

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 Globally Harmonized
System of Classification and Labelling of Chemicals

4 December 2015

Thirtieth session

Geneva, 9 – 11 December 2015

Item 3 (a) of the provisional agenda

Classification criteria and hazard communication:

Dust explosion hazards

Dust explosion hazards: Status report and December 2015 meeting agenda

Transmitted by the expert from the United States of America on behalf
of the informal correspondence group on dust explosion hazards

I. Introduction

1. This informal paper provides an update of the work performed by the correspondence group since the 29th session of the UN Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals (UNSCGHS).

II. Background

2. At the 22nd session, the Correspondence group presented several workstreams to the UNSCEGHS. The UNSCEGHS reviewed and reached consensus on the workstreams presented below.

- (a) Workstream 1: review the existing national consensus and reference regulations developed by competent authorities, identify the common pieces of information used to communicate the hazards, and determine how and if this information is to be addressed;
- (b) Workstream 2: ensure that any information proposed to be included in section 9 of the SDS is communicated to the working group on Section 9 of Annex 4;
- (c) Workstream 3: start the discussion and develop an outline or work plan for guidance or a separate chapter in the GHS containing more detailed information on the conditions under which a dust explosion hazard could be encountered.

3. The correspondence group completed its work on Workstream #1 in the 2011-12 biennium. For Workstream #2, representatives from the Dust Explosion Hazards correspondence group have worked with the Annex 4, Section 9 correspondence group to develop safety data sheet guidance for the GHS.

4. The Dust Explosion Hazards correspondence group began work on Workstream #3 in 2013 and continued this work through 2014. Throughout the discussions on this workstream, views remained divided on the nature of the hazard and how to proceed on the issue. At the 27th session of the UNSCEGHS, there was a lively discussion on how to

address dust explosion hazards in the GHS. After some discussion, the Sub-committee agreed that the Dust Explosion Hazards correspondence group should continue work on the issues using a step-by-step approach. The Sub-committee agreed that the correspondence should agree on a definition for “combustible dust” and then develop the related criteria and discuss hazard communication. At that point, a decision will be made whether to include dust explosion hazards in the GHS as a new hazard class or as guidance. (See ST/SG/AC.10/C.4/54)

5. At the 28th session, the correspondence group met and began its discussions of the questions listed in Appendix A to Annex II of INF. 26. [UN/SCEGHS/28/INF.26]

6. The UNSCEGHS agreed to keep the work being done on dust explosion hazards on its programme of work for the 2015-2016 biennium. [See ST/SG/AC.10/C.4/56]

7. The correspondence group met in February and April 2015 to discuss and further refine the definition of explosible dust and began the discussion of developing a flow chart for the hazard. The meeting summaries were provided to the Sub-committee at the 29th session. [UN/SCEGHS/29/INF.14].

III. Status report

8. The correspondence group met in mid-July and in October 2015. A summary of the meetings is provided in Annex I and Annex II, respectively. Both of these meetings included the review of flowcharts for “substance as presented”. There is substantial work yet to be done by the correspondence group on the flowcharts, and once the flowcharts are more fully developed, they will be provided to the Sub-committee for review and discussion.

IV. December 2015 meeting agenda

5. The December meeting will include a discussion of workstream #3 and a continuation of the current discussions on the explosible dust flowcharts. The agenda for the meeting is presented in Annex III. As always, Sub-committee members are invited to participate in the meeting.

Annex I

Dust Explosion Hazards: 9 July 2015 meeting summary

- Participants at the correspondence group meeting included representatives from U.S. OSHA, Health Canada, Germany (both BAM and BAUA), Australia, Argentina, European Union (European Commission), International Paint and Printing Council (IPPIC), and International Dry Bulk Terminals Group (IDBT) or International Bulk Terminals Association (IBTA).
- The chair reviewed the meeting agenda and the results of the April meeting. The chair also reviewed the feedback received from the meetings in Geneva, noting that some concerns were expressed about under-warning and having trouble separating dust hazards resulting from the material as presented versus that from the hazards resulting from handling and processing. The chair explained that by developing the flowchart for substances as presented initially, the expectation is that it can be used as a framework in the future, especially for the handling and processing flowchart(s).
- The group continued discussions on the flowchart using the list of possible questions to be answered to identify dust explosion hazards, as well as the informal paper submitted by Argentina [see Appendix A; UN/SCEGHS/29/INF.19].
- Several comments were made on the combined flowchart, including the following.
 1. Remove the BAM flowchart from the “combined” flowchart and just show the one flowchart for the team’s consideration. Therefore, this chart is not provided as part of the meeting summary; instead two option charts are provided to reflect the group discussion [see item #4 below for an explanation].
 2. Question #1 in the Argentinian paper [UN/SCEGHS/29/INF.19] [Is the substance or mixture classified as a Class 1/Explosive?] is not necessary in the flowchart. It was agreed to address the issue as a note [see note 1 in the flowcharts].
 3. Regarding Question #3 in the Argentinian paper [UN/SCEGHS/29/INF.19] [Is it classified as a flammable solid?], the group did not agree that the substance should be removed from the dust hazard flowchart by classifying the substance as a flammable solid. While the focus of the question was to address intrinsic hazards of the substance, several members expressed concern about those hazards that could develop during processing. It was agreed that Question #3 in the Argentinian paper would not be included in the flowchart.

However, the group proposed to include a note for questions #2 and #3 in the flowchart. The note explains that “If a substance or mixture is classified as a flammable solid, then this question is answered as “yes” and by-passed.” [See note 2 in the flowcharts].
 4. The group discussed Questions #4 and #5 of the flowchart, noting that Question #4 [Will it form explosible mixtures with air at atmospheric pressure and normal temperature?] appears to be the fundamental question of the entire conversation. The group could not agree on the order of these two questions, noting that if one answers Question #4 as a “yes,” then the substance is considered an explosible dust/air mixture. However, if the

question is answered as “unknown,” then the next question should be Question #5 [Does the substance contain particles of a nominal size <500 µm ?].

However, several members of the group felt that Question #5 should be answered first, as there is evidence that once the size is identified, then hazards from dust are more likely. Therefore, both proposals are offered in separate flowcharts for the group’s consideration and discussion at the next meeting. The e-file containing Option 1 shows Question #4 first [Will it form explosible mixtures with air at atmospheric pressure and normal temperature?], while the e-file containing Option 2 shows Question #5 first [Does the substance contain particles of a nominal size <500 µm ?].

5. Some experts also stated that there is evidence that size does not matter. The mass to surface area influences the potential for the hazard.
 6. Experts also discussed the impact of flammability limits, minimum ignition energy, and minimum explosive concentration. No firm resolution was determined; however, representatives from Argentina agreed to think on the discussion.
- The group suggested that the flowchart of the substance in the form as presented was as complete as possible at this time and suggested that discussion should move to developing flowcharts for processing and handling. The group agreed to focus first on developing a flowchart for handling, to address, among other things, abrasion resulting from the process of shipping. Once the handling flowchart is complete, the group will develop one for processing.

Requesting input from other experts, the chair agreed to develop a thought starter for the handling flowchart for the next meeting. The thought starter will use the questions agreed upon by the group and presented in Appendix A.

- The Parking Lot is provided in Appendix B.
- The group agreed to meet again in October. Meeting dates for October will be proposed in a doodle poll and sent along with the meeting summary.

Appendix A to Annex I

Possible questions to be answered to identify dust explosion hazards

- Is the substance or the mixture a solid?
- Is it classified as “flammable solid”?
- Is it completely oxidized?
- Will it burn or glow in air?
- Will it form explosible mixtures with air at atmospheric pressure and normal temperatures?
- Has experience shown it burns or explodes when dispersed in air and ignited?
- Does the substance contain particles of a nominal size <500 µm?

Use and handling

NOTE: The bracketed text indicates that the actions referred to in the questions can occur by virtue of the nature of the substance [or mixture] and during processing or handling.

8. Can small particles accumulate to form layers? [Substance [or mixture], Process]
9. a. Is the moisture content of the substance [or mixture] particles such that it suppresses the possibility of the formation of an explosible dust/air mixture? [Substance [or mixture], Process]
b. Could the content of the moisture or the desensitizer be reduced during use?
10. Could particles of a nominal size <500 µm develop due to handling of the substance [or mixture] in the supply chain (e.g., storage and transport)?

NOTE: Substances presented in the dust form – applies to person filling and person removing substance [or mixture] from container.

11. Could particles of a nominal size <500 µm develop due to handling during use of the substance [or mixture] (e.g., mixing, milling, grinding, conveying)?
12. Is the substance [or mixture] able to form a dust cloud during use? [Handling, Processing]

Appendix B to Annex I

Parking lot

Processing of liquids and solids that could produce explosible dusts

Define minimum concentration of particles (see question #8 in the list of possible questions to be answered to identify dust explosion hazards)

The need for explanatory notes, including self-sustaining propagation, confinement issues, and the IEC explanations

Discuss hazard versus risk.

Define concentration in air (amount) and the space in which confinement occurs and determine how or if this should be addressed for this hazard.

Regarding Question # 9a, think about and better understand the details of moisture conditions and how it may impact explosible dust/air mixtures. For example, “moisture” may be of two types (i.e., added water as in a substance or mixture with water versus a hydrate from of a substance or mixture). How does the moisture content suppress the formation of an explosible dust/air mixture? [See Appendix A, Possible questions to be answered to identify dust explosion hazards, in April 2015 meeting summary]

Discuss/review explosible dust/air mixtures

Annex II

October 20, 2015 dust explosion hazard correspondence group meeting summary

Representatives attending: US OSHA, US Department of Labor, US Coast Guard, Health Canada, Germany (both BAM and BAUA), United Kingdom, Australia, Brazil, Argentina, South Africa, Sweden, European Union (European Chemicals Agency (ECHA)), European Chemical Industry Council (CEFIC), National Grain and Feed Association (NGFA), Grain and Feed Trade Association (GAFTA), International Bulk Terminals Association (IBTA)

The Chair reviewed the progress of the correspondence group, including the results of the team meeting in July 2015. The Chair also noted the plan to have a face-to-face meeting at the December meetings in Geneva, and the expectation to provide an informal paper for the June/July meetings in 2016.

Discussion on confined space as a relevant factor for an explosion to occur. A concern was raised that dust explosions only occur in confined spaces. Several representatives noted that dust explosions have occurred in unconfined spaces, and confinement was not necessary. However, confinement can influence the impact of the explosion. The group discussed minimum concentration. One expert reminded the team that a recent incident in Taiwan occurred in an open area. Other experts mentioned that this incident was a flash fire not an explosion. Some experts noted that a dust cloud can form in an unconfined space when there is sufficient concentration of a substance, the particles of the substance become distributed in air, and there is an ignition source.

Some experts [Argentina], referencing the definitions used by the National Fire Protection Association (NFPA), considered that confinement was necessary for the hazard to exist, and that without the confined [or enclosed] space, there is no explosion hazard. Other experts suggested that even when there is no confinement, dust explosions pose deflagration hazards, and noted that the damage from an explosion is more than that from deflagration and requested that the group focus on the conditions under which the hazard may occur. The group discussed how confined space impacts this hazard in the grain industry. Some experts suggested that the group should have a broader hazard identification discussion rather than that limited to those that are in confined spaces, noting the recent Taiwanese incident. Some experts felt that terminology might be contributing to the misunderstanding.

The group was reminded that the working group's efforts are an iterative process and that issues will be reconsidered as necessary as the work progresses. The issue of how confined spaces might affect dust explosions or explosible dust hazards was moved to the parking lot and will be considered at a later time, once the group has considered the various aspects of the hazard, including substances as presented, and the impacts of handling and of processing.

Action Item: Representatives from BAM and US OSHA agreed to provide some examples that provide a technical explanation on dust explosion hazards occurring in unenclosed or open spaces – suggestions included information on the Taiwan incident and some incidents from the US Chemical Safety Board (CSB).

Flowchart options #1 and #2 for substances in shipped form: The Chair explained that the main difference between these two flowchart options is the order of questions #4 [Will it form explosible mixtures with air at atmospheric pressure and normal temperature?] and question #5 [Does the substance contain particles of a nominal size <500 µm?].

One expert [Argentina] did not agree with the use of question #4 in flowchart option #1 [or #5 in option #2], explaining that should this question be posed, the flowchart is not necessary, and reminded the group that during the July meeting there was some discussion to re-phrase the question to: Is the substance or mixture able to form a dust cloud in the air?

Other experts did not agree with how the arrows exit Question #4 in the October thought starter provided as part of the team meeting agenda. In the October thought starter, the “No” arrow from question #4 goes to Question #10 [Could particles of a nominal size <500 µm develop due to handling of the substance [or mixture] in the supply chain (e.g., storage and transport)?]. The suggestion was to have the arrow exit more appropriately out of question #5 [Does the substance contain particles of a nominal size <500 µm?]. Some experts suggested that the size question be asked first, because it is easier and provides a good separator for identifying the hazard. Other experts were concerned about how the concentration or the size of the particles might affect the hazard.

The group agreed to place the discussion of clarifying how concentration affects the hazard in the parking lot. In addition, the size and shape of the particles should be included as part of the concentration discussion. For example, NFPA standards note that some fibers or flakes may pass through a sieve; in this case, the size criteria does not always work and it might be better to consider the volume to surface ratio.

The group discussed the order of the questions and how to pose them. A suggestion was made to ask the easy questions first. The group also discussed posing questions on evidence or evidence early in the flowchart. A suggestion was made to modify question #6 [Is there evidence/ experience that shows the solid burns or explodes when dispersed in air and ignited?] and ask this early in the flowchart, and then ask it again with a difference emphasis later on in the flowchart. Some experts noted that the purpose of question #4 was to base the answer on known experience and existing evidence by asking whether there is available data and other evidence about the properties of the substance. The purpose of question #6 is to serve as one that completes the analysis by considering that if one can still not determine if there is a dust hazard, then more information or test data is needed. Some experts also suggested adding a question on evidence either at the beginning of chart or between questions #3 and #4.

Some experts expressed concern about the development of test data, since the GHS explicitly states that it does not request testing but rather relies on the use of available data. Other experts noted that the July minutes reflect the group’s future intention of discussing how data needs will be addressed for this hazard [placed in parking lot]. Suggestions were made to develop an explanation on particle size, develop guidance for each of the questions, including what is meant by each of the questions. The group agreed that guidance on the questions would be helpful to identify the intention of each question and the considerations necessary to answer the question.

The group also discussed re-phrasing Question #4 to ask whether the substance or mixture is able to form a dust cloud; some experts felt that this question was not appropriate. Two suggestions were considered. The first suggested re-phrasing the question #4 is: Is there data or evidence from experience that the substance may form a dust/air mixture? If the answer is yes – the exit arrow would go to explosible dust/air mixture. If the answer is no or unknown, then the exit arrow would continue with the next questions in the flowchart.

The second suggested re-phrasing the question #4 is: Is the substance or mixture able to form dust cloud in air? If the answer is yes – the exit arrow goes to explosible dust air mixture.

The group considered whether the flowchart questions are in the correct order. The suggestion was made to reorder the question and modify certain ones to reflect the

discussions of the group. The suggested order for the substance as presented flow chart questions is: #1, #2, revised #4 [evidence/experience], #3, #5, and revised #6.

To help the group analyze the flowcharts and facilitate discussion, a suggestion was made to keep the handling flowchart separate from that of the flowchart for substances as presented. Once the group has agreed upon the order and content of the questions for the flowchart on substances as presented, the Chair proposes to rejoin it with the handling flowchart. However, an expert suggested including a reference to the handling flowchart at question #5. The Chair agreed with these suggestions and will develop a thought starter for the December meeting based on the results of the discussions.

Action item: Develop a thought starter on evidence, experience, and test data – Ed Baird to draft.

Action items:

- Germany to develop guidance on Question #5 [Does the substance contain particles of a nominal size <500 µm?];
- Health Canada to develop guidance on Question #2 [Is the solid completely oxidized?] [remove footnote 2 for question 2];
- Question #3 [Will it burn or glow in air?] may be more difficult to develop guidance so it was placed in the parking lot for now. Guidance will be developed for this question in the future.

Appendix A to Annex II

Possible questions to be answered to identify dust explosion hazards

8. Is the substance or the mixture a solid?
9. Is it classified as “flammable solid”?
10. Is it completely oxidized?
11. Will it burn or glow in air?
12. Will it form explosible mixtures with air at atmospheric pressure and normal temperatures?
13. Has experience shown it burns or explodes when dispersed in air and ignited?
14. Does the substance contain particles of a nominal size <500 µm?

Use and handling

NOTE: The bracketed text indicates that the actions referred to in the questions can occur by virtue of the nature of the substance [or mixture] and during processing or handling.

15. Can small particles accumulate to form layers? [Substance [or mixture], Process]
16. a. Is the moisture content of the substance [or mixture] particles such that it suppresses the possibility of the formation of an explosible dust/air mixture? [Substance [or mixture], Process]
b. Could the content of the moisture or the desensitizer be reduced during use?
17. Could particles of a nominal size <500 µm develop due to handling of the substance [or mixture] in the supply chain (e.g., storage and transport)?

NOTE: Substances presented in the dust form – applies to person filling and person removing substance [or mixture] from container.

18. Could particles of a nominal size <500 µm develop due to handling during use of the substance [or mixture] (e.g., mixing, milling, grinding, conveying)?
19. Is the substance [or mixture] able to form a dust cloud during use? [Handling, Processing]

Appendix B to Annex II

Parking lot

Processing of liquids and solids that could produce explosible dusts

Define minimum concentration of particles (see question #8 in the list of possible questions to be answered to identify Dust Explosion Hazards)

The need for explanatory notes, including self-sustaining propagation, confinement issues, and the IEC explanations

Discuss hazard versus risk.

Define concentration in air (amount) and the space in which confinement occurs and determine how or if this should be addressed for this hazard.

Regarding Question # 9a, think about and better understand the details of moisture conditions and how it may impact explosible dust/air mixtures. For example, “moisture” may be of two types (i.e., added water as in a substance or mixture with water versus a hydrate from of a substance or mixture). How does the moisture content suppress the formation of an explosible dust/air mixture? [See Appendix A, Possible questions to be answered to identify dust explosion hazards, in April 2015 meeting summary]

Discuss/review explosible dust/air mixtures

Discuss how confined space might affect dust explosions or explosible dust hazards

Clarify how concentration affects the hazard, including the size and shape of the particles;
Develop guidance/explanation on particle size

Discuss how data needs will be addressed [test data]

Develop guidance for each of the flowchart questions, including what is meant by each of the questions: guidance on Question #3 [Will it burn or glow in air?] to be developed

Appendix C to Annex II

Correspondence group agreements

Scope of the discussion on dust explosions hazards for the purposes of the GHS is:

*Substances or mixtures supplied in a form that pose a dust explosion hazard.
[UN-SCEGHS-27-INF17e]*

Definition:

*“Combustible dust” means finely divided solid particles of a substance or mixture that are liable to catch fire or explode upon ignition when dispersed in air.
[UN-SCEGHS-27-INF26e].*

Annex III

December 2015 meeting agenda

- Discuss Workstream 3 [Discuss and develop an outline or work plan for guidance or a separate chapter in the GHS containing more detailed information on the conditions under which a dust explosion hazard could be encountered.]
 - As a starting point, introduction of chapter 3 of Germany's December thought starter [provided in separate email]
 - Details of what goes into chapter or annex, including
 - Issues regarding substances and mixtures
 - Issues regarding the definition
 - Issues regarding when dust explosion hazards can occur
 - Chapters 1 and 2 of Germany's December thought starter [provided in separate email]
 - Continue discussion of flowchart for substances as presented
 - As a starting point, see December 2015 thought starter for substances as presented [provided in separate email]
 - Other items
 - Schedule next meeting and identify agenda
-