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DEACTIVATION & DECOMMISSIONING

FIU PROJECT: Waste and D&D Engineering and Technology Development: *Adapting Intumescent Coatings as Incombustible Fixatives to Address Safety Basis Requirements*

CLIENT: U.S. Department of Energy EM
FIU PRINCIPAL INVESTIGATOR: Dr. Leonel Lagos
SRNL PRINCIPAL INVESTIGATOR: Mr. Michael Serrato
SITE: Savannah River Site and DOE Complex-wide
COLLABORATOR: Savannah River National Laboratory

Description:

The objective of this FIU-SRNL collaborative research effort is to address a high priority operational and safety requirement highlighted by the Defense Nuclear Facility Safety Board (DNFSB) and SRS site personnel to support D&D risk reduction activities for the SRS 235-F PuFF facility. A review of Basis for Interim Operations (BIOs) across the DOE EM Complex outline contingency scenarios involving a potential release of residual radioactive contamination resulting from thermal (fire) and seismic stressors.

FIU and SRNL researchers have identified and are testing and evaluating a cost-effective commercial-off-the-shelf (COTS) fire resistant coating technology (i.e., intumescent coating) that has demonstrated significant promise in mitigating this risk. In close coordination with stakeholders and end users, FIU and SRNL have conducted a series of highly successful bench- and full-scale cold tests on the technology, and planning is underway to conduct evaluations in a radioactive environment within the SRS facility during FY 2018.

Benefits:

- Addresses a high priority requirement identified by DNFSB and SRS personnel
- Potential for broader applications to satisfy BIO and safety basis requirements across the entire DOE EM Complex
- Provides a cost-effective COTS fire retardant platform for immobilization of radioactive contamination requiring minimal research investment relative to potential deployment

Table 1. Types of Accidents (and Frequencies) Summarized

DOE Site/Facility	Fire Events	Explosion Events	Loss of Confinement (Spill) Events	Natural Phenomena Hazards	Other Events
RFETS Bldg 440	• ***1,200 Drum Fire (EU)*** • ***15 Crate Fire (U)*** • Truck Fire (EU)		• LLW Repack Spill (U) • Drum Spill (A)	• ***Earthquake Collapse (U)***	• ***Aircraft Crash (EU)***
RFETS Bldg 664	• ***3 Drum Fire (EU)*** • ***15 Crate Fire (U)*** • *336 Drums + 72 Crates Fire (EU)* • Truck Fire (EU)		• *Multi-Container Drop*	• ***Earthquake Collapse (U)***	• ***Aircraft Crash (worst-case) (EU)*** • ***Aircraft Crash (realistic case) (EU)***
SRS APSF	• *Accountability Mgmt. Room Fire (U)*	• *Explosion in Repackaging Area (A)*		• *Seismic Induced Full Facility Fire (U)*	
SRS HB-Line	• Full Facility Fire (EU) • Full Facility Fire & Secondary Events (EU) • ***Intermediate Fire (U)*** • ***Intermediate Facility Fire & Secondary Events (EU)***		• Spill (A)	• Earthquake with Secondary Events (EU)	
SRS Bldg 235-F	• Fire – Best Case (U) • Fire – Worst Case (U)			• Design Basis Earthquake (EU)	
SRS SWMF	• ***TRU Pads – Internal Culvert Drum Fire (U)***	• ***TRU Pads – Culvert Explosion (U)***	• TRU Pads – High Energy Vehicle Impact (EU) • ***TRU Pads – Dropped Steel Box (A)***	• TRU Pads – Tornado (EU)	• 634-7E Buried Waste Helicopter Crash (EU)
Hanford WRAP Facility	• *4 Drum Fire (U)* • *Single Drum Fire in Glovebox (U)*	• ***Drum Explosion with 4 Drum Fires (U)*** • *Single Drum Explosion in Glovebox (U)*	• Solid Waste Box Failure (A)	• ***Design Basis Earthquake (U)*** • Beyond DBE (EU)	
INEEL RWMC	• ***Vehicle Fire (U)***	• *Drum Explosion (A)*	• *Box Spill (A)*	• Design Basis Earthquake (U)	
LANL RAMROD Facility	• Small Fire (A) • Medium Fire (EU) • Large Fire (EU)	• Small Natural Gas Explosion (A) • Large Natural Gas Explosion (EU)	• Coring Glovebox Spill (A)	• Design Basis Earthquake (U)	• Aircraft Crash (EU)

Note: Scenarios in *Italics* are risk dominate events, based on Risk Class I or II for the collocated worker. ***Bold Italics*** denotes that it is also risk dominant for the public.

Fire-Related Contingency Scenarios across the DOE EM Complex

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Accomplishments:

- Bench-scale testing by FIU and SRNL confirmed the IC technology's superior fire retardant qualities, as well as its ability to perform in adverse environmental conditions. Overall adaptability as an incombustible fixative capable of enhancing a facility's posture against certain fire contingencies was proven.

Fire resistant qualities of intumescent coatings (middle) compared to existing industry fixatives (left and right)

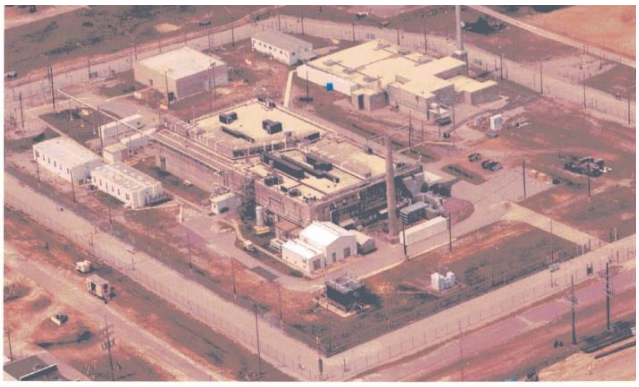
- A full-scale cold demo at FIU's Hot Cell Test Bed facility successfully demonstrated the coating technology could be applied under real world operational constraints and conditions.

Application of IC technology simulating operational conditions at the FIU Hot Cell Test Bed Facility

- The evaluation process resulted in the development and promulgation of two international ASTM standards on fixative technologies, and identified a path forward to support the potential updating of relevant DOE guidance documents and handbooks.

FY18 Hot Demo and Way Ahead:

- A radiologically hot demonstration is currently being planned for FY18 that will entail the application of a select IC technology in cells 6/7 in the SRS 235-F PuFF facility and on other identified contaminated areas elsewhere at SRS.
- In conjunction with this hot demo, the release of plutonium (Pu) material is also being characterized during thermal stress to quantify potential release fractions from the coated contaminated substrate, which is directly applicable to safety basis concerns from the DOE-HDBK-3010.



SRS 235-F building (center)

- This material is currently being considered as an end state solution for residual Pu hold up to aid in mitigating anticipated residual contamination for the SRS 235-F hot cell plutonium hold-up remediation project, currently ongoing.

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