

# Bulletin 2003-02, “Leakage from Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity”

August 19, 2003



## **SOUTH TEXAS FINDINGS**

- Identified boric acid deposits at two vessel lower head penetrations while performing bare metal visual examination
- Analysis of deposits for lithium identified reactor coolant as source
- Results of UT and ET examinations shows
  - Axial indications in leaking nozzles only
  - Indications confirm leak path
  - No evidence of wastage
- Root cause under investigation; projected to be completed in late September or October 2003

## **SOUTH TEXAS FINDINGS (continued)**

- Leaking nozzles have been repaired; repairs required NRC approval
- None of the available information suggests that STP Unit 1 is unique with regard to being susceptible to lower head penetration cracking

# BACKGROUND

- ASME Section XI requires visual examination of RCPB each refueling outage at normal operating pressure conditions for evidence of leakage; performed at startup
- ASME Section XI visual inspections of the RCPB, including the vessel lower head, are generally performed without removing insulation
- Inspections performed without removing insulation would not be effective at finding small amounts of through-wall leakage as would be expected from flaws due to PWSCC or other potential cracking mechanisms
- Visual inspections of the vessel lower head at South Texas were direct bare metal visual (BMV) inspections of the vessel surfaces

## TECHNICAL OBSERVATIONS

- EdF has performed volumetric and surface examinations at 12 units since 1992; no cracking has been discovered
- Some US licensees routinely perform direct visual exams of the lower head
- A number of additional direct visual exams performed during the Spring 2003 outages; no evidence of reactor coolant leakage
  - Not clear that each penetration visually inspected as discussed in bulletin
- MRP has recommended all PWRs with vessel lower head penetrations perform BMV exams of each penetration in their next outage
- Risk associated with failure in vessel lower head penetrations may be high

## REQUESTED INFORMATION IN BULLETIN

- RPV lower head penetration inspections performed to date and findings
- Description of inspection program during next and subsequent refueling outages
- If unable to perform BMV inspection of each penetration during next refueling outage, describe inspections able to perform and actions to be taken to permit inspection of each penetration during subsequent refueling outages
- If do not intend to perform either BMV or volumetric exam, provide basis for concluding requirements are and will continue to be met

## **BULLETIN (continued)**

- Within 30 days after plant restart following next lower head inspection, summary of the inspections performed, conditions found, and any actions taken
- Provide response within 30 days if entering refueling outage before end of 2003
- All other addressees, provide response within 90 days

## REASONS FOR REQUESTED INFORMATION

- Information requested necessary to permit NRC staff to verify compliance with regulatory requirements and plant- specific licensing bases
- Information will also permit NRC staff to assess condition of vessel lower head penetrations, identify conditions that may need additional inspections or other actions, and to determine need for additional regulatory actions.

## OTHER CONSIDERATIONS

- Bulletin requests information on process used to resolve source of findings of boric acid deposits or corrosion
  - Process should be based on sound engineering arguments relying only on verified assumptions
  - Conclusive chemical analysis results may be necessary in some cases
  - Industry guidance may be appropriate
- Temporary Instruction to be issued for use by NRC Regional Inspectors

# LONGER TERM IMPLICATIONS

- Age of deposits at South Texas between 3 and 5 years
  - Bulletin requests information on next and subsequent inspections
  - One time inspections not likely to resolve uncertainties
- To determine need for non-visual inspections
  - Will need to understand generic implications of South Texas 1 root cause
  - Will need results of ongoing lower head penetration inspections

## **LONGER TERM IMPLICATIONS (continued)**

- NRC staff considering need for additional regulatory actions to address cracking and leakage of RCPB materials, e.g., a performance based rule

## Specific Information Requests

- a) A description of the RPV lower head penetration inspection program that has been implemented at your plant. The description should include when the inspections were performed, the extent of the inspections with respect to the areas and penetrations inspected, inspection methods used, the process used to resolve the source of findings of any boric acid deposits, the quality of the documentation of the inspections (e.g., written report, video record, photographs), and the basis for concluding that your plant satisfies applicable regulatory requirements related to the integrity of the RPV lower head penetrations.

## Specific Information Requests (continued)

- b) A description of the RPV lower head penetration inspection program that will be implemented at your plant during the next and subsequent refueling outages. The description should include the extent of the inspections which will be conducted with respect to the areas and penetrations to be inspected, inspection methods to be used, qualification standards for the inspection methods, the process used to resolve the source of findings of boric acid deposits or corrosion, the inspection documentation to be generated, and the basis for concluding that your plant will satisfy applicable regulatory requirements related to the structural and leakage integrity of the RPV lower head penetrations.

## Specific Information Requests (continued)

- c) If you are unable to perform a bare-metal visual inspection of each penetration during the next refueling outage because of the inability to perform the necessary planning, engineering, procurement of materials, and implementation, are you planning to perform bare-metal visual inspections during subsequent refueling outages? If so, provide a description of the actions that are planned to enable a bare-metal visual inspection of each penetration during subsequent refueling outages. Also, provide a description of any penetration inspections you plan to perform during the next refueling outage. The description should address the applicable items in paragraph (b)

## Specific Information Requests (continued)

- d) If you do not plan to perform either a bare-metal visual inspection or non-visual (e.g., volumetric or surface) examination of the RPV lower head penetrations at the next or subsequent refueling outages, provide the basis for concluding that the inspections performed will assure applicable regulatory requirements are and will continue to be met.

## **Specific Information Requests (continued)**

Within 30 days of plant restart following the next inspection of the RPV lower head penetrations, the subject PWR addressees should submit to the NRC a summary of the inspections performed, the extent of the inspections, the methods used, a description of the as-found condition of the lower head, any findings of relevant indications of through-wall leakage, and a summary of the disposition of any findings of boric acid deposits and any corrective actions taken as a result of indications found.

# Required Response

Addresses Required to Respond:

All holders of operating licenses for pressurized-water nuclear power reactors (PWRs) with penetrations in the lower head of the reactor pressure vessel (RPV), except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor pressure vessel.

## Required Response (continued)

- addressees may choose to submit written responses providing the information requested above within the requested time periods, or
- addressees who choose not to provide the information requested or cannot meet the requested completion dates are required to submit written responses within 15 days of the date of this bulletin. The responses must address any alternative course of action proposed, including the basis for the acceptability of the proposed alternative course of action.