



Welcome to the World of Trelleborg

8th INTERNATIONAL CONFERENCE FOR FIRE BRIGADES IN THE HIGH HAZARD INDUSTRY

Bob Kelly – Trelleborg Offshore Boston, Inc.





**Vapour / fire suppression for LNG spill
containment**

DryFoam

Bob Kelly General Manager – Trelleborg Offshore, Boston USA



Agenda

- DryFoam – What is it?
- Back ground
- Vapor suppression
- LNG / LPG vapor suppression
- Silo deployment
- UL testing
- Questions

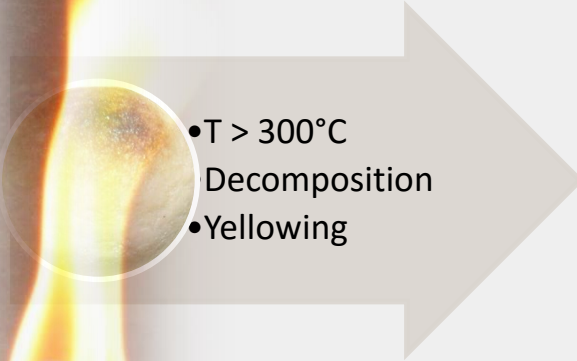
Engineered floating beads

- Beads are comprised of composite materials with engineered attributes
 - Low specific gravity (0.17 g/cc) that allows multiple layers
 - Oil phobic / hydro phobic
 - Compatible with most fuels e.g. gasoline, diesel, heptane, crude oil, ethanol
 - Anti-static / Nontoxic
 - Excellent thermal resistance
 - Intumescent layer - 20-30x volumetric expansion when activated
- Beads offer a fire protection solution where water is absent or scarce

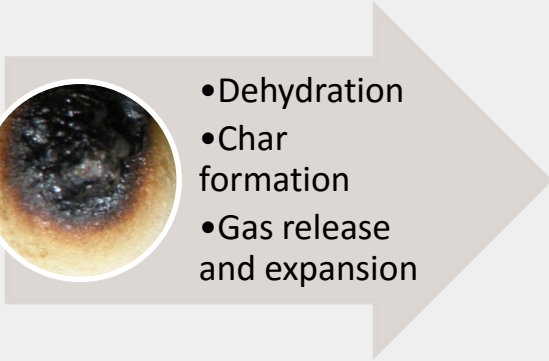
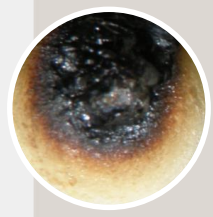


Intumescent layer - Material Design

Carbonaceous char formation



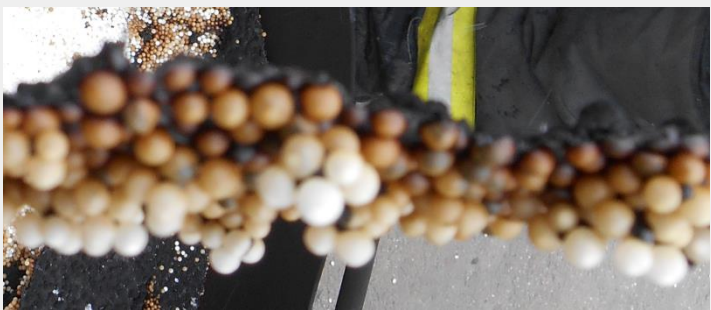
- $T > 300^{\circ}\text{C}$
- Decomposition
- Yellowing



- Dehydration
- Char formation
- Gas release and expansion



- Arrest decomposition
- Carbonaceous Char



Post fire observation



- Expanded char layer formed protective insulating barrier
- Brown spheres started activation
- Whites spheres below – The top layer of beads (~1 inch) protects underlying beads and flammable liquid below.

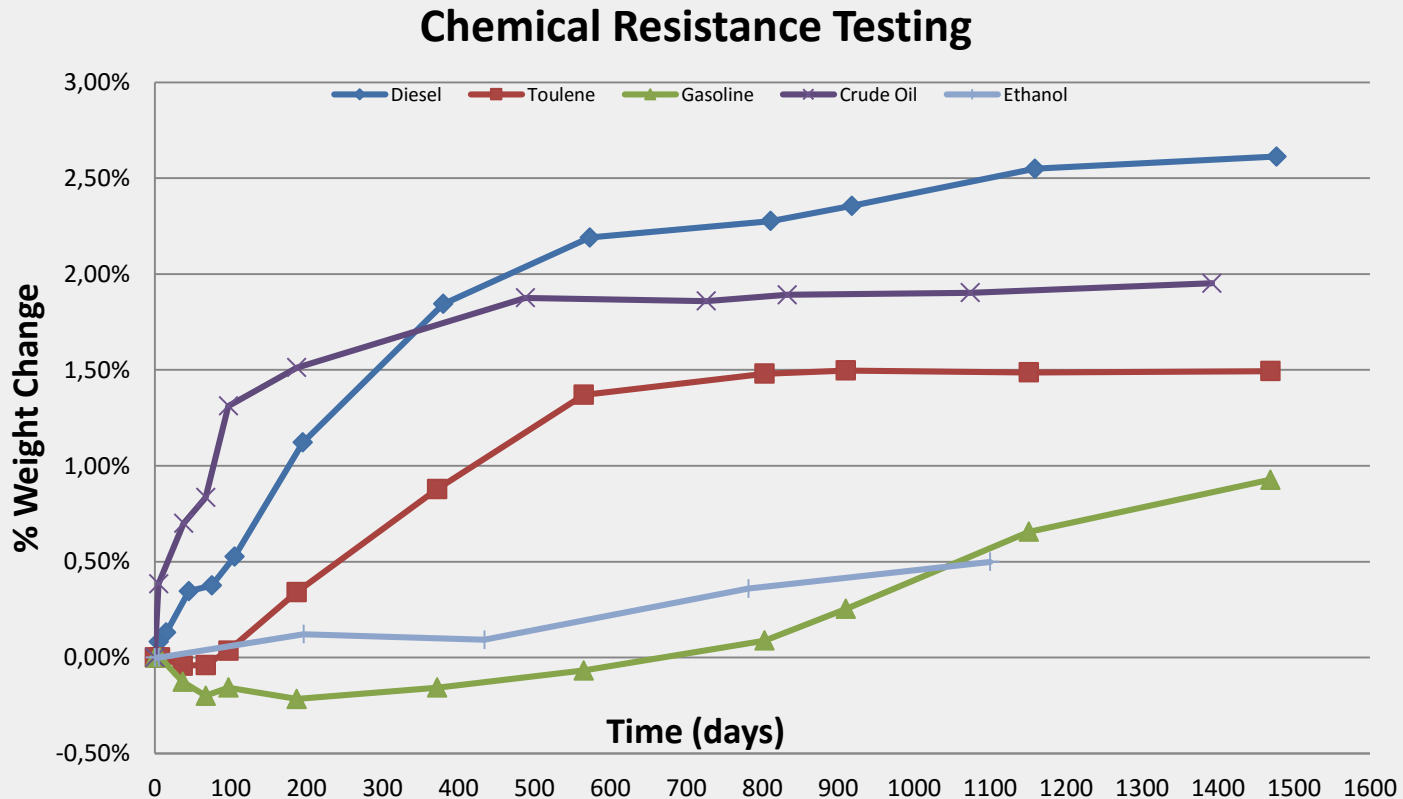
Super sack drop test – Vapor suppression is immediate and effective



Hybrid foam



Long term aging

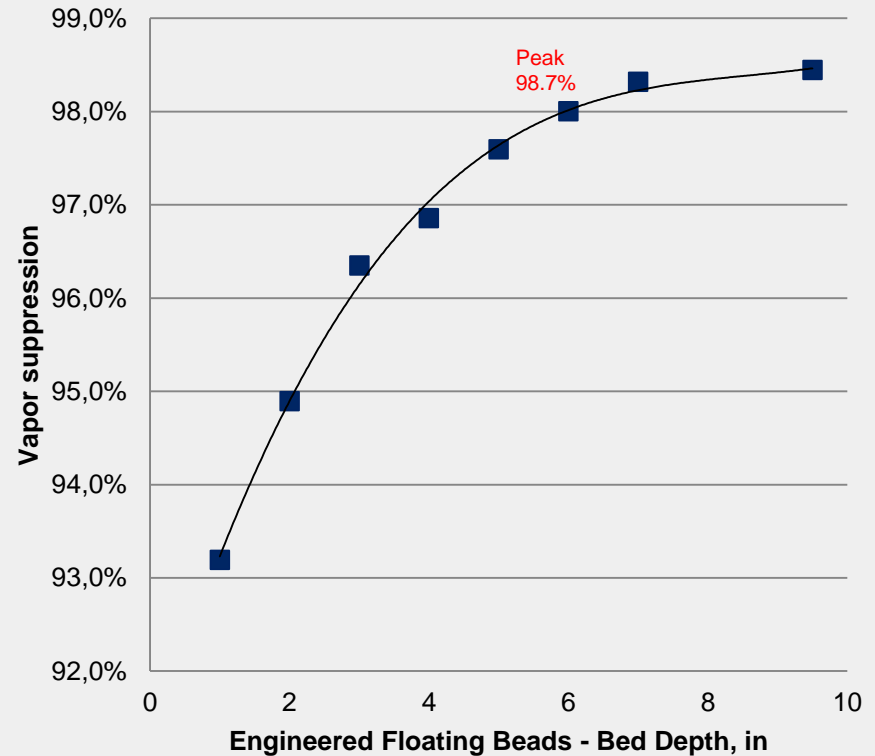


Summary: Beads have excellent chemical resistance when subjected to long term exposure to hydrocarbons.

Vapor suppression - testing

- 3rd party testing (SwRI)
- Test done with acetone
- 72" diameter test vessel
- Uncontrolled vs Engineered beads
- Varying bed thickness
- Beads unaffected by turbulent environment
- Vapor suppression is a function of bed thickness

■ Graph





LNG / LPG Vapor suppression

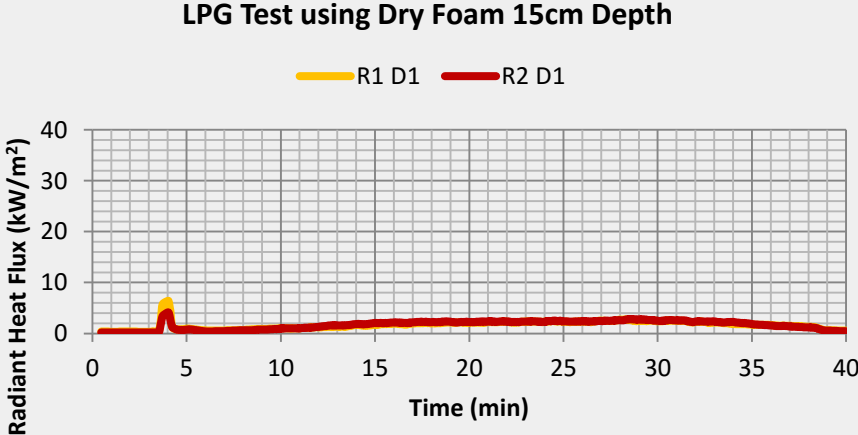
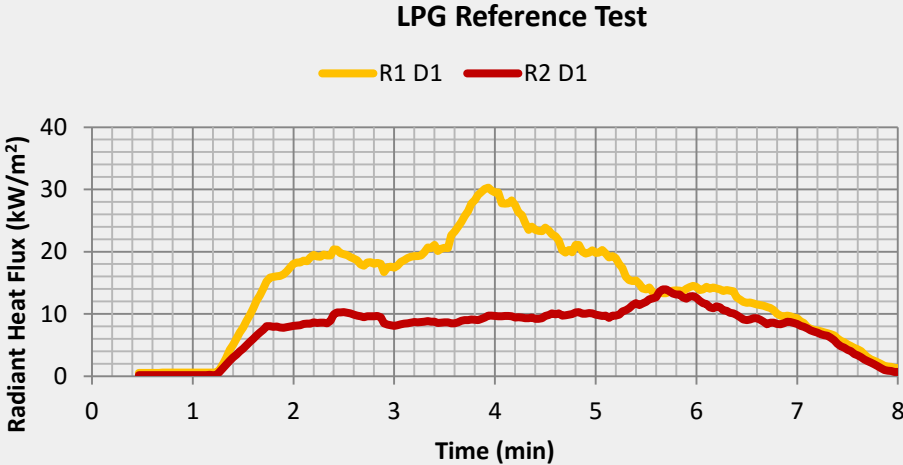
Passive fire protection / prevention

LNG / LPG Vapor suppression

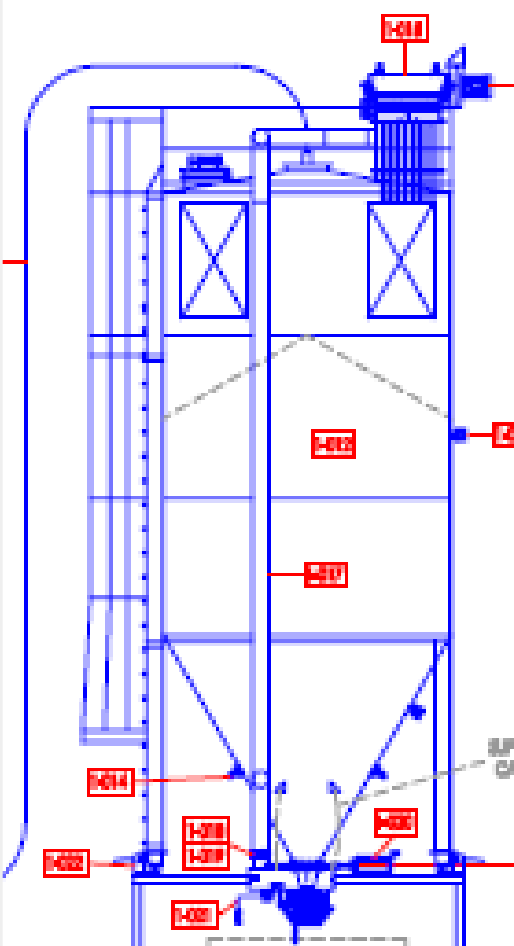
- Pre-Positioned in containment area or silo
- Reduce boil off rate - Mitigate vapor cloud scenario
- Significant reduction in heat – Reduced threat to remaining storage structures
- Easy to install or deploy in catchment sump
- Beads easily conform to irregular shaped catchment sumps



LNG / LPG Vapor suppression



Silo flow rates



| Diameter Inches | Flow Rate Cu ft/sec |
|--------------------|---------------------------|
| 6 | 0.8 |
| 8 | 1.5 |
| 10 | 2.3 |
| 12 | 5.3 |
| 14 | 16.1 |

Silo testing





UL testing

"Buoyant Dry Media for Passive Fire Protection of Flammable Liquids"

UNDER DEVELOPMENT

UL - Testing layout

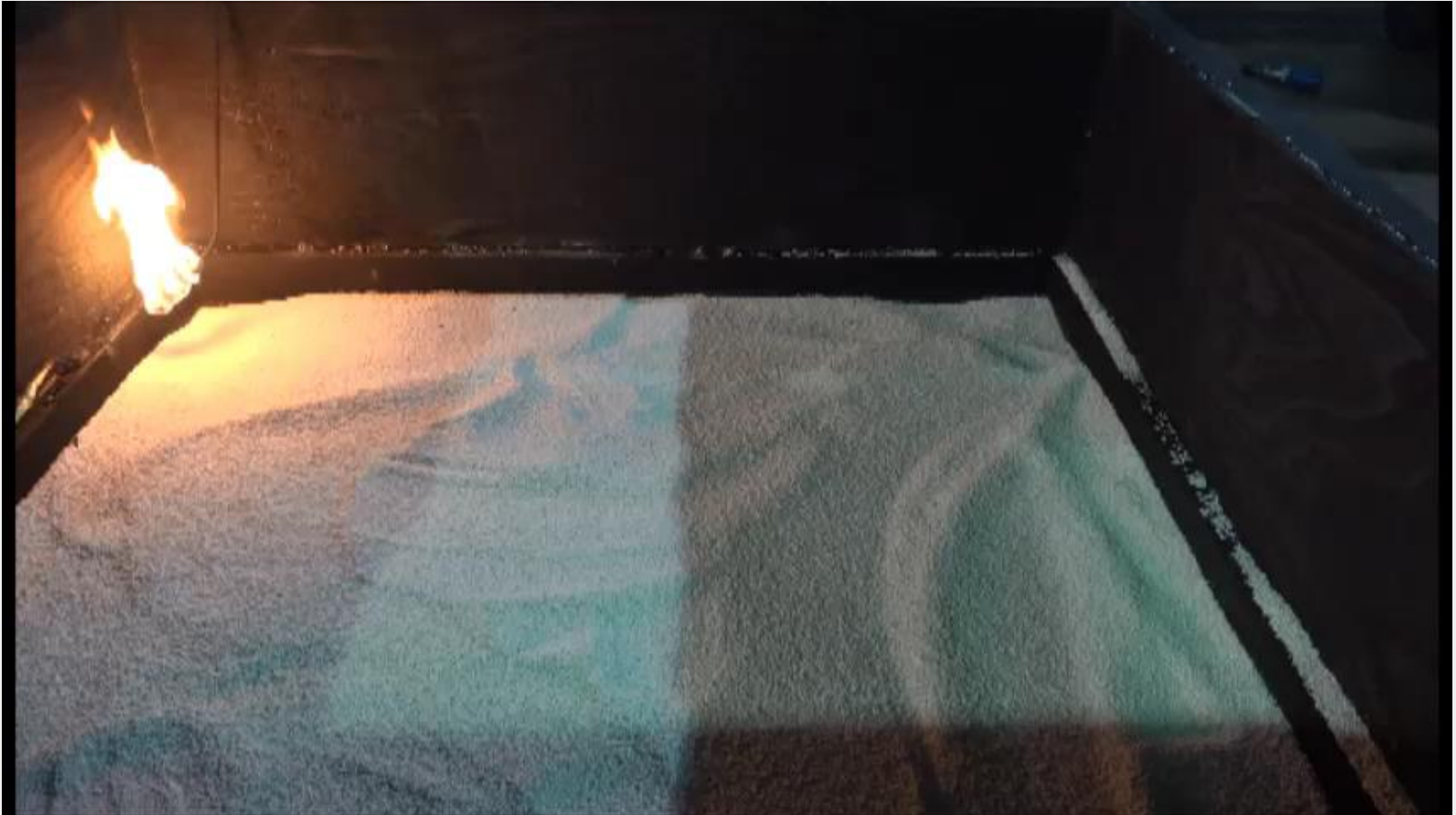
- Stove pipe test
- Torch test
- Explosive vapor test
- Compatibility test
 - 30 day (In process)
 - 200 day (In process)
 - 5 Chemicals



Stove pipe test - Ethanol



Torch test - Ethanol



Vapor flash - Ethanol



Questions

