



UNITED STATES
NUCLEAR REGULATORY COMMISSION

REGION II
101 MARIETTA ST., N.W., SUITE 3100
ATLANTA, GEORGIA 30303

MAR 29 1982

SSINS: 50-269

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MEMORANDUM FOR: D. G. Eisenhut, Director, Division of Licensing
Office of Nuclear Reactor Regulation

FROM: J. A. Olshinski, Director -
Division of Engineering and Technical Programs

SUBJECT: CORE BARREL ASSEMBLY THERMAL SHIELD BOLTS - OCONEE UNIT 1

Description of Event

On July 15, 1981, Duke Power Company (DPC) reported that while performing a visual inspection of Oconee 1 reactor vessel internal components, as part of the ten (10) year inservice inspection (ISI) program, four (4) of the 96 thermal shield bolts and one of the 24 guide blocks were observed missing from their appropriate location. This report was followed by a licensee event report dated July 23, 1981, and preliminary notification PNO-II-81-52;52A and 52B issued on July 16, August 7, and September 28, 1981, respectively.

Investigation and Findings

On July 24, 1981, the licensee issued the first of three reports on the occurrence, the possible causes, metallurgical investigation, evaluations, safety concerns, corrective actions and inspections for the other two Oconee Units. On August 11, 1981, Babcock & Wilcox (B&W), in a memorandum to V. Stello from J. H. Taylor, Manager, Licensing, provided OIE headquarters with specific details of the event with additional information regarding the potential applicability of this problem to other operating B&W plants. During this time-frame, July - October, 1981, RII actively pursued the activity on this event at the Oconee site, at B&W's Lynchburg Research Center, and the NRR sponsored meeting at headquarters on October 9, 1981. This activity has been documented in RII Reports 50-269/81-16, and 81-24.

The licensee's final report dated January 8, 1982, states in part that the failure was caused by intergranular stress corrosion cracking (IGSCC) in the bolt head to shank fillet region. The hot heading of heavily cold reduced bar stock material resulted in a pronounced microstructural transition region which was coincident with the bolt head to shank fillet region. This unique processing condition reduced the resistance of the bolt material to IGSCC in the fracture zone. B&W stated that the material, A-286, was the correct material for this application; however, the improper fabrication of the bar stock was the main contributant to the failed bolts. By researching fabrication records, B&W stated that bolts manufactured from this bar stock were installed at Oconee 1, 2, 3, Crystal River 3, AND 1. Rancho Seco and Davis Besse.

CONTACT: N. Economos
(242-4667)

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DPC replaced all the thermal shield bolts with Inconel X-750 studs and nuts designed with a special crimp - cup and baseplate locking device. Examination by UT and remote video methods of other A-286 bolted reactor internals joints revealed no evidence of metal distress in the bolts. Also, the licensee and B&W stated that the bolts in these joints were not manufactured from heavily cold reduced bar stock material.

Inspection Findings at Oconee 2, Crystal River 3

a. Oconee Unit 2

Inspection of Oconee 2 reactor internals was performed as planned during the year ISI outage on January 22, 1982. Inspection results indicated, as had been predicted, that a total of twenty four (24) thermal shield bolts had failed. Of these, 19 had their heads broken off during removal.

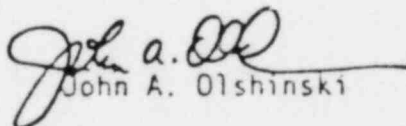
The licensee has replaced all the bolts in question with similar Inconel X-750 studs similar to those installed in Oconee Unit-1.

b. Crystal River 3

Inspection of approximately sixty (60) thermal shield bolts conducted with the aid of a remote control video camera disclosed no discernable bolt failures. The surface appearance of the bolts and clips showed no evidence of distressed metal - these observations were documented in RII Report 50-30/81-21.

Staff Recommendations

The licensee has stated and the staff has agreed that because of the function served by the thermal shield and the manner in which it is structurally considered in the accident analyses, the bolt failures were not believed to have significant public health and safety implication. In view of these findings the RII staff feels that Oconee-3 thermal shield bolts should be inspected in the same manner since the effective full power years (EFPY) for the three Oconee plants are quite similar; e.g., Unit 1, 5.08; Unit 2, 4.82; and Unit 3, 4.86. Other B&W plants with thermal shield bolts made of similar materials and manufactured in the same manner should be inspected during the next scheduled refueling outage. Provisions should be made to remove existing thermal shield bolts and replace them with the newly designed bolts made from the X-750 Inconel material during the 10-year ISI outage or when a sufficient number have failed visual inspection, whichever occurs first.


John A. Olshinski

cc: Director, ETP,
Regions I, III, IV
and V

TASK INTERFACE AGREEMENT

PROBLEM: FAILED THERMAL SHIELD BOLTS IN OCONEE 1 REACTOR AND POSSIBLY OTHER B&W REACTORS

LEAD OFFICE: IE NRR JOINT

NOTIFICATION: RO-269/81-1 Barrel Assembly Thermal Shield Bolts Broken, July 23, 1981

REFERENCES: Memorandum for J. H. Sniezek from R. C. Lewis, dated September 25, 1981

ACTION PLAN:

1. Review and evaluate the results of the B&W metallographic examination of failed thermal shield bolts on Oconee 1. Determine whether or not the problem is limited to the thermal shield bolts, and which B&W reactors may be affected. (IE)
2. Based on results of item 1, determine if any licensee actions (other than replacement of bolts) are needed prior to restart of Oconee 1. (IE)
3. Determine the need for inspection of bolts at other B&W reactors. Establish licensee requirements for bolt examinations, and issue generic correspondence as appropriate. (IE)
4. Evaluate the acceptability of continued operation of B&W reactors with broken (or suspect) thermal shield bolts. Evaluation includes:
(See continuation sheet.)

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NRR: Designate Lead Project Manager to assign TACS and coordinate correspondence, meetings, and reports (P. Wagner)

OFFICE COORDINATORS:

G. B. Georgiev (24866) Ext.

RB

R. Mattson: *RJM* 10/19/81 () Ext.
 R. Vollmer: *RJV* 10/22 (27707) Ext.
 Staines: *J. Staines* 10/22 (27492) Ext.
 T. Norek: *T. Norek* 10/23 27817 Ext.
 D. Eisenhut: *D. Eisenhut* NRR

APPROVED:

E. J. Jordan 10/24/81
IE

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|-----------------------------|----------------------|-------------------|----------------------|
| cc: V. Stello, Regional Dir | N.C. Moseley, IE | R.J. Mattson, NRR | S.H. Hanauer, NRR |
| H.D. Thornburg | J.H. Sniezek, IE | G.C. Lujnas, NRR | D.G. Eisenhut, NRR |
| B.K. Grimes, IE | R. DeYoung, IE | R.L. Tedesco, NRR | T.H. Novak, NRR |
| E.L. Jordan, IE | C. Michelson, AEOD | E.G. Case, NRR | R.H. Vollmer, NRR |
| R. Baer, IE | J.A. Olschinski, NRR | R.A. Purple, NRR | Lead Project Manager |
| | G.M. Holahan, NRR | T.E. Murley, NRR | P. Wagner |

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G. B. Georgiev (24866) Ext.

R. Mattson: R. Mattson 10/19/81 () Ext.
 R. Vollmer: R. Vollmer 10/22 (27207) Ext.
 G. Lainas: G. Lainas 10/22 (27492) Ext.
 T. Novak: T. Novak 10/23 27817 Ext.
 D. Eisenhut: D. Eisenhut 10/23 NRR

APPROVED:

E. J. Jordan 10/27/81
IE

- cc: V. Stello, IE N.C. Moseley, IE R.J. Mattson, NRR S.H. Hanauer, NRR
 Regional Directors; J.H. Sniezek, IE G.C. Lainas, NRR D.G. Eisenhut, NRR
 H.D. Thornburg, IE R. DeYoung, IE R.L. Tedesco, NRR T.H. Novak, NRR
 B.K. Grimes, IE C. Michelson, AEOD E.G. Case, NRR R.H. Vollmer, NRR
 E.L. Jordan, IE J.A. Gishinski, NRR R.A. Purple, NRR Lead Project Manager
 R. Baer, IE G.M. Holahan, NRR T.E. Murley, NRR P. Wagner

TASK INTERFACE AGREEMENT

(Continued)

ACTION PLAN: Continued

- (a) Investigate LPMS sensitivity to loose parts and thermal shield vibration at affected B&W plants. (NRR:DSI(CPB))
 - (b) Review licensing changes as needed. (NRR:DL & DE(ORAB & MTEB))
 - (c) Review event to establish generic licensing implications. (NRR:DL & DE(ORAB & MTEB)) (Including safety significance of bolts relative to seismic + blowdown load analyses)
5. Provide technical support to IE, as required, regarding licensee actions prior to restart of Oconee 1, need for inspection of bolts at other B&W reactors and requirements for such inspections, and/or generic correspondence. (NRR:DL & DE(ORAB & MTEB))