D&D Research Review

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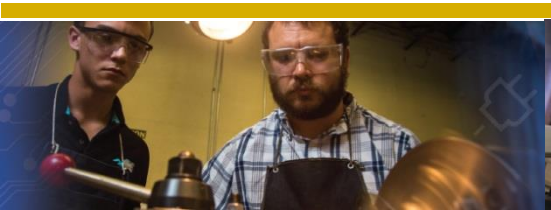
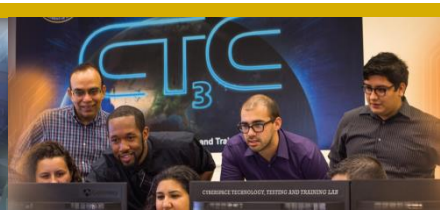
DOE Fellows: Joshua Nuñez, Tristan Simoes-Ponce

Florida International University





Activity 1 - Operational Tests and Evaluations (Hot Demo)

Incombustible Fixatives

FIU Applied Research Center

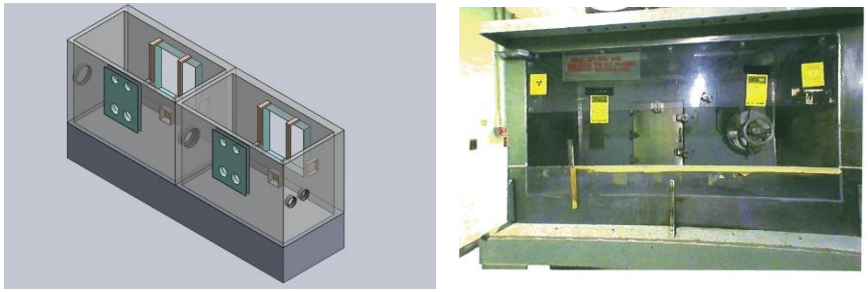
Scope

To develop and characterize a fire resistant radiological contamination fixating technology deployable in non-standard environments (e.g., hot cells, wing cabinets, etc.)

SRNL environmental testing (left) and FIU direct flame testing (right)

Down Selection

- Environmental (SRNL) – temperature/humidity effects
- Radiological (SRNL) – gamma irradiation, 5 MRad
- Adhesion (SRNL) –fixative remains adhered to substrate
- Fire (FIU) – performance under direct flame
- Mass Loss (FIU) – performance at discrete temperatures increasing to 800ºF



FIU cold test mockup (left) and potential hot test stand – contaminated wing cabinet at SRS 235-F PuFF Facility (right)

Field Testing

- Cold demo completed at FIU (Fall 2017)
- SRNL incorporated cold demo results and prepared hot demo test plan (Winter 2018)
- SRNL to conduct fixative hot test/demo at SRS 235-F PuFF Facility (Summer 2018)

Benefits

- Commercial fire resistant materials adapted for radiological application.
- Stabilization of residual contamination influences facility disposition approach.
- Reduces worker risk levels and technical uncertainty.

Activity 1- Operational Tests and Evaluations (Hot Demo)

Incombustible Fixatives

Purpose

To determine the performance of FireDam as a fixating material in a radiological area

Application Methods

- Slow pour
- Spray (Graco Ultra Max)

Application Areas

- Hot Cell Interior
  - Spray coat horizontal and vertical
  - Slow pour horizontal
- Wing Cabinet/Hood
  - Spray coat horizontal and vertical
  - Slow pour horizontal
- F/H Labs Coupons
  - Spray coat
  - Slow pour

Characteristics of Interest

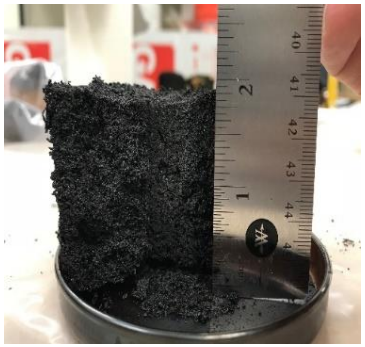
- Hot Cell Interior – 235-F Personnel
  - Document lessons learned on application methods
  - Monitor subjective performance (adhesion, appearance, etc.) - pictures
- Wing Cabinet/Hood – 235-F Personnel
  - Document lessons learned on application methods
  - Monitor subjective performance (adhesion, appearance, etc.) – pictures
  - Monitor thickness over lifetime (Defelsko PosiTector-6000 FNTS)
- F/H Labs Coupons – SRNL Personnel
  - Heat testing – muffle furnace
  - “Fixating capacity” testing – how much material is released during heating

Activity 2 - Radiological Shielding Foams Fire Testing

Executive Findings

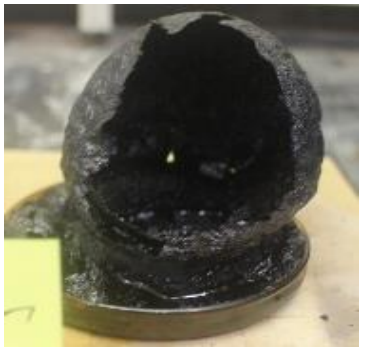
FIU Applied Research Center

- **Intumescent Foams**
  - Best in class and met fire safety requirements
  - Maintained structural integrity
  - Excellent thermal insulation
  - No flame or smoke propagation
- **Fire Rated Foams**
  - Failed to meet fire safety requirements
  - Loss of structural integrity
  - Poor thermal insulation
  - Flame and smoke propagation
- **Non-Fire Rated Foams**
  - Failed to meet fire safety requirements
  - Loss of structural integrity
  - Poor thermal insulation
  - Flame and smoke propagation



Intumescent Foam Sample
Post Mass Loss Test

Intumescent Foam Sample
(cut in half)
Post Direct Flame Test



Non-Fire Rated Foam Sample
Post Mass Loss Test

Fire Rated Foam Sample
Post Direct Flame Test

Activity 2 - Radiological Shielding Foams Fire Testing

Best in Class Two hour Direct Flame Test

Hilti

- Duration: 2 hours
- Flame and smoke propagation:
- Structural integrity:
- Thermal insulation:

3M

- Duration: 2 hours
- Flame and smoke propagation:
- Structural integrity:
- Thermal insulation:

Hilti

3M

Overall, the Hilti samples were the clear front runner for best in class

Activity 2 - Radiological Shielding Foams Fire Testing

Post-Testing Observation
Intumescent Sample

Intumescent Sample Cut in Half

Activity 2 - Radiological Shielding Foams Fire Testing

Fire-rated Foam-Two Hour Direct Flame Test

23 FR

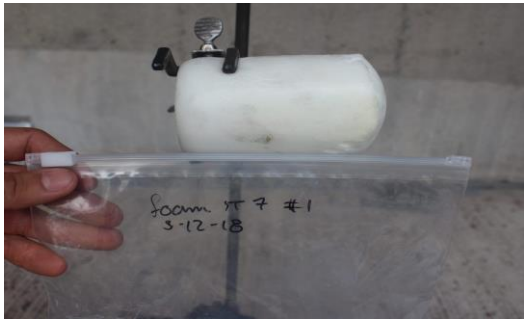
- Duration: 13 min & 25 seconds
- Flame and smoke propagation:
- Structural Integrity:
- Thermal Insulation:

7 FR

- Duration: 2 min & 37 seconds
- Flame and smoke propagation:
- Structural Integrity:
- Thermal Insulation:

23 FR

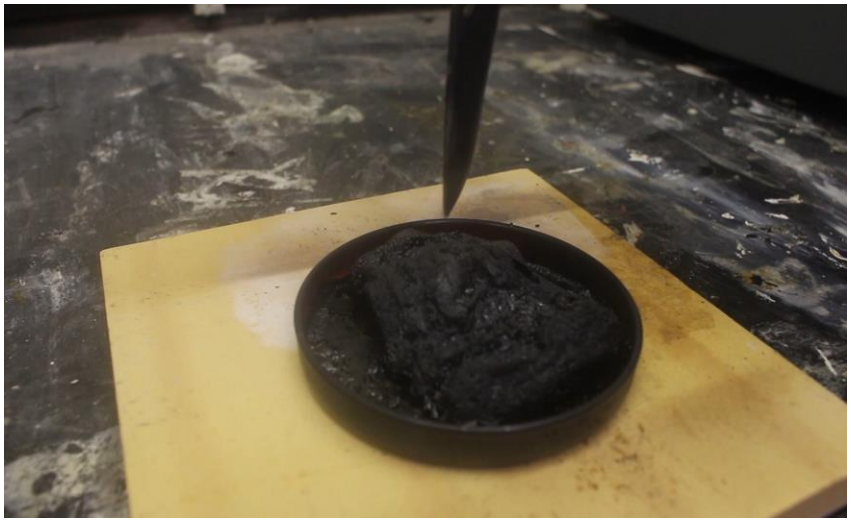
7 FR



Activity 2 - Radiological Shielding Foams Fire Testing

Post Testing Observations

Fire Rated Samples



Fire Rated Sample

Activity 2 - Radiological Shielding Foams Fire Testing

Non-Fire Rated Foam-Two Hour Direct Flame Test

iT-14

- Duration: 3 min & 3 seconds
- Flame and smoke propagation:
- Structural integrity loss:
- Thermal insulation:

iT-8

- Duration: 14 min & 45 seconds
- Flame and smoke propagation:
- Structural integrity loss:
- Thermal insulation:

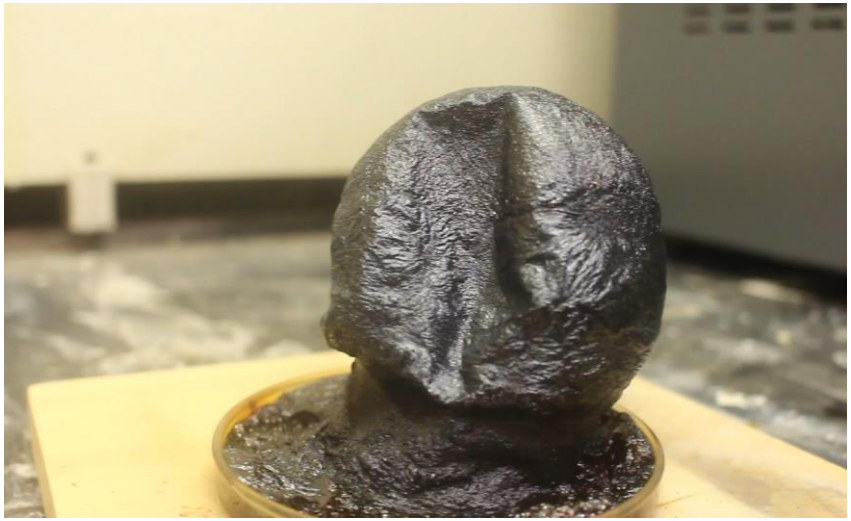
iT-14

iT-8

Activity 2 - Radiological Shielding Foams Fire Testing

Post Testing Observations

Non-Fire Rated Samples



Non-Fire Rated Sample

Activity 3 - Standards Development
The Mandate

"There is general acceptance by the community on the utility of fixatives to immobilize residual contamination and mitigate risk during D&D activities, *but a more formal process needs to be available for site personnel and regulators to confirm their capabilities. Uniform standards can play a significant role in this effort*."

Andrew Szilagyi, Director
DOE EM's Office of Infrastructure and D&D

Spraying fixative at the PFP/PRF and "Fixed" Contamination in Blue

Activity 3 - Standards Development
Meeting Operational Requirements

- First 2 x ASTM Standard Specifications for fixative technologies ISO D&D activities formally published in July 2017:
  - E3104-17: Specifications for Strippable & Removable Coatings to Mitigate Spread of Radioactive Contamination
  - E3105-17: Specifications for Permanent Coatings Used to Mitigate Spread of Radioactive Contamination
    - Referenced in SRNL'S Incombustible Fixative and ACE 2.0 Test Plan: Radiological Hot Field Test of Intumescent Coatings and Electrostatic Precipitators

- Standard Practice for Preparation of Fixed Radiological/Surrogate Contamination on Porous Test Coupon Surfaces for Evaluation of Decontamination Techniques being drafted
  - Currently being balloted for full Subcommittee concurrence

ASTM News Article Highlighting Newly Established ASTM Standards for D&D Technologies

***Link**: https://www.astm.org/standardization-news/?q=update/coatings-help-prevent-radioactive-contamination-decommissioning*

Activity 4 – Potential Applications of Intumescent Technologies to Address Other DOE-EM Problem Sets

FIU Applied Research Center

- Identify broader applications for intumescent technologies across the DOE complex
  - Engage DOE sites to identify problems and challenges related to fire/extreme heat conditions.
  - Formal report due 31 July 2018.

	PROJECT TASKS	TECHNICAL LEAD	DUE DATE	STATUS
Jan 2018	Develop and Review P.O.A.M.	Sinicrope/ Viera/ DOE Fellows	1/18/18	Complete
	Develop technical progress report outline	Viera/ DOE Fellows	1/31/18	Complete
Feb 2018	Progress Report: Sections 1 and 2	Viera/ DOE Fellows	2/15/18	Complete
	Review of existing IC technology applications complete	Viera/ DOE Fellows	2/21/18	Complete
March 2018	Finalize Waste Management Conference Poster	Viera/ DOE Fellows	3/8/18	Complete
	Progress Report: Section 3	Viera/ DOE Fellows	3/16/18	Complete
	Waste Management Conference Presentation	Tristan	3/19/18	Complete
	Brief potential DOE challenge areas for IC application	Viera/ DOE Fellows	3/22/18	Complete
April 2018	Progress Report: Section 4	Viera/ DOE Fellows	4/23/18	Complete
	Brief DOE-EM on recommended technologies to test for Year 9	Sinicrope/ Viera/ DOE Fellows	4/30/18	Complete
May 2018	Progress Report: Section 5	Sinicrope/DOE Fellows	5/11/18	Complete
	Finalize and Review Progress Report	Sinicrope/DOE Fellows	5/24/18	In Progress
June 2018	Technical Progress Report Complete	Sinicrope/DOE Fellows	6/1/18	In Progress

Proposed D&D Scope for Performance Year 9

- Testing and evaluation of technologies to support open air demolition
  - FD intumescent fixative
  - Resuspension rates, airborne release fractions (ARF), and respirable fractions (RF) when exposed to thermal/impact stressors
- FIU/SRNL radiological foams testing (cold demo)
  - Volume test in glovebox
  - Fire testing in pipes
- Continue support to SRNL (hot demo)
- Continue D&D standards development initiative with ASTM E10.03

Demolition of the Plutonium Finishing Plant at the Hanford Site was halted in mid-December after radioactive dust was discovered far from the plant site. Vartabedian, R. (2018, April 16)