Proposed Automated Data Analysis For Nuclear Waste Vitrification At SRS: A Case Study

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Extended Summary

The Savannah River Site (SRS), in operation since the early 1950's, produces plutonium and tritium for the Department of Defense. During these years of operation, about 70 million gallons of radioactive waste have been generated and stored on the site in waste storage tanks. The Defense Waste Processing Facility (DWPF), will immobilize this high-level radioactive waste by converting it into a stable borosilicate glass waste form suitable for long term storage in a geologic repository. This conversion is accomplished by batch processing of the waste, mixing it with a borosilicate glass forming frit, and feeding the resulting mixture to a joule heated melter which is used to produce the glass waste form. The DWPF melter fills two foot diameter, ten feed tall stainless steel canisters with the borosilicate glass.

After a canister is filled, the top is sealed by welding a 12.9 cm diameter plug into the canister nozzle using an upset resistance weld. During this weld a force of 330,000 newtons is applied to the plug and a current of 240,000 amperes is passed through the plug and canister nozzle. The oversized plug is forced into the canister nozzle, and a 1 cm thick, solid state weld, is made in 1.5 seconds. Weld quality is ensured by recording the important weld parameters (applied force and current over the duration of the weld, as well as dimensional information for the canister opening and canister plug) to judge the acceptability of a production weld. The exact means of determining weld acceptability was yet to be specified.

Initially the DWPF will be operated for just under 2 years using simulated (non-radioactive) feed materials. During this time a large amount of data will be generated with respect to the range of operating conditions under which the DWPF welder is expected to operate. The quality of the welds will be determined by destructive examination. In addition, defective welds will be made. A model could be developed based on this information, or set of weld "fingerprints", to predict the quality of the welds produced under actual or radioactive operations where destructive examination of welds is not possible.

One means which appears very attractive as a possible model or tool for assessing weld acceptability, is the use of neural networks in this context would be akin to pattern recognition. The neural network would be designed and "trained" using the data and information from non-radioactive operations to judge the acceptability of a given weld.