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October 26, 1984

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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
DOCKET NOS. 50-445 AND 50-446
CLARIFICATION TO SGEB ADDITIONAL QUESTION RESPONSES

Dear Mr. Youngblood:

Per our discussion last week, we hereby forward revised responses to NRC questions 130.37, 130.38, and 130.39.

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

Sincerely,

J.B. George
Vice President
Project General Manager

JBG/bh
Attachment

cc: J.J. Stefano
John Beck

1300
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NRC LICENSING QUESTIONS
COMANCHE PEAK STEAM ELECTRIC STATION
SGEB ADDITIONAL QUESTIONS ON CABLE TRAY SUPPORTS
STRUCTURAL ENGINEERING ASPECTS

QUESTION 130.37

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).

RESPONSE 130.37

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 the 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 inaccordance 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 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.

QUANITY 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 an approximate resultant acceleration affect based on the following formula:

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

= 5.129 g's

where, D.L. = gravitational dead load

Ax,y,z = OBE acceleration for X,Y,Z directions

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	ELEVATIONS	NO. CABLE TRAY SUPPORTS	
		GENERIC	SPECIALS
REACTOR BLDG	ABOVE 860'-0"	92	193
ELECTRICAL CONTROL	NONE	0	0
AUX BLDG	ABOVE 873'-0"	147	81
SAFEGUARDS	ABOVE 831'-6"	335	243
FUEL BUILDING	NONE	0	0
		=======	========
TOTAL NO. SUPTS		574	517
Estimated 80% use HKB---------		460	414

Estimated average of 4 Bolts per support

GENERICS	1840
SPECIALS	1656
	====
TOTAL BOLTS	3496

The total number of supports associated with cable tray raceway is approximately 13,500. It is estimated that 80 % (10,800) of these supports utilize expansion anchors. At 4 bolts per supports, the total number of expanion anchors used

for cable tray supports is 43,200.

Based on these approximate figures, supports utilizing expansion anchors at the above tabulated building elevations would represent 8.1 % of the supports utilizing expansion anchors. Additional SPECIAL supports at lower building elevations which are designed based on the acceleration values for their respective elevations may be involved. These supports are estimated to be not more than the total number of supports identified above. These supports added to the supports identified in the above tabulation would potentiallly increase the number of bolts to approximately 7000. This represents approximately 16.2 % of the expansion anchors used for cable tray supports that would have an associated factor of safety between 3.0 and 4.0.

QUESTION 130.38

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 conjunction 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.

RESPONSE 130.38

The design of cable tray supports is based on working-stress design methods. By comparison of SSE accelerations to 1/2 SSE accelerations for each respective building floor elevation 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. For 1/2 SSE loading combinations, the allowable stress levels are those found in Appendix A of the American Institute of Steel Construction Inc., "MANUAL of STEEL CONSTRUCTION ", AISC.

A review of the allowables provided in Appendix A of the

AISC Manual when increased by a factor of 1.25 results in the following areas in which the resultant value would exceed the yield (Fy) of the materials used .

(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, 1/2 SSE maximum load on bolts attaching the tray to the support is approximately 4.7 kips per bolt. With an increase of 25% in load from 1/2 SSE to SSE, the SSE load would be 5.875 kips. Thickness of the support member at point of attachment is a minimum of 0.200 inches. Based on ASTM A325 5/8" diameter bolts and A36 steel supports, the 1/2 SSE allowable bearing

stress of 1.35 times Fy for the support would be 48.6 ksi. For the connection, the allowable bearing load would be equivalent to approximately 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 AISC Specification.

QUESTION 130.39

In support of the damping values used for the design of cable trays and supports with welded conections, 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 to RG 1.61.

RESPONSE 130.39

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 byt may be by welded connection if embedded plates are available. The supports consist 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.