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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****Forty-fourth session**

Geneva, 25 November – 4 December 2013

Item 2 (c) of the provisional agenda

**Listing, classification and packing: miscellaneous****Packing requirements for UN1873****Transmitted by the Council on Safe Transportation of Hazardous  
Articles (COSTHA)<sup>1</sup>****Introduction**

1. At the forty-third session, COSTHA presented in documents ST/SG/AC.10/C.3/2013/30 and informal document INF.5 arguments and test data supporting the compatibility of packagings constructed of fluoropolymers with high concentration perchloric acid.
2. Perchloric acid is regulated either as UN1873 as a 5.1(8) when in solutions with a concentration of more than 50% but not more than 72% perchloric acid, or as UN1802 as a 8(5.1) when in solutions with a concentration up to 50% perchloric acid.
3. UN1802 is required to be packed in accordance with P001 which authorizes glass, plastic, or metal inner containers. UN1873 is required to be packed in accordance with P502 and while P502 authorizes glass, plastic, and metal inner containers, special packing provision PP28 limits the construction of inner packagings and inner receptacles to glass for combination and composite packagings. Plastic 1H1 single packagings are permitted for UN1873 up to a maximum capacity of 250 l.
4. The availability of high quality, low reaction plastics has increased since adoption of PP28. In particular, the use of fluoropolymers has resulted in very stable, chemically resistant packaging which would technically fall under the definition of plastic packaging.

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<sup>1</sup> In accordance with the programme of work of the Sub-Committee for 2013-2014 approved by the Committee at its sixth session (refer to ST/SG/AC.10/C.3/84, para. 86 and ST/SG/AC.10/40, para. 14).

The current language in PP28 prohibits the use of these chemically stable and safe packagings.

### **Compatibility of fluorinated plastics with UN1873**

5. Fluoropolymers are fluorinated plastics. Most plastics are chains of carbon atoms with hydrogen or other atoms attached to them. In fluoropolymers, fluorine atoms replace all (type one fully fluorinated polymers) or some (type two partially fluorinated polymers) of the hydrogen atoms. This creates a high binding energy among atoms within the plastic molecules and makes these plastics highly stable. As a result fluoropolymers generally exhibit superior resistance to heat and chemical attack than other plastics. Type one fully fluorinated polymers such as fluorinated ethylene-propylene (FEP) and perfluoroalkoxy (PFA) generally emphasise these properties. Literature confirming the properties and chemical resistance of fluoropolymers is widely available.

6. Fluoropolymer inner packagings meet the construction requirements of 6.1.4. To support this assertion tests were conducted on FEP and PFA bottles that contained UN1873 perchloric acid in concentrations from 67%-72% w/w for periods ranging from almost six to greater than fourteen years, far more than the six months suggested in 6.1.5.2.4. These tests included;

- (i) 24 hr stack
- (ii) 2.55 m drop
- (iii) 95 kPa internal pressure
- (iv) ASTM D2463 impact resistance drops up to 3.25 m.

The bottles used passed all tests. Testing results were submitted in preparation for the 43<sup>rd</sup> session and distributed as informal document INF.5.

### **Increased safety**

7. Glass inner containers provide protection from chemical reactions for perchloric acid. However, physical hazards such as impacts and extreme temperatures can have a detrimental effect on glass. Plastic packaging provides greater flexibility in certain circumstances, being able to absorb hard impacts without shattering or cracking. Fluoropolymers in particular have been shown to provide long term flexibility without the embrittlement associated with other plastics. The results of the ASTM D2463 impact resistance drop tests for blow molded thermoplastic containers on the test report published as informal document INF.5 (43<sup>rd</sup> session) confirm these assertions.

### **Industry needs**

8. UN1873 is used by industries such as geochemical and semiconductor for elemental analyses. Most elements in high purity perchloric acid used for elemental analyses are certified at concentrations as low as one part in  $10^{12}$  (part per trillion). This level of purity cannot be maintained unless chemically pre-cleaned fluoropolymer containers are used. Glass and metal containers are unsuitable as they are incapable of maintaining purity at ppt levels.

## Justification

9. Given the discussion above, COSTHA believes the special packing provision of PP28 is too restrictive and overly limits the use of safe and available packaging options. Paragraph 4.1.1.2 requires that packagings in direct contact with dangerous goods are constructed of materials that are compatible with those dangerous goods. It has been demonstrated that there are plastics available that are compatible with UN1873. Current options as outlined in 6.1.1.2 are limited to competent authority approvals or exemptions which may require multilateral agreements for international or intermodal transport.

## Proposal

10. COSTHA suggests the current text of PP28 be replaced with the following text:

Current

PP28 For UN1873, only glass inner packagings and glass inner receptacles are authorized respectively for combination packagings and composite packagings.

Proposed

PP28 For UN 1873, metal inner packagings and metal inner receptacles are not authorized. For all packagings the requirements of 4.1.1 shall be met.

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