AMENDED FINAL REPORT REGARDING PIPE
SUPPORT DESIGN DEFICIENCIES

San Onofre Nuclear Generating Station
Units 2 and 3

INTRODUCTION

This report is submitted pursuant to 10CFR50.55(e)(3). It describes design deficiencies related to certain safety related pipe supports. This report includes a description of the deficiencies, analysis of the safety implications and a summary of the corrective action taken.

BACKGROUND

By letter dated July 6, 1979, Edison submitted a final report related to a lack of documented design calculations for certain safety related pipe supports. This report amends that report to include six additional deficiencies relating to safety related pipe support design activities. These deficiencies were reviewed in a meeting with the NRC resident inspector on January 31, 1980 and are considered reportable in accordance with 10CFR50.55(e).

DESCRIPTION OF DEFICIENCY

1. Insufficient Pipe Bearing Surface

   A maximum of 500 large pipe supports for thin wall piping may not meet design requirements for pipe bearing surface. In these cases, loading conditions could result in local pipe stress allowables being exceeded. The problem was discovered in mid 1977. Design practices and criteria prior to this date did not provide for specific evaluation of local stresses.

2. Frictional Loading on Pipe Support Framing

   The effect of loads imposed by thermal expansion movement of piping on pipe support framing may not have adequately considered in the design of certain 8 inch and larger pipe supports. The number of supports affected is included in (1) above. The problem is that the structural load resulting from the thermal expansion of the pipe would cause additional loading on the pipe support structure. The problem was discovered in late 1977 and was most probably attributable to a lack of written design criteria and formal civil structural design calculations to support design verification activities.

3. Lack of Reinforced Branch Connections

Eight-six ASME thin wall pipe spools provided to Bechtel by Pullman Power Products required detailed design calculations to determine the adequacy of the fabricated spools to meet design requirements. The spools in question were fabricated using non-reinforced branch connections. This condition resulted from the material specification allowing the vendor to utilize either a tee or a branch connection while the original Bechtel stress analysis was based on piping isometric drawings which indicated tee connections.

4. Use of Dissimilar Metal Attachments

Carbon steel integral attachment material had been used on stainless steel lines with design temperatures between 150 F and 300 F. In certain configurations (about 100 pipe supports) the use of carbon steel may result in over stressing the welds between the attachment and pipe. The problem was discovered when it was determined that dissimilar metal attachments were being supplied based on material substitutions allowed by the piping material specifications.

5. Embed Plate Stiffness

Supports attached to base plates may have been designed without adequate consideration of plate stiffness. Additionally, certain plate designs may not have adequately considered biaxial bending. These problems may affect 500 pipe supports. This problem was discovered in late 1978 and was attributed to lack of formal design criteria and documented civil/structural calculations. A maximum of 500 hangers were affected by this problem.

6. Use of Structural Tees Instead of Dummy Stubs

Under certain loading conditions, the specified structural tees may have insufficient lateral strength. Additionally, the local stress at the pipe tee interface may exceed local stress allowables. Dummy stubs should have been specified. This problem may affect 50 pipe supports.

Analysis of Safety Implications

While no specific safety analysis has been conducted, a generic review of the deficiencies described above and those addressed in our report of July 6, 1979 indicates that the design functions of certain individual safety related pipe supports could have been affected if the deficiencies had gone uncorrected. The corrective action measures described

in the following section of this report will assure that design deficiencies are corrected and that the pipe supports can perform their safety related functions.

CORRECTIVE ACTION

In order to provide a systematic review of the six problems identified above, a startup system review program was initiated to review the total design of each piping system prior to turnover to startup. This program consists of a piping isometric drawing review, a pipe stress review (by checklist), a pipe support design review, pipe support walkdown inspection, and an analysis performed to support the design. All identified deficiencies are to be corrected prior to turning the system over for startup. Details of specific corrective actions applied to the individual problems are identified as follows:

1. Insufficient Pipe Bearing Surface

   Specific criteria was developed in 1978 to require evaluation of local bearing stresses and to specify acceptance criteria. This criteria was incorporated into the startup review program to assure that this problem is corrected. The addition of a wrapper plate or increased bearing surface is a typical physical modification required to resolve this problem.

2. Frictional Loading on Pipe Support Framing

   Design criteria has been developed to require evaluation of fractional loading resulting from pipe thermal expansion in the design of the pipe support structure. This criteria was included in the startup review program to assure this problem is corrected. The addition of bracing is a typical physical modification required to resolve this problem.

3. Lack of Reinforced Branch Connections

   All cases have been analyzed and only four of the 86 cases required the addition of a collar to reinforce the existing branch connection. The addition of a reinforcing collar reduces the stress intensification factor to an acceptable value.

4. Use of Dissimilar Metal Attachments

The specifications were revised to require stainless steel attachments on stainless steel pipe. The startup system review program includes a check for proper attachment material consistent with the above criteria. The substitution of a stainless steel attachment for a carbon steel attachment is the physical modification required to resolve this problem if calculations cannot support the existing design.

5. Embed Plate Stiffness

Design criteria has been developed to identify the procedure to be followed in the design of all base plates to incorporate plate flexibility and biaxial bending characteristics. This criteria is included in the startup review program to preclude recurrence of the problem. The physical modification required to resolve this problem consists of the addition of a brace or stiffening of the structural connection to the base plate.

6. Use of Structural Tees Instead of Dummy Stubs

Specific design criteria has been developed to require evaluation of both the local stresses in the pipe and the lateral strength of the tee. This criteria is included in the startup review program to preclude recurrence of the problem. Substitution of a dummy stub for a structural tee or stiffening the existing structural tee is the required physical modification needed to resolve this problem.

Additional corrective actions taken by Bechtel to date beyond those discussed above include: the addition of several senior supervisors with strong civil structural background to the pipe support group; combining the pipe support and stress groups under one chief engineer; and revision of the project internal procedures governing the preparation, checking, review and approval of design calculations. Although all deficiencies have not been corrected to date, all deficiencies will be corrected prior to turning the system over for startup.