



UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 REGION II
 101 MARIETTA STREET, N.W., SUITE 2900
 ATLANTA, GEORGIA 30323-0198

Report Nos. 50-369/94-27 and 50-370/94-27

licensee: Duke Power Company
 422 South Church Street
 Charlotte, NC 28242-1007

Docket Nos.: 50-369 and 50-370

License Nos.: NPF-9 and NPF-17

Facility Name: McGuire Nuclear Station 1 and 2

Inspection Conducted: November 14-16, 1994

Inspectors: *G. Maxwell* *January 5, 1995*
 for G. Maxwell, Sr. Resident Inspector Date Signed

- R. Shewmaker, Senior Structural Engineer, Low Level Waste Management Branch, NMSS
- R. Rothman, Section Leader, Civil Engineering & Geosciences Branch, NRR
- R. Bryant, Civil Engineer, FERC, Atlanta, GA
- R. Crisp, Director and Civil Engineer, FERC, Atlanta, GA
- D. Hyatt, Civil Engineer, FERC, Atlanta, GA

Approved by: *R. V. Crlenjak* *1/6/95*
 R. V. Crlenjak, Chief, Branch 3 Date Signed
 Division of Reactor Projects

SUMMARY

Scope:

A special inspection was conducted on the standby nuclear service pond (SNSWP) dam (the ultimate heat sink). The inspection included examination of its crest, embankments, reservoir, discharge structure, and associated instrumentation. The safety audit was performed by NRC staff and its technical advisor, the Federal Energy Regulatory Commission (FERC). A separate report

ENCLOSURE 1

will be issued by FERC to NRC who will transmit it to Duke Power Company.

Results:

No violations were identified.

In general, the SNSWP dam and its associated structures and instrumentation were operating safely as designed and maintained in good condition. However, the inspectors identified a discrepancy. According to the as-built plans and the FSAR, the north end of the dam should have wave runup protection to meet the design basis probable maximum flood (PMF) and wind-driven wave protection runup level requirement (paragraph 2.e.3.). However, the protection does not exist. The downstream hazard potential was classified as "Low" since, in the unlikely event of the dam failing, there would be no lives in jeopardy and minimal economic loss. Some routine maintenance recommendations were suggested by the audit team to enhance existing field conditions observed and to improve the licensee's current program for monitoring the dam's performance (paragraph 2.e).

REPORT DETAILS

1. PERSONS CONTACTED

Licensee Employees

- *D. Cook, Engineering Support Section
- *R. Cross, Compliance Specialist
- *M. Hunt, Mechanical and Civil Equipment Engineering
- *W. Maynard, Hydro Support
- *T. McMeekin, Vice President, McGuire Nuclear Station
- *J. Thrasher, Mechanical and Civil Equipment Engineering

Other licensee employees contacted included engineers, technicians, and administrative personnel.

NRC Resident Inspectors

- *G. Maxwell, SRI
- *R. Shewmaker, NMSS
- *D. Hyatt, FERC
- *R. Crisp, FERC
- *R. Bryant, FERC
- *R. Rotham, NRR

*Attended exit interview

Acronyms and abbreviations used throughout this report are listed in the last paragraph.

2. NRC Staff/FERC Audit of the Standby Nuclear Service Water Pond (SNSWP) Dam and Associated Structures (NRC Inspection Procedure 37551 and 45053 were used).

a. Audit Criteria

The audit/inspection evaluated conformance of the facility to the Federal Guidelines for Dam Safety (June 1979), the Proposed NRC Dam Safety Program (April 1991), and other incorporated documents, such as NRC Regulatory Guide 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants.

The Final Safety Analysis Report (FSAR) for the McGuire Nuclear Station originally addressed the SNSWP in Appendix 2G. The current version of the FSAR does not physically contain Appendix 2G, but Section 2.6 of the current FSAR indicates that the information contained in the former Appendices 2 A through H has been removed and is now archived in the Nuclear Licensing Files of the McGuire Nuclear Station for the lifetime of the plant. These changes were made in 1991 and 1992 in the revisions to the FSAR document. Table 3-1 of the FSAR identifies the essential elements of the SNSW Pond System that are relevant to dam safety as Category I. These include the dam itself, the nuclear service

water piping and the nuclear service water intake and discharge structures. These elements are described in Appendix 2G and illustrated in the associated figures 2G-1, 2G-1A, 2G-2, and 2G-3.

b. Structural Review

Prior to performing the walkdown examination of the dam facilities, the NRC engineers and FERC consultants met with licensee engineers and discussed the following pertinent topics:

- 1) McGuire's dam design criteria and assumptions made; demography, geologic, and seismic considerations; foundation and embankment compaction efforts utilized; expected seepage, settlement, stresses, and the results of stability analyses performed
- 2) Hydrologic data
- 3) Pertinent structural and design features of the pond's discharge structure
- 4) Instrumentation of the dam
- 5) Any modifications, major maintenance or repairs that may have been implemented on the dam and associated structures since original construction

c. Previous Dam Inspections and Findings

The audit team reviewed the data and results of the ongoing licensee inspections (Enclosure 2) conducted on the subject SNSWP dam/structures.

d. Inspection of the SNSWP Dam, Reservoir, and Associated Structure

- 1) The audit team examined the subject SNSWP dam, reservoir, and associated structures by performing a thorough walkdown and visual inspection of these facilities.
- 2) The dam was examined for the condition of the crest, shoulders, groin areas, upstream and downstream embankment slopes, and rip-rap, and for adequate grass cover. These attributes were inspected for any evidence of cracking, misalignment, slides, depressions, sinkholes, bulging, burrowing animals, surface runoff erosion, uncontrolled seepage, horizontal or vertical movements, and inappropriate vegetation growth.
- 3) The reservoir's perimeter and the downstream overflow channel were examined for any signs of slides, erosion, burrowing animals, debris, or undercutting of the subject concrete structures.

e. Audit Conclusion/Findings

FERC will prepare the dam safety audit report for the NRC Dam Safety Officer. The report will list the audit findings, conclusions and recommendations. After review and approval a copy will be issued to the licensee. Audit observations and findings mentioned at the exit interview included the following:

- 1) The downstream dam failure hazard potential was classified as "Low."
- 2) The following routine maintenance recommendations were suggested by the audit team to enhance existing dam conditions and the instrumentation monitoring program:
 - a) At the downstream toe, north of the V-notched weir, two wet areas exist. The team recommended that better drainage be established so that the collection of water in these areas would not mask any dam seepage that may occur.
 - b) The 54" outlet piping should be visually inspected yearly to ensure that it has not degraded and/or become partially obstructed.
 - c) The elevation near the outlet collection should be verified yearly.
 - d) Upstream rip-rap needs to be re-arranged in some areas to enhance detecting (by visual inspection) localized movement which may occur. For example, on the south end of the dam exposed spots of bedding gravel can be seen along the water's edge. Also, near the midsection of the dam irregularities exist in the rip-rap profile. In some spots the rip-rap bedding gravel is now 3 feet below the top of the concrete parapet wall whereas the design documentation indicates the distance should be 2 feet.
 - e) The toe drain outlet structure (the relief riser) has silt build-up in it. It should be inspected periodically when piezometer readings are being taken (monthly).
 - f) A joint exists in the south end of the concrete parapet wall that indicates movement has occurred. It should be monitored for future movement.
 - g) There are no piezometers located in the embankment. This may inhibit detection of pore pressures, impacting the ability to obtain an accurate stability analysis for the type embankment dam (silt) that is

constructed at McGuire. The existing piezometers monitored foundation groundwater conditions.

- h) The grass mowers that are being used on the downstream side of the dam are leaving large ruts in the embankment that can lead to initiation of erosion. Equipment being used may not be appropriate or the timing of the mowing operations may not be the best. The mowing operation should be reviewed for possible improvements.
- i) The elevation of the two bench marks on the north abutment should be verified every 5 years.
- j) When seepage measurements are being taken, the waste water pond (located downstream) level should be recorded.
- k) The plant as-built drawings should be reviewed and updated to reflect those areas of the dam that were over-excavated during construction.
- l) The soil located around a recently installed leachate drain line (approximately 8" in diameter) needs to receive additional compaction and the backfill needs to be brought to the profile of the dam's downstream face. This drain line runs across nearly the entire length of the embankment and is buried approximately 1 to 1½ feet deep.

3. A portion of the length of the dam crest has a concrete parapet with a top elevation of 748.5 feet. This parapet is necessary to meet the design basis probable maximum flood (PMF) and wind-driven wave runup level requirement. The FSAR on page 2G-1 indicates that the crest is approximately 1260 feet long with a width of 36 feet which accommodates the roadway on top of the dam. On page 2G-3 of the FSAR it is stated that the top elevation of the SNSW Pond Dam is 747.0 feet with a parapet wall extending to elevation 748.5 feet along the entire length of the dam. As indicated on page 2G-2, probable maximum flood for the pond is based on the probable maximum precipitation event that was defined as 30 inches of rainfall over a six hour duration. This produces a water level in the pond at Elevation 746.9 feet. This flood condition could then be acted upon with 40 mph winds across the pond and produce wave runup to Elevation 748.35 feet. The upstream slopes are protected by rip rap; however, the design provided for some wave over topping of the parapet wall from the wave action and the parapet wall was provided with a water collection trench on the downstream side of the wall to collect the water and

transfer it laterally to the abutments of the dam. The design identified a quantity of water equal to 0.008 cfs per foot of wall as overtopping the wall. This was to be collected in the trapezoidal trench drain on the back side of the wall, but integral with the wall. The trench was to be placed with a 0.5% slope.

However, the actual parapet terminates short of the north end of the dam, leaving an area at an elevation of what appears to be about 747 feet that is susceptible to being topped by the design basis event. During the inspection it was found that the concrete parapet wall and trench drain combination exist for only approximately 700 feet of the dam crest, terminating short of the north end of the dam, and the trench drain does not appear to be on a slope of 0.5%. The high area at the north end of the dam consists of compacted fill at an elevation of approximately 747.0 feet that is susceptible to be topped by a portion of the design basis wind-driven wave runup. It is not clear that the current as-built and existing condition is consistent with the design description contained in Appendix 2G. The statement that, "Therefore, it is positively determined that the drainage ditch will adequately carry all possible wave overwash without causing any erosion of the dam," does not appear to be fully substantiated. This was brought to the attention of the licensee at the exit meeting on November 16, 1994.

The licensee initiated an investigation and indicated that the abutment at the north end, which did not have a concrete parapet, had a rip-rap wall with substantial thickness up to an elevation of 748.6 feet for two-thirds of the abutment length. The licensee considers the rip-rap to provide protection from waves similar to the parapet wall. Also, the licensee postulates that wave runup to the top of the rip-rap elevation will cause some water to migrate through the voids, but no surges of water will occur because of the energy dissipation of the rip-rap. Any water that possibly could get beyond this point will not erode the well-vegetated abutment because of the low velocity and volume of the water. Finally, the licensee considers that, based on this review, the SNSWP dam is operable and meets the design basis criteria.

On December 7, 1994, the operability question for the dam, in its as-built condition, was discussed during a teleconference between the NRC staff and the licensee. During the discussion, the licensee indicated that additional construction (compacted soil) on the north end of the dam was being planned. However, it is not an immediate threat to the operability or reliability of the SNSWP dam.

The staff has identified this condition as Unresolved Item 50-369,370/94-27-01: SNSWP dam construction, contingent upon review of construction and design changes proposed by the licensee to correct the as-built dam discrepancies.

The final FERC audit report may contain additional findings, and in addition some of the findings listed above may be revised after final evaluation.

3. Exit Interview

The inspection scope and findings identified as follows were summarized on November 16, 1994, with those persons in paragraph 1. Also, a tele-conference discussion was held on December 7, 1994, between the NRC staff and the licensee. The unresolved item was discussed during the tele-conference. The following items were discussed in detail:

<u>Item Number</u>	<u>Status</u>	<u>Description and Reference</u>
URI 50-369,370/94-27-01	Open	SNSWP Dam Construction

The licensee representatives present offered no dissenting comments, nor did they identify as proprietary any of the information reviewed by the inspectors during the course of their inspection.

4. ACRONYMS AND ABBREVIATIONS

FERC	-	Federal Energy Regulatory Commission
NMSS	-	Office of Nuclear Materials Safety & Safeguards
NRR	-	Office of Nuclear Reactor Regulation
PMF	-	probable maximum flood level
SNSWP	-	Standby Nuclear Service Water Pond
FSAR	-	Final Safety Analysis Report

ENCLOSURE 2

LICENSEE STANDBY NUCLEAR SERVICE WATER POND INSPECTIONS

INSPECTIONS	FREQUENCY	MOST RECENT	PROCEDURE/GUIDANCE
Visual Inspection per T.S. 3/4.7.5	Annually	4/7/94	PT/O/A/4400/04
Visual Inspection (Env. monitoring group)	Monthly	10/5/94	PT/O/A/4400/04 (sections 12.9 - 12.13)
Pond Elevation ¹	Monthly	10/5/94	PT/O/A/4400/04 (sections 12.9 - 12.13)
Observation wells/piezometers ²	Monthly	10/5/94	PT/O/A/4400/04 (sections 12.9 - 12.13)
Seepage Flow ³	Monthly	10/5/94	PT/O/A/4400/04 (sections 12.9 - 12.13)
Vert. and Horz. Movements ⁴	Annually	11/8/94	Conventional Survey Techniques
In-house Engineering insp.	Annually	11/3/94	DPC Manual of Inspection
Out-of-house inspection	Every 5 years	8/30/94	MCS-1124.05-00-0002

¹ Pond Elevation is measured at the overflow outlet structure.

² Six observation wells and two piezometers are measured to determine water levels.

³ Seepage flow is measured using a V-notch weir downstream of discharge riser.

⁴ Vertical settlement and horizontal displacement are measured from surface monuments M1-M12. Additional monuments (M1A-M9A), located on top of the parapet wall on crest of dam, are also measured for vertical settlement and horizontal displacement.