FIU | Applied Research Center
FLORIDA INTERNATIONAL UNIVERSITY

U.S. DEPARTMENT OF ENERGY

HIGH LEVEL WASTE/WASTE PROCESSING

PROJECT: Pipeline Integrity Analysis. *Evaluation of Ultrasonic and Fiber-Optic Acoustic Sensor Systems for Pipeline Erosion, Corrosion, Leak and Anomaly Detection*

CLIENT: U.S. Department of Energy (U.S. DOE)
PRINCIPAL INVESTIGATOR: Dr. Leonel Lagos
TASK LEAD: Dr. Aparna Aravelli
LOCATIONS: Hanford Site, WA and SRS, SC

Description:

FIU's Applied Research Center (ARC) is supporting the U.S. Department of Energy's Hanford and Savannah River Sites for pipeline integrity analysis using ultrasonic transducers (UTs), SRNL's mass loss coupons and fiber-optic acoustic sensors for erosion, corrosion leaks and anomaly detection.

This task was developed to provide the sites with a means to evaluate the structural integrity of waste transfer pipeline components. This has involved the evaluation of potential sensor systems and the viability of utilizing them to provide real time data. The sensor systems provide thickness, mass loss and wear rate measurements of pipeline components and fittings found in jumper pits, evaporators, and valve boxes.

FIU-ARC engineers work closely with key WRPS personnel and SRNL scientists to evaluate various types of UT, fiber-optic and erosion coupon systems suitable for pipelines at Hanford, SRNL and other nuclear waste sites across the US.

Objectives

- Investigate and evaluate SRNL's erosion coupons coupled with UT sensors using in-house developed pipe loop systems.
- Test and validate the state-of-the art fiber-optic sensor systems for leaks and imperfections in pipe sections.

Benefits:

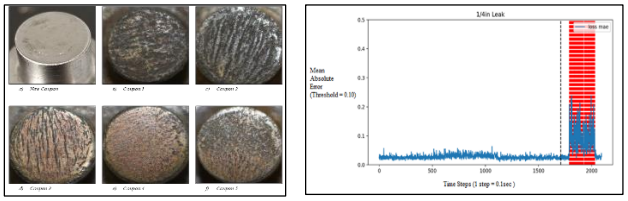
- Assist engineers to understand the failure potential of HLW transfer components due to erosion, corrosion and wear, predicting the existing system's remaining useful life and use in future designs.
- Erosion coupons aid in-situ measurements without interrupting the waste transfer process and fiber-optic sensors can be used for long-term automated anomaly detection and monitoring.

Accomplishments:

- Test and evaluation of the erosion coupons using UT sensors developed by SRNL scientists.
- Anomaly detection in pipes using fiber-optic sensors.

Erosion Coupon, Thickness measurement, Fiber-optic Sensors

Pipe Loops at FIU – Bench Scale and Engineering Scale



Surface Erosion and Anomaly (leak) detection

Bench and Engineering Scale Testing

- Pipe wear formation using abrasive (sand-water mixtures) and corrosive (chemical) simulants.
- The loops are manufactured with 2- and 3-inch pipe sections (straight and elbows) and include 5 UT sensor locations and 4 Cleveland Electric Laboratory (CEL) fiber-optic sensors.
- Initial test results indicate UT sensors can detect changes in thickness up to 0.01 mm, mass loss up to 0.001 gm and the acoustic sensors can detect leaks, strikes and imperfections caused by several events.

ABOUT

Since 1995, the Applied Research Center at Florida International University has provided critical support to the Department of Energy's Office of Environmental Management mission of accelerated risk reduction and cleanup of the environmental legacy of the nation's nuclear weapons program. ARC's research performed under the DOE-FIU Cooperative Agreement (Contract # DE-EM0005213) can be classified as fundamental/basic, proof of principle, prototyping and laboratory experimentation.

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