UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE INSERVICE TESTING PROGRAM

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-275 AND 50-323

1.0 INTRODUCTION

The Code of Federal Regulations, 10 CFR 50.55a, requires that inservice testing (IST) of certain American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 pumps and valves be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code (the Code) and applicable addenda, except where alternatives have been authorized or relief has been requested by the licensee and granted by the Commission pursuant to Sections (a)(3)(i), (a)(3)(ii), or (f)(6)(i) of 10 CFR 50.55a. In proposing alternatives or requesting relief, the licensee must demonstrate that (1) the proposed alternatives provide an acceptable level of quality and safety; (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; or (3) conformance is impractical for its facility. Section 50.55a authorizes the Commission to approve alternatives and to grant relief from ASME Code requirements upon making the necessary findings. NRC guidance contained in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," provides alternatives to the Code requirements determined acceptable to the staff. Alternatives that conform with the guidance in GL 89-04 may be implemented without additional NRC approval, but are subject to review during inspections. GL 89-04, Supplement 1, and NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," give further guidance. The NRC staff's findings with respect to authorizing alternatives and granting or not granting the relief requested as part of the licensee's IST program are contained in this safety evaluation.

2.0 BACKGROUND

In a letter dated February 16, 1996, Pacific Gas and Electric Company (PG&E), licensee for the Diablo Canyon Power Plant (DCPP), Units 1 and 2, submitted a request for approval of an alternative related to the Inservice Testing Program for Pumps and Valves. Specifically, Relief Request P-RR-3 for the second ten-year interval for both units and P-RR-10 for the remainder of the Unit 2 first ten-year interval which proposes a change in the testing of the centrifugal charging pumps in the chemical and volume control system. The licensee requested a response from the NRC by March 1, 1996, based on the next quarterly test schedule. The second ten-year interval for Unit 1 began January 1, 1996, and for Unit 2 will begin June 1, 1996, with the IST program

developed to the requirements of the 1989 Edition of the ASME Code (1988a OM Standards) as required by 10 CFR 50.55a(f)(4). IST for the remainder of the Unit 2 first ten-year interval is conducted in accord with Subsection IWP of the 1977 Edition, Summer 1978 Addenda, of the ASME Code. The staff has evaluated the proposed alternative and the results are given below.

3.0 RELIEF REQUEST P-RR-3 (P-RR-10)

Both the OM Standards (1989 Edition of the ASME Code) and Subsection IWP require that for pump IST the resistance of the system be varied until either the flow rate or the differential pressure equals the reference value and then the other is measured and compared to its reference value. Recognizing that not all plant designs included flow paths for quarterly pump testing where the flow rate could be measured, the NRC issued Position 9 in GL 89-04 giving guidance on pump testing using minimum-flow return lines with or without flow measuring devices. Position 9 indicates that for those pumps which cannot be tested quarterly with flow measurement, a full-flow test during cold shutdown or refueling outages is an acceptable alternative to the Code requirements. This relief request involves an alternative to the Code requirements that follows the guidance in Position 9 with some variation. The affected components are the two centrifugal charging pumps in both units (total of four pumps) that function post-accident to pump high-head-pressure coolant injection, boron injection, and safety injection recirculation to the reactor vessel.

3.1 Basis For Relief

The licensee states the following basis for the request:

> Technical Specification 4.0.5 states that inservice testing of ASME Code Class 1, 2, and 3 pumps, valves, and snubbers shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50, Section 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50, Section 50.55a(g)(6)(i).
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> Prior to initial startup of DCPP Units 1 and 2, PG&E had requested relief from measuring the flow rate for the centrifugal charging pumps in accordance with the requirements of Section XI of the Code. In Supplemental Safety Evaluation Report (SSER) 31, dated May 1985, the NRC provided the following response to PG&E regarding the relief request: It is the staff's position that monitoring pump differential pressure while the pumps are being tested in a fixed resistance configuration may not adequately monitor the hydraulic characteristics of these pumps and, therefore, detect possible pump degradation. Accordingly, the requested relief from the requirements of Subsection IWP of Section XI of the ASME Code was denied.

Per PG&E Letter No. DCL-86-238, dated August 12, 1986, the relief request was withdrawn. Instead of installing instrumentation for measuring the flow rate through the charging minimum-flow recirculation line, PG&E used an alternative method to test the centrifugal charging pumps. This was accomplished by closing the motor-operated isolation valves (CVCS-8195 and CVCS-8106) within the non-instrumented fixed resistance charging minimum-flow recirculation line and feeding forward through the normal injection flow path, which allows the existing flow instrumentation in the normal injection flow path to be used.

Based on recent review and evaluation of DCPP's accident analyses, this previous testing method is no longer acceptable (refer to PG&E's 1-hour, non-emergency report made to the NRC on February 1, 1996, in accordance with 10 CFR 50.72). It has recently been determined that closing the charging minimum-flow recirculation line with the plant in Mode 1, 2, or 3 would cause both trains of charging pumps to become inoperable for certain transients or accidents requiring safety injection, thus placing the plant in an unanalyzed condition.

The proposed flow path for performing quarterly centrifugal pump testing (Mode 1, 2, or 3) is through a combination of the non-instrumented, fixed resistance minimum-flow path and the normal, instrumented injection flow path. As stated in NRC Bulletin 88-04, the test point for monitoring pump performance for degradation should be in a region sufficient to prevent damage to the pump. The proposed combination of flow paths would yield a test point at a higher flow on the pump performance curve, thus providing more meaningful test data and avoiding potential pump damage. However, because the flow through the charging minimum-flow path would be unmeasurable, this testing would not be in compliance with the Code requirements for flow measurement.

NRC Staff Position 9 of Generic Letter 89-04 (or NUREG-1482) provides an alternative method for testing pumps using a minimum-flow return line without flow measuring devices. This position is applicable in cases where flow can only be established through a non-instrumented minimum-flow path during quarterly pump testing, and a path exists at cold shutdowns or refueling outages to perform a test of the pump under full or substantial flow conditions.

The PG&E proposed test differs from NRC Staff Position 9 in that only a portion of the total flow will be through a non-instrumented flow path, whereas Position 9 assumes the total flow to be through the non-instrumented flow path. Although the combination flow path does not strictly meet the guidelines of Position 9, the flow configuration PG&E is proposing to use will yield more meaningful test data to adequately monitor the hydraulic characteristics and detect pump degradation. Therefore,

under the guidance of Response 3.3-2 of NUREG-1482 (page G-23), PG&E is requesting specific NRC approval of a relief to implement this alternative to quarterly instrumented testing.

3.2 Proposed Alternative Testing

The licensee proposes:

On a quarterly frequency, pump differential pressure and vibration will be measured and trended using a combination of the non-instrumented minimum-flow path and the instrumented normal injection flow path. On a refueling frequency, a second set of reference values will be used, so that pump differential pressure, flowrate, and vibration will be measured and trended using only the instrumented flow path under full or substantial flow conditions.

3.3 Evaluation

The licensee previously tested the centrifugal charging pumps in accordance with the Code requirements by closing off the minimum recirculation flow path, which is not instrumented for flow, and measuring flow in the injection flow path. The pump minimum recirculation flow protects the pump from damage in the event that the discharge valve either fails to open or closes inadvertently when it is required to be open. Apparently, closing the motor-operated valve in the minimum recirculation flow path also has the potential to make both trains of charging pumps inoperable for certain transients or accidents that depend on injection flow. Once the licensee recognized that closing the minimum recirculation line would put the plant in an unanalyzed condition, the previous test method was no longer acceptable.

The licensee could isolate the injection line, test the pumps using only the minimum recirculation flow path, and test at higher flow with the minimum recirculation flow path isolated during refueling outages. If the licensee implemented such a test plan, it would be in accord with the situation addressed by Position 9 of GL 89-04 and would meet all of the guidance for the alternative given in Position 9. However, the licensee recognizes that testing on minimum recirculation only is more detrimental to the pump (*see* NRC Bulletin 88-04, "Potential Safety-Related Pump Loss," May 5, 1988), and gives less useful information than a test at higher flow, beyond the "flat" portion of the pump performance curve. Therefore, the licensee has proposed that for the quarterly testing, it continue to operate the pumps with flow through the injection flow path, as in the past, but without isolation of the minimum recirculation flow. In this manner, the plant will not be placed in an unanalyzed condition. In addition, the quarterly testing will be supplemented by a test during refueling outages that will specify that the minimum recirculation flow path be isolated and the actual flow measured in the injection flow path. All of the required parameters will be monitored during each test with appropriate reference values to the test.

The only other option for a more long-term approach would be to modify the plant by either (1) installing flow instrumentation in the minimum recirculation flow path, (2) replacing the minimum recirculation flow path with piping that would accommodate full system flow, or (3) modifying the control system and valve for the isolation of the minimum recirculation flow path so that it can be repositioned if an accident occurred during pump testing. Either modification would be a burden on the licensee that would not be off set by potential improvements in testing. The proposed alternative testing will meet all of the ASME Code requirements except that the portion of the flow through the minimum recirculation flow path will not be measured. That flow will, for most conditions, be the same from test to test because the flow path is a fixed-resistance path. If any blockage occurs in the flow path, the test results will most likely indicate that there is a change in the condition of the pump and actions will be taken appropriately. Testing during refueling outages can also identify slight changes in the performance of the pump and provide a means of monitoring for degradation supplemental to the quarterly testing. Therefore, the proposed alternative will provide an acceptable level of quality and safety for monitoring the condition of the centrifugal charging pumps. Testing with the minimum recirculation flow path valved in will also ensure compliance with the requirements of Technical Specification 4.5.2(f)(1) provided the pressure differential at the higher flow rate (i.e., combined injection flow and minimum recirculation flow) exceeds the 2400 psid specified minimum value.

4.0 CONCLUSION

The staff has determined that the proposed alternative to perform quarterly testing of the centrifugal charging pumps using an instrumented injection flow path and a non-instrumented minimum recirculation flow path, supplemented with a test during refueling outages that uses only instrumented flow paths, is authorized pursuant to 10 CFR 50.55a(a)(3)(i) based on the acceptable level of quality and safety afforded by the alternative testing.

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