Sub-Committee of Experts on the Transport of Dangerous Goods
(Nineteenth session,
2-6 July 2001, agenda item 8(a))

EXPLOSIVES, SELF-REACTIVE SUBSTANCES AND ORGANIC PEROXIDES

Comments on ST/SG/AC.10/C.3/2001/13
Classification of fireworks

Transmitted by the Expert from the United States of America

1. Introduction

A recent accident in the Netherlands has generated considerable interest in the classification and quality control of fireworks, with specific attention focused on hazards associated with the ignition of fireworks in a storage or transportation scenario. Current fireworks consumption in the United States is estimated at approximately 200 million pounds per year, with a large percentage (estimated at 85-90%) manufactured in China. Consumer fireworks account for an estimated 67% of this total, with fireworks for use in public displays accounting for the remainder.

In the United States fireworks are regulated as pyrotechnic articles under Class 1 according to the UN Recommendations. The classification, including assignment of a division number and compatibility group letter, is accomplished by a dual system (i.e., testing in accordance with the UN Class 1 scheme or based on limitation of size, content and chemical compositions in the firework articles).

2. United States Experience and Practice

The United States created a system for the classification of fireworks over 50 years ago, which served both transportation and other regulatory purposes. Under this system, the weight and type of pyrotechnic composition in a fireworks device determined its classification. A number of tests over the years, and unintentional incidents, have validated the premise that the behavior of fireworks articles in a fire situation is quite dependent on the quantity and type of pyrotechnic composition per article.

When the United States underwent the transition to the UN Recommendations in the early 1990's, this philosophy was carried over, and a default system is used today to distinguish between articles that are classed as 1.3G versus 1.4G. Devices that are classed as 1.4G under the U.S. system will burn but not deflagrate or mass explode in a fire situation, while it is possible, and in some cases quite likely, that a fire situation involving articles classed as 1.3G will produce a violent fire or a series of explosions. Magazine storage, with required minimum separation distances, is mandatory for the storage of 1.3G fireworks, while 1.4G fireworks are considered to be a potential fire risk, but not an explosion hazard. Federal licenses and permits are also required for firms or persons engaging in business involving 1.3G articles. The Netherlands proposal under consideration does not provide any differentiation in classification based on powder weight per item, and we feel that this should be included in any attempt to develop an international default system for fireworks.

3. APA Standard 87-1

The United States has incorporated into its transportation regulations a Standard for fireworks and pyrotechnic articles that has been prepared by the American Pyrotechnics Association. This Standard, known as APA Standard 87-1, contains the default classification system previously contained in the DOT regulations. It also incorporates a number of requirements of the U.S. Consumer Product Safety Commission pertaining to the construction, labeling, and performance of consumer fireworks.

All fireworks transported in the Unites States, including imports and exports, must be approved and assigned a classification by DOT based on actual testing (in accordance with the UN classification scheme) or in accordance with the APA Standard 87-1. An applicant requesting approval based on APA Standard 87-1 submits a document that contains required information regarding a specific device. The size of the device, as well as the various formulas and weights of each type of composition contained in the device must be specified. A detailed diagram of the device must also be provided, along with a certified statement attesting to the thermal stability of the compositions in the device. APA Standard 87-1 contains a Table of "Standard Fireworks Chemicals" that have been used with good experience in the fireworks industry. Only formulas containing chemicals found in the Table of "Standard Fireworks Chemicals" can be approved under the provisions of APA Standard 87-1. If chemicals that are not contained in the standard table are used in a fireworks device, testing in accordance with the UN Recommendations is required. The U.S. DOT also has the discretion and authorization for requiring full testing for any device in which there is any uncertainty regarding its proper classification.

The default weight limits for distinguishing between a 1.3G and a 1.4G fireworks article in the U.S. are provided in Table 1 (see Annex 1). The current list of Standard Fireworks Chemicals from APA Standard 87-1 is provided in Table 2 (see Annex 2).

4. Enforcement and Quality Control Considerations

With the large quantity of foreign-manufactured fireworks that are imported to the U.S. each year, there has been concern regarding proper classification as well as quality control associated with the devices. The U.S. DOT, through its enforcement program which includes cooperation with other governmental agencies, strives to ensure that fireworks are transported in accordance with applicable regulatory requirements. The U.S. Consumer Product Safety Commission (CPSC) conducts an annual import surveillance program in which products intended for the consumer market are sampled and tested for compliance with the CPSC regulations (performance and consumer safety based). Devices that are mislabeled, perform unreliably in a hazardous manner, or contain excessive amounts of explosive composition are seized, and the importer can be subject to considerable fines.

In an effort to further address quality concerns associated with consumer fireworks, the U.S. fireworks industry has created the American Fireworks Standards Laboratory, or AFSL. The AFSL has established a quality control monitoring program in China that enables U.S. fireworks importers to have fireworks monitored for compliance with both CPSC and DOT requirements prior to export from China. This monitoring is carried out by an internationally-recognized, independent third-part testing company with offices at several locations within China. Devices that are found to be in compliance receive high-security, numerically-sequenced labels that are placed on each shipping carton following examination of the fireworks. Devices that do not meet U.S. requirements are returned to the manufacturer.

This inspection program was established in 1994, and over 2 million shipping cartons of consumer fireworks passed through the AFSL program in the year 2000. It is believed that this program, which is voluntary at the present time, is now covering 80-90% of the consumer fireworks coming to the U.S. from

China. CPSC has now focused its import surveillance program on shipments that have not received AFSL examination, thereby helping to insure that all consumer fireworks coming to the U.S. from China comply with U.S. regulations, including proper transportation classification, packaging and marking.

5. Recommendation on harmonization

We support the suggestion by the Netherlands to harmonize classification criteria of all fireworks. We would like to offer the following views for discussion:

- *Categorization of fireworks according to use*

  Since fireworks are produced and used by many countries any effort to develop a single standard is not easy. Perhaps a more general categorization can be achieved. In our APA Standard 87-1 certain categories are established which could be used as the starting point for discussion.

- *Transport classification*

  We agree with the Netherlands that proper classification of fireworks is an important safety issue. However, we feel the basic principles for classifying fireworks are already laid down in the UN Model Regulations. We are of the opinion that the main focus of discussion at the Sub-Committee should be developing a harmonized understanding of how to utilize the existing scheme.

- *Enforcement and quality control*

  While these areas are generally not covered by the UN Model Regulations or any other international regulations, it is important to stress the need of including these in the implementation of dangerous goods regulations, particularly at the national level.

- *Intersessional working group*

  Based on points described above we are not sure about the need to create a formal intersessional working group. A working group discussing different approaches used by different countries would serve to identify problems, if any, that are not addressed in the current UN Model Regulations.

TABLE 1

Default Limits for 1.4G Classification
(From APA Standard 87-1)

Category of Device	**Weight Limits of Pyrotechnic Composition for 1.4G Classification**
Fountain, Cone-type	50 grams
Fountain, Cylindrical	75 grams
Sky Rocket, Missile, Helicopter	20 grams
Roman Candle	20 grams
Aerial Shell, Mine, Comet (contained in firing tube)	60 grams
Firecracker and ground-based reports	0.05 grams
Any aerial report component	0.13 grams
Reloadable aerial shell, maximum 12 shells per package, max. 44 mm diameter	60 grams per shell, 400 grams per package
Aerial display shell, without launch tube, bulk packed	classed as 1.3G unless tested
Multiple-tube devices, dense-packed	200 grams total pyrotechnic composition
Multiple-tube devices, with minimum tube separation of 13 mm on a base	500 grams total pyrotechnic composition
Wheel	60 grams per driver, 200 grams total composition
Ground Spinner	20 grams
Toy Smoke Devices, Wire sparklers	100 grams

TABLE 2

*** Standard Fireworks Chemicals From APA Standard 87-1 (2001 Version)**

Chemical	Typical Use
Aluminum	Fuel
Ammonium Perchlorate	Oxygen Donor
Antimony	Fuel
Antimony Sulfide	Fuel
Barium Carbonate	Neutralizer
Barium Nitrate	Oxygen Donor
Barium Sulfate	Oxygen Donor
Bismuth Oxide	Oxygen donor
Boric Acid	Neutralizer
Calcium Carbonate	Neutralizer
Calcium Sulfate	Oxygen Donor
Carbon or Charcoal	Fuel
Copper Metal	Color Agent
Copper Oxide	Oxygen Donor, Color Agent
Copper Salts (except Copper Chlorate)	Color Agent
Dextrine	Fuel/Binder
Hexamethylenenetetramine (Hexamine)	Fuel
Iron and Iron Alloys (e.g., ferro/titanium)	Fuel
Iron Oxide	Oxygen Donor
Magnalium (Magnesium/Aluminum)	Fuel
Magnesium (in display fireworks and theatrical pyrotechnics only)	Fuel
Magnesium Carbonate	Neutralizer
Magnesium Sulfate	Oxygen Donor
Nitrocellulose - see Miscellaneous Compounds	
Nitrocellulose based lacquers	Binder
Phosphorus, Red (only as provided in Table 3.7.1)	Fuel
Potassium or Sodium Benzoate	Whistle
Potassium Bichromate (Potassium Dichromate) (not to exceed 5% of formulation)	Oxygen Donor
Potassium Chlorate (only as provided in Table 3.7.1)	Oxygen Donor
Potassium Hydrogen Phthalate	Whistle
Potassium Nitrate	Oxygen Donor
Potassium Perchlorate	Oxygen Donor
Potassium Sulfate	Oxygen Donor
Silicon	Fuel
Sodium Bicarbonate (Sodium Hydrogen Carbonate)	Neutralizer
Sodium Nitrate	Oxygen Donor

Sodium Salicylate	Whistle
Sodium Salts (except Sodium Chlorate)	Color Agent
Sodium Sulfate	Oxygen Donor
Strontium Carbonate	Color Agent
Strontium Nitrate	Oxygen Donor
Strontium Salts (except Strontium Chlorate)	Color Agent
Strontium Sulfate	Oxygen Donor
Sulfur	Fuel
Titanium (particle size must not pass through 100 mesh sieve if 1.4G or 1.4S Fireworks)	Fuel

Miscellaneous Compounds:

Organic compounds (compounds such as lactose, shellac, red gum, chlorinated paraffin and polyvinyl chloride, consisting of some combination of carbon with hydrogen, oxygen and/or chlorine; nitrogen may be present if it accounts for less than 10% (by weight) of the compound.)
Nitrocellulose containing greater than 10% nitrogen by weight is permitted as a propelling or expelling charge provided there is less than 15 grams of nitrocellulose per article.

NOTE: Exact chemical identity of each "Organic compound" must be included when submitting an Approval Application to the U.S. DOT.