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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

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LISTING, CLASSIFICATION AND PACKING

Comments on ST/SG/AC.10/C.3/2005/43
Discussion of issues on PRBA's lithium ion battery proposals

Transmitted by the expert from the United States of America

1. Document ST/SG/AC.10/C.3/2005/43 from PRBA provides additional technical information on lithium ion battery technology to support the Sub-Committee's review of the proposals presented in three PRBA papers (ST/SG/AC.10/C.3/2005/44, -/2005/45, and -/2005/46). The expert from the United States of America provides the following comments in order to clarify some of the detailed technical points and to assist the Sub-Committee's consideration of these proposals.

2. **Lithium ion batteries contain "no lithium"**

The interpretation provided in ST/SG/AC.10/C.3/2005/43 that the UN Test Manual definition for lithium ion batteries specifies that lithium ion batteries contain no metal is not entirely correct. The UN Test Manual does not state that lithium ion batteries contain no lithium metal. Rather, the Manual observes that a lithium ion cell or battery is constructed with no metallic lithium in either electrode. The cell or battery is constructed with lithium compounds (i.e. lithium cobalt dioxide, graphite (carbon) etc.). The lithium is in the "+1 ionic state" in the cell or battery as constructed and uncharged. At this stage the article (cell or battery) cannot function as a battery because it cannot produce electric current. However, when the cell or battery is charged, the lithium ion is converted into lithium in a "zero valence state" which is chemically referred to as lithium metal. At this stage the article can function as a battery because it can produce electrical current. Chemical equations shown on page 3 of 2005/43 illustrate this mechanism. The presence of lithium as lithium metal in a lithium ion battery is demonstrated by the fact that a charged lithium ion battery will generate hydrogen gas when exposed to water.

Lithium ion batteries have both "chemical hazards" and "electrical hazards" like lithium metal batteries. Because of the way lithium batteries are constructed, the risk of a "chemical hazard" in the transport environment is limited. However, the potential electrical hazard of a

lithium ion battery is no less than that of a lithium metal battery. This is why the UN Model Regulations regulate both types of batteries as Class 9 materials and subject them to the same testing requirements. Tests for lithium batteries in the UN Test Manual were designed to ensure: (1) the battery's integrity in order to minimize chemical hazards, and (2) that no fire or disassembly occur due to internal or external short circuiting.

4. Fire tests conducted by U.S.A. and the UK

The expert from the United States of America and the expert from the United Kingdom separately conducted fire tests on both lithium metal and lithium ion batteries. The purpose of the testing conducted by the U.S. was to determine whether the current Halon fire suppression system is effective on a package of lithium batteries (either type) involved in a fire in the cargo compartment of a passenger-carrying aircraft. The purpose of the tests conducted by the United Kingdom was to determine whether a battery fire on a passenger-carrying aircraft could be extinguished by fire extinguishing media already provided on the aircraft. The results of these tests are used to assess the risk of carrying lithium batteries aboard aircraft. They should not be interpreted to demonstrate that one type of lithium battery is safer than the other.

5. Safety record of transport of lithium batteries

The overall safety record for the transport of lithium batteries is good considering the high volume of shipments. However, the incidents that have occurred must be taken into account and considered in the overall evaluation of any potential amendments to the UN Model Regulations. One incident under certain conditions could lead to a catastrophic incident involving numerous fatalities (e.g. a passenger airline crash). While it is recognized that recalls of lithium batteries were prompted by incidents that primarily occurred while the lithium batteries were in the hands of consumers and not directly related to transport, the incidents cannot be ignored. Both lithium metal and lithium ion batteries have been involved in transport incidents (as noted in ST/SG/AC.10/C.3/2005/43). In most of the incidents "electrical hazard" appears to be the probable cause. Most recently we were made aware of an incident involving a passenger's computer bag containing a laptop computer and a spare battery which caught on fire in the overhead compartment within an aircraft passenger cabin prior to departure from Chicago to Frankfurt. The fact that lithium batteries have been implicated in several transport incidents demonstrates the potential risk of lithium batteries in transport.

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