

## 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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### PROPOSALS OF AMENDMENTS TO THE RECOMMENDATIONS ON THE TRANSPORT OF DANGEROUS GOODS

#### Fuel cell cartridges containing hydrogen in a metal hydride - comments on ST/SG/AC.10/C.3/2006/82

Transmitted by the expert from the United States of America

#### **Background**

1. The expert from the United States of America has reviewed ST/SG/AC.10/C.3/2006/82 and appreciates the work undertaken by the expert from Canada in developing provisions for the transport of fuel cell cartridges containing Division 2.1 substances. The United States of America supports the inclusion of such provisions and offers the following comments on the proposal:
2. With respect to the provisions for fuel cell cartridges containing hydrogen in a metal hydride, the expert from Canada presented two options: include a reference to ISO Technical Specification 16111, or adopt the specific tests required by the Technical Specification and include them in a special provision applied to the newly proposed hydrogen in a metal hydride fuel cell entry. The United States of America favors the adoption of a special provision until such time that ISO 16111 is published as a completed international standard.
3. With respect to the special provision (3CC) proposed by the expert from Canada in ST/SG/AC.10/C.3/2006/82, the U.S. agrees with the text proposed by Canada but believes some minor amendments should be made with respect to the fire test and the hydrogen cycling test.
4. Concerning the fire test, although paragraph 6.1.2 of ISO TS 16111 defines direct flame impingement so that it is equivalent to what is commonly known as a fire engulfment test, the lack of a definition of direct flame impingement in the Model Regulations leaves this point unclear. It is proposed that the phrase "fire engulfment" be employed as it is more commonly used within the Model Regulations and more clearly understood within the transport community.
5. With respect to the hydrogen cycling test, the proposed language omits a requirement from the ISO TS 16111 that the rated charging pressure shall be used during filling and that temperatures

shall be held within the normal operating range. It is proposed that this requirement be added consistent with ISO TS 16111 paragraph 6.4.2.

### **Proposal**

It is proposed that the special provision 3CC proposed in ST/SG/AC.10/C.3/2006/82 be adopted with the following amendments to the fire test and hydrogen cycling test:

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#### **Fire test**

A fuel cell cartridge filled to rated capacity with hydrogen shall be subjected to ~~direct flame impingement~~ **a fire engulfment test**. The cartridge design, which may include a vent feature integral to it, is deemed to have passed the fire test if

- (a) the internal pressure vents to zero gauge pressure without violent rupture of the cartridge; or
- (b) the cartridge withstands the fire for a minimum of 20 minutes without rupture.

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#### **Hydrogen cycling test**

This test is intended to ensure that a fuel cell cartridge design stress limits are not exceeded during use.

The fuel cell cartridge shall be cycled from not more than 5% rated hydrogen capacity to not less than 95% rated hydrogen capacity and back to not more than 5% rated hydrogen capacity. **The rated charging pressure shall be used for charging and temperatures shall be held within the operating temperature range.** The cycling shall be continued for at least 100 cycles.

Following the cycling test, the fuel cell cartridge shall be charged and the water volume displaced by the cartridge shall be measured. The cartridge design is deemed to have passed the hydrogen cycling test if the water volume displaced by the cycled cartridge does not exceed the water volume displaced by an uncycled cartridge charged to 95% rated capacity and pressurized to 75% of its minimum shell burst pressure.

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