Secretariat

Distr.: General
26 March 2012

Original: English

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-first session
Geneva, 25 June – 4 July 2012
Item 3 (a) of the provisional agenda
Listing, classification and packing:
Proposals of amendments to the list of dangerous goods of Chapter 3.2

Neutron radiation detectors

Transmitted by the Dangerous Goods Advisory Council[1]

Introduction

1. Neutron detection is a key component in the identification of illicit nuclear materials (e.g., plutonium) passing through ports of entry and borders of a country. Radiation detection systems can be employed to scan freight containers or perform searches using portable radiation detectors. Additional applications for neutron radiation detectors include nuclear reactor monitoring, neutron-based cancer treatments, cosmic ray research, neutron spallation, non-destructive testing and health physics applications. Since 2009, a shortage of Helium-3 gas commonly employed in neutron detectors has necessitated the use of alternative technologies. One such technology employs boron trifluoride (BF_3) as the neutron detection medium. The effectiveness and safety of this technology has been demonstrated over the last 70 years in the applications listed. In spite of the important safety and security role these devices play, the small quantity of toxic gas present at atmospheric pressure often causes delays in their transport. The problems seem unwarranted in light of the low risk posed and DGAC submits this paper to provide a basis for discussion on how transport of these devices may be facilitated.

2. Neutron radiation detectors described in this proposal are hermetically sealed electron tube devices that contain non-pressurized BF_3 gas that functions as the detection medium. They have been transported worldwide for over 70 years. With more than

[1] In accordance with the programme of work of the Sub-Committee for 2011-2012 approved by the Committee at its fifth session (refer to ST/SG/AC.10/C.3/76, para. 116 and ST/SG/AC.10/38, para. 16).

250,000 BF_3 sensors in service worldwide in the nuclear power and radiation protection industries, there is no known incident of a BF_3 leak in transport.

3. Considering their role in preventing nuclear terrorism, as well as their importance in other health and safety applications, it is essential that BF_3 based neutron radiation detection systems and detector system components can be rapidly deployed worldwide.

Discussion

4. A number of safety features are inherent in the design and construction of neutron radiation detectors, the component of radiation detection systems containing BF_3:

- The gas is non-pressurized with the pressure at the time of filling kept at 105kPa absolute at 20^{o}C or below;

- The amount of gas is relatively small. The largest radiation detector systems contain not more than 55 grams of gas;

- Radiation detectors are extremely rugged, having a minimum burst pressure of 1800 kPa. Under requirements of the United States Department of Transportation neutron radiation detectors must be packed in strong outer packagings that are capable of withstanding a 1.8 meter drop test without leakage;

- The detection systems and neutron radiation detectors transported as components are packaged with an absorbent material that is capable of absorbing all of the gas contained in package. A study by Brookhaven National Laboratory shows the absorbent material to be highly effective in absorbing the gas should it leak from the radiation detector under use or transport conditions; and

- Radiation detectors are hermetically sealed. Each unit is helium mass spectrometer leak tested to a 1 x 10^{-10} standard cc/sec leak tightness before filling.

5 In the case of land transportation in the United States of America and Canada, these devices are authorized for transport under permits. Under ADR/RID, it is understood that they fall under the equipment exemption in section 1.1.3.1(b) so that these regulations do not apply.

6 A recent amendment to be incorporated in the 2013-2014 ICAO Technical Instructions will permit air transport on cargo aircraft as UN 1008 BF_3 under a new Special Provision. While this will somewhat ease air transport problems, air transport will continue to prove difficult owing to the refusal of many air carriers to accept any Division 2.3 goods.

7 In the case of sea transport, while these devices can be transported under UN 1008, it is the practice of some carriers to require a freight container containing toxic gases to be used exclusively for that purpose. As such, it is sometimes necessary to dedicate an entire freight container for use in transporting one radiation detector. As is the case with air carriers, some ocean carriers refuse to ship Division 2.3 goods, creating serious logistical problems. The need for permits and approvals further complicates transport.

8 The transport difficulties brought on by the Division 2.3 hazard classification appear unwarranted in view of the small risk these devices pose and contrary to the shared objectives of safety and security. DGAC would welcome a discussion on alternative approaches to transporting these devices. One solution could be to permit these devices as UN3363 Dangerous Goods in Apparatus. While UN3363 is limited by SP 301 to substances that are permitted as limited quantities, this could be overcome by a new special provision. To provide a basis for discussion and provide a better understanding of the requirements

contemplated, the proposal below is provided. The proposal includes elements from the new ICAO TI special provision to be included in the 2013-2014 edition.

9 To provide a better understanding of radiation detectors and systems, DGAC plans to provide an additional informal paper prior to the meeting.

Proposal

10. DGAC proposes the following:

Introduce in the glossary two new terms:

Neutron radiation detector is a hermetically sealed electron tube transducer that converts neutron radiation into a measureable electric signal. The gas in the device is the neutron detection medium.

Radiation detection system is an apparatus that contains neutron radiation detectors as components.

Add a new special provision XXX against UN3363 to read as follows:

XXX Neutron radiation detectors containing non-pressurized BF_3 gas in excess of 1 gram and radiation detection systems containing such neutron radiation detectors as components may be transported under this entry, provided:

(a) The pressure in each neutron radiation detector does not exceed 105 kPa absolute at 20^{o} C;

(b) The total amount of BF_3 in neutron radiation detectors per outer packaging or per radiation detection system does not exceed 55 grams;

(c) Each neutron radiation detector is of welded metal construction with brazed metal to ceramic feed through assemblies. The burst pressure of detectors is not less than 1800 kPa;

(d) Each neutron radiation detector (including multiple detectors as, for example, in a device) is contained in a sealed plastic liner with sufficient absorbent material to absorb the entire gas contents; and

(e) Each neutron radiation detector is packed in a strong outer packaging capable of withstanding a 1.8 meter drop test without leakage and each radiation detection system is packed in a strong outer packaging unless neutron radiation detectors are afforded equivalent protection by the radiation detection system.

Neutron radiation detectors containing not more than 1 gram of BF_3, including those with solder glass joints, and radiation detection systems containing such detectors where the neutron radiation detectors meet and are packed in accordance with the above conditions, are not subject to these Regulations.