



# Risk of Exposure to 1.4S Explosives for Emergency Responders

Research and Development Forum

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# Why study the risk of exposure for emergency responders to 1.4S explosives?

- Criteria for 1.4S was linked to risk assessment for explosive responders originally, but both the criteria and the emergency response procedures may have changed over time
- The protection of emergency responders from fire and fragments in the event of an incident regarding packaged Division 1.4S explosives is critical
- Research is necessary to identify if there are any safety gaps/concerns between the current criteria and emergency response procedures





# Manual of Tests & Criteria (MTC) - 1.4S Classification

- UN 6(a) Single Package or UN 6(d) Unconfined Package Tests
  - No mass detonation
  - No effect outside package (charges/detonators/cartridge power device)
- UN 6(c) Bonfire Test (0.15 m<sup>3</sup> package volume)





# UN Manual of Tests and Criteria (MTC) - 1.4S Classification

- UN 6(c) Bonfire Test (0.15 m<sup>3</sup> package volume)
  - Fireball/jet cannot exceed 1 meter from packages
  - No fiery projection exceeding 5 meters from packages
  - Witness screens placed 4 meters from package edge may not be dented more than 4 millimeters
  - No projections with kinetic energy greater than 8 Joules
  - Thermal effect criteria: burning time of 100 kg net explosive mass must exceed 330 seconds





# Risk of 1.4S Explosive Exposure to Emergency Responders

- Model Regulations 1.4S definition:
  - “Substances and articles...so packaged or designed that any hazardous effects arising from accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not *significantly* hinder fire-fighting or other emergency response efforts in the *immediate vicinity* of the package.” (Section 2.1.1.4(d))
- 2012 Emergency Response Guide (ERG) 1.4S guidance
  - Packages with 1.4S may burn vigorously in a fire with localized detonations and projection of fragments
  - Effects are usually confined to *immediate vicinity* of packages
  - If fire threatens 1.4S packages, consider isolating at least 15 meters (50 feet) in all directions. Fight fire with normal precautions from *reasonable* distance.





# Does 1.4S test criteria correlate to the physical hazard experienced by a emergency responder?

- Survey interested parties/organizations:
  - What is typical gear for responder / firefighter?
  - What test methods are used, or may be adaptable to assess human physical risk posed by 1.4S explosives to emergency responder?
  - Survey/compare test methods for evaluating human physical risk from fire and fragments
- Can we gather additional info from current tests?
  - Preference would be to gather data from current UN 6(c) test setup as opposed to introduction of a new test for 1.4S classification
- Field trials with “typical” 1.4S articles.





# Difficulties with Thermal Effect Measurement

- Direct measurement of average thermal flux with irradiometers may be difficult due to issues with calibration and baseline correction, especially with wood fires.
  - Newer irradiometer technology may be able to overcome this
- Burn time calculation only works if the mass of material burning in each “event” is known. Must see separate identifiable events.
  - High Speed camera might be able to identify separate events
- Propane fire may burn more evenly with less background noise.

