Dominion Engineering, Inc.

High Efficiency Ultrasonic Fuel Cleaning (HE-UFC™)

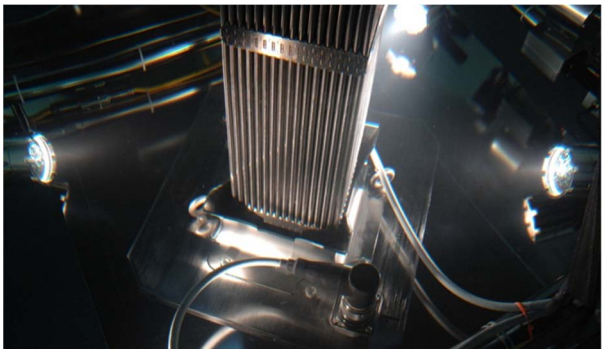
Background

HE-UFC™ is a safe and effective method for removing activated corrosion products ("crud") from nuclear fuel. This technique has been used at PWRs and BWRs to improve fuel performance and integrity, reduce source term and plant dose rates, reduce outage duration through optimized shutdown practices, and remove foreign objects (a common cause of costly fuel failures).

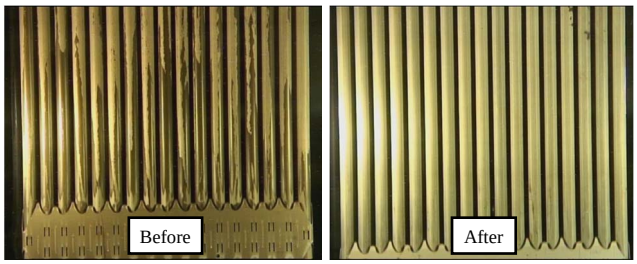
HE-UFC™ is synergistic with other activities that reduce radiation exposure to plant workers and may be performed in concert with zinc injection programs and chemical decontamination. HE-UFC may also be used for contamination control, for example by cleaning used fuel prior to transfer to dry storage casks, transport off-site (e.g., for reprocessing), or other maintenance activities.

Description

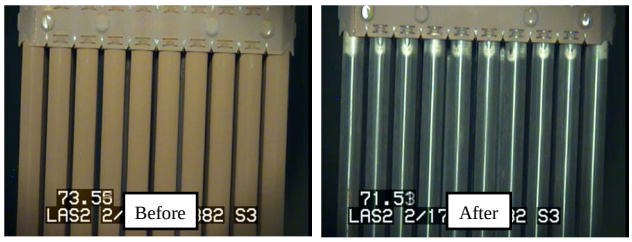
During HE-UFC™, fuel crud is disrupted using ultrasonic energy and collected in an integrated filtration system. The cleaning process is typically performed during refueling outages and has little or no impact on the critical path outage schedule. The cleaning process takes about 2-3 minutes per fuel bundle. The HE-UFC™ system can be supplied with optional components such as a 4-face camera system that facilitates simultaneous cleaning and inspection, and a crud sampling system for fuel crud and chemistry diagnostics.



HE-UFC™ cleaning operations



PWR HE-UFC™ cleaning results



BWR HE-UFC™ cleaning results

(BWR HE-UFC™ performed without dechanneling)

Benefits

- Reduced source term and plant dose rates
- Reduced outage time through optimized shutdown practices at PWRs (RCPs can be secured up to 24 hours earlier)
- Removal of foreign objects, reducing risk of costly fuel failures
- Enhances other dose reduction activities (Zn injection programs, chem decon, etc.)

Industry Experience

- >4,000,000 fuel rods cleaned at 45 units with no fuel integrity issues
- 10X decreases in PWR shutdown releases observed, shortening cleanup time required and reducing contamination of plant piping
- 10,000 Ci of crud activity + 0.7 lbs of Stellite foreign objects removed at LaSalle (equivalent to 170,000 Ci source of Co-60)
- Improved primary chemistry performance (reduced Co-58/Co-60 levels after HE-UFC)

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