U. S. NUCLEAR REGULATORY COMMISSION

REGION I

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Licensee:	Baltimore Gas and Electric Company
Facility:	Calvert Cliffs Nuclear Power Plant, Units 1 and 2
Location:	Lusby, Maryland
Dates:	August 12-September 6, 1996
Inspectors:	S. Chaudhar , Senior Reactor Engineer J. Carrasco, Reactor Engineer
Approved by:	Michael C. Modes, Chief Civil, Mechanical, and Materials Engineering Branch Division of Reactor Safety

EXECUTIVE SUMMARY

The scope of this inspection was to review and assess the engineering and technical support to the plant operations by focusing on the design modification process, the configuration management, and the engineering involvement in the resolution of technical issues affecting the plant. These activities were assessed to ensure compliance with the NRC regulatory requirements, updated final safety analysis report (UFSAR), and engineering procedures.

The inspectors concluded that the reviewed design modification packages were complete and thorough. The pertinent design requirements were established and documented in the design modification packages. The responsible engineers were cognizant of the pertinent regulatory requirements, and compliance to the Engineering Procedure EN-1-100 was evident.

Although a violation was identified (a "defacto" modification without proper engineering/design review), the licensee's engineers engaged in discussion of technical issues were knowledgeable and they articulated the safety significance and the consequences of postulating cases toward the resolution of technical issues. The exchange of engineering ideas and concepts in meetings is evidence of good engineering involvement in the resolution of plant issues.

Based on the limited sample of issue reports (IRs) reviewed, the inspector concluded that the IR process and implementation at Calvert Cliffs is carefully implemented and it has a number of checks and balances specially for those IRs that involve reportability, leading into a licensee event reports (LERs). The reviewed LERs were found to be prepared in an excellent manner.

Report Details

III. Engineering

E1 Conduct of Engineering (37550)

E1.1 Design Modification Process and Implementation

a. Inspection Scope

The scope of this inspection was to review and assess engineering and technical support to the plant operations by focusing on the design modification process, configuration management, and engineering involvement in the resolution of technical issues affecting the plant. These activities were assessed to ensure compliance with the NRC regulatory requirements, updated final safety analysis report (UFSAR), and engineering procedures.

b. Observations

The inspector reviewed several design modification packages and the configuration management activities as it applies to the design modification process.

Design Modification Process and Implementation

The inspector reviewed and verified the implementation of the Calvert Cliffs Nuclear Power Plant administrative procedure for engineering services, No. EN-1-100, Revision 5. This procedure provides the controls, and guidance to the engineers engaged in the design and modification of the structures, systems, and components described in the safety analysis report (SAR) and covered by quality assurance (QA) programs.

The inspector interviewed a number of design modification engineers and reviewed a number of design modification packages with the following observations:

Modification ES199501141: This activity removed deadleg piping from the service water system (SWS) to avoid interference during the service water heat exchanger replacement in a future outage. The sole function of the existing piping was to provide pressure boundary for the SWS. The deadleg piping and valves removed provided no flow direction or flow control functions. The new caps and the requalification of the as-built configuration satisfied the requirements of the original construction code.

The safety evaluation screening form was prepared in accordance with Attachment 2 of Procedure EN-1-100. The licensee used the Attachment 2 form to determine whether the modification impacts the safety analysis report (SAR); in this case, a safety evaluation was found to be necessary, and it was performed. The reviewed safety evaluation was found complete and thorough. The design input requirements were performed in accordance

with Attachment 8 of EN-1-100. The basic standards were identified and documented in a consistent format to facilitate the review of the modification.

Modification ES199501888: This activity modified the design of several test points for the saltwater system from screw-mounted thermal wells to flange-mounted thermal wells. This new branch connection design is intended to reduce or eliminate the likelihood of galvanic corrosion of the test points and the potential for saltwater system through-wall leaks. Impact on safety was carefully considered prior and during the modification. For example: it was evident in the design modification package that specific temporary pipe supports were required, and this was clearly specified as part of the design instructions for each pipe spool replacement location. These support requirements ensured that the appropriate saltwater headers remain operable during the installation of this modification.

The safety evaluation screening for the modification was completed in accordance with Section 5.7.1 G.8 of Procedure EN-1-100. The reviewed safety evaluation 50.59 were found complete and thorough. The design instructions were complete and included in the modification package as prescribed in Section 5.7.1 G.11 of Procedure EN-1-100. Operational impact of the modification was assessed, completed and included in the package as required by Section 5.7.1 G.12 of the procedure.

Modification ES199502266: This modification covered the steel platform near the No. 12 Steam Generator (SG) hand hole. The steel platform created an interference in the lancing operation of the SG. The modification covered a temporary configuration of the platform during the current lancing, and the permanent configuration of the structure for future ease in SG lancing operations.

The modification of the platform was supported by engineering calculation BGE Calculation CA02027 and a safety evaluation was included in the package. The safety evaluation was performed in accordance with the instructions contained in Section 5.7.1.G.8 of the Engineering Procedure EN-1-100 and was found to be complete and thorough.

Modification 89-0174-00: This modification replaced the existing saltwater system air compressor in Unit 2, with larger-capacity machines. The new compressors were installed to enhance the reserve margin of the saltwater air system. The design change indicated that, although the replacement compressors were duplex rather than the existing simplex units, they functioned in the same manner as the existing compressors. Furthermore, the modification was limited to the replacement of the compressors; it did not change air quality, air system load demand; configuration, the function, or operation of the system or operated loads.

The modification was supported by extensive design review and an excellent safety evaluation. The modification package was complete and thorough.

c. Conclusion

The reviewed design modification packages were found complete and thorough. The pertinent design requirements were established and documented in the design modification package. The responsible engineers were cognizant of the pertinent regulatory requirements, and compliance to the Engineering Procedure EN-1-100 was evident.

E1.2 Management of Plant Design Basis and Configuration Control

a. Scope

The scope of the inspection was to assess the degree to which the engineering organization maintained the plant design bases current and to verify that the regulatory requirements and licensee commitments were properly implemented, and plant design conformed to the description documented in SAR.

b. Observations

The inspector verified and reviewed specific aspects of the licensee's configuration management as they applied to design and design modifications for Calvert Cliffs Units 1 and 2, and he noted that the licensee had an in line interactive engineering design and design modification tool named Nucleis System. Through a hands-on demonstration, the inspector noted that the system was a comprehensive plant management information system capable of retrieving plant configuration documents used in the preparation and implementation of design modifications.

At Calvert Cliffs, configuration management document changes such as drawings are evaluated via an Engineering Services Package (ESP) process, which is outlined in Procedure EN-1-100 (Engineering Services Overview). A typical configuration document stored in the Nucleis System includes the following drawings: high level drawings such as piping and instrumentation diagrams (P&IDs) and the FSAR single line drawings, lower level mechanical piping drawings such as as-built configurations (i.e., piping isometric drawings), and drawings that are, in most cases cross-linked to unique equipment, were retrievable via NORMS/IMAGING (a subroutine in the Nucleis System). These drawings can be retrieved in an effective and efficient manner. This feature enables the design engineer to perform a design modification with the design basis in front of the design engineer. The data base also contains the regulatory requirements applicable to the design modification process such as NRC information notices, NRC bulletins, NRC generic letters, and other industry information.

c. Conclusions

The licensee's configuration management has the necessary computerized design modification documents. These documents are available and retrievable in a user-friendly manner, and they are being used effectively in the plant design modification process. The controlling procedure assures conformance to system description given in SAR.

E1.3 Engineering Involvement with the Resolution of Technical Issues

a. Scope

The scope of the inspection was to assess and evaluate the extent and quality of engineering involvement in site activities. It included engineering involvement with the resolution of a recent plant issue (unauthorized modification).

b. Observations

The inspectors verified that the licensee has a clear and concise procedure (No. EN-1-100, Revision 5) that outlines engineering services at Calvert Cliffs. The engineering services process is driven by a well prepared screening process used to determine whether a proposed engineering service is a like-for-like replacement or a configuration document change is required.

To assess the licensee engineering involvement on the resolution of the plant technical issues, the inspector attended one of the routine meetings that the licensee conducts to resolve technically complex issues. In this particular meeting, several engineering issues were discussed in technical and regulatory detail. The inspector noted that the plant engineers present in the meeting were cognizant of issues affecting the daily operations of the plant, for example:

Issue No. IR1-011-016 was discussed in detail. This issue addressed the Westinghouse's Nuclear Safety Advisory Letter No. 96-003 that identified a potential for voiding in the containment fan coolers (CFCs) during a loss of coolant accident (LOCA) coincident with a loss of off-site power (LOOP). It appeared that initially this issue was not adequately addressed, because the potential of a water hammer scenario in the CFCs and in the component cooling water (CCW) resulting from the potential voiding in the CFCs was not analyzed by Westinghouse. Further into the meeting's discussions, it became evident that other utilities performed an in-depth analysis with a recommended corrective action(s). One of them consisted of pressurizing the surge tanks to 20 psig to prevent voiding and thereby avoiding the potential of water hammer in the CFCs or the CCW piping.

The inspector asked the licensee about a possible corrective action or an action plan to be applied to Calvert Cliffs, and the licensee stated that they would evaluate the specific scenario to determine if the potential existed to void the CFCs during a transition from normal operations to post accident mode. If, as a result of this evaluation, the CFCs are determined to be susceptible to water flashing, an effort would be made to quantify this effect.

If the CFCs were determined to be susceptible to water flashing, a water hammer analysis would be pursued to determine the impact of the steam voids on system performance.

Compensatory and corrective measures would be taken if the results from the water hammer analysis indicated that the steam voids would challenge the ability of the CFCs to perform its design function.

Issue Report IR-042-701, dated August 9, 1996: This issue report documented the problem of missing welds for guide blocks of the foundation pedestal of the Auxiliary Feed Pump (AFP) Numbers 11 and 12. In the installation of Terry Steam Turbines for AFP pumps, a sliding support is used under the governor and pedestal to provide for axial expansion and movement of the casing. Two steel blocks are welded to the base pedestal pad parallel to the machined sides of the turbine pedestal. A clearance is required on each side of the guide block to allow for movement. The turbine pedestal is held in place by means of hold-down bolts in such a manner that the pedestal is permitted to slide between the two guide blocks.

AFW Pump Turbines 11 and 12 were overhauled in the refueling outage of the summer of 1996. To facilitate the overhaul, the turbines were removed from the support base, and the welded guide blocks were removed from the base. The removal of the turbine was covered by the maintenance order (MO) issued for the turbine overhaul. By review of documentation and discussions with cognizant personnel regarding this IR, the inspector determined that following the overhaul, the turbines were reinstalled without guide blocks welded to the base plate. Welded guide blocks were included in the original design of the turbine to assure seismic qualification of the AFW pumps.

The pumps were tested and declared operable for entry into Mode 3. Although the welding was required and indicated on the applicable drawing for the guide blocks, the inspector was informed that it was intentionally left out based on "informal" e-mail advice of the responsible system engineer to the maintenance personnel. The rationale was that the blocks served no function in the operation of the turbine and pump. The elimination of welds from the guide block effectively changed the installed configuration of the turbines, thus, in effect, implementing a design change/modification without proper analysis, evaluation, and approval. The plant operated in Mode 3 or greater with the guide blocks unwelded, until its discovery on August 8, 1996. Furthermore, the discovery of this unauthorized design change did not occur due to any formal procedural control review, safeguard, or checks; rather, it was discovered during an informal conversation between maintenance and quality verification (QV) personnel. When QV consulted the system engineering work group leader regarding this omission, the group leader indicated that there was no operability concern, because he was under the impression that the unwelded configuration had been approved. Additionally, when this issue was brought to the attention of the shift supervisor, he agreed that the matter could wait until the next day when the system engineer would be available for review of the issue. The following day, it was determined that the turbine pedestal configuration with missing welds had been neither reviewed nor approved by the "responsible design

organization" (RDO), the design engineering group on site. On further inquiry by the licensee regarding this discrepancy, the vendor indicated that, according to their records, the welded guide blocks were necessary to maintain the seismic qualification of the equipment. Once the above information was assembled, the shift supervisor (SS) was notified of the unqualified equipment in the AFW system. The SS immediately declared the AFW turbine pump "inoperable," and implemented the appropriate action statements (LCOs) required by the unit technical specifications (TS). On the same day (August 9, 1996), the guide blocks were welded back to the pedestal base, and the plant exited the LCO action statement. The plant was in LCO for approximately six (6) hours. Also, according to the licensee, the plant had operated for approximately 17 days in Mode 3 or better.

However, after the identification and correction of the deficiency, the licensee's design engineering organization initiated a study and analysis to determine the seismic adequacy of the turbine pump, without welded guide block. The licensee's evaluation, which was supported by a detailed calculation (CA03402, Rev. 0), concluded that the pumps were "functional" for intended service without the welded guide block. The engineering analysis and calculations indicated that the taper pin at the coupling would withstand all loading conditions (seismic, thermal) without deformation, because the stresses in the pips would be less than allowable; thus, the turbine was not expected to move under these stresses.

It, therefore, was concluded that the pumps remained "functional" to perform the intended design service; hence, plant safety was not compromised during the discrepancy. The inspector reviewed the evaluation and the supporting calculations and found it to be acceptable.

Although the plant safety was not compromised, the above incident disclosed a weakness in the licensee's management controls applied to the engineering design change/modification, and maintenance programs. The failure of the established and approved procedural controls was not an isolated oversight in one area or one function; rather, it involved: (1) Plant Engineering department as the system engineer, without authority, informally directed the maintenance to delay welding required by approved design, thus effectively implementing a "defacto modification" as defined in ES-1-100; (2) the Maintenance accepted such informal advice to override the documented requirements of approved technical manual and applicable design drawings; and (3) tag-out was cleared, and the plant was placed in Mode 3 by the Operations Department.

The above incident indicated that the licensee's management controls were not effective, e.g., the controls provided by Procedures E-1-100; MD-1-100-; reviews by Plant Engineering supervisor and Design Engineering supervisor; and OP-6 reviews by Maintenance general supervisor, Operations post-maintenance test coordinator, or the senior reactor operator did not identify, control, and prevent the occurrence.

The failure of the management controls in the design control area is a violation of 10 CFR 50, Appendix B, Criterion III; the failure of the maintenance organization to assure that the configuration of the equipment met the approved design drawing (welded guide blocks); and the operations clearing tag-out is a violation of Criterion V, which requires that activities affecting quality shall be accomplished in accordance with instructions, procedures, or drawings (VIO 96-09-01).

c. Conclusion

The inspector concluded that the violation identified above was isolated. Overall, the licensee's engineering program was effective in identifying and resolving technical issues; the licensee's engineers engaged in this discussion were knowledgeable; and they articulated the safety significance and the consequences of postulating cases towards the resolution of technical issues. The exchange of engineering ideas and concepts in the meeting was evidence of a good engineering involvement in the resolution of plant issues.

E1.4 Licensee's Control on Engineering Activities, Self-Assessment, and Corrective Action Program.

a. Scope

The scope of this inspection was to review and assess the effectiveness of the licensee's root cause determination and corrective action program. The NRC had reviewed the self-assessment program in an earlier inspection (95-10) and had been found to be effective.

b. Observations

The evaluation of root cause determination and the corrective action program was performed by review of issue reports (IRs), the primary document for problem reporting and resolution, and the LER submitted to the NRC for reportable occurrences. This review was done in conjunction with the other aspects of the engineering review performed during this inspection.

The inspector noted that there was a detailed procedure (PEG-6, Rev. 4) documenting the philosophy and guidelines for performing root cause analysis by Plant Engineering personnel. The procedure clearly provided guidelines as to how these analyses would be assigned, performed, statused, reported, and approved using plant engineering section (PES) corrective action data base.

The inspector reviewed the root cause analyses performed for LER and determined that the analyses were detailed, thorough, and of high technical quality. In addition to the LERs, the sample of IRs, which required root cause determination, was selected to assess the thoroughness of the analysis and the effectiveness and validity of the corrective actions recommended by the analyses. The closed corrective action document from the PES data base indicated excellent technical analyses and evaluations and effective corrective actions.

The inspector also reviewed and assessed the licensee's issue report (IR) process and implementation focusing on the technical adequacy of its dispositions and the timing of reportability if applicable. The inspector reviewed a number of IRs and noted that there is a multilevel of checks and balances especially when the IRs involve a reportability issue. These IRs lead into licensee event reports (LERs). The reviewed LERs were found thorough and technically excellent.

A typical LER process starts with the generation of an issue report (IR). An IR can be originated by anyone in the plant stating a concern or an observation. The IR initiator and his supervisor reviewed the issue to determine if a concern existed in any of the following areas: personnel/equipment safety, operability, reportability, and potential trip hazard. The initiator attached an evaluation of the issue to the issue report, which includes information supporting operability of the structure system or component in question. In cases that reportability is established, the IR is taken to the on-duty senior shift supervisor in the control room. The shift supervisor completes Attachment 1, "Nuclear Operations Checklist for Timely Notification," and completes a 10 CFR 50.72 verbal notification to the NRC Operations Center.

The inspector reviewed a sample of LERs with the following observations: The abstract is limited to 1400 spaces (i.e., approximately 15 single-space typewritten lines) of the reviewed LER abstracts were found clear and in adequate detail sufficient to form a good concept of the problem in hand. The description of the event, the root cause analysis, and recommended corrective action were found to be written with technical know-how and in sufficient detail.

c. Conclusion

Based on the sample of issue reports (IRs) reviewed, the inspector concluded that the IR process at Calvert Cliffs is carefully implemented and it has a number of checks and balances; especially, for those IRs that lead to a licensee event report (LER). The reviewed LERs were found to be prepared in an excellent manner.

L1 Review of UFSAR Commitments

A recent discovery of a licensee operating their facility in a manner contrary to the Updated Final Safety Analysis Report (UFSAR) description highlighted the need for a special focused review that compares plant practices, procedures and/or parameters to the UFSAR descriptions.

While performing the inspections discussed in this report, the inspectors reviewed the applicable portions of the UFSAR that related to the areas inspected. The inspectors verified that the UFSAR wording was consistent with the observed plant practices, procedures and/or parameters.

X1 Exit Meeting Summary

During this inspection, periodic meetings were held with station management to discuss inspection observations and findings. September 6, 1996, an exit meeting was held to summarize the conclusions of the inspection. BGE acknowledged the findings presented.

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