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RECIP.NAME	RECIPIENT AFFILIATION
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SUBJECT: Forwards responses to concerns re design & analysis practices for pipe supports recently expressed to NRC by anonymous former employee.Requests ack of receipt of matl.

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JAMES D. SHIFFER
VICE PRESIDENT
NUCLEAR POWER GENERATION

January 11, 1985

PGandE Letter No.: DCL-85-010

Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Docket No. 50-275, OL-DPR-80
Docket No. 50-323
Diablo Canyon Units 1 and 2
Pipe Support Concerns

Dear Mr. Knighton:

Enclosed is PGandE's response to pipe support concerns that were recently expressed to the NRC Staff by an anonymous former employee on the Diablo Canyon Project. The concerns relate to design and analysis practices for pipe supports at the Diablo Canyon Power Plant.

Kindly acknowledge receipt of this material on the enclosed copy of this letter and return it in the enclosed addressed envelope.

Sincerely,

for J. D. Shiffer

Enclosure

cc: R. T. Dodds
J. B. Martin
H. E. Schierling
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ENCLOSURE

1. Concern No. 1:

The most limiting combination of various piping loads were not always used as input for gang support calculations.

Response:

For all structural frames supporting one or more pipes, a sufficient number of piping load combinations are considered to assure that the structural frame meets the Project criteria and has no safety concerns. In the case of a frame supporting more than one pipe, all piping loads will tend to be in the opposite direction of the earthquake motion in at least the initial portion of the first cycle of building movement. This type of load combination, i.e., all plus or all minus values, is included in the pipe support frame analysis. For this evaluation, the peak loads are assumed to occur simultaneously. The random nature of piping vibrations precludes the peak value of forces, reactions, stresses, and displacements due to the full magnitude of each earthquake load from occurring at the same time and in the precise load combination that maximizes member stresses. Therefore, the present Project method of load combinations for the analysis of pipe support structures is satisfactory.

2. Concern No. 2:

Unusual structural components or details, such as intermediate plates, were not always analyzed because they appeared too complex.

Response:

In pipe support design, plates other than baseplates are, in general, used as cover plates for tubular structural members or as intermediate rigid links to connect two structural members. When used as cover plates, they perform no structural function and, consequently, no analysis is required.

Intermediate plates are generally used to connect two structural members of the same size in order to facilitate welding. In this case, the plate thickness is designed to be greater than the required weld size. Therefore, these plates form essentially a rigid link and, as such, it is not necessary to analyze the intermediate plates. However, when "unusual components or details such as intermediate plates" appear to be subjected to significant stresses, the necessary calculations are performed and/or any justification needed would be provided.

3. Concern No. 3:

The weld stresses were not always analyzed for all weld configurations of a pipe support and were not always properly modeled.

Response:

Weld configurations that were analyzed were properly modeled. However, contrary to the allegation, all weld stresses need not be analyzed. It is considered acceptable and appropriate to analyze only certain welds in a pipe support. Pipe support design engineers routinely perform weld calculations as part of their daily activities. These engineers have sufficient experience to determine which weld or welds will be subjected to the highest loads and stresses. The analysts rigorously analyze those determined to be worst case conditions. Acceptance of those worst cases demonstrates acceptance of the remainder without further analysis. Additionally, conservative methods are used in the design of welded connections, including the use of enveloped loads. Pipe support engineers follow the methods described in "Design of Welded Structures" by O. W. Blodgett. This reference is an industry standard for structrual welding. Thus, Project analyses and modeling are adequate, acceptable, and consistent with industry practice.

4. Concern No. 4:

Flare bevel welds were not analyzed for shear in the base metal.

Response:

It is not necessary to consider shear stress in the base metal for flare bevel welds for the following reasons:

Flare bevel welds used in pipe supports exist in rectangular structural tubing steel attachments. For this application, the worst scenario is a situation where the effective throat thickness of the weld is equal to the width of weld connected to the base metal. While it is theoretically true that the shear stress in the base metal could control the design, the following two conditions would have to exist at the same time:

(1) The shear stress is equal to or greater than the normal stress.

(2) The combined normal and shear stress in the weld equals the weld allowable stress.

The coexistence of the above two conditions is unlikely. Since pipe supports are subjected primarily to axial and bending forces, the normal stress is generally much higher than the shear stress. Also, the likelihood of the combined stress in a weld reaching the allowable stress value is low. Thus, the shear stress in the base metal will not reach the allowable stress.

The conservatism of the analysis method has been demonstrated by Project tests that show the actual effective throat in flare bevel welds is larger than the 5/16R effective throat utilized in design (R being the tube corner radius).

5. Concern No. 5:

The design of pipe supports using wide flange beams or channels did not always include the effect of torsion.

Response:

The effects of torsion on wide flange beams and channels were considered as required by Item 7 of the License Condition to the Diablo Canyon Unit 1 Low Power License. The effects of torsion for Unit 2 have been considered through Project Instruction I-59, "Instruction for the Evaluation of Licensing Condition No. 7." Instruction I-59 defines the required evaluation and combination of stresses due to torsional moments in open sections containing flanges.

6. Concern No. 6:

Civil structures to which pipe supports are attached may not be properly analyzed for torsional loads.

Response:

Structural elements have been reviewed for the reactions resulting from pipe support attachments. The reactions on structural elements include bending moments, torsion, shear, and axial forces. Both the local and the overall effects of pipe support reaction forces have been considered in the design and evaluation of civil structures.

7. Concern No. 7:

The allowable stress values selected for lugs attached to pipes may not be based on the maximum operating temperature of the pipe. Stresses in the lug welds may be understimated due to improper weld geometry.

Response:

For Unit 1, lugs attached to pipes were qualified as discussed in the Design Verification Program Phase I Final Report. Their qualification was reviewed in detail by the IDVP. All Unit 2 small bore pipes with a temperature greater than 200°F are thermally analyzed using the computer program ME101. The temperatures used are based on DCM M-71, "Piping Pressures, Temperatures, and Operation Modes." For Design Class 1 small bore pipes with a lug attachment, a local analysis is performed as part of the piping qualification. The forces and moments used for local stress evaluation (ME210) include those from the applicable thermal analyses results. The allowable stress for the lug weld material was based on the maximum operating temperature of the pipe.

The weld geometry, in terms of the angle between the lug and the tangent to the pipe surface, is more pronounced on 2-inch and smaller piping.

However, the typically specified 1/4-inch fillet weld is considered adequate since the axial load for small pipe shear lugs is generally small, and the weld capacity is comparatively large.