Via e-mail

April 17, 2006

Nuclear Regulatory Commission
Ganesh Cheruvenki
One White Flint North
Rockville, Maryland

Reference: March 3, 2006 e-mail request to Craig Harrington of Texas Utilities

Dear Ganesh:
We are pleased to be able to provide the information you requested in the reference e-mail to support the development of a NUREG on bottom mounted nozzles. The information provided below does not contain any proprietary information. We have restated your request and responded to each item below.

(1) The bottom mounted instrumentation--their purpose (just a brief description)

Terminology: Bottom Mounted Nozzle (BMN), Bottom Mounted Instrumentation (BMI) nozzle, Incore Monitoring Instrumentation (IMI) nozzle, are synonymous terms with regard to B&W and Westinghouse NSSS designs. Incore Instrument (ICI) nozzle is a term used in Combustion Engineering designed NSSSs, and for all but three CE units, the ICI nozzles penetrate the Reactor Vessel (RV) Closure Head instead of the RV Bottom Head.

The function of the BMN penetration is to provide primary system pressure boundary-qualified entrance into the reactor vessel for the incore instrumentation through the bottom head of the reactor vessel. Incore instrumentation is used to monitor performance of the reactor core during operation.

(2) The materials and fabrication methods that were used by B&W and Westinghouse.

There are a variety of design variations for the BMNs throughout the fleet. The following information provides general information about the materials and fabrication methods.

- BMNs are made from Alloy 600 SB-166 bar or SB-167 seamless pipe.
- BMNs are welded to the ID the RV bottom head using partial penetration J-groove welds. The J-groove welds are made using Alloys 82/182. Some J-groove welds were buttered, Post Weld Heat Treated (PWHT), then welded to completion without subsequent PWHT. Some J-groove welds were fully welded without butter and subsequently PWHT, depending on the particular unit and fabrication vendor.

- Some BMNs have austenitic stainless steel safe ends or piping reducers welded to the outboard end of the nozzle.
- Some BMNs have circular weld pads surrounding, but not connected to, the BMN on the OD of the RV bottom head. Such weld pads are made of either alloy steel, austenitic stainless steel, or Alloys 82/182.

(3) The reasons for unsuccessful UT on the B&W nozzles.

After the first phase of the Oconee Unit 1 (ONS-1) hot functional test in March 1972, an inspection of the RV internals revealed several components, including the BMNs had failed. A visual inspection of the RV lower head revealed 21 BMNs had broken off. Of the 21 broken BMNs, 18 of them failed within 0.125 inch of top of the J-groove weld and the remaining three failed at 0.5 inch above the J-groove weld. It was concluded that the root cause of the failure of the original BMNs at ONS-1 was fatigue caused by flow-induced vibration (FIV).

By the time of the ONS-1 HFT in March 1972, all BMNs had already been installed in the RV lower head of all seven currently operating B&WOG units. After the ONS-1 hot functional test, the BMN design was modified to strengthen the nozzle portion inside the reactor vessel. The portion of the original nozzles inside the RV were cut off above the J-groove weld, and replaced by a 2- inch O.D. Alloy 600 nozzle that was attached by a full penetration butt weld. Except for Davis- Besse, the modification was performed in the field without PWHT. The modification for Davis-Besse's BMNs was performed in the shop after the final RV PWHT.

The modification to the B&W-designed BMNs results in two nozzles joined end to end with two slightly different diameters and potentially a slight diametral offset. This results in a slight "step" on the nozzle ID which causes UT probe lift-off and signal loss when performing the TOFD UT technique. Current demonstration efforts at the EPRI NDE center have shown this "step" in the nozzle to be problematic for obtaining 100% UT coverage and to promote false-positive indications in the B&W BMNs. Industry efforts are currently underway to improve the UT technique for B&W BMN nozzles and with a focus to minimize the potential for false-positive indications.

Please contact me if you have any questions at 650-855-2605 or cking@epri.com.

Best Regards,

Christine King

Program Manager

EPRI Materials Reliability Program

cc: Melvin Arey, Duke Power; Craig Harrington, Texas Utilities; Dana Covill, Progress Energy; Greg Kammerdeiner, First Energy; David Steininger, EPRI; Ben Grambau, AREVA