

## **Dangerous Goods Panel Working Group on Energy Storage Devices**

DATE: February 16, 2023

TIME: 0900 – 1030 EST

LOCATION: MS TEAMS

### **I. Bowtie Diagram Review**

Following the previous meeting (November 2022), the bowtie diagram was amended based on those discussions and suggestions. A small group also populated the right side of the diagram with recovery controls. The recovery controls assume traditional commercial air transport operations with larger aircraft and all controls may not be applicable to all aircraft or all operators. Generic escalation factors were included to identify cases in which a recovery control e.g. active fire suppression, depressurization etc. is not present. Unique identifiers for Causal Scenario (CS), Preventative Controls (PC), Escalation Factors (EF), Recovery Controls (RC), and Hazardous Consequence (HC) were added for ease of identification and categorization. A revised bowtie diagram incorporating these amendments was transmitted to the group prior to the meeting.

The group reviewed and discussed the bowtie diagram preventative and recovery controls. There was a question of how the diagram reflects a lack of transparency and potential rough handling and indiscriminate loading of consignments of batteries contained in equipment that are not required to display package marks or have a waybill. Such packages are treated as general cargo. This was recognized as appropriate and agreed to add to the diagram appropriate escalation factors associated with PC-8 – Handling.

Reviewing the recovery controls, the group discussed the wording of EF-5 – Degraded effectiveness of fire suppression system due to localized density of lithium battery. This text was drafted to recognize that while fire suppression systems can be effective at suppressing fires involving lithium batteries, they are not designed to prevent thermal runaway propagation.

The group discussed whether fire containment covers (FCCs), Fire Resistant Containers (FRCs) and plastic wraps weaken fire detection controls. Escalation factor RC-EF4 – Use of FRCs, plastic wrap, and FCCs may cause delay in smoke detection. It was noted that FRCs are certified to the same standards as traditional containers and provide equivalent or greater protection than traditional containers. Any degradation of fire detection capability would also be observed in traditional containers. Fire containment covers (FCCs) protect the contents from external fire sources and restrict the amount of available oxygen which aids in suppressing fires inside the cover while permitting the release of smoke. The benefits of protective features provided by FRCs, and FCCs outweigh any disadvantages from potentially delayed detection. This is noted as a mitigating control to RC-EF4.

### **I. Overview of safety risk analysis method**

The next steps for the group would be to translate this diagram into a qualitative analysis. The goal of any analysis is to produce results that are credible, repeatable, and understandable. A concern was expressed that conventional risk analysis using a reductionist approach that divides the system into components and analyzes them individually will not yield a credible outcome in this case. While this is a well-developed process employed for many years, conventional probabilistic risk assessments encounter

several problems when applied to a complex system such as the one the group is examining. Confirmation bias, sparse data about low probability events, and tailoring of data by different safety groups based on differing views all contribute to erroneous risk calculations.

An alternative risk assessment approach, notably System-Theoretic Accident Model and Processes ([STAMP](#)) that better examine complex systems and interactions offers some advantages to conventional methods. This method based on systems theory considers human interaction and the interactions of various system components and failures are characterized as flaws in the system. A STAMP informed analysis could provide the DGP with a different perspective on the performance of the existing safety system.

## **II. Analysis Working group**

A small working group will convene during the next few weeks to consider how a STAMP informed method could be applied. Preparatory material will be transmitted prior to the first meeting.