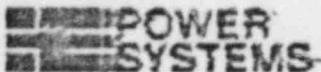


R. DeYoung
Jordan

82-725-000



November 8, 1982
LD-82-087

50-530

Mr. Richard C. DeYoung, Director
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: 10CFR21 Report on Target Rock Solenoid Actuated Valves, Models
77L-001 and 77L-003

Dear Mr. DeYoung:

This letter confirms Mr. A. E. Scherer's verbal notification to you of
November 5, 1982, pursuant to 10CFR21, concerning a potential defect in Target
Rock solenoid actuated valves.

Four Target Rock Valves procured by Combustion Engineering (C-E) for use at
Palo Verde Nuclear Generating Station, Unit 3, were shipped to C-E for
additional qualification testing in accordance with NUREG-0588. For this
program, two one-inch Target Rock Model 77L-001 (Serial No.'s [17] and [18])
and two two-inch Target Rock Model 77L-003 (Serial No.'s [5] and [6]) were
received. These valves were intended for use as the Safety Injection Tank Vent
Valves (Model 77L-001) and as the Pressurizer Auxiliary Spray Valves (Model 77L-
003).

The major components of the NUREG-0588 test program involved irradiation to 60
Megarads, thermal aging at 260°F for 635 hours, mechanical cycling,
vibrational aging to represent normal service vibration, seismic testing and
finally testing in a simulated LOCA environment.

Inspections conducted prior to the test program as well as the results of the
test program itself revealed a large number of anomalies including:

- Incorrect valve assembly
- Significant missing parts
- Limit switch valve position indicator failures
- Valve failure to open (due to electrical short in solenoid leads during seismic test)
- Valve failure to close (due to failure to seat properly during seismic test)
- Horn and shorted valve operator electrical leads.

Mr. Richard C. DeYoung
November 8, 1982

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The significance of and relation between these various defects is difficult to trace in all the circumstances in which the operation of these valves would be important to the safety of the plant. C-E believes, however, that assurance of operability of the auxiliary pressurizer spray valves is very important in the Palo Verde design since they play a vital role in the principal path to cold shutdown in accident situations involving extended loss of off-site power. C-E believes that the number and variety of defects observed during the valve test program are also not consistent with the required level of assurance of operability which our design places on these valves.

In appraising the safety significance of the observed defects, C-E has considered the vibratory damage of the solenoid as a common mode of failure which, in a seismic event, could potentially disable several redundant valves at one time. Although the 1-inch valve failed due to a displaced seat in the seismic test, evidence of solenoid lead wire damage also exists, presumably for the same reasons as those that led to the electrical shorting of the 2-inch valve solenoid. Thus, both valve models appear vulnerable to solenoid damage due to motion within the housing caused by external vibration when combined with the degradation of wire insulation associated with radiation and aging at elevated temperatures.

Attachment (I) provides additional information as required by 10CFR21.21.

If you have any questions on the above, please feel free to contact me or Mr. A. E. Scherer of my staff at (203)688-1911, Extension 3822.

Very truly yours,

COMBUSTION ENGINEERING, INC.

J. M. West
Vice President
Nuclear Power Systems

JMW:ckk

Attachment

Information Concerning Potential Safety Hazard for Certain
Target Rock Solenoid Actuated Valves

1. Name and address of the individual or individuals informing the Commission.

Combustion Engineering, Inc.
1000 Prospect Hill Road
P. O. Box 500
Windsor, CT 06095-0500

2. Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect.

The basic components which are the subject of this report are Target Rock Solenoid Valve Model Numbers 77L-001 and 77L-003 supplied to Palo Verde Units 1, 2, and 3 which are being constructed by Arizona Public Service.

3. Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect.

The valves in question were procured by C-E from:

Target Rock Corporation
1966 E. Broadhollow Road
East Farmingdale, NY 11735

4. Nature of the defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply.

The conditions noted below were found during inspection and in conducting NUREG-0588 qualification testing. For this program two Target Rock Model 77L-001, Serial No.'s [17] * and [18] (1") valves, and two Model 77L-003, Serial No.'s [5] and [6] (2") valves were received at C-E. Each valve was disassembled and inspected, and one of each model, [5] and [18], was subsequently subjected to testing. The following was observed during conduct of this program.

- a. Incorrect Valve Assembly -- Examination found an off-center insulating washer wedged in the land between the pressure housing and the lower case of the reed switch housing. This prevented pressure from the assembly nut being transmitted to the bottom of the solenoid housing and the lower O-ring seal. The misalignment was corrected.
- b. Significant Missing Parts -- The delivered valves lacked O-ring seals on both valves [5] and [6]. In addition, rubber grommets protecting the solenoid leads from chafing by the housing were missing on valves [17] and [18]. The missing O-rings were replaced.

* For convenience, these valves will be subsequently identified only by the serial number in square brackets, viz. [17].

c. Limit Switch Valve Position Indicator Failures

- d. Valve Failed to Open -- About 75% through the seismic test, valve [5] failed to open due to an electrical short in the solenoid leads, which welded together at a point about 1-in. from the solenoid. On disassembly, the solenoid was observed to be free to move in all directions.

The lead wires of the other valve tested [18] were also damaged to the extent of exposing the conductors, but they had not as yet come into contact either with each other or with the housing, where the grommet was missing.

- e. Valve Failed to Close -- Although valve [18] was still operating electrically at termination of the test, it was unable to seat properly in the closed position because the soft seat ring had started to come out of its retention groove in the end of the plunger.

The safety significance of these defects is, of course, dependent on the particular usage of the valves. They are employed in two important locations in the Palo Verde reactors. The service applications are as follows:

The Safety Injection Tank (SIT) Vent Valve is a one-inch model of the subject valves.

The Pressurizer Auxiliary Spray Valve is a two-inch model of the subject valves.

C-E believes that the potential safety significance can be summarized as follows:

Failure of the SIT Vent Valve does not present a significant safety hazard because shutdown and depressurization can be accomplished without it. Removal of a SIT from service for repair is also permitted by the technical specifications.

Failure of the Pressurizer Auxiliary Spray Valves could present a significant safety hazard because, in the Palo Verde design, these valves play a vital role in the principal path to cold shutdown for accident situations involving extended loss of off-site power.

5. The date on which the information of such defect or failure to comply was obtained.

Testing of the subject valves was terminated on or about September 22, 1982 and a review for potential safety hazards instituted. The evaluation was completed on November 4, 1982, concluding that a defect may exist.

6. In the case of a basic component which contains a defect or fails to comply, the number and location of all such components in use at, supplied for, or being supplied for one or more facilities or activities subject to the regulations in this part.

Table 1 provides information pertaining to the number and location of Target Rock Model 77L-001 and Model 77L-003 valves supplied by C-E. Other model number Target Rock solenoid actuated valves have been supplied by C-E for a variety of applications, but are not the subject of this report. This is because C-E does not have sufficient information at this time to determine that the reported defect can be extrapolated to these valves.

7. The corrective action which has been, is being, or will be taken, the name of the individual or organization responsible for the action and the length of time that has been or will be taken to complete the action.

Appropriate corrective actions including potential modifications of the valve design are being considered by C-E in consultation with Target Rock. No schedule for implementation of corrective actions has been established at this time.

8. Any action related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees.

See Attached C-E Infobulletin B2-11, dated November 9, 1982.

TABLE 1

LOCATION OF TESTED TARGET ROCK SOLENOID VALVES IN C-E PLANTS

PROJECT	QTY	TAG NO.	SIZE	SAFETY CLASS	MODEL NO.
Palo Verde 1	8	SI-605, 606 607, 608 613, 623 633, 643	1"	2	77L-001
Palo Verde 1	2	CH-203, 205	2"	1	77L-003
Palo Verde 2	8	SI-605, 606 607, 608 613, 623 633, 643	1"	2	77L-001
Palo Verde 2	2	CH-203, 205	2"	1	77L-003
Palo Verde 3	8	SI-605, 606 ¹ 607, 608 613, 623 633, 643	1"	2	77L-001
Palo Verde 3	2	CH-203, 205 ¹	2"	1	77L-003

Note:

1. Palo Verde 3 valves, Tag Nos. SI-605 and CH-203 are presently being qualification tested at C-E.

AN ADVISORY CONCERNING A TECHNICAL DEVELOPMENT RELATED TO THE APPLICATION OR OPERATION OF NUCLEAR PLANT EQUIPMENT SUPPLIED BY COMBUSTION ENGINEERING.

November 9, 1982

TARGET ROCK SOLENOID VALVE
FAILURE DURING QUALIFICATION TESTING

Introduction: This bulletin is to advise utilities of anomalies observed during qualification testing of Target Rock solenoid actuated valves performed by Combustion Engineering. C-E has reported this information to the NRE under 10CFR21.

Discussion: C-E was requested by a utility customer to perform qualification testing of certain Target Rock solenoid valves to upgrade them to the requirements of NUREG-0588. For the qualification program two Target Rock model 77L-001 one-inch valves and two Target Rock model 77L-003 two-inch valves were received by C-E, and one of each model valve was subsequently tested. The major components of the program involved irradiation exposure to an accumulated 50 megarads, thermal aging at 260°F for 605 hours, mechanical cycling, vibrational aging to represent normal service, seismic testing, and finally testing in a simulated LOCA environment. Similar valves had been previously qualified by Target Rock for irradiation, aging and seismic vibration under IEEE-323-1974 (IEEE Trial-use Standard, General Guide for Qualifying Class 1 Electrical Equipment) and IEEE-344-1975 (IEEE Guide for Seismic Qualification of Class 1 Electrical Equipment).

During the NUREG-0588 qualification testing at C-E, a number of anomalies were identified in these valves. The testing was finally discontinued when both test valves failed to function for different reasons during the seismic tests. The anomalies and failures noted during the testing included incorrect valve assembly as received, missing parts as received, failure of valve position indicator limit switches during testing, failure of a valve to open on demand as a result of solenoid lead shorting from vibration induced wear, and failure of a valve to fully close when de-energized due to a seat malfunction.

In appraising the safety significance of the observed problems, C-E has considered the vibratory damage of the solenoid as a common mode of failure which, in a seismic event, could potentially disable several redundant valves at one time. Although the model 77L-001 valve failed due to a displaced seat in the seismic test, evidence of solenoid lead wire damage was noted, ostensibly for the same reasons as those that led to the electrical shorting of the model 77L-003 valve solenoid. C-E believes that assurance of operability of some of these valves is very important in the System 80 design since they play a vital role in achieving cold shutdown during events involving extended loss of off-site power.

Recommendations: C-E recommends that utilities consider a review of safety related systems which incorporate Target Rock solenoid valves and that, if necessary, such valves be inspected on a schedule consistent with plant operations to verify their consistency with the manufacturers drawings. Utilities should also consider increasing the frequency of surveillance testing of Target Rock solenoid valves installed in safety systems until appropriate corrective actions are evaluated. C-E, in consultation with Target Rock, is evaluating potential modifications to models 77L-001 and 77L-003 valves.

Applicability: Target Rock model 77L-001 and 77L-003 solenoid valves have been supplied by C-E for use in the safety injection tank vent system and the pressurizer auxiliary spray system at Palo Verde Units 1, 2 and 3. Other model Target Rock solenoid valves have been supplied by C-E for use in a number of safety and non-safety applications in various plants.

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