50-528

Arizona Nuclear Power Project
P.O. BOX 52034 • PHOENIX, ARIZONA 85072-2034

November 12, 1984
ANPP-31094-TDS/TRB

U. S. Nuclear Regulatory Commission
Region V
1450 Maria Lane - Suite 210
Walnut Creek, California 94596-5368

Attention: Mr. T. W. Bishop, Director
Division of Reactor Safety and Projects

Subject: Final Report - DER 84-58
A 50.55(e) Reportable Condition Relating To Auxiliary Feedwater System Solenoid Valve Failed To Open In Response To AFAS Signal.
File: 84-019-026; D.4.33.2

Reference: A) Telephone Conversation between J. Ball and T. Bradish on August 8, 1984
B) ANPP-30449, dated September 6, 1984 (Interim Report)
C) ANPP-30873, dated October 17, 1984 (Time Extension)
D) ANPP-30995, dated October 29, 1984 (Time Extension)

Dear Sir:

Attached is our final written report of the deficiency referenced above, which has been determined to be Not Reportable under the requirements of 10CFR50.55(e).

Very truly yours,

EEVanBrunt/ASK

E. E. Van Brunt, Jr.
APS Vice President
Nuclear Production
ANPP Project Director

EEVB/TRB/nj
Attachment

cc: See Page Two

IE-27

cc: Richard DeYoung, Director
Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

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FINAL REPORT - DER 84-58
DEFICIENCY EVALUATION 50.55(e)
ARIZONA PUBLIC SERVICE COMPANY (APS)
PVNGS UNIT 1

I. Description of Deficiency

The following deficiencies were identified with Target Rock Solenoid Valves which are installed in various safety-related systems.

A. NCR SM-4628 and DER 84-58:

The steam supply bypass solenoid valve JSA-A-UV138A is used in the slow starting of the auxiliary feedwater turbine. During the pre-operational testing of the steam supply bypass line to the auxiliary pump (AFA-P01), this valve failed to open in response to the AFAS signal as required by design.

B. NCR SM-4623 and DER 84-63:

Valve JSIB-HV613 is located on a Safety Injection Tank (SIT) vent line. This valve is required for relieving pressure during cooldown of the reactor. This is a failed close valve and did not close when required during testing. The valve was opened when SIT pressure was 600 psig and would not close via the handswitch at 200 psig. The power was shut off to the valve and it still would not close.

C. NCR SE-4721 and DER 84-67:

Valves JSGBUV-1135A, -1135B, -1136A, -1136B, JSGAUV-1133 and -1134 are used in steam drain trap applications. These are fail-close valves that did not stroke when required during testing. It was initially reported that the control room indication lights did not reflect the true state of the valve; however, the actual condition was inoperative valves.

Investigation of the valve conditions mentioned above indicated that the valves were mechanically stuck and could not be made to operate. The following evaluation, reportability assessment, and corrective action plan are also applicable to DERS 84-63 and 84-67.

Evaluation

After disassembly of the valves by the vendor's field service representative (Target Rock Corp.), evidence of three types of foreign dirt were found in the valves. The following description of contamination is adapted from Target Rock letter C4990, attached, dated October 2, 1984, relating their evaluation.

4.1 Grey Rust: This is due to water chemistry during the running of high temperature water and steam through the valve. The grey rust deposits onto the internal surfaces of the valves and is typical of normal plant operation. The grey rust flakes off when the valve internal surfaces are scraped. The flakes are thin and brittle and can easily be broken up.

4.2 Red Rust: This is due to rusting in the steam generating system. The red rust is carried along by the system fluid during a prestart-up flush operation. It contains fairly large particles that are spherical in shape. There are also a large amount of fine particles that have a powdery appearance. When the valve internal parts are dried, the red rust deposits onto the valve internal surfaces and gives them a red coloration. The dried red rust is soft and becomes a fine red powder when the coated surfaces are rubbed.

4.3 Hard Dirt: This is due to construction dirt in the lines. It may be weld particles or slag or metal fragments. Such material is carried along by the system fluid during a prestart-up flush operation. If these particles become lodged at the valve seat and the valve is pressurized, they can cause indentations in the valve disc and body seat and subsequent increase in the valve seat leakage.

The discoloration and flaky grey rust deposits have been noted before when valves in similar applications have been disassembled. This is considered normal and has not prevented valve operation in the past. Hard dirt usually damages the valve seat and increase seat leakage, although the possibility of hard dirt jamming the disc does exist. The amount of dirt in the area above the disc piston ring was not sufficient to block the pilot ports and passages which would have prevented the opening of the valve under pressure. The valve failed to open due to the presence of a significant amount of red rust inside and spherical particles of red rust on the main disc below the piston ring. This prevented the actuation of the valve by wedging the main disc. The radial clearance in this area is 0.005 of an inch. The valve could have been easily opened if pressure had been applied to the inlet port before actuating it at the site, because there was not enough dirt to clog the pilot disc and pressure provides a strong assist to open the disc.

The root cause of the valves' failure to operate is the inability to completely clean and/or flush moisture and debris from these small branch lines which accumulated during construction and startup activities. This condition is unavoidable and not unexpected since the valves are welded in the lines and must be installed prior to hydrostatic and startup testing of the systems.

During testing activities, steam and/or water flow is insufficient to completely remove the bits of debris remaining in the systems. Based on actual experience with valves of similar design, the failure of these valves to function during normal system operation is not expected to occur since removal of remaining particles occurs when the systems are exposed to normal operating parameters (e.g., flow, pressure). In addition, careful control of plant chemistry during operation minimizes the formation of corrosion products which contributed to this condition. This condition is only applicable to Target Rock solenoid valves since these are the only pilot-operated valves purchased by the project and, as such, the only valves susceptible to this type of failure to operate.

II. Analysis of Safety Implications

Based on the above discussion, DER 84-58, 84-63, and 84-67 have been evaluated as Not Reportable under the requirements of 10CFR50.55(e) since the conditions do not represent a Quality Assurance program breakdown, a significant deficiency in design or construction, or a deviation from performance specifications as defined by the regulation.

This condition is evaluated as Not Reportable under the requirements of 10CFR Part 21, since it does not constitute a defect in a basic component.

III. Corrective Action

The remedial action will be to disposition NCRs SJ-4628, SM-4623, and 1SE-4721 to either clean and reinstall the valves or to replace the valves with clean valves from Unit 3 or from the warehouse.

Copies of this report with the referenced Target Rock letters will be transmitted by Engineering to the Transition Manager, Startup Manager, and Maintenance Manager for information and to ensure that appropriate instructions are included in work orders generated in accordance with Procedure 30AC-9ZZ01.

If the condition recurs during startup testing on other systems or in Units 2 and 3 the remedial action shall be to (1) back-flush the line if possible and/or (2) disassemble the valve, clean the internals, and polish the main disc and pilot disc seats. A light lapping of the valve seat will be performed if needed. Based on this report, Startup will be directed to establish this corrective action plan as a pre-requisite to startup testing for similar conditions.

Proper plant chemistry control will inhibit the formation of corrosion products which have been identified as a contributing factor to the failure of these valves to operate. This type of control should prevent these failures during future plant operations.

The disposition of this DER shall be applicable to all future nonconformances found concerning contaminated Target Rock solenoid valves. Applicable NCRs shall cross-reference this DER for reportability disposition.

IV. References

1. Startup Field Report/Nonconformance Report (SFR/NCR) 1AF-3 1/SJ-4628; SFR/NCR 1CD-178/SE-4721; SFR/NCR 1SI-752/SM-4623 Startup Implementation Documentation for work performed in Unit 1.

2. Target Rock letters to W. G. Bingham; C-990, dated October 2, 1984, and 41048, dated October 8, 1984.

Target Rock Corporation, P.O. Box V, 1966E Broadhollow Rd., East Farmingdale, N.Y. 11735 / Phone: (516) 293-3800

SUBSIDIARY OF CURTISS-WRIGHT CORPORATION

Please refer to: C4990

October 2, 1984

C

233322
JOB 10407
FILE JM-603
OCT 8 '84

Bechtel Power Corporation
Post Office Box 60860
Terminal Annex
Los Angeles, CA 90060

Attention: W.G. Bingham
Project Engineering Manager
Western Power Division

Subject: Arizona Nuclear Power Project
Bechtel Job 10407
Deficiency Evaluation Reports in regard to Target Rock
Solenoid Valves, File: JM-603
TRC Project 76HH

Reference: 1) Bechtel Letter, (B/TR-E-49052, MOC336995)
Dated 9/5/84, W.G. Bingham to D. Vater
2) Bechtel Letter, (B/ANPP-E-121740, MOC 341716)
dated 9/24/84, W.G. Bingham to J.D. Houchen

Gentlemen:

On 9/17/84 six (6) model 76HH-008 solenoid valves were received at Target Rock Corporation from the Palo Verde Nuclear Plant. Mr. A. Wissman of Bechtel came to Target Rock to witness the as received inspection and subsequent disassembly of the valves. Pictures taken of the valves are enclosed. When the electrical enclosure covers were removed from the valves it was noted that all of the switch assemblies were loose or missing. Available information was that before the valves were cut out of the line at Palo Verde, they were energized to open but failed to actuate. The inlet port was uncovered so that the motion of the main disc could be viewed. Without cleaning or modifing the as received valves in any way, the valves were energized to open by applying 125 VDC to the solenoid coils. Five out of the six valves opened in a normal manner. The sounds from the sixth valve indicated that the pilot disc was moving but the main disc did not lift. A brass drift was inserted into the outlet port and the underside of the main disc was lightly tapped while the solenoid coil was energized. The main disc then lifted and thereafter operated in a normal manner. At this point all the top works from the valves were removed and the valves were cut open by removing the body to bonnet seal welds. Taking care to keep the parts from each assembly separate, the valves were disassembled and inspected. The following outlines some of the findings and observations.

1. All of the sleeves which guide the main discs were examined and no evidence of damage or dirt contamination was found.

2. All of the piston rings that are mounted onto the main disc were examined and all were found to move freely.

3. All of the main disc and pilot disc ports were examined and no evidence of damage or dirt clogging was found.

4. Identification of Dirt Contamination
Evidence of three types of dirt were found in the valves. They can be described as follows:

4.1 Grey Rust: This is due to water chemistry and running high temperature water and steam through the valve. The grey rust deposits onto the internal surfaces of the valves and is typical of normal plant operation. The grey rust flakes off when the valve internal surfaces are scraped. The flakes are thin and brittle and can easily be broken up.

4.2 Red Rust: This is due to rusting in the steam generating system and the red rust is carried along by the system fluid during a pre-start up flush operation. The red rust contains fairly large particles that are spherical in shape. There is also a large amount of fine particles that have a powdery appearance. When the valve internal parts are dried, the red rust deposits onto the valve internal surfaces and gives them a red coloration. The dried red rust is soft and become a fine red powder when the coated surfaces are rubbed.

4.3 Hard Dirt: This is due to construction dirt in the lines. It may be weld particles or slag or metal fragments. This material is also carried along by the system fluid during a pre-start up flush operation. If hard dirt is caught at the valve seat and the valve is pressurized this can cause indentations in the valve disc and body seat and subsequent increase in valve seat leakage.

5. Dirt contamination of the valves
Since five of six valves operated normally in the as received condition the amount of dirt found in the valves was not enough to prevent actuation. (It was reported that all six valves did not acutate at the site.) Much of the dirt may have been carried out of the valve by the water that was released when the valves were cut out of the line. However, all of the valves had their internal surfaces discolored with a coating of grey rust. The valves were still wet internally and particles of red rust appeared to be insuspension in the pockets of water. Two of the valves were comparitively dirty and one valve was almost without any red rust. The valve with the stuck disc was examined and hard dirt indentations were noted on the main disc seat. This may have caused the disc to wedge shut and presented actuation before the disc was tapped open. Only two of the valves had significant amounts of dirt in the area above the main disc piston rings and the pilot disc. There were some red rust deposits on the disc below the piston ring groove.

Failure Analysis

The discoloration and flaky grey rust deposits have been noted before when valves in similar applications have been disassembled. This is considered normal and has not prevented valve operation in the past. The effect of hard dirt is usually to damage the seat and increase seat leakage although the possibility of hard dirt jamming the disc does exist. The amount of dirt in the area above the disc piston ring was not sufficient to block the pilot ports and passages which would have prevented the opening of the valve under pressure. It is felt that the failure of the valves to open was due to the presense of a significant amount of red rust in the valve, or by the spherical particles of red rust on the main disc below the piston ring. This could have prevented the actuation of the valve by wedging the main disc. The radial clearance in this area 0.005 and the relatively soft red rust could have wedged the disc. However, even if this were the case the valves could have been easily opened if pressure was applied to the inlet port before actuating the valves at the site. This is because there was not enough dirt to clog the pilot disc and pressure provides a strong assist to open the disc. Since the valves failed to actuate several days after the start up-flush and that there was still a considerable amount of dirt in the valves indicates that the flushing was incomplete. This gave the dirt in the valve a change to "set" and increased the possibility of interference with valve operation. The fact that the valves opened in the as received condition can be explained by a partial drying out and breaking down of the red rust particles which wedged the disc closed. This could also have been aided by the shocks and vibrations that the valves experienced during shipment. Although it is not always possible, a back flush would probably have been able to clear the valves.

Conclusions

Based on the inspection of the valves the debris which was caused to flow through the lines during the initial start up phase at Palo Verde was responsible for the failure of the valves to open. It is felt that an attempt should have been made to pressurize the valves and then energizing the valves to open. Indications are that the discs were not tightly wedged into their seats. Also back flushing (if possible) should have been attempted.

In order to return the valves to service the only work that is required is a cleaning of the valve internals and a polishing of the main disc and pilot disc seats. A seat leakage check might indicate that a light lapping of the valve seat is needed to reduce seat leakage.

Based on the field experience of over 10,000 Target Rock valves of similar design which spans a period of 12 years, the failure of the valves to operate after the start up flush should be classified as a non-typical occurence. This includes valves that have been used in the same or similar application as in Palo Verde. It is felt that the present design of the valves can tolerate a significant amount of dirt during normal operation. Also it is important to make sure that a flush operation is maintained for a sufficient time to assure that most of the debris is removed. During start up operations at other plants the only valve operational deficiencies that have been noted is increased seat

leakage due to seats that have been damaged by hard dirt. This can sometimes be corrected by backflushing but usually requires relapping of valve seats.

The screwed and seal weld design of the body to bonnet joint has several advantages. A bolted gasket sealed joint would greatly increase the size of the valve, especially for high pressure and high temperature valves. Also the seal weld provides a hermetic seal for the body to bonnet joint and this eliminates the maintenance problems associated with leakage of gasketed joints. Gasketed joints are considered justified where valves must be subsected to full line differential pressure while flowing. (As is the case for throttling or control valves) The cutting of the seal weld after the valve top works have been removed should take, on the average, about 1 hour. This is with the use of the Target Rock seal weld cutter.

Of the similar valves installed in the field the incidence of cutting the seal weld to allow repair of the valve has been minimal. Many seal welded valves have been installed and operating for more than 10 years without ever having to be serviced or repaired. Target Rock feels that these advantages justify the continued use of the screwed and seal welded bonnet to body joint.

With regard to the use of the valve for steam drain application, Target Rock feels that once the plant is beyond the start up stage, the line construction dirt will have been eliminated. And, as demonstrated in other plants, trouble free operation should be experienced.

Very truly yours,

TARGET ROCK CORPORATION

Steven Karidas
Project Engineer

Caroline Bullock
Contracts Administrator
FOR: Thomas D. Crowley
Contracts Manager/Power Products

CB/kb

cc: D.M. Pattarini
D.K. Veter
T.D. Crowley
A. Szeglin
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If you have any questions please call the undersigned.

Very truly yours,

TARGET ROCK CORPORATION

Steven Karidas

Steven Karidas
Project Engineer

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cc: V. Liantonio
K. Wenzel
T. Crowley

ENCLOSURES - CONTROLS