

Battery Safety Council Forum 6 'Hazard Analysis and Risk Assessment'

You are invited to participate in a Technical Workshop (Forum 6) on the topic of hazard analysis and risk assessment in the context of lithium-ion cells and batteries. The forum will be held in Washington, DC on July 24-25th, 2018. This Forum is sponsored by The Battery Safety Council (BSC) in collaboration with the Battery Task of the International Energy Agency's (IEA) Technology Collaboration Program on Hybrid and Electric Vehicles (TCP-HEV). The Battery Safety Council is an ad hoc group organized by a group of government and industry staff dedicated to the exchange of technical information on battery safety. The Charter of the BSC and Rules of the Road for participants are at the end of this announcement. For more information on the TCP-HEV, please go to www.ieahev.org.

For more information regarding the BSC or this forum, please contact the Chairs, Dana Schulze (Dana.Schulze@ntsb.gov) or Judy Jeevarajan (Judy.Jeevarajan@ul.com). The core team members include Daphne Fuentesvilla (U.S. Navy), Jim Barnes (BTA), Dan Doughty (Battery Safety Consulting) and Phil Gorney (DoT) and Joanna Cardema (The Aerospace Corporation).

Meeting Location:

300 M Street SE DC 20003 (near Navy Yard)

Cost and Registration:

There is no cost to attend the Forum, but pre-registration is required. If you have received this Announcement and Invitation from the BSC, please follow the registration information that you have received from the BSC.

If you have received this invitation from James A. Barnes, the Operating Agent of the Battery Task of the HEV-TCP, please inform him directly at barnesjim@aol.com if you wish to attend. He will submit your name and expression of interest to the BSC organizers. Please **do not make any non-refundable travel arrangements** until you receive a confirmation of your registration from Dr. Barnes or the BSC meeting registration system.

Background:

Lithium-ion cells and batteries have been used extensively in various applications and sizes in the past three decades. The improvements in material components used in lithium-ion batteries have led to the use of this chemistry in high energy as well as high power applications. However, with the constant changes that are being made, it is also understandable that the safety of this chemistry is not fully understood and can vary widely based on cell, battery or system design. It is imperative for cell and battery manufacturers as well as system manufacturers and users to study and analyze the hazards associated with the battery in the actual application, configuration and environment to prevent catastrophic incidents.

Hazard and Risk assessments are safety management tools performed many different ways and may not necessarily follow a stream-lined process. Failure modes and effects analysis (FMEA) is among the common techniques used to understand the safety risks involved in the usage of a battery system in a specific application and environment. Most of these assessments start with listing all the hazards that could be encountered due to foreseen and unforeseen circumstances

and considering the resulting worst-possible and worst-credible safety risks, using existing safety controls and their known effectiveness as the discerning factors. This can also be summarized by looking at each hazard cause and understanding its probability and severity in light of the system in which the hazard is present. The inclusion of safety controls provides a chance at reducing the probability and/or severity of the undesired effect that a hazard might cause.

Hazard and risk assessments can be performed in different ways. Some are based on empirical testing or historical data while others are based on multi-physics simulation modeling and analysis. When modeling studies are conducted, the models need to be validated by experimentation and the safety assessment authority needs to understand how the model validations are carried out and if it can be used as a tool for the FMEA and risk assessment process. A question exists as to whether the presence of standards, regulations and guidelines help with the hazard categorization. While working on hazard categorization using empirical test data, different levels of testing at various system levels such as from cell to module to battery to full system level may need to be analyzed. Questions arise as to whether this type of testing should require testing to failure or testing to a level just enough to verify the controls.

The safety assessment process may utilize a combination of different techniques, such as FMEA, fish bone analysis, fault tree analysis, etc., all with the goal of determining appropriate system safety requirements and to aid in decision-making about the level of risk to be accepted in a deployed system.

In summary, this forum will focus on hazard and safety risk assessment approaches. Tentative topics include:

- Approaches to hazard/safety risk assessments by organization (Navy, Army, FAA, commercial cargo carriers, NASA, CPSC, etc.). Not necessarily restricted to lithium battery hazard assessments (e.g. fire department may want to discuss broader approach to hazard/safety risk assessment and lessons that could be applied to batteries)
- Failure modes for lithium batteries: high temperature, overcharge, overdischarge, the family of short circuit failures (internal short, external hard short, crush, puncture, etc.), cold temperature charge, exceeding LEL (lower exposure limit), etc.
- Assessing severity of an event
 - Test methods
 - Analysis methods validation and reliability
 - Multi-physics modeling tools and reliability
- Assessing probability of an event
 - Use of historical data
 - Similarity analysis to validate the relevance of historical data
 - Assumptions, their validation and uncertainty introduced

The core team is looking forward to active participation from the attendees. Please contact one of the core team members if you are interested in presenting at Forum 6.

Important Information for Participants at the Battery Safety Council Forum

BSC Forum Charter: The purpose of the Forum is to foster a candid, open discussion of the issues related to battery fires by individuals who are knowledgeable about the field. Neither the BSC nor the IA-HEV are standard-setting organizations. Each Forum is designed as follows:

1. Attendance is limited to allow for open discussion.
2. The number of formal presentations is limited to provide more time for open discussions.
3. The output of the Forum is an exchange of information and ideas. There will be no Forum proceedings issued, nor will invited speakers be required to provide a written paper or presentation slides for the audience.
4. To encourage open exchange of ideas, all activities at the Discussion are “off the record” and not for citation – except when a speaker specifically releases the information.
5. The language of the Forum is English.

A general summary of the discussions along with any presentations which are cleared for public release will be available after the meeting. But the workshop will not make any formal recommendations as to detection or prevention of internal short circuits. The organizers hope that attendees will be able to use the information that they have learned to develop appropriate standards for their organizations. **All Participants are expected to honor the following “Rules of the Road” regarding information learned while at the Forum:**

Rules of the Road (Courtesy: CAST)

1. Consider all information to be proprietary property of the presenting organization.
2. Do not use any information presented by another participating organization for commercial, competitive, punitive or litigation purposes.
3. Do not share the proprietary information of the participants with external parties without the written consent of the owner.
4. Endeavor to inform other participants as quickly as possible of any significant safety issue arising from our data sources.
5. Work to implement rational solutions to safety issues identified through information sharing.
6. Treat all participants with equality, respecting all viewpoints as worthy of consideration.
7. Acknowledge that the level and method of information sharing rests with the participant; it is expected that each participant will speak with honesty and candor.
8. Do not record (audio or video) or take photographs of presentations from other organizations without prior approval from Council chairs.
9. Understand that many organizations use social media to share information. Exercise extreme caution and focus on safety when sharing information within your organizations through these channels. Do not discuss or share information shared within the Council using social media outside your organizations.
10. Only share safety issues/mitigations within your organizations for the purpose of improving battery safety. Do not share a presenter’s identity or organization.

BSC Core Team

The forum logistics have been jointly organized by the NTSB and Underwriters Laboratories, Inc. (UL). For more information please contact Dana Schulze (Dana.Schulze@ntsb.gov) or Judy Jeevarajan (Judy.Jeevarajan@ul.com). Other core team members are Jim Barnes (barnesjim@aol.com), Daphne Fuentevilla, (daphne.fuentevilla@navy.mil), Phil Gorney (phillip.gorney@dot.gov), Joanna Cardema (joanna.d.cardema@aero.org), and Daniel Doughty (dhdoughty@gmail.com).

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