U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-346/91016(DRS)

Docket No. 50-346 License No. NPF-3

Licensee: Centerior Service Company
c/o Toledo Edison Company
300 Madison Avenue
Toledo, OH 43652

Facility Name: Davis-Besse Nuclear Power Station

Inspection At: Oak Harbor, OH 43449

Inspection Conducted: November 4, 1991 through January 30, 1992

Inspectors: F. Maura for — R. Langstaff — 2/4/92 Date

F. Maura — F. Maura — 2/4/92 Date

K. Salehi — K. Salehi — 2/4/92 Date

F. Maura for — S. Sanders — 2/4/92 Date

Approved By: M. P. Phillips — M. P. Phillips, Chief, Operational Programs Section — 2/6/92 Date

Inspection Summary

Inspection on November 4, 1991, through January 30, 1992 (Report No. 50-346/91016(DRS))

Areas Inspected: Routine, announced, team inspection of the engineering department's performance over the last 17 months, including two events late in the SALP period, and specifically, the design, testing, and closure of plant modifications. The inspection module used during this inspection was 37700.

Results: Of the five areas inspected, one violation with three examples was identified. The violation involved failure to follow procedures due to lack of attention to detail.

The following strengths were identified:

- Engineering department's self-assessment to improve its performance.
- Department Policy Manual, and the familiarity with its directives shown by engineering personnel.
- Strong commitment of Systems Engineering section to the support of plant operations.
- Quality and timeliness of the modification packages.
- The program controlling temporary modifications (TMs) and the low number of TMs.
- Experience level and initiative shown by engineering department personnel.
- Overall training program and opportunities for advanced education.

The following weaknesses were identified:

- Large backlog of work including the suspended modifications and large number of old items.
- Causes of the station blackout diesel auxiliary transformer failure.
- Lack of aggressiveness to determine root cause and take corrective action following the second failure, within three weeks, of the No. 2 emergency diesel generator to develop rated voltage on November 8, 1991.

DETAILS

1. Persons Contacted

Toledo Edison Company

+*S. Jain, Director, Engineering Department
*L. Storz, Plant Manager
*J. Barron, Supervisor, Test/Projects
*N. Bonner, Manager, Design Engineering
+*E. Caba, Manager, Performance Engineering
S. Fox, Supervisor, Engineering Planning
*G. Gibbs, Director, Quality Assurance
*D. Haiman, Manager, Engineering Assurance/Services
*C. Hengge, Supervisor, Systems Engineering
+ G. Homma, Compliance Supervisor
J. Lash, Manager, ISE
*N. Peterson, Licensing Engineer
D. Lightfoot, Manager, Integrated Planning
*A. Rabe, Supervisor, Quality Verification
*R. Schrauder, Manager, Nuclear Licensing
+*R. Simpking, Supervisor Operations Training
+ T. Swim, Supervisor, Civil/Structural Design
*D. Timms, Manager, Systems Engineering
*V. Watson, Principal Staff Engineer
*R. Zyduck, Manager, Nuclear Engineering

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*N. Jackiw, Section Chief, DRP, RIII
*W. Levis, Senior Resident Inspector

*Denotes those attending first exit meeting of November 22, 1991.
+Denotes those attending final exit meeting of January 30, 1992.

The inspectors also interviewed other licensee employees including members of the operations, maintenance, technical, training, quality assurance and engineering staff.

2. Engineering Department

The Engineering Department consisted of five sections: Systems, Design, Performance, Nuclear, and Engineering Assurance/Services. This inspection focused on the effectiveness with which the department supported the other plant departments. As a result, the inspection concentrated on the Systems and Design sections.

a. Policy

The Engineering Department had a Policy Manual which specified what was expected of each individual, how business was to be conducted, and what documentation was to be maintained. Specific areas covered in the manual included the use of engineering judgements/assumptions, procedures, existing calculations, engineering evaluations, design basis documentation, contractor oversight, control of overtime, trending, system walkdowns, etc. Interviews with various engineering personnel and document reviews showed excellent familiarity with the directives of the Policy Manual. This was considered a strength.

b. Self Assessment

Engineering management actively pursued, during the ninth SALP period (July 1990 - November 1991), improvements in the department's performance. One of the most significant actions taken was a self-assessment initiative to solicit information regarding department's performance. Candid surveys were conducted among the departments receiving engineering support (customers), and also within the engineering department (internal). The results from the customers' survey were classified and prioritized. Issues were then assigned to specific managers for resolution. A Focus Group was formed in March 1991 to address the weaknesses identified by the internal survey. One of the issues still under evaluation was the lack of a priority system.

The fact that this self-assessment and Engineering Department corrective actions have been effective was noted during interviews conducted by the inspectors with operations and maintenance personnel. In all cases, the customers indicated that engineering support had improved and was rated good. They were specifically supportive of Design and Systems Engineering. Overall, management had been aggressive in identifying and correcting Engineering Department weaknesses. This was considered a significant strength.

c. Systems Engineering

The Systems Engineering section showed a strong commitment to the support of plant operation. System engineers were assigned "ownership" of specific systems and a backup engineer was also assigned. Based on a review of the assignment list, the number of assigned safety-related systems to each engineer was not considered excessive. Several procedures in the Policy Manual and other documents outlined the functions and responsibilities of the system engineers. Interviews and record reviews showed that department instructions were understood and were being followed. For example, system walkdowns were being performed at least once per week (sometimes daily), the section manager was accompanying the engineers in two walkdowns per week to ensure they were being performed correctly and to offer constructive advice, a systems engineer attended the daily Operations Turnover Meeting, and with one documented exception, the System Performance Books were being kept up to date no less frequently than monthly.

d. Design Engineering

The Design Engineering section was subdivided into five functional units such as civil, electrical, mechanical, etc. They were responsible for the design of plant modifications, establishing equipment specifications, providing support to other plant groups as requested.

This section had one of the largest work loads in the department (see section 3 of this report). Complete modification packages for the seventh refueling outage were prepared in advance of the outage which significantly improved the planning and installation process. The technical quality of the modification packages was good as noted in Section 4.b. The present manager, who had been on the job since February 1991, brought both engineering and operations experience to the department. The sections' biggest challenge appeared to be the elimination of the modification backlog by 1993 while continuing to meet the day-to-day design engineering needs of the station.

e. Performance Engineering Function

The Performance Engineering section functions included reviewing industry and NRC documents for applicability to the plant, interfacing with the B&W Owners group, performing event investigations, root cause analysis, the ISI/NDE program, and post maintenance or modification testing; etc.

The Performance Engineering section continued to use sophisticated diagnostic equipment to detect equipment deficiencies and improve the plants' predictive maintenance program. The section was involved in industry-wide programs such as the Erosion/Corrosion EPRI program and the MOV Users Group.

f. Staffing, Experience Level, and Training

At the time of the inspection, the number of employees within the Engineering Department was approximately 233. The department's staff included a large number of experienced engineers. For example, engineers in the Design Section had an average experience level of approximately 14 years, and the Systems Section averaged approximately 10 years.

The Engineering Department had a formal training program for all its engineers. The program included classroom training plus required reading. System engineers were provided detailed training on their assigned systems, were scheduled for simulator training, and were given the opportunity to attend industry seminars related to their systems or associated component performance. The program took into consideration the individuals' prior education, training, and work experience. In addition, an Individual Development Plan was used to plan the career goals and development of each engineer. The licensee had a continuing education program that encouraged personnel to obtain advanced degrees. Records on the training status, and plans, for each individual were maintained by the Engineering Assurance/Services Section.

The overall experience level and initiative shown by personnel in the department, plus the depth of the training available were considered a strength.

3. Engineering Workload

The workload of the Engineering Department consisted of an accumulated backload of proposed, partially processed and suspended plant modifications; and, other documents requiring engineering action such as Requests for Assistance (RFA), Field Problem Resolution (FPR), Potential Condition Adverse to Quality (PCAQ), etc.

a. Plant Changes/Modifications

Early in 1991, at the request of the Engineering Director, the Independent Safety Engineering (ISE) group performed an independent evaluation of QA Surveillance Report SR-90-PLOPS-20 which covered the chlorine gas event of October 8, 1990. The ISE concluded that management had failed to aggressively complete plant changes. The review identified that emphasis had been placed on completion of the initial engineering work and on starting the modification, but not on job completion.

ISE's evaluation noted that there was a high number of open plant changes, many of which were of advanced age. The ISE recommended that a program be developed to reduce the modification backlog.

The inspectors reviewed the Plant Change Backlog Reduction Plan approved on September 5, 1991. The plan noted that the backlog included approximately 1600 proposed plant changes of which approximately 80% were in quality (Q), or augmented quality (AQ) systems or components. The plan subdivided the work by its origination time, established a methodology to be used to process the changes based on their age and status of completion, prioritized the work, and proposed completion by the end of 1993. While no concerns were identified with respect to the licensee's plan to eliminate the backlog in plant changes, the large backlog in plant modifications, several of which have been suspended for a long time, was considered a weakness.

b. Work Other Than Modifications

The remaining backlog of engineering work consisted of a variety (10 types) of other documents, e.g., PCAQs, RFAs, and RPRs, which came to engineering for review and action. A review of the Davis Besse Activity Tracking System (DBATS) showed that as of November 22, a total of 491 documents were assigned to the different engineering sections. The largest groups were RFAs (279), PCAQs (81), and FPRs (55). Of the 491 documents, approximately 25% were over a year old (approximately 24 documents were between 2.5 and 5 years old and approximately 54 were between 1 and 2.5 years old). The bulk of the work was distributed between the Design Section (223) and the Systems Section (187). Each document was assigned to a specific individual within the responsible section and an estimated completion date was established. To change the completion date required approval from the section manager. Other than by completion date, the assignments were not prioritized. The inspectors reviewed the trending of RFAs, the largest source of incoming work, and noted a reduction over the years in both the total number of RFAs outstanding and of old RFAs. This trend was considered a positive indication that management's effort to reduce the backlog was working. However, while there will always exist a backlog of work outstanding, the large percentage of items over 1 year old coupled with the lack of a prioritization scheme, was considered a weakness.

4. Design Changes/Modifications

a. Modifications Reviewed

The inspectors reviewed the safety evaluation, design packages, and maintenance work orders (MWOs) for three modifications and two temporary modifications performed during the seventh refueling outage. The following were among the items considered in the review of each package:

- o Design calculations
- o 10 CFR 50.59 safety evaluations
- o Purchase orders and associated specifications
- o Post modification test results
- o Training records
- o Changes to procedures and critical drawings
- o Interviews with operation and maintenance personnel
- o Walkdown of the modification

The specific documents reviewed were as follows:

(1) Modification 90-0059 Service Water System: This modification was intended to improve maintenance and inspection capabilities for essential portions of the service water system piping and components, provide accurate and reliable flow measurements for system balancing and testing, and compliance with the requirements of Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment." This modification included installation of six isolation valves, six flow instruments (four orifice plates, two flow nozzles), and several spool pieces at various locations throughout the service water system.

(2) Modification 90-0078 Redundant Steam Generator Level Indication: This modification, in response to the Reg Guide 1.97 requirements, added two independent and redundant steam generator level indicators in the Post Accident Monitoring Panel located in the control room.

(3) Modification 87-1315, Replacement of Service Water Valves SW-1424, SW-1429, SW-1434: This modification replaced the service water flow control valves downstream of each of the three component cooling water (CCW) heat exchangers with valves of different design. The old valves had a history of severe cavitation which had caused erosion of the valves. The replacement valves

also provided better flow control and greater expected reliability.

(4) Temporary Modification (TM) 89-0050: This TM, in conjunction with TM 89-0051, removed two valves in the service water system which had little functional value. Removal of these valves was pursued as a temporary modification because one of the control valves was needed in another part of the service water system in a timely manner. At the time of the inspection, this TM was in the process of being converted to a permanent modification.

(5) Temporary Modification 91-0043: This TM jumpered out fire detection zone (FDZ) 410 which was located in a containment passageway. FDZ 410 had previously been declared inoperable due to repeated false alarms. Restoring FDZ 410 to operability would have required replacement of all of the detectors in the FDZ with more reliable detectors and would have extended the refueling outage. The licensee planned to leave FDZ 410 inoperable for the following fuel cycle and, during the next refueling outage, replace the detectors in FDZ 410.

b. Inspection Findings

In general, the design reviews and 10 CFR 50.59 safety evaluations were of good quality. The inspectors considered the use of design reports for permanent modifications a good practice. The reports consolidated information about the modification such as the description and purpose of the modification, design inputs, functional and performance requirements, and design assumptions. With the exceptions discussed in Sections 4.b.(1),(2) and (3), all of the areas reviewed, were found to be satisfactory.

As a result of the licensee's attention in this area, there were only 15 TM in place as of November 22, 1991, of which only 4 TMs had been in place longer than 6 months, with the oldest being about two years old. The licensee had several means for tracking TMs. At the end of refueling outages, justifications were prepared for each TM to be left in place beyond the outages. When TMs were installed beyond 180 days, justifications were also prepared to leave the TMs in place. When the plant was in an operating status, the listing of existing TMs were reviewed once a week during the plan of the day (POD) meetings. The low number of TMs and the program controlling them were considered a strength.

Deficiencies were noted in the following areas:

(1) Attention to Detail

The inspectors identified a general concern with a lack of attention to detail in verifying that testing and training requirements had been completed before the MWO work verification checklist item was signed off and the component or system could be released for operation. For modification 90-0059, the MWO work verification checklist had the training requirements signed off as completed on October 4, 1991. However, 12 ROs/SROs did not receive the training until October 9 and 10. While, in this instance, the event had no safety significance, the signing of the training requirement as completed could have released the system for operation before the required training was completed. This was a violation of procedure DC-PN-00007, Attachment 26, page 2, block 2 which requires verification that the training requirements had been met.

For modification 90-0078, the MWO work verification checklist indicated testing had been completed on October 13, 1991. However, the procedure to calibrate the level indicators was not initiated until October 18, and was not completed until November 2, 1991. As in the previous example, this was a violation of procedure DB-PN-00007, Attachment 26, page 2, block 5 which requires verification that functional checks, such as calibrations, have been completed.

These two examples were considered a violation of 10 CFR Part 50, Appendix B, Criterion V (346/91016-01(DRS)).

(2) Temporary Modification Tracking

Although the program for tracking temporary modifications was good, the inspector noted some weaknesses in implementation. During the inspection, some of the listing of TMs presented at the POD meeting were incomplete. The licensee was aware of the problem and corrected it prior tothe end of the inspection. The licensee had also identified that their justifications for TMs to be left in place beyond the outage omitted several TMs. The licensee had documented the omission on Potential Condition Adverse to Quality Report (PCAQR) No. 91-0566. The inspector also found that the TM package for TM 91-0043 had not been fully updated to reflect the installation status. However, operations personnel were able to determine the status through review of the maintenance work order (MWO). The inspector recognized that the TM was still considered in the installation phase because the paperwork had not yet been signed off as complete.

(3) 50.59 Safety Evaluation

The 10 CFR 50.59 safety evaluation for TM 91-0043 noted that leaving FDZ 410 inoperable was within a Technical Specification's action statement and that the required compensatory measures would be in effect until the zone was repaired. The compensatory measures consisted of conducting an hourly fire watch when the area was accessible. However, during operation, the area in FDZ 410 was not accessible.

The inspectors questioned the conservatism of leaving an FDZ in an inaccessible area inoperable for a full fuel cycle. During the onsite portion of the inspection, the licensee was not able to provide specific information detailing what equipment was covered by FDZ 410. The licensee provided additional information on December 6 and 18, 1991, which listed the affected equipment and showed that the detectors were not needed to meet the requirements of 10 CFR Part 50, Appendix R.

This issue has been forwarded to the region's fire protection specialist and may be the subject of further review by the NRC.

5. Station Blackout Diesel Auxiliary Transformer Failure

On October 14, 1991, the station blackout diesel auxiliary transformer XDF-8 had a catastrophic failure when it was initially energized from a 4160V bus. The transformer was part of modification 89-0109 which installed a station blackout diesel generator. The licensee conducted a thorough investigation into the causes of the event which included recommendations for remedial corrective actions and for actions to prevent recurrence. The inspectors reviewed the tests performed on the transformer, cables, and associated protective relays prior to the event; the reduced level of electrical protection for the transformer, caused by the lack of DC control power to some of the protective relays and the lack of the required internal wiring to activate the indicating instantaneous trip of one of the 50/51 relays; the damaged equipment; the replacement transformer; and the results of the licensee's investigation. The inspectors agreed with the findings of the investigation which determined that inadequate design, coupled with installation and testing errors caused the catastrophic failure of the transformer. Examples of inadequacies in design were: (1) the use of an extremely flexible insulating terminal strip to connect both the primary and secondary cables to the transformer; and (2) the use of control power from one breaker to operate another breaker's control scheme. The installation errors included: (1) the use of cable much higher in load carrying capacity than required, due to unavailability of the correct size in the warehouse; and (2) the higher stresses caused by the routing, bending, etc., of the larger cables which caused the weak terminal strip to bend and reduce the clearance between the cable bolting pads and the "C" channel support member. The testing errors included: (1) the failure to detect the lack of the jumper required to activate the indicating instantaneous trip (IIT) of the relay associated with the transformer supply breaker; and (2) the disconnecting of the 125Vdc control power from some of the relaying scheme for the sole purpose of conserving the 125Vdc battery bank, which resulted in a reduced level of electrical protection for the transformer.

The inspectors considered the proposed recommendations adequate to prevent the recurrence of this type of event. While no further concerns existed at the conclusion of the inspection, the engineering department's performance on this project was weak.

6. Emergency Diesel Generator Failures

On October 21, 1991, with the reactor in Mode 5, the No. 2 Emergency Diesel Generator (No. 2 EDG) failed to develop rated voltage as the generator field failed to flash during the performance of the SFAS Integrated Time Response test. After 3 to 5 minutes the EDG was shutdown. A Potential Condition Adverse to Quality (PCAQ) report, No. 91-0521 was generated. The licensee determined that failure of the speed relay was the most probable cause of the problem. The relay was replaced on the same day, and satisfactory post maintenance test start of No. 2 EDG was performed. On October 22-23, 1991, satisfactory SFAS Integrated Time Response tests were performed. On November 8, 1991, with the reactor at 100% power a delay of 35 to 50 sec was experienced before rated voltage developed during theperformance of the No. 2 EDG monthly surveillance test. The EDG was kept on the line for a few hours, a strip chart recorder was connected, and following engine shutdown, a fast start was performed within 10 minutes. Rated speed and voltage were reached within 7.7 seconds with no abnormalities noted. Operations, with the concurrence of Systems Engineering, declared the No. 2 EDG operable. A PCAQ report was not generated to document the occurrence as required by procedure NG-QA-00702, Rev. 2, "Potential Condition Adverse to Quality Reporting", step 6.1.5 and 6.1.7. During an interview on November 21, the PCAQ Review Board Chairman stated that the Review Board had already closed PCAQ 91-0521, and that they were not aware of the November 8 failure. Failure to generate a PCAQ report is considered another example of a violation of 10 CFR Part 50, Appendix B, Criterion V (346/91016-01(DRS)).

The failure of the No. 2 EDG to develop an output voltage within the required 10 seconds on November 8 was the second failure in 18 days. The failure was intermittent in nature. The licensee suspected the field flashing contactor (FFC) relay was the problem, but little or no consideration was given to suspect the new speed relay as the cause of the failure. With no specific actions taken, and based on repetitive testing, on November 8, the licensee declared the No. 2 EDG operable. During the next 12 days the station continued to operate while the licensee developed an action plan to test, and replace if necessary, the FFC relay. The FFC relay was replaced on November 20, 1991. The slow response by the licensee to determine the root cause of the No. 2 EDG field failures and take adequate corrective action to prevent its recurrence, while continuing to operate at approximately 100% power after having experienced two failures of the No. 2 EDG to develop rated voltage within less than three weeks, was considered a significant weakness.

On December 3, 1991, the No. 2 EDG experienced its third failure within a 6-week period to develop rated voltage. The licensee traced the intermittent failure to a cold solder joint on the speed relay which had been installed after the October 21, failure. Following the third failure of the No. 2 EDG the licensee's corrective actions were considered aggressive and comprehensive. Details of the corrective actions taken following the December 3 failure are discussed in Inspection Report No. 50-346/91022.

7. Exit Interview

The inspectors met with the Engineering Department Director and members of his staff daily throughout the inspection. A preliminary exit interview was held with licensee representatives (denoted in Section 1) prior to leaving the site on November 22, 1991. A final telephone exit was held on January 30, 1992. During both exits the inspectors summarized the scope and findings of the inspection. The inspectors also discussed the likely informational content of the inspection report with regards to documents or processes reviewed by the inspectors during the inspection. The licensee did not identify any such documents or processes as proprietary.