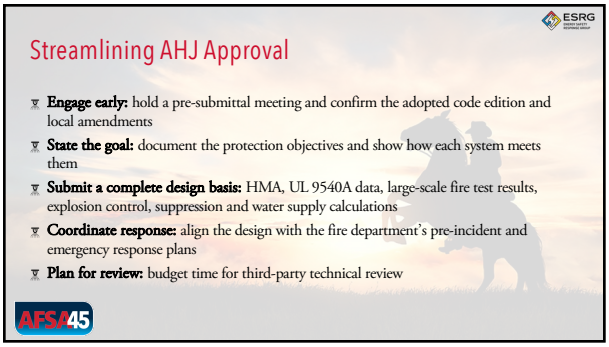

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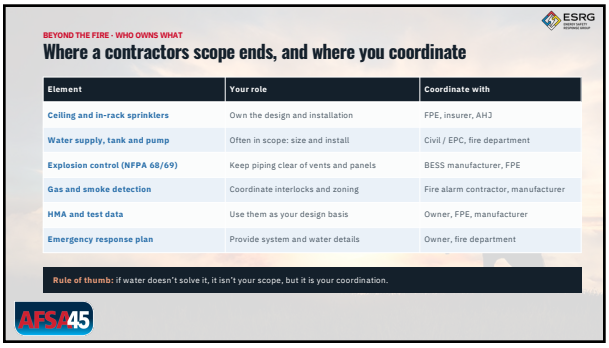

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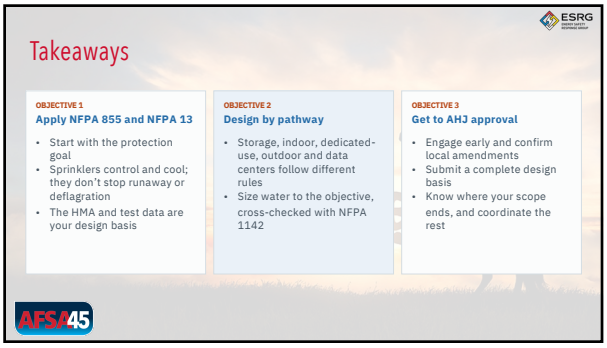

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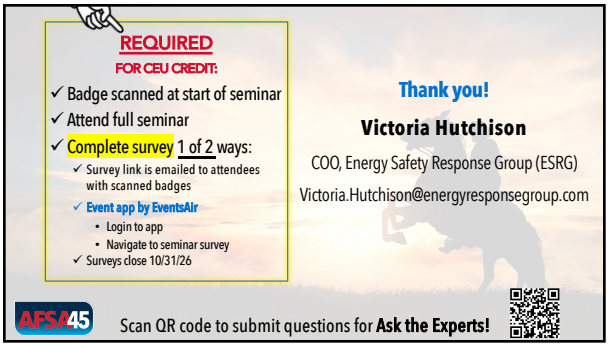
REQUIRED
FOR CEU CREDIT:
✓ Badge scanned at start of seminar
✓ Attend full seminar
✓ Complete survey 1 of 2 ways:
✓ Survey link is emailed to attendees with scanned badges
✓ Event app by EventsAir
• Login to app
• Navigate to seminar survey
✓ Surveys close 10/31/26
Thank you!
Victoria Hutchison
COO, Energy Safety Response Group (ESRG)
Victoria.Hutchison@energyresponsegroup.com
AFSA45
Scan QR code to submit questions for Ask the Experts!

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2027 Training Schedule

WEBINARS

1/6	Updates to NFPA 20
1/20	Calculating Pressure Reducing Hose Valves
2/3	Consumer Alert: Nitrogen in Sprinkler Systems
2/17	Reviewing Hydraulic Calculations
3/3	Updates to NFPA 13, 2028 Ed.
3/17	Updates to NFPA 13R & 13D, 2028 Eds.
4/7	Topic Coming Soon
4/21	NFPA 25: Roles & Responsibilities
5/5	Standpipe Flow Test Procedures
5/19	Storage 101
6/2	NFPA Technical Meeting - Voting Guide
6/16	Topic Coming Soon
6/30	Topic Coming Soon
7/7	Updates to NFPA 14, 2027 Edition
7/21	Adjacent Hazards & Design Methods
8/4	Acceptance Testing
8/18	Modifications to Existing Systems
9/22	Topic Coming Soon
10/6	Seismic 101
10/20	Proposed Updates to NFPA 25, 2029 Ed.
11/3	Evaluating Fire Pump Flow Tests
11/17	Top 10 Tech Reviews
12/1	Designing Water Storage Tanks
12/15	Pump Room Layout

PROGRAMS

Feb 9 - Mar 5 Apr 20 - May 14 Aug 3 - Aug 27** Oct 26 - Nov 19	Beginning Design School*
Apr 26 - May 7 Nov 1 - 12	Intermediate Design School*
Feb 8 - 10** Apr 12 - 14 Jul 12 - 14 Oct 11 - 13	Sprinkler Hydraulics Calculations Workshop
Apr 19 - 21 Oct 18 - 20	Advanced Hydraulics Calculations Workshop
Feb 11** Apr 30 Jul 23 Sep 24	Introduction to the Fire Sprinkler Industry
Mar 1 - 3 May 17 - 19 Aug 16 - 18 Oct 18 - 20**	NFPA 25 Essentials Workshop
Jun 7 - 10 Sep 20 - 23	Experienced Inspector Skills Lab
Mar 4 - 5 May 20 - 21 Aug 19 - 20 Oct 21 - 22**	NFPA 25 Fire Pump Workshop
Spring Summer Fall	ITM Inspector Development Program* *This program is 20 months.*

** Hybrid course **At General Air Products Lab, Exton, PA*

AFSA46

September 8-11	Manchester Grand Hyatt San Diego, CA

For More Details Visit:
firesprinkler.org

AFSA
American Fire Sprinkler Association

Dates subject to change. Programs subject to minimum registrations.

rev 9/14/2026

Virtual Instruction Path (VIP)

for Sprinkler Fitting Apprentices

Level 1 - Begins January 2027

Level 2 - Begins February 2027

Level 3 - Begins January 2027

Level 4 - Begins March 2027

www.firesprinkler.org/VIP

AFSA
American Fire Sprinkler Association

HANDS-ON WORKSHOPS FOR 2027

FEATURING AFSA'S TRAINING LAB

NFPA 25 Essentials Workshop

Mar | May | Aug | Oct

Description: Understand roles, responsibilities, and NFPA 25 ITM procedures through hands-on testing of wet systems, dry systems, and fire pumps.

NFPA 25 Fire Pump Workshop

Mar | May | Aug | Oct

Description: Develop practical NFPA 25 fire pump ITM skills, including no-flow and full-flow testing, water supply graphing, and performance evaluation.

Introduction to the Fire Sprinkler Industry

Feb | Apr | Jul | Sep

Description: This course is designed for those new to the industry. An introductory, wide-ranging 8-hour course that provides a broad overview of core fire sprinkler industry concepts for those new to the field.

Experienced Inspector Skills Lab NEW

Mar | Sep

Description: Take your ITM expertise beyond the basics. Designed for experienced technicians, this course combines focused classroom instruction with hands-on system lab training to strengthen your application of current NFPA 25 inspection, testing, and maintenance requirements. Refine fire sprinkler testing practices, improve documentation, deliver more consistent service, and help reduce liability while reinforcing knowledge commonly covered on certification exams.

Learn more about AFSA's fire sprinkler lab featuring functional risers, a spray room, fire pumps, and an interactive classroom.

firesprinkler.org/lab