EZASSI

Thermal Runaway and Fire Propagation in Stationary Storage

Research Signals · October 2026

A Research watch on the science and test evidence behind thermal runaway, fire propagation and off-gas in stationary storage, and on the UL 9540A, NFPA 855 and CSA C800 changes that follow from it, read for a North American maker of modules, packs and containerized storage systems that buys LFP cells. Four signals from one cycle.

#	SIGNAL	CONFIDENCE	HORIZON	STATUS
1	UL published the sixth edition of UL 9540A on March 13, 2026 and began large-scale fire testing under it on April 23; UL says a January 1, 2027 effective date will be set	High	Immediate (0–3 months)	Verified
2	EPRI reports battery storage failures per GWh fell 98% from 2018 to 2025, and its 2024 root-cause analysis put cells behind only 3 of 26 classified incidents	Medium	Short-term (3–12 months)	Review
3	CSA moved its large-scale fire test from a technical specification to the C800:25 standard, and a proposed NFPA 855 amendment would cite it	Medium	Short-term (3–12 months)	Review
4	Research on LFP off-gas points to a flammable gas hazard that depends on chemistry and state of charge, but the newest work is still conference talks	Medium	Short-term (3–12 months)	Review

Every signal rests on two or more dated events. Confidence is published as a band. Where a signal sits below High, the reasoning names the evidence that is missing. Status says where the evidence stands: Verified, Review, or Inconclusive — we looked, and the evidence does not yet support a firmer call.

SIGNAL 1 OF 4

UL published the sixth edition of UL 9540A on March 13, 2026 and began large-scale fire testing under it on April 23; UL says a January 1, 2027 effective date will be set

HIGH Immediate (0–3 months) · Validation & Technical Milestones · Verified

UL 9540A Edition 6 was published and approved by ANSI on March 13, 2026. UL Solutions announced enhanced large-scale fire testing under the sixth edition on April 23, 2026. UL's Code Authority page says an effective date of January 1, 2027 will be established. The fifth edition is still listed as active.

REASONING

Two dated UL actions point the same way, and the trade press confirms the first. UL's standards store lists Edition 6 as current and active, with the fifth edition also active. UL's FAQ says the unit-level test is no longer required for non-residential systems, so the evidence UL asks for moves toward installation-level fire behavior. Sources disagree on whether NFPA 855 (2026 edition) makes large-scale fire testing mandatory or treats it as guidance, so this watch does not state either. The band is High because the dates are set by the test-method owner and fall inside this planning cycle.

PATTERN

March 13, 2026: UL 9540A Edition 6 published and approved by ANSI and SCC. April 6, 2026: IndustryWeek reported the publication and said the new edition formally adds large-scale fire testing to the certification framework. April 23, 2026: UL Solutions announced enhanced large-scale fire testing under the sixth edition of ANSI/CAN/UL 9540A. January 1, 2027: the effective date UL's Code Authority page says will be established for Edition 6.

IMPLICATION

A module, pack or container qualified under an earlier edition may face questions from customers and local fire authorities once Edition 6 is in effect. Which edition a project must meet depends on the contract and the authority, and that is not settled by the standard alone. The open question on NFPA 855 means a design team should not assume a large-scale test is either required or optional for a given bid.

RECOMMENDED ACTION

This quarter, list which UL 9540A edition governs the test report for each product family and each open bid. Ask a test laboratory for sixth-edition lead times and costs before the end of November 2026. Confirm in writing with each project's fire authority which edition and which large-scale test it expects.

SOURCES & WHAT THEY SIGNAL

- **UL Standards — UL 9540A Edition 6 product page** — Edition 6 published and ANSI-approved March 13, 2026; listed active, with Edition 5 also active.
- **UL — Installation codes and requirements for energy storage systems FAQ** — Edition 6 published March 13, 2026; unit-level test no longer required for non-residential systems.
- **UL Code Authority — Understanding UL 9540A, NFPA 855 and large-scale fire testing** — States that an effective date of January 1, 2027 will be established for Edition 6.

- **UL Solutions — Enhanced large-scale fire testing for battery energy storage systems** — April 23, 2026 announcement of testing under the sixth edition.
- **IndustryWeek — What the 6th edition of UL 9540A means for battery storage safety certification** — April 6, 2026 report on the March 13 publication and the added large-scale fire test data requirements.

SIGNAL 2 OF 4

EPRI reports battery storage failures per GWh fell 98% from 2018 to 2025, and its 2024 root-cause analysis put cells behind only 3 of 26 classified incidents

MEDIUM Short-term (3–12 months) · Publication & Preprint Output · Review

PV Magazine USA reported on October 14, 2026 that EPRI found global failures per deployed GWh fell 98% from 2018 to 2025, with a further 50% fall from 2024 to 2025. EPRI said it lacked the evidence to tell whether chemistry alone is a system-level risk factor. EPRI's May 2024 root-cause paper found integration, assembly and construction the most common cause.

REASONING

Two EPRI analyses, two years apart, agree that the weak points sit at the system level and not in the cell. The 2024 paper could assign a root cause to only 26 of 81 incidents, so its shares are a partial picture. The 2026 figures reach this watch through a trade report, and EPRI's own page did not load with text. The band is held at Medium for those reasons.

PATTERN

May 2024: EPRI's root-cause white paper named integration, assembly and construction as the most common root cause, with operation second. Cells were the direct cause in 3 of 26 classified incidents, and about 72% of failures with a known system age came in construction, commissioning or the first two years. October 14, 2026: PV Magazine USA reported EPRI's update, a 98% fall in failures per GWh from 2018 to 2025 and a rate of 0.04 failures per GWh in 2025.

IMPLICATION

For a maker that assembles modules and containers, the EPRI record says the integration and commissioning steps carry most of the incident history. A safety case built on the chemistry alone is harder to defend with insurers and utilities, because EPRI itself did not attribute risk to chemistry. Cell supplier controls still matter, but they are one part of the evidence.

RECOMMENDED ACTION

Within 90 days, map the root-cause categories in EPRI's 2024 paper to your plant checklists for balance-of-system parts, wiring, enclosure sealing and controls settings. Add commissioning checks to the field handover for the first two years of each system.

SOURCES & WHAT THEY SIGNAL

- **PV Magazine USA — Battery energy storage failures are down 98% since 2018** — October 14, 2026 report of EPRI's 98% decline, the 50% fall in 2025 and the chemistry statement.
- **EPRI — Insights from the BESS Failure Incident Database: analysis of failure root cause** — May 2024 white paper; root causes, 3 of 26 cell-attributed incidents, early-life failures.

SIGNAL 3 OF 4

CSA moved its large-scale fire test from a technical specification to the C800:25 standard, and a proposed NFPA 855 amendment would cite it

MEDIUM Short-term (3–12 months) · Validation & Technical Milestones · Review

CSA's large-scale fire test procedure, first run as TS-800 in February 2025, is now Section 9.7 of CSA/ANSI C800:25. NFPA Tentative Interim Amendment 1852 asked NFPA 855 to cite C800, with comments closing October 17, 2025. Whether NFPA adopted it is not shown in the sources opened.

REASONING

Three dated items show one test method becoming a formal standard. Test results are company-reported, which limits what they prove. Engineering commentary calls C800 a reliability and quality-assurance protocol with a fire section that is not yet required and is used as guidance where an authority asks for a large-scale test. The band is held at Medium because the NFPA outcome is open.

PATTERN

February 2025: Prevalon and CLOU ran large-scale fire tests under CSA TS-800, reported on April 24, 2025; both said the fire stayed within the ignited unit or its immediate spacing. July 9, 2025: Jensen Hughes described C800:25 as newly published, with its large-scale procedure in Section 9.7. October 17, 2025: comments closed on NFPA TIA 1852, which asked that NFPA 855 cite C800 Section 9.7.

IMPLICATION

A fire-test campaign planned only around UL 9540A may not produce the data a customer or authority asks for under C800, especially on projects in Canada. A single campaign that serves both would save a repeat test. Vendor test reports are a weak basis for design decisions, because they are company-run and chosen for publication.

RECOMMENDED ACTION

Within 90 days, ask your test laboratory and certification body for a written crosswalk showing which outputs of a sixth-edition UL 9540A campaign also satisfy C800 Section 9.7. Ask project owners in Canada which standard their authority expects.

SOURCES & WHAT THEY SIGNAL

- **NFPA — Proposed TIA 1852 on NFPA 855** — Asks NFPA 855 to cite C800 Section 9.7; says C800:25 was ANSI-approved; comments closed October 17, 2025.
- **Jensen Hughes — UL 9540A vs. C800: how LSFT is reshaping BESS design and compliance** — July 9, 2025 analysis of C800:25 Section 9.7 and its role beside UL 9540A.
- **Energy-Storage.News — UL Solutions tests thermal runaway to the new UL 9540A; Prevalon and CLOU run TS-800 tests** — April 24, 2025 report of the February 2025 TS-800 tests; company-reported results.

SIGNAL 4 OF 4

Research on LFP off-gas points to a flammable gas hazard that depends on chemistry and state of charge, but the newest work is still conference talks

MEDIUM Short-term (3–12 months) · Publication & Preprint Output · Review

A 2024 university review put the lower flammability limit of LFP off-gas at 6.2%, against 7.9% for NMC, in an inert atmosphere. NIOSH measured thermal runaway pressures in sealed enclosures, and its 2022 paper found NMC cells reached higher pressures than LFP. In June 2026 national labs showed cell-level thresholds by chemistry and state of charge, with no published data yet.

REASONING

The evidence is dated and comes from different groups, but it agrees on direction: LFP gas is flammable, and the hazard varies with conditions. The newest items are presentations, not peer-reviewed results. The band is held at Medium, and the status stays at Review, because no single study covers the cell formats and charge states a maker ships.

PATTERN

2022: NIOSH published a comparison of thermal runaway pressures in sealed enclosures for NMC and LFP cells. April 12, 2024: PV Magazine India reported a Sheffield, Imperial College and St Andrews review that found LFP reaches its flammability limit at an off-gas volume about 18% smaller than NMC. March 21, 2025: the NIOSH paper was posted to PubMed Central. June 2–4, 2026: Sandia and PNNL's forum included Oak Ridge work on cell-level thresholds by chemistry, capacity and state of charge, and Sandia work on module-to-rack scale models.

IMPLICATION

Calling LFP low fire risk without addressing off-gas can invite questions from customers and insurers. The tested charge state and enclosure free space both change the result, so a test at reduced charge may not show the worst gas case. A maker does not control cell chemistry, but it does control enclosure volume, venting and detection.

RECOMMENDED ACTION

Within 90 days, ask each LFP cell supplier for off-gas composition, lower flammability limit and vent volume at maximum operating charge. Use that data in the enclosure-level gas calculation before the next container design is final.

SOURCES & WHAT THEY SIGNAL

- PV Magazine India — How safe are lithium iron phosphate batteries? — April 12, 2024 report of a three-university review: lower flammability limit of 6.2% for LFP and 7.9% for NMC.
- NIOSH — Comparison of thermal runaway pressures within sealed enclosures (PubMed Central) — 2022 paper posted March 21, 2025; NMC pressures higher than those measured earlier for LFP.
- Sandia National Laboratories — 2026 Energy Storage Safety and Reliability Forum — June 2–4, 2026 program with thermal runaway sessions, including thresholds by chemistry and state of charge.
- UL Research Institutes — Electrochemical Safety Research Institute ongoing research — Project list, page updated June 26, 2025, including gas and smoke studies at various states of charge.

SET UP A SIGNAL ON YOUR QUESTION

A watch on your question runs every cycle.

These signals came from one cycle of a standing watch. Name a company, a market or a regulation, and the watch keeps running whether or not anyone opens the platform. Every signal arrives rated for confidence and horizon, with the dated events behind it and the sources that carry the weight.

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