PROJECT FACT SHEET

Advanced In-situ Instrumentation for HLW Tank Mixing and Retrieval

FIU's Applied Research Center is assisting the Department of Energy's Hanford site in monitoring the mixing of high level radioactive waste and WTP feed delivery consistency by evaluating promising in-tank technologies for slurry characterization.

As the DOE's Hanford site begins preparations for the transfer of high-level radioactive waste (HLW) from the double-shell tank s (DST) to the Waste Treatment and Immobilization Plant (WTP), the influence of waste feed consistency on the waste stabilization process – and final stabilized waste form - is currently under analysis. In order to characterize feed consistency prior to transfer, a suite of instrumentation will be required to monitor the waste preparation and mixing process in real time. FIU has focused its instrumentation efforts on identifying improvements to the in-situ, near-real time monitoring of the mixing process. Specifically, this project has identified innovative technologies applicable for in-tank monitoring of slurry rheological characteristics. Prior technology evaluation methods have identified in-situ ultrasonic techniques as viable approaches for monitoring of the mixed suspension characteristics, but the potential benefits of broadband analysis and spectroscopic techniques have not been considered. This project evaluated the use of an ultrasonic spectroscopy (USS) method in the characterization of high-level radioactive waste mixing within a +1M gallon tank. The method can provide material characteristics across a wide bandwidth, the bulk density of the mixed suspension, and has the potential to track changes during the mixing process. The evaluation consisted of testing a commercially-available variant in a matrix of suspensions; the technology was lowered into a mixing vessel for real-time sampling a various tank heights. The density results were compared to standard in-line commercial technologies utilized in the nuclear and process industry.

(a)

(b)

(a) Experimental setup utilized to evaluate candidate technologies. (b) USS probe submerged into $NaNO_3$ + Aluminum Hydroxide mixture during test trials

Project Objectives

The primary objective of the project was to identify possible technologies that could enhance current out-of-tank instrumentation through an in-situ, real-time monitoring of the mixing process. Additional objectives included: evaluation of possible candidate technologies through confirmatory testing; comparison of testing results to sampling and real-time monitoring collected by standardized techniques; and determination of path forward with promising candidate technologies for possible deployment at a DOE Weapons Complex Facility.

Project Benefits

Benefits of performing such a technology search and screening for this Site need are:

- Identify technology gaps and performance metrics
- Provide site engineers with a tool that will allow a measure of bulk density (i.e. mix consistency) as a function of tank waste depth during mixing.
- Provide site engineers with bulk density data in near real time, which will allow mixing process changes if necessary

Project Accomplishments

- 15 technologies identified were reduced to 4 possible candidates with deployability potential.
- Experimental setup that can be used for other candidate technologies was developed.
- USS was evaluated in two separate test trials to measure accuracy.
- USS showed applicability in monitoring bulk density of solution at specific frequencies, and showed spectral changes as a function of particle distribution of mixture.

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