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JAMES P. McGAUGHY, JR.
VICE PRESIDENT

July 5, 1983

Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, N.W.
Suite 2900
Atlanta, Georgia 30303

Attention: Mr. J. P. O'Reilly, Regional Administrator

Dear Mr. O'Reilly:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket No. 50-416/417
License No. NPF-13
File 0260/15525/15526/16694.4
PRD-82/38, Final Report, Nelson
Stud Failure
AECM-83/0387

Reference: 1) AECM-83/033, 1/20/83
2) AECM-83/0166, 3/15/83
3) AECM-83/0329, 6/7/83

On December 21, 1982, Mississippi Power & Light Company notified Mr. R. Butcher, of your office, of a Potentially Reportable Deficiency (PRD) at the Grand Gulf Nuclear Station (GGNS) construction site. The deficiency concerns Nelson Stud failures on embed plates.

As previously reported, MP&L evaluated this deficiency and determined that it was reportable under the provisions of 10CFR21 for Unit 1 and that the investigation to determine reportability on Unit 2 was continuing. The determination has been made that this deficiency is not reportable for Unit 2.

Details are provided in our attached Final Report.

Yours truly,

J. P. McGaughy, Jr.
J. P. McGaughy, Jr.

RDC:dr
ATTACHMENT

cc: See page 2

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Mr. J. P. O'Reilly
NRC

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cc: Mr. J. B. Richard
Mr. R. B. McGehee
Mr. T. B. Conner

Mr. Richard C. DeYoung, Director
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. G. B. Taylor
South Miss. Electric Power Association
P. O. Box 1589
Hattiesburg, MS 39401

FINAL REPORT FOR PRD-82/38

1. Name and address of the individual ... informing the commission:

J. P. McGaughy, Jr.
Vice-President, Nuclear
P.O. Box 1640
Jackson, Mississippi 39205

2. Identification of the facility ... which ... contains a deficiency:

Grand Gulf Nuclear Station (GGNS) Unit 1
Port Gibson, Mississippi 39150

3. Identification of the firm ... supplying the basic component which ... contains a deficiency:

The basic components were furnished and fabricated for Grand Gulf by Bristol Steel and Iron Works through Bechtel Power Corporation; who provided the design for these components and installed them.

4. Nature of the deficiency ... and the safety hazard which ... could be created by such a deficiency ...:

A. Description of the Deficiency

- 1) This PRD concerns the failure of 3/8" diameter X 6" long machine welded headed concrete anchor (studs) installed on a 6" X 6" X 3/4" embedded plate, designated Type 86. The failure occurred at the stud to plate connection weld. Two of these Type 86 embed plates failed when the tubular steel supports for the neutron monitoring system, SRM/IRM motor modules, attached to the plates were being modified.
- 2) A subsequent investigation and tension testing program was implemented on the remaining Type 86 plates. The tension testing program identified several additional plates that did not support the specified design capacity. It was also determined from the investigation program that several of the plates had deviations from the specification and drawing requirements.
- 3) During normal handling of embed plates at the Unit 2 jobsite a stud was severed from a plate that was fabricated by Bristol Steel. The plate was to be used as an embed plate in Unit 2, however it was not yet installed.

B. Analysis of Safety Implications

The Type 86 embed plates which failed were used to anchor the neutron monitoring system, SRM/IRM motor module supports. The neutron monitoring system is operated by off-site power and; therefore, is not required for safe shutdown of the plant.

Piping which is part of the reactor coolant pressure boundary system is located below the motor module supports. The collapse of these supports could jeopardize the pressure boundary piping and possibly result in a LOCA condition. Additionally, the potential exists that safety related conduit could be damaged by the collapse of the supports.

MP&L has determined that all (29) Type 86 embed plates located in the RPV pedestal wall could possibly fail and are potential deficiencies. This condition is a defect in a basic component which could create a substantial safety hazard in Unit 1.

5. The date on which the information of such deficiency ... was obtained.

Mississippi Power & Light received information of the deficiency on December 17, 1982. We reported the deficiency to Mr. R. Butcher, of your office, as a Potentially Reportable Deficiency on December 21, 1982. An evaluation for Part 21 has been completed and the MP&L "Responsible Officer," Mr. J. P. McGaughy, Jr., has been notified.

6. In the case of the basic component ... the number and location of all such components.

The embedded plates which failed are designated Type 86 and are shown on drawing C-1070B. Thirty plates of this type were provided by the fabricator, of which only 29 were installed. All 29 were embedded in the Unit 1 Reactor Pressure Vessel (RPV) pedestal wall - outside face.

7. The corrective action which has been taken ... the name of the individual ... responsible for the action; and the length of time that has been ... taken to complete the action.

A. Corrective Actions Taken

- 1) Our investigation and testing program has demonstrated that the failure of the Type 86 embed plates is unique to this plate and was caused by a combination of items including:

- a. Cold welds made with a low current setting. This causes porosity, incomplete fusion between the toe of the fillet and the plate surface, and a more brittle nature to the weld. However, tests results showed that cold welds have a capacity which exceed the minimum specified ultimate capacity of the stud.

- b. The studs used in fabricating the Type 86 embed plates had substantially higher yield strength than normal, causing the weld to carry the load and changing the mode of failure to a weld failure rather than yielding in the stud.
- c. The small size of the plate and the size and configuration of the weld on the outside face of the plate leads to a heat induced distortion in the plate. This distortion is capable of damaging the small diameter studs reducing their tensile capacity.

These conditions resulted in the stud weld being the weak link in the structural system. The combination of these parameters with the application of additional external loads caused the premature failure of the stud welds.

Our investigation of all other embed plates having 3/8" diameter studs have shown no evidence of failures nor have plates of similar size and weld configuration. All remaining Unit 1 Type 86 embed plates have been abandoned or replaced by surface mounted plates that have been attached to wall using expansion anchors.

- 2) A review was conducted of all documentation pertinent to the Unit 1 RPV pedestal pour. This detailed review indicated that the Type 86 and 81E embeds were not addressed as part of the installation and inspection documentation for this pour. This was due to the omission of these embeds as line items on the preplacement inspection checklist. A comprehensive investigation and review of documentation for other concrete pours indicates that this lack of proper QC inspection and sign-off for these two embeds in the Unit 1 pedestal pour is a unique and isolated case. The Type 86 embed plates have been abandoned, as noted above, and a subsequent ultrasonic examination was conducted on the two Type 81E embed plates. This examination confirmed that the embed plates conform to the drawing and specification requirements.
- 3) All available embed plates at the Unit 2 site that were fabricated by Bristol Steel and not yet installed in the concrete were reinspected. This reinspection consisted of:
 - a. A visual inspection in accordance with AWS D1.1-72.
 - b. All studs were tapped with a hammer for soundness.
 - c. Bend tests were performed on any stud not passing the AWS visual criteria or the worst looking stud on the plate so that at least one stud was bend tested on each embed plate.

This reinspection and analysis of the results indicates that on a statistical basis a 95% confidence level exists that the studs have a reliability of at least 99.6%. This reliability level exceeds the acceptance level used for wedge type expansion anchors in IE Bulletin 79-02. These studs serve a purpose identical to that of the expansion anchors. The studs are therefore capable of performing their intended function in a manner that creates no unreasonable risk to the health and safety of the public.

- 4) It has been determined that the noted deficiency is not applicable to Unit 2 because:
- 1) the Unit 2 Type 86 plates were fabricated using an approved stud welding procedure which should preclude the use of low current,
 - 2) the material test reports of the studs used for Unit 2 shows a yield stress only slightly in excess of the minimum specified yield stress, and
 - 3) to date no attachment welds have been made to the plates to cause preload.

The Architect/Engineer for Unit 2 in order to preclude recurrence of the cited condition is to redesign the attachment welds to preclude weld induced heat distortion of the embed plates. The redesign effort will occur prior to Unit 2 fuel load and QAR-F-389 will remain open to track this condition to completion.

B. Responsible Individual

C. K. McCoy
Plant Manager
Mississippi Power & Light Co.
Responsible for Unit 1

T. H. Cloninger
Unit 2 Project Manager
Mississippi Power & Light Co.
Responsible for Unit 2

C. Length of Time to Complete Actions

All work has been completed to determine the cause and extent of this deficiency. All corrective action necessary to eliminate this deficiency in Unit 1 has been completed.

8. Any advice related to the deficiency ... that has been, is being, or will be given to purchasers or licensees:

Since this deficiency did not originate with MP&L, we have no advice to offer.