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REGION V USE

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 Reactor Safety and Projects

Subject: Final Report - DER 84-34
A 50.55(e) Reportable Condition Relating To Critical Friction
Type High Strength Connectors.
File: 84-019-026; D.4.33.2

Reference: A) Telephone Conversation between P. Narbut and T. Bradish on
May 17, 1984
B) ANPP-29744, dated June 13, 1984 (Interim Report)
C) ANPP-30167, dated August 9, 1984 (Time Extension)
D) ANPP-30419, dated September 4, 1984 (Time Extension)
E) ANPP-30589, dated September 20, 1984 (Time Extension)

Dear Sir:

Attached is our final written report of the Reportable Deficiency under
10CFR50.55(e), referenced above.

Very truly yours,

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

EEVB/TRB/nj
Attachment

cc: See Page Two

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Mr. T. W. Bishop
DER 84-34
Page Two

cc: Richard DeYoung, Director
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FINAL REPORT - DER 84-34
DEFICIENCY EVALUATION 50.55(e)
ARIZONA PUBLIC SERVICE COMPANY (APS)
PVNGS UNITS 1, 2, 3

I. Description of Deficiency

During a Bechtel inspection walkdown of critical, friction-type, high strength connectors, some nonconforming conditions were discovered on the safety injection (SI) tank keyways. The conditions do not comply with specific requirements of sections of the "Specification for Structural Joints Using ASTM A325 or A490 Bolts." There are a total of 32 connections, each containing 6 A490 bolts (i.e., 192 bolts) per unit.

The nonconforming conditions have been evaluated by engineering and classified into two categories:

A. Incomplete Tightening of Fasteners

The connectors which were found to be incompletely tightened are identified and documented on NCRs CC-4686, 4687, and 4688 for Units 1, 2, and 3, respectively. This condition is considered to be safety significant.

B. Other Nonconforming Conditions

The connectors which exhibited nonconformances other than incomplete tightening are not considered to be safety significant and are identified per NCRs CC-4673, CC-4672, and CC-4671 for Units 1, 2, and 3, respectively. In connection with the Bechtel Engineering review of this condition, Bechtel design drawing 13-C-ZCS-573 was found not to fully reflect all AISC requirements; however, it does cross-reference drawing 13-C-00A-001, Civil/Structural General Notes, on which it explicitly states under Structural Steel General, Note 1: "All material and work shall conform to the AISC Specification, Seventh Edition for the Design, Fabrication and Erection of Structural Steel for Buildings." Although it is not required to reiterate all provisions of applicable codes and standards on engineering drawings, the drawing was however clarified and reissued as an aid to construction. The nonconformances were:

- ° Lacking a hardened washer under the nut and/or head. The purpose of the hardened washer is to minimize galling and brinnelling of the parts.
- ° Trimming of washers beyond the specification allowances.

- ° Incomplete covering of long slotted holes by plate washers. The purpose of the plate washer is to assure adequate bearing.
- ° Illegible legend markings "2H" or "DH" on nuts.
- ° Irregular edges on slotted holes.

Evaluation

A. Incomplete Tightening of Fasteners

The keyways limit translational movement of the top of the SI tanks SIE-X01A, -X01B, -X01C, and -X01D during a seismic event. Since the keyway brackets are slotted in the horizontal direction, connections with incompletely tightened bolts could result in excessive movement of an SI tank. This may cause an overstress condition in SI tank anchor bolts or may have significant effects upon various SI piping up to and including a 14-inch main safety injection line, which connects to the reactor coolant pressure boundary.

If the bolts are at the end of the slots closest to the key, which then becomes a bearing connection, no slippage can occur and the condition would not be reportable as safety significant under the requirements of 10CFR50.55(e). To determine the location of the bolts within the slots of the keyways would require the replacement of all of the A490 bolts.

B. Nonconformances Other Than Incomplete Tightening

Various other nonconforming fastener hardware conditions were noted during the walkdown. In some cases, but not all, these nonconforming conditions occurred in conjunction with incomplete tightening, however, none of these conditions alone would have necessarily prevented the fasteners from being properly tightened. These nonconformances are evaluated as not safety significant; since the deficiencies, if they were to remain uncorrected, would not at any time during the lifetime of the plant adversely affect the safety of operations of the plant.

C. Summary

The inspection walkdown was conducted for all 32 connections in each of the three units, therefore the six NCRs cover 100% of the critical friction-type fasteners. It has been concluded that the major factors contributing to the noted deficiencies were failure of craft personnel and field engineering personnel to pay close attention to detailed requirements of AISC specification for structural joints using ASTM A325 or A490 bolts, poor workmanship on the part of craft personnel performing the work, and failure of Quality Control inspection to verify proper installation.

Tightening of fasteners in friction-type connections, as opposed to other types of connections, is critical due to the fact that the connection strength is dependent on the clamping force developed between the plies of the connection, which in turn relies on the amount of pre-load in the fasteners. Tightening of fasteners in other types of connections, such as bearing-type, is not as critical since the strength of the connection is based on the strength of the fasteners. The purpose of tightening in these type of connections is to prevent the fasteners from becoming dislodged from the connection.

The inspection walkdown included all accessible critical friction-type connections for all three units and all deficient conditions have been identified and the appropriate corrective action is being taken. The walkdown results indicate that only 2% of the bolts making up all friction-type connections were not torque inspected due to inaccessibility or other prohibitive conditions. Based on this, it is concluded that no other condition exists where improper tightening of bolts in a structural connection would result in a safety-significant condition.

II. Analysis of Safety Implications

In the absence of an extensive, detailed, non-linear stress analysis to evaluate the adequacy of the existing installation, it is assumed that had this condition remained uncorrected it could have constituted a safety significant condition and is therefore reportable under the requirements of 10CFR50.55(e). Based on the above evaluation, the PVNGS Project has determined that the defect does not exist in a basic component and is therefore not reportable under the requirements of 10CFR Part 21.

III. Corrective Action

All incompletely tightened SI tank keyway bolts and nonconforming fastener hardware shall be reworked/repared per the dispositions of NCRs CC-4686, CC-4687, CC-4688, CC-4671, CC-4672, and CC-4673. The dispositions describe the application of a calibrated torque wrench which has been set at the proper installation torque which corresponds to the minimum bolt preload. The corrective action for the incomplete bolt tightening condition will be performed simultaneously with the corrective action for nonconforming fastener hardware.

Drawing 13-C-ZCS-573 has been revised to clarify the connection hardware requirements and preclude recurrence of the condition. All of the nonconforming conditions on NCRs CC-4673, CC-4672, and CC-4671 shall be reworked to conform with the drawing and the specification. DCPs 1SC-ZC-157, 2CC-ZC-157, and 3CC-ZC-157 were issued to alert jobsite personnel of the drawing clarifications.

Beginning in December 1983 the importance of quality and workmanship was reemphasized by Project Management on a jobsite-wide basis. To maintain this emphasis, a quality orientation for new employees and a weekly quality meeting for all field personnel was initiated. The overall quality control program at the jobsite is considered to be effective; however, as an additional precautionary measure, training sessions to emphasize the requirements of the specification for high-strength bolting for structural joints were conducted prior to September 1, 1984 for field engineering and quality control personnel.

The corrective action to resolve all six NCRs and the three DCPs will be completed prior to fuel load for all three units.