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January 30, 1991

Mr. Roy Zimmerman, Director
Division of Reactor Safety and Projects
U. S. Nuclear Regulatory Commission
1450 Maria Lane, Suite 210
Walnut Creek, California 94596-5368

Dear Mr. Zimmerman:

Subject: Docket Nos. 50-206, 50-361 and 50-362
Application of Edison's Root-Cause Determination Program
San Onofre Nuclear Generating Station

In a letter to Mr. Jesse Crews dated October 27, 1989, I discussed changes in, and increased formalization of, the Southern California Edison program at San Onofre for the determination of the root-causes of events and conditions which are potentially adverse to quality and safety. The necessary staffing and program development was completed at mid-year 1990, and the program has been fully implemented yielding several important results already.

The purpose of this letter is to summarize for your information my present assessment in this regard and the lessons-learned for future use.

ASCO Solenoid Valve Failures

During the ongoing refueling outage at Unit 1, one of seven normally energized ASCO Model 206-380 solenoid valves failed to stroke properly during test. (Two of the total of nine valves were removed without test for further study.) This failure occurred despite prior efforts by Edison to identify and correct the cause of unreliable operation of these valves. These efforts are briefly summarized as follows:

- o During 1987, as reported in LER 1-87-16, these valves were found to function unreliably following periods of operation in the normally energized condition. Our evaluation traced the problem to the formation of a thin, adhesive film on the top of the solenoid slug.

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- o Initial discussions with the manufacturer did not disclose the source of the material which formed this film. As they appeared to function reliably following cleaning to remove the film and any other foreign material, the valves were allowed to remain in service.
- o Subsequently, ASCO advised Edison that Dow Corning 550, which is used in the initial assembly and break-in of the valves, was the source for the formation of the adhesive film. Edison confirmed this information and concluded that the valves would operate reliably with the Dow Corning 550 removed from the area where it would form the offending adhesive film. (Minimum lubricant continued to be used, as required, to install O-rings when assembling the valves following maintenance.)
- o Unreliable valve function occurred again in December 1988 and June 1989. Following investigation, Edison attributed these recurrent problems to the continuing formation of the adherent film due to incomplete removal of excess lubricant. The valves were very carefully cleaned and inspected, and they were again returned to service. However, quarterly stroke testing was also implemented for seven of the nine valves which could be stroked with the unit at power, and the other two valves were scheduled to be tested when plant conditions permitted.
- o Notwithstanding their careful cleaning and inspection, CV-82 failed to stroke properly when tested during the current refueling.

Our formalized root-cause program was applied to the CV-82 failure with the following results:

- o It was determined that the temperature distributions which exist in the normally energized application will result in the transport of any lubricant which exists within the solenoid to the area where the adherent film forms that interferes with reliable function. Therefore, prior efforts to ensure removal of the lubricant from this area were not entirely effective.
- o The design margin in the force which strokes the valve upon deenergization is inadequate to overcome even a trace of adherent film in a critical area.

Based on these findings, all nine of the valves have been removed from service and replaced with functionally equivalent components with substantially greater design margin. We now expect these valves to perform reliably.

This experience provided us with an example in which the increased formality and multi-disciplined, rigorous evaluation process provided by our improved program identified the fundamental causes of unreliable component operation which had not been identified by prior, more narrowly based and executed evaluations.

Unreliable TDAFWP Operation

The Unit 2 Turbine-Driven Auxiliary Feedwater Pump (TDAFWP) experienced unreliable operation in October 1990. The causes and circumstances of this event, including our delay in identifying the root cause, are discussed separately in Edison's response to a Notice of Violation issued by NRC letter dated January 4, 1991.

Since the event occurred after our improved program had been implemented, we have evaluated why it did not respond to the first indication of TDAFWP unreliability with a sufficiently thorough evaluation to promptly identify the root cause. We have concluded that this resulted from a management failure to recognize the importance of a more broad-based and formal evaluation at the first indication of a problem with the TDAFWP.

Incorrect Assembly of Valve CV-518

The incorrect assembly of Unit 1 containment spray system orifice bypass valve CV-518 was identified as a result of a flow test performed during the current outage. The valve operator was not properly aligned with the actual position of the valve. Event causes and corrective actions will be addressed in LER 1-91-001.

This incorrect assembly is a significant event which has been subjected to thorough evaluation by our improved program, and the results will be summarized in the LER. Among the inputs to this evaluation is a Maintenance Incident Investigation Report (MIIR) which discusses an apparently similar incorrect assembly of a functionally identical valve, CV-517. The incorrect assembly of CV-517 occurred, and was recognized and corrected, at the same time in 1989 that the CV-518 event began, yet CV-518 was not then identified and addressed.

In the case of CV-517, the MIIR was evidently generated and processed for the necessary, but too limited, purpose of ensuring revision of the applicable maintenance procedure. Collateral considerations were not addressed, and the incident investigation process at the time did not go significantly beyond the procedure revision tracking function.

Mr. Roy Zimmerman, Director

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Conclusion

Our improved root-cause determination program has worked successfully to identify and correct a number of important problems which were adverse to quality and safety, other than those discussed above (e.g., steam generator feeding failures). The examples above represent cases where the evaluation performed initially was unsuccessful because it was too limited, too informal and/or lacked necessary technical or human performance expertise.

I am confident that the resources and program we now have in place will prevent repetition of unsuccessful evaluations, such as those above. If you have any questions or comments, or if you would like additional information, please let me know.

Sincerely,

R M Beal
to H. A. Roy

cc: Mr. John B. Martin, Administrator, USNRC Region V
Mr. C. W. Caldwell, USNRC Senior Resident Inspector, SONGS
Mr. L. E. Kokajko, Project Manager, SONGS 2 and 3