TEXAS UTILITIES GENERATING COMPANY
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October 3, 1984

Mr. B. J. Youngblood, Chief
Director of Nuclear Reactor Regulation
Division of Licensing
Licensing Branch No. 1
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Comission
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
DOCKET NOS. 50-445 AND 50-446
RESPONSE TO SGEB ADDITIONAL QUESTIONS

Dear Mr. Youngblood:

Attached are the responses to SGEB Questions 130.37, 130.38 and 130.39 as they will appear in Amendment 53 to the CPSES FSAR.

Should you have any questions in this matter please contact this office.

Sincerely,

John W. Beck

John W. Beck
Manager, Licensing

BSD:tls
Attachment

c - J. J. Stefano

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Q130.37 In Cygna's response to CASE's question Walsh #5 and during the ASLB hearing of May 1, 1984, Cygna identified a safety factor of three (3) for the SSE condition as related to Hilti expansion anchors. As part of the justification Cygna referred to NRC Document MS 129-4. This NRC document (MS 129-4) is in a draft form, and has not been converted into a draft NRC Regulatory Guide and/or issued for public comments. Since this guide has not been finalized and recommends a safety factor lower than the manufacturer's recommended safety factor of four, we request that you justify your basis for accepting a safety factor of three. Also, as part of this response you should identify the total number of Hilti expansion anchors used on cable tray supports and the number and locations of expansion anchors that have a safety factor of less than four (4).

R130.37 A) Justification for F. S. = 3.0

The factor of safety on expansion anchors (Hilti Kwik-Bolts) used for Cable Tray Supports has been established to be a minimum of 4 for Operating Basis Earthquake loading conditions (Maximum Working Load Conditions). These loading conditions per the FSAR are considered to be severe environmental loads and will be encountered infrequently during plant life. Steel structures subject to this loading condition are designed based on elastic working stress design methods and meet the requirements of AISC working stress allowables. The expansion anchors which are used with these steel structures have been designed in accordance with the manufacturer's recommendation of a minimum

factor of safety of 4 for the maximum working load conditions, OBE, (copy of Hilti Kwik-Bolt Technical Information, pg. C3, attached).

The factor of safety on expansion anchors used for Cable Tray Supports when subjected to full Safe Shutdown Earthquake (SSE) loading conditions is a minimum of 3. The SSE load per the FSAR is considered to be an extreme environmental load which is credible but highly improbable. The steel structures which are subjected to this loading condition when designed using working stress design methods are allowed to be stressed to a level of 1.6 times the stress of OBE loading conditions. This increased allowable in stress levels is partly attributed to the high improbability of the occurrence of such SSE loading combinations. This same rational is likewise applicable to the associated factor of safety of 3 for expansion anchors. As provided within the Hilti Kwik-Bolt Technical Information sheet, actual factor of safety to be used depends on the application and should be selected by the designer on this basis. Since the loading condition in question is one of extreme environmental conditions and highly improbable, the lower factor of safety is applicable.

Other technical information and Codes that support this decision are NRC IE Information Notice No. 79-14 and ACI 349, Appendix B. As provided in the NRC IE Information Notice No. 79-14, Class IE electrical cable support systems should be designed to withstand the effects of SSE and remain functional. Expansion anchors designed based on a factor of safety of 3 for SSE conditions will meet this requirement.

ACI 349, Appendix B, Section B.7.2 provides for a factor of safety of 3 for expansion anchors which do not meet the ductility requirements of Section B.7.1.

Based on the above, factor of safety of 3 for SSE loading combinations is acceptable for Hilti Kwik-Bolt expansion anchor use.

B) Quantity Estimate of Cable Tray Supports Having FS < 4.0

Estimation of the number of cable tray supports that would have a factor of safety less than 4 was determined by the following method.

Generic designs of cable tray supports were based on accelerations of Ay = 1.67g's and Ax = Az = 2.67g's for OBE conditions. This would provide a resultant acceleration affect based on the following formula:

Resultant acceleration = 1.0 + SRSS (Ax,y,z)

= 5.129 g's

The estimation approach utilized this resultant acceleration for comparison purposes to the computed resultant accelerations associated with SSE conditions for damping factor of 7%. The following are the building areas which would potentially have factor of safety less than 4.0 on expansion anchors.

BUILDING	ELEVATION	NO. CABLE TRAY SUPPORTS GENERIC	SPECIALS
Reactor Bldg.	Above 860'-0"	92	193
Electrical Control	None	0	0
Auxiliary Bldg.	Above 873'-0"	147	81
Safeguards	Above 831'-6"	335	243
Fuel Building	None	0	0
Total No. Supports		574	517

Estimated 80% use HKB-----873

Estimated average of 4 bolts per support

GENERICS	1838
SPECIALS	1654
TOTAL BOLTS	3492

The above is an estimate only. Based on these figures supports utilizing HKB at the above building elevations would have F.S. < 4.0 and represents only 10% of the expansion anchors used for cable tray supports. Additional SPECIAL supports may be involved but would not significantly increase these estimates. Maximum number of bolts that may have a F.S. < 4.0 would be approximately 8000. In order to provide an exact total

number and locations of Hilti expansion anchors have a F.S. <4.0, extensive design calculations would have to be reviewed as supplemented by field walkdowns.

HILTI KWIK-BOLT TECHNICAL INFORMATION

1. **Anchor Spacing**

   The minimum anchor spacing and edge distance for 100% effective anchor performance according to EAMI (Expansion Anchor Manufacturers Institute) are as follows:

   Minimum Anchor Spacing = 10 hole diameters
   Minimum Edge Distance = 5 hole diameters

   According to EAMI, anchor efficiency is reduced on a straight-line basis down to 50% at 5 diameters center-to-center anchor spacing.

2. **Minimum Embedment**

   The minimum embedment for satisfactory anchor performance is 4½ bolt diameters (6½ bolt bolt diameters for the Super Kwik-Bolt). Deeper embedments will yield higher tension and shear capacity as indicated in the TR-111: "Kwik-Bolt Testing Program." Embedment depths indicated in all test reports are before setting (tightening).

3. **Maximum Working Loads**

   The maximum working loads should not exceed ¼ of the average ultimate values for a specific anchor size. Actual factor of safety to be used depends on the application and should be selected by the designer on this basis.

4. **Combined Loading**

   Combined loading should be calculated on straight line interaction diagram of pure shear (S) and pure tension (T).

$$\frac{S\ applied}{S\ allowable} + \frac{T\ applied}{T\ allowable} \leq 1$$

5. **Standard Kwik-Bolt Materials**

   a. Stud (bolt material is AISI 11L41 for bolt diameters ¼"-½" and AISI 1144 for diameters ⅝"-1¼", meeting the chemical requirements for ASTM specification A 108.

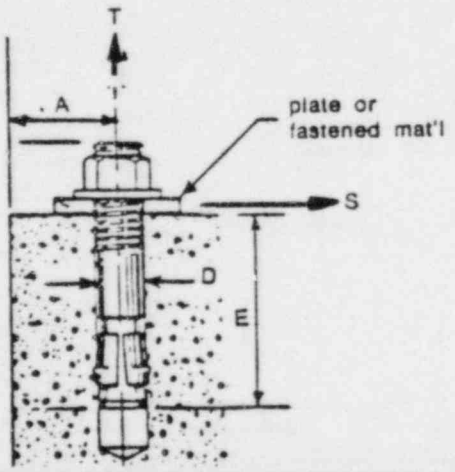
   b. The two independent expansion wedges are made from AISI 1050 spring steel.

   c. Nuts are of commercial manufacture, meeting ASTM A 307, Grade A (e.g., AISI series 10XX).

   d. Washers are fabricated from SAE standard material in accordance with ASA standard #B27.2-1949.

   e. Kwik-Bolts are plated in accordance with the requirements of Federal Specification QQ-Z-325C, Type II, Class 3, (clear chromate treatment).

   f. The Kwik-Bolt meets the dimensional requirements of Federal Specification FF-S-325, Group II, Type 4, Class 1.



A = EDGE DISTANCE
D = BOLT DIAMETER
E = EMBEDMENT DEPTH (BEFORE TIGHTENING)
T = APPLIED TENSION LOAD
S = APPLIED SHEAR LOAD

Q130.38 In response to a staff question at the ASLB hearing of May 3, 1984, (pages 13722-13725) Cygna witnesses stated that under SSE load conditions, the yield strength might be exceeded for certain components. At the same time, it was emphasized that the design is considered elastic and the use of the 1.6 factor in conjuction with some of the code allowable stress values brings the condition where the yield strength of certain components may be exceeded for the SSE load combinations. Identify all of the cases in the design of the cable tray supports where this condition occurs and provide detailed explanations for each controlling case.

R130.38 The design of cable tray supports is based on working-stress design methods. By comparison of SSE accelerations to 1/2 SSE accelerations per the methodology as described in Response 130.37, increase in stresses due to SSE loading conditions would be of an order of magnitude of 5 to 23 percent over 1/2 SSE stress levels. Per the FSAR, allowable stress levels for SSE loading conditions are allowed to be increased to a value equivalent to 1.6 times the allowable stress levels for 1/2 SSE loading combinations. This infers that allowables for 1/2 SSE conditions that are equal to or greater than .625 Fy when increased by the factor of 1.6 for equivalent allowables for SSE conditions, that the resultant SSE allowables would be equal to or exceed Fy of the materials used in fabrication.

By use of the acceleration comparison values, the actual stress levels of the supports for SSE conditions would be increased to a value equivalent to a maximum

of 1.25 times the actual stress levels for 1/2 SSE loading combinations. This infers that allowables for 1/2 SSE conditions that are equal to or greater than .8 Fy when increased by the ratio factor of 1.25 for equivalent SSE conditions, the resultant SSE allowables would be equal to or exceed Fy of the materials used in fabrication.

A review of the allowables provided in Appendix A of the AISC manual indicates that the only areas that have allowables exceeding 0.8 Fy are:

(1) 1.5.1.5 BEARING (on contact area),
Bearing on milled surfaces, including bearing stiffeners and pins in reamed, drilled or bored holes:

Fp = 0.90 Fy

(2) 1.5.2 RIVETS, BOLTS, AND THREADED PARTS,
Bearing on projected area of bolts in bearing-type connections and on rivets:

Fp = 1.35 Fy

For cable tray supports, there are no conditions in which the items identified in (1) above are used; therefore, this provision is not applicable to the design.

For item (2), based on the structural shapes and bolting materials used in attachment of the tray to the support, maximum load on bolts attaching the tray to the support is approximately 4.7 kips per bolt.

Thickness of the support member at point of attachment is a minimum of 0.200 inches. Based on 5/8" diameter bolts and A36 steel supports, the allowable bearing stress for the support would be 48.6 ksi. For the connection, the allowable bearing load would be equivalent to approximately 6.1 kips. With an increase of 25% in load from 1/2 SSE to SSE load conditions, the SSE load would be 5.875 kips which is less than the allowable bearing of 6.1 kips. Therefore, the SSE load condition would meet the allowable of AISC without the 1.6 increase as provided for in the FSAR.

The conclusions of the above are that there are no conditions under SSE loading combinations that would exceed the yield of the materials except as permitted by the ASIC Specification.

Q130.39

In support of the damping values used for the design of cable trays and supports with welded connections, Cygna referred to ANCO"s test results report on "Seismic Testing of Electric Cable Support Systems." This report provides good engineering test results related to allowable damping values to be used in the design of cable trays and their supports. Also, the results of this report with accompanying justifications have been accepted by the staff for accepting design damping values greater than the values identified in NRC Regulatory Guide 1.61. However, Cygna's answer to Walsh's question does not establish all of the specific ties (e.g., configuration) with the ANCO's report. We acknowledge the fact that the cable trays may be acceptably designed to higher damping values than those identified in RG 1.61, but good documentation and a clear determination of the applicability of test results is a must. Provide the necessary documentation and justifications. The FSAR should also be revised to accurately reflect how the design of the cable tray supports conforms of RG 1.61.

R130.39

The design of the cable tray and associated support systems are based on damping factors as provided in NRC Regulatory Guide 1.61 for bolted steel structures. The configuration of the tray and support system consist of tray segments with bolted splice connections, tray attachment to the respective supports by bolted connections and support attachment to the concrete super-structures generally by bolted connections but maybe by welded connection if embedded plates are available. The supports consists of various relatively light weight structural steel shapes, welded together

such as to provide a structural element to support the cable tray raceway. As indicated above, the total system configuration consist of structural elements connected together via bolted connections which indicates that the system performance in response to earthquake conditions would be that of a bolted steel structure. Critical damping values used in cable tray/support design are based on damping values no higher than 4% and 7% for Operating Basis Earthquake and Safe Shutdown Earthquake respectively.