E2-7 (13)

NMC
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Nuclear Management Company, LLC

May 23, 2004

Enforcement/Investigations Officer
U.S. Nuclear Regulatory Commission
Region III
2443 Warrenville Road
Lisle, IL 60532-4352

Point Beach Nuclear Plant, Units 1 and 2
Dockets 50-266 and 50-301
License Nos. DPR-24 and DPR-27

Response to Request for Information 04-A-0067

On May 21, 2004, a request for information was forwarded to Nuclear Management Company, LLC (NMC). The request relates to information received by the Nuclear Regulatory Commission (NRC) regarding a concern at the Point Beach Nuclear Plant (PBNP) associated with ultrasonic testing (UT) examinations of the PBNP Unit 1 reactor vessel head.

NMC's response is enclosed. If you have questions or require additional information regarding this response, please contact Mr. Aldo Capristo, NMC Fleet Employee Concerns Manager, at 920/755-7633. Supporting records for this request for information are available for review at PBNP.

This letter contains no new commitments and no revisions to existing commitments.

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Enclosure

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ENCLOSURE 1

Response To NRC Request For Information
Tracking Number 04-A-0067

Background

In a letter dated May 21, 2004, the Nuclear Regulatory Commission (NRC) notified Nuclear Management Company, LLC (NMC) of a concern at the Point Beach Nuclear Plant (PBNP) associated with ultrasonic testing (UT) examinations of the PBNP Unit 1 reactor vessel head.

The NRC letter dated May 21, 2004, requested that the documented results of NMC's investigation include sufficient information for the NRC to determine: (a) If the concerns were substantiated; (b) that the evaluation was of sufficient depth and scope to determine that the appropriate root cause and generic implications were considered; (c) that the corrective actions, both planned and completed, were sufficient to correct the specific example(s) and generic implications and to prevent recurrence; and (d) if the evaluation identified any deficiencies with a license condition, the corrective actions taken and planned to address the deficiencies.

The investigation scope included a review of prior corrective action program documents associated with the issue. The results of that review are summarized in the evaluation below. The PBNP Employee Concerns Program (ECP) Manager coordinated this review. The PBNP ECP Manager reports to the NMC ECP Manager and is independent of Engineering, the work group involved in the determination of appropriate repair activities.

Concern from Tracking Number 04-A-0067:

"An individual is concerned that the UT examination was not capable of finding the damage discovered within the penetration 26 "J" groove weld, and that primary water stress corrosion cracking (PWSCC) damage probably exists in other penetration "J" groove welds in the Unit 1 reactor pressure vessel head. The individual believes that the licensee will not pursue the PT examinations of other "J" groove weld(s) in view of the potential for finding additional evidence of PWSCC damage.

The individual stated that 'UT' examinations revealed an anomaly in the root of the Penetration 26 "J" groove weld. The anomaly was believed to be manufacturing related. The presence of the indication lead (sic) to the performance of a surface PT examination of the penetration 26 "J" groove weld. The PT examination revealed numerous crack-like surface indications. Follow up grinding and re-examination revealed that the indications had depth and deemed to be not acceptable for continued operation."

Evaluation:

During the spring 2004 PBNP Unit 1 refueling outage (U1R28), non-destructive examinations (NDE) were performed on the Unit 1 reactor pressure vessel (RPV) head as required by NRC Order "Issuance of First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors", dated February 20, 2004. During the performance of these ultrasonic test (UT) examinations, possible flaw indications were observed on Penetration 26.

The UT inspections were performed by a contractor utilizing one of the two methods specified in Order EA-03-09 for the examination of the Alloy 600 CRDM tubing and "J" groove welds. The examination included UT of the tubing, UT of the counterbore region for corrosion products, and above-head visual examinations. NMC performed the above-head visual inspections. A contractor performed the UT examinations. The UT that was performed for control rod drive mechanism (CRDM) Penetration 26 disclosed an indication in the "J" groove weld area that extended into the CRDM tube base material on the downhill side of the penetration. The indication was initially determined to be a crack by the UT analyst. Corrective action program document CAP 056265 was initiated on April 30, 2004, to document the discovery of this anomaly.

Research on the potential flaw disclosed that the indication was likely fabrication related, and not a result of PWSCC. This conclusion was based upon a review of the fabrication records for the reactor pressure vessel, which was manufactured by Babcock & Wilcox (B&W) under contract to Westinghouse Electric Corporation, the nuclear steam supply system (NSSS) vendor. Official fabrication records for the Unit 1 RPV do not fully document repairs performed on Nozzle 26; however, weld sizing records from 1969 indicate the likelihood that a repair was performed on that nozzle, as documented in a September 1969 report entitled, "Field Repair of Unit 1 Reactor Vessel Closure Head." The RPV was fabricated in accordance with ASME Boiler & Pressure Vessel (B&PV) Code Section III.

A comparison of UT data from U1R28 and U1R27 was performed. The comparison determined that the indication (reflector) was recorded during U1R27. During U1R27, however, scanning was only performed using an axial blade probe. The U1R28 inspection scan used both axial and circumferential blade probes. Evaluation of the indications also determined that the indication did not possess the characteristics indicative of PWSCC and that there was no change in the nature and size of the UT indications between U1R27 and U1R28. Non-growth of an indication is expected and is consistent with fabrication-type indications.

In response to this indication, the decision was made to perform a follow-up dye penetrant test (PT) examination of the "J" groove material to confirm whether PWSCC cracking was occurring in Penetration 26. The PT examinations disclosed that minor surface indications were present that required further evaluation. Two areas containing these indications were identified. The first of these areas was approximately 1-1/2" in length by 5/8" in width. The second area was approximately 2-1/2" in length by 5/8" in

width. Each area was comprised of several small linear indications of various lengths. These indications were on opposite sides of the Nozzle 26 penetration approximately 90 degrees from the downhill side. The orientation of the short cracks was transverse to the weld beads. Four separate PT examinations were performed; two of which involved removal of weld metal in an attempt to clear the indications.

The results of these examinations revealed that the initial PT indications were extremely faint. The surface indications of the "J" groove weld at the time of the initial PT examination were partially ground. Mechanical surface conditioning of the examination area was not performed prior to conduct of this examination. The second PT was performed following minor mechanical cleaning and showed a slight increase in coloration. The third PT was performed after grinding approximately 1/16" and produced results consistent with that from the second PT. A fourth PT was performed following additional grinding and produced results similar to the previous PTs.

The location of surface cracking was adjacent to the large UT signature and hypothesized field repair region. The orientation of the short cracks was transverse to the weld beads. Finally, the extent of the cracking was determined to be minor.

At the time the Unit 1 RPV was fabricated, construction practices did not include PT between each weld pass of a "J" groove weld. A PT was performed on the root weld and there was additional PT at various depths through the weld pass, with PT of the final weld. The construction code applicable at the time of the repairs allowed different size indications to remain in the weld without repair. It is believed that the stresses associated with the repair of the "J" groove weld on Penetration 26 aggravated prior existing fabrication-related metallurgical defects commonly observed in Alloy 82 and 182 welds, creating minor surface cracking that was observed during confirmatory PT examinations.

The nondestructive examinations performed on Penetration 26 indicate that the tubing, counterbore region and RPV head area are free of defects, wastage and boric acid deposition.

An extent of condition evaluation was conducted. This evaluation concluded that the tubing, counterbore region and other areas on the RPV head are free of defects, wastage and boric acid deposition and thus, the structural integrity and leak integrity of the RPV head is assured. This conclusion was arrived at based upon the following considerations:

1. A review of ultrasonic signatures obtained during the U1R27 and U1R28 under-head inspections. The specific details associated with this review are included as Enclosure 2.

2. Review of available fabrication records to ascertain if other penetrations may have been repaired during original fabrication.

3. Inspection of the Alloy 600 control rod drive mechanism (CRDM) tubing, counterbore region and RPV head in accordance with NRC Order EA-03-09.

4. Probabilistic fracture mechanics analyses were performed by SIA and documented in report MRP-105, "Probablistic Fracture Mechanics of PWR Reactor Pressure Vessel Top Head Nozzle Cracking," dated March 2004. The model used was submitted to the NRC via NMC letter dated March 30, 2004. The report is benchmarked on data acquired from 30 plants that have performed nondestructive examinations of RPV nozzles, of which 14 plants have experienced leaks or cracks. The results of this work indicate that the probability of leakage over the next operating cycle at PBNP Unit 1 was less than 1.5%.

   The above probability of leakage figure over the next operating cycle is less than the 5% that is consistent with other regulatory positions on this issue, such as the NRC to NEI letter dated December 9, 2003, that addressed SAI report MRP-75, "PWR Reactor Pressure Vessel Upper Head Penetrations Inspection Plan, Revision 1."

5. The leakage integrity of the reactor coolant system boundary was verified by visual examination of the top of the reactor pressure vessel head. There was no evidence of defects, wastage or boric acid crystal deposition on the top of the RPV head. Leakage integrity was further verified by the absence of axial and circumferential flaws in the Alloy 600 tubing, as well as the absence of corrosion products in the counterbore region adjacent to the Alloy 600 tubing above the "J" groove weld.

There was no technically sound reason to expand the use of PT to additional penetrations unless the initial UT examination revealed the existence of an indication potentially requiring repair. The PT examination is utilized for confirmation purposes only and is not specified in either NRC Order EA-03-09 nor the currently applicable edition of ASME Section XI. The PT exams must be performed manually, and personnel radiation exposure for such an exam are approximately 100 mR. Additionally, since 100% examinations are being conducted during each refueling outage prior to replacement of the RPV heads, the extent of condition is known.

NMC is conforming to NRC Order EA-03-09 in the management of PWSCC at PBNP by performing essentially a 100% UT inspection to verify that PWSCC has not occurred until replacement of the reactor pressure vessel heads in both of the PBNP units. The Unit 1 reactor vessel pressure head replacement is scheduled during the fall of 2005; and the Unit 2 reactor pressure vessel head is scheduled to be replaced during the spring of 2005.

The Penetration 26 "J" groove weld repair was performed on May 12-22, 2004, in accordance with Work Order 0213476 under modification request MR 03-041. This work was performed in accordance with approved plant procedures and work documents. Final acceptance of the weld is pending performance of the reactor coolant system pressure test that will be conducted when Unit 1 is being returned to service.

Conclusions

The concerned individual (CI) raised an issue that the UT examination was not capable of finding the damage discovered within the penetration 26 "J" groove weld. This element of the concern is **NOT SUBSTANTIATED.** The UT examination did identify an indication, which was subsequently examined in greater detail utilizing PT. These examinations subsequently resulted in repair of the affected penetration weld.

The CI raised an issue that primary water stress corrosion cracking (PWSCC) damage probably exists in other penetration "J" groove welds in the Unit 1 reactor pressure vessel head. The results of both the UT inspections and visual inspections have not revealed the presence of PWSCC in the Unit 1 reactor pressure vessel head. These quantitative measures lead NMC to conclude based on technically sound bases that PWSCC probably does NOT exist in other penetrations and therefore, this element of the concern is **NOT SUBSTANTIATED.**

The CI believes that the licensee will not pursue the PT examinations of other "J" groove welds in view of the potential for finding additional evidence of PWSCC damage. This concern is **NOT SUBSTANTIATED.** PT was performed for this penetration only to be used as a confirmatory examination to aid in the characterization of the nature and significance of the UT signature. Additional PT examinations were further not warranted, as there were no other UT indications of sufficient magnitude to require confirmatory examination using PT, nor is there any NRC or ASME Section XI Code requirement to perform duplicative examinations.

The statements made by the CI in Paragraph 2 of the concern details are **SUBSTANTIATED** as statements of fact on the record, were previously known to NMC, and were acted upon during the course of NMC's evaluation of the test data. UT examinations revealed an anomaly in the root of the Penetration 26 "J" groove weld. The anomaly was believed to be manufacturing related based upon a review of the field repair records. The presence of the indication led to the performance of a surface PT examination of the penetration 26 "J" groove weld as a confirmatory. The PT examination revealed numerous crack-like surface indications. Follow up grinding and re-examination revealed that the indications had depth and were determined to be not acceptable for continued operation. The decision was made by NMC to repair the Penetration 26 "J" groove weld for the final operating cycle of PBNP Unit 1 prior to its scheduled refueling outage and reactor pressure vessel head replacement in 2005. The affected weld was repaired in accordance with approved plant documents and procedures.

ENCLOSURE 2

Extent Of Condition Evaluation Regarding Examination Of Alloy 600 Tubing & J-Groove Welds At PBNP U1R28 (Penetrations With Fabrication Related UT Signals)

Pen #	1969 NSSS Vendor Report	U1R28 Data	Ring Location	Comment/Extent of UT Reflector	Priority By Qualitative Ranking
37		X	9	350-359° @ interface Geometrical Reflector	2
36		X	9	14-22°, 11% TW tube Geometrical Reflector	2
9		X	2	143° spot @interface Geometrical Reflector	2
49		X	4	6-55° @ interface Geometrical Reflector	2
6		X	2	214-228°, 11% TW tube Geometrical Reflector	2
43		X	4	3-20°, 3% TW 83-91°, 20% TW Geometrical Reflector	2
29		X	8	17-50°, 10% TW Geometrical Reflector	2
26		X	8	88-96°, 7% TW 134-181°, 19% TW Crack like Morphology	1
25		X	7	117-137°, @ interface 151-175°, @ interface Geometrical Reflector	2
1		X	0	58° spot, 12 % TW Geometrical Reflector	2
4		X	3	82° spot, 7% TW Geometrical Reflector	2
11		X	5	355° spot, 8% TW Geometrical Reflector	2
4	X		3	UT @ DH 12-14 inches, UT @ UH 22-24 inches	2
3	X		3	UT@ UH 16-18 inches	2
40	X		1	UT@ DH 10-14 inches	2
39	X		1	UT@ DH 4-12 inches	2
26	X		8	UT@ DH 14-17 inches	3
27	X		8	UT@ UP 3-5 inches Noted as a weld repair during construction	3

- UT reflector for penetration #26 possessed crack-like morphology. Follow-up dye penetrant inspection (using a separate method to confirm presents of flaw)
- UT reflector characteristic of geometry but not crack-like in morphology
- Construction records provide evidence that a repair may have been performed during fabrication