

**Committee of Experts on the Transport of Dangerous Goods
and on the Globally Harmonized System of Classification
and Labelling of Chemicals**

Sub-Committee of Experts on the Transport of Dangerous Goods

18 June 2024

Sixty-fourth session

Geneva, 24 June-3 July 2024

Item 4 (f) of the provisional agenda

Electrical storage systems:

Miscellaneous

Lithium cells and batteries, classification, and identification

Transmitted by the Medical Device Transport Council (MDTC)

I. Introduction

1. The MDTC has been involved in the Informal Working Group (IWG) on the Hazard-Based Classification of Lithium Batteries and Cells since it was established and has contributed to the work. The positions expressed in this paper are consistent with opinions brought forward by MDTC throughout the work of the IWG. MDTC understand that some members of the IWG are of the opinion that the TDG Sub-Committee should take a two-step approach to adopting text in the *Model Regulations* and the *Manual of Tests and Criteria* to incorporate a hazard based classification and testing system. While the MDTC supports the work of the IWG and appreciates the progress that is being made, we do not support amending the *Model Regulations* to address a hazard-based classification scheme for lithium batteries until a comprehensive and complete proposal that has been well vetted and verified through validation testing has. Based on the latest information provided within document ST/SG/AC.10/C.3/2024/13 we are of the opinion that there is a significant amount of work yet to be done and that it is not realistic to include amendments in the *Model Regulations* in the current biennium. We are providing comments related to the IWG proposal and an explanation of why we don't believe amendments should be adopted this biennium as well as concerns with technical details, the direction and approach of the work.

II. Comments

2. The MDTC agrees with the expert from the UK's comment in document ST/SG/AC.10/C.3/2024/20 that the current status of IWG work is not a user-friendly approach. We believe the proposed approach is overly complicated such that it will lead to confusion by consigners, carriers and others in the supply chain including downstream shippers and reverse logistics. We contend that the primary cause of most lithium battery incidents is non-compliance with current regulations, and this can be tied to the fact that the lithium battery regulations are overly complex. The proposed classification scheme will increase the regulatory complexity and result in increased incidents in transport. The proposed classification scheme will be almost impossible for downstream consignors to meet. Reverse logistics shipments from consumers or retail entities will become a significant compliance challenge. It will also be difficult for enforcement bodies to comprehend and implement and will increase the administrative burden. The objective of the work should be to enhance safety and simplify regulatory complexity and burden while incentivizing the battery industry to design safer cells and batteries. Furthermore, incident data that we have reviewed indicates a decline in lithium battery incidents even though the volume of shipments is increasing significantly as the demand for lithium batteries is on the rise.

3. Transport Canada conducted a safety study of commercially available lithium batteries that were obtained from online marketplaces.¹ This study attempted to identify substandard batteries in relation to UN 38.3 testing and associated transport requirements such as packaging and labeling. The study found that the original equipment manufacturer (OEM) supplied batteries were in compliance with existing UN 38.3 testing requirements, and that 10 out of 20 batteries supplied by third parties failed the tests with 4 resulting in fire and explosion. Compliance with packaging, marking, labeling, and state of charge requirements, if applicable, were found to be incorrect in 16 of 24 packages that were purchased. It was noted that Test Summary documents were not easily obtained, and that only 4 documents were received out of 24 requested. A similar study was conducted by the US Federal Aviation Administration that showed compliance gaps consistent to those identified by Transport Canada, including 19 of 20 shipments of UN 3480 Lithium ion batteries transported by air at a state of charge exceeding 30 per cent.² While these studies represent a small sample size, they demonstrate that shipments originating from OEMs tend to have a higher compliance rate to existing requirements compared to those originating from non-OEM. The studies also demonstrate that there are likely high rates of non-compliance to existing requirements, we concur with recommendation from Transport Canada that we would prefer to see strategies to, “increase awareness and compliance with safety requirements” rather than increased regulation. The MDTC suggests that the proposed classification scheme will introduce requirements that are exponentially more complicated than the current scheme and that will likely produce more non-compliance and not significantly enhance safety.

4. The MDTC contends that the current proposal does not incentivize manufacturers to design and produce safer cells or batteries. The testing protocols require that manufacturers push their cells or batteries beyond the effective limits of integrated safety features. It does not account for other mitigation measures such as placement in equipment or packaging. The intent of the IWG work was to address various battery designs and chemistries and incentivize industry to design safer batteries. Many battery manufacturers are now designing their battery packs with propagation resistant materials that result in safer battery systems. Forcing cells and batteries into their worst-case testing scenarios proposed is akin to crash testing automobiles without the benefit of airbags and seatbelts for its passengers.

5. The most recent IWG proposal does not provide lithium battery manufacturers and consignors with any motivation to test their cells and batteries. Batteries that are tested and shown not to propagate for instance are not afforded significant regulatory relief. Testing according to the proposed methodology will be expensive, and the results of which will not provide any appreciable increase in safety. Our members see no real benefit to performing the tests and expending resources unless there are regulatory and safety benefits. The proposal also includes a hazard category for untested cells and batteries, this raises concerns because it sends a message that cells and batteries tested to 38.3 T1-T8 but not tested to T9-T11 are unsafe, which is not always true.

6. The packing instructions are just placeholders in the IWG proposal. Much more work is needed. The MDTC believes that packaging should be a factor in hazard characterization as it is in the classification of explosives. We also believe that any update to the *Model Regulations* should be delayed until all associated special provisions and packing instructions are complete. The addition of additional classification criteria and entries to the dangerous goods list will be of no practical value until manufacturers and downstream shippers have a complete understanding of the new requirements.

¹ Research Publication Links:

Plain Language Report Abstract - <https://tc.canada.ca/en/dangerous-goods/publications/lithium-battery-transport-research#toc5>.

Technical Summary Document (PDF) - <https://tc.canada.ca/en/dangerous-goods/publications/lithium-battery-transport-research/research-summary-evaluation-analysis-substandard-lithium-ion-batteries-383-testing>.

² *Lithium Battery Air Safety Advisory Committee Meeting Minutes*, Oct. 20, 2022, <https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2023-04/FINAL-LIBSAC-Minutes-Oct-20-2022.pdf>.

7. The current proposal does not consider mitigating safety factors such as the use of well-designed packaging materials. Certain cells that may propagate under the proposed testing conditions will not propagate based on separation and use of dividers, trays, or other thermally resistant inner packaging. Packaging should be considered in the risk mitigation and hazard characterization scheme. Some of the lithium metal batteries used in implantable devices while very small with low energy density will propagate using the test scheme in the IWG proposal but when properly packaged in trays that separate them, they pose a very minimal risk and have no history of propagation. Because these cells are implanted in the human body, they are not designed with a vent so when placed adjacent to each other in the proposed test fixture they will propagate. Based on the proposed scheme these extremely safe cells will likely be assigned to the highest hazard category, which is not a true characterization of the hazard or risk they pose in transport.

8. The current proposal creates a system that is more granular than necessary, including 9 divisions and 48 additional entries in the Dangerous Goods List resulting in a possible 56 total entries related to lithium and sodium batteries. We do not believe that there is a need to have distinctions in Packing Instructions, Special Provisions, or otherwise in the regulations to warrant this volume of entries.

9. While the MDTC believes that the current proposal results in too many new entries related to lithium batteries, we would like to encourage the Sub-Committee to explore the idea of creating separate entries for lithium batteries contained in equipment and lithium batteries packed with equipment. The current consolidated entries result in confusion related to the application of special provisions, packing instructions, hazard communication, and other operational challenges. With new state of charge mandates and recommendations passed by the International Civil Aviation Organization at their Dangerous Goods Panel DGP/29 meeting for lithium batteries packed with or contained in equipment, allowing for this distinction would help to reduce operational confusion.

10. We agree state of charge is a factor for mitigating risk. However, allowing state of charge as a factor in classification poses significant challenges for verifying compliance. While it can be controlled by the original manufacturer, downstream consignors may not be able to control or verify the state of charge (SOC) and according to the proposal would need to ship under a different hazard category and potentially need to repackage, remark, and document their shipments accordingly. This will lead to an overly complex and unmanageable situation and based on the Transport Canada and Federal Aviation Administration (FAA) studies previously mentioned will not enhance compliance.

11. The proposal does not address battery testing and hazard characterization reasonably. The tests for both cells and batteries need to be better defined, for instance the testing apparatus should be more clearly communicated. Additional work and appropriate testing protocols need to be developed to address this gap. Furthermore, we suggest that illustrations be included to show the cell and battery test fixtures and test methods more visually.

12. The proposal attempts to address electrically connected batteries as follows:

“When cells or batteries that have been tested through categorization tests (T.9 to T.11) are electrically connected, the assembled battery may be assigned to the division of tested component cells or batteries without retesting if the assembled battery is of a type that has been verified as preventing: {Remainder undefined}.”

Depending on how electrically connected cells are assembled into a battery pack could have a significant impact on safety. For instance, assembling cells into battery packs or modules using propagation resistant materials and technologies. Until this is addressed the MDTC cannot support the IWG proposal.

13. MDTC supports the alternate cell initiation method that is addressed in the battery testing paragraph 38.3.6.3.2:

“In the cases where the application of a heater on a cell is not technically possible, other equivalent ignition methods may be applied (overcharge of one cell, overcharge of a module, use a laser, use specially prepared cells with internal short circuit system, ...). This alternative method would only be acceptable in the case it generates a thermal runaway reaction on the initiation cell.”

The proposal includes this for batteries but not for cells. MDTC proposes to also include an alternate initiation for cells. We disagree with the use of a heating element to initiate a thermal runaway event to evaluate the hazard of the lithium battery in all cases. Batteries that go into thermal runaway often do so due to an internal short. It is therefore more realistic to induce an internal short and evaluate how the battery reacts. In our experience an internal short occurs when there is a foreign material, such as a copper particle, on the cathode that corrodes and forms a dendrite over time that creates an electronic bridge through the separator and connecting to the lithium anode. If there is enough current passing through the short then there could be a safety issue, but if the current is small then the hazard condition will be low. An internal shorting test like this which is latent – is more realistic for certain cells such as those used in implantable medical devices.

14. The proposal should include an approval provision for low hazard cells and batteries e.g., solid state which will not experience a thermal runaway even at temperatures exceeding 375 °C. These cells and batteries may be so safe that they can be excepted from the requirements of the *Model Regulations*.

15. The MDTC is concerned that the IWG proposal will not enhance emergency response to incidents and will likely increase confusion for responders. The IWG should consider “How does the hazard based classification system improve emergency response? Will there be different response procedures that will need to be developed?”

16. We believe that work remains in the area of hazard communication. The MDTC is concerned that the current proposal will lead to unnecessary complexity, especially considering the proposed 9 categories. It is not clear how many new battery marks and labels will be needed. Based on the current text, the MDTC believes that this proposal will result in unintended compliance failures by many shippers as this introduces many variable factors that shippers may not be immediately able to verify. If a shipper attempts to offer a used battery powered product that was tested under certain conditions, they will need to verify the Test Summary to determine the division, and any limiting factors such as state of charge. Where state of charge is a factor, the shipper would need to evaluate SOC based on information available from the device, many devices have charge indicator lights or other non-numeric visual means to display state of charge that may not provide sufficient information to verify an accurate state of charge. These issues will make shipping for consumers, retailers, and other down stream shippers very challenging.

17. On the basis of the above comments the MDTC cannot support the IWG proposal at this time and believes that a significant amount of work is needed to develop a reasonable and effective hazard based system of classification. Additionally, we are of the view that not enough testing and validation has been done and more will be needed. We do support the concept of a more granular approach to classification based on the hazards posed in transport. However, we cannot support the proposal as is currently written due to the fact that it is overly complex and will lead to non-compliance. We will continue to work with the IWG to develop a classification system that will enhance safety, incentivize cell and battery manufacturers to procedure safer products, improve compliance and reduce complexity.
