

## **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**

25 June 2014

**Twenty-seventh session**

Geneva, 2 – 4 July 2014

Item 3 (d) of the provisional agenda

**Classification criteria and related hazard communication:**

**Dust explosion hazards**

### **Dust explosion hazards: Status report**

**Transmitted by the expert from the United States of America, on behalf  
of the informal correspondence group**

#### **I. Introduction**

1. The correspondence group met during the 26<sup>th</sup> session of the Sub-Committee to discuss how to proceed with 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.
2. To move the work forward, the correspondence group agreed to meet via conference call before the summer session. Indeed, two conference calls were held – one in February and one in May. This paper summarizes the results of these conference calls, and presents a thought starter for use during the 27<sup>th</sup> session of the Sub-Committee.

#### **II. Agreement on the scope of dust explosions hazards in the GHS**

3. The correspondence group agreed that the 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. A summary of this discussion is found in the February Meeting summary provided in Annex I.

#### **III. Discussions on the definition of dust explosions hazards**

4. The correspondence group began and continues its discussions on the definition of this hazard. Using the definition proposed by Canada as a starting point, the group also is using information from the International Electrotechnical Commission (IEC). These definitions contain current IEC (and ISO) international terminology and are from the IEC 60079-0 standard.
5. The definition at the conclusion of the May conference call, and which is still under discussion is: “combustible dust” means a substance or mixture that is in the form of finely divided solid particles that is liable to catch fire or explode upon ignition when dispersed in air [or other oxidizing medium].

6. Several members of the correspondence group expressed doubts regarding the condition “or other oxidizing medium”; therefore, this text was placed in square brackets pending further information. The correspondence group agreed to review existing regulations, national consensus standards, and test methods for application and use of “other oxidizing medium.” See Annex II for a summary of the May meeting discussions.

#### **IV. Discussions on developing a harmonized approach to dust explosion hazards**

7. Members of the correspondence group have opposing positions regarding whether to proceed with developing a hazard class or developing guidance (e.g., in an annex) to the GHS. Therefore, to move forward with the discussions, the correspondence group agreed to use a stepwise decision method when developing a harmonized approach to dust explosion hazards. That is, once the definition and criteria are developed, then a decision will be made on how to proceed with the hazard communication elements. At that point in the process, then a decision can be made if the agreed texts should be in the form of a new hazard class or in the form of some type of guidance (e.g., an annex).

#### **V. Next meeting of the correspondence group**

8. The next meeting of the correspondence group will be held at the 27<sup>th</sup> session of the Sub-Committee. Experts are invited to participate in the discussions. A meeting agenda and thought-starter for the meeting are provided in Annex III.

## Annex I

### Dust explosion hazards: 26 February 2014 meeting summary

1. The group had a lengthy discussion on the scope of Dust Explosion Hazards

The thought starter proposed a scope for a chapter: Chemicals that pose a dust explosion hazard in the shipped form. However, concerns were raised that the group had not agreed to proceed with a chapter. Therefore, the discussion was limited to the scope of the hazard.

Several members expressed concern that limiting the scope of the hazard to the shipped form is outside of the scope of the GHS, and expressed views that the scope as drafted may have implications for transport. Suggestions were made to adjust the text to say “in the form in which it is placed in the market” or “in the form of dust that poses the hazard.” There was also a discussion about the use of the term, chemical.

After further discussion, the scope of the hazard was refined to read: Substances or mixtures supplied in a form that pose a dust explosion hazard.

A question was also raised about how this hazard applies to agriculture. A CAS number for flour was found by one of the group. In addition, there was discussion about application of grain handling.

*NOTE: As mentioned during the meeting, the chair suggests that questions about whether the scope of this hazard includes agriculture are outside of the scope of this correspondence group.*

2. The group began discussing the definition of dust explosion hazards using Canada’s definition as a starting point. The group also discussed the link between flammable solids and combustible dust. Canada if a substance is classified as a flammable solid under Canada’s proposal, it would also be classified as a combustible dust.

The definition left on the floor when the call ended was as follows: “combustible dust” means a mixture or substance that is in the form of finely divided solid particles that is liable to catch fire or explode upon ignition when dispersed in air or other oxidizing medium.

3. Another call is planned for late April or early May. Holidays were noted. The chair agreed to send a doodle poll of proposed meeting dates. The meeting will be held at the same time of day.

*[NOTE: After the meeting, the chair was informed that the IMO’s working group meeting on the IMSBC (International Maritime Solid Bulk Cargoes) Code is planned the week of April 28<sup>th</sup>. Therefore, the doodle poll will propose dates for the first two weeks of May.]*

## Annex II

### Dust explosion hazards: 8 May 2014 meeting summary

The chairman stated that a policy discussion on proceeding with a chapter is needed, since the correspondence group has not had such a discussion. The chairman introduced the discussion, providing a review of the work the group has done to date, noting that an informal paper was submitted by the U.S.A, Canada, and Australia to the Sub-Committee in December 2013 proposing that a chapter be developed on dust explosion hazards (INF.16, 26<sup>th</sup> session). Those experts who supported the paper all have workplace regulations that align with the GHS and suggested a harmonized approach would benefit their stakeholders. Several countries did not support the informal paper when it was introduced at the Sub-Committee, expressing concern that this hazard may be outside the scope of the GHS.

The U.K. provided an update on a recent meeting of EU Member States and the European Commission in the context of the Competent Authorities for REACH and CLP. The expert explained that the consensus at the meeting was that if dust explosion hazards are introduced as a new hazard class into the GHS, the Member States and the Commission would exercise the building block approach and not pick it up in their CLP regulations. The group had a lively discussion on the proceeding with the development of a chapter in the GHS covering dust explosion hazards. One expert expressed support for proceeding with a harmonized approach to dust explosion hazards in the GHS, as long as it does not contradict existing strategies for risk reduction. Several experts supported the development of a chapter, explaining that for countries implementing workplace regulations and picking up this hazard in their regulatory system, a harmonized approach allows for standardization of definition, criteria, and communication elements, providing a benefit to all who pick up the hazard.

The group also discussed the draft informal paper submitted by CEFIC, which does not support the development of a chapter on dust explosion hazards in the GHS. Those in support of the CEFIC paper generally do not think that dust explosions are an intrinsic hazard that should be covered by the GHS, and feared that many new substances and mixtures would be classified if such a hazard class was introduced.

The group discussed the use of guidance as a harmonized approach. Concerns were raised that guidance is often not followed, as explained in the “Combustible dust hazard study” issued by the US Chemical Safety Board<sup>1</sup>. In addition, different countries implement regulations in different manners, and there are advantages to having a chapter. The group discussed developing guidance, and agreed that if the group proceeds with guidance, the information would be provided in an annex. The annex developed would contain a definition, classification criteria, and safety data sheet communication elements.

The group agreed to put off the decision as to whether dust explosion hazards would be a separate chapter or an additional annex in the GHS. However, the group agreed to work on a definition, criteria, and determine whether hazard communication elements were needed and if so, develop them. It was agreed that these would appear in either the chapter or the annex, once that decision was made. The group also agreed to take a stepwise approach

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<sup>1</sup> The report was issued in November 2006 and can be consulted at:  
[http://www.csb.gov/assets/1/19/Dust\\_Final\\_Report\\_Website\\_11-17-06.pdf](http://www.csb.gov/assets/1/19/Dust_Final_Report_Website_11-17-06.pdf)

when developing each harmonized piece. That is, once the definition and criteria are developed, then a decision will be made on how to proceed with the hazard communication elements.

### **Dust explosion hazard scope**

The group reviewed the scope, and generally agreed that the scope of the discussions is:

Substances or mixtures supplied in a form that pose a dust explosion hazard.

### **Definition discussion**

The group reviewed the definition established at the February meeting, that is:

“combustible dust” means a substance or mixture that is in the form of finely divided solid particles that is liable to catch fire or explode upon ignition when dispersed in air or other oxidizing medium.

The group discussed deleting the text “or other oxidizing medium” from the definition as these medium are outside of the normal situation. A number of points were made concerning oxidizing medium, including:

- Agreement that this is outside of normal operations and suggestion that others make a judgment on process-specific medium
- Suggestion to keep consistent with the existing definition of “dust” in GHS - keep air in the definition. However, if not combustible in air, it may not be combustible in other oxidizing medium. Suggestion to include information about specialty environments on the SDS
- Reminder that GHS covers normal conditions and not specific situations.
- Suggestion to capture those substances or mixtures that exist in “normal” conditions that do not include air.
- Testing in other oxidizing medium? One expert (representing ISO/IEC) stated that every procedure reviewed requires testing in air at standard temperatures. However, some national consensus standard definition’s (such as NFPA) include the phrase “other oxidizing medium” and questions arose about testing requirements.

Since consensus was not reached, the group agreed to place the text “or other oxidizing medium” in square brackets as a placeholder. In addition, group members agreed to review regulations, national consensus standards, and test methods for application and use of “oxidizing medium.”

At the end of the meeting, the definition was:

“combustible dust” means a substance or mixture that is in the form of finely divided solid particles that is liable to catch fire or explode upon ignition when dispersed in air [or other oxidizing medium].

The group agreed to table discussions on two items until the next meeting:

1. whether combustible dusts should be a subgroup under flammable solids because substances which are not identified as flammable solid could also give rise to dust explosion hazards.
2. whether to include a reference to “effective ignition” and “resulting in a flash fire” in the definition of the hazard.

## Annex III

### Dust explosion hazards: July 2014 meeting agenda and thought starter

#### Meeting agenda

- Review May meeting results
- Continue discussion of definition with a goal of reaching consensus
- Discuss classification criteria (time permitting)
- Identify next steps: Next meeting?

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#### Thought starter

This thought starter provides the agreed scope of the hazard and information to consider for the definition, including the information provided in the January thought starter. It also contains some introductory remarks on classification criteria, should time permit the initiation of this discussion.

#### **Dust explosion hazard scope:**

Substances or mixtures supplied in a form that pose a dust explosion hazard.

#### **Draft definition (as of 05/08/2014):**

“Combustible dust” means a mixture or substance that is in the form of finely divided solid particles that is liable to catch fire or explode upon ignition when dispersed in air [or other oxidizing medium].

#### **Discussion points on the definition:**

1. What additional information was gathered from review of regulations, national consensus standards, and test methods for the application and use of “oxidizing medium?” Let’s discuss and agree on how to proceed with this portion of the definition. See Appendix A, information from the U.S.A regarding the application and use of “oxidizing medium”.
2. Should the definition include a reference to “effective ignition” and/or “resulting in a flash fire?”

**Classification criteria introduction:**

Several of you commented on the classification criteria proposed by Canada as a starting point. I looked at the definitions of physical hazards contained in the GHS Purple Book and found that most definitions do not provide the criteria necessary to classify a substance or mixture. For example, the definitions of explosives or flammable solids are more general. One finds the criteria necessary to classify the given substance or mixture in the classification criteria portion of the hazard chapter.

I also noticed that what IEC calls a “definition”, the GHS Purple Book considers being more along the lines of criteria. When I compare the Canadian criteria and IEC “definition,” I find a number of similarities. These similarities are highlighted in the information provided below. I believe if I compared some examples, say one being a chemical dust (e.g., ascorbic acid) and another being a plastic dust (e.g., epoxy resin) against these two, I would come up with the same classification - that of a combustible dust.

**Discussion points on criteria, using the information provided in Appendix B:**

1. How does the GHS criterion proposed by Canada align with the criteria posed in the IEC definition?
2. What are the differences between the Canadian criteria and the IEC “definition”, and what can we agree upon?
3. Several of you have commented that particle size is important for classification. What particle size is acceptable? Please discuss the reasoning behind your preference.
4. Tabled from May meeting: Should combustible dusts be considered a sub-set of flammable solids?

## Appendix A

### Information from U.S.A regarding the application and use of “oxidizing medium.”

#### Questions posed to NFPA:

- Do you know the origin or reasoning behind the phrase “or in the process-specific oxidizing medium” in your dust standards?
- Do you know of any examples of processes where these mediums might be used in industry?

RESPONSE: We don't use air in the event that the process is conducted in an inert medium (due to possible reactivity with moisture in air or exposure to oxygen) but there might be an oxidizing gas present, like chlorine that can still promote and support combustion from the fire triangle/dust pentagon perspective. So, even though oxygen might have been excluded from the environment, there are other oxidizing gases that can support the combustion reaction.

It's not common, but it is technically possible in terms of the combustion process and owing to the fact that within the [NFPA] 654 crowd, that standard is currently dealing with a variety of dust types, including chemicals, plastics, pharmaceuticals, for example, where this might occur by design within the process.

#### Comment from the American Chemical Council (ACC):

ACC incorporated the phrase “or other oxidizing medium” into the definition of combustible dust to be consistent with NFPA 654. Although there are instances where oxidizing medium (other than air) are used for normal processes in industry, such as oxygen rich environments, fluorine, chlorine, bromine, and nitrogen, these media do not behave the same as a defined combustible dust would in air. Thus, we [ACC] support removing the phrase “or other oxidizing medium.”



## Appendix B

### Classification criteria considerations

**Canada's Definition:** "combustible dust" means a mixture or substance that is in the form of a powder that is liable to catch fire or explode when dispersed in a gas containing oxygen.

**Canada's Classification criteria:** A mixture or substance that: (a) has been shown to catch fire or explode when dispersed in a gas containing oxygen; or (b) is classified in a division of the hazard class "Flammable Solids" and 5% or more of its composition by weight has a particle size  $\leq 500 \mu\text{m}$ , is classified in Combustible Dusts – Category 1.

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**IEC's Definitions:** "combustible dust": finely divided solid particles, 500  $\mu\text{m}$  or less in nominal size, which may be suspended in air, may settle out of the atmosphere under their own weight, may burn or glow in air, and may form explosive mixtures with air at atmospheric pressure and normal temperatures

NOTE 1 This includes dust and grit as defined in ISO 4225.

NOTE 2 The term solid particles is intended to address particles in the solid phase and not the gaseous or liquid phase, but does not preclude a hollow particle.

"explosive atmosphere": mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour, dust, fibres, or flyings which, after ignition, permits self-sustaining propagation

"explosive dust atmosphere": mixture with air, under atmospheric conditions, of flammable substances in the form of dust, fibres, or flyings which, after ignition, permits self-sustaining propagation

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#### Comments from Dieter on the Canadian proposal:

...about the definition: "combustible dust" means a mixture or substance that is in the form of a powder that is liable to catch fire or explode when dispersed in a gas containing oxygen.

A substance that is liable to catch fire would be classified as pyrophoric.

The explosion will only occur when:

The substance is dispersed in air and

There is an effective ignition source (we know 13 types of ignition sources, each having different characteristics and energy.

So it would be good to add .. explode upon effective ignition ...

The term "in a gas containing oxygen" is vague. Nothing will occur in gas mixtures containing only low levels of oxygen. So you might argue that by testing under such conditions no classification would apply. On the other hand, oxygen levels just slightly above the standard value of 21 % make things much worse. Thus, I would suggest to write "... upon effective ignition when dispersed in air".

Dust explosibility depends on many factors, one of them being the particle size. A substance that is not dust explosible as stored in a warehouse may become dust explosible under process conditions, especially if mechanical handling (conveying, grinding ...) is involved. A small fraction of fine particles in a large mass of coarse particles may accumulate and still cause an incident. How would your definition apply in this case?

About the classification criteria: "A mixture or substance that: (a) has been shown to catch fire or explode when dispersed in a gas containing oxygen; or (b) is classified in a division of the hazard class "Flammable Solids" and 5% or more of its composition by weight has a particle size  $\leq 500 \mu\text{m}$ , is classified in Combustible Dusts – Category 1."

Section (a) catches substances that have been involved in an incident and thus builds on experience. Again, you use the expression "in a gas containing oxygen"; see my comments above.

Section (b) essentially says "all substances classified as flammable solids" have a dust explosion hazard. Good catch, I believe that is true. The second part about the particle size needs further investigation. How about a mixture of coarse flammable material containing 6 % of fine silica? The silica would not pose a dust explosion hazard. On the other hand, a small fraction (let's say, 0.5 %) of other material will create a severe hazard, especially if accumulated under process conditions.

In short, I believe it would be straightforward to simply say "(b) is classified as "Flammable Solid".

BUT - here comes the tricky part - your definition catches only a fraction of the whole realm of dust explosibility. Many substances not classified as flammable may be dust explosible. As a matter of fact, most organic substances will show this behavior. Unfortunately, I do not see a simple way to cover that. I believe it would be also difficult for a common person to understand the difference between a "flammable solid" and a "combustible dust". I am not a native speaker but in my understanding flammable and combustible have essentially the same meaning.

In our European legislation, a different approach has been chosen. The regulations cover explosive atmospheres as a whole, i.e., gases, liquids and dusts. This allows for a more comprehensive treatment. I attach a link to the directive which I believe might be quite helpful for you. The approach is not classification, but rather prevention of or protection against explosions whatever the cause may be.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:023:0057:0064:EN:PDF>

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