Industry Failures: Battery Energy Storage Systems Lessons Learned

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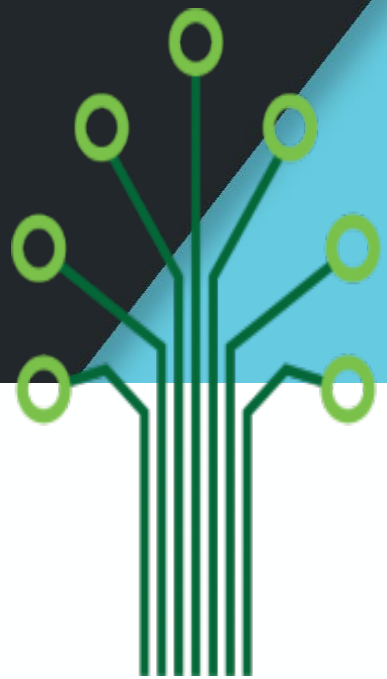

ENERGY STORAGE SYSTEMS

SAFETY & RELIABILITY FORUM

AGENDA

1. Look at some recent failures
2. Lessons Learn and Recommendation

LEGAL DISCLAIMER

The information provided is only my opinion and I do not represent NFPA or the 855 Committee.

Information details may be subject to NDA's or legal complications

Any reliance on this information is at your own discretion.

BESS FIRE IN XXXXXX

CONFIDENTIAL

LARGE SCALE TEST RESULTS

- Wood Environment & Infrastructure Solutions, Inc. (Wood) and AECOM Technical Services, Inc. (AECOM) were hired to perform an environmental assessment of the facility site to establish whether any environmental hazards (particulate matter, heavy metals, etc.) presented health and human safety concerns.
- Safety Engineering Laboratories, Inc. (SEL) was retained to analyze and forensically inspect the evidentiary data to determine the originating cause of the battery failure.
- Colwell Consulting, LLC (Colwell) was retained to forensically analyze all available data and evidence in an effort to determine the cause of the container explosion.
- CP Fire, LLC (CP Fire) was retained to assess the suitability, functional performance, and corresponding effectiveness of the BESS's fire suppression system.

REDACTED

BESS CAUSED BY XXXXX

Report protected by NDA

HEADLINE

Data unsubstantiated

Questions & Discussion

Thanks For Taking The Time To See This!!

We Hope This Will Help.

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Should not be public – implies liability

FROM FAILURE & LARGE-SCALE TESTING

LESSON LEARNED (LL) #1

Share the data!*

*But Don’t always believe what you read!

SURPRISE, AZ

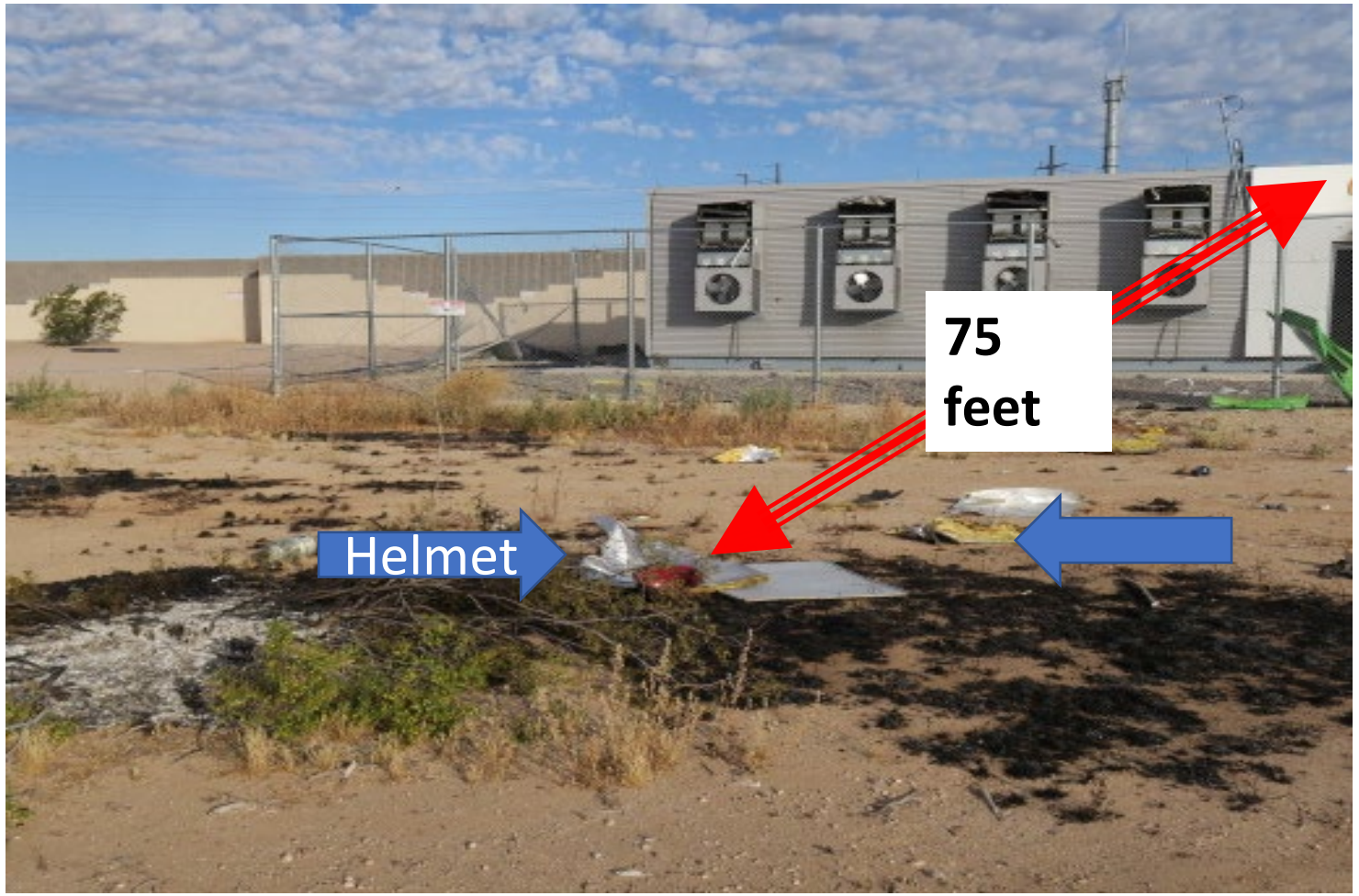
Approximately three years after the Lithium-Ion ESS explosion event at the APS facility in Surprise, AZ, the main parties will discuss the lessons learned and the profound changes to the industry. Multiple reports were released on 9/20 with the root cause, recommendations, and impacts.

- What have we learned about safety, fire, and explosion protection?
- How has it changed the way the industry approaches these issues?

- Provide information on a case study for Lithium-Ion Energy Storage System failure
- Understanding the Hazards of Lithium-Ion ESS
- **Applying industry best practices from lessons learned**
- Review code application for NFPA 855 and advances in the future

ESS Explosion

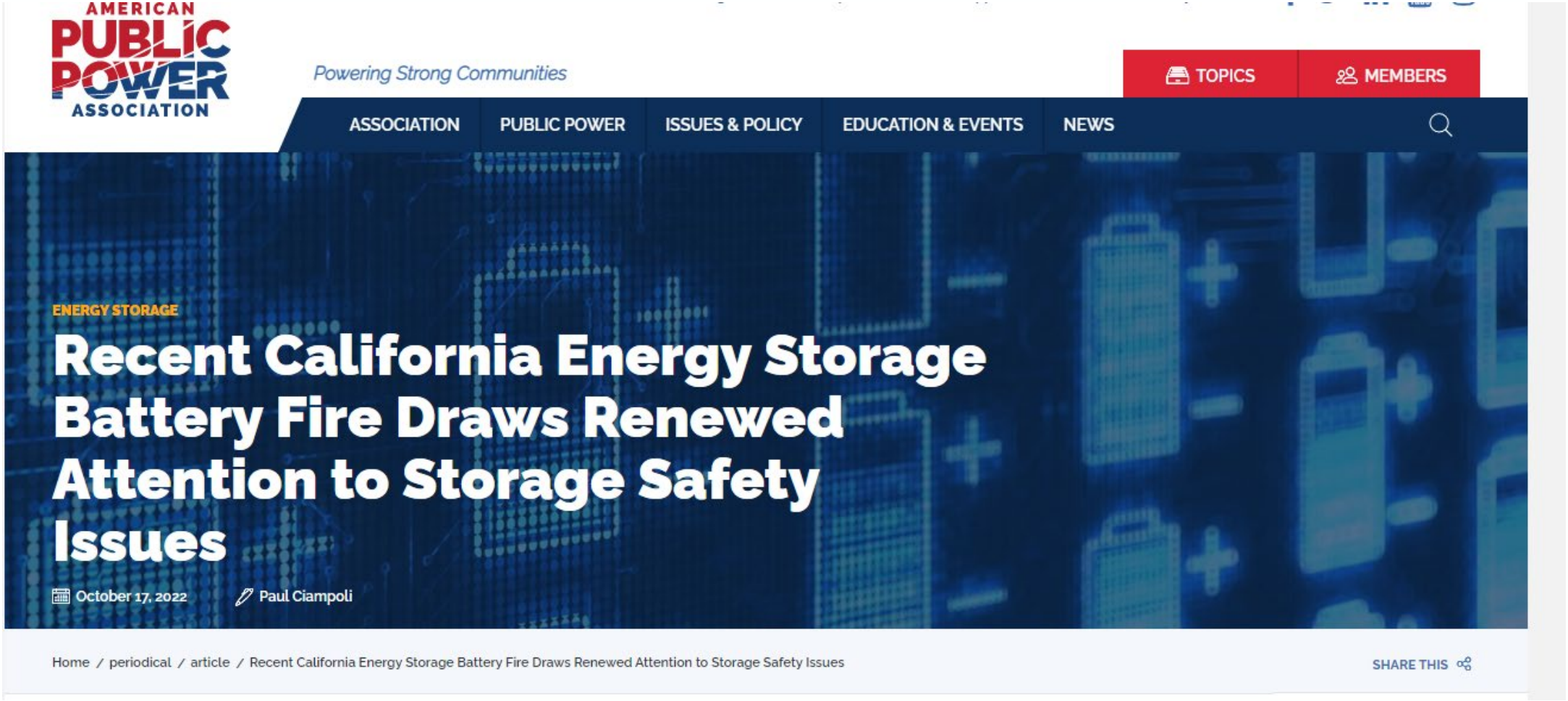
- Explosion
- Enough pressure to remove two doors
- 4 firefighters affected by the blast wave
  - 2 FF were thrown approximately 75 feet
  - Blunt object (Fencepost)



LL# 2

Provide better clarity during an event!

MOSS LANDING



LL# 3

Battery *Systems* Fail!
Plan for it.

UK – CARNEGIE ROAD EVENT

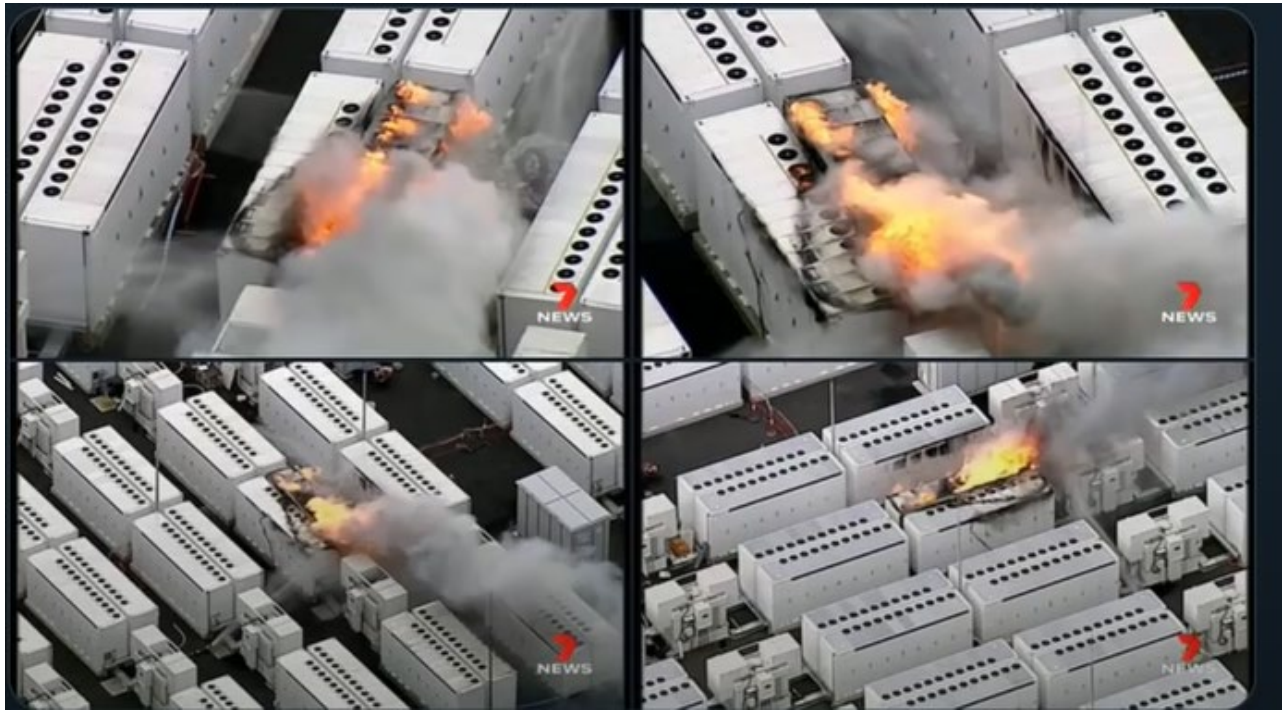
UK – CARNEGIE ROAD EVENT

LL# 4

Real World Failures are not what we see in the lab. Other conditions must be taken into account.

MOORABOOL, NEAR GEELONG

“REGULATORY (Expected Listings)
Lithium-Ion Cells NRTL listed to UL 1642
System NRTL listed to UL 1973, UL 9540, UL 9540A, UL 1741 SA, IEC 62619, IEC 62477-1 IEEE 1547
Compliant with grid codes and safety standards of all major markets.”



https://www.youtube.com/watch?v=ukuSxK5VpI8

TESLA MEGAPACK FIRE 7/30 AUSTRALIA VICTORIA BIG BATTERY PROJECT

September 27, 2021, Update

- Blamed on an undetected coolant leak
- Short circuits went undetected during testing

- Short circuits occurred when the Megapack had been switched off after initial testing, which removed fault protections.
- Questions around why it spread to the second megapack when UL9540 testing indicated that it didn’t…

LL# 5

Unanticipated Conditions. Safety is a holistic approach.

SAFETY

LA SALLE COUNTY FIRE

Illinois Policy Articles

“Big Batteries to store renewable energy create a fire hazard.”

“…Greatest risk is to those putting out the fires.”

LL# 6

Human Error. The hazard is different over time.

ELKHORN – MOSS LANDING FAILURES

https://youtu.be/_RCWoV4ph4M

CHANDLER/GARLAND ESS FAILURES

https://www.datacenterdynamics.com/en/news/4mw-of-aes-lithium-batteries-burn-in-chandler-arizona/

LL #7

Water is not your Friend! Application of water should be a last resort.

LARGE-SCALE FIRE TEST

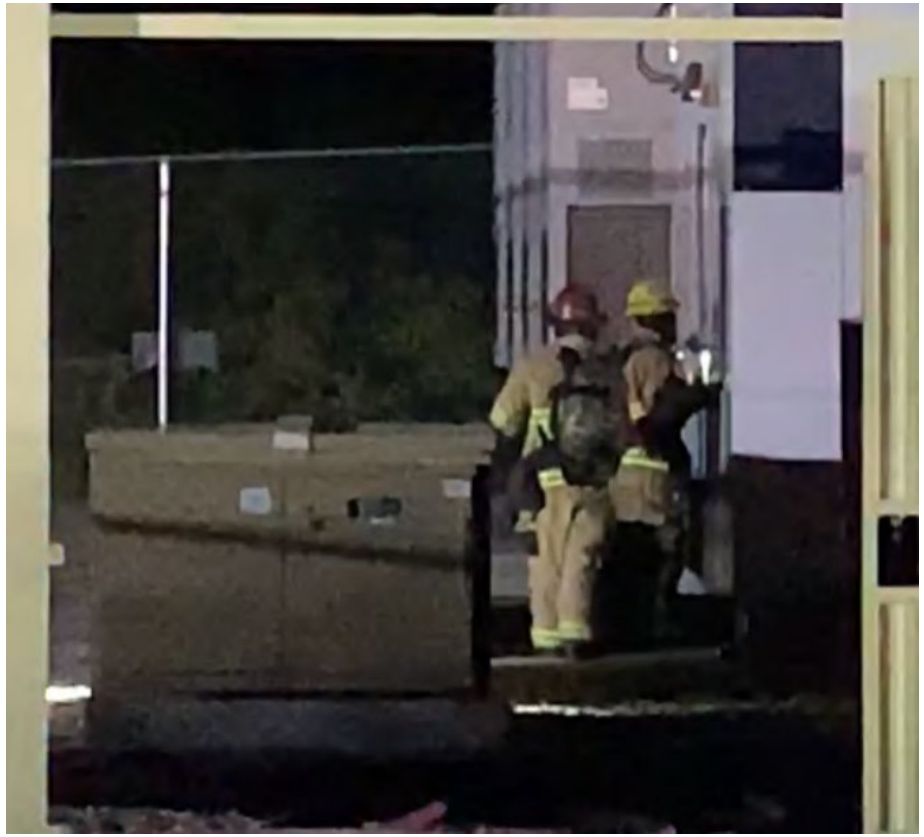
LARGE SCALE FIRE TEST

LL# 8

Not only let it Burn but make it Burn!*

*Yes, I know it is not always feasible!

HOW DO WE …?



- Get ahead of the technology
- Provide a code that doesn’t restrict technology
- Provides pathways for disruptive technology
- Use the TIA process to make quick, needed adjustments to the codes
- Ensure appropriate representation to committees
- Include all industry parties to stay involved in the process

FAILURE TO PLAN

1. Share the data!*
2. Provide better Clarity during an event!
3. Battery *Systems* Fail! Plan for it.
4. Real World Failures are not what we see in the lab. Other conditions must be taken into account.
5. Unanticipated Conditions. Safety is a holistic approach.
6. Human Error. The hazard is different over time.
7. Water is not your Friend! Application of water should be a last resort.
8. Not only let it Burn but make it Burn!*

Questions & Discussion

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