

## 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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Electric storage systems

### Fuel cells containing dangerous goods

Transmitted by the US Fuel Cell Council

Reference: ST/SG/AC.10/C.3/2010/5

### Introduction

1. ST/SG/AC.10/C.3/2010/5 submitted by the International Electrotechnical Commission (IEC) proposes adding new Proper Shipping Names to the existing entries for FUEL CELL CARTRIDGES containing dangerous goods. The new Proper Shipping Names proposed are for FUEL CELLS containing dangerous goods. ST/SG/AC.10/C.3/2010/5 also proposes to specify that only batteries meeting SP 188 may be contained in equipment associated with FUEL CELL CARTRIDGES and FUEL CELLS.

### US Fuel Cell Council Considerations

#### Fuel Cells Containing Dangerous Goods in an Internal Reservoir

2. The US Fuel Cell Council has considered the issue of fuel cells containing dangerous goods. Some fuel cell systems might contain an internal reservoir containing fuel (dangerous goods) and shipping such a fuel cell system must be done safely. The US Fuel Cell Council has reached the conclusion that fuel cell systems containing internal reservoirs containing fuel can be shipped as FUEL CELL CARTRIDGES CONTAINED IN EQUIPMENT providing that certain requirements are met:

3. The internal reservoir must be effectively sealed and must meet the definition of a fuel cell cartridge from SP 328:

*"Fuel cell cartridge means an article that stores fuel for discharge into the fuel cell through a valve(s) that controls the discharge of fuel into the fuel cell."*

4. The fuel must be sealed in the internal reservoir and must not leak out during transport.

5. The internal reservoir must meet the requirements for a FUEL CELL CARTRIDGE CONTAINED IN EQUIPMENT, as follows:

a) As required by Special Provision SP 328, the internal reservoir must be constructed to prevent fuel leakage under normal conditions of transport;

- b) Internal reservoir design types must pass a 1.2 meter drop test in accordance with SP 328.
- c) Internal reservoirs using hydrogen stored in metal hydrides as fuel must meet all requirements of Special Provision SP 339, including a 1.8 meter drop test.
- d) Internal reservoir design types using liquids as fuels must pass an internal pressure test at a pressure of 100 kPa (gauge) without leakage in accordance with SP 328.
- e) The entire system must be protected against inadvertent operation and activation as required by Packing Instruction P004.
- f) Internal reservoirs containing liquefied flammable gases must meet the requirements of Special Provision 338.

6. For these reasons the US Fuel Cell Council believes that the current Model Regulations are sufficient to ensure safe transport of fuel cell systems with internal reservoirs containing fuel (dangerous goods) and that no change to the Model Regulations is required.

### **Fuel Cells Containing Dangerous Goods as Residual Fuel**

7. The US Fuel Cell Council has considered the issue of fuel cells containing dangerous goods in residual fuel. Fuel cell systems might contain residual fuel after use and shipping such a fuel cell system must be done safely. The US Fuel Cell Council has reached the conclusion that fuel cell systems containing residual fuel can be shipped as FUEL CELL CARTRIDGES CONTAINED IN EQUIPMENT providing that certain requirements are met:

- a) All of the requirements of Special Provision 328 must be met including the requirement that the fuel must be sealed in the fuel cell system and must not leak out during transport;
- b) Fuel cell design types must pass a 1.2 meter drop test in accordance with SP 328;
- c) The entire system must be protected against inadvertent operation and activation as required by Packing Instruction P004.

8. Conditions a) and b) above are required by Special Provision 328. Condition c) above is required by Packing Instruction P004.

9. In order to ensure that all shipments comply with the requirements of P004 the US Fuel Cell Council recommends that the following clarified text be added to SP 328:

*"For fuel cell cartridges contained in equipment, the entire system shall be protected against short circuit and inadvertent operation."*

10. Likewise the text of P004 should be changed to be consistent with the text above.

### **Fuel Cells Containing Batteries**

11. The US Fuel Cell Council has considered the issue of fuel cell systems containing batteries because some fuel cell systems containing fuel (dangerous goods) being shipped as FUEL CELL CARTRIDGES CONTAINED IN EQUIPMENT might also contain batteries, which may be regulated as dangerous goods. In accordance with Section 5.1.4 *Mixed packaging* of the Model Regulations, "when two or more dangerous goods are

packed within the same outer packaging, the package shall be labelled and marked as required for each substance."

12. The US Fuel Cell Council has reached the conclusion that the Model Regulations provide sufficient guidance for shipment of equipment that might contain both batteries and fuel cell cartridges. In the case of fuel cell systems containing a fuel cell cartridge and lithium or lithium ion batteries, the shipment would have to comply with all requirements associated with all applicable proper shipping names. For example, both FUEL CELL CARTRIDGES CONTAINED IN EQUIPMENT and LITHIUM BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT would apply. For these reasons, the US Fuel Cell Council believes that the current Model Regulations are sufficient to ensure safe transport of fuel cell cartridges contained in equipment which may also contain a battery.

## **Proposal A**

13. Revise SP 328 as follows:

328 This entry applies to fuel cell cartridges including when contained in equipment or packed with equipment. Fuel cell cartridges installed in or integral to a fuel cell system are regarded as contained in equipment. Fuel cell cartridge means an article that stores fuel for discharge into the fuel cell through a valve(s) that controls the discharge of fuel into the fuel cell. Fuel cell cartridges, including when contained in equipment, shall be designed and constructed to prevent fuel leakage under normal conditions of transport.

Fuel cell cartridge design types using liquids as fuels shall pass an internal pressure test at a pressure of 100 kPa (gauge) without leakage.

Except for fuel cell cartridges containing hydrogen in metal hydride which shall be in compliance with special provision 339, each fuel cell cartridge design type shall be shown to pass a 1.2 meter drop test onto an unyielding surface in the orientation most likely to result in failure of the containment system with no loss of contents.

For fuel cell cartridges contained in equipment, the entire system shall be protected against short circuit and inadvertent operation.

## Proposal B

14. Revise P004 as follows:

P004	PACKING INSTRUCTION	P004
This instruction applies to UN Nos. 3473, 3476, 3477, 3478 and 3479		
<p>The following packagings are authorized provided that the general provisions of 4.1.1.1, 4.1.1.2, 4.1.1.3, 4.1.1.6 and 4.1.3 are met:</p> <p>(1) For fuel cell cartridges, packagings conforming to the packing group II performance level; and</p> <p>(2) For fuel cell cartridges contained in equipment or packed with equipment, strong outer packagings. Large robust equipment (see 4.1.3.8) containing fuel cell cartridges may be transported unpackaged. When fuel cell cartridges are packed with equipment, they shall be packed in inner packagings or placed in the outer packaging with cushioning material or divider(s) so that the fuel cell cartridges are protected against damage that may be caused by the movement or placement of the contents within the outer packaging. <del>Fuel cell cartridges which are installed in equipment shall be protected against short circuit and the entire system shall be protected against inadvertent operation.</del> <u>For fuel cell cartridges contained in equipment, the entire system shall be protected against short circuit and inadvertent operation.</u></p>		

## Conclusion

15. The US Fuel Cell Council believes that new proper shipping names for FUEL CELLS containing various types of dangerous goods are not necessary, but that the Sub-Committee may wish to consider the proposals above to further strengthen the Model Regulations and to provide additional clarification.