April 1, 1992

Docket No. 50-266
and 50-301

Mr. James J. Zach, Vice President
Nuclear Power Department
Wisconsin Electric Power Company
231 West Michigan Street, Room P379
Milwaukee, Wisconsin 53201

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Region III, DRP

Dear Mr. Zach:

SUBJECT: STRUCTURAL AUDIT AT POINT BEACH NUCLEAR PLANT UNIT 2
(TAC NO. M81818)

A structural audit was performed at the Point Beach Nuclear Plant during the period October 21 through October 24, 1991. The audit team included Messrs. Goutam Bagchi, Yong S. Kim, Hai-Boh Wang, David Tang, and James A. Gavula of the NRC staff, and Messrs. Joseph Braverman and Richard Morante of the Brookhaven National Laboratory.

Point Beach is one of several sites to be visited to obtain information about performance of structures at operating facilities. Upon completion of the other site audits, we hope to draw some general conclusions and determine whether regulatory action is necessary at licensed facilities. We appreciate your accommodating the audit team during the refueling outage and are grateful for the substantial help provided by your staff to the team members.

The audit team made a number of observations at the Point Beach site which should be of interest to you. Therefore, I am enclosing a copy of the "Summary Version of the Point Beach Trip Report."

NRC is not imposing any requirement for action on Wisconsin Electric Power Company by providing this trip report to you. However, I encourage you to review the report and to take such actions as you deem appropriate.

If you have any questions on the audit team observations, we will be pleased to discuss them with you.

Sincerely,
Original signed by,

Robert B. Samworth, Sr. Project Manager
Project Directorate III-3
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

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cc:

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6612 Nuclear Road
Two Rivers, Wisconsin 54241

SUMMARY VERSION OF THE POINT BEACH TRIP REPORT

Purpose: Audit of Structures and Civil Engineering Features

Location: Point Beach Nuclear Plant - Units 1 and 2, Two Rivers, Wisconsin

Date: October 21-24, 1991

Personnel: G. Bagchi (NRC), Y. Kim (NRC), H.B. Wang (NRC), D. Tang (NRC), J. Gavula (NRC), R. Morante (BNL), J. Braverman (BNL)

Background:

The objective of the plant visit was to obtain information about the performance of structures at operating plants to be used with information obtained from visits to other sites to draw some general conclusions. To achieve this objective, an assessment of the existing conditions and past performance of structures and civil engineering features at Point Beach Nuclear Plant was performed. Any failures, degradations, maintenance, surveillance, modifications and repairs of safety related structures were of interest. Structures reviewed include buildings, tanks, cable tray and conduit supports, anchorages, underground structures, and the water intake structure.

Inspection Summary

October 21, 1991:

The audit team was joined by R. Samworth, NRC Project Manager for Point Beach Nuclear Plant (PBNP). The afternoon of October 21 was devoted to health physics training, whole body counting, dosimetry and badging, and introduction to Wisconsin Electric Power Company (WE) representatives. Discussions were held regarding specific details, which included walkdown supplies (cameras, rulers, flashlights, etc.), composition of the audit team for the two walkdown groups, and the specific path to be followed through the plant.

The audit team developed a list of structures, components, and areas of concern that should be covered during this plant visit. This list and a walkdown agenda were given to WE prior to the site visit and the final list was provided on the following morning to enable them to develop the most effective path for the walkdown.

October 22, 1991:

An entrance meeting was held with WE personnel and the NRC/BNL representatives. G. Bagchi described the purpose and scope of the visit.

A formal presentation was then made by WE personnel. Some of the topics covered include design and codes for category 1 structures, seismic design criteria, containment tendon surveillance, support anchorages, spent fuel pool and racks, intake structure, masonry walls, free spaces and settlement monitoring, and structural LERs. Another important topic for discussion was the use of cathodic protection systems at the site for selected structural components, particularly the piles which support the two containments and fuel pool basemats.

October 23, 1991:

During the initial walkdown inside Unit 2 containment, the audit personnel were separated into two teams. Team A consisted of Y. Kim, H.B. Wang, and J. Braverman. Team B consisted of D. Tang, J. Gavula, and R. Morante. G. Bagchi participated in the walkdowns conducted by Team B. Team A began the walkdown inside containment from the top down, while Team B conducted its walkdown from the basemat of the containment working up, until the two teams met.

Team A examined the polar crane and crane girder, containment liner dome region, and containment spray supports from a distance, by standing on a steel platform beneath the crane girder. Team A also examined the structural steel at the top of the shield wall surrounding the steam generator, the main steam pipe support anchorage to shield wall, supports to the accident fan coolers, conduit supports, and the shield wall. In addition, the containment liner below the dome was examined up close at various elevations and near the containment personnel hatch and equipment hatch.

Team B examined the accessible areas on Elevations 8' and 21'. Specifically, the containment liner, the "leak chases" which enclose the liner butt welds, the liner deflection monitoring gages, concrete floors and walls, structural anchorage to walls and floors, the service water piping, containment cavity cooling units, and containment penetrations were reviewed for signs of degradation and conditions which may warrant monitoring or remedial action.

In the latter part of the morning, the two teams joined to perform walkdowns of the Unit 2 tendon gallery, Units 1 & 2 outside containment, and facade structure surrounding the containment. The entire tendon gallery was examined (all 360°) including the concrete floor, walls, ceiling, tendon bearing plates, and tendon grease caps. The review of the outside containment encompassed the containment vertical wall, mat, and dome; buttresses; and tendon bearing plates and tendon grease caps. Although the facade structure was examined, it is not a seismic category 1 structure.

In the afternoon, the entire audit team examined areas in the auxiliary building (elevations -19 ft to +26 ft), turbine building (elevations 8 ft to 44 ft), control building (elevations 8 ft to 44 ft) and fuel pool building.

These reviews included walkdowns in the diesel rooms, cable spreading room, battery rack room, vital switchgear room, and control room. Structural components reviewed include concrete floors, walls, and ceiling; conduit; cable tray; piping support anchorages; seismic gaps; equipment supports; tanks; and masonry walls.

October 24, 1991:

In the morning, the entire audit team examined the pumphouse (ground elevation); the forebay structure; the exterior walls of the auxiliary building, turbine building, and control building; the tornado missile protection for the diesel generators; and the fuel oil pumphouse (including the fuel oil tank, pumps, and associated supports). In the water intake pumphouse, the primary areas of review included the pumphouse structure, north and south pump rooms, and equipment supports and anchorages. The other areas include the forebay concrete structure, water baffle concrete structure, and discharge piping. The intake crib could only be visually observed at a distance since it is located 1750 feet offshore. The 14 ft. diameter intake piping between the intake crib and forebay structure is buried below the lake bed and could not be viewed.

The above describes the structures and scope of the walkdown review effort for aging related degradation effects. During all of the walkdowns, a walkdown log was maintained in which the team recorded for each observation the building area, elevation, location, component or item, aspect reviewed, picture no., observation no., and any comments. Data were recorded for structural components when aging degradation effects were present as well as when they were not. Pictures were taken for selected items to enhance the documentation and these were noted in the log. Duplicates of the pictures were provided to the licensee before leaving the site. In addition, measurements were taken when appropriate (such as crack width), to determine the severity of the degradation.

WE personnel provided responses and documents to address the questions raised by the audit team during the formal presentation session and during the walkdowns. The audit team then reviewed the observations noted during the entire visit. A list of the more meaningful observations, including those that would be of benefit to WE, was compiled. This list, which is discussed in the next section of this trip report, was conveyed verbally to WE at the exit meeting held in the afternoon.

Results/Observations

During the exit meeting held on October 24, 1991, G. Bagchi reiterated the purpose of the NRC staff visit and the observations noted as a result of the formal presentation given by WE and the walkdowns performed by the audit team. It was explained that the observations were being presented to WE for their benefit and do not represent requirements by the NRC staff.

While most of the structural features examined at Point Beach Nuclear Plant were in very good condition after 20 years of operation, there were some components which did show varying degrees of aging degradation. Some of the observations are discussed below, with a more complete list and detailed description presented in Summary Attachment A. Although the purpose of our visit was to identify aging-related degradation effects on safety-related structural plant features, a few other items were included which would be of interest (e.g., seismic gap observation and pipe support movement in turbine building).

Observations noted inside containment included liner plate separation on the order of 1 inch in several places, two gouges in the liner plate of about one eighth-inch depth, and corrosion of some service water-piping/valves/supports and associated equipment. Outside containment, observations at several locations include corrosion of tendon bearing plates, grease leakage at tendon caps, and cracks at buttresses. In the tendon gallery, there were instances where groundwater seeping in through cracks in the walls and ceiling is causing (a) corrosion in the vertical tendon bearing plates and (b) concrete degradation. In addition, grease leakage is occurring at some tendon caps.

The Point Beach technical specifications include a surveillance program to ensure containment structural integrity by periodically inspecting randomly selected tendons for symptoms of material deterioration or lift-off force reduction. Prior to the time of the audit no special consideration had been given to selecting tendon anchors near cracks, areas of water intrusion, or other apparent degraded areas.

Assurance of the effectiveness of the cathodic protection system for the steel piles supporting the two containments and the fuel building is based on electrical characteristics of the protection system. There has been no physical examination of piles to verify that they are adequately protected.

In several structures (pumphouse, auxiliary building, and diesel generator building), some concrete cracks in the walls, floor, and roof have permitted water infiltration to occur. The cracks were not judged to be severe at the time of the audit but were noted because of the possibility of progressive degradation.

The seismic gap between the turbine building and the control building at certain locations could not be located. The grout beneath some equipment base plates in the pumphouse was severely degraded, and in the diesel generator rooms a number of anchor bolts did not have full thread engagement. Although the integrity of the seismic-category-1 masonry walls is dependent on the absence of cracks, there is no formal surveillance or visual examination program for the identification and subsequent repair of cracks.

Conclusion

Considering that the plant has been operating for approximately 20 years, most structural plant features have performed very well. Some structures or components, however, do show signs of varying levels of aging degradation.

The most striking examples of degradation relate to concrete cracking and degradation primarily associated with water infiltration from groundwater.

It is noted that WE was aware of some of the observations identified by the staff and was in the process of monitoring or addressing some of the concerns. Examples of this include the containment liner separation and corrosion of piping components of the service water piping system.

SUMMARY ATTACHMENT A

POINT BEACH NUCLEAR PLANT SITE AUDIT
LIST OF CIVIL/STRUCTURAL OBSERVATIONS

Inside Containment (Unit 2)

1. At several locations inside containment, the liner plate is separated from the concrete. It is not known whether voids may exist in the concrete. Dr. Newmark's report to the NRC (page 68, Appendix D) dated 3/11/70 described the possibility that a snap through of a liner plate could lead to larger than normal deformations. Although the liner separation is being monitored, no evaluation has been made.

2. Gouges in the liner of approximately, 1/8" depth were observed at two locations (elev. 66' and about elev. 46'). WE indicated that at least in one case the gouge was in existence at the time of construction and evaluated for acceptability. WE has not established acceptance criteria which would be applied to gouges discovered in the liner in the future.

3. Extensive corrosion and paint blistering were identified in the service water piping and associated valves. Substantial corrosion was also noted on the containment cavity coolers. WE has replaced some of the piping in the service water piping system and is examining the cause of this degradation to prevent its occurrence in the future.

4. In several locations (e.g. elev. 66' East side) the liner paint has either peeled off or was scratched. In addition, some structural supports inside containment (at top of shield wall) were not painted or coated. WE has no formal procedure for the evaluation or repainting of exposed liner surfaces.

Outside Containment

1. At the buttresses, substantial corrosion of the tendon plates and grease caps was observed at several locations.

2. Grease leakage was found at several horizontal tendons (e.g., Unit 1, buttress A, azimuth 250°). In addition, grease leakage (possibly from a vertical tendon) to the outside surface of the containment concrete wall was located at Unit 2 Elevation 6' 6" near azimuth 350°.

3. Horizontal cracks in the buttresses along the centerline of the hoop tendons were found at a number of locations (e.g. Unit 1, buttress D, azimuth 70°). WE has not determined whether the tendons associated with the largest concrete cracks lose prestressing force more than the other tendons.

4. Chunks of concrete were missing at the edge of several buttresses, next to bearing plates for the hoop tendons. An example of this is Unit 1, Elevation 85' Buttress D.

Outside Containment - cont'd

5. Minor radial cracks on the concrete ledge of the containment foundation mat were observed, uniformly spaced around much of the containment. These cracks were more numerous in Unit 1 than Unit 2.

6. In the Unit 2 tendon gallery, groundwater was seeping in through cracks in the walls and ceiling at several locations. Corrosion in the vertical tendon bearing plates and localized degradation of concrete was observed. There would appear to be a potential for corrosion of reinforcing steel.

7. WE relies on cathodic protection systems (CPS) to prevent corrosion of the steel piles which support the containment and fuelpool basemats. CPS operating data is used to establish that the system is functioning properly and implicitly preventing corrosion. In the absence of visual inspection of a representative pile and of an analysis of data from elsewhere on long term integrity of piles, the audit team could not conclude whether the CPS is effective in preventing corrosion.

Intake Structure (Crib and Forebay)

1. Because the fourteen (14) ft. diameter intake pipes were inaccessible, the audit team could make no observations nor draw any conclusions. WE indicated that periodic inspection is performed using divers and no significant indications of degradation have been reported. It was pointed out by G. Bagchi that if significant leakage were to develop through the joints of this piping, the surrounding soil could be dissolved or removed leading to the development of large voids in the ground causing foundation failure. This situation occurred at the Bailey fossil fueled power plant.

2. WE's diving inspection procedure used for the crib structure and forebay area of the pumphouse was reviewed. Although the procedure calls for various observations to be made, it does not include inspection of damage to concrete structures. No conclusion for submerged structures could be reached due to lack of accessibility and inspection data.

3. The concrete surrounding the two large discharge pipes has developed cracks and appears to have degraded chemically.

Pumphouse

1. There are a number of cracks in the exterior concrete walls and roof of the pumphouse. The cracks in the roof show some signs of water infiltration and possible concrete degradation.

2. The grout beneath some of the safety-related equipment base plates is severely degraded. In some cases a significant portion of the grout is

missing. The equipment is located in the north and south service water pump rooms. Examples where this problem exists are beneath the screen wash pump check valve, service water pump P-32E, and the Zurn strainomatic base plates.

Auxiliary Building

1. In the central auxiliary building, elevation -19', there are several small cracks in the concrete walls. In addition, groundwater is seeping in through the floor and some of the cracks in the walls. The walls show signs of calcium formation and the floor has a bulge where the ground water has infiltrated. All of these indicate that some concrete degradation has occurred.

2. Also, in the central portion of the auxiliary building, on the West side, there are two large vertical cracks. These may need to be monitored.

Other

1. A seismic gap at the front wall and basemat elevation between the control building and turbine building could not be located. According to WE, a 2" seismic gap should be present between structures to accommodate building seismic movement.

2. Anchor bolts and nuts in several equipment supports did not have full thread engagement. Examples of this include the starting air receiver tanks for the diesel generators.

3. There is no surveillance or visual examination program for the identification and subsequent repair of cracks in seismic category 1 masonry walls.

4. Concrete cracks were observed above the two diesel generator exhaust piping penetrations, on the exterior of the emergency diesel generator building east (lakeside) wall.

5. In various areas where groundwater seepage is occurring it may be necessary to test core samples to determine whether or not there is any concrete strength reduction. Reduction in strength may occur due to loss of alkalinity.

The following items were observed for nonsafety related structures or components or are not directly related to aging degradation:

1. In the turbine building, Elevation 26', at Valve No. IP/P481, there is visible vibration of the piping and apparent shifting of the deadweight support stanchions.

2. Inservice surveillance reports for containment were requested for the team to review at a later date to gain insights on trends of the loss of prestressing force.