Dominion Engineering, Inc.

Bottom Nozzle Debris Elimination (BNDE™) System

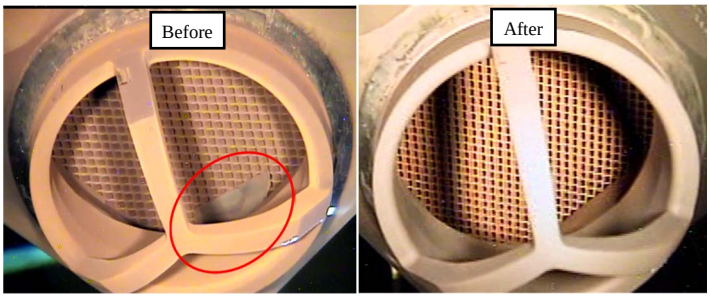
Background

Foreign material is a common cause of fuel failures, particularly at BWRs. Each fuel failure may cost a utility on the order of 10 MUSD due to plant downtime, increased regulatory scrutiny and related costs. Additionally, foreign material containing Stellite™ may become activated, and significantly elevate Co-60 levels in reactor water and increase plant dose rates.

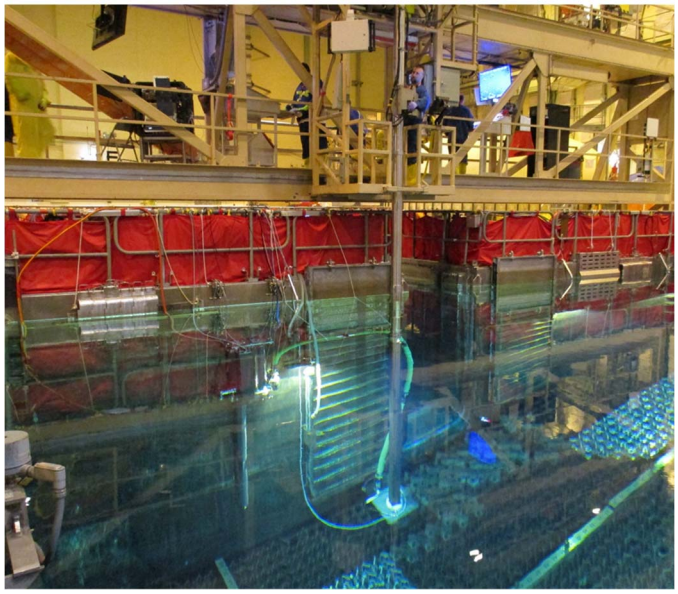
Foreign material typically becomes trapped on the underside of lower tie plates in fuel assembly bottom nozzles. This provides an opportunity to remove foreign material before it breaks into smaller fragments and migrates past the lower tie plate and into fuel bundles. However, removing foreign material can be labor intensive and time consuming, making it challenging and expensive to remove foreign material from large numbers of fuel assemblies.

Description

DEI's bottom nozzle debris elimination (BNDE™) system is designed for quick and efficient removal of foreign material from fuel assemblies, and simultaneous inspection to confirm foreign material removal. Similar to DEI's high efficiency ultrasonic fuel cleaner (HE-UFC™), the BNDE™ system uses a combination of ultrasonic energy and reverse flow to disrupt and capture foreign material. However, the BNDE™ cleans only the bottom nozzle, not the full length of the fuel rods.



Foreign object removal by BNDE™ system



BNDE™ system installation

Features and Benefits

- Uses a combination of ultrasonic energy and reverse flow
- Effectively removes foreign material from fuel assembly bottom nozzles
- Cleaning and inspection occurs in parallel
- Process takes ~3 minutes per fuel bundle, making it practical to remove foreign material from large numbers of reload fuel bundles during refueling outages

Industry Experience

- Proven to arrest fuel failures at units experiencing persistent debris-related fuel failures
- Up to several lbs of foreign material and >100,000 Ci of activated foreign material removed at a single unit

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