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June 15, 1983

Mr. James C. Keppler
Administrator, Region III
US Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

ULNRC-636
SUBJ: Integrated Design
Inspection 50-483/82-22

Ref: NRC Letter DeYoung To Schnell, Union Electric, Dated 4/4/83:
Subj. As Above

Dear Mr. Keppler:

In accordance with the reference request, please find enclosed Union Electric's response to the findings and unresolved items identified in the subject design inspection of the SNUPPS/Callaway Auxiliary Feedwater System. The order of response has been arranged to coincide with the sequence used by NRC in the reference report. For purposes of brevity, specific inspection findings and unresolved items have, in most instances, been paraphrased rather than repeated in their entirety.

Aside from the responses addressing each inspection finding and unresolved issue, we believe it appropriate to comment on the conclusions cited in Mr. DeYoung's April 4th letter as follows:

1. The findings related to the lack of formal control of Bechtel newsletters; i.e. Item 1, and the indicated need for improvement in control of the Bechtel design process; i.e. Item 4, taken together appear to reflect the inspector's concerns with the control of design interface information. As noted in the response to finding 4-4, the need for improving internal design interface processes is acknowledged and actions have been taken to this effect over the past 12 months. Several of these actions are described in the enclosure. Notwithstanding this recognition of the benefit to be achieved from improvements in this area, we continue to believe that the interface controls in place over the life of the project have been effective and have been instrumental in producing a satisfactory design product. This conclusion appears to be substantiated by many of the inspection team's individual comments and observations contained in the body of the NRC report.

2. The concerns regarding seismic classification of the pump turbine exhaust pipe; i.e. Item 2, and the alleged noncompliance with FSAR commitments; i.e. Item 5 are addressed in the enclosed response to Findings 2-1, 2-7 and 6-3. As indicated in the detailed response to Findings 2-1 and 2-7, we are satisfied that the present system design meets all current regulatory requirements and licensing commitments and will satisfactorily function during events beyond the existing design bases established by NRC. Finding 6-3 involves an acknowledged inconsistency in the final design configuration from that specified in the FSAR. This inconsistency in configuration was the result of an oversight in updating descriptive material in the FSAR which has since been corrected. We concur with the inspector's conclusions that the functional design requirements have not been compromised by this oversight.

3. The conclusion in Item 3 of the NRC summary that the ability of motor controllers to withstand specified fault currents had neither been considered nor assured in the design process is not correct. As indicated in the discussion in response to Finding 5-1, existing data is available to demonstrate the capability of the controllers to meet the interrupting short circuit fault conditions established by approved design specifications. We are confident that a re-examination of available data and supporting design documentation will result in a similar conclusion on the part of the NRC inspector.

We believe the enclosed details together with the clarification and comments noted above satisfy all outstanding issues and questions raised in the reference inspection report. Should you have any questions concerning our response, please let us know.

Very truly yours,

Donald F. Schnell

Donald F. Schnell

SJS/ACP/sla

Encl.

cc: John T. Collins, Administrator, Region IV
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STATE OF MISSOURI)
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Donald F. Schnell, of lawful age, being first duly sworn upon oath says that he is Vice President-Nuclear and an officer of Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Donald F. Schnell
Donald F. Schnell
Vice President
Nuclear

SUBSCRIBED and sworn to before me this 15th day of June, 1983

Barbara J. Pfaff
BARBARA J. PFAFF
NOTARY PUBLIC, STATE OF MISSOURI
MY COMMISSION EXPIRES APRIL 22, 1985
ST. LOUIS COUNTY

FINDING 2-1

This finding questions the design adequacy of the auxiliary feedwater pump turbine exhaust line which is non seismic category I beyond the boundary of the auxiliary building. The finding states that the design provisions for the line are shown on Figure 10.4-10; however, it contends that the design is improper in that it violates FSAR commitments related to the seismic design capability of the active AFW Turbine driven pump.

RESPONSE

The response to this finding is divided into three parts which address 1) the design adequacy of the exhaust line 2) the compliance with the FSAR, and 3) the content of the FSAR.

1. Design Provisions

The design of the AFP turbine exhaust line was established during the early phases of the project and it was shown in the PSAR and the FSAR as being non-seismic Category I beyond the boundary of the auxiliary building.

The design was based on current licensing requirements for system operation following a single failure. The design flow rate is delivered by the system for all credible initiating events and has been accepted by the NRC during both the PSAR and FSAR review phases.

The following exhaust line failure mode considerations were evaluated in establishing the design:

(a) The auxiliary boiler building is designed to UBC seismic considerations and is not expected to fail during a seismic event.

(b) If the auxiliary boiler building were to catostrophically fail and the exhaust line were sheared off completely, the AFP turbine would operate properly.

(c) Even if the exhaust line were to crimp significantly, the AFP turbine driven pump would still deliver design flow rates. The back pressure on the turbine may be increased significantly before the required flow rates will not be available. A local constriction of 90% of the free area of the exhaust line is required before the design flow will not be delivered. This type of failure is not considered to be credible.

Breaks in seismic Category I piping are not postulated during a seismic event. Thus a MSLB or MFLB inside containment or in the steam tunnel are not postulated following a seismic event and the design of the exhaust line does not enter into the evaluation of these breaks.

For a seismically induced MSLB in the turbine building, various single failures can be postulated, none of which result in adverse conditions even if the AFP Turbine is inoperable. If an MSLIV fails to close, one steam generator will blow down; however, 2 motor driven AFW Pumps are available to feed 3 intact steam generators. If one motor driven pump train fails for any reason, the other motor driven pump will feed 2 steam generators as required. In this case the break has been isolated by the MSLIV and all 4 steam generators are intact.

The turbine driven pump subsystem is designed to be independent of AC power as required by the NRC for defense-in-depth to reduce the consequences of a total loss of all AC power. Loss of all AC power is not a design basis condition of SNUPPS since it would require failure of both of the diesel generators to start concurrent with a loss of offsite power. However, the design capabilities of the SNUPPS plants for this condition were evaluated by the NRC staff and the ACRS and were found to be acceptable.

The possibility of both a seismic event and a total loss of AC power occurring simultaneously is remote. Even if this combination were to occur, the auxiliary boiler building would have to fail in a manner which would result in the nearly perfect sealing of the entire flow area of the exhaust line before the turbine driven pump would fail to deliver the required flow.

To summarize the design provisions of the AFW system, the system design meets all current requirements and will function for events beyond current design bases established by the NRC.

2. Compliance With The FSAR

The design of the AFP turbine exhaust pipe is in accordance with the original design intent and the FSAR requirements. The declassification of the exhaust line to non seismic and B31.1 was shown in the PSAR and the FSAR. The design of the AFW pump and turbine meet the FSAR requirements stated in Section 3.9(B).3.2.2.1: the pump is designed and qualified to operate during a safe shutdown earthquake. This section makes no commitment for the design of the exhaust line nor does it address the exhaust line.

The regulatory requirements for the seismic design of systems are addressed in Regulatory Guide 1.29. The SNUPPS response to this regulatory guide is provided in Table 3.2-3. As noted therein, the SNUPPS implementation of seismic requirements is shown on Table 3.2-1. The text of Section 3.2 states the following:

> "For identification of system and subsystem boundaries, Table 3.2-1 is supplemented (i.e., referenced to applicable figures) by piping and instrument diagrams which have been marked to clearly show the limits of the seismic category I and the various quality group classifications on a system."

Section 5.4 of Table 3.2-1 describes the AFW system pumps and provides a reference to Figure 10.4-9. Figure 10.4-9 clearly indicates the limits of the seismic Category 1 piping. Section 10.4.9 also references this table for the definition of seismic design limits.

In summary, it is SNUPPS position that there is no violation of FSAR commitments.

3. Content of the FSAR

This finding implies that the SNUPPS FSAR did not fully describe the design of the exhaust line. We believe that the FSAR content is appropriate.

The SNUPPS FSAR is written in accordance with Regulatory Guide 1.70. This regulatory guide and the Standard Review Plans (SRPS) do not require descriptions of design provisions which have not been provided nor do they require justification for not providing certain features. The SNUPPS FSAR does clearly identify the design of the exhaust line and references the specific location in which the exhaust line provisions can be reviewed.

UNRESOLVED ITEM 2-1

This unresolved item addresses the fact that the final room temperature calculations for the turbine driven pump room were not completed at the time of the audit. Since the AFW turbine driven pump is to be independent of AC power, no Class 1E cooling or ventilation is provided. The components within the room are designed for the ambient conditions resulting from the operation of the pump. This item also indicates an apparent need to calculate the resultant environment following a non-mechanistic pipe break in the steam tunnel.

RESPONSE

The audit report correctly indicates that the calculations had not been finalized and that, on the basis of engineering judgment, the final calculations would likely support the conditions previously specified. The final calculation has been completed and it confirms that room conditions will be maintained below equipment qualification temperature of 150°F during operation of the AFW turbine driven pump. These conditions are based on heat sinks and conduction heat losses from the room; no credit is taken for the non-safety related ventilation system since it is powered from AC power.

With respect to the environmental effects of a non-mechanistic break in the steam tunnel, please refer to the discussions provided in response to Finding 2-7. As noted in the response to Finding 2-7, the environmental conditions in an adjacent valve compartment stabilized when the fire dampers closed. For the turbine driven pump room, the HVAC system is isolated by valves which close on an SIS. Therefore, the amount of steam released into the room will be less than the analyzed compartment. The heat transfer through the slab would be a much slower transient which is not expected to provide a significant effect on the room's environment. The turbine driven pump can be expected to function during this transient even though it is not specifically qualified for the resultant conditions.

It should be noted that both motor driven pump rooms are provided with Class 1E air coolers which will minimize the effects of any steam release through the drains or conduction through the floor slab separating the pump rooms from the main steam tunnel. Since the total loss of AC power is not postulated with a nonmechanistic break in the tunnel, one or both motor driven auxiliary feedwater pumps would be available to mitigate the effects of the nonmechanistic break and to ensure the health and safety of the public.

As noted in the response to Finding 2-1, the turbine driven pump is designed to be independent of AC power for defense-in-depth for an event which is beyond the design basis of the SNUPPS plants. That event is the total loss of AC power (both onsite and offsite) in which both diesel generators fail to start. That event is very improbable and is not postulated to occur with any other DBE or with a nonmechanistic break in the steam tunnel. Therefore, the turbine driven pump is not considered to be subjected to these potentially adverse transients while it is the only source of auxiliary feedwater.

In summary, the required finalization of the AFW turbine driven pump room temperature calculation has been completed. Since the effects of a nonmechanistic break in the steam tunnel are not a design consideration for the room, the related effects are not included in the calculations.

FINDING 2-2

This finding addresses minor errors on the flow diagram at three nodes for one of the five analyzed modes of AFWS operation. The errors resulted from the use of previously calculated pressure drops from another case; however, the line was stagnant for this specific case and no flow related pressure drops would exist.

RESPONSE

Bechtel agrees with the substance of this audit finding and with the auditor's observation that this was not a systematic error, and that it had no effect on the design. The mode which was being analyzed would never exist in the actual plant. The mode was considered only to demonstrate the maximum pressure which the piping could potentially experience for defense in depth. The mode assumed that the pumps were operating in a recirculation mode with suction from the ESW system [higher pressure than the condensate storage tank (CST)] due to the unavailability of the CST. This case also assumed that the flow was returned to the CST. This flow scheme would not be used during a test since it would result in contamination of the CST water with essential service water. This flow scheme would not exist during system operation since the discharge valves to two steam generators would not be closed.

In summary, the errors had no significance and the flow diagram will be corrected to reflect the pressures of the assumed no flow condition.

FINDING 2-3

This finding addresses an error in AFWS calculation AL-20 wherein the head loss assigned to flow restriction orifices had been changed in one part of the calculation but not in another. The auditor concluded that this inconsistency had no effect on the results of the calculation since sufficient margin was provided in subsequent steps.

RESPONSE

The calculation has been revised to correct the error. Bechtel agrees with the finding in that an error existed, that the error was limited in scope and not systematic and that the error did not adversely affect the results.

FINDING 2-4

This finding addresses the fact that zone of influence drawings for pipe break effects evaluation had not been prepared in accordance with the instructions contained in the Project Engineering Manager internal memorandum of August 19, 1980.

RESPONSE

The zone of influence drawings were not prepared because other, more effective means were available to determine the area and equipment affected by each break. As noted by the inspector, the 3/4" engineering model was effectively utilized in actually determining the influence of breaks. The instructions have since been revised to reflect actual practice.

FINDING 2-5

This finding addresses an apparent misstatement in the documentation contained on a target sheet which is used to document the evaluation of the effects of a specific break. The break number is FC01-01. The Dynamic Effects Analysis (target sheet) stated that there would be "no whip"; whereas, the inspector's evaluation was that the pipe could potentially whip. (Note: The target sheet should have stated that while the pipe could whip, no impact would result due to the absence of unacceptable targets in the area). This misstatement was indicated to have no impact since there were no unacceptable targets in the area.

RESPONSE

The specific target sheet was completed as a formality following the evaluation of the content of the room, the significance of the break, and the effect on safe shutdown. All components within the room and particularly those in proximity to the break were associated with the turbine driven auxiliary feedwater pump. The pump was made inoperable due to the pipe break in question, therefore it was determined that no adverse effects would result whether the pipe whipped or not.

Without confirmatory analysis, the pipe should have been considered to potentially whip since the distance to the first rigid restraint was beyond the hinge distance. As noted above, this misstatement has no impact since there are no unacceptable targets in the area. A notation has since been made on the specific target sheet which states that "this pipe may potentially whip, however, there are no unacceptable targets if the pipe should whip".

This is considered to be an isolated case. In other areas of the plant where essential targets exist, the engineers determined whether the pipe actually would whip. All evaluations are conservative and ensure that the plant can be shutdown and the effects of the break mitigated.

FINDING 2-6

This finding reflects the inspector's view that the break by break effects analysis (target sheets) are quasi design documents and therefore should have been subject to controls of EDPI 4.37-01, Design Calculations, or other controls of a similar scope requiring the target sheets to be signed, dated, checked, and approved as they were developed. The finding also indicates the inspector's understanding that since this was not done, a final review near the end of the project would be performed (by Bechtel) to ensure the accuracy of the documents; however, in the interim period, these documents should be subject to formal control.

RESPONSE

High energy line break (HELB) has been a design consideration from the very early stages of the SNUPPS job. The engineers initially assigned to the SNUPPS Project were knowledgeable in HELB considerations and ensured that basic separation criteria were included in the plant layout. Since the SNUPPS concept of power block duplication provided for a detailed engineering model, the design for HELBs has been integrated into the base design of the plant and reflected on the engineering model. Starting in 1977, an informal Hazards Protection Task Force (HPTF) was formed to ensure that HELB considerations are incorporated into the design. Interdisciplinary meetings were held to define the HELB program requirements, formalize interfaces and establish design responsibilities.

In 1980, the Bechtel Project Engineering Manager issued the instructions referenced in Finding 2-4 to formalize previous agreements and to ensure that each discipline was aware of the other disciplines' design responsibilities and interfaces. Each discipline is responsible for developing appropriate design calculations to support HELB-related designs issued by the discipline. These calculations were generated in accordance with EDPI 4.37-01 and the design drawings were generated in accordance with EDPI 4.46-01. The finding acknowledges that data on the target sheets were extracted from design calculations and piping isometric drawings which have, since inception, been properly controlled.

The HPTF is not a design group. It serves mainly an advisory function and allows for interdisciplinary discussion of HELB concerns. Engineers within each discipline perform the actual design duties. The target sheets reflect the design of the plant, since the design had to exist prior to the development of the list of targets which could be impacted. The target sheets, therefore, do not form a basis of the design. Similarly, the action plans which summarize the potentially adverse conditions identified on the target sheets provide recommendations for discipline evaluations and designs. The discipline receiving the action plan determines if a design modification is required and notifies the HPTF coordinator of the results of the evaluation. The status of action plan resolution and the method of resolution is maintained.

Similarly, the HPTF documentation is not the primary backup for information submitted to the NRC. The design calculations and design drawings provide the primary backup for licensing submittals. The HPTF documentation does indicate that extraordinary efforts of review and coordination have been properly performed. It also provides a convenient well organized location for verification that the HELB program was correctly implemented.

The main issue in this finding is with the adequacy of the controls provided for the HPTF review documentation. Bechtel considered the need for controls and established those controls which were deemed appropriate, necessary, and cost effective to ensure that the design provided was correct and met the licensing commitments. Although Bechtel determined that signing, dating, checking and approving of the target sheets were not required, adequate controls were implemented.

Following completion of the target listings, the HPTF Coordinator issues dated action plans (by signed and dated memos to the disciplines) which document the need for additional evaluations or design work to be performed by a discipline. The action plans were controlled and reviewed informally by the Project Engineer and the supervisor of the Mechanical discipline, and the disciplines receiving the action plans. There was and still is daily contact between the HPTF Coordinator and supervision within the Mechanical group.

The target sheets have always been maintained in one central location along with other data relevant to the HPTF efforts. These files are closely supervised and controlled within the Mechanical group. As noted in the finding discussion a final review of this documentation will be performed to ensure that it reflects the final design. Since continuous control has been exercised, no significant deviations are expected to be found.

In summary, adequate and proper HELB control has been provided throughout the design phase. These controls have functioned properly for many years, and need not be altered prior to the final review of the HPTF documentation which is scheduled for the near future. All action plans have been dated, reviewed and transmitted to the design disciplines. The design disciplines will continue to exercise design controls for design functions to close out the action plans. Bechtel will continue to ensure that the HELB effort is adequately controlled and implements the licensing commitments.

FINDING 2-7

This finding identified an apparent instance where a statement in the FSAR had not been implemented in the design. The statement was that there is no water drainage to lower elevations of the auxiliary building following a nonmechanistic break of a main feedwater line. The main issue is whether the effects of nonmechanistic breaks in the steam tunnel should be considered in the design basis of the rooms below the steam tunnel.

RESPONSE:

In 1977 the NRC advised the SNUPPS utilities that the SNUPPS main steam tunnel room would have to be designed to withstand the pressure effects of a nonmechanistic break in a main steam or main feed line. The NRC also stated that any equipment required for safe shutdown located within the room should be qualified to the resultant environment. On March 9, 1978, the NRC accepted the design modifications and analyses provided by SNUPPS which allowed the venting of the structure and provided the parameters required for qualification of items within the room.

Flooding within main steam tunnel room from this nonmechanistic break was calculated. In order to ensure the integrity of the walls and to preclude the need for equipment qualification in a submerged condition, two twenty-inch drain lines were provided to drain the water to the turbine building. During preparation of the licensing submittal, note was taken of these large drain lines as well as certain sealed penetrations through the floor of the steam tunnel. it was erroneously assumed that there would be no drainage to the lower elevations of the plant even though the small drain lines were shown on the drainage system P&IDs. The FSAR will be revised to eliminate this error.

Although it was never SNUPPS' intent to extend the effects of this improbable, nonmechanistic break outside the steam tunnel, water drainage and steam escape through the small drain lines have been considered. Water drainage to lower elevations will not adversely affect safety-related equipment because the water goes to the auxiliary building basement which has a 7-foot design flood depth. Similarly steam escape is not likely to affect safety-related equipment due to the small driving force (steam tunnel pressure) and because fire dampers in the ventilation ducts close when the room temperature exceeds that normally anticipated. When the dampers close, the driving force equalizes, and passive heat sinks take effect to reduce room temperature.

FINDING 3-1

The finding noted that stress newsletters had not been evaluated for use on the SNUPPS project and were not controlled properly or implemented uniformly. The inspector judged this to be a violation of Bechtel Procedure EDPI 4.1-01, "Design Criteria".

RESPONSE

Bechtel concurs that the issuance of and the use of documents similar to stress newsletters should be subject to normal design document controls. Therefore, Bechtel recalled all stress newsletters and issued them as controlled documents on December 10, 1982. New issues or revisions to existing newsletters are also being controlled in accordance with guidelines issued by the Chief Engineer in his Dec. 10th memorandum.

Newsletters do not contain design criteria as defined in EDPI 4.1-01; therefore, the prior lack of formal control of the newsletters is not considered to be a violation of the EDPI. The newsletters contain information, such as discussions of analysis techniques and clarifications of code interpretations and procedures, which is available to the project through other sources.

UNRESOLVED ITEM 3-1

This item addresses the contention that for skewed supports (which did not align with east-west, north-south or vertical directions), the seismic anchor movement applied to the support by computer program ME 101 is the global movement multiplied by the cosine vector. It was noted that this practice might yield nonconservative results for some cases.

RESPONSE

ME 101 analysis of skewed piping utilizes input of two global seismic movements at the support point on the pipe. The program calculates the components of these two displacements in the direction of the support and two separate static analyses are performed. The responses (i.e, loads, deflections, moments) from the two analyses are then combined by the Square Root of the Sum of the Squares (SRSS) method. This methodology is acceptable because the transient responses of the components due to dynamic motions are relatively uncorrelated and have random peaking.

Therefore no further study or corrective action is necessary.

FINDING 3-2

This finding addresses stress analysis problem 60 which had not employed the correct enveloped seismic response spectrum. The finding discussion indicated that since no formal design requirements exist to address response spectra input for branch lines, this problem could apply to other analyses where branch lines have been decoupled from larger piping systems. (Note: the discussion of Finding 3-1 indicates this type of error could have been avoided by use of an appropriate newsletter).

RESPONSE

Bechtel concurs that stress problem 60 used the incorrect seismic response spectrum. The stress problem has been reanalyzed with a new response spectrum which envelops the containment shell and Auxiliary Building. The results of the reanalysis do not significantly differ from the previous analysis.

In an effort to evaluate the potential for similar error, Bechtel has reviewed the stress input for four other stress problems (P-43, P-70, P-225 and P-27BY). These stress problems were chosen for review based on their similarity to problem 60. It was found that the proper spectrum was used in all cases. Therefore, it has been concluded that this error is an isolated incident and no further review is necessary.

It should be noted that the application of the building response spectra in pipe stress analysis problems is performed in accordance with normal stress analysis criteria. The misapplication of response spectra as noted in this finding is the result of analyst error and not the general misapplication of stress analysis newsletters.

FINDING 3-3

This finding related to the fact that drawing M-03AB01 did not reflect the correct "as-built" condition at the connection between the steam supply to the auxiliary feed pump turbine and the main loop 3 header. It was noted that the piping fabricator had supplied a configuration slightly different from that described on the Bechtel drawing.

RESPONSE

The subject connection has since been incorporated onto the applicable design isometric drawing. The drawing has been reviewed by the Bechtel stress group and the relevant stress problem (P-60) reanalyzed with the correct geometry and stress intensification factor. The stresses resulting from this change were found to be within code allowable limits.

Identification of inconsistencies between "as-built" configuration and the applicable design drawings such as that noted by the inspector are explicitly addressed in the SNUPPS IE 79-14 walkdown program currently underway at Callaway. The 79-14 walkdown program provides for reconcilation of all physical differences between as-built configuration and approved design; such reconcilation will be reflected in the final design drawings and stress analyses. This program provides assurance that other inconsistencies are corrected prior to fuel load.

FINDING 3-4

This finding addresses the fact that pipe stress analysis problem 60 did not contain documentation for calculation of the stress intensification factor (SIF) used. The finding indicated that this was in violation of EDP 4.37, Design Calculations.

RESPONSE

Bechtel concurs that problem 60 did not provide the origin for the SIF used in the calculation. The specific value used has been confirmed to be correct. Since this problem has been reanalyzed, the origin of the SIF value has been indicated.

The prior lack of documentation is not considered a violation of EDPI 4.37-01. Assumptions are listed in the calculation; it is not required that the justification for every assumption be documented.

FINDING 3-5

This finding indicates that piping stress analysis problem 44A did not contain an evaluation of the imposed loads and movement due to the thermal expansion of the attached buried piping outside the auxiliary building. This is contrary to Section ND-3651 of the 1974 Edition of the ASME Code. The inspector noted that this appeared to be a unique situation involving an interface, without an anchor, between Non-Seismic Category I buried pipe and Seismic Category I pipe inside a building.

RESPONSE

Bechtel concurs that loads and movements from the attached buried piping had not been fully addressed in problem 44A. As such, a design procedure has been developed by Bechtel to address buried pipe installations. This procedure has been transmitted to the engineering group in the form of a Stress Newsletter.

As a result of this finding problem 44A has been reanalyzed to properly account for buried piping. The reanalysis results show that all pipe stresses are within code allowables. Bechtel is presently conducting a review of all SNUPPS analyses involving above-the-ground/buried piping interfaces. At present, it is unlikely that any physical modification to the piping systems will be required as a result of the review.

FINDING 3-6

The finding indicated that stress analysis problem 44A did not contain an analysis of piping from the condensate storage tank inside the building for the cold condition. It also noted that this omission did not appear to be systematic since a check (by the inspector) of the section from the ESSW and AFW discharge piping confirmed they had been analyzed for the low temperature condition.

RESPONSE

Bechtel concurs that the cold condition had not been evaluated in the pipe stress analysis. Problem 44A has been revised to account for the cold condition of the piping. The results of the reanalysis indicate that all piping stresses are within code allowables and that there is no significant increase in pipe support loading. Bechtel further concurs with the NRC that this is an isolated omission.

UNRESOLVED ITEM 3-2

This item indicates that the Auxiliary Feedwater system piping had not been evaluated for compliance with NRC MEB document "Interim Technical Position Functional Capability of Passive Piping Components for ASME Class 2&3 Piping Systems". It also indicates that, in the inspector's view, stresses at some points in the piping system exceed the minimum limits given in the technical position.

RESPONSE

The Auxiliary Feedwater system has since been evaluated and the piping system meets the function capability requirements of the technical position. The results of the evaluation indicated that no stress limits were exceeded and no modification was required.

UNRESOLVED ITEM 3-3

This item addresses the fact that stiffness calculations had not been performed for pipe support O-AL04-C009/135Q, which utilizes a two-strut design in accordance with Hanger Engineering Standard (HES) 16. Additionally, this item notes that an evaluation had not been performed to verify that the strut stiffnesses met the requirements of Specification M-217 for the entire range of angles allowed by HES-16, revision 1.

RESPONSE

As a result of this item, and in order to demonstrate the acceptability of HES-16, revision 1, calculations were performed using varying strut restraint angles. The calculations demonstrate that the minimum stiffness requirements as specified in Specification M-217 were achieved when struts were separated by as little as a 22° - included angle.

The two-sway strut application is similar to a truss design in which the structural members experience only axial loading; i.e., the members do not experience any bending or shear loading.

As axial deflections are generally not significant in overall stiffness calculations, the omission of sway strut stiffness contribution to overall stiffness calculations would not have a significant effect.

Bechtel has concluded that two strut applications such as the one addressed in this item in accordance with HES-16, revision 1, meet the minimum stiffness requirements specified in Specification M-217 and further utilized in piping stress analysis. The evaluation is available for NRC review in Bechtel's Gaithersburg Office.

UNRESOLVED ITEM 3-4

This item addresses the lateral vibrations of struts and rods which was not considered for the SNUPPS project. No criteria were available for evaluating the frequency of supports in the unrestrained direction. FSAR Section 3.7(B).3.7 stated that the seismic design of piping included the effects of the seismic response of supports. This item contends that significant lateral vibration of the support would reduce its buckling capacity and could affect the response of the piping system. This question should be addressed to determine whether it has any effect on the design.

RESPONSE

The SNUPPS FSAR states that the seismic design of piping systems "included the effect of the seismic response of the supports..." The design of struts and rods considered appropriate effects of the seismic response of these elements by specifying axial stiffness criteria which preclude amplification of seismic loads in the direction of loading. Since struts and rods are not intended to transfer lateral seismic loads, no amplification in these directions need be considered.

In response to this item, Bechtel has performed a two-fold evaluation of the effects of lateral vibration. The study addresses the following:

1. The ability of sway struts and spring supports to function while subjected to lateral vibration.
2. The effect of dynamic loads resulting from support lateral vibration on the piping system.

The study indicates acceptable results for both of the above noted areas of concern.

FINDING 3-7

This finding indicates that support AL01-R005/135Q was not intended to provide vertical support; however, the field inspection of the support indicated that there was no clearance at the bottom of the pipe and the pipe motion would be restrained in the vertical direction. This was indicated to be a nonsystematic error that was not picked up on the detail checking.

RESPONSE

Revision 3 of the support drawing was issued on January 6, 1983 to remove the discrepancy between the dimensions shown in the Bill of Materials and the support detail. This support will be reworked to obtain the proper vertical clearance.

Bechtel concurs with the NRC inspector that this was a nonsystematic error. As noted in the audit finding discussion, this condition would most likely have been observed and corrected as a result of the IE Bulletin 79-14 walkdown.

FINDING 3-8

This finding indicates that the stress analysis stiffness input did not consider the contribution of component support (snubbers, sway struts, etc.) flexibility and, in essence, assumes the snubbers involved to be rigid. In the opinion of the inspector this omission constituted a violation of Bechtel Specification M-217. It also indicated that the inclusion of the snubber stiffness value in support O-FC01-R020/135Q would have resulted in an overall stiffness value less than that used in the input to stress analysis problem 60. The inspector further noted that snubber stiffness characteristics in general were not being checked for compliance with M-217. This finding together with unresolved items 3-3, 3-4 and 3-6 indicates need for improved guidance in this area.

RESPONSE

Bechtel Specification M-217 was not explicit regarding the applicability of stiffness criteria to various classes of supports. As noted in the response to Unresolved Item 3-6, Specification M-217 has been revised to reflect the current policy which is summarized as follows:

> For ASME Class 1 piping analysis, the pipe support stiffness value will encompass the contribution of all elements in the pipe support assembly including component standard supports. For ASME Class 2 and 3 and ANSI B31.1 piping analysis, the stress analysis input will consist only of the minimum stiffness values established in Specification M-217. The stiffness values are calculated based on the stiffness of the structural pipe support members only, assuming that the component standard supports are infinitely rigid.

The basis for the above policy is that component standard supports are normally loaded axially and are therefore significantly stiffer than the associated support structural members. Therefore, the omission of component support stiffness contribution from the pipe stress analysis input does not generally affect the validity of the result.

To provide an example of how Bechtel's design practice ensures the piping system's ability to meet code requirements, Bechtel has performed a study wherein one restraint stiffness in a piping stress analysis was modified to include the stiffness value of a typical snubber attached to a pipe support designed in accordance with M-217 stiffness criteria. The study utilized normal frequency design considerations and evaluated the effect of the worst case snubber/pipe support combination. The results indicate that seismic response of the piping system is not significantly affected and that pipe support loading and pipe stresses would increase slightly. The full text of this study is available for NRC review at Bechtel's Gaithersburg office. A draft of the revised section of Specification M-217 has been attached for information. The responses to unresolved items 3-3 and 3-6 are also addressed by the attachment. The findings noted above and unresolved items 3-3, 3-4, and 3-6 did not indicate any deviation from Bechtel standard design criteria. As such, the need for further guidance in the area of pipe support stiffness applications is unnecessary. However, the revision to Specification M-217 will serve to further document Bechtel's current position.

DRAFT

C. The stiffness of a support in the restraining direction will be determined as follows:

1. For supports on Nuclear Class 1 Stress Problems the total stiffness will be calculated using the individual component stiffnesses (e.g., clamp stiffness, strut stiffness, frame stiffness, etc.).

2. For all other supports (excluding Non-Q, Non-II/I, and Non-Seismic) the support stiffness shall only include the stiffness of any supplementary pipesupport steel (e.g. frame stiffness, beam stiffness, etc.). However, the stress analysis group may require the total support stiffness for specific stress problems or supports. In such cases the total support stiffness will be calculated using the method described in Section 4.2.C.1.

In neither case shall the support stiffness include the stiffness of any building steel or building structure or any structure outside the jurisdictional boundary established in the ASME Code Subsection NF.

UNRESOLVED ITEM 3-5

This item identified that the ASME Code stress intensification factor was used to reduce the collapse moments when designing boundary anchors in the vicinity of fittings. The general acceptability of this practice is questionable, since the code stress intensification factors would not generally correlate with section collapse properties.

RESPONSE

It should be noted that the SIF reduction provision of TB-011 has had limited usage on SNUPPS. Only three anchors have been designed utilizing the reduced SIF. These anchors were all within three pipe diameters of elbows. There are no instances where the SIF reductions were applied to other fittings.

The use of pipe collapse loads for the design of seismic boundary anchors assumes total collapse of the adjoining non-seismic portion of the pipe and therefore reflects an extremely conservative design approach. For some boundary anchors located within three (3) pipe diameters of a fitting, the collapse loads are reduced by application of the stress intensification factor, which accounts for lower strength and, hence, lower collapse loads at weaker points in the piping system. In order to approximate the actual section collapse properties, the stress intensification factors are reduced by 25%. The 25% reduction factor was previously determined by comparison of the test data referenced in TB-011 with calculated stress intensification factors. In light of the hypothetical worst load case event postulated, Bechtel has concluded that the present seismic boundary anchor design practices are acceptable.

UNRESOLVED ITEM 3-6

This item addressed the approval of the design modification requested in Field Change Request (FCR) 2FC-1191-MH without an evaluation of the contribution of the building's structural member to the support's overall stiffness computation. It was noted that the method of attachment to the I-Beam would offer minimal resistance to rotation and could affect the design stiffness of the support.

RESPONSE

As a result of this item, Specification M-217 has been revised to further clarify the position that only structural members designed by the pipe support group are to be considered in overall stiffness calculations. This revision indicates that building structural members are to be assumed as infinitely rigid and not included in the stiffness calculations. The basis for this revision is as follows:

1. Building structural members are normally significantly larger and more rigidly framed than the associated pipe support structure. As such, they do not contribute appreciably to the overall support stiffness.

2. Many structural members (such as the structural member in question) are composite sections which are mechanically connected to the adjacent reinforced concrete slab. Structural members in this configuration undergo minimal deflection or rotation and do not contribute significantly to the overall stiffness calculation.

3. Limitations must be placed on the scope of stiffness calculations. This limit is selected to be the building structural steel (the point where additional structural elements do not significantly alter the stiffness). It is not feasible to consider all structural deflections beyond this point.

In summary, Bechtels evaluation of FCR 2FC-1191-MH was performed in accordance with the normal procedure. The revision to Specification M-217 clarifies and justifies the Bechtel design practice.

UNRESOLVED ITEM 3-7

This finding addressed the design adequacy of the angle supports for the AFP Turbine control panel shown in the Terry Corporation Qualification Report. The finding indicates that an unsymetrical bending analysis using appropriate analytical methods should have been performed on the angle supports to properly predict the stresses in the supports.

RESPONSE

The subject angle supports will not be installed in the plant. The control panel will be mounted on a rectangular frame which will be rigidly connected to the auxiliary building wall. The supports shown in the Qualification Report were used to mount the panel to the shaker table. The panel was mounted to the test supports in the same manner that it will be supported to the frame which will be attached to the auxiliary building wall. This frame is symetrical and rigid. Based on the above considerations, which were not presented to the author of this finding, this issue is considered to be closed and no analysis is required.

UNRESOLVED ITEM 3-8

This finding addressed a potential inadequacy in stress problem 60 wherein a nozzle was assumed to act as a rigid point at the boundary of the stress problem. The AFP turbine test report results indicated that several points within the pump/turbine package had low natural frequencies which could invalidate the assumption that the nozzle is rigid.

RESPONSE

The assumption that treats the nozzle as a rigid point is potentially unconservative. The AFP test report indicates that the turbine casing is rigid and that selected appurtenances on the skid have low natural frequencies. Stress problem 60 will be revised so the the problem is terminated at the rigid turbine casing. The analysis will consider the trip and throttle valve and include the valve frequency.

FINDING 4-1

The Union Electric review in 1973 of the Bechtel Civil-Structural Design Criteria Specification C-O was conducted prior to issuance (in March 1974) of Union Electric Procedure QE-303 governing design document review. The inspector noted this to be a procedural oversight which was corrected with issuance in 1974 of the referenced procedure.

RESPONSE

As noted by the inspector, this oversight was corrected with issuance of Union Electric Procedure QE-303 in March, 1974. Review comments generated prior to that date with respect to Specification C-O were verified to have been properly dispositioned. Design document review activities subsequent to March 1974 have been carried out in accordance with written and approved procedures subject to QA audit and surveillance.

FINDING 4-2

The training and experience records for a civil/structural engineer employed by NPI from June 1975 to May 1976 could not be located. This was indicated to be a record keeping error without impact on the design.

RESPONSE

An updated copy of the engineer's education, training and work experience records have been obtained and placed in the NPI personnel files. A check of these files confirms this to be an isolated record keeping error. Qualification and training records were verified to be on hand at NPI for current and previously employed professional/technical staff.

FINDING 4-3

Bechtel procedure EDPI 4.37-01, Section 4.2, which requires all calculations to be microfilmed by the 15th day of the month following approval, was violated due to a delay in processing Auxiliary Building seismic analysis calculations for microfilming. This was a procedural matter that had no apparent effect on the design.

RESPONSE

The calculation in question (13-08F) involves large amounts of computer generated data which must be microfilmed with the calculation. The computer output was cross-referenced in the parent calculation to facilitate retrieval. All computer data microfilm records were verified for proper cross-referencing prior to forwarding the parent calculation for microfilming. This task was necessary to ensure the absence of operator error during microfilming, and was performed as the schedule permitted due to the extensive data involved. The calculation in question has been microfilmed.

The subject matter of the calculation (floor response spectra) was critical to ongoing design tasks. Therefore, review and approval by the Civil group supervisor was expedited to allow its use during the cross-refetence verification process. This practice was limited to the calculations generated for seismic related analysis, and is of a unique nature due to the extensive computer generated work associated with the seismic analysis. The timing prescribed by the procedure applies to calculations in general and does not recognize extraordinary circumstances such as exist in this case.

Although a technical violation of EDPI 4.37-01, Section 4.2 is acknowledged, this process did not affect the technical content of the calculation and was, in fact, intended to ensure the accuracy of the final record.

UNRESOLVED ITEM 4-1

In the design of an electrical raceway support involving the use of clip angles connecting a vertical steel tube to a base plate, assumptions regarding a hinged connection at the base were questioned. The design did not account for partial fixity developed at this connection. It was requested that the welds and angles be evaluated in terms of actual fixity of the attachment to determine whether or not adequate strength exists.

RESPONSE

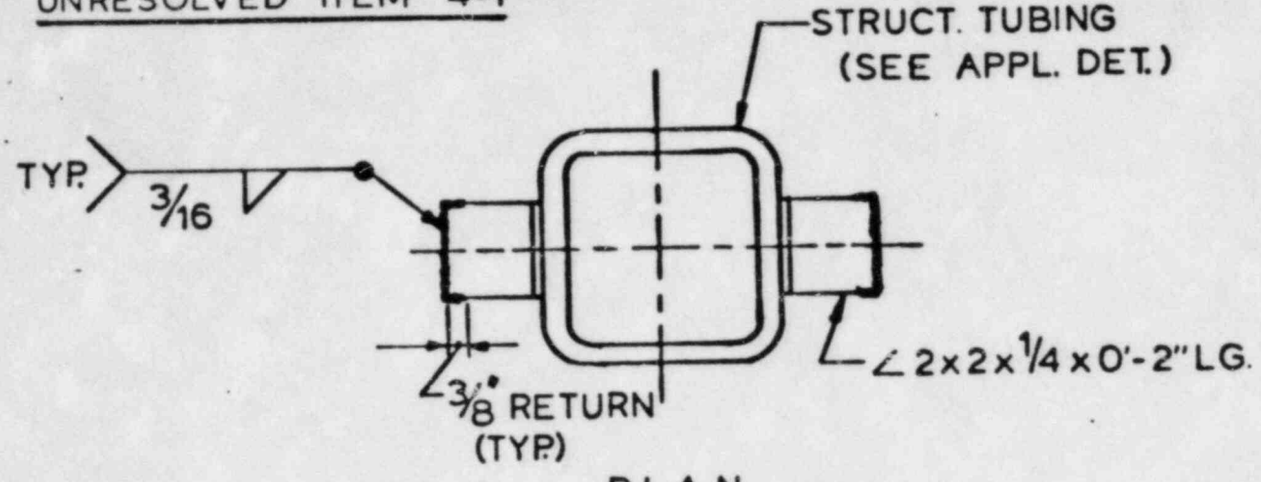
The subject connection detail was utilized in the design of cable tray supports located within the Auxiliary and Control buildings involving tubular steel members spanning between floors. The detail in question consists of two, 2" x 2" x ¼" steel angles, two inches in length, field welded to the steel tube and a surface mounted or embedded base plate at the floor surface. The details are shown on the design drawings as follows:

Det. 17, Dwg. C-0418
Det. 14, Dwg. C-0419
Det. 22, Dwg. C-0420

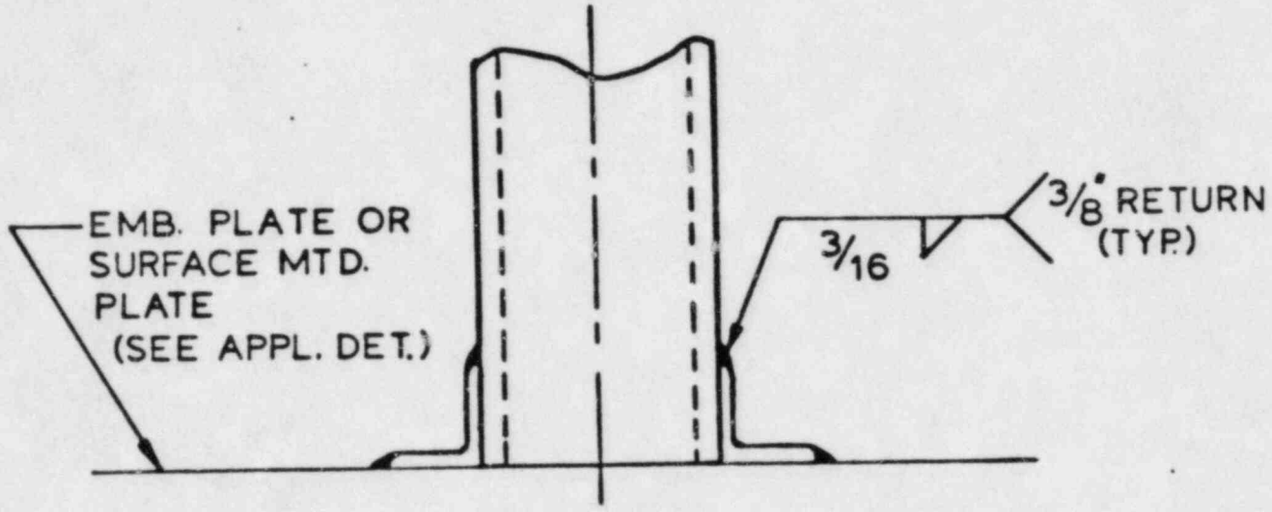
The three details referenced above (see attached sketch), specify a 3/16" fillet weld to the base plate and the steel tube along the length of the angle, with a 3/8" long weld return at each end. This weld configuration allows the end of the steel tube to rotate without damaging the weld by allowing the legs of the angle to bend. This rotation can readily be developed even in the absence of a gap between the end of the tube steel and base plate. Therefore, although the connection attracts some moment when the tube is loaded in the horizontal direction (seismic loading), this moment is immediately relieved upon rotation of the joint, approaching a hinged connection. In addition, the assumption of a hinged boundary yields conservative design moments for the tube section being connected.

We therefore maintain that the assumptions made in the design of there connections are consistent with standard design practices and do not require further evaluation.

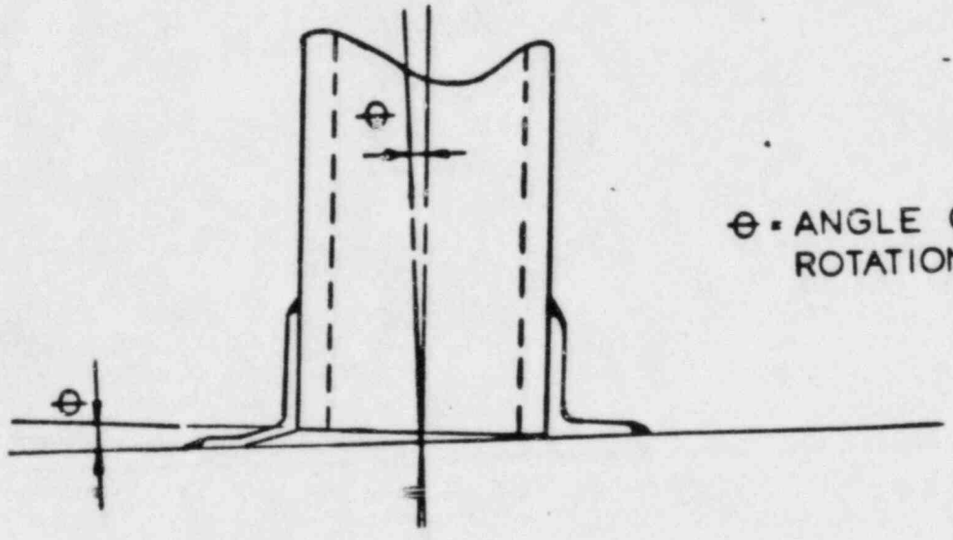
UNRESOLVED ITEM 4-1



PLAN



ELEVATION



ROTATED POSITION

FINDING 4-4

Certain findings and questions identified in the course of the inspection lead to a conclusion that, although subunit interfaces are generally understood, established project practices indicate certain inconsistencies. Consequently, the inspection team concludes there is need for more formal and precise methods for controlling subunit interfaces and training to enhance the effectiveness of the subunit interface control.

RESPONSE

Engineering Department Project Instructions (EDPI's) are utilized by the architect-engineer to provide design and design interface controls applicable to all disciplines on the SNUPPS Project. Specific requirements regarding preparation of design criteria; drawing and specification control, preparation, and review; control of engineering calculations; design change control, processing of nonconformances, field changes, and supplier deviations; and off-project design reviews are prescribed in these project procedures. These procedures are supplemented by Bechtel division-wide design guides and standards; special scope and desktop procedures; engineering checklists; and formal indoctrination and training sessions of cognizant engineering department personnel. These controls are further enchanced by use of a Correspondence Control Book issued to all Project Engineers and Group Supervisors and utilized by each design discipline within Bechtel Project Engineering. This book provides a reference index of applicable procedures, letters, interoffice memos and directives, and flow charts to be utilized by the discipline in performing the day-to-day design function and assuring effective coordination and communication within and between the design disciplines. We believe these interface controls have, in general, been effective in assuring a satisfactory technical product; a conclusion which appears to be reflected by the inspection team's findings and conclusions stated throughout the NRC inspection report; e.g. Section 5.1, Auxiliary Feedwater Components; Section 4.4, Generic Embedded Plate Program; Section 4.5, Pipe Supports, Hangers and Restraints Pgs. 4-15 and 4-18) and Section 4.6, Control of Design Changes.

It is recognized, however, that with the myriad of interface possibilities which exist in a project of the scope and complexity of SNUPPS, there are areas which would benefit from improved definition and communication, including those that relate to internal and subunit design interfaces. The inspection team's findings reinforce the Project's recognition of the need for improved definition and coordination in a number of activities which rely heavily upon inter and intradisciplinary design interfaces. This understanding of need has led to management actions to provide improved procedural controls to assure effective management of design interfaces. These procedural controls have and will continue to be supplemented by formal indoctrination and training sessions and monitored by internal audit and surveillance. Examples of actions that have been taken in recent months to strengthen design interface controls and are as follows:

1) IE 79-14 Walkdown Procedures: Two procedures issued in February and April, 1983, provide details for performing and documenting walkdown inspections at each site, for identifying uncertainties and deviations, and specifying methods by which the "as-built" data is examined against the approved seismic analysis.
2) Plant Design Interface Logic: This flow diagram displays design activities and interrelationships for piping design as carried out by subunit design disciplines. This flow diagram logic was issued on 1-31-83 and is presently in use.
3) As Built Drawing Criteria: This document specifies criteria to be used by each design discipline in preparing "as built" design drawings to reflect departures or waivers from the standard plant design. An initial version of the criteria was issued in March, 1983 and is to be finalized in May or June, 1983. This criteria document will be supplemented by desktop procedures to be prepared for each design discipline. These supplemental procedures will be available for use this July. Informal and formal training sessions are planned to assure proper understanding among the various engineering disciplines.
4) Procedure to Analyze/Reanalyze Stress Problems: This procedure, issued 1-17-83, identifies various tasks and checks necessary in performing piping stress analysis. Special emphasis is placed on information interfaces.
5) Environmental Review Desktop Procedures: This procedure, issued in 1982, provides detailed instructions and guidance for undertaking a project engineering review of all environmental equipment qualification reports prepared by SNUPPS equipment vendors. This procedure was supported by indoctrination and training for cognizant personnel.

In addition to project-wide procedures, special purpose or supplemental desktop procedures, and subunit (discipline) training, heavy emphasis will continue to be placed on the quality and closeness of supervision. The NRC inspection team was able to see first-hand that the design supervisor functions in a continuing and direct fashion to assure that day-to-day design work is carried out effectively and efficiently. The Project Management organization is structured to enhance first-line supervision by providing avenues for interdisciplinary and subunit coordination and resolution of interface items. This on-the-job supervision assures procedural controls are clearly understood and are functioning properly to manage all aspects of the design process including design interfaces. The need for additional procedures and interface guidance for the final stages of design will be continually assessed and actions taken where more specific definitions are considered necessary.

UNRESOLVED ITEM 4-2

Pipe anchor FB01-A002/135 was designed by the civil group to attach to a split base plate by straddling the two halves of the plate. However, actual field conditions had the anchor relocated within pipe support location tolerances so that it was attached on only one of the plate halves. This as-built condition would not normally have been detected in subsequent system walkdowns. This specific condition was determined to be adequate based on revised calculations performed during the inspection. However, further evaluation should be conducted to determine if similar instances of mismatch between hanger group tolerances and civil load paths exists.

RESPONSE

The only pipe supports attached to split base-plates are civil-designed pipe anchors, and are limited to the following six (6) supports:

EJ01-A001/132
FB01-A002/135
EF05-A005/121
EJ02-A001/132
EG02-A003/132
EC03-A001/121

Anchor FB01-A002/135 has been reviewed and found to be adequate attached to one plate. The remaining anchors will be reviewed and modified as necessary to insure that the design requirements are satisfied. In addition, all other civil-designed pipe anchors will be reviewed to insure consistency between the civil design load path and the plant design installation tolerances.

Design load paths for all pipe hangers and anchors designed by the hanger group are reviewed by the civil group taking installation tolerances into consideration by controlling attachment point locations. If a hanger or anchor is installed outside these tolerances, they are documented by the constructor on a Deviation Notice for supports attached to embedded plates, surface-mounted plates, and structural steel. These Deviation Notices are submitted to Bechtel and reviewed by the civil group for final acceptance of the redefined load paths. Therefore, except for the civil-designed anchors defined above, mismatches between hanger group tolerances and civil group load paths are controlled and evaluated using existing project procedures.

FINDING 4-5

The design drawing for isolation restraint FC02 was issued for construction prior to final approval of the design calculations, as required by EDPI 4.37-01 and 4.46-01.

RESPONSE

The design calculations for isolation restraint FC02 were prepared, checked and reviewed by the group leader prior the the issue of the design drawing for construction. The signed and dated pages of the calculation were reviewed by the NRC inspector during the inspection at Bechtel in November, 1982. However, final signature approval of the calculation did not occur until after issue of the design drawing because part of the computer output attached to the calculation was misplaced during processing of the calculation. The computer analysis was rerun in mid-November, 1982 and attached to the calculation. The calculation was then approved and processed in accordance with project procedures.

This finding is a technical violation of Bechtel project procedures, which had no adverse effect on the final design product. The approved calculation is retained in the project calculation file.

FINDING 4-6

No specific design calculations exist to document the basis for selection of embedded plates as well as their placement on the design drawings. The lack of documented analysis for each plate is contrary to EDPI 4.37-01 which requires such design calculations be made. However, the team was able to conclude that a controlled process for these selections had been in effect.

RESPONSE

The design of embedded plates, utilized on the SNUPPS Project for connection of structures and system supports to concrete walls and slabs, is well documented by design calculations generated and maintained on project. These calculations provide the basis for standard load capacities assigned to each plate type (i.e., maximum moments, shear, pullout and combinations thereof). The selection process utilized to identify the type of plate required to transfer the system design loads to the concrete structure merely involves a comparison of system design loads to the plate capacity. Nomographs based on plate design interaction equations are utilized for quick reference in the plate selection process involving repetitive cases, such as small pipe hangers. These nomographs represent a graphic solution of the interaction equations and are properly documented in project calculations. Where standard plate capacities are exceeded due to unusually large loads, such as those associated with pipe whip restraints, special plates are designed to transfer the loads. The design for these special plates is included in the applicable system support/restraint structure calculation.

With regard to documentation for placement of embedded plates on the design drawings, having determined the type of standard plate to be used from a load capacity consideration, its location is determined in order to coincide with the support configuration and location defined by the system layout drawings or hanger detail drawing. Deviations from the design intent regarding the support or restraint member and embedded plate interface are documented by the field via Middle Third Deviation Notices (MTDNs) and reviewed by engineering on a case by case basis. This serves as a second check on the placement of the plate versus its attachment location.

In summary, a documented analysis for the selection of each specific embedded plate is not necessary, since the parameters involved in standard plate selection and location are retrievable and can be verified with relative ease, and since adequate tracking exists to ensure proper embedded plate/support member interface. The intent of EDPI 4.37-01, therefore, has been satisfied.

UNRESOLVED ITEM 4-3

It was noted that the exterior wall penetration at Elevation 1991'0" in the Auxiliary Building was not constructed as detailed on the Bechtel design drawings. No information such as an FCR or DCN was available to address this change.

RESPONSE

A later review of records confirms that the condition noted by the inspector was previously documented (by the Constructor) on Nonconformance Report (NCR), No. 2SN-0955-C, and processed to Bechtel for review and disposition in 1979. The deviation noted was subsequently approved by Bechtel on a "use-as-is" basis on 9/25/79. Copies of the NCR are available on-site for the inspector's review and information.

FINDING 4-7

Imperfections (honeycombing) in concrete placement 2C135W01 on 7/12/77 were first reported on an NCR on 7/27/83. This is contrary to the requirements of Specification C-103 which specifies that..."imperfections in formed concrete requiring repair shall be repaired as soon as practical after removal of forms and shall be completed without delay..." The inspector noted that the delay in NCR initiation may have impacted NCR trending analyses performed by the Constructor.

RESPONSE

Constructor practice was to accumulate inspection results until a determination could be made of the extent of the honeycombing (i.e., chipping down to solid concrete to determine the size of the honeycombed area). After this determination was made, project procedures were followed which resulted in the NCR. A re-examination of the pour records and the referenced NCR indicate the delay had no substantive impact on the quality and acceptability of the repair. Discussions with Bechtel design personnel indicate the nature of the imperfections cited are not unusual for this type of construction and do not infer an absence of controls at the time of concrete placement. Bechtel further indicates that resolution of the reported imperfections through the use of non-shrink grout is a standard and technically acceptable repair process permitted per design specification.

Although this specific case involved an unusually long time to make a determination of reportability, we do not believe it constitutes a deficiency in the implementation of project procedures.

FINDING 5-1

The capability of the Motor Control (MCCs) to withstand fault currents has not been addressed or assured in the design process. Information from the MCC qualification report indicated that the controllers could withstand fault currents of 5,000 A with limited damage. Potential fault current in this application is 10,000 A or more.

RESPONSE

The MCC qualification report was submitted to Bechtel for review and approval. We concur that the review of this report did not detect the fact that the short circuit test reported in the qualification report was at a fault level less than that to which the SNUPPS MCCs were applied. This omission was in conjunction with the incomplete review cited in Finding Number 5-3 concerning MCC configuration.

We do not concur with the conclusion that this incomplete review of the qualification report demonstrates that the capability of the MCCs to withstand fault current has not been assured in the design process. Review of the MCC qualification report is one of many documents reviewed in the course of the design to verify the equipment capability. The MCC technical specification requires that the MCCs have a symmetrical short circuit capability of 25,000 A, RMS. Confirmation that the MCCs can meet their required interrupting capability was obtained by engineering review of the MCC design drawings, the circuit breaker specifications published by the supplier and a test certificate provided by the supplier.

The test certificate, reviewed by the inspector and listed in the report as satisfactory to demonstrate that the circuit breakers can interrupt the maximum available short circuit, does in fact state that the test was done on combination starters, i.e. breakers with controllers. Thus it also demonstrates that the SNUPPS MCC controllers can withstand the fault current interrupted by the breaker.

FINDING 5-2

Revised Floor Response Spectra (FRS) curves were forwarded to the Electrical Group from the Civil Group with a request that their impact on equipment qualification be examined. No evidence could be found documenting that the impact of the revised FRS curves on the Motor Control Centers (MCCs) had been evaluated and no systematic tracking was in place to assure that such revised spectra were addressed.

RESPONSE

In September of 1978, revised FRS curves for the Callaway ESW Pumphouse were transmitted to the Electrical Group from the Civil Group. The revised curves affected two kinds of electrical equipment located in the subject pumphouse: Load Centers and Motor Control Centers.

Upon receipt of the revised FRS curves, the Electrical Group reviewed and forwarded them to the Load Center Supplier (General Electric) via a revised technical specification. As noted by the inspector, the revised curves were not forwarded to the MCC Supplier. It was not possible from examining project files to positively determine that this inaction resulted from a conscious engineering decision based on engineering evaluation that the revised curves had been examined and found to be enveloped by the Supplier's Test Response Spectra (TRS) curves.

During the course of the inspection, the enveloping of the revised FRS curves by the Supplier TRS curves was confirmed and documented. Consequently there is no need to transmit the revised FRS curves to the Supplier.

The discipline group supervisors have been instructed to ensure that future revisions of seismic response spectra are examined for impact and followed up as appropriate.

FINDING 5-3

The short circuit testing documented in the MCC qualification report is based on a configuration different from that specified for use on SNUPPS. The supplier qualification report indicates that the test controllers were protected with current-limiting fuses whereas the SNUPPS controllers are protected with molded case circuit breakers. This finding, in connection with the fault current finding (No. 5-1), indicates a weakness in the review an approval of environmental qualification reports.

RESPONSE

The MCC environmental qualification report was submitted for Bechtel review and approval. The Bechtel review did not identify that the configuration of the MCC units used in the test was different from the configuration utilized in the SNUPPS MCC design and that the 5000 A fault current test was also less than SNUPPS design values, as identified in finding 5-1.

However, in view of the fact that the capability of the MCCs to withstand fault currents was adequately assured in the design process, as outlined in the response to finding 5-1, the consequences of this incomplete review are minimal. Molded case circuit breakers and current limiting fuses are both widely accepted by industry for the protection of motors, controllers, circuits and personnel. Industry standard UL-508, which governs the testing of Industrial Control equipment, provides specific acceptance criteria for both cases of protection. These criteria do not differ significantly from each other, indicating that the use of either circuit breakers or fuses is acceptable and that both provide adequate fault protection. Both fuses and circuit breakers are documented in the MCC qualification report as being qualified to IEEE 323 and could, if desired, be used interchangeably. Therefore, the selection of either fuses or circuit breakers does not impact equipment qualification capacity in any manner. A clarifying statement to this effect will be provided as a supplement to the MCC Qualification Report.

To strengthen the total equipment qualification effort, Bechtel has had in place, since June 1982, a qualification specialist review group set up to re-examine all equipment qualification reports, including those previously reviewed and approved. This re-examination covers specific input criteria, equipment configuration, test results, specification requirements, industry and regulatory requirements, FSAR commitments and necessary related parameters as delineated in NUREG-0588 and which are pertinent to evaluate the acceptability of the reports. The group's activities are specifically designed to uncover any inconsistencies of the type described in this finding and to initiate appropriate corrective action. To date, the group has reviewed 31 specifications and qualification reports and conducted one supplier qualification audit. They have uncovered discrepancies which have been documented to the NRC via SLNRC 83-0015, dated March 19, 1983. These findings are being tracked for project follow-up action. This added effort will assure that the design goals of the review group are being fulfilled.

FINDING 6-1

This finding notes certain logic diagrams were not submitted to SNUPPS and the SNUPPS Utilities for review prior to initial issuance as required by EDPI 4.41-01.

RESPONSE

Early in the design process it was considered helpful for SNUPPS and the SNUPPS Utilities to review logic diagrams before they were issued for construction. This was done to assure Utility concurrence with basic design concepts and philosophy prior to development of the detailed circuitry design shown on the electrical schemetics. As the design progressed, logic diagrams became more and more repetitious and generally reflected additions or changes to systems included in the original design. For example, the same logic approach for controlling a motor-operated valve installed in a specific system would be used over and over again as additional valves were added to other systems. Consequently, review of plant logics in later systems was largely redundant and of lesser technical value. In addition, changes or additions of a substantive nature were reflected in System Descriptions, P&IDs, SNUPPS/Utility correspondence and were generally reviewed with the SNUPPS Staff/Technical Committee at regularly scheduled meetings.

A 100% review was carried out to identify all the logic diagrams that had not been forwarded to SNUPPS for review prior to their "Issue for Construction". This list was reviewed with SNUPPS Staff and with the SNUPPS/Utility Technical Committee and it was determined that continuing review of logic diagrams before their issuance for construction was no longer necessary for the reasons noted above. Administrative procedures are in process of revision to reflect the SNUPPS/Utility position in this matter. It should be noted, however, that SNUPPS and the SNUPPS Utilities are forwarded copies of all issues of logic diagrams and thus they are available for review and comment at any time.

FINDING 6-2:

Logic diagram J02AL01 was noted to be incorrect. Specifically, the logic diagram indicated that the AFW pump would start given a coincidence of signals whereas the FSAR and electrical schematic E-03AL01B correctly notes that the pump would start given any of the signals. The sample reviewed by the inspector was not sufficient to determine whether this was an isolated or systematic error.

RESPONSE

The discrepancy noted in this finding between the logic diagram and the schematic had been identified previously through the normal internal review process prior to the start of the NRC inspection. This inconsistency has since been corrected. All logic diagrams, after preparation by the Control System group, are coordinated with the Electrical and Mechanical group. The Electrical group has the responsibility for issue of the schematic diagram based on input from the logics. As all logics are reviewed and signed off by the Electrical group, this assures consistency between the two design documents. This checking and coordination is a standard feature of project engineering design controls and assures occasional design document inconsistencies are identified and corrected. The fact that the error noted between the logic and the schematic was subsequently detected and corrected attests to the effectiveness of the review process.

FINDING 6-3

This finding involves a discrepancy identified during the inspector's review of the emergency backup nitrogen accumulator system. Specifically, it was noted that single check valves are provided to prevent bleeding pressure from the accumulator in the event of a pressure loss in the nonsafety grade control air system instead of double check valves described in FSAR Section 9.3.1.2.3. The inspector concluded that system requirements could be met even with loss of one accumulator system and that no regulatory requirements exist for use of double check valves.

RESPONSE

The description of double check valves isolating the safety-related air system from the nonsafety-related air system was included in the initial draft of the FSAR section before design of the system was completed. The final design of the safety-related air supply system incorporates completely independent air systems for each steam generator, thus permitting use of a single check valve for isolation. Consequently, the functional requirements of the system are satisfied as was indicated by the inspector. The final design configuration was reflected in FSAR Figure 9.3-1 (sheet 5). However, FSAR paragraph 9.3.1.2.3 was overlooked and consequently not updated to reflect the final design. This paragraph has since been updated in FSAR Revision 11 issued on 3/10/83.

FINDING 6-4

A discrepancy was noted in that Calculation J-435 (Reference 6.41) has not been checked (computer input check) and approved prior to issuing the purchase specification as required by section 3.4 of Bechtel procedure EDPI 4.37-01 (Reference 1.16). Although a procedure violation had occurred, a review of the latest calculations indicated that the flow elements identified in the purchase specification were correct and the discrepancy noted had no apparent effect on the final design.

RESPONSE:

The computer calculations were performed for orifice plate sizing before issue of the specification for purchase. The flow rates and orifice sizing information were included in the purchase specification, which was reviewed, checked and signed off by an independent design engineer. The situation noted in the finding occurred because the calculations were not signed by a checker and entered into the calculation file before placing the purchase order.

It is normal design practice and direction was given by the Group Supervisor to perform final computer calculations on orifice plates after process design parameters are finalized. This calculation is then used to determine the calibration of the differential pressure transmitter associated with the orifice plate and is entered into the calculation file.

Our normal project practice is to have calculations completed and signed by a checker before issue of a purchase specification. This is an isolated incident where the procedure was not strictly followed. A memo has been issued to all Project Personnel emphasizing the requirement for checking and approving calculations before issue of purchase specifications.