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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

October 14, 1982

IE BULLETIN NO. 82-03: STRESS CORROSION CRACKING IN THICK-WALL, LARGE-DIAMETER, STAINLESS STEEL, RECIRCULATION SYSTEM PIPING AT BWR PLANTS

Addressees:

Those licensees of operating boiling water reactors (BWRs) identified in Table 1 for action. All other licensees and holders of construction permits (CPs) for information only.

Purpose:

This bulletin is to notify all licensees and CP holders about a matter that may have a high degree of safety significance, and to require specific actions as set forth below for those licensees listed in Table 1. Specifically, this matter involves the degradation in the recirculation system piping in the reactor coolant pressure boundary (RCPB) that was found at the Nine Mile Point Unit 1 Nuclear Generating Station. This information was described in considerable detail in Information Notice 82-39, dated September 21, 1982. Action by the affected licensees identified in Table 1 is required to (1) provide a reasonable level of assurance that inspections which are currently being performed or scheduled are sufficient to detect cracking in BWR thick-wall recirculation piping welds and (2) to assist the NRC in determining the generic significance of the piping degradation found at Nine Mile Point. The affected licensees are those owners whose plants are currently in or scheduled to be in a refueling mode or extended outage through January 31, 1983.

This bulletin is provided to all other licensees and holders of construction permits for information only at this time. Licensees not listed in Table 1 will be notified by January 15, 1983 as to the scope and extent of any required actions.

Description of Circumstances:

During a primary system hydrotest in March 1982 at Nine Mile Point Unit 1 (NMP-1), leakage was visually detected at two of the ten furnace-sensitized, recirculation system safe-ends. Further visual inspection revealed three pinhole indications and a single ½-inch-long axial indication, all of which were located in the heat-affected zone of the welds where the safe-end joined the pipe. About nine months before the leak, these safe-ends were ultrasonically (UT) inspected; at that time, the inspection did not disclose any reportable indications. Subsequent to the leak, the UT procedure was modified; UT

Table 1

Plants Currently in or Scheduled to be in
a Refueling Mode or Extended Outage Through January 31, 1983

LICENSEE	PLANT(S)
Northern States Power Company	Monticello Nuclear Generating Station
Tennessee Valley Authority	Browns Ferry Unit 2 Nuclear Generating Station
Commonwealth Edison Company	Quad Cities Unit 1 Nuclear Generating Station Dresden Unit 2 Nuclear Generating Station
Northeast Utilities	Millstone Unit 1 Nuclear Generating Station
Georgia Power Company	Hatch Unit 1 Nuclear Generating Station
Carolina Power & Light Company	Brunswick Unit 1 Nuclear Generating Station*
Jersey Central Power & Light Company	Oyster Creek Nuclear Generating Station
Iowa Electric Light & Power Company	Duane Arnold Nuclear Generating Station

*To be performed during the November 1982 refueling outage, not the current outage.

examination of the two affected safe-ends and one other safe-end confirmed the presence of indications of intermittent cracking around the pipe's inside diameter (ID). Additional examinations revealed cracking in heat affected zones of recirculation pump discharge welds. Dye penetrant examination confirmed these crack indications. The UT examinations were extended to other welds in the five loops of the recirculation system. The results of these examinations disclosed ID cracking in a large number of the welds examined.

Two boat samples removed from the area of the through-wall cracks in one safe-end were sent for evaluation -- one to General Electric Co. and the other to Battelle Laboratories. In addition, a boat sample from the crack region of the elbow weld was evaluated by Sylvester Associates, consultants to the licensee. The results of these metallurgical evaluations concluded that the degradation resulted from intergranular stress corrosion cracking (IGSCC) in the sensitized region of the weld's heat affected zones.

Based on the fact that NMP-1 has furnace-sensitized safe-ends, the licensee decided to replace all 10 recirculation system safe-ends without further investigation beyond that described above. Based on recirculation system findings, the licensee decided to also replace all recirculation system piping while the facility was shut down for safe-end replacement.

On September 16, 1982, a meeting was held between General Electric, BWR licensees, and NRC staff to review past IGSCC experiences and the general implications of NMP-1 IGSCC degradation in main recirculation piping welds. The staff had the benefit of the metallurgical evaluation of the NMP-1 event and an update of the general IGSCC experiences relative to all operating BWR plants.

On September 27, 1982, a meeting was held between BWR licensees and the NRC staff to discuss the extent and results of examining welds in the recirculation system for all BWR licensees with plants currently in or scheduled to be in a refueling mode or extended outage through January 31, 1983. As a result of this meeting, the NRC staff has determined that additional information is needed to assess the effectiveness of the UT methods employed or planned to be used and to determine whether such piping should be designated "service-sensitive" in accordance with NUREG-0313, Rev. 1, issued by NRC letter dated February 26, 1981.

To provide a reasonable level of assurance that inspections which are currently being performed or scheduled are sufficient to detect cracking in thick-wall, recirculation system piping welds and to assist the NRC in further evaluating this issue, the affected licensees (identified in Table 1) are requested to take the following actions.

<u>Actions to be Taken by Licensees of BWR Facilities Identified in Table 1</u>:

1. Before resuming power operations following the current refueling or extended outage, the licensee is to demonstrate the effectiveness of

the detection capability of the ultrasonic methodology used or planned to be used to examine welds in recirculation system piping. This demonstration shall be made on representative service-induced cracked pipe samples. Arrangements should be made to allow NRC to witness this demonstration. This demonstration shall employ those procedures and standards, the same type of equipment (same transducer size, frequencies and calibration-standards), and representative UT personnel from the inservice inspection (ISI) organization utilized or to be utilized in the examinations at the plant site.*

2. Before resuming power operations following the current refueling or extended outage, the licensee is to provide a listing of results of recirculation system piping inspections.

3. Before resuming power operations following the current refueling or extended outage, the licensee (if the inspections indicate the presence of cracks) is to describe the corrective actions taken and report these in accordance with the appropriate regulations.

4. To assist NRC's further evaluation of this issue, the following shall be submitted by December 1, 1982:

   a. A description of the sampling plan used or to be used during this outage for UT examinations of recirculation system piping welds and the bases for the plan. The description should:

      (1) Provide an isometric drawing of the recirculation system piping showing all the welds, and the number of welds and their location that have been examined or will be examined.

      (2) Identify criteria for weld sample selection (e.g., stress rule index, carbon content, high stress location, and their values for each weld examined).

      (3) Describe piping material(s), including material type, diameter, and wall thickness.

      (4) Estimate the occupational radiation exposure incurred or expected and briefly summarize measures taken to maintain individual and collective exposures as low as reasonably achievable.

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*We understand that Electric Power Research Institute (EPRI) has arranged to have samples from the Nine Mile Point Unit 1 plant available for industry demonstrations of UT methodology. The samples have been taken to Battelle Memorial Institute in Columbus, Ohio for characterization and subsequent use.

b. A summary description of the UT procedures and calibration standards used or to be employed in the examination at the licensee's plant site. This description should include the scanning sensitivity, the evaluation sensitivity and the recording criteria.

c. A summary of the results of any previous inspection of the recirculation system piping welds which used the validated examination methodology as discussed in Action Item 1 above.

d. An evaluation of the crack-detection capability of ultrasonic methodology used or planned to be used to examine recirculation system piping welds. This evaluation should result from conducting the demonstration required in Action Item 1 above, and should include a comparison of the service-induced pipe crack sample to those welds actually examined in the licensee's plant in terms of pipe wall thickness and diameter, weld geometry, and materials.

5. The written reports required by Items 2, 3, and 4 shall be submitted to the appropriate Regional Administrator under oath or affirmation under provisions of Section 182a, Atomic Energy Act of 1954, as amended. The original copy of the cover letters and a copy of the reports shall be transmitted to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, D.C. 20555 for reproduction and distribution.

This request for information does not require Office of Management and Budget approval since the number of plants asked to provide the information is limited to nine reactor plants.

Although no specific request or requirement is intended, the following information would help the NRC evaluate the cost of implementing this bulletin:

- Staff time to perform requested demonstration
- Staff time to prepare written responses

If you have any questions regarding this matter, please contact the Regional Administrator of the NRC Regional Office or one of the technical contacts listed below.

Richard C. DeYoung, Director
Office of Inspection and Enforcement

Technical Contact: William J. Collins, IE
492-7275

Warren Hazelton, NRR
492-8075

Attachment
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October 14, 1982

LIST OF RECENTLY ISSUED IE BULLETINS

Bulletin No.	Subject	Date of Issue	Issued to
82-01 Rev 1, Supp 1	Alteration of Radiographs of Welds in Piping Subassemblies	08/18/82	All power reactor facilities with an OL or CP
82-02	Degradation of Threaded Fasteners in the Reactor Coolant Pressure Boundary of PWR plants	06/02/82	All PWR facilities with an OL for action and all other OLs or CPs for information
82-01 Rev. 1	Alteration of Radiographs of Welds in Piping Subassemblies	05/07/82	All power reactor facilities with an OL or CP
82-01	Alteration of Radiographs of Welds in Piping Subassemblies	03/31/82	The Table 1 facilities for action and to all others for information
81-02 Supplement 1	Failure of Gate Type Valves to Close against Differential Pressure	08/18/81	All power reactor facilities with an OL or CP
81-03	Flow Blockage of Cooling Water To Safety System Components by CORBICULA SP. (ASIATIC CLAM) and MYTILUS SP. (MUSSEL)	04/10/81	All power reactor facilities with an OL or CP
81-02	Failure of Gate Type Valves to Close Against Differential Pressure	04/09/81	All power reactor facilities with an OL or CP
81-01 Rev. 1	Surveillance of Mechanical Snubbers	03/04/81	Specific power reactor facilities with a CP
80-17 Supp. 5	Failure of Control Rods to Insert During a Scram at a BWR	02/13/81	To all specified BWRs with an OL & All BWRs with a CP

OL = Operating License
CP = Construction Permit