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REGION I

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LICENSE NOS. DPR-53
DPR-69

LICENSEE: Baltimore Gas and Electric Company

FACILITY NAME: Calvert Cliffs, Units 1 and 2

INSPECTION AT: Lusby, Maryland

INSPECTION DATES: January 10-14, 1994

INSPECTOR: _____ 01/26/94
Joseph E. Carrasco, Reactor Engineer Date
Materials Section, EB, DRS

APPROVED BY: _____ 1/28/94
for Michael C. Modes, Chief Date
Materials Section, EB, DRS

Areas Inspected: A safety inspection was conducted to determine whether the licensee's provisions for the analysis, design and construction of a safety-related building and a station blackout building for diesel generators at the Calvert Cliffs Nuclear Power Plant are being performed in accordance with recommended engineering practices and regulatory requirements.

Results: The work plans and the inspection records (WP&IR's) were found to be adequate for civil work (see NRC Inspection Report 93-14). The contractor stated that for later phases of the project (e.g., electrical and mechanical work inside the building) the WP&IR's shall be more detailed. The amount of detail will be commensurate with the complexity of the task being performed. Further, the inspector noted that the weekly monitoring of building settlement showed that the settlement was negligible.

In terms of mechanical equipment and piping, the inspector found the sample of calculations supporting the design of the equipment foundation to be acceptable and conservative. Further, based on the sample review performed for the pipe stresses and the pipe supports, it appears that the pipe stress and pipe supports are being properly analyzed and designed. The licensee's stress analysis and design personnel displayed acceptable technical expertise, design experience, and inter-discipline communication skills. However, it is the understanding of the NRC that the licensee will continue to review the calculations to ensure their technical adequacy.

DETAILS

1.0 PURPOSE AND SCOPE

The purpose of this safety inspection was to determine whether the licensee's provisions for the analysis, design and construction of a safety-related building and a station blackout (SBO) building for diesel generators at the Calvert Cliffs Nuclear Power Plant are being performed in accordance with recommended engineering practices and regulatory requirements.

2.0 BACKGROUND

The licensee initially responded to the requirements of the station blackout rule (10 CFR 50.63) by committing to install two safety-related diesel generators. By letter, dated February 12, 1991, the NRC accepted this concept.

In a letter, dated July 7, 1993, the licensee revised its commitment and proposed to construct one safety-related and one nonsafety-related diesel generator building. In a Supplemental Safety Evaluation (dated September 22, 1993), the NRC staff determined that the licensee's revised Station Blackout (SBO) submittal provides an acceptable means for coping with an SBO event and, therefore, is acceptable.

3.0 PROJECT STATUS

The inspector performed a walkdown of the project and noted that the licensee's scheduled goals of 1993 were met.

- The most significant accomplishment was the completion of the roof structural steel and metal decking. The safety-related building is now completely enclosed, which will enable the licensee to continue work during adverse weather conditions.

- The inspector noted substantial progress of the work below grade walls on the station blackout building.

- The fuel oil tank was being welded in-situ next to the safety-related diesel generator building under adequate supervision of the licensee's contractor quality control personnel.

No deficiencies were observed and the building appeared to be structurally sound and well built.

4.0 REVIEW OF THE PROJECT'S QUALITY VERIFICATION ACTIVITIES

The inspector reviewed audits of the licensee's contractor by licensee personnel, and interviewed licensee engineers and quality verification personnel. The inspector found that the activities connected with this construction phase of the diesel generator project are being conducted in accordance with the contractor's quality control program which meets the applicable requirements of 10 CFR 50, Appendix B.

During the inspector's review of the licensee's self-assessment documentation, the inspector noted several licensee self-identified findings. Based on the safety significance of those findings, the inspector selected two for followup, with the following details:

- The review performed by the licensee's QA personnel on the nonconformance reports (NCRs) generated by the contractor indicated an apparent lack of root cause analysis and preventive action. The inspector verified that the licensee had properly implemented corrective action by revising Procedure No. QCI 0601A, "Processing of Nonconformance Reports."

  In Revision 1 to this procedure, the licensee incorporated Section 12, "Corrective Action," which instructs the Project quality control (QC) Engineer to route each NCR to the appropriate organization for investigation of the cause. The inspector concluded that the revision to the procedure coupled with a trained person performing the root cause investigation will enable the licensee to perform root cause analysis and preventive action for the proper disposition of the NCRs. The inspector determined that the licensee's corrective action is appropriate.

- Another self-identified concern by the licensee was that work plan and inspection records (WP&IR's) did not appear to be sufficiently detailed to ensure that all requirements are properly met during accomplishment of the work.

  Through a series of interviews with licensee personnel, the inspector determined that for this phase of construction (which is basically soil excavation, foundations, and concrete work) the amount of information shown on a typical WP&IR is adequate and sufficient to execute the work. For example:

  a) the placement of reinforcing steel (rebar) may be indicated in detail in one area of the drawing because the same rebar arrangement is typically repeated in other areas of the structure.

  b) this phase of construction involved massive placement of concrete and, because each placement is typical, one set of instructions can be used for subsequent placements.

Based on these findings, the inspector considered the WP&IR's to be adequate for civil work (for more detail on WP&IR's, see NRC Inspection Report 93-14). The licensee's contractor stated that for later phases of the project (e.g., electrical and mechanical work inside the building) the WP&IR's shall have an amount of detail commensurate with the complexity of the task being performed.

Conclusion

Based on interviews with the licensee's contractor and previous NRC Inspections regarding WP&IR's, the inspector found that the WP&IR's are adequate for this construction phase.

5.0 REVIEW OF THE IMPLEMENTATION OF 10 CFR 50.59 SAFETY EVALUATIONS

The inspector verified that the licensee has performed an internal assessment to ensure that the requirements of 10 CFR 50.59 are being met for the diesel generator project. By reviewing the licensee's self-assessment, the inspector noted that, with the exception of one commitment, the requirements of 10 CFR 50.59 and the licensee's commitments in the safety evaluations were met. The one exception was commitment No. 3, which states that the site erosion and sediment control plan will be maintained throughout the duration of construction. The licensee's self-assessment indicated that the contractor has not monitored and documented the structure's settlement on a weekly basis. During this period, it was reported that the safety-related diesel generator building had settled 1/8" since the original elevation was taken.

The inspector discussed this finding with the licensee contract personnel who stated that, although the monitoring of building settlement was not prescribed in the safety evaluation, it was incorporated in the "Diesel Generator Project, Construction Scope," Revision 1, Section 2.1.1.b. The licensee initiated corrective action, and the inspector verified its implementation. In particular, the inspector verified that data sheets existed showing monthly monitoring of the building. Further, the contractor initiated weekly monitoring of the building during the week of November 29, 1993, and performed the monitoring in accordance with Procedure No. G-006 (Rev. 0). The inspector noted that the weekly monitoring of the building settlement showed that the settlement was negligible. The inspector had no further questions in this matter.

6.0 REVIEW OF THE CIVIL/STRUCTURAL AND MECHANICAL DESIGN

Equipment Foundation Status

The inspector reviewed and discussed with the design engineers the status of the foundation design. Approximately 100 pieces of equipment are to have foundation design. The design personnel indicated that the design completed to date includes the non-Category I tank at

elevation 35'-6" and the safety-related battery racks at elevation 66'-6". A licensee engineer indicated that the electrical equipment in the control room area at elevation 45'-6" is scheduled to be designed next.

Seismic Gap Between Buildings

The inspector requested information regarding the 3-inch seismic gap between the safety-related and the SBO buildings. The inspector noted that a 3-inch gap was originally intended for two safety-related buildings with rigid reinforced concrete shear walls. In response, the licensee's design consultants indicated that, with the use of a more flexible steel framed SBO building, the 3-inch gap was maintained for the foundation, but seismic gaps of 4-inch and 6-inch were used at SBO building elevations 66'-6" and 83'-0", respectively. The inspector had no further questions in this matter.

Battery Rack Mounting

The inspector reviewed the battery rack mounting (Calculation D-C-93-100, Revision 0) as follow:

- The use of equivalent static analysis. In this analysis, the 1.5 amplification factor is properly used to generate the design forces. This factor was multiplied by the peak acceleration obtained from the applicable response spectra, with the upper floor acceleration to be used for wall-mounted equipment.

- The proper damping factors were used in accordance with Regulatory Guide 1.61.

- Safe Shutdown Earthquake (SSE) loading was used conservatively with the pertinent normal allowable stress.

- Co-directional responses were combined by square-root-of-sum-of-squares (SRSS) method.

- Factor of safety of 4 on test values for expansion anchors were used, consistent with NRC Bulletin 79-02.

- Results show that significant margin remains.

Conclusion

Based on the verification of the key points described above, the inspector concluded that Calculation D-C-93-100 (Rev. 0) supporting the design of the equipment foundation is acceptable and conservative. The inspector had no further questions in this regard.

7.0 REVIEW OF THE PIPE STRESS AND THE PIPE SUPPORTS

The inspector discussed the scope of the pipe stress with the responsible design engineer. The systems that encompass the mechanical piping for this project are the Lube Oil Drain System, Cooling Water System, Fuel Oil System and Fuel Oil Storage and Transfer System.

One calculation, D-M-93-264, was selected for review in detail. This calculation is a pipe stress analysis for the Fuel Oil Storage & Transfer System. The stress isometric number is 91-644-H, sheet 5 which was reviewed to ensure that the proper geometry was incorporated into the mathematical model used in the analysis.

The inspector noted that the correct analytical assumptions were made to obtain an accurate and realistic mathematical model for the stress analysis. For example, since the Fuel Oil Storage Tank is not rigid, this tank is modeled together with the piping system. It was also noted that the tank was mathematically modeled previously by the vendor. This model was easily coupled with the piping model. The inspector verified that, based on this model, stresses due to weight, thermal, and seismic effects were evaluated for this piping system.

The inspector verified the loads and load combinations to ensure the following:

- Weight analysis included the weight of the pipe, flanges and other components at the pertinent locations.

- Two thermal cases were considered (one with a maximum temperature of 120 degrees F and another with a minimum temperature of 15 degrees F - 1st and 2nd levels/0 degree F - 3rd level.

- The seismic analysis was performed for the Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE). The proper response spectra were used at the corresponding elevations.

- The nozzle loads were reviewed to ensure that the loads were within the vendor's recommended allowable.

- The flanges were evaluated to meet the ASME Code allowable.

- The piping movements at the wall penetrations were clearly listed for the design of the penetrations.

- The maximum resultant pipe stresses were extracted from the computer output and checked with the ASME Code allowable. These resulting stresses were within the Code allowable.

In terms of the design of the pipe supports, the inspector reviewed a limited sample of supports. These supports were designed with the aid of a computer. The program used to analyze the supports is a standard frame analysis program. The computer program was discussed with licensee personnel in detail to ensure that it has adequate capability for frame analysis. Support attributes examined were mathematical model, code check, joint weld analysis, and local stress calculations. A sample of typical input data (such as joint configurations, joining structural members and weld analysis at specific joints) were reviewed and, in addition, the results were found to be within Code allowable.

Conclusion

Based on the limited sample review performed for the pipe stresses and the pipe supports, the inspector concluded that the pipe stress and pipe supports are being properly analyzed and designed. The licensee's stress analysis and design personnel displayed acceptable technical expertise, design experience, and inter-discipline communication skills. However, it is the understanding of the NRC that the licensee will continue to review the calculations to ensure their technical adequacy.

8.0 MANAGEMENT MEETINGS

Licensee management was informed of the scope and purpose of the inspection at an entrance meeting for the inspection. The findings of the inspection were discussed with licensee management at an exit meeting on January 14, 1994. See Attachment 1 for attendance.

ATTACHMENT

Persons Contacted

Baltimore Gas and Electric Company

*	D. V. Graf	Manager
*	M. J. Gahan	Principal Engineer, CEU
*	M. D. Milbradt	Compliance
*	A. R. Thornton	Manager DGP
*	C. R. Mahon	Integration Manager DGP
*	G. J. O'Connell	Sr. Civil Engineer
*	E. F. Wasson	DGP

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	P. R. Wilson	Senior Resident Inspector
*	H. K. Lathrop	Resident Inspector

* denotes those present at the exit meeting.