Southern California Edison Company

P. O. BOX 800
2244 WALNUT GROVE AVENUE
ROSEMEAD, CALIFORNIA 91770

July 24, 1980

Director of Nuclear Reactor Regulation
Attention: D. M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
Failure of the Salt Water Cooling System
San Onofre Nuclear Generating Station
Unit 1

By letter of June 20, 1980, you requested that we provide certain information concerning failure of the Salt Water Cooling System of San Onofre Nuclear Generating Station Unit 1. The enclosure to this letter transmits the responses to Items 1, 2, and 3, of your letter concerning the operating history of the Salt Water Cooling System. Item 4 of your letter involves analysis of the performance of the Component Cooling Water System during a loss of coolant accident with failure of the Salt Water Cooling System as well as a review of procedural action, thus requiring considerably more time for preparation of a reply. As agreed in a telephone discussion on July 1, 1980, the response to Item 4 of your letter will be submitted by August 4, 1980.

If you have any questions or desire additional information concerning the enclosure, please contact me.

Very truly yours,

J. G. Haynes

J. G. Haynes
Chief of Nuclear Engineering

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Enclosure

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ENCLOSURE
SALT WATER COOLING SYSTEM FAILURE

Item 1. The south pump, G-13B, shaft failed due to apparent excessive vibration resulting from worn bearings.

Question: A. Was the vibration noticed by the auxiliary operators in the course of shift tours? How often do they tour this area? Are vibration measurements made on these pumps?

Response: The Plant Equipment Operator is required by Operating Instruction to tour this area twice in each eight hour shift. A review of maintenance records on this pump over the last year and discussions with operators reveal that excessive shaft vibration was not noticed or reported prior to the failure. However, on 10 occasions during the 8 months preceding the failure, operators turned in maintenance requests for repair of excessive packing leakage. On two of these occasions, maintenance reported that packing leakage was due to probable bearing or bushing wear inside the pump. The leakage was not considered severe enough to result in taking the pump out of service.

The saltwater cooling pumps are of the vertical turbine type with submerged inaccessible pump bearings. The pumps' bearings are in the motors; however, the motor housing must be disassembled to gain access to the bearings. Our September 4, 1979 letter submitted revisions to the Inservice Pumps Testing Program, including a detailed request for relief from specific code requirements, which was initially submitted by our September 28, 1977 letter as required by 10 CFR 50.55a(g). In particular, our September 4, 1979 letter requested relief from the monthly measurement of pump vibration based on the inaccessibility of the bearings; however, we committed to perform the monthly measurement of motor thrust bearing temperature and lubricant level for which we had previously sought relief as part of our September 28, 1977 letter. We stated that these measurements will provide adequate indication of bearing condition and that they would be incorporated into station procedures following your review and approval.

In order to help prevent failures of this type, thrust bearing temperature, lubricant level, and shaft vibration measurements will now be taken on a monthly basis during normal plant operation. These vibration measurements must be taken at the coupling between the pump shaft and motor; however, it is expected that these measurements, as well as the thrust bearing temperature and lubricant level measurements, will assist in identifying conditions which might be indicative of thrust bearing damage.

As discussed in the response to Item 1, Question B below, preventive maintenance procedures for these pumps are in the process of being formulated. These procedures will address excessive packing leakage as discussed above and will indicate that such leakage is due to probable bearing or bushing wear inside the pumps requiring corrective actions.

Question: B. When was the last time, previous to this event, that the bearings and shaft were inspected? How often is this performed? What were the manufacturer's maintenance recommendations in this regard?

Response: During the refueling outage of September - October 1978, the south saltwater cooling pump was completely overhauled by the manufacturer. This was the last time the bearings and shaft for this pump were inspected. A new shaft and bearings were installed at that time. As discussed in the response to Item 1, Question C below, the bearings and shaft of the north saltwater cooling pump were last inspected in March, 1975 following the replacement of a broken pump shaft. This type of overhaul and/or inspection, if determined to be necessary, is usually scheduled to be performed during refueling outages. Based on a review of the manufacturer's literature and recent discussions with representatives of the manufacturer, there are no required or recommended maintenance intervals. However, notwithstanding the manufacturer's recommendation, preventive maintenance procedures are in the process of being formulated. The procedures will be implemented prior to resumption of plant operation following the current refueling outage.

Question: C. Have you experienced any similar failures of pump bearings or shafts?

Response: The only failure on a similar system took place in March 1975; the north saltwater cooling pump experienced a broken pump shaft during normal plant operation. This failure was due to fatigue from excessive vibration resulting from worn shaft bearings. Other failures have been experienced on non-similar systems for different applications and are therefore not included.

Item 2: We understand that the failure of POV-5 to open at the discharge of the north pump was caused by a deteriorated O-ring in the ASCO solenoid valve supplying air to the valve operator.

Question: A. When was the last time, previous to this event, that the O-ring was inspected or replaced? What was the manufacturer's recommendations in regard to O-ring inspections or replacements?

Response: A review of past records indicates that the only maintenance requested on this ASCO solenoid valve was in June, 1972. It appears that this was the last time that the O-ring for this valve

was inspected or replaced. However, since the failure, the entire solenoid valve has been replaced. At the time of the failure, the manufacturer had no recommendations in regard to O-ring inspection or replacement. Since the failure, we have obtained from the manufacturer a recommendation which we are now in the process of evaluating. Prior to resumption of plant operation following the current refueling outage, preventive maintenance procedures for these valves will be formulated and implemented.

Question: B. Had you experienced any previous difficulty in the operation of this valve or other similar valves and if so what were the corrective measures needed?

Response: This type of valve had occasionally exhibited sluggish behavior. The manufacturer indicates that sluggish behavior indicates that cleaning is required. We had always been able to restore operation of the valve simply by manually opening and closing it a few times. It should be noted that it is not possible to determine whether the failure of POV-5 was related to the dessicant problem which has been experienced in other valves at San Onofre Unit 1 since the investigation into the failure was not directed at identifying the presence of dessicant in the line and any evidence of such has now been destroyed.

Question: C. How often is the non-operating pump placed in service?

Response: The operation of the salt water cooling pumps is rotated on a weekly basis under existing administrative controls.

Question: D. How often is the automatic start of the pumps tested?

Response: The automatic start of the pumps is tested monthly under existing administrative controls.

Item 3. We understand that the loss of pumping capability of the auxiliary saltwater cooling pump was caused by a leak in the suction line which allowed air into the line so that the pump lost its prime.

Question: A. When was the last time, previous to this event, that the auxiliary saltwater pump was operated? How frequently is it operated?

Response: The auxiliary saltwater cooling pump was operated on March 10, 1980, several hours before the event. This pump is operated on a weekly basis under existing administrative controls. Since the event, this pump had been tested daily during low tide conditions until the present outage made it unnecessary to do so. Since then, it has been determined that there is no correlation between low tide and loss of prime. Weekly testing of this pump will be resumed upon return to service.

Question: B. Was the leak associated with a gasket or seal? How often are gaskets or seals inspected and/or replaced?

Response: Problems with the auxiliary saltwater cooling pump priming system have been associated with gasket and seal leakage as well as the air release valve sticking in the prime line. The priming system operates by passing an air flow through an eductor to draw air out of a vacuum tank. This provides a vacuum to draw priming water up into the pump. The tank vacuum is monitored by a pressure switch which opens a valve that causes air to flow through the eductor. A strainer on the suction line is installed in a suction tee with a removable blind flange to facilitate cleaning. The gasketed flange joint between the suction tee and blind flange has been one source of vacuum leaks. The pump shaft seal packing, priming system valves, vacuum tank gage glass and the threaded piping joints have also been sources of vacuum leaks. The air release valve has stuck occasionally, either isolating the pump or allowing water to fill the vacuum tank. This system is in the process of being upgraded to correct the above deficiencies, and should be completed during the current refueling outage.

At present, all maintenance, including gasket and gear replacement is done on an as-needed basis. However, preventive maintenance procedures for this pump as well as its priming system are in the process of being formulated. The procedures will be implemented prior to resumption of plant operation following the current refueling outage.