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

Attention: Mr. T. W. Bishop, Director
Division of Resident
Reactor Projects and Engineering Programs

Subject: Final Report - DER 83-74: Relating To Undersized Welds In Unit 1 Auxiliary Building Discovered During The NRC CAT Inspection.
File: 84-019-026; D.4.33.2

Reference: (1) ANPP-28749, dated January 31, 1984

Dear Sir:

Attached for your information is our written report of DER 84-74. This report provides follow-up information given in Attachment D, Part II, Response to Violations II.B.3 and II.B.4, transmitted in Reference (1).

Very truly yours,

EE Van Brunt/TRB

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

EEVB/TRB
Attachment

cc: See Page Two

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cc: Richard DeYoung, Director
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FINAL REPORT - DER 83-74
DEFICIENCY EVALUATION 50.55(e)
ARIZONA PUBLIC SERVICE COMPANY (APS)
PVNGS UNIT 1

I. Description of Deficiency

During the September 1983 NRC inspection of Train A of the Safety Injection System, 12 pipe supports were found which did not meet the criteria of the design drawing and applicable tolerances allowed by Procedure WPP/QCI 201.1. The supports had been verified acceptable during the period July 14, 1980 to September 15, 1982. The welds and deficiencies are described in NRC Inspection Report No. 50-528/83-34, Pages V-5, 6 and 7. Specific pipe support violations are identified on NCRs PA-7141, PA-7149, PA-7151, PA-7154, PA-7155, PA-7170, PA-7171, PA-7229, PA-7230 and PC-7238. The majority of problems identified were related to the size and quality of welds which were performed by the craft and accepted by Quality Control. In reviewing the violations, most of the problems are a result of unclear procedures for inspecting welds.

For example, along circumferential areas of piping, problems arise when a pipe stanchion or a pipe lug is prepared to fit up to a pipe.

The fitup of pipe spools and support stanchions leaves a gap between the inside and outside diameters of the stanchion. Although the design drawing specified the pipe spool to support stanchion attachment weld to be an all-around fillet weld, this attachment weld in many cases was made by filling in the gap between the spool and the stanchion and becomes equivalent to a partial penetration weld. This type of weld has in all cases been shown to be structurally adequate for the design loads.

Another common problem detected on welded piping attachments such as support stanchions was the omission of the fillet weld cap on a full penetration weld required by the design drawing. Fillet weld caps are normally specified on all support stanchions with full penetration attachment welds to provide a smooth stress path transition between the pipe spool and the stanchion. However, due to the size ratio between the pipe and the support stanchions used on this project, the majority of all stanchions do not actually require the fillet weld caps at the points of obtuse intersection.

Even though these cases do not cover all discrepancies found, they are an example of the types of occurrences observed. When designing pipe supports, certain criteria are used by Engi-

neering which tend to establish a large factor of safety in the assembly. To meet stiffness requirement, deflection allowables are established. By designing the assembly to meet these allowables, stresses in the individual members are kept significantly below the allowables established by code. For small bore piping, actual stresses tend to be not more than 20% of allowables while for large-bore piping, stresses are generally never more than 60% of allowables. In addition, weld sizes are usually governed by code minimums and not strength requirements.

During subsequent reinspection of pipe supports on Train B of the Safety Injection System, Nonconformance Reports (NCRs) PA-7319 to PA-7326 and PA-7329 to PA-7332 were initiated to document undersized and/or incomplete welds on hangers located in Unit 1 Auxiliary Building. These items were previously inspected and accepted by QC after commitments noted in DER 79-10 which included revising construction WPP/QCI 201.1 to require a Bechtel visual inspection of previously completed vendor welds plus the usage of weld fillet gauges.

Since a number of supports on safety-related systems were found to be "substandard" with regards to the design requirements, the project elected to implement a major and comprehensive reinspection program. The following types and categories of supports and pipe racks were included in this reinspection program:

A. All ASME Nuclear Class 1 pipe supports.

B. All ASME Nuclear Class 2 and 3 pipe supports included in the Condensate Transfer and Storage System, the Essential Chilled Water System, the Essential Cooling Water System, the HVAC Containment Building, and the Containment Hydrogen Control System.

C. All pipe supports in the In-Service Inspection Program which includes the Auxiliary Feedwater System, the Chemical and Volume Control System, the Reactor Coolant System, the Main Steam System, and the Safety Injection and Shutdown Cooling System.

D. All other safety-related pipe supports inspected and accepted by Construction QC prior to June 1980.

The reinspection program included 2199 pipe supports and pipe racks. All inspections of the program were completed on December 16, 1983. A total of 2,047 pipe supports and 104 pipe racks were inspected. The remaining 48 pipe supports were deleted from the program due to inaccessibility. All nonconforming conditions noted during the reinspection program were documented on NCRs PX-7370 and PA-7313. These NCRs identify a total of 1,269 nonconforming conditions on 807 different pipe supports or pipe rack assemblies.

The majority of nonconforming conditions were concerning welds. A total of 925 (72.9%) of all conditions reported addressed weld quality, weld size and weld length/location deficiencies. Weld quality includes the general quality of weld (example, weld splatter) and accounts for 93 (7.4%) of all deficiencies. Weld size is the evaluation of all welds either undersize, oversize or cases where the size of weld is unclear on the applicable design documents. This case accounts for all incomplete welds, short welds, intermittent spacing incorrect, missing welds and incorrect locations of welds and accounts for 267 (21%) of all deficiencies. All weld deficiencies were evaluated as not having an adverse affect for the respective systems with the following justifications: (1) All linear indications which resulted in code violations were removed. (2) As stated previously, Engineering has enough conservatism to account for construction practices. (3) Of all the undersize welds which violate the AISC, AWS or ASME Code requirement, 87% were 1/16" undersize, 11% were 1/8" undersize, and the remaining 2% were noted as being 3/16" undersized. The welds which were 3/16" undersized were on obtuse angles where accurate measurements could not be made, or in low stress areas where the minimum AISC weld size was not required for strength. The design of the subject pipe support welds have been qualified as described in Bechtel's M&QS Report GRS-020-02, which is included with DER 80-3. The "as-built" calculations indicate that the designs are sufficient to carry the project design loads. Therefore, the installed and as-designed pipe supports are acceptable without repair.

While the majority of the problems involved welds, the most severe problems found involved pipe support configuration and pipe support component deficiencies. Pipe support configuration deficiencies include all fabrication problems, such as members which were distorted or missing, and accounts for 165 (13%) of all deficiencies. Pipe support component deficiencies include trueness, correct installation, hardware being in place and in the right orientation. This case accounts for 135 (10.6%) of all deficiencies.

The most severe deficiencies identified by the reinspection program include five supports which have undocumented disassembly after final Construction QC acceptance. These include hangers 1EC013H00E, 1EC014H00M and 1EC061H00J which were found with the high-strength bolts removed; hanger 1EC015H00E had a member completely removed; and hanger 1SI220H007 which had one of two snubbers disconnected at one end. These conditions represent an overall failure rate of 0.2 percent and are evaluated as safety-significant.

The evaluation of the reported hanger configuration and component deficiencies also indicates that the adequacy of 41 pipe supports with problems in their categories have been rendered indeterminate. The various problems include: (1) components skewed beyond manufacturers tolerance, (2) component pipe clamp bolt loose, (3) strut lock nut loose, (4) strut retainer ring missing, (5) cotter pins missing and (6) various jam nuts missing. In each of the above cases, the missing locking device will not cause a failure of the support but could lead to component failure. Many cases involved documentation of field routed instrument air line and conduit attached to pipe racks. These loads are typically very small and had no impact on the overall analysis.

In connection with this reinspection program, Quality Assurance conducted an overview of the QC reinspection program on a random sample of 99 pipe supports to assess inspection effectiveness. This resulted in rejection of 7 pipe supports accepted by QC during this reinspection program for a 7 percent error rate. CAR S-83-56 was issued to QC to establish cause and obtain the necessary corrective measures to avoid recurrence. All deficiencies found as a result of this overview program, however, were dispositioned as "use-as-is."

II. Analysis of Safety Implications

Engineering calculation analysis 13-MC-ZZ-584 provides justification that non-conforming pipe support welds would not degrade the structural integrity of the pipe supports, and if left uncorrected, would not represent a significant safety condition. The five supports, evaluated as safety significant above, have been reassembled and restored to their original acceptable condition.

III. Corrective Action

The scope of the reinspection program was adequate to determine the types, severity, and frequency of deficiencies which can be expected throughout each of the units. Additional inspections of Quality Class "Q" pipe supports in Unit 1 will be performed to address the safety-significant findings of the initial sample reinspection program.

The additional inspections will cover all supports for flanged spools designed to be removable and all sway strut, mechanical shock suppressors, and spring cans not included in the initial inspections. No additional reinspection for weld size, length, or quality is required based upon the evaluated acceptance rate in the reinspection program.

Action to preclude recurrence in Units 2 and 3 is being initiated by implementing revised procedures for control of work performed in Startup coupled with the use of Bechtel Construction procedures by Startup to cover disassembly and reassembly as described in other parts of this response.

In addition, inspection of randomly sampled pipe supports and hangers will be conducted in Units 2 and 3 to verify that the results of the Unit 1 inspection are applicable to Units 2 and 3.

The following training sessions including specialized training by Bechtel's Material and Quality Services (M&QS) on inspection techniques have been conducted with QC and Field Engineering personnel:

- October 20, 1983 - Instruction of Pipe Support and Welding QCE's by Bechtel M&QS on proper use of fillet weld gauges and on visual weld inspection criteria.

- October 27, 1983 - Instruction of Pipe Support and Welding QCE's and Welding FE's by Bechtel M&QS on proper use of M&QS weld gauge for skewed fillet welds.

- December 7, 1983 - Reinstruction of Pipe Support and Welding QCE's by PFQCE on weld reinspection acceptance criteria.

- December 14, 1983 - Reinstruction of Pipe Support and Welding QCE's by Lead Welding QCE on pipe support accept/reject criteria.

To preclude recurrence of identified conditions and improve and direct the Quality Assurance activity relative to the installation and QC acceptance of pipe supports and other key construction activities, the following Quality Assurance program improvements are being implemented.

A. A Corrective Action Reverification Program has been established by Bechtel Jobsite QA. The purpose of this program is to reverify the effectiveness of previous corrective actions taken for selected quality problems which:

- Were serious enough to have been reported to the NRC (DERs)
- Have a history of recurrence (trends/audit/surveillance CAR's)
- May be generic (Bechtel Power Divisions CIDS computer program).

B. The Field QA Surveillance Program will be upgraded to include a selective sampling of QC accepted installations on a monthly basis to continually assess effectiveness of the inspection program in vital areas of pipe supports.

- NCRs have been dispositioned "Use-As-Is" for pipe support welds and "REWORK" for deficiencies of the pipe hangers.
- QA verification of corrective action taken by QC for CAR S-83-56 will be verified upon closure of the applicable NCRs.
- Project Quality Program Manual, Procedure 16.0 - Corrective Action - has been revised to include the corrective action reverification program.
- Project Quality Program Manual, Procedure 18.6 - Project Quality Assurance Surveillance - has been revised to specifically establish a monthly program for an overview of previously accepted installations by QC.

DER 83-74 final report closes corrective action for NRC Audit 50/528, Section II.B.3 and II.B.4.