

FIU

Applied Research
Center



DOE-FIU Cooperative Agreement Annual Research Review - FIU Year 3

Test and Evaluation of Down-Selected Foams/Foam Plug Technologies to Mitigate Contaminant Release during Nuclear Pipe Dismantling

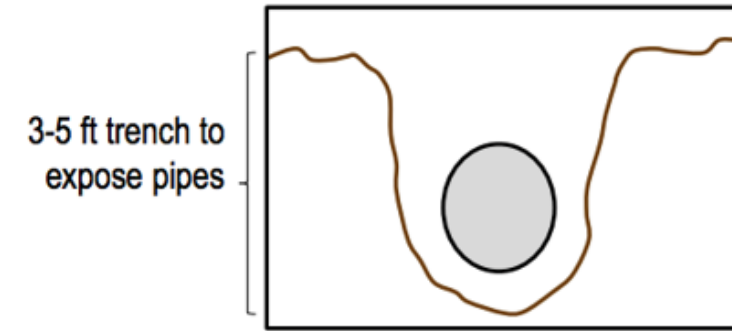
Bryan Torres

Worlds
Ahead

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Overall Needs

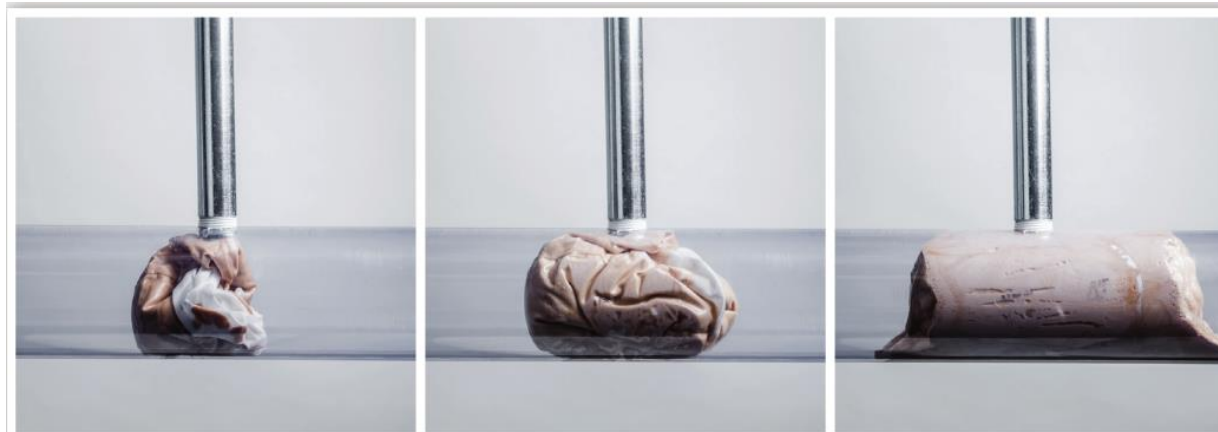
- By FY '27, the F/H Laboratory Deactivation Project Team plans to remove all the buried LAD and HAD piping in the Courtyard between 772-F and 722-1F.
- The driver for removal is to prevent future release(s) to the environment from the buried, highly-contaminated piping.
- The intent is to remove the piping to within 1' of the respective building and then to cap both the 2 & 3-inch "core" pipe and the 3 & 4-inch "jacket" pipe.
- The piping is generally buried to a depth of 3-5 feet.
- Total length of piping to be removed is approximately 250 feet. Piping will be cut to 5' lengths.



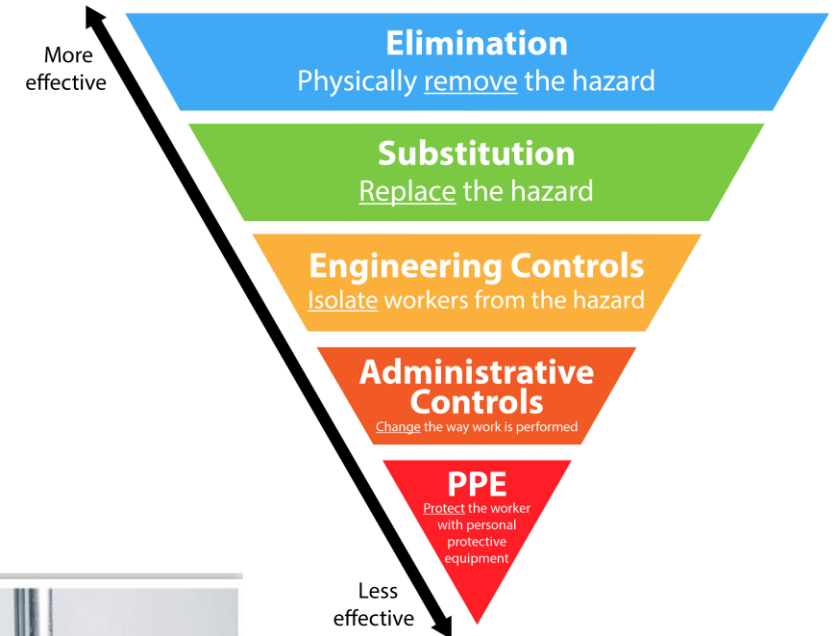
Mitigating hazards

FoamBag™

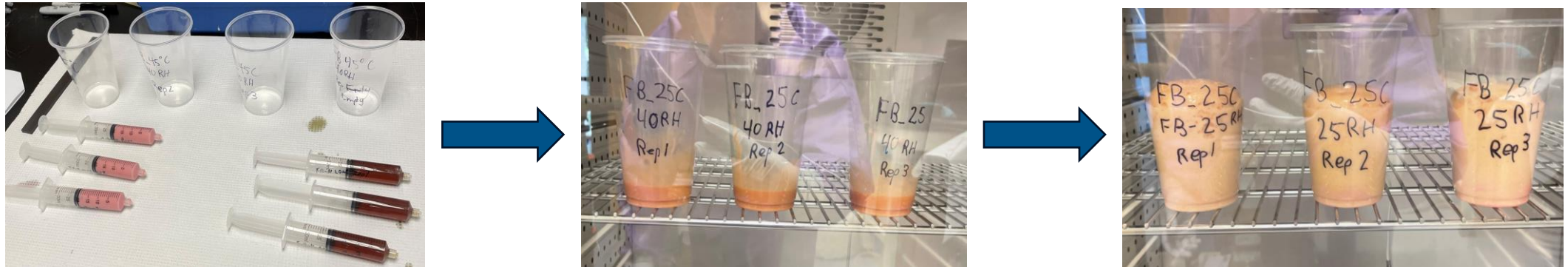
- Expanding PU resin foam.
 - Used in the UK in gloveboxes at Sellafield & meets the UK gas industry technical standard T/SP/E/59.
- A possible engineering control.
- Injected into a semiporous bag via an injection tube which passes up through the standpipe assembly.
- Hot tap compatible.



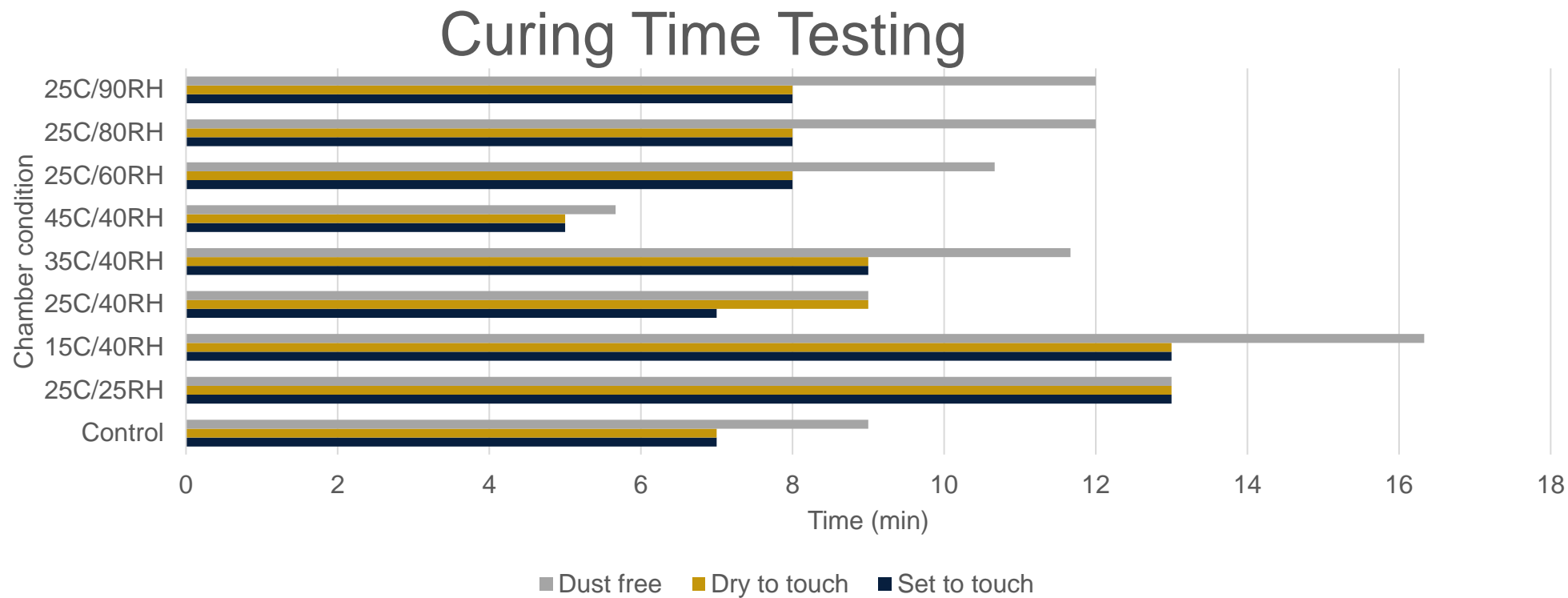
The FOAMBAG™ holds the resin foam in place as it expands. At full expansion some of the foam seeps through the semi-porous panels of the bag to form an adhesive seal with the pipe



Environmental Chamber and Water Uptake Testing



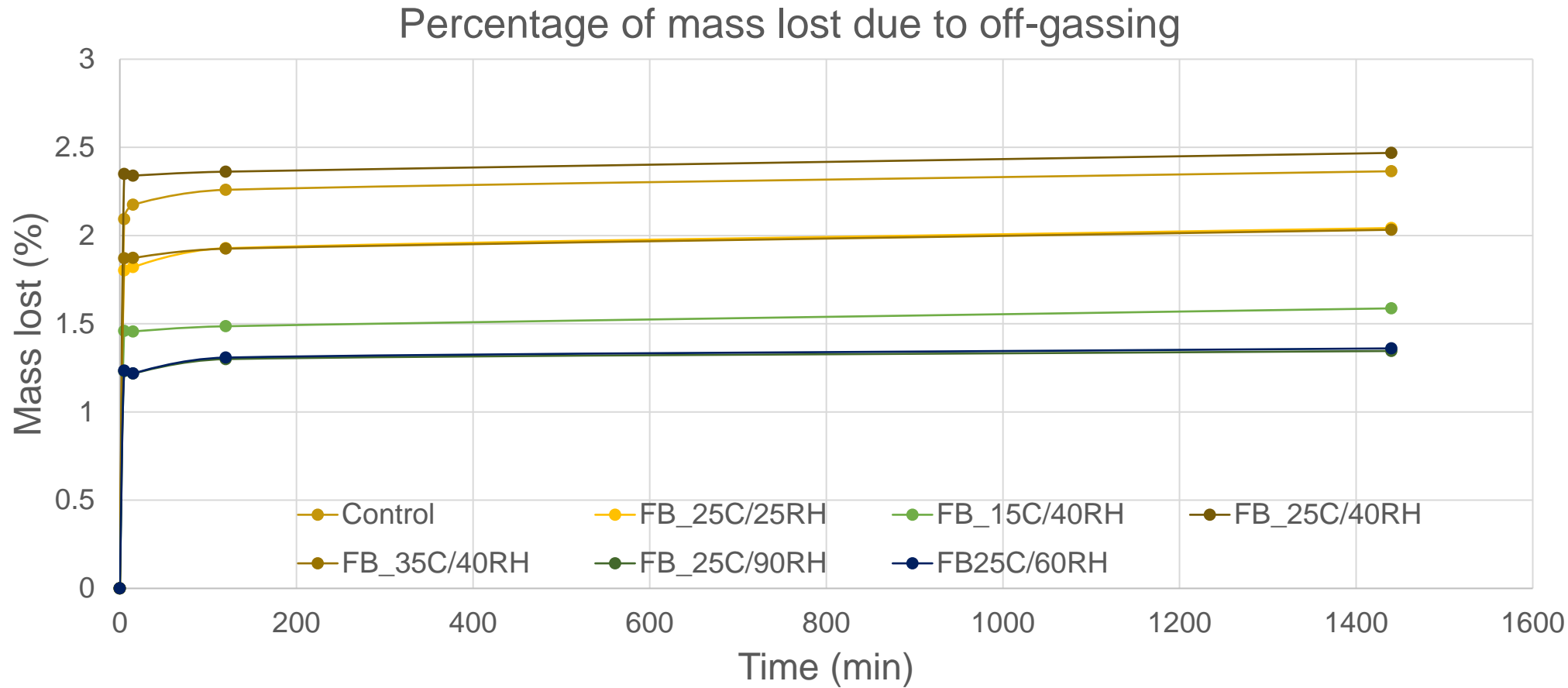
- 1:1 ratio.
- 20 mL of resin and 20 mL of hardener.
- Environmental conditions are set.
- Set-to-touch, dry-to-touch, and dust-free tests are performed as per ASTM D1640 standard for environmental chamber cure time testing.
- For water uptake testing, samples are weighted at 5 min, 15 min, 2hr, and 24hr after mixing.



- The set-to-touch test, dry-to-touch, and dust free test show a curing time of 5 to 20 minutes, which validates the manufacturer's data.
- Curing time provides sufficient work time during hot tap procedures.



Water Uptake – Results

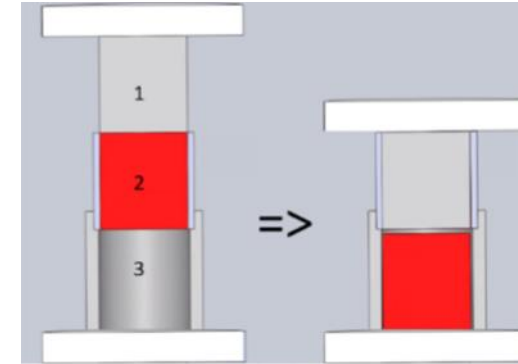


- Change of mass due to water uptake in 24 hours is minimal.
- Mass lost is most likely due to off gassing
- GC-MS results are pending.



Evaluation of the adhesion and bonding properties of the foam plug to Hastelloy C-22 piping:

- 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 in Hastelloy C-22 pipes of FoamBag™ & compared to Hilti CP-620.
- Adhesion is tested in ideally dry conditions and moist condition. Moist conditions are created by spraying a known amount of water into pipe sections prior to FoamBag™ application.

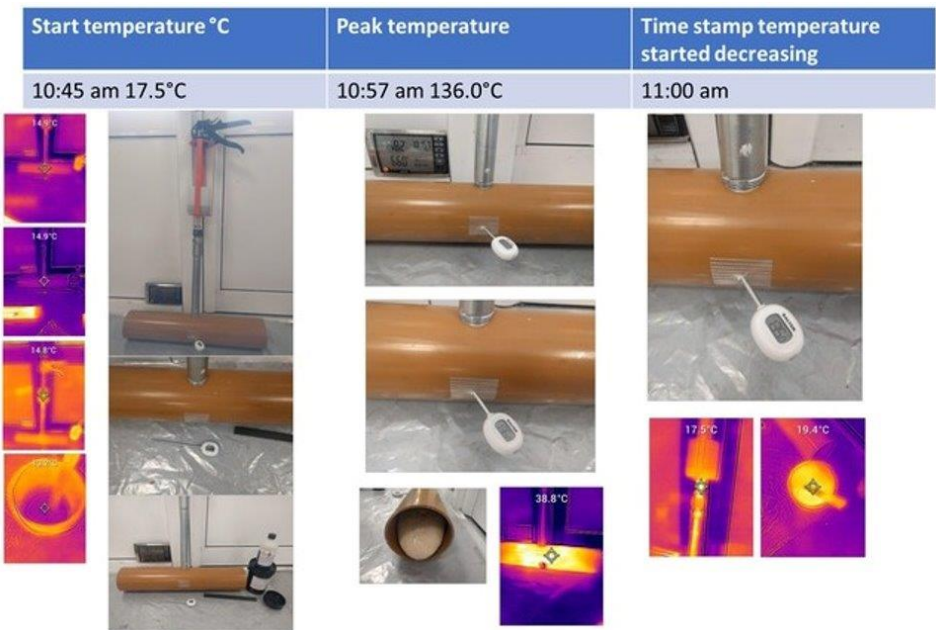


1 – Aluminum "Plunger"
2 – Pipe Foam Sample
3 – 3D printed (ABS) Bucket

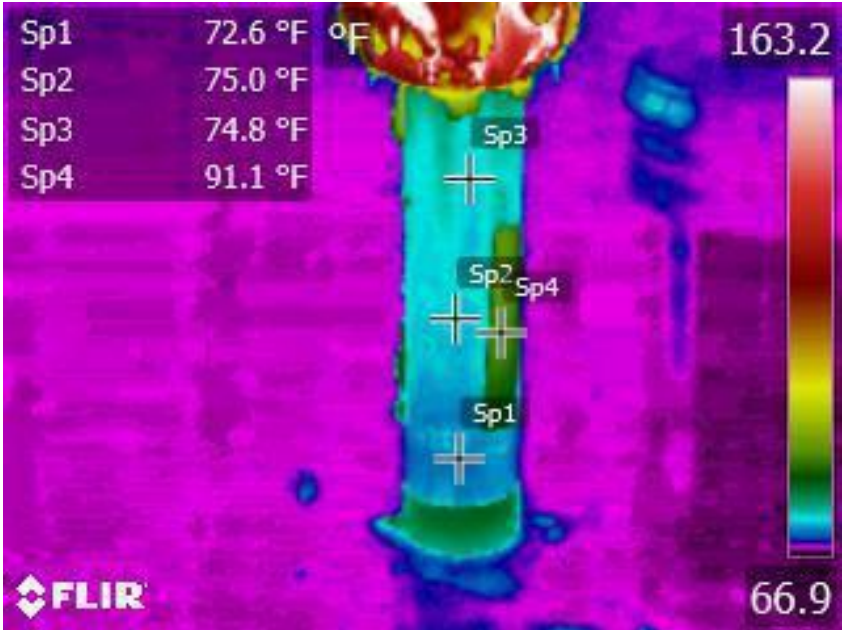


Objective 3: FoamBag™ – Curing Temperature Profile

Internal temp. profile



Max external temp. in Hastelloy C-22 pipe



External temperature is not a burning hazard.

Thermal Resistance

FoamBag Only



All samples continued to burn after the torch was removed and did not self-extinguish.

FoamBag w/ Additive



All samples w/ the additive self-extinguished.

Research Highlights & Accomplishments: Technology Comparison to Support Down-selection

	Curing Time	Max Curing Temp.	Average Plug Strength	Adhesion to Wetted Surface	Fire Retardant	Environmental Chamber	Headspace	Hot Tap Compatible
Hilti	1-3 mins	276°F	7733 lbf	888 lbf	YES	PASS	PASS	FAIL
FoamBag	15-45 mins	277°F	9684 lbf	4741 lbf	YES*	PASS	In progress (SRNL)	PASS

*Fire retardant with addition of Exolit AP 750 additive



FIU Year 4 Projected Scope

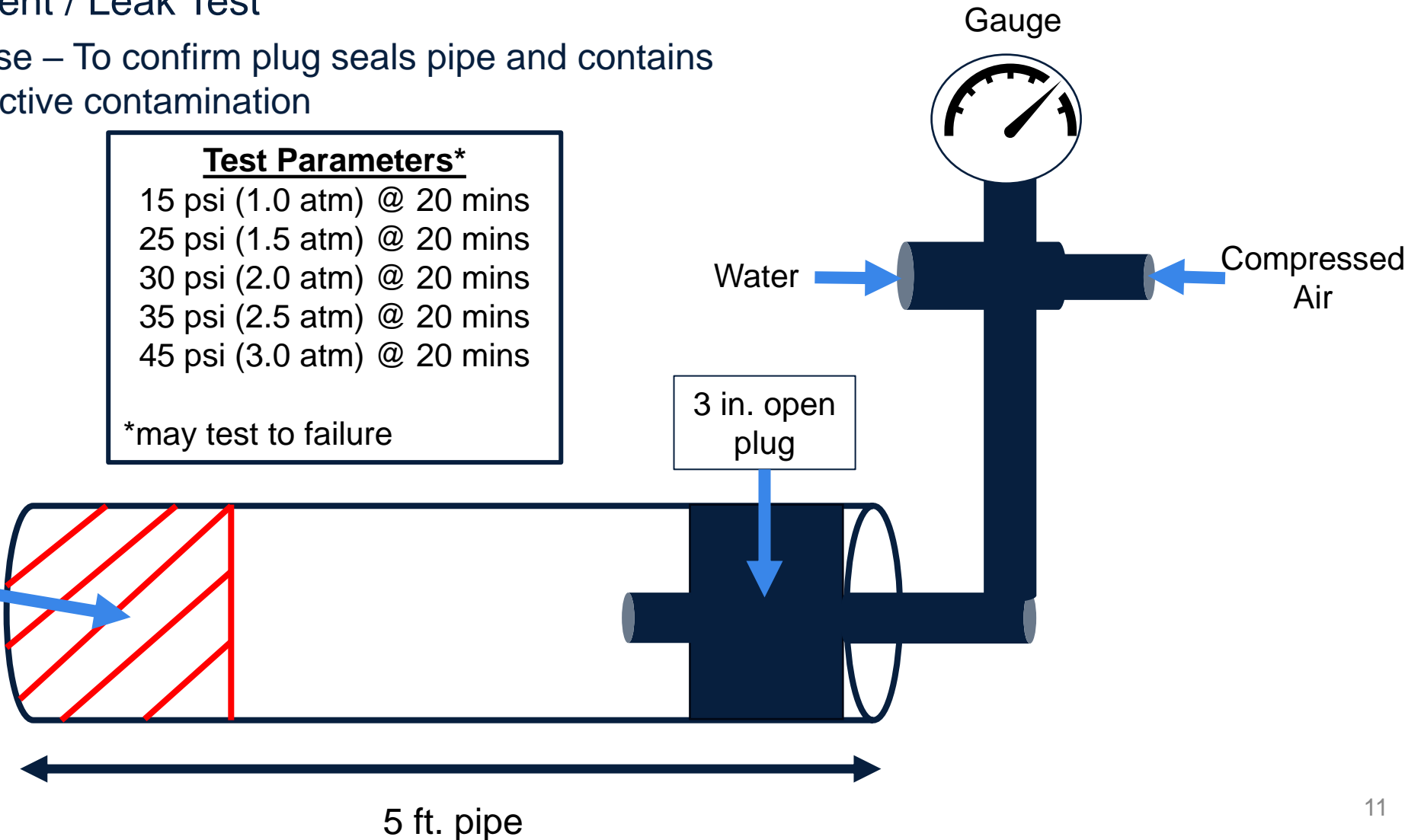
- Containment / Leak Test
 - Purpose – To confirm plug seals pipe and contains radioactive contamination

Test Parameters*

15 psi (1.0 atm) @ 20 mins
 25 psi (1.5 atm) @ 20 mins
 30 psi (2.0 atm) @ 20 mins
 35 psi (2.5 atm) @ 20 mins
 45 psi (3.0 atm) @ 20 mins

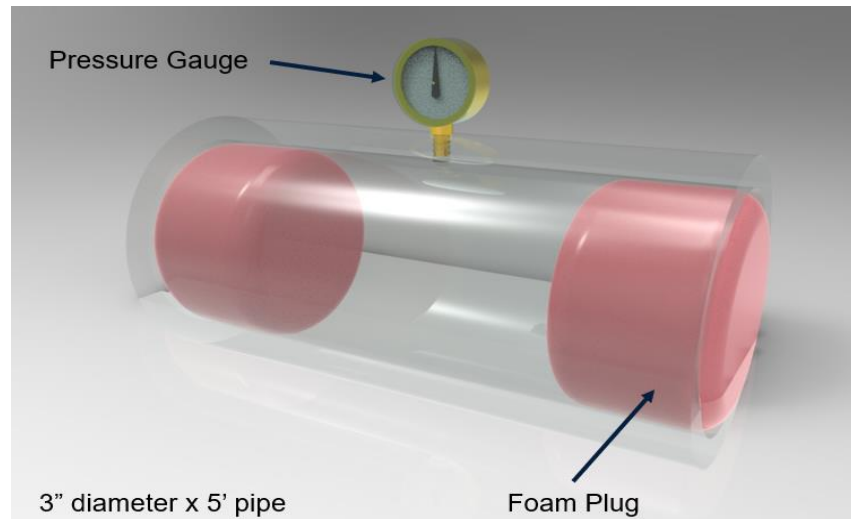
*may test to failure

FoamBag acts
as “closed plug”
in the system



FIU Year 4 Projected Scope

- Confirm Internal Pipe Pressure Conforms to SRS Manual under the following conditions:
 - During curing process (potential heat generation up to 277°F for 5 mins.)
 - During cutting process (heat generation from mechanical and/or torch cutting methods)



- SRS Manual 1S LLW WAC section 5.3 identifies the **maximum** amount of **allowable pressure** within a pressurized container to be **1.5 atm** (22 psi).
- Pressure will be monitored for 24 hours.



Acknowledgments

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- **Dr. Jennifer Wohlwend (Mentor at SRNL)**
- **Mr. Nicholas Espinal (DOE Fellow)**





Thank You. Questions?