



# BSI Faraday Battery Challenge

## Workshop 2 – July 5, 2023

In July 2021, BSI and the Faraday Battery Challenge released a roadmap titled "Battery Manufacturing and Technology Standards Roadmap" to enhance battery manufacturing and innovation in the UK.

On July 5, 2023, BSI conducted a second workshop with industry stakeholders to revitalize standardization efforts in three key focus areas: Fire Risk Management, Recyclability, Second Life, and Circularity, and Performance and Abuse Testing.

The workshop aimed to gather insights, address gaps, and inform the upcoming phase of the BSI Faraday Battery Challenge.

The discussions explored the need for additional guidance, identified opportunities for data sharing and raising awareness, and sought consensus on good practices. The findings and recommendations from the workshop will shape the future direction of the BSI Faraday Battery Challenge to align with industry needs and aspirations.

Below are the key findings and recommendations.

### Fire Risk Management

#### Fire Risk Management- Standardization gaps

Attendees identified key standardization gaps for Fire Risk Management, including:

- Establishing baseline battery test protocols for fair comparisons of different battery sizes
- Developing certified tests for extinguishing media and assessing performance against fire, gas, and explosion
- Defining a standardized formulation for fire test protocols
- Disseminating consistent information to local fire services on handling lithium battery fires
- Addressing safety implications of diverse battery chemistries
- Examining disparities between lithium-ion and lithium metal fire safety
- Raising public awareness about the risks of lithium-ion batteries
- Promoting knowledge sharing in the insurance sector
- Bridging the gap in storage facilities for vehicles involved in incidents without fire
- Improving the translation and sharing of international studies for emergency response best practices
- Providing guidance on handling particulate emissions, breathing apparatus, and treatment during fire incidents
- Addressing container/packaging and transit concerns for batteries
- Incorporating firefighting considerations into battery design

### **Fire Risk Management - Recommendations**

- Provide additional guidance and standardized tests for OEMs to validate their protection approaches
- Develop specific guidance for classifying lithium-ion battery fires
- Create tailored standards to prevent unfounded performance claims based on battery size and chemistry
- Define guidelines for detecting and determining safe levels of emitted gases
- Establish thresholds for battery sizes in relation to extinguishing media
- Develop standards for testing extinguishing media and devices
- Incorporate battery age, history and accident records into fire risk standards
- Provide more information and guidance for assembly and disassembly processes and those affected by hazards
- Offer guidance on battery and fire suppression system location for emergency service access
- Establish a common standard for the quantity and storage locations of batteries in buildings
- Encourage collaboration and information sharing among European countries on suppressing lithium-ion battery fires
- Address inconsistencies in approaches and equipment used by fire brigades without a common standard
- Mitigate the risk of switching hazards from fire to gas/explosion during extinguishing by implementing a common standard

### **Fire Risk Management - Recommendations**

**To address standardization gaps in Fire Risk Management, the following opportunities were highlighted:**

- Apply a hierarchy of control within the guidance
- Consider indicating the battery chemical "type" to address environmental, health, and risk impacts
- Establish a unified fire standard for all OEM EV producers to assist fire and rescue services

- Address non-aligned guidance from fire services worldwide
- Be cautious of conflicts of interest in research and guidance
- Learn from international fire and rescue services and adopt relevant practices
- Incorporate existing transport guidance on charge levels and packaging
- Reference NTA 8133:2021 nl for extinguishing lithium battery fires
- Address variation in advice and guidance at local and national levels
- Balance containment measures with the risk of explosive gas build up
- Establish a link to the proposed scope of the battery boxes base document
- Explore novel firefighting agents more effective in suppressing lithium-ion fires
- Attendees stressed the importance of developing comprehensive guidance and potentially a common standard to ensure standardized and effective Fire Risk Management

### **Fire Risk Management - Scoping**

**In terms of essential elements for new Fire Risk Management guidance for batteries, attendees highlighted the following:**

- Standard flooding points for controlled flooding of battery modules
- Design considerations for access points for extinguishants in battery packs
- Detailed component breakdown for different battery chemistry types
- Specific firefighting requirements for EVs, BESS, and warehouses
- Differentiated guidance for LFP and NMC chemistries
- Increased awareness of lithium battery hazards
- Tailored Separate training and guidance for FRS, manufacturers, and recycling facilities
- Mitigating vapor cloud explosion risks in confined spaces
- Guide on Fire Risk Management for charging points
- Handling requirements for packs at different stages (end-of-life, second life, recycling)
- Addressing high-voltage risks in crashes with limited brake access
- Emphasizing gas and explosion risks associated with lithium batteries

### **Recyclability, Second Life, and Circularity**

#### **Recyclability, Second Life, and Circularity - Standardization Gaps**

**Attendees identified key standardization gaps for Recyclability, Second Life, and Circularity, including:**

- There are gaps in standards for safe battery discharging rates, which is a bottleneck for recycling
- Clarification is needed on IP ownership and access to BMS software to enable access to battery usage history
- Testing and standardization is challenging as cells age differently within a pack
- Used battery module traceability needs improvement
- Insurance coverage for battery incidents requires involvement from insurance companies
- Guidance is lacking on sale of used batteries/modules, DIY repair/replacement, shipping of used batteries, EWC codes, and repair/scraping of damaged vehicles

- Uncertainty exists around details required in battery passports
- Lack of standardized database for cell chemistry MSDS/spec sheets
- Gaps in standards for retrofitting and converting ICE vehicles
- Difficulty obtaining manufacturers' spec sheets and MSDSs
- DIY system owners should notify fire/rescue services
- No standards exist yet for black mass

### **Recyclability, Second Life, and Circularity - Recommendations:**

**Attendees confirmed the need for additional guidance on Recyclability, Second Life, and Circularity, noting recommendations:**

- Crash repair centres to regulate usable vs non-usable batteries after accidents
- Clarifying insurance company policies on Second life batteries and incident responsibility
- Providing clear guidance on regulations for R&D companies
- Using standards to regulate Second life battery markets for consumers
- Lacking standards for black mass composition, contamination levels, etc
- Involving insurance companies in discussions
- Needing agreed quality standards and testing protocols to commoditize black mass
- Requiring training/qualifications for working on Second life systems
- Guidance needed on determining battery state of health

Overall, attendees confirmed the need to address gaps through additional guidance and standards development to improve battery Recyclability, Second Life, and Circularity

### **Recyclability, Second Life, and Circularity - Opportunity**

**To address standardization gaps in Recyclability, Second Life, and Circularity, the following opportunities were highlighted:**

- There is a lack of consensus on the definition of waste and the process of transforming waste back into a product suitable for use in new batteries
- The standards matrix needs updating, particularly regarding the content of secondary materials
- The DEFRA consultation on enhancing battery regulations in the UK by the end of 2023 presents a potential standard development opportunity. It aims to assess the UK's alignment with stricter EU regulations on battery materials and information disclosure for second life batteries. The objective is to promote the reuse and recycling of battery materials. Please note that this consultation has not yet been published
- The Office for Product Safety and Standards (OPSS) has conducted a study on second life batteries for home energy storage, which is relevant to both fire management and the broader topic, link any standards solution to the study

## Recyclability, Second Life, and Circularity - Scope

The participants were assigned the responsibility of identifying the essential components required for developing new guidance in this field. Additionally, they were encouraged to highlight any subjects that should be excluded from the scope of the guidance or delegated to other sources (such as existing guidance).

- Prioritize shipping and international transportation guidance for packs with unknown State of Health to ensure safe handling and minimize risks
- Address liability issues in guidance, determining responsibility in cases of incidents during the second life of batteries
- Establish standards for the level of discharge, clarifying what constitutes 0 Volts considering rebound effects
- Consider including guidance on the collection of batteries in the overall standardization efforts and explore further research and discussion on this topic
- Develop separate standards for second life and recycling, recognizing the different legal and regulatory classifications of these activities
- Explore the inclusion of repurposed batteries for renewable energy storage facilities in the scope of second use, requiring additional research and discussion
- Engage shipping companies such as DHL, TNT, etc., in discussions to address questions and challenges related to shipping batteries internationally, including the harmonization of standards and regulations
- Include a primary assessment process in transport requirements to determine the condition of batteries (red/amber/green) and ensure appropriate handling and transportation measures are followed

## Performance and Abuse Testing

### Performance and Abuse Testing- Key standards gaps identified

Attendees were tasked with identifying the largest standardization gaps for Performance and Abuse Testing and the following was identified:

- Lack of standard methods to consistently trigger thermal runaway
- Need for baseline test protocols allowing comparisons across battery sizes (Wh)
- Additional guidance required on triggering thermal runaway
- Tests needed reflecting real-world conditions during use, transit, reuse
- Inconsistent test protocols and data presentation in R&D
- Variability in manufacturer abuse test definitions
- Emerging chemistries like Na-ion need specific standards
- Limited data sharing among OEMs, hinders standards development

## Performance and Abuse Testing- Recommendations

Attendees confirmed the need for additional guidance on Performance and Abuse Testing, noting recommendations:

- Avoid overly restrictive tests, focus on meaningful safety assessments

## Performance and Abuse Testing - Opportunity

**To address standardization gaps in Performance and Abuse Testing, the following opportunities were highlighted:**

- Sharing existing data among OEMs, industry, and academia would be beneficial in enhancing understanding and knowledge
- Industry-specific training guidance is necessary, but there is currently no need for a standard in this regard
- Leveraging the knowledge and research from projects like ReLiB and SafeBatt by Faraday Institution could be valuable
- There is a need to raise awareness within the community about the extensive portfolio of existing standards
- Rather than creating new standards, attention should be given to improving current standards to address emerging applications such as e-scooters, drones, and homemade battery packs

## Performance and Abuse Testing- Scope

**When identifying critical elements for any new guidance or complementary resources, attendees suggested including:**

- Standard PPE, RPE, test equipment, containment, and hazardous waste handling requirements
- Clear information on testing batteries generically vs. integrated in products
- Testing procedures like cycling, performance at temperature extremes, thermal runaway onset, overcharge/discharge, mechanical/crush, short circuit, altitude, gas/particle emissions during lifetime and failure
- Charge testing like cold charging, fast charging, charger compatibility

## Next steps...

Please email any questions or comments to [faradaybatterychallenge@bsigroup.com](mailto:faradaybatterychallenge@bsigroup.com)

More details can be found on the Faraday Battery Challenge webpage [here](#)