INSENSITIVE MUNITIONS INDUSTRY CONTRIBUTION FOR NEW STANAG-AOP 4382 EDITION OF THE SLOW HEATING TEST

IMEMG's Expert Working Group on Hazard Assessment & Classification

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• European Organisation assembling twenty one leading armament groups working with Insensitive Munitions technologies
IMEMG express the armament industry's viewpoint with regards to relevant transnational regulations and requirements.

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*Hazard Assessment & Classification Expert Working Group presents this analysis*
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INTRODUCTION
Various works are conducted by AC326 National Experts in the aim to define the new edition of STANAG-AOP 4382

Technical arguments for changes can be extracted from the MSIAC Survey Questionnaire on the Slow Heating Test (December 2016) and the MSIAC Science of Cook-off workshop (March 2017)
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• The most important question is about the heating rate value: 3.3°C/h

  – Reasons for a change? If modification, which new value? And why?
  – Must heating rate represent the most severe accident scenario or the most severe munition response?

• STANAG-AOP are under responsibility of National Experts, nevertheless IM Manufacturer Designers can bring feed-back and improvement suggestions
IM Manufacturer Designers are concerned about objectives of the Slow Heating Test.

- Must test represent the most severe accident scenario or most severe munition response? It implies various test parameters...
  - heating rate value: unique value or according to munitions size
  - heating system: forced airflow or natural convection
  - preconditioning temperature and duration: today unclear rules
Major question is about the maximum response to slow heating: Type V

- It is pertinent if we consider that this threat can occur only in a closed space?
- Projections and propulsion effects will be confined in this space without any external effect

→ **Type IV** response requirement appears to be more appropriate
THE HEATING RATE VALUE
THE HEATING RATE VALUE

- Slow Heating Test is performed with 3,3°C/h rate for 3 decades and ...

  - Is change really necessary ?
  - Why not, if the new heating rate is representative of the most severe accident scenario, it is the responsibility of AC326 National Experts
  - But, really there is a real concern if it must be representative of the most severe munition response, because :
    » it depends on munition size and architecture
    » it depends also on energetic material (cast-cured, melt-cast ...)
    » that it could introduce disconnectedness between nations and test centers
HEATING DEVICES
HEATING DEVICES

- STANAG 4382 ed2 “The test is usually performed by placing the test item in a disposable oven and heating the item with circulating heated air”

- Is forced airflow the most representative of accidental scenario (circulating steam)? Or is it the natural convection (battleship magazine)?
- It would be preferable to define more precisely the heating devices
PRECONDITIONING PHASE
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- STANAG 4382 ed2 “precondition the test item at 50°C for 8 hours or until the test item reaches thermal equilibrium at 50°C, whichever occurs first”

  - Why this preconditioning phase? Maximum ambient temperature?
  - This requirement is not pertinent for large munitions because 8 hours are insufficient to reach thermal equilibrium...
  - It would be more simple to start test at room temperature, global test duration would be more or less same
THE TYPE V RESPONSE TO SLOW HEATING
RESPONSE TO SLOW HEATING

- Slow Heating Threat corresponds to "Fire in an adjacent magazine, store or vehicle" with heating rate from 1°C to 30°C per hour"

- if an accidental scenario is able to heat munitions: some ten hours, higher than 150 to 300°C (300 to 500°F),

- this scenario requires a **closed space**: magazine battleship, armored vehicle, storehouse, bunker, igloo... **but not in open field conditions**
RESPONSE TO SLOW HEATING

• is it pertinent to require a Type V response?
  ➢ No-hazardous effects beyond 15 meters.

• i.e. it is reminded that the “20 Joules fragment” is not able to go through only 2 mm thick aluminum sheet (test 6c UN Orange Book ST-SG-AC10-11 Rev6).

• i.e. Typical walls of warships ammunition stores are some 8 mm thick steel sheets ...

  ➢ Type IV seems be a sufficient requirement for such a threat !!!
CONCLUSIONS AND PERSPECTIVES
CONCLUSIONS

- Concerns about objectives of heating rate modification
- Need for more precise STANAG-AOP 4382 requirements
- Change the maximum response from Type V to Type IV
  - because the **Type V effects are contained** inside the confined space (battleship magazine, underground store, armored vehicle ...) where the slow heating threat can occur (some ten hours up to higher than 150 to 300°C)
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