



## Session 4B:

### Li-Ion BESS: Explosion Control Guidance

2. Session Description - This work presents guidance for the design of explosion control systems for lithium-ion based Battery Energy Storage Systems (BESS). The guidance is based on NFPA 855, the standard for the installation of stationary energy storage systems in North America and incorporates both active and passive mitigation strategies in accordance with NFPA 69 and NFPA 68. The study emphasizes the importance of understanding fire testing data and its limitations, particularly from UL 9540A tier-level tests, in informing design decisions. It provides an overview of explosion hazards, key input parameters for analysis including the composition and volume of flammable gases vented during thermal runaway events. Testing and modeling methodologies for designing mitigation measures are also discussed. Case studies are included to demonstrate the calculation process for both mitigation approaches across various enclosure geometries derived from literature and published data. The study further highlights current limitations in analysis methods, validation data gaps, and challenges in applying existing methodologies to different enclosure configurations, identifying areas for future research. The findings offer a practical reference for practitioners focused on BESS explosion safety.

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Dr. Anil Kapahi is the Director of Research, Development, Testing, and Evaluation (RDT&E) at Jensen Hughes, bringing 20 years of experience in engineering consulting and academia. He has led multidisciplinary teams in assessing fire, explosion, and toxicity hazards across transportation, energy, and industrial sectors. With over 40 scholarly publications, Dr. Kapahi serves as a principal investigator for the Department of Transportation (DOT) and the United States Navy (USN), developing a comprehensive approach to quantify fire and explosion risks in large-scale battery systems. He has designed passive and active explosion mitigation measures for more than 50 battery energy storage system (BESS) enclosures of various sizes and battery chemistries. Dr. Kapahi is an active technical member of the NFPA 855, NFPA 68, and NFPA 69 committees.