UNITED STATES NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report of Operations Inspection

IE Inspection Report No. 50-346/77-14

Licensee: Toledo Edison Company
Edison Plaza
300 Madison Avenue
Toledo, OH 43652

Davis-Besse Nuclear Power Station
Unit 1
Oak Harbor, OH

License No. CPPR-80
Category: B

Type of Licensee: PWR (B&W) MWe

Type of Inspection: Special, Announced

Dates of Inspection: February 16-18, March 1-3, 8, 14-16, 1977

Principal Inspector: R. J. Cook R.J. Cook 5/29/77 (Date)

Accompanying Inspectors: None

Other Accompanying Personnel: V. Noonan, DOR (March 1, 1977, only)
J. Rajan, DSS (March 1, 1977, only)

Reviewed By: W. S. Little, Chief
Nuclear Support Branch
5/25/77 (Date)

SUMMARY OF FINDINGS

Inspection Summary

An inspection was performed on February 16-18, March 1-3, 8, 14-16, 1977, (77-14): regarding examination of damage to vessel internals as a result of the hot functional test (HFT) and/or the core support assembly (CSA) removal, review of possible causes for the damage, review of diagnostic noise monitoring capabilities, and the review of applicable facility records.

Enforcement Items

None.

Licensee Action on Previously Identified Enforcement Items

None inspected.

Other Significant Items

A. Systems and Components

None.

B. Facility Items (Plans and Procedures)

None.

C. Managerial Items

None.

D. Deviations

None.

E. Status of Previously Reported Unresolved Items

None inspected.

Management Interview

A management interview was conducted with Mr. Evans, Station Superintendent at the completion of the inspection on March 16, 1977. Mr. Tambling, RIII was in attendance. The following items were discussed.

A. The inability to determine the sensitivity of the installed Loose Parts Monitor (LPM) for known energy impact phenomenon was discussed. The licensee agreed to perform additional preassembly testing to establish the response of the LPM to remotely initiated signals. (Paragraph 6, Report Details)

B. The lack of existing LPM baseline data, data analysis and data correlation were discussed. The licensee agreed to develop a testing program for acquiring LPM baseline data at various power plateaus and to investigate for internal assembly anomalies. (Paragraph 6, Report Details)

C. The inspector stated that another RIII inspector would follow the details of the vessel internals repairs. The licensee acknowledged the comment. (Paragraphs 3 and 4, Report Details)

REPORT DETAILS

1. Persons Contacted

J. Evans, Station Superintendent
B. Beyer, Maintenance Engineer
J. Hartigan, Assistant Engineer
R. Brown, Assistant Engineer
G. Meyer, Assistant Engineer
D. Bolfa, Maintenance Machinist
J. Buck, Operations Quality Assurance Supervisor
J. Huges, QC (TECo/Bechtel)
A. Casalena, QC Inspector - TECo
C. Wills, B&W Supervisory Engineer
C. Hillings, B&W QC Supervisor
B. Donavan, B&W Nuclear Services Engineer

2. General

During the removal of the vessel internals, galling occurred where the core support assembly (CSA) mates with the vessel keys located at the vessel flange and at the outlet nozzle contact surfaces. Further examination of the CSA revealed that gauling had occurred on at least one guide block associated with each of the 12 pairs of blocks used to ensure lower CSA alignment. A bolt used in the block attachment to the CSA was found broken in one guide block. Gauling was also found on some of the lugs attached to the vessel inside wall which engage the CSA guide blocks.

An inspection was conducted to examine the extent of damage incurred by the vessel internals, review of possible causes for the gauling, and to review vibration monitoring capabilities.

3. Vessel Condition

During the inspection, the inside of the vessel was physically examined. This examination revealed by evidence of galling that at least 5 of the alignment lugs attached to the vessel wall had been in contact with the CSA guide blocks during hot functional testing (HFT). Ideally, a 20 mil clearance would exist on either side between the guide lug and the CSA guide block. Die penetrant testing of the guide lug attachment did not disclose any surface cracking. The licensee had dressed the "mating" lug surfaces with light grinding.

TECo QA noted that a nominal 1/2" - 15° chamfer at the top of the vessel guide lugs had not been formed during the original manufacture. This 15° chamfer was formed in place by grinding. The

chamfers were shaped to conform with the original design using B&W Construction Field Procedure No. 318. These chamfers were examined and compared to the construction prints and appeared to agree with the original design.

The vessel outlet nozzle mating surfaces were found galled. This galling is attributed to removal of the CSA in a nonplumb alignment with the vessel. At the time of the inspection the galled surfaces had been relieved by hand grinding to an intended width/depth ratio of 3/1. The gauge depths are nominally 1/16 to 1/8 inch deep with the nozzle oriented towards the west being the most severely galled. Die penetrant testing after relieving disclosed no signs of surface cracking.

The vessel support ledge for the CSA was examined over the entire contact surface. No indications of CSA "rocking" or deformed metal which might indicate gross CSA motion were noted.

During HFT, the inner O-ring seal between the closure head and the reactor vessel flange leaked. This leakage damaged the vessel flange seating surface. Patch weld was added to the vessel flange at the damaged surface locations and machined to the original sealing surface. B&W Weld Control Records, Welding Instruction Sheets, General Procedure and personnel qualifications were reviewed. No discrepancies were noted.

Vessel keys (4 keys) were examined and found to be galled on the sides. The gall marks are vertically oriented and essentially run the full length of the key. It appears that these gall marks were formed during CSA removal. Upset metal was removed by hand grinding. The key geometry was not damaged enough to require further action.

4. Core Support Assembly (CSA) Condition

The CSA has 12 pairs of guide blocks evenly spaced around the periphery of the lower extremities. At least one block of each pair of blocks showed signs of being in contact with the mating vessel guide lug either during hot functional testing (HFT) or CSA removal. One of the blocks located at a designated Y-axis position was found with cracked capture welds on a bolt head used to maintain block attachment to the CSA. Further investigation revealed that the bolt was no longer flush with the CSA as a result of cyclic fatigue. This failure is attributed to loading of the bolt as a result of a dowel pin not being fitted to specifications and therefore, unable to assume the design dowel pin loading.

Measurements of the CSA guide block horizontal opening were taken and compared to the thickness of each mating vessel guide lug. It was found that these openings were nominally 100 to 230 mils in excess of the guide lug thickness. The original design is for a nominal 40 mil clearance with 20 mils existing on either side of the guide lug. The CSA guide blocks were subsequently repositioned to establish nominal design clearances and welded in place.

While the CSA was located on the support stand it was noted that stand support pads had come in contact with locking clips for core barrel-thermal shield bolts. This caused a deflection on the contacted locking clips of about 1/8 inch. These deflected clips were located between the designated X and Y-axes. Ideally, the CSA support stand would make contact only with the heads of the core barrel-thermal shield bolts when the CSA is supported upright. It was determined by the licensee that the CSA support stand is elliptical which causes some of the support pads to engage the locking clips. The licensee subsequently placed metal sheathing between the core barrel-thermal shield bolts and the support pads. The licensee ultimately plans to remove interfering metal from the contact pads.

The CSA outlet nozzles were found galled with the marks running in a prefered vertical direction. The gall marks on either side of a vertical axis through the centerline of the nozzle appear to match those marks found on the reactor vessel outlet nozzles. At the time of the inspection the upset metal had been relieved by grinding. The galling is attributed to removal of the CSA in a nonplumb configuration with the reactor vessel.

Essentially all the contact surface between the CSA and reactor vessel was examined on the CSA. No indications of plastic deformation or upset metal were noted.

The CSA keyways were examined and found galled. These gall marks were in a predominantly vertical orientation and appear to match the gall marks in the reactor vessel keys. The galling is believed to have occurred during CSA removal. The upset metal was removed by light grinding on 3 of the 4 keyways. The remaining keyway was heavily ground and the fitup tolerance was destroyed. This keyway was subsequently brought within design tolerance by weld buildup and machining. The key/keyway design calls for a clearance of 10 to 16 mils. The clearances were found to be 15, 18, 23 and 44 mils on a nominal average across the engaged surface. The licensee indicated the repairs restored the keyways such that the function has not been impaired.

5. Inspection of Internals Adapter Assembly

During investigations to determine the loss of plumb when the CSA was removed, a lifting nut on one of the internals handling adapter trusses (Part No. 258, B&W Drawing No. 181309E) was found to be loose and not in the previously set position. During the disassembly, it was noted that a staking allen screw in the lifting nut could not be removed. After removal of the nut from the lifting bar (Part No. 257, B&W Drawing No. 181309E), it was noted that the last four threads were damaged. An end cap disc plate was also found damaged. The licensee procured an identical internals handling adapter truss from another plant for use during subsequent CSA handlings.

6. Noise Monitoring Capability

The capability of the installed Loose Parts Monitor (LPM) to detect indications of gross core barrel motion and derive quantitative information were reviewed. The licensee had not instituted a rigerous program for procuring baseline data using the installed LPM during hot functional testing (HFT). However, enough data was taken which could show a comparison between spectra taken at a reactor coolant system (RCS) temperatures and pressures of 385°F and 1500 psig with data at 530°F and 2170 psig. These traces indicate that a low frequency ($9H_z$) spike may have existed at 385°F which appears much less pronounced at 530°F. The first mode beam model frequency for the core barrel is about $9H_z$. The amplitude of the signal could not be correlated to any known energy impact forces. Correlations with noise data taken by B&W during HFT was not available at the site. The data taken during HFT with the installed LPM was on a 0 to 512 H_z full scale which is ackward for gross motion monitoring. However, the LPM has the capability of changing the full scale to 0 to $25H_z$ for examing low frequency spectrum.