Project 3 - Task 2: D&D

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Objectives

Overall Needs:

fixative technology to immobilize and/or isolate residual contamination within a 3D void space. These fixatives need to remain functional under a number of stressors (thermal, impact, and environmental). Mitigate risk of worker / environmental exposure during D&D activity.

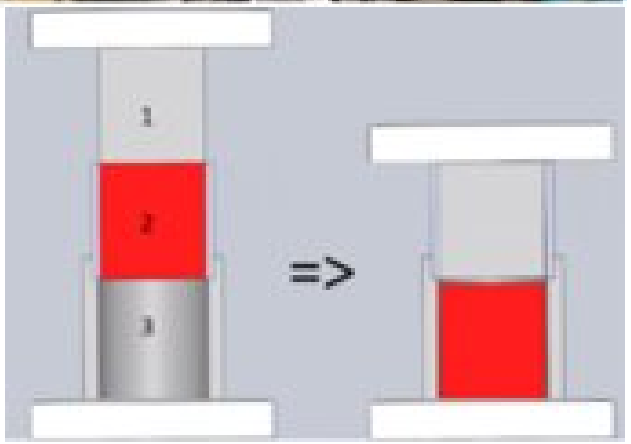
Objectives:

- Evaluation of the adhesion and bonding properties of the Hilti CP-620 foam plug to Hastelloy C-22 piping
- Develop a leak test standard operating procedure to test for the effectiveness of the Hilti CP-620 foam plug
- Gather information and reference material to initiate the construction of the mock-up test of the F/H labs courtyard
- Identify other potential technologies that could be used as permanent foaming fixatives
- Reevaluate

Adhesion/Bonding

FIU Year 2 Highlights:

- Adhesion to Hastelloy C-22 pipes needed to be tested.
- Tested pipe samples (3" diameter x 14" length) with MTS 43 Criterion tensile tester to determine how well foam adheres to pipe under ideal conditions.
- The plug strength / adhesion of Hilti CP-620 foam in Hastelloy C-22 pipes was compared to its plug strength / adhesion in 304-stainless steel pipes.



1 – Aluminum “Plunger”
2 – Pipe Foam Sample
3 – 3D printed (ABS) Bucket

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Adhesion/Bonding

FIU Year 2 Highlights:

- Hastelloy pipes average load before failure is 7,733 lbf.
- Stainless-steel average load before failure is 8,451 lbf.
- The difference in pipe material seems insubstantial.

Hastelloy C-22

Baseline Testing Values	
Sample	Load (lbf)
C-22-1	7250.07
C-22-2	6940.50
C-22-3	9983.59
C-22-8	6963.39
C-22-9	6988.26
C-22-10	8273.61
AVERAGE	7733.24 ± 1213.72

304-Stainless Steel

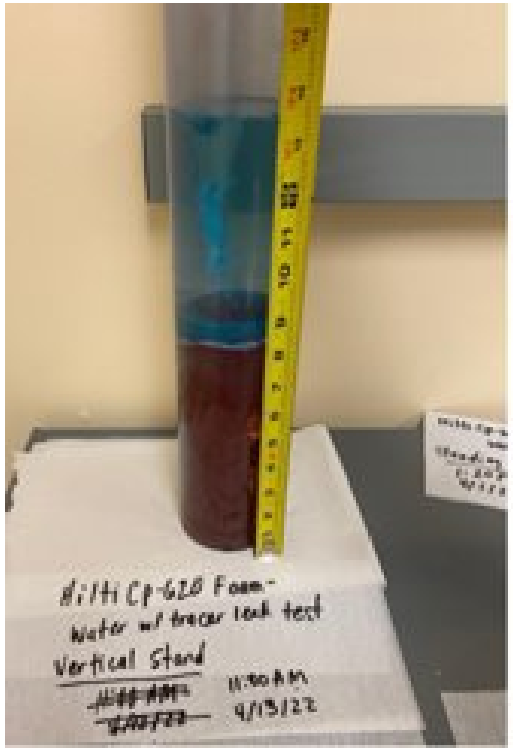
Baseline Testing Values	
Sample	Load (lbf)
304SS-1	8792.23
304SS-2	7996.41
304SS-3	8798.43
304SS-6	8952.68
304SS-1*	7990.96
304SS-2*	8179.50
AVERAGE	8451.70 ± 442.91

* Results from previous testing included

Hilti Water Leak Test

FIU Year 2 Highlights:

- Foam was applied inside the clear 3-foot PVC pipe and allowed to cure before adding water with a blue UV reactive dye.
  - Water was added to create 1-inch of standing water when laying horizontally.
- The pipe was stood up vertically and monitored for over a week.
- **No water leaked** out of the pipe after more than one week.



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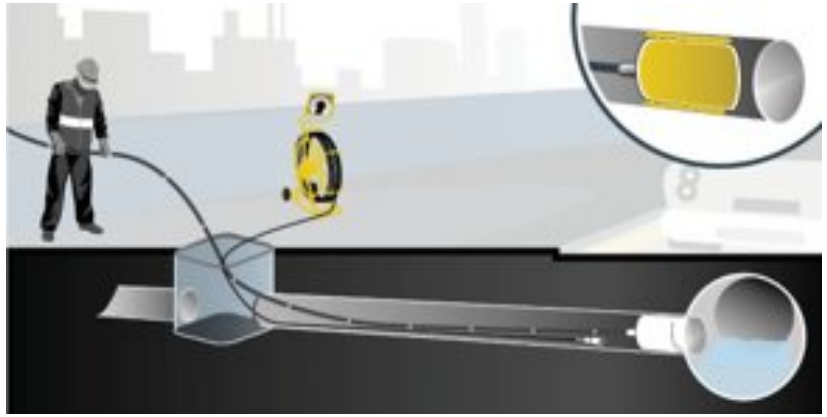
Alternative Foam Plug Technologies

FIU Year 2 Highlights:

- **DRAIN BLOCK™**
  - is a semi-porous bag containing a sealed bag of PU resin foam that can be positioned inside a lateral drain or pipe.



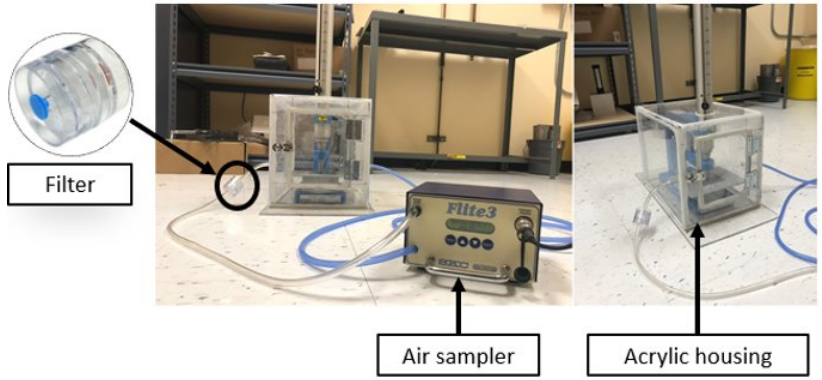
- **FOAMBAG™**
  - very similar to the DRAINBLOCK technology but is designed for use with a hot tap.
  - The FOAMBAG technique has been in use in the UK in gloveboxes at Sellafield and meets the UK gas industry technical standard T/SP/E/59.

The FOAMBAG™ holds the resin foam in place as it expands. At full expansion some of the foam seeps through the semi-porous panels of the bag to form an adhesive seal with the pipe

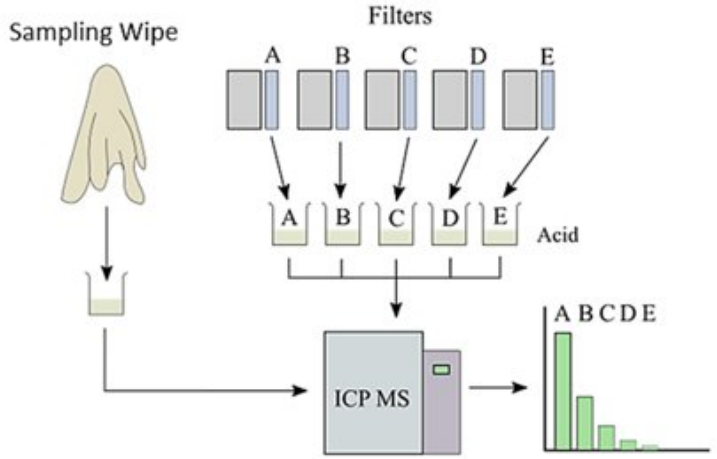
Certification of Polymer Fixatives

FIU Year 2 Highlights:

- Outdated regulations such as the DOE-HDBK-3010 provide **no guidance on how to properly credit fixative technologies** that immobilize the contamination in a solid polymer material.



- BYK Gardner Impact Tester (ASTM D2794) evaluates impact resistance and determines the exact point of failure.



- Metal coupons are contaminated with a surrogate contaminant Cesium Chloride (CsCl).

Conclusion of Baseline Impact Testing

- Powder contaminant under impact is **very similar** to the ARF presented in DOE-3010-HDBK.
- Initial results for fixatives, FD and PBS, showed a **significant reduction** in the ARFs.
  - Fixatives produced ARFs less than liquid contaminant from this dataset.
  - Supports further investigation into implementing a “Fixative State” in the DOE-HDBK-3010.

FIXATIVE STATE

- Reduces ARFs ↓
- Reduces RFs ↓

Contaminant Form	Impact ARF
Gas / Vapor	1.0
Powder	3e-4
Liquid	4e-5
Metal / Solid	No significant airborne release is postulated for this accident configuration.

Higher Risk

Lower Risk

2022 Internships

FIU Year 2 Highlights:

- Spring and Summer internships at Savannah River National Laboratory
  - Advanced Engineering
  - Seeking to increase productivity by automating the receipt inspection of waste storage containers
    - worked on end of arm tooling for a six-axis robot
    - Designed an alignment tool for a component of the container
  - Conceptualized, designed, and drew parts for tools that are currently being used on the robot

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Path Forward

Future work

- Analyze DRAIN BLOCK™ and FOAMBAG™ for use as permanent foaming fixatives.
- Continue gathering data to substantiate a "fixative/polymer state" to be added to DOE-HDBK-3010.
- Complete cold-demo test of Hilti for SRNL.

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Thank You. Questions?