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Containment Options for IEDs and RDDs Using Aqueous Foam

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National Nuclear Security Administration

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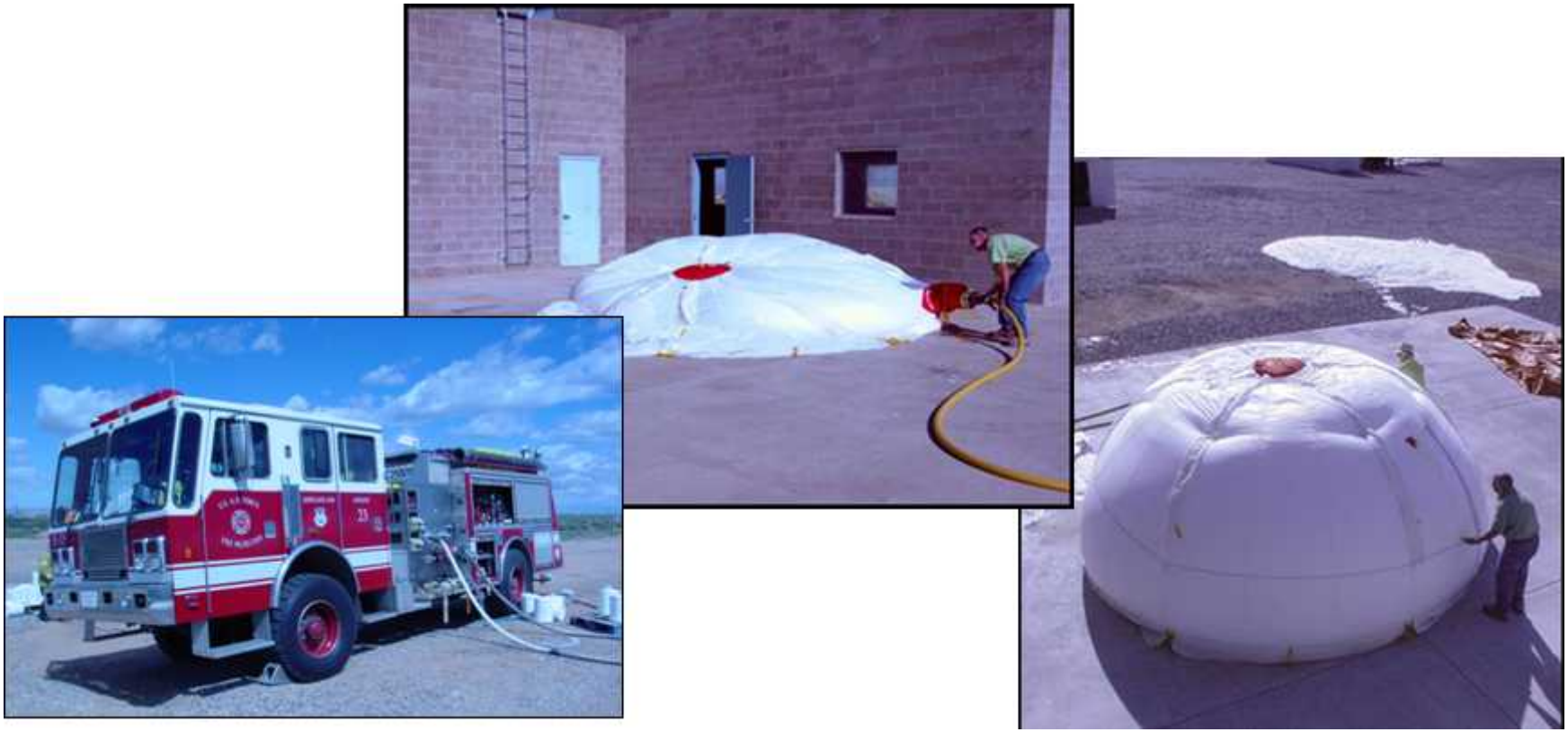
National Emergency Response

- Aqueous foams were developed as part of the rapidly-deployable equipment set for the national response to a radiological terrorist incident.

Objective

- **Develop safe, practical mitigation methods that can be rapidly implemented for high explosive detonations involving the dispersal of hazardous materials.**



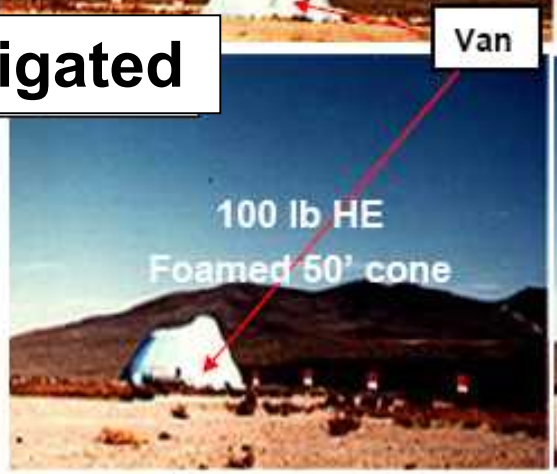
Aqueous Foam Characteristics

- Benefits
  - Suppresses cloud buoyancy
  - Attenuates pressure and impulse
  - Scrubs particulate material
  - Easy to generate large volumes
  - Environmentally safe
  - Low water drainage
- Shortcomings
  - Must be confined
  - Slightly electrically conducting
  - Does not stop fragments

Cloud Buoyancy
Unmitigated vs. Mitigated

Unmitigated

Mitigated

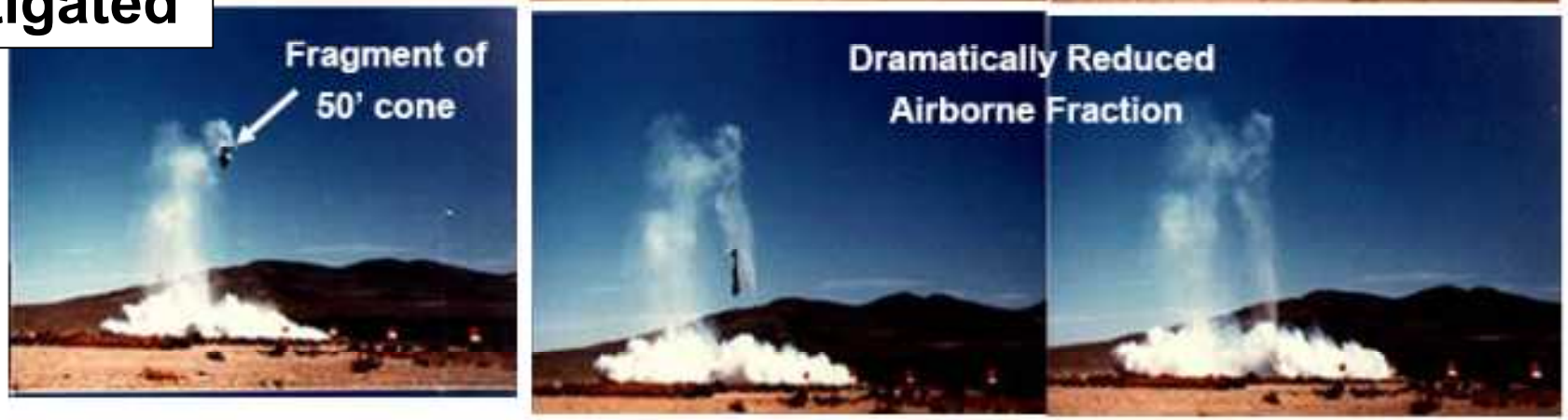


Prompt Effects (Blast, Fragmentation, Thermal, etc.)

Effect on Cloud Buoyancy and Particle Capture

Unmitigated

Mitigated



Dispersal Downwind of WMD Materials (Source Term)

Pressure Attenuation

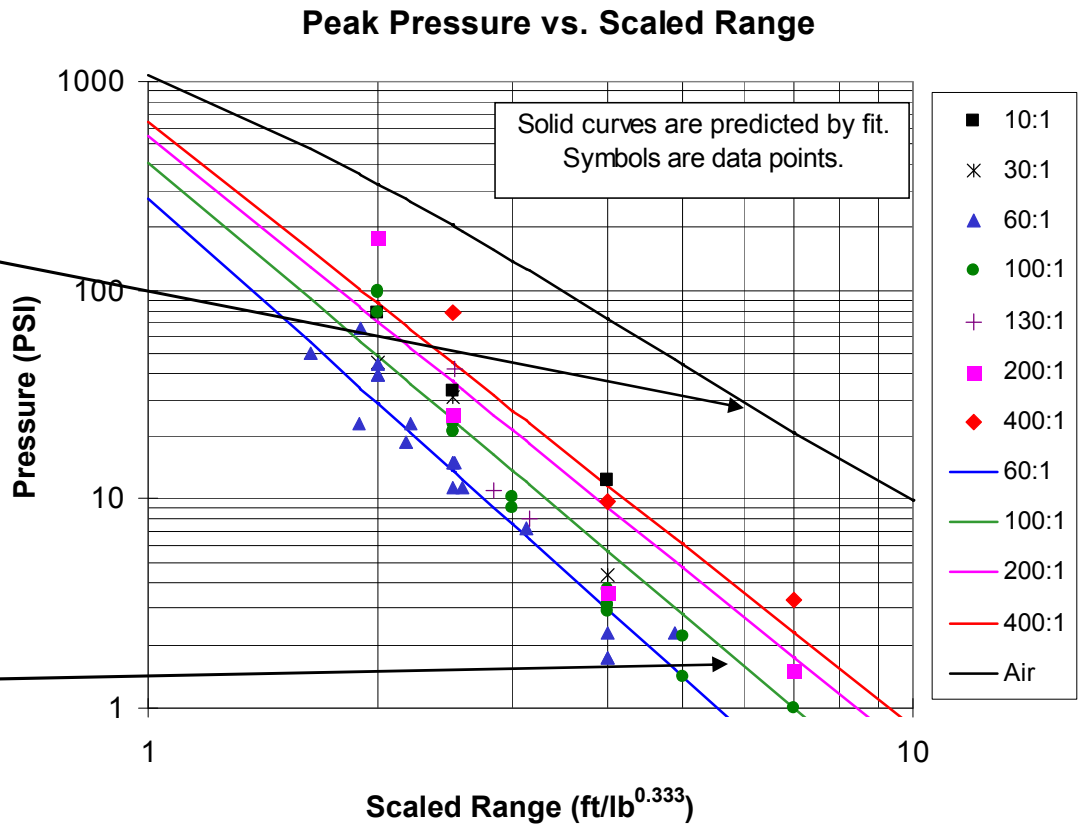
- Explosive energy dissipated by:
  - Mechanical breakup of foam - shock passage though liquid-air-liquid interfaces
  - Absorbing heat liberated from explosive charge
- Explosive tests (1-50 lb)
  - Peak side-on and reflected pressures were measured inside and outside foam
  - Impulse calculated from pressure/time data
- Large tests (50 lb) verified 1/3 power scaling
- Optimal expansion ratio exists between 60-100:1

Pressure Attenuation

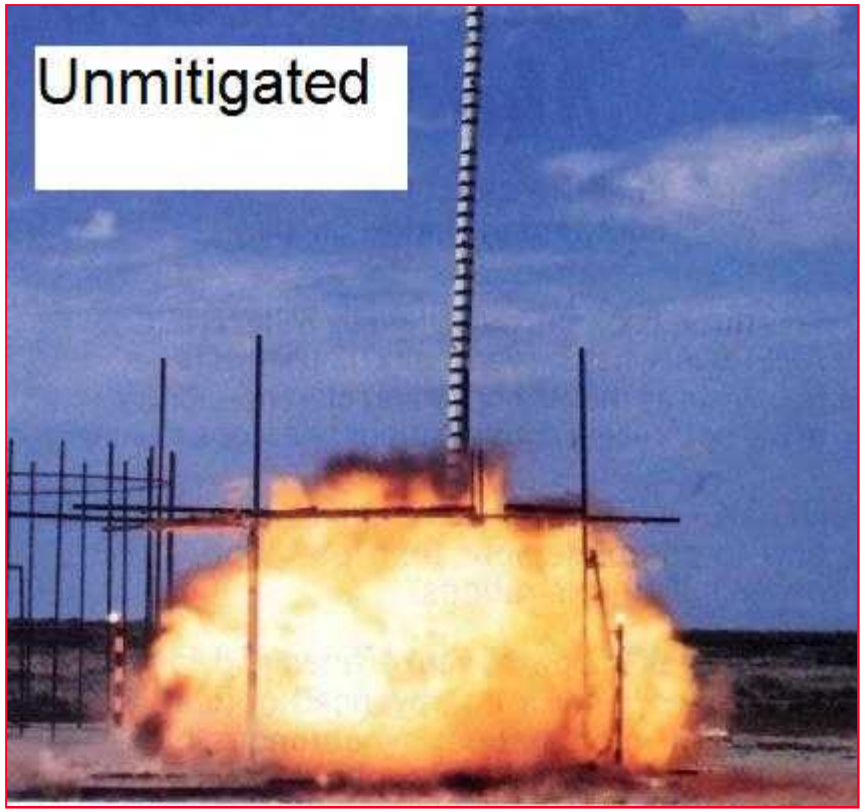
~25 psi

"Witness" vans at 30 feet from unmitigated and mitigated 100 lb detonations

~1.5 psi



Pressure & Thermal Effects Attenuation



Basic Equipment Characteristics

- Wide variety of containment sizes and shapes, including asymmetric and improvised enclosures
- Minimal operator training required
- Leverages standard fire department support apparatus

Basic Equipment Characteristics

Questions?