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**United Nations Changes to  
Explosives Hazard Classification Benchmarks**

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Background

Most, if not all, NATO nations hazard classify explosives based on publications produced by the United Nations (UN) Committee of Experts on the Transport of Dangerous Goods (TDG) and on the Globally Harmonized System (GHS) of Classification and Labelling of Chemicals. That UN Committee's three publications, and the relevance of each to explosives, are:

1) the GHS, or "purple book," which describes recommended explosives hazard classification and hazard communication criteria applicable during manufacturing, transport, storage, supply and use in workplaces and for consumers;

2) the Model Regulations, i.e., the "orange book," where recommended explosives classification assignment criteria and hazard communication provisions pertaining specifically to transport are described; and

3) the Manual of Tests and Criteria (MTC), a compilation of recommended testing protocols classifiers may utilize in assigning hazard classifications to explosives.

What's Recently Happened at the UN

The first edition of the MTC published in 1986 provided descriptions of test methods and procedures for assigning transport hazard classifications to explosives and organic peroxides. Over the years, since the GHS Sub-Committee was established in combination with the existing UN committee presiding over hazard classification assignments for transport, new parts of the MTC, such as relating to assigning other-than-transport classifications to various dangerous goods for example, have been added. The context of the MTC's explosives classification verbiage, nonetheless, has until recently remained completely focused on transport; however, that focal point was agreed to be changed during the UN Committee meetings concluding on December 7, 2018.

The verbiage regarding explosives classification assignments within the upcoming seventh revised edition of the MTC, to be published in 2019, will remove much of the text specifically referring to transport. The next edition of the MTC will thus shift to a compilation of protocols classifiers may utilize in assigning explosives hazard classifications intended to apply across the explosives life cycle.

There is a problem, however, in fulfilling that good intention, i.e., the current GHS explosives hazard classification assignment system is ill-suited for classifying explosives other than those in their transport packaging configuration. So, within the UN committee, work is ongoing to develop an improved GHS explosives hazard classification system that will be functional across the entire explosives life cycle. Though still requiring further development, the framework for such an improved system was noted as satisfying the UN Committee's experts during their meetings that ended December 7, 2018.

Within that continuing UN work it has now been recognized by the GHS Sub-Committee that explosives hazard classification assignments must consider configurational and other parameters because magnitudes of explosive hazards posed are not an intrinsic property of an explosive substance, mixture or article. Such recognition has been a struggle to garner, as other GHS hazard classification assignments are based on chemicals' intrinsic properties (e.g., toxicity, carcinogenicity). Another challenge has been gaining the Sub-Committee's acceptance that explosive articles are within the scope of the GHS, as the scope verbiage regarding articles in all editions of the purple book to date has been very ambiguous.

The new framework basically intends to extend the existing explosives hazard classification system that assigns Class 1 Divisions to explosives in their (outermost) transport packaging configurations, to assign accompanying classifications to primary packagings therein in which the explosives will be retained until use. Within the framework's architecture, this extension will be accomplished by overlaying elements of a Categories and Sub-categories system, as are traditionally used within GHS hazard classification architectures, onto the existing Class 1 Divisional hazard classification system for transport. Such overlaying ensures compliance with the UN committee's mandate that no GHS explosives classification system improvement can affect explosives hazard classification assignments for transport, with Class 1 Division assignment criteria remaining completely unchanged.

A key deliverable from the improved GHS classification system under development will be appropriate hazard classification assignments to explosives in their primary packagings. Primary packagings are often present during the supply phase of commercial explosives' life cycles, following some unpacking from transport packaging to facilitate distribution and then use. More importantly, primary packagings are typically what is required to be labeled for GHS hazard communication purposes. Contrary to the six Class 1 Divisions within the hazard classification system for transport that communicate the differing explosive hazards possibly posed by transport packaging configurations, the gradation of explosive hazard severities the GHS Sub-categories will communicate via labeling will be limited to three echelons representing high hazards (Sub-category 2A), medium hazards (Sub-category 2B), and low hazards (Sub-category 2C).

At this time and subject to further deliberation and potential revision within the ongoing UN work, Sub-category 2C will encompass explosives configurations that:

- 1) satisfy Compatibility Group (CG) S within Division 1.4 criteria during UN 6 (c) fire testing; and

2) do not require additional attenuating features at any packaging level above the primary packaging or an unpackaged explosive article to mitigate the forcefulness exhibited during UN 6 (a) or (b) testing so that no significant witness plate shape changes (e.g., a perforation, gouge, or substantial bowing) nor instantaneous scattering of most of the confining media is observed.

Sub-category 2B will similarly encompass explosives configurations that are the same as Sub-category 2C except they will only satisfy Division 1.4 other than CG S criteria, instead of CG S, in UN 6 (c) fire testing. Sub-category 2A explosives configurations will be all the rest.

The data necessary to decide which of the three new GHS explosives Sub-categories should be assigned to primary packagings are observable and to be utilized when UN Series 6 testing results in Class 1 Division assignments for explosives in their transport packaging configurations. Further usage of data that is already being generated while conducting UN Test Series 6, and which indicates the relative forcefulness explosives trigger when functioned as intended, will be in compliance with another UN committee stipulation that no new testing can be required within any improved GHS explosives hazard classification system developed. The indicative data to be utilized for explosives Sub-category assignments has previously only been used within the process for deciding whether Division 1.1 explosives hazard classifications should be assigned for transport.

Category 1 represents another deliverable from the improved GHS explosives hazard classification system framework. Category 1 is intended to apply during the manufacturing or processing of explosives, for example, before explosives become packed in their primary and subsequently in their transport packaging configurations (or after transport to another explosive operating location where following unpacking, further manufacturing, processing, assembly, maintenance, inspection, etc. may occur). Whether or not all such explosive manufacturing, processing, etc. operations within explosives life cycles are within the scope of the GHS has also been ambiguous in prior editions of the purple book, but the new framework, if adopted, should remedy that situation by making it obvious that Category 1 venues are definitely within scope.

The simple structure of the improved GHS explosives hazard classification framework can be depicted as follows:

| <b>Category</b>     | <b>1</b>              | <b>2</b>                        |                    |                 |
|---------------------|-----------------------|---------------------------------|--------------------|-----------------|
| <b>Division*</b>    | <i>not applicable</i> | 1.1, 1.2, 1.3, 1.4, 1.5 and 1.6 |                    |                 |
| <b>Sub-category</b> | <i>not applicable</i> | 2A (high hazard)                | 2B (medium hazard) | 2C (low hazard) |

*\* According to the UN orange book and MTC, i.e. assigned a Division within Class 1 as packaged (or configured, if shipped unpackaged) for transport.*

As depicted above, no Class 1 Divisions or GHS Sub-category assignments are applicable within Category 1. This is purposeful because Category 1 pertains to explosives in other than primary packagings or transport packaging configurations, which cannot be appropriately assigned hazard classifications by executing the limited explosives testing protocols currently included in the UN MTC. Accordingly, any future purple book text incorporating the improved explosives hazard classification system framework will probably include supplemental guidance that points

to applications of situation-specific risk assessment and risk management as being necessary for explosives safety management, including Process Safety Management, systems safety engineering, and quantity-distance (QD) siting (or licensing), of Category 1 venues. This approach of providing such a pointer is necessary because internationally harmonizing risk assessment procedures and risk management decisions is clearly not within the scope of the GHS.

*Might Such UN Changes Affect NATO Nation's Explosives Hazard Classification Assignments?*

The changes to be included in the 2019 seventh revised edition of the UN MTC should not directly drive any reforms, including retroactively, to how NATO nations assign explosives hazard classifications for transport. Conversely, eventual changes to the GHS explosives hazard classification system, assuming future adoption by the UN based on the framework being developed, may affect NATO nations' explosives hazard communication labels as that new system's implementation occurs over time in nations or specific regions (e.g., the European Union (EU)).

Coincident with the UN committee's past few years of activities towards shifting the explosives hazard classification landscape, however, NATO nations have been independently considering how they might want to similarly adjust military munitions hazard classification assignment protocols to better represent explosive hazards posed across munitions' life cycles. These independent activities are respecting that NATO nations have been pursuing development and acquisition of Insensitive Munitions (IM) under a policy promulgated over twenty years ago. That IM policy compels munitions acquisition activities for NATO forces to encourage specific safety and suitability for service improvements. The goal of such IM improvements is significant reductions in the relative severity of explosive hazards potentially posed to NATO forces over munitions' lifetimes. Achievement of IM improvements normally occurs via acquisitions of munitions and packaging designs that meet military performance requirements while also being able to withstand exposure to six extreme but credible unplanned stimuli. Each of those six stimuli pertain to ranges of threats that might be experienced within munitions' life cycles, but not necessarily during transport. So, there exists quite a defensible position for NATO nations to pursue assigning hazard classifications based on the relative severities of explosive hazards posed when IM are subjected to those six threat stimuli. Classification assignments derived from that larger body of evidence, or "NATO IM hazard classification assignments," would definitely be more representative of explosive hazards posed across munitions' life cycles than classifications assigned based only on exposures to transport threats.

There are also other logical reasons for future NATO IM hazard classification assignments to shift from being based on just the potential explosive hazard posed during transport, as they always have been, to a more comprehensive life cycle-based scheme. All NATO explosives safety management is predicated on hazard classifications assigned based on the UN protocols. For example, QDs applied for explosives storage and explosive operating locations are determined, inter alia, by the classification(s) of the explosives involved. Classifications used for such broad purposes should understandably not only reflect explosive hazards posed during transport. Time-wise, transport typically represents very small proportions of munitions life cycles, and during

transport QD is not the mechanism used to safely manage the hazards, except at certain transportation nodes.

The counterpoint that classification assignments must remain as is, communicating only explosive hazards posed during transport to first responders, seems rather indefensible because such personnel also routinely respond to non-transportation explosive emergencies. Emergency responders' general modus operandi upon arrival onto a scene, at least in North America and the EU, is to not fight explosives fires other than those that only involve explosives classified as CG S within Division 1.4. Instead, first responders try to rapidly evacuate people within a rather large perimeter around the scene to keep everyone out of harm's way while the explosive emergency is resolved. The evacuation distances they use are hazard classification assignment-dependent too, but typically the same distance applies to multiple Class 1 Divisions (e.g., 1.1, 1.2 and 1.3). Therefore, assigning NATO IM hazard classifications based on those larger bodies of evidence rather than just transport threats, which will usually result in assignments within those multiple Class 1 Divisions, should not deleteriously affect first responders' business whatsoever.

### Conclusion

The UN explosives hazard classification landscape continues shifting. Forward-thinking NATO nations apparently have a grand opportunity to potentially leverage the UN's recent explosive hazard classification progress for their own purposes. If NATO nations desire to have IM accomplishments more comprehensively reflected in enhanced life-cycle-based hazard classification assignments, and consequently fully integrated into the day-to-day management of explosives safety risk, that actually might be achievable. It seems realizable through an effort aimed at transitioning the existing UN Test Series 7 from a very rarely applicable protocol to assign Division 1.6, into a methodology routinely used to assign Divisions 1.1 to 1.6 (excluding 1.5) to military munitions undergoing IM improvement.