Arizona Public Service Company

August 2, 1984
ANPP-30111-TDS/TRB

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

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

Subject: Final Report - DER 83-78
A 50.55(e) Reportable Condition Relating To No Documentation Of Users Test And No Controlling Procedure For Rock Bolt Expansion Anchors.
File: 84-019-026, D.4.33.2

Reference: A) Telephone Conversation between P. Narbut and K. Parrish on November 9, 1983
B) ANPP-28393, dated December 8, 1984 (Interim Report)
C) ANPP-28801, dated February 6, 1984 (Time Extension)
D) ANPP-29494, dated May 14, 1984 (Time Extension)
E) ANPP-29716, dated June 11, 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,

E. E. Van Brunt

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

EEVB/TRB:db
Attachment

cc: See Page Two

cc: Richard DeYoung, Director
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Washington, D. C. 20555

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FINAL REPORT - DER 83-78
DEFICIENCY EVALUATION 50.55(e)
ARIZONA PUBLIC SERVICE COMPANY (APS)
PVNGS UNITS 1, 2, 3

I. Description of Deficiency

A. PVNGS purchases commercial grade/off-the-shelf rock bolts and performs user's acceptance testing to assure suitability for safety-related applications.

B. Specification 13-CM-307, Paragraph 6.7.3 states: "The use of rock bolt expansion anchors shall be limited to Williams Form Engineering Corporation, Portland, Oregon and qualified for Quality Class Q material by a User Test as noted in Attachment G..." 10CFR50, Appendix B, Criteria V, requires that activities affecting quality shall be "Prescribed by documented instructions, procedures, or drawings ... Instructions, procedures or drawings shall include quantitative or qualitative acceptance criteria..."

C. During the QA investigation in response to NRC Region IV, Item of Noncompliance for PVNGS User Test Program, the following conditions were noted:

1. Test reports failed to show traceability between test results and Project Material Receiving Reports (MRRs) or any other project material receiving documentation.

2. No user test documentation could be found for rock bolts documented by MRR Nos. 124613, 127325, 137819, 142788, 154256 and 89745.

3. User tests documented by Western Technologies Inc. (WTI) test reports 22701224 and 25400029 did not include yield strength as required by Specification 13-CM-307.

4. User tests to determine minimum elongation and documented by WTI test report 22702101 were performed using a 4-inch length in the threaded portion in lieu of a 2-inch length as required by Specification 13-CM-307.

C. NCRs CX-4402 and CX-4497 were generated to document test results which did not cross reference the applicable MRR and for shipments for which no test results could be found or for which tests were incomplete or improperly performed. Receiving and testing data for rock bolts included in NCRs CX-4402 and CX-4497 are shown in Table I.

D. During review of test results, it was noted that yield strength was not determined in strict accordance with ASTM A 370, as required by Specification 13-CM-307. NCR CX-4674 was generated to document this deviation.

E. Project Work Plan Procedure 4.0, Receiving Inspection, Rev. 21 failed to provide adequate instruction and requirements for user tests for rock bolt expansion anchors. This has been determined to be the primary cause of failure to perform all user tests, as required by Specification 13-CM-307, and failure to provide traceability between material receiving documentation and user test results.

F. Currently, no other material purchased under a Civil/Structural specification is qualified for Quality Class "Q" by user tests. Therefore, no other user tests have been affected.

TABLE I

SUMMARY OF NONCONFORMANCES

NCR No.	MRR No.	Date Received at Jobsite	Date of User Test	Size	Quantity	No. of Bolts User Tested	Yield Strength (lbs)	Ultimate Strength (lbs)	Elongation (%)	Nonconforming Condition
CX-4402	67115(a)	10-1-79	6-9-80	1"ϕ x 1'-6"	100	3	-	53,000	14.8	No MRR No. Recorded on Test Report
							-	51,700	14.0	No Yield Strength Reported
							-	52,800	14.8	
CX-4402	98032(a)	11-17-80	11-28-80	1"ϕ x 1'-6"	64	2	49,000	59,400	4.69	No MRR No. Recorded on Test Report
							49,000	59,500	3.13	Elongation Based on 4" Length
				2"ϕ x 3'-0"	36	2	166,000	224,000	3.13	
							173,000	223,000	2.35	
CX-4402	102815(a)	1-14-81	1-16-81	1"ϕ x 2'-0"	100	3	-	59,500	15.0	No MRR No. Recorded on Test Report
							-	58,200	13.0	No Yield Strength Reported
							-	58,200	18.0	
CX-4402	124613	10-13-81	N/A	1"ϕ x 2'-0"	200					No User Tests Performed
CX-4402	127325	11-2-81	N/A	1"ϕ x 2'-0"	250					No User Tests Performed
CX-4402	137819	3-23-82	N/A	2"ϕ x 3'-0"	25					No User Tests Performed
CX-4402	142788	6-1-82	N/A	2"ϕ x 3'-0"	45					No User Tests Performed
CX-4402	154256	12-11-82	N/A	1"ϕ x 2'-0"	20					No User Tests Performed
CX-4497	89745	7-16-80	N/A	1"ϕ x 1'-6"	200					No User Tests Performed

Notes: (a) MRR No. not shown on test report; determined by correlating test results to MRRs.

II. Analysis of Safety Implications

A detailed investigation of the rock bolts cited in the referenced NCRs indicated that rock bolts are installed in areas of equipment supports, pipe supports, missile shield supports, and pipe whip restraint embeds. This investigation indicates that the subject rock bolts are acceptable for the intended service in each case. Failure to perform the required user tests does not in itself indicate any structural deficiency in the bolting material. The lack of proper documentation for user tests is evaluated as not reportable under the requirements of 10CFR50.55(e) and 10CFR Part 21 since if left uncorrected, this procedural omission would not represent a safety significant condition.

III. Corrective Action

A. All user test results can be identified with corresponding MRRs to which the rock bolts were received by correlating dates of receipt of material to the dates of user tests. A procedure change to WPP/QCI 4.0 has been issued to control user tests for all future rock bolts purchased under Specification 13-CM-307.

B. Rock bolt test samples were randomly selected for user tests from MRR Nos. 124613, 137819 and 142788. Bolts from these three MRRs were available in the warehouse and had traceable heat numbers. All test samples met acceptance criteria provided in Specification 13-CM-307 and therefore all bolts from these three MRRs are considered acceptable for use as Quality Class Q.

C. All bolts from MRR No. 154256 are installed and no samples are available for user tests. In addition, any bolts from MRR Nos. 89745 and 127325 still in storage in the warehouse have been mixed with bolts from MRR Nos. 67115, 98032, and 102815 and are not traceable to a specific heat number or MRR. The total number of bolts remaining in the warehouse from these five MRRs was approximately 230 at the time the survey was made. In an effort to provide test data for acceptance of bolts from MRRs 89745 and 127325, 28 bolts were selected for testing from the 230 remaining. All test samples were 1-inch diameter. All 28 samples tested exceeded minimum requirements for yield strength and all but one sample exceeded minimum requirements for ultimate strength. This one sample failed to meet minimum elongation requirements and reached only 97% of the required minimum ultimate strength. Two other samples failed to meet minimum elongation requirements. Five additional samples were tested and met all acceptance criteria. Based on these test results, all bolts represented by this sampling are considered acceptable for use as Quality Class Q.

D. It is acknowledged that for the test program discussed in III.C above, an argument may be made that the results may not be totally indicative of the strength properties of bolts from MRRs 89745 and 127325 due to the uncertainty of the number of bolts included from these two MRRs in the test program. It is also acknowledged that no bolts were available for testing from MRR No. 154256. As a result of these uncertainties, a tolerance limit statistical analysis was performed on the data for the 33 samples tested. Results of this statistical analysis are shown in Appendix A. This statistical analysis considered the primary acceptance criteria to be a minimum yield strength. This is appropriate since all rock bolts are designed to remain in the elastic range under all loading conditions. For the results of the analysis to be considered a valid indication of the condition of rock bolts from MRRs not represented specifically in the tests, it must be established that a similarity of material exists. Hollow core rock bolts furnished by William Form Engineering are fabricated from ASTM A 615 grade 70 material, regardless of application. A supplier survey of Williams performed by Bechtel in 1978 indicated that it was William's standard procedure to perform physical tests on samples of rock bolt bar stock material as it is received from the mill to verify accompanying material test reports. Recent discussion with representatives of Williams confirmed that this procedure is still in effect. Although traceability of an individual rock bolt may not be available, there is adequate assurance that the bar stock material used in making these rock bolts has comparable strength characteristics.

The results of the statistical analysis indicate a 95% confidence level that 99% of all 1-inch diameter rock bolts from MRRs 154256, 89745, and 127325 will meet or exceed the minimum yield strength requirement of 37,000 lbs, as required by Specification 13-CM-307.

E. A review of all tests results indicates that only samples from MRR No. 98032 were tested for elongation based on a 4-inch length in the threaded portion in lieu of a 2-inch length as required by Specification 13-CM-307. This is a procedural error and is not an indication of any material deficiency. Elongation, in itself, is not an indication of strength. The intent of the user test is to guarantee that the bolts can adequately resist applied loads. Based on the results of the yield and ultimate strength tests, it can be concluded that bolts from MRR 98032 are acceptable for use and no further testing is required. To prevent recurrence of the procedural error, a procedure change to WPP/QCI 4.0 has been issued to require elongation tests to be performed based on percent of elongation in 2-inches in the threaded portion.

F. NCR CX-4674 was generated to document that yield strength was being determined by visual observation of load measuring gauges during strength tests in lieu of utilizing the 0.2% offset method prescribed by ASTM A 370. As load is applied to the test sample, the yield strength is considered to be that point where a slight hesitation followed by a drop on the gauge is observed. This method generally conforms to the "Halt of the Pointer Method" for determining yield point as described in Section 13.1.1 of ASTM A 370 and is thus considered acceptable. No further action is required.

G. It is the Project's decision to accept all rock bolts covered by NCRs CX-4402, CX-4497, and CX-4674 based on the following:

1. Test results discussed in III.B and III.C above.

2. Statistical analysis discussed in III.D and given in Appendix A.

3. Specification 13-CM-307 requires that a test load or installation torque be applied to all rock bolts at installation. The test load is equivalent to 120% of the maximum allowable design load and installation torque will generally produce a pretension load of at least 100% of the maximum design load. This in effect requires that 100% of all rock bolts be proof loaded to at least 100% of their allowable design load and gives an added measure of confidence in the ability of all rock bolts to perform their intended function.

APPENDIX A

STATISTICAL ANALYSIS OF TEST DATA

The quality of many manufactured products, such as materials heat-treated to or worked to a particular mechanical property value, is often controlled by specifying a minimum value (e.g., a minimum proof load strength value) that allows for only a small proportion of the manufactured products to fall below this minimum (referred to as a tolerance limit). Specifically, the tolerance limit may be described as follows: In order to be reasonably sure that at least a certain percentage (say y% ... a chosen number) of the entire product population lies above a certain tolerance limit (say $T_{y\%}$ ... a specific number), it is necessary to find a number, k, such that there is a specified high probability (say P ... a chosen number close to 1) that the tolerance limit value will include at least y% of the population.

Mathematically, the tolerance limit may be expressed as follows:

$$F(x) = \int_{T_{y\%}}^{\infty} P(x)dx$$

Where $F(x)$ = area under normal distribution curve or probability density function
$P(x)$ = normal distribution function
$T_{y\%}$ = tolerance limit value defined as $\bar{x}-k\sigma$
$\bar{x}$ = mean of tested samples (estimation of true mean)
σ = standard deviation of test samples (estimation of true standard deviation)
k = constant determined by probability and conformance desired

For the 23 (1" ϕ x 1' -6") and 10 (1" ϕ x 2' -0") test samples received, the following quantitative limit analysis was performed:

Tolerance Limit Calculation of the 1" ϕ Rock Bolts

Variables

a. test sampling = n = 33
b. degrees of freedom = 31
c. mean of yield strength = x = 43,988 lbs
d. standard deviation = σ = 2,236 lbs.
e. constant, k, for 99% conformance with 95% confidence level = 3.03*
f. tolerance limit = $T_{y\%} = T_{.99}$

Calculation

$T_{.99} = \bar{x}-k\sigma$
$T_{.99} = 43,988 - (3.03)(2236)$
$T_{.99} = 37,213$ lbs.

*Bowker, A. H. & Lieberman, G. L., Engineering Statistics, Prentice-Hall Publishers (1972), Pages 314-315, Table 8.4.