FIU | Applied Research Center
FLORIDA INTERNATIONAL UNIVERSITY

U.S. DEPARTMENT OF ENERGY

HIGH LEVEL WASTE/WASTE PROCESSING

PROJECT: Evaluation of Pipeline Flushing Requirements for HLW at Hanford and Savannah River

CLIENT: U.S. Department of Energy
LOCATION: Hanford Site, WA
PRINCIPAL INVESTIGATOR: Dr. Leonel Lagos

Description:

In U.S. Department of Energy (US DOE) complexes, pipelines that carry high-level radioactive waste must be properly flushed to prevent stationary or moving beds of solid sediment and address lines that are prone to hydrogen gas buildup. Guidelines exist that establish a minimum flush volume and velocity of water that is used for post-transfer flushing operations to achieve a satisfactory cleaning of pipelines. However, the Defense Nuclear Facilities Safety Board (DNFSB/TECH-40, 2016) has indicated the need for vigorous investigations on the technical basis for prescribing flush velocity and flush volumes in pipelines. Consequently, further studies are being investigated that will significantly assist the US DOE in waste remediation by optimizing the operational conditions and minimize the flush volume and consequent downstream waste, which will in turn assist these DOE waste remediation sites by preserving tank storage, preventing additional waste processing, and minimizing dilutions and changes to waste chemistry.

Objective:

To perform these investigations, an engineering scale pipe loop was developed and constructed at Florida International University (FIU) to study the flushing of non-Newtonian slurries. This facility was designed to create sediment beds of various materials and bed heights and investigate parameters that affect the efficiency of flushing operations. The objective is to determine flush-to-line volume ratios via repeatable sediment beds inside the pipeline in both fully-flooded and gravity-drained conditions in various pumping modes (rotational ramp and oscillatory sweep) which lead to satisfactory cleaning of transport lines with a minimum amount of water usage.

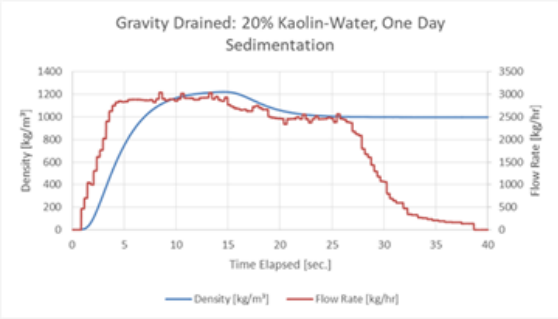
Benefits:

- Investigates the technical basis for prescribing flush velocity and flush volumes in pipelines.
- Minimizes the flush volume and consequent downstream waste.

Accomplishments:

- A 165-foot (50.3m) test loop composed of 3-inch schedule 40 carbon steel pipes and fittings was constructed. This experimental loop can perform various functions such as slurry circulation, pump cleaning, flushing, sediment and water retrieval, filtration, and post-flush circulation. The pipeline was sloped at the rate of 0.15% (3-inch height difference, 100 feet of pipe length) to emulate conditions at Hanford site and facilitate gravity draining.
- Tests were performed using two flushing methods, fully-flooded and gravity-drain conditions using various concentrations of kaolin as the simulant. Results indicate that approximately 1.5 lines of volume is needed to completely flush the pipeline with the described conditions.

Pipeline constructed for flushing experiments at FIU



Results for the 20% gravity drained condition

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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