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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-seventh session**

Geneva, 22 – 26 June 2015

Item 2 (i) of the provisional agenda

**Explosives and related matters: miscellaneous****Analogy approvals based on test results obtained using the  
Manual of Tests and Criteria****Transmitted by the Sporting Arms & Ammunition Manufacturers'  
Institute (SAAMI)<sup>1</sup>**

1. Unlike the majority of chemical products which are self-classified by industry, explosives often require written approval from one or more competent authorities before transport due to national or regional explosives laws. Similarly, self-reactives and organic peroxides may be included in these laws or other legislation. Products thus controlled are approved for transport on the basis of classification procedures in the United Nations Manual of Tests and Criteria.

2. For practical reasons, while some products are tested, others are approved by comparison, called “analogy”, or other non- testing methods. The analogy method is not documented as an option in the Manual. At the forty-fifth session of the Sub-Committee , the Working Group on Explosives held an informal discussion to discuss common methods used for analogy approvals. Support existed for the development of guidance for the Manual which would document generally accepted practices of competent authorities, and thereby increase harmonization and provide assistance to developing countries. This working paper documents the methods used for analogy classification. SAAMI proposes a discussion of the methods so that further development can take place, leading to a proposal for amendments to the Manual later in the biennium.

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<sup>1</sup> In accordance with the programme of work of the Sub-Committee for 2015-2016 approved by the Committee at its seventh session (refer to ST/SG/AC.10/C.3/86, para. 86 and ST/SG/AC.10/42, para. 14).

## Discussion

3. The degree of hazard of products may or may not vary substantially based on minor variations in specifications or the packaging configuration. The classification process requires expert judgment to avoid under- or over-testing and the resulting impacts on safety and efficiency. The appropriate use of the Manual is described in its introduction in Section 1.1.2:

“It should be noted that the Manual of Tests and Criteria is not a concise formulation of testing procedures that will unerringly lead to a proper classification of products. It therefore assumes competence on the part of the testing authority and leaves responsibility for classification with them. The competent authority has discretion to dispense with certain tests, to vary the details of tests, and to require additional tests when this is justified to obtain a reliable and realistic assessment of the hazard of a product. In some cases, a small scale screening procedure may be used to decide whether or not it is necessary to perform larger scale classification tests...”

Experts should bear in mind that, regardless of existing or additional methods developed for the Manual, competent authorities retain their discretion when issuing classification approvals because expert judgment is a fundamental basis of the classification process.

4. For efficiency many products are not tested when assigned a classification. Some products are so well characterized already that new variations are classified and approved without testing, and similar products may be approved in comparison to them. For products which require characterization, classification is based on empirical data derived by testing and the interpolation of these results to a controlled spectrum of related products and packaging configurations. The standard practice of competent authorities is to group products into “families” based on similar specifications and packaging. Competent authorities or their designees select one or more products in the family to bound the parameters thought to be key for the particular products being approved. The selected product(s) are tested and approved based on passing results. The classification and approval of un-tested products by comparison to similar tested products is described as being “by analogy”.

5. Similarly, small scale testing may be used at the competent authority’s discretion to reduce or eliminate large scale testing and/or broaden the range of a multi-variable family.

6. While analogy is a significant basis for product classifications, there are no existing procedures in the Manual. Also not included are parameters for the use of small scale tests to replace large scale testing. While these do not exist in the Manual, many decision methods for approvals without testing are well known and broadly accepted. Others may be individual practices of states based on expertise, national experience, reciprocity, and other factors.

## Proposal

7. SAAMI proposes a new section in the Manual in principle. No decision is requested at this time, only a discussion of the following information so that it may be developed into a proposal which may find the acceptance of the experts

8. Since testing and analogy are not the only legitimate bases for approvals, we would create an introductory paragraph to list all bases in an open-ended manner to preserve their legitimacy:

- Testing
- Analogy
- Negligible change / not new
- National regulations or laws
- Reciprocity
- Discretion of the competent authority

9. Information required to classify analogy might include:

- Technical data package
- Summary of test and results of the parent product
- Comparison of parent product to new
- Applicable UN Series 3 or 4 sensitivity test results or alternative

10. We propose to develop guidelines for the approval for simple analogies (single parameter variability) substances and articles.

- One degree of separation (one change), not multiple changes (e.g., a change in the configuration of the article or substance, a change in an explosive substance within an article, a change in the packaging configuration, a reduction in the explosive quantity, etc.)
- Consideration for percentage changes that shouldn't trigger retesting

11. Once simple analogies are outlined, experts may wish to provide some guidance on more complex, multiple variable analogies. These could be augmented by specific tests, primarily small scale, which are selected to address identified variables that are beyond or exceed the boundaries of the existing test data.

12. The parameters to provide the basis of detailed discussion in the explosives working group are attached in the annex to this document.

## Annex

### Substance parameters

#### Substance parameters

- Chemical – Formulation
  - Percentages
  - Variations or substitutions in fuels, oxidizers, inert/binder materialsRequires UN Series 3 to confirm the material is not forbidden
- Physical
  - Surface area type
    - Fine particles
  - Particle size distribution
  - Density
    - Pressed pellets
    - Ball or granules
    - Flake
    - Extruded
  - Guideline for substances of the same surface area type

#### Article parameters

- Explosive substance characteristics
  - See Substance parameters - Physical (above)
- Article configuration
  - Range of substances
  - NEW range
  - Dimensions
  - Material of construction
  - Fabrication (Confinement)
    - Welded, extruded, crimped
    - Wall thicknesses

#### Inner packaging configuration, substances or articles

- Weight (N.E.W.)
- Volume (substances)

- Head space or height within packaging (substances)
- Material of construction
  - Fibreboard
  - Plastic
  - Metal
    - Alloy
    - Thickness
- Construction
  - Taped
  - Glued
  - Pressed
  - Crimped
  - Welded
- Design
  - Geometry
  - Spacing/dimensions (articles)
  - Protective features
    - Protection from ignition
    - Limitation of reaction severity

### **Intermediate packaging configuration, substances or articles**

- Weight (N.E.W.)
- Material of construction
  - Fibreboard
  - Plastic
  - Metal
    - Alloy
    - Thickness
- Construction
  - Taped
  - Glued
  - Pressed
  - Crimped
  - Welded
- Design
  - Geometry

- Spacing/dimensions
- Protective features
  - Protection from ignition
  - Limitation of reaction severity

### **Outer packaging configuration, substances or articles**

- Net Explosive Weight in inner, intermediate, and outer packaging
- Materials of construction for outer packaging
  - Metal packaging (higher confinement, fragment producing)
  - Wood packaging (inhibiting heat transfer into and out of the package; potential source for slow cook off resulting in a mass explosion hazard)  
*NOTE:* Metal or wood packages should NEVER be recommended by analogy to materials tested in thin-walled fibreboard or plastic packaging; if such packaging are desired, they must be included as part of the test program in the UN Series 6 tests.
  - Filler (e.g., foam, kraft paper, etc.)
- Design
  - Shape of outer package and method of confinement in the UN Series 6 (a) and 6 (b) tests
  - Free space/interspace between outer packages
  - Protective features
    - Protection from ignition
    - Limitation of reaction severity

### **Complex article parameters**

- Same as substances and articles listed above BUT with multiple energetic substances or article components
  - Multiple variables
- Identify KEY contributing parameters
  - Fuel/oxidizer/binder ratios
  - Critical height/Diameter of energetic substances
  - Confinement
- Develop test requirements based on KEY contributing parameters

### **Analogy decision tree**

- This decision tree will be constructed following consensus on key parameters in consideration for analogies

- The complexity of the decision tree will increase based on the number of metric variables outlined above

**Analogies within families of substance or article (differentiated from analogies)**

- Defining families of articles and substances to be evaluated at a later date
  - Broader than analogies
  - Bounds a range of variables
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