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 **26 June 2014**

Forty-fifth session
Geneva, 23 June – 2 July 2014
Item 2 of the provisional agenda
Explosives and related matters

Report of the Working Group on Explosives

Transmitted by the chairman of the Working Group

Introduction

1. The working group met from 23 to 26 June 2014 in a parallel session to the plenary meeting of the Sub-Committee on the Transport of Dangerous Goods. This meeting of the working group was well attended with 40 experts in attendance from Australia, Belgium, Canada, China, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Spain, Sweden, United Kingdom, United States of America, EU Commission, AEISG, CLEPA, COSTHA, ICCA, IME, and SAAMI. A list of participants is provided in Annex 1 to the report. The group was tasked to discuss technical matters related to official papers and to discuss informal papers as time allowed. Mr. Ed de Jong (Netherlands) served as chair of the working group and Mr. David Boston (IME), as secretary.

2. The following papers were discussed.

Document	Title
Agenda Item 2(a)	Tests and criteria for flash compositions
ST/SG/AC.10/C.3/2014/59 - (Netherlands)	*Classification of fireworks*
UN/SCETDG/45/INF.5 - (Netherlands)	*Behaviour of waterfalls in large quantities; results of a research project*
UN/SCETDG/45/INF.18 - (United Kingdom)	*The effectiveness of the current UN series 6(a) and 6(b) tests when used to classify fireworks for transport*
UN/SCETDG/45/INF.19 - (Japan)	*Comments on the apparatus, materials and criteria of US- and HSL Flash Composition Tests*
UN/SCETDG/45/INF.20 - (United Kingdom)	*The effectiveness of US and HSL modified plugs for the HSL flash composition test*
Agenda Item 2(b)	Review of test series 6
ST/SG/AC.10/C.3/2014/1 - (IME / SAAMI)	*Correction to Figure 10.3: Procedure for Assignment to a Division of Class 1*

Document	Title
ST/SG/AC.10/C.3/2014/4 - (IME)	*Recommendations for improvement of the Series 6 Tests*
ST/SG/AC.10/C.3/2014/42 - (Germany)	*Proposal for an alternative for the test 6 (c) for the testing of CARTRIDGES, SMALL ARMS (UN No. 0012)*
ST/SG/AC.10/C.3/2014/53 - (USA)	*Proposed field-portable gas fuel UN 6 (c) test assembly*
UN/SCETDG/45/INF.36 - (Germany)	*Properties of Aluminium witness screens*
UN/SCETDG/45/INF.51 - (Germany)	*Heating of Aluminium witness screens during UN 6(c)-tests*
Agenda Item 2(c)	Review of tests in parts I and II of the Manual of Tests and Criteria
ST/SG/AC.10/C.3/2014/6 - (IME)	*Recommendations for improvement of Series 1 (a) and 2 (a) Gap Tests and Series 1 (c) and 2 (c) Time/Pressure Tests*
ST/SG/AC.10/C.3/2014/11 - (AEISG)	*Review of Test Series 8*
UN/SCETDG/45/INF.4 - (Chairman of the Working Group on Explosives)	*Review of tests in parts I and II of the Manual of Tests and Criteria*
Agenda Item 2(d)	Review of packing instructions for explosives
ST/SG/AC.10/C.3/2014/20 - (SAAMI)	*Review of packing instructions for explosives*
Agenda Item 2(e)	Miscellaneous
ST/SG/AC.10/C.3/2014/3 - (Austria)	*Classification of Ammunition, Smoke, containing titanium tetrachloride*
ST/SG/AC.10/C.3/2014/22 - (Italy)	*Classification of articles under UN No. 0349*
ST/SG/AC.10/C.3/2014/37 - (SAAMI)	*Treatment of examples in Section 1.1.2 of the Manual of Tests and Criteria*
ST/SG/AC.10/C.3/2014/39 - (Canada)	*New entry for "Rocket motors" 1.4C*
ST/SG/AC.10/C.3/2014/48 - (USA)	*Determination of friction sensitiveness using the Allegany Ballistics Laboratory (ABL) friction machine*
ST/SG/AC.10/C.3/2014/51 - (USA)	*Determination of impact sensitiveness using the Modified Bureau of Mines (MBOM) Impact Machine*
ST/SG/AC.10/C.3/2014/52 - (USA)	*Thermal stability test at 75°C using the simulated bulk auto-ignition temperature (SBAT) apparatus*
ST/SG/AC.10/C.3/2014/55 - (COSTHA)	*Proposal to clarify what is meant by; "as presented for transport" in SP280*
UN/SCETDG/45/INF.10 - (United Kingdom)	*Proposal concerning the format of approvals issued by Competent Authorities for Class 1 Dangerous Good*
Agenda Item 11(a)	Desensitized explosives
ST/SG/AC.10/C.3/2014/2 (ST/SG/AC.10/C.4/2014/2) - (Germany)	*Implementation of a new chapter 2.17 "Desensitized Explosives" in the GHS and implementation of "Classification procedures, test methods and criteria relating to the class of desensitized explosives" in a new Part V of the Manual of Tests and Criteria*

3. In addition to Annex 1, which is the list of participants:

(a) Annex 2 contains amendments proposed to the Model Regulations (18th Revised Edition),

(b) Annex 3 contains amendments proposed to the Manual of Tests and Criteria (5th Revised Edition), and

(c) Annex 4 contains amendments proposed to the GHS Document (5th Revised Edition).

(d) Annex 5 contains amendments to Section 18 of the Test Manual.

(e) Annex 6 contains the adopted revisions to the new GHS section on desensitized explosives.

Agenda Item 2(a) – Tests and criteria for flash compositions

4. **Subject:** Classification of fireworks.

Documents: *ST/SG/AC.10/C.3/2014/59 - (Netherlands)*

Informal documents: *UN/SCETDG/45/INF.5 - (Netherlands)*
UN/SCETDG/45/INF.18 - (United Kingdom)

Discussion:

- **2014/59:** The Netherlands reviewed testing done with fireworks that ensued following the Enschede accident in 2000, specifically the CHAF project. With one exception, CHAF proved that the TS6 was predictive of large scale fireworks behavior. The exception is fireworks known as "waterfalls", a type of fountain fireworks. TS6 and the default table for classification of fireworks indicate 1.3G classification for waterfalls; however, tests on a full container load of waterfalls resulted in a mass explosion and indicated that classification should be 1.1G rather than 1.3G. To ensure that waterfalls aren't mistakenly accepted into 1.3G, the Netherlands proposes amendments to:

  - The definition of flash composition
  - The default table
  - Section 2.3.5.1 of the test manual
  - Consequential amendments to Note 2 of section 2.1.3.5.5, Appendix 7 of the Test Manual, and the default table.

  The working group considered whether it might be advisable to amend the proposal to read "only" flash composition. It was also discussed that following the proposals in 2014/59 might result in consumer fireworks being classified as 1.1G, which is not reflecting their actual hazard. It was also suggested that the effect observed during the CHAF test would occur only with a high density of flash composition, whereas consumer fireworks don't have that kind of density. As an alternative to the proposals of 2014/59 it was suggested to simply add a new row to the default table that covered just the entry of waterfalls and not the broader category of fountains.

  In summary, the working group concluded that whatever was to be done should not affect a broad range of products.

  Conclusion: The Netherlands will continue the work, taking into account the comments of the working group, to develop the proposal further. The Netherlands requested that any other comments be passed to them fairly soon so that they could be considered as they develop a proposal for the December session.

- **INF.18:** The UK is looking into the mechanisms that may be causing the anomalous waterfall effect that was reported in 2014/59 and that doesn't agree with 6(c) results on packages of waterfalls. Modified 6(a) tests, where some packages were wrapped in plastic were performed to examine if the mechanism might be propagation caused by

trapped hot gases released by the burning waterfalls. Those were the ones that mass exploded. Based on the extremely limited testing done in the UK, it appears this might be the mechanism for the effect, i.e. relatively strict confinement that traps the explosion gases and doesn't allow them to dissipate. The UK plans to continue studying the effect to determine if the modified test might be of use in evaluating waterfall (and/or other "certain" fireworks) classifications.

The working group agreed that it would be useful to have such tests and encouraged the UK to continue the work. Others may want to participate in this work and the UK was requested to prepare a scope of the project and circulate it to working group members so that they might consider more carefully whether to participate.

Conclusion: The UK will carry on the research and will develop a scope of project to see if others might be interested in participating.

5. **Subject:** Flash composition tests.

Documents: *None*

Informal documents: *UN/SCETDG/45/INF.19 - (Japan)*
UN/SCETDG/45/INF.20 - (United Kingdom)

Discussion:

- **INF.19:** As part of an evaluation of the proposed USA flash composition test, Japan has conducted experiments of US-, HSL- and modified HSL tests for 69 kinds of fireworks compositions. As a result of this work, some recommendations for adjusting criteria for the proposed US test were made in INF.19.

  The working group reviewed and generally supported the proposals in para. 21 of INF.19, such as black powder generally not being flash composition.

  Conclusion: Japan will take the comments of the working group and prepare a formal proposal.

- **INF.20:** Reports on testing done at HSL comparing a US proposed plug (see ST/SG/AC.10/C.3/2013/23 from the 43rd session) and a modified HSL plug in place of the plug that is currently used in the test. In addition to testing at HSL, testing was to be done by other labs and coordinated by HSL. Due to difficulties in getting appropriate samples delivered to other labs, so far, only HSL has completed their work.

  The HSL work demonstrates that proposed US plug and the HSL modified plug give comparable results and are more reliable than the plug described in the current UN method, by improving both reproducibility and usability.

  INF.20 recommends that a formal proposal to modify Figures A7.1 to A7.8 inclusive be prepared. The proposal will include instructions on modifying the existing plug to the modified HSL version to limit costs. The suggestion was made to have a more general description with some examples on how to achieve that.

  Conclusion: Upon completion of the testing in USA and Japan, a formal proposal may be forthcoming.

Agenda Item 2(b) – Review of test series 6

6. **Subject:** Correction to Figure 10.3: Procedure for Assignment to a Division of Class 1 (Test Manual) and Figure 2.1.3 (GHS).

Documents: *ST/SG/AC.10/C.3/2014/1 - (IME / SAAMI)*
ST/SG/AC.10/C.4/2014/11 - (IME / SAAMI)

Informal documents: *None*

Discussion: Box 33 of Figure 10.3 of the test manual indicates that test 6(d) is applied to all 1.4S candidates; however, the test is only required for the eight 1.4S entries to which SP347 applies. A similar error exists in the flow chart in Figure 2.1.3 of the GHS. In …C.3/2014/1 and …C.4/2014/11, IME and SAAMI propose to correct these errors by inserting a box into the flow charts that would indicate that the 6(d) test is only applied when required by SP347.

Canada observed that the intent of box 33 was not just to require the 6(d) test, but is actually evaluating a part of the definition of 1.4S. However most of the working group did not agree and felt that the proposal in …C.3/2014/1 was appropriate and in full agreement with para. 16.1.1 and 16.2.2 in the test manual that states that the 6(d) test is only used if special provision 347 applies.

The working group observed that the correction to Figure 10.3 would also be required for Figure 10.8 in the test manual.

Conclusion:

- …C.3/2014/1 – The majority of the working group supported the proposal to insert a new box 32a between boxes 32 and 33 in Figure 10.3 and Figure 10.8 of the test manual as shown in Annex 3.

- …C.4/2014/11 – working under the assumption that the GHS does not recognize or use the Special Provisions contained in Chapter 3 of the Model Regulations, the working group agreed the best solution was to list the 8 numbers as shown in Annex 4.

7. **Subject:** Recommendations for improvement of the Series 6 Tests.

Documents: *ST/SG/AC.10/C.3/2014/4 - (IME)*
ST/SG/AC.10/C.3/2014/42 - (Germany)
ST/SG/AC.10/C.3/2014/53 - (USA)

Informal documents: *UN/SCETDG/45/INF.36 - (Germany)*
UN/SCETDG/45/INF.51- (Germany)

Discussion:

- **2014/4**: In this paper, IME:

    1. In *Introduction***,** reports on the status of the review of the Series 6 Tests in the UN Manual of Tests and Criteria;
    2. In *Discussion*, reviews issues uncovered in two surveys conducted by IME, United States of America and Canada regarding improvement of the test series;

3. In *Proposals*, presents several longer-term issues and reviews that are necessary to complete the review of the test series; and
4. In *Annex 2*, proposes some revisions to the test series

The working group discussed the timing of the work and concluded that it was preferable that the revisions (with some amendments) in Annex 2 should be implemented in the current biennium rather than put off until a more complete proposal including results of longer term reviews (described in *Proposals*) could also be included.

The working group considered and endorsed the proposals enumerated in para. 21 of 2014/4.

Regarding the revisions in Annex 2, the working group:

1. Considered that the revisions to section 16.2.2 would require consequential amendments in section 10.4.3.4.
2. Agreed that the performance of the 6(d) test in lieu of the 6(a) and 6(b) tests should be permissive rather than mandatory.
3. Agreed that in section 16.4.1.2, the thickness of the mild steel used as a witness plate should be changed from "3.0 mm" to "3 mm". This change would minimize problems in witness plate material selection by utilizing the tolerance specifications provided in section 1.5.1.
4. Agreed that the hazards described in 16.6.1.1 were the ones that would arise in a fire and therefore, the phrase "or any other dangerous effect" was not needed.
5. Agreed that, in the case of a liquid hydrocarbon pool fire, that some clarification should be added better describe the placement of the grid.

Conclusion: The working group agreed to the revisions proposed in Annex 2 of …2014/4 with some modifications. Further, the working group agreed to the consequential amendments needed to section 10.4.3.4 resulting from the amendments to section 16.2.2. These amendments are shown in Annex 3 of this report. Finally, the working group endorsed the proposals contained in para. 21 of 2014/4.

- **2014/42**: The working group considered the proposal for a new 6(e) test which would solve problems of performing the 6(c) tests on small arms ammunition to be classified under UN0012 as 1.4S by looking directly at the kinetic energy of the projectile rather than burning thousands of cartridges. France and the USA questioned if the test represented the worst-case scenario. Germany argued that, in their experience, this was the case. There was general support for such a test, but the working group considered that it was preferable to place it in a new appendix to the test manual rather than adding it as a new series 6 test. A small ad hoc working group convened to adapt the proposal for this purpose, which was accepted, with some revisions, by the working group as a whole.

  The working group also noted that such a test might be useful in other evaluations, but preferred to reserve the test for UN0012 candidates for the present time. Should another application for the test be developed, it could be considered as the subject of future work.

  Conclusion: The working group accepted the proposed test, to be placed in a new Appendix 9 to the test manual. The proposed Appendix 9 as well as consequential amendments are shown in Annex 3 of this report.

- **2014/53**: In 2014/53, USA is making no proposal, they are sharing an additional method of building a fire for the 6(c) test. The additional method described by the USA is a practical and field-portable gas fuel assembly. In its review of the test, the working group considered the potential effects of wind and reconciling the profile of a wood fire with that of gas fire to ensure that the new method provided adequate burning as described in the 6(c) procedure. Germany offered to research their data on this and to share with the working group.

  Conclusion: The working group appreciated the work done by USA in developing this method, sharing all the details, and agreed that such a method would be acceptable for use in performing the 6(c) test.

- **INF.36 and INF.51:** The working group noted the work done by Germany in examining witness screen construction, projection hazard evaluation by dent depth measurement, and the potential effects of heating on witness screen performance. The working group agreed that this work should continue as part of continuing review of test series 6 and specifically the 6(c) test.

Agenda Item 2(c) – Review of tests in parts I and II of the Manual of Tests and Criteria

8. **Subject:** Recommendations for improvement of Series 1 (a) and 2 (a) Gap Tests and Series 1 (c) and 2 (c) Time/Pressure Tests.

Documents: *ST/SG/AC.10/C.3/2014/6 - (IME)*

Informal documents: *UN/SCETDG/45/INF.4 - (Chairman of the Working Group on Explosives)*

Discussion: 2014/6 formalizes the proposals originally described in INF.10 of the 43rd session, taking into account the comments and suggestions of the working group from that previous session.

The working group did not support the proposal to remove the dimensions or the density of the booster in the 1(a) and 2(a) test. Also, France was not in favor of referring to plasticized explosives as a potential booster material. Several experts also expressed the opinion that the witness plate in these tests was desirable for evaluating results. Germany questioned the addition of and meaning of the word "nominal" in IME's proposal describing the steel tube used for these tests. UK reported that tests it had conducted using "nominal" steel tubes had no effect on the results. Nevertheless, the working group did not accept that proposal, as the removal of the decimal from the wall thickness had the desired effect of removal of over specification of the tube.

In considering proposals to amend sections 11.4.1.2.1 and 12.4.1.2, the working group also considered proposals for additional amendments to those sections made in INF.4.

Conclusion: The working group accepted the proposals to amend sections 11.4.1.2.1 and 12.4.1.2 as described in 2014/6 and INF.4 with some modifications. Additionally, the working group accepted the proposals in 2014/4 to amend sections 11.6.1.2.2 and 12.6.1.2.2 to clarify that washers of deformable materials may be used in lieu of a lead washer. These amendments are shown in Annex 3 of this report.

9. **Subject:** Review of Test Series 8.

Documents: *ST/SG/AC.10/C.3/2014/11 - (AEISG)*

Informal documents: *None*

Discussion: The working group noted the efforts of AEISG to coordinate the group's review of Section 18 of the test manual (Test Series 8). Much of the review had been done previously during the 43rd session, and 2014/11 presented a final review of recommended amendments taking into account comments received during the 43rd and 44th sessions and intersessionally.

Conclusion: The working group agreed to the amendments to Section 18 proposed in 2014/11 with some modifications and a consequential amendment in Section 10.4.2.5. These amendments are shown in Annex 5 of this report.

10. **Subject:** Review of tests in parts I and II of the Manual of Tests and Criteria.

Documents: *None*

Informal documents: *UN/SCETDG/45/INF.4 - (Chairman of the Working Group on Explosives)*

Discussion: Some of the amendments proposed in INF.4 had already been reviewed by the working group when it considered 2014/6. The working group considered the other amendments in INF.4 and generally agreed with them, with some modifications.

Conclusion: The working group accepted the amendments proposed in INF.4 with some modifications. These amendments are shown in Annex 3 of this report.

Agenda Item 2(d) – Review of packing instructions for explosives

11. **Subject:** Review of packing instructions for explosives.

Documents: *ST/SG/AC.10/C.3/2014/20 - (SAAMI)*

Informal documents: *None*

Discussion: The working group reviewed the revisions proposed in 2014/20 and noted that there may also be differences in other language versions of the Model Regulations. As these other versions were not available to the working group, it is advised that these be reported to the sub-committee as they are discovered. France recommended to review the definitions of types of packagings in 6.1 of the Model Regulations.

Conclusion: The working group adopted the amendments proposed in 2014/20. These changes to Section 4.1.4 are shown in Annex 2 of this report.

Agenda Item 2(e) – Miscellaneous

12. **Subject:** Classification of Ammunition, Smoke, containing titanium tetrachloride.

Documents: *ST/SG/AC.10/C.3/2014/3 - (Austria)*

Informal documents: *None*

Discussion: There was some support for the proposal in 2014/3; however, the general feeling of the working group was that there was little opportunity for exposure to titanium tetrachloride during transport and may set a precedent for other subsidiary labels.

Conclusion: The working group did not support the proposal in 2014/3. However, if the sub-committee should decide to approve the proposal, there should be a slight amendment to the addition to the special provision 204 such that "toxic" should really be "toxic by inhalation".

13. **Subject:** Classification of articles under UN No. 0349.

Documents: *ST/SG/AC.10/C.3/2014/22 - (Italy)*

Informal documents: *None*

Discussion: The working group recognized and reviewed the problem described in 2014/22 and the proposal to address that problem and observed:

- The issue described is part of a much larger issue in that there are other explosives in the Table 1.4.1 of the Model Regulations that, when packaged appropriately, could be classified into Division 1.4 and 1.4S and would no longer be subject to the security provisions of Chapter 1.4. In addition, other explosives classified as Articles, Explosive, n.o.s., could attract security provisions which are not currently specified.

- A possible solution might be to add some security provision(s) to special provision 178.

- Another possible solution might be to provide some guidance in Chapter 1.4 on how to deal with Table 1.4.1 explosives that might drop out because of packaging.

Conclusion: The working group did not support the proposal by Italy, but did encourage Italy to continue to study the problem and the observations of the working group and develop a more comprehensive proposal for future consideration.

14. **Subject:** Treatment of examples in Section 1.1.2 of the Manual of Tests and Criteria.

Documents: *ST/SG/AC.10/C.3/2014/37 - (SAAMI)*

Informal documents: *None*

Discussion: The working group reaffirmed its observations from the 43rd Session that examples were meant only for guidance and were not intended to become regulatory obligations. Since the wording proposed by the working group at the 43rd Session was not fully acceptable to the sub-committee, the working group devised new wording taking a revised SAAMI proposal as the starting point.

Conclusion: The working group adopted this proposal. The adopted text is shown in Annex 3 to this report.

15. **Subject:** New entry for "Rocket motors" 1.4C.

Documents: *ST/SG/AC.10/C.3/2014/39 - (Canada)*

Informal documents: *None*

Discussion: The working group supported the proposal by Canada and observed that there may be some opportunity for a similar classification in 1.4S.

Conclusion: The working group unanimously supported the creation of a new entry for model rocket motors in Division and Compatibility Group 1.4C. This new entry may be found in Annex 2 of this report.

16. **Subject:** Test Series 3.

Documents: *ST/SG/AC.10/C.3/2014/48 - (USA)*
ST/SG/AC.10/C.3/2014/51 - (USA)
ST/SG/AC.10/C.3/2014/52 - (USA)

Informal documents: *None*

Discussion: The new tests proposed for TS3 in 2014/48, 2014/51, and 2014/52 were reviewed by the working group. USA provided detailed analysis comparing the new tests and establishing consistency with existing tests. Additionally, Canada provided confirmation from its national laboratory that all three proposed tests were comparable to existing tests. Adoption of the proposed tests would allow standardization of testing for both transport and GHS purposes. COSTHA observed that, from an industry perspective it is very helpful to standardize testing. Having to purchase different types of testing apparatuses can be very costly. Being able to use the same apparatus for in process testing and transport testing would be very helpful.

Conclusion: The working group adopted the ABL, MBOM, and SBAT tests as proposed in 2014/48 (with one minor modification), 2014/51, and 2014/52. With the addition of these new tests, Table 13.1 will also need to be updated. These new tests and the update to Table 13.1 can be found in Annex 3 to this report. The working group also noted that the table of contents of Part I of the test manual would need to be updated by the secretariat.

17. **Subject:** Proposal to clarify what is meant by "as presented for transport" in SP280.

Documents: *ST/SG/AC.10/C.3/2014/55 - (COSTHA)*

Informal documents: *None*

Discussion: The working group considered the proposal by COSTHA and agreed with it in principle and suggested that a note to SP280 would be appropriate.

Conclusion: The working group developed a note to be added to SP280. The note may be found in Annex 2 of this report.

18. **Subject:** Proposal concerning the format of approvals issued by Competent Authorities for Class 1 Dangerous Goods.

Documents: *None*

Informal documents: *UN/SCETDG/45/INF.10 - (United Kingdom)*

Discussion: The working group agreed that some form of guidance regarding the content of approvals was desirable. The working group supported the elements listed in proposed section 2.1.3.7.4, but some of the group did not support inclusion of an example form as it could be taken as a required format.

Conclusion: The working group supported the proposal to add a new Section 2.1.3.7 to the Model Regulations as described in the annex to INF.10, with some modifications. The new Section 2.1.3.7 may be found in Annex 2 to this report.

Agenda Item 11(a) – Desensitized explosives

19. **Subject:** Implementation of a new chapter 2.17 "Desensitized Explosives" in the GHS and implementation of "Classification procedures, test methods and criteria relating to the class of desensitized explosives" in a new Part V of the Manual of Tests and Criteria.

Documents: *ST/SG/AC.10/C.3/2014/2 (ST/SG/AC.10/C.4/2014/2) - (Germany)*

Informal documents: *None*

Discussion: The working group reviewed the changes to the proposed new GHS chapter for desensitized explosives that had been made based on comments received since the 43rd Session.

Conclusion: The working group unanimously supported the changes described in Annex 6 to this report and that the square brackets be removed from the test method.

Annex 1
Working Group on Explosives (23 – 26 June 2014)
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