NMC
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Point Beach Nuclear Plant
Operated by Nuclear Management Company, LLC

January 25, 2005

NRC 2005-0008
10 CFR 54

U.S. Nuclear Regulatory Commission
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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 Additional Information
Regarding the Point Beach Nuclear Plant License Renewal Application
(TAC Nos. MC2099 and MC2100)

By letter dated February 25, 2004, Nuclear Management Company, LLC (NMC), submitted the Point Beach Nuclear Plant (PBNP) Units 1 and 2 License Renewal Application (LRA). On November 17, 2004, the Nuclear Regulatory Commission (NRC) requested additional information regarding Reactor Coolant Pump Flywheel Fracture Mechanics Analysis (LRA Section 4.4.2) and several Aging Management Programs (LRA Sections 2.1.6, 2.1.18, and 2.1.23). The enclosure to this letter contains NMC's response to the staff's questions.

On December 1, 2004, the NRC staff verbally provided additional time for NMC to respond to this request for additional information in order for further clarifications to be provided. The clarifications allowed the PBNP License Renewal project staff to clearly understand the information needed.

Should you have any questions concerning this submittal, please contact Mr. James E. Knorr at (920) 755-6863.

There are no new commitments made or previous commitments revised as part of this response.

A093

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I declare under penalty of perjury that the forgoing is true and correct. Executed on January 25, 2005.

Dennis L. Koehl
Site Vice-President, Point Beach Nuclear Plant
Nuclear Management Company, LLC

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC
PSCW

ENCLOSURE

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2 LICENSE RENEWAL APPLICATION

The following information is provided in response to the Nuclear Regulatory Commission (NRC) staff's request for additional information (RAI) regarding the Point Beach Nuclear Plant (PBNP) License Renewal Application (LRA).

The NRC staff's questions are restated below with the Nuclear Management Company (NMC) response following.

NRC Question RAI 4.4.2 (Reactor Coolant Pump Flywheel Analysis):

The staff needs explanation as to the number of reactor coolant pump (RCP) start/stop cycles that are assumed in the 60-year RCP flywheel fatigue crack growth assessment for the Point Beach Units.

NMC Response:

During normal operation, the reactor coolant pump (RCP) flywheel possesses sufficient kinetic energy to potentially produce high-energy missiles in the unlikely event of failure. Conditions that may result in overspeed of the RCP increase the kinetic energy and the potential for failure. The aging effect of concern is fatigue crack initiation in the RCP flywheel bore keyway.

An evaluation of the probability of failure over the extended period of operation was performed in WCAP-14535-A, "Topical Report on Reactor Coolant Pump Flywheel Inspection Elimination," for all operating Westinghouse plants and certain Babcock and Wilcox plants. It demonstrates that the RCP flywheel design has a high structural reliability with a very high flaw tolerance and negligible flaw crack extension over a 60-year service life. The NRC reviewed and approved WCAP-14535 for application with certain conditions and limitations. (The WCAP was subsequently republished as WCAP-14535-A). PBNP verified the RCP flywheel material and invoked this analysis as the basis for reducing the frequency of performing RCP flywheel inspections.

The Westinghouse analysis, which assumed 6000 cycles of RCP starts / stops for a 60-year plant operating life, is extremely conservative for PBNP. The following is an estimate of RCP start / stop cycles for PBNP based on discussions with PBNP Operations personnel:

Table 1: Estimation of RCP start / stop cycles for PBNP

Decade Number	Number of Years	Approximate Number of Start / Stop Cycles Per Year	Total Number of Start / Stop Cycles Per Period
1	10	5 (fill and vent)	50 (fill and vent)
2	10	5 (fill and vent) 10 (SG crevice flushing)	50 (fill and vent) 100 (SG crevice flushing)
3-6	40	5 (fill and vent)	200 (fill and vent)
Total	60		400

The total estimated RCP start / stop cycles is approximately 400 cycles for a 60-year operating period. Assuming an additional 100 start / stop cycles occur to account for maintenance activities and inadvertent pump trips, the total number of pump start / stop cycles then becomes approximately 500. Even using very conservative start / stop cycle estimates (one refueling every year), the total number of cycles is less than 10% of the assumed number of cycles in the WCAP-14535-A analysis.

NMC has evaluated the analysis associated with the structural integrity of the RCP flywheel and determined it to remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

NRC Question RAI B2.1.6-1 (Boric Acid Corrosion Program):

The staff seeks additional clarification regarding the list of components that are within the scope of the Boric Acid Corrosion Program and the process the applicant uses to augment the list of components within the scope of the AMP based on pertinent industry experience. This is RAI B2.1.6-1. Specifically, the staff requested the following actions of the applicant:

- Submittal of a discussion on how NMC's responses to NRC Bulletin 2002-01, dated March 29, 2002, and May 16, 2002; responses to the NRC's RAIs on the bulletin, dated January 17, 2003; response to NRC Bulletin 2003-02, dated September 19, 2003; responses to NRC Order EA-03-009, dated March 3, 2003, April 11, 2003, and April 18, 2003; and response to NRC Bulletin 2004-01, dated May 28, 2004 have been used to update the list of component locations and types of visual inspections credited within the scope of the Boric Acid Corrosion Program or within the scope of other aging management programs (AMPs) that provide for implementation of similar or more conservative types of inspections.

- If the responses were used to supplement the scope of the Boric Acid Corrosion Program or other AMPs, identification of the component locations that have been added to the scope of the program and clarification of the type of visual examinations (i.e., specification on whether VT-1, VT-2 or VT-3 will be used and whether the visual examinations will be enhanced, bare-surface, qualified, etc.) that will be implemented on those components within the current scope of the program.

NMC Response:

PBNP's response to NRC Bulletin 2004-01 stated that no Alloy 82/182/600 materials exist in the Unit 1 or Unit 2 pressurizers. The response did not require any augmentation of the Boric Acid Corrosion AMP. PBNP's response to NRC Bulletin 2002-01 concluded that the existing boric acid program was in compliance with Generic Letter 88-05 (LRA page B-74). Enhancements to the Reactor Coolant System Alloy 600 Inspection AMP will include the development of new implementing documents to meet the commitments made in response to NRC Bulletins 2002-02, and 2003-02, and NRC Order EA-03-009 (LRA page B-164).

In response to NRC Bulletin 2003-02, a bare metal visual examination of the Reactor Pressure Vessel (RPV) lower head and Bottom Mounted Instrument (BMI) nozzles was performed by Visual Test (VT)-2 qualified individuals during the Unit 2 October 2003 and the Unit 1 April 2004 refueling outages. The examinations were performed directly with a resolution capability of VT-1 and had acceptable results. The insulation on the RPV lower head was modified and now provides access ports. A bare metal visual examination is performed by VT-2 qualified individuals via the access ports each refueling outage. The visual examinations will continue until industry experience, changes to the ASME code, or a change in regulatory requirements justify a change to the inspection frequency or method. Additionally, a VT-2 examination subject to the pressure and temperature requirements, and other requirements specific to the performance of an ASME Section XI code-required system pressure test, is conducted.

The First Revised NRC Order EA-03-009, dated February 20, 2004, requires a bare metal visual examination of the RPV head surface and either ultrasonic test (UT) of the head penetration nozzle, eddy current (EC) or dye penetrant testing of the wetted surface of each J-groove weld and RPV nozzle base, or combinations of these non-visual Non-Destructive Examination (NDE) methods. The bare metal visual examination is performed by VT-2 qualified individuals when the RPV head is removed and located in the lay down area. The revised Order also requires visual inspections each refueling to identify potential boric acid leaks from pressure retaining components above the RPV head. These inspections are satisfied by the performance of a VT-2 inspection of the control rod drive mechanisms (CRDMs), conoseals, piping, etc., located above the RPV head subject to the pressure and temperature requirements and other requirements specific to the performance of an ASME Section XI code-required system pressure test.

PBNP is in compliance with the revised NRC Order for PBNP Unit 2 and is in compliance with the revised Order for PBNP Unit 1 with the exception of the relaxation regarding the examination distance below the J-groove weld on 17 RPV nozzles that was approved by the NRC in a Safety Evaluation (SE) dated June 4, 2004. The relaxation for PBNP Unit 1 will remain in effect until the end of the current operating cycle (fall 2005), at which time the RPV head will be replaced.

Note: The Unit 1 and Unit 2 RPV heads are scheduled for replacement in 2005.

NRC Question RAI B2.1.18-1 (Reactor Vessel Surveillance Capsule Program):

GALL Program XI.M31 suggested that standby capsules are to be removed and placed in storage. Even though the capsules do not contain limiting material, these standby capsules provide general embrittlement trends and provide assurance that current embrittlement methodologies apply to Point Beach. Leaving the capsules in the vessel, further exposure would not provide any meaningful data. Please justify your decision of not removing the capsule and keeping it in storage.

NMC Response:

While there are no current plans to remove the standby capsules from the reactor vessel, the standby capsules might be removed at some time in the future to support industry needs. The lead factor for these locations is low enough to allow extended neutron exposure. Removal of these capsules will not directly support demonstration of adequate Upper Shelf Energy (USE) and Pressurized Thermal Shock (PTS) margins for the PBNP Unit 1 and Unit 2 reactor vessels; consequently removal was not required by the AMP. In addition, the remaining original surveillance capsules at PBNP do not contain materials representative of the PBNP RPVs' limiting welds. Thus, these capsules are of limited value to PBNP. The B&W Owners Group (B&WOG) is currently evaluating the future need for the remaining original surveillance capsules at PBNP in support of the Master Integrated Reactor Vessel Surveillance Program (MIRVP). The removal schedule for these capsules will be based on the needs of the B&WOG MIRVP. The Reactor Vessel Surveillance Aging Management Program will require that all withdrawn surveillance capsules not discarded as of August 31, 2000, be placed in storage for potential future use.

NRC Question RAI B2.1.23-1 (Thimble Tube Inspection Program):

Section B2.1.23 indicates that eddy current examinations are performed on a periodicity consistent with the severity of wear damage for each thimble tube. The frequency of inspections is based on the maximum wall loss noted in a region of active wear and the projected wear which would occur based on a known wear rate.

1. Identify the wear rate that is currently being used and how did you calculate the wear rate. Based on this wear rate, how were the inspection intervals determined to ensure that wear resulting from flow induced vibration does not result in the wall thickness below the minimum required thimble tube integrity?

2. Specify the NDE uncertainty that is used in the calculations along with a justification for the NDE uncertainty value assumed in the calculation. Note that we would like the NDE uncertainty to be specified as a given percentage of the nominal wall thickness for the thimble tubes.

The applicant's Operating Experience identified certain problems related to inspection deferrals, calculation methodology, and record retention.

Explain the problems in detail and how and when are you going to address the issues.

NMC Response:

Based on a conservative calculation of the collapse strength for a thimble tube, an incore thimble tube is assumed to collapse at design pressure after it has worn 83% through wall. This calculation assumes uniform wear around the circumference of the tube with no credit taken for any reinforcement around the worn area. For a typical tube, fretting wear will be localized resulting in a large volume of sound tube material surrounding the worn area. Consequently, the wall loss would have to be in excess of 83% of nominal wall thickness before collapse would occur.

To ensure that tube failure does not occur between inspections, tubes exhibiting a wall loss in excess of 60% will be capped and taken out of surface. Tubes will also be capped if their indicated wall loss plus the predicted wall loss, between inspections, exceed 60%. The 60% capping limit was established as follows:

FACTOR	% Wall Loss
Maximum allowable wall loss	83%
Potential error in eddy current inspection	-10%
Uncertainty in wall loss geometry	-10%
Capping Limit	63%

The error in the eddy current inspection results is accounted for by reducing the maximum allowable wall loss by 10%, which is consistent with the accuracy assumed in the industry for these types of eddy current inspections (i.e., industry standard). The maximum allowable wall loss is further reduced by an additional 10% to account for any uncertainty introduced by wall loss geometry. The capping limit is also established at 60% versus 63% to provide additional conservatism. Taken together, this provides an overall conservative approach for establishing the capping limit and calculating the inspection frequency.

To prolong the life of thimble tubes experiencing wear, a tube may be repositioned to move the worn area away from the wear area. This will move the degraded portion of the tube into an area where fretting is not occurring and place intact tube material in the area where fretting is occurring. This will extend the life of the thimble tube without undue risk of failure. The repositioning of a thimble tube is evaluated on a case-by-case basis. However, the previously discussed capping limit is adhered to in all cases.

Damage to thimble tubes has generally been observed as a decelerating phenomenon, where the progression of damage decreases with time. Therefore, a conservative method for calculating the wear rate takes the total wall loss over the life of the thimble tube divided by the operating time of the tube. Unless the wear has been found to increase during an inspection period, the assumption of wear decrease with time is the method used for determining the wear rate. The wear rate is determined for each thimble tube and wear location (i.e., thimble tubes may have fretting wear at multiple locations).

The frequency of inspection is based on the maximum wall loss (i.e., worst case flaw depth) noted in a region of active fretting and the projected wear that would occur based on a known wear rate. The maximum inspection frequency for thimble tubes is determined as follows:

$$F = \frac{WL_{max} - WL_{meas}}{WR}$$

WL_{max} = Capping Limit (%)

WL_{meas}= Wall Loss Measured (%)

WR = Wear Rate (% / year)

Inspections are normally performed during the outage that is prior to the outage identified as the one before the unit thimble tube reaches the calculated lowest minimum thimble tube life, or at least every six years, to ensure conservative testing intervals. For example: If the lowest minimum thimble tube life is 5.5 years, the next inspection would be at three years, one outage prior to the 4.5 year outage. If the lowest minimum thimble tube life is 12.8 years, the next inspection would be at six years. However, this does not preclude thimble tube inspections being scheduled more frequently to ensure conservatism.

The PBNP Unit 1 thimble tubes were last inspected during the 2001 refueling outage with the lowest minimum thimble tube life calculated at 10.85 years using a calculated wear rate of 4.33 % / year. Table 1 below provides the thimble tube inspection history and plan for PBNP Unit 1. The next inspection is scheduled at 4.5 years during the 2005 refueling outage, to ensure conservatism.

TABLE 1 PBNP Unit 1 – Thimble Tube Inspection History and Plan

C - Completed (100%) D - Deferred
B - Baseline New tubes X - Scheduled

1988	1989	1990	1991	U1R19 1992	U1R20 1993	U1R21 Apr 94	U1R22 Apr 95	U1R23 Apr 96	U1R24 Mar 98	U1R25 Oct 99	U1R26 Apr 01	U1R27 Sept 02	U1R28 Spring 04	U1R29 Fall 05	U1R30 Spring 07	U1R31 Fall 08	U1R32 Spring 10	U1R33 Fall 11	U1R34 Spring 13	U2R33 Spring 17	
C	C	C	C		C		C	C	*Baseline 5 New Tubes	D	C			X(1)							

* March 1998 decision made to replace capped thimble tube, and next 4 worst tubes. Baseline inspection performed on 5 new thimble tubes, without inspecting the other thimble tubes at the time.

The PBNP Unit 2 thimble tubes were last inspected during the 2000 refueling outage with the lowest minimum thimble tube life calculated at 10.71 years using a calculated wear rate of 2.33 % / year.

Table 2 below provides the thimble tube inspection history and plan for PBNP Unit 2. The next inspection is scheduled at 4.5 years during the 2005 refueling outage, to ensure conservatism.

TABLE 2 PBNP Unit 2 – Thimble Tube Inspection History and Plan

C - Completed (100%) D – Deferred
B – Baseline New tubes X - Scheduled

1988	1989	1990	1991	U2R18 Oct 92	U2R19 Oct 93	U2R20 Oct 94	U2R21 Oct 95	U2R22 Nov 96	U2R23 Jan 99	U2R24 Nov 00	U2R25 Apr 02	U2R26 Oct 03	U2R27 Spring 05	U2R28 Fall 06	U2R29 Spring 08	U2R30 Fall 09	U2R31 Spring 11	U2R32 Fall 12	U2R33 Spring 14		
C	C	C		C		C	C	D	D	C			X(1)								

PBNP identified several concerns related to inspection deferrals, calculation methodology, and record retention. As noted in Table 1, the inspection of the PBNP Unit 1 thimble tubes was deferred from the 1999 refueling outage to the 2001 refueling outage, resulting in an inspection interval of five years. As noted in Table 2, the inspection of the PBNP Unit 2 thimble tubes was also deferred from the 1996 and 1999 refueling outages to the 2000 refueling outage, resulting in an inspection interval of five years. However, in neither case did the inspection interval exceed the lowest minimum thimble tube life. The concerns identified the fact that these inspections were deferred without a documented evaluation showing that the extended inspection interval would not result in any problems. The program implementing document, HX-02, "Thimble Tube Condition Assessment Program," requires an engineering evaluation or calculation to be performed demonstrating, with a high degree of confidence, that there would be no thimble tube problems with an extended inspection interval prior to a deferral being allowed.

Following the PBNP Unit 2 thimble tube inspection performed during the 2000 refueling outage, it was discovered that the eddy current contractor had reported the results using an averaged flaw depth method (i.e., mixed frequency amplitude wall loss) instead of the worst case flaw depth method (i.e., maximum wall loss) described above. The results of this inspection were subsequently reanalyzed using the worst case flaw depth method, which resulted in the lowest minimum thimble tube life being calculated at 10.71 years. A review of past inspection results also identified inconsistent methods being used to determine the wear rate. However, as indicated in Table 1 and 2, the frequency of inspections conducted during this time period offsets any potential non-conservatism in the method used to calculate the wear rate.

While resolving the issue related to calculation methodology, it was discovered that the worst case flaw depth method has been largely replaced in the industry with the mixed frequency amplitude wall loss method. Therefore, future inspections may be analyzed using both of these methods to determine if PBNP should change to the current industry standard method. One of the reasons that the current 4.5 year inspection interval was chosen, where 6 years is allowed by the program, was to allow timely comparison of the worst case flaw depth data analysis method with the mixed frequency amplitude wall loss data analysis method over two inspections to facilitate final resolution of the questions related to possible adoption of the current industry standard methods of eddy current data analysis.

The issue expressed regarding record retention involved copies of the official records being maintained by the Thimble Tube Condition Assessment Program Engineer for ease of reference. This increased the burden associated with locating the records whenever they were needed. The official records are retained and stored in accordance with ANSI N45.2.9-1974, "Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants."

Therefore, the issues related to inspection deferrals, calculation methodology, and record retention have been appropriately addressed.