TU ELECTRIC

Log # TXX-88332
File # 10130
IR 87-37
IR 87-28
Ref. # 10CFR2.201

William G. Counsil
Executive Vice President

April 11, 1988

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NOS. 50-445 AND 50-446
RESPONSE TO NRC INSPECTION REPORT NOS.
50-445/87-37 and 50-446/87-28

REF: 1) NRC letter dated February 8, 1988 from Mr. C. I. Grimes to Mr. W. G. Counsil

2) NRC letter dated October 15, 1987 from Mr. C. I. Grimes to Mr. W. G. Counsil

3) TU Electric letter dated February 4, 1988 from Mr. W. G. Counsil to the NRC.

Gentlemen:

We have reviewed your report dated February 8, 1988, which provided results of your inspection of the CPSES Design Validation Program. The inspection was conducted by the Office of Special Projects as well as NRC contractors from October 26 to December 4, 1987, at the Stone & Webster offices in Boston and Cherry Hill, and at Comanche Peak.

In accordance with your request in reference (1), please find TU Electric's responses to the Mechanical/Fluid Systems open items F-21 through F-42, Instrumentation & Controls open items I-10 through I-23, Electrical open items E-17 through E-30, Systems Interaction Program open items S-1 through S-15, and Civil/Structural open items C/S-16 through C/S-56. The responses to Instrumentation and Controls open items I-5 and I-6 from reference (2) are also included for your review.

For HVAC Systems open items (M-1 through M-14) the actual project actions are consistent with the responses provided in the follow-up inspections (see reference (1)) except for open items M-3, M-6 and M-11. For these items, the attached responses clarify the project actions.

IE01
11

The Engineering Functional Evaluation (EFE) Team will evaluate the significant open items identified in references (1) and (2) and will determine whether additional EFE actions are required. The results of this evaluation will be discussed within the EFE report, which is scheduled to be completed in May, 1988.

Very truly yours,

W. G. Counsil

JCH/grr

c-Mr. R. D. Martin, Region IV
Mr. D. P. Norkin, OSP
Resident Inspectors, CPSES (3)

OPEN ITEM F-21

Document Number: Calculation 215-10, Revision 1,
Diesel Generator Exhaust Pressure Drop

a. The calculation determines the exhaust pressure drop through the emergency relief path. Reference 9, which provides emergency relief valve pressure losses, contains conflicting data, which results in the exhaust system overall pressure drop being either 13.26 in. W.C. Or 15.56 in. W.C., from the D/G exhaust expansion joint outlet flange to the atmosphere. This calculation selected the least conservative Reference 9 data, and calculated a pressure drop of 13.26 in. W.C.

b. In the calculation it is stated that 15 in. W.C. pressure loss is acceptable. This evidently is a misinterpretation of the diesel manufacturer's interface requirements (design criteria 2b and 2c above) which require a 10 in. W.C. maximum pressure drop. Calculated pressure losses exceed the manufacturer's allowable by 33 to 56 percent, depending on which Reference 9 data are used.

c. The calculations do not account for exhaust gas composition or reduced atmospheric pressure from standard conditions.

RESPONSE

This was an original design calculation to check the operation of the emergency relief path. The reviewer did not rigorously review the calculation details since field testing of the relief path was already planned to verify acceptable relief valve operation. The calculation will be voided and the validation record will be revised by April 30, 1988 to identify the field test which will be the method of validation for the exhaust relief path.

With regard to item (b) of this open item, information from IMO-Delaval letter dated December 3, 1987 states that operation of the diesel at rated load for up to seven (7) days with a 15 in. W.C. (water column) exhaust gas backpressure will not impair present or future reliability.

Since the calculation is not required due to field testing, item c is not applicable.

SIGNIFICANCE/EXTENT

There is no safety concern because field testing will be the basis for validation of the diesel generator exhaust path.

OPEN ITEM F-22

Document Number: Calculation 16345/6-ME(B)-062, "Spent Fuel Pool Cooling System Pressure Drop"

The calculation incorrectly utilizes the pipe friction factor (f) for fitting form friction loss calculations.

The reference manual (Crane Technical Manual 4.0, dated 1981) utilizes a constant, (ft), which varies slightly from the friction factors determined within this calculation. The Crane Manual abandoned the method utilized within this calculation in 1976.

The calculation assumes the same resistance coefficient (K) for diaphragm valves as that for gate valves. In fact, the hydraulic resistance for the diaphragm valve is more than ten times higher than that for the gate valve.

While these discrepancies probably do not impact the results of this calculation, for certain flow alignments which may occur in the system (and are not addressed in this calculation) these discrepancies may significantly change the results. These particular flow alignments should be addressed in a calculation.

RESPONSE

The technique of actually calculating friction factors is technically acceptable, notwithstanding the fact that friction factors have been tabulated for convenience in the recent editions of Crane Technical Paper No. 410. The differences noted are inconsequential.

The calculation did not determine a resistance coefficient for diaphragm valves; it incorrectly assumed the value to be the same as a gate valve which is "8 ft". Revision 1 of the calculation corrected the mistake by determining the resistance coefficient for diaphragm valves to be "140 ft". This results in revised flowrates through the purification and cooling loops which are less than previously calculated but which still satisfy the system design flowrate requirements.

Additional flow alignments have been reviewed and it has been determined that reevaluation of these alignments would not yield results which are significantly different than the results obtained from evaluation of the flow alignments presently addressed in the calculation.

SIGNIFICANCE/EXTENT

There is no safety concern because the new calculated flowrates still satisfy the system design flowrate requirements. A sample of similar calculations were reviewed for determination of resistance coefficients for diaphragm valves. Based on this review, it was concluded that the resistance coefficients for diaphragm valves are properly calculated.

OPEN ITEM F-23

Document Number: Calculation 16345-ME(B)-073, Component Cooling Water Surge Tank Volume

To determine liquid expansion volumes, the calculation averages the cooling water supply and return temperatures, then calculates volume based on the average temperature. This is a non-conservative calculation method; greater expansion volumes are calculated if actual supply and return temperatures are used because of the non-linear relationship between temperature and density.

RESPONSE

Applying the actual supply and return temperatures to the calculated volume increases the total by approximately 15 gallons out of about 800 gallons total. This volume of water is judged to be insignificant to the evaluation of the effects of expansion/contraction (see Open Item F-24). The conservative nature of the assumptions regarding starting and ending temperatures (minimum heat loads and coldest cooling water temperature, and maximum heat loads and hottest cooling water temperature), making this additional 15 gallons even less significant.

SIGNIFICANCE/EXTENT

There is no safety concern because the engineering judgement to average the cooling water supply and return temperatures was reasonable based on the objective of the calculation.

OPEN ITEM F-24

Document Number: Calculation 16345-ME(B)-073, Component Cooling Water Surge Tank Volume

The maximum expansion volume calculated is based on a transient which begins with minimum heat loads and coldest (wintertime) cooling water temperature, and terminates with maximum LOCA heat loads and hottest (summertime) cooling water temperatures. This is an unrealistic transient. Conservatism of this sort may be unacceptable in this case because the calculated value precludes meeting design criteria as stated in the DBD. See Open Item F-25.

RESPONSE

The safety-related design criteria of calculation 16345-ME(B)-073 are met. Several parameters, including various volumes between level setpoints which were calculated and listed in Revision 0 of the DBD, have no safety function. These informational analyses and resulting "criteria" have been deleted from the DBD and will be deleted from the calculations.

Therefore, the conservative transient postulated to calculate maximum expansion volume is acceptable.

SIGNIFICANCE/EXTENT

There is no safety concern because the CCW system can accommodate the conservative expansion/contraction transient discussed above.

OPEN ITEM F-25

Document Number: Calculation 16345-ME(B)-073, Component Cooling Water Surge Tank Volume

The calculation states (pg. 41) "That there is not adequate expansion volume between HI level and HI HI level; however, it is not a critical design parameter." Apparently no further action was taken.

It is noted that the HI HI alarm setpoint is designated to alert the operator that there is potentially as little as 16 seconds to determine which CCW train is experiencing inleakage, and to isolate the affected CCW loop, this conflicts with the above conclusion on page 41. The calculated liquid expansion may result in the violation of the DBD Section 5.4 criteria prohibiting crossover flow.

RESPONSE

As discussed in Open Item F-24, certain differential volumes between CCW surge tank setpoints, including the volume discussed above, were analyzed for information only, and therefore do not have acceptance criteria. There is no specific time requirement to determine which CCW train is experiencing inleakage. The effects of crossover flow on system performance have been evaluated and it has been determined that crossover flow is not detrimental to the proper operation of the system.

Sections 5-11 of the DBD will be revised to delete the prohibition of crossover flow when it is updated to incorporate the results of the validation (6/30/88).

In the next revision of the calculation (5/31/88) the revised DBD criteria will be referenced and the informational analysis will be deleted.

SIGNIFICANCE/EXTENT

There is no safety concern because the safety-related system performance criteria are met.

OPEN ITEM F-26

Document Number: Calculation 16345-ME(B)-073,
Component Cooling Water Surge Tank Volume

The calculation states (pg. 40) that the volume allowance between LO level and HI level should be sized for volume fluctuation during normal plant operations. 465 gallons is provided; however, no basis or numerical calculation justifies this volume.

The calculation shows (pg. 40) volume changes between LO level, LO LO level, and Empty setpoints as several hundred percent in excess of stated requirements. It may be possible that the liberal margins between these setpoints could be utilized between level setpoints where inadequate capacity exists (Open Item F-25), i.e., by revising setpoints.

RESPONSE

The criteria for the volume allowance between HI and LO level is not safety-related. In view of the 1 gpm system leakage rate determined earlier in the calculation, no additional justification for the 465 gallon volume allowance was deemed necessary. As discussed in Open Item F-24, all safety-related design criteria for the CCW surge tank have been met.

The margins provided between the LO, LO-LO and Empty level process setpoints are required for instrument accuracy considerations.

SIGNIFICANCE/EXTENT

There is no safety concern because the system is properly validated.

OPEN ITEM F-27

Document Number: Calculation 16345-ME(B)-073,
Component Cooling Water Surge Tank Volume

It is stated in the calculation (pg 41) that thermal contraction will not jeopardize the tank out-leakage volume, as makeup to the surge tank of 50 GPM is greater than the contraction rate. No basis or other justification for this statement was found; indeed it appears that contraction rates exceeding 50 GPM are possible. It is also noted that the scenario within the calculation violates DBD Section 4.3.1.1 criteria, which prohibits volume contraction from reaching the low level alarm setpoint; at this level there is no makeup flow automatically provided.

RESPONSE

Because of the large makeup flow rate (50 gpm) and the long term nature of the thermal contraction process, no additional justification was deemed to be required.

As a result of the expansion/contraction analysis, it was determined that volume contraction can be accomodated and still maintain level above the Empty setpoint, even if no credit is taken for makeup capability. Maintaining level above this value assures that adequate water volume for the worst case postulated pipe break is available while still maintaining suction head pressure for proper pump operation. Therefore, DBD-ME-229 will be revised by June 30, 1988 to change the prohibition of volume contraction from reaching the LO level setpoint to apply to the Empty setpoint.

SIGNIFICANCE/EXTENT

There is no safety concern because the judgement made regarding thermal contraction was appropriate based on the purpose of the calculation. Based on the analyses discussed above, the prohibition of volume contraction from reaching the LO level setpoint is more appropriately applied to the Empty level setpoint.

OPEN ITEM F-28

Document Number: Calculation 16345-ME(B)-088, Station Service Water System Steady State Hydraulic Calculations

The calculations show the diesel generator cooling water flowrate about 9% below DBD nominal stated flow requirements, and that there is slightly less than this amount of flow recovery available by manually throttling ("Tuning") the system. It should be verified that the system meets or exceeds minimum required flows at the maximum anticipated temperatures.

RESPONSE

The discrepancy identified in the calculation has been resolved. The diesel generator vendor has determined that 1,507 gpm is the minimum required flowrate to the diesel generator cooling heat exchangers.

The calculation has been revised to establish 1,507 gpm as the minimum flowrate criterion. The calculated flowrate, 2,179 gpm, exceeds the minimum required flowrate at the maximum anticipated supply temperatures. Thus the system performance criterion of the DBD is met.

Actual system flowrates will be included in Sections 5-11 of the DBD when it is revised to incorporate the results of the validation (6/30/88).

SIGNIFICANCE/EXTENT

There is no safety concern because the system exceeds minimum required flows at the maximum anticipated temperatures.

OPEN ITEM F-29

Document Number: Calculation 16345-ME(B)-094, Determination of Minimum Pressure in Air Receiver Tanks to Provide 5 Diesel Starts

The calculation does not address additional air consumption that will occur during first start attempts with high inlet air pressure and resulting increased air density.

The calculation is based on requirements of the manufacturer, 2.1 seconds cranking time, whereas the DBD and SRP require consideration of a longer cranking interval (3 seconds per start attempt). This longer interval results in a minimum initial air receiver pressure of approximately 250 psig vs. 220 psig delineated in this calculation. The calculation should use the largest air start requirement, in accordance with the SRP and DBD.

RESPONSE

The calculation was only intended as a rough check of the air receiver tanks. Therefore, this calculation will be voided and the validation record revised by April 30, 1988 to identify the vendor test data and the field test which will demonstrate the adequacy of the air receiver tanks.

Vendor test data indicates that the diesel started ten times with a tank pressure of 210 psig. The vendor shop test will be repeated in the field to confirm the diesel generator start capability and to establish the tank pressure setpoint.

The CPSES commitment is that each air receiver tank will provide for five starts of the diesel generator without recharge. DBD-ME-011 will be revised to clarify this requirement by May 31, 1988.

Based on the information provided above, the CPSES diesel start capability commitment is met.

SIGNIFICANCE/EXTENT

There is no safety concern because the diesel generator start capability was verified by a shop test and will be confirmed by a field test.

OPEN ITEM F-30

Document Number: Calculation 16345/6-ME(B)-228, Spent Fuel Pool Cooling and Cleanup System Instrument Setpoint Calculation

The fuel pool cooling pump discharge low pressure alarm setpoint is based on the pump reaching "runout" flow discharge pressure conditions. This condition is not relevant to system functional requirements of providing at least 3600 GPM system flow. The alarm setpoint should be based on the minimum pump discharge pressure which will provide minimum flowrate within the system.

The setpoint calculation considers only pump total dynamic head pressure. The calculation needs to consider pump inlet pressure (static head minus suction piping losses) to determine pump discharge pressure.

RESPONSE

The purpose of this alarm is to provide indication that the operating pump has stopped, malfunctioned or that the pump is approaching runout due to abnormal system conditions. It is not provided to monitor flow since other flow indication is provided (low flow alarm).

The calculation will be revised by April 30, 1988 to include inlet pressure in the pump discharge low pressure alarm setpoint determination.

SIGNIFICANCE/EXTENT

There is no safety concern because the low pressure alarm does not perform a safety function.

OPEN ITEM F-31

Document Number: Calculation 16345/6-ME(B)-228, Spent Fuel Pool Cooling and Cleanup System Instrument Setpoint Calculation

The spent fuel pool cooling circuit low flow alarm setpoint is 3200 GPM, while the heat exchanger design flow is 3600 GPM. The low flow alarm should be set to assure that flowrates meet or exceed minimum requirements. The flowrate of 3200 GPM may represent an unanalysed operating condition which potentially fails to meet fuel pool heat removal requirements.

RESPONSE

Calculation 16345/6-ME(B)-228 did not adequately document the basis for the spent fuel pool cooling circuit low flow alarm setpoint of 3200 gpm. The calculation has been revised to provide justification that a flowrate of 3200 gpm satisfies the requirement for maintaining fuel pool temperature at or below 140°F while handling the maximum normal heat load with normal cooling systems in operation and assuming a single active failure. Therefore, a low flow alarm setpoint of 3200 gpm is adequate for the alarm to perform its intended function.

SIGNIFICANCE/EXTENT

There is no safety concern because the low flow alarm setpoint was properly determined.

OPEN ITEM F-32

Document Number: Calculation 16345-ME(B)-230, Service Water System Process Setpoints (Safety Related)

The calculation states "Set the low pressure switch to activate when the pressure in the safety related header drops to 80% of normal operating pressure". No basis or justification for the selection of the 80% value is given.

The normal pressure is determined to be 30.17 psig, (pg. 4) and the process setpoint pressure is calculated based on 60% rather than the stated 80% (30.17 * 0.6 = 18.1 psig).

RESPONSE

The purpose of the low pressure switch, i.e., to automatically start the standby train of service water in the event of a pump failure in the operating train, will be explicitly stated in the next revision of the calculation (5/31/88).

When the process value was lowered to 60 percent to accommodate the instrument error and spurious response considerations evaluated in the related adjusted setpoint calculation, the 80 percent was inadvertently left in the purpose statement discussed above. The revised purpose statement will only specify the required switch function without reference to the process value developed further on in the calculation.

SIGNIFICANCE/EXTENT

There is no safety concern because the identified inconsistency was an administrative error. The calculation properly determined the 60 percent process setpoint. The basis for the setpoint was appropriate and will be added to the calculation.

OPEN ITEM F-33

Document Number: Calculation 16345/6-NU(B)-023,
Ultimate Heat Sink and Maximum Sump Temperature

Nominal fouling conditions were assumed in accordance with the heat exchanger data sheet. The "80% cleanliness allowance" used to determine this unit's performance is unrealistic, and results in a non-conservative heat transfer coefficient for the component cooling water heat exchanger which is about 65% higher than the value obtained by use of industry accepted standard fouling factors (Section 2.3, TEMA Standards). The heat exchanger cleanliness dictated by the analysis will be difficult to continuously maintain. It is noted that CPSES calculation 0509-2 shows a Langelier's index of 1.45 and Rynar index of 4.7, both of which indicate moderate to heavy scaling tendency in the service water system heat exchanger tubes. Even if one assumes a very minimal fouling resistance for this heat exchanger, such as the fouling resistance associated with the very clean deionized primary reactor water of the RHR heat exchanger, the overall heat transfer coefficient obtained is lower than the heat transfer coefficient used as input to this analysis. This illustrates the unrealistically high cleanliness assumed in this analysis.

RESPONSE

The calculations have been revised to use a more realistic fouling factor associated with the scaling conditions expected at CPSES. The data selected for the heat exchangers in question is the HEI Standard for Power Plant Heat Exchangers, which suggests the use of a fouling factor of 0.0003 for both inside and outside tube surfaces. These factors will be used in lieu of the nominal 80 percent value in the next revision to calculation 16345/6-NU(B)-023, which evaluates the combined effects on CCW maximum temperature. The calculation also considers the effects described in Open Items F-34, F-35, and F-42. In addition, this calculation maximizes CCW temperature by choosing design inputs (flows, temperatures, single train operation, etc.) such that the results are conservative.

Although the results indicate that the CCW temperature rises approximately one half of a degree above the design temperature of 135^{o}F for a period of ten minutes, this transient is judged to be inconsequential with respect to the design ratings of the cooled components.

SIGNIFICANCE/EXTENT

As discussed in the response to Open Item F-10, each of the affected heat exchangers is being reevaluated using a conservative fouling factor. These evaluations will be completed and Calculation 16345/6-NU(B)-023 will be revised by April 30, 1988.

OPEN ITEM F-34

Document Number: Calculation 16345/6-NU(B)-023, Ultimate Heat Sink and Maximum Sump Temperature

For the residual heat removal heat exchanger, which also provides heat flux into the component cooling water system, the heat exchanger is correctly assumed to be in the clean condition. However, adjustments have not been made to account for increased flowrate on the tube side of the exchanger.

The higher operating temperature for the analysis also causes an increase in the heat transfer coefficient; this has not been accounted for. The heat transfer coefficient should be about 25% higher than the value used as input for the analysis. This discrepancy causes results in the non-conservative direction.

RESPONSE

The original purpose of calculation 16345/6-NU(B)-023 was to determine the total integrated heat which was rejected to the ultimate heat sink over a 30 day time period. The original objective of the analysis was later expanded to include the development of the maximum outlet temperature of the component cooling water (CCW) heat exchanger. However, the maximum RHR system flow rate was not used.

Calculation 16345-ME(B)-316, Revision 0, has been developed to determine the heat exchanger coefficient (UA) for the RHR exchanger based on a clean heat exchanger, maximum RHR system flow rates, and maximum containment sump temperature. The results from this calculation are used as input into Revision 1 of 16345/6-NU(B)-023, which is expected to be completed by April 30, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the effect of the conservative RHR heat exchanger parameters are now used as input into the integrated heat load analysis is negligible.

OPEN ITEM F-35

Document Number: Calculation 16345/6-NU(B)-023, Ultimate Heat Sink and Maximum Sump Temperature

Heat flow into the component cooling water system from other miscellaneous sources is listed as 5.146 million BTU per hour. This value does not include pump energy input of 1000 horsepower. This load should be increased to 7.691 million BTU per hour.

Resolution of the above discrepancies may result in an increase of cooling supply temperature to 150°F, and maximum return temperatures to 200°F. Such results need to be evaluated for potential overheating of safety related equipment.

Open Items F-33 through F-35, taken together, are significant due to their cumulative potential for overheating safety related equipment. These items are related to Open Item F-10 (previous inspection) concerning the containment spray heat exchanger heat transfer coefficient. Appropriate corrections should be made to other containment cooling/ultimate heat sink evaluations (e.g., maximum containment pressure and temperature analysis).

RESPONSE

The heat input from the CCW pumps has been included in the analysis, assuming the entire 1,000 Bhp results in heat input to the CCW. The calculated load is 2.55×10^6 BTU/hr per pump, which, combined with the LOCA heat load of 367.85×10^6 BTU/hr and flow of 14,757 gpm results in approximately one half of a degree above the design temperature of 135°F for a period of ten minutes. This transient is judged to be inconsequential with respect to the design ratings of the cooled components. Revision 1 of calculation 16345-NU(B)-023 will satisfactorily resolve this issue and is expected to be completed by April 30, 1988. Appropriate corrections have been made to other containment cooling/ultimate heat sink evaluations.

SIGNIFICANCE/EXTENT

There is no safety concern because the affected heat load analyses, including the other containment cooling/ultimate heat sink evaluations, properly address the effect of the additional CCW pump heat load, which is inconsequential.

OPEN ITEM F-36

Document Number: Design Basis Document DBD-0233, Revision 0, Station Service Water System

DBD Section 4.3, page 13, states 115°F is the maximum normal operating temperature of the Safe Shutdown Impoundment (SSI). This apparently is a typographical error and should be changed to 102°F.

DBD Table 1, page 16 indicates 2523 gpm (minimum) flowrate to the diesel generator cooling heat exchangers. It is noted that the actual minimum value occurs under normal operating conditions and is listed in Table 1 as 2267 gpm.

RESPONSE

In Design Basis Document DBD-ME-0233, Revision 1, the maximum SSI operating temperature has been deleted from Section 4. The DBD now reflects the design criteria and reads "The maximum allowable SSW system supply temperature from the SSI is 115°F."

Table I has been clarified; it now lists the flowrates which were specified in the procurement specification equipment data sheets.

The 2,523 gpm flowrate was determined using the normal elevation of the Safe Shutdown Impoundment (SSI). The 2,267 gpm flowrate represented the flowrate using the extreme low SSI water level. The latter design flowrate has been updated to 2,179 gpm which is the current calculated minimum flowrate.

The diesel generator vendor has established 1,507 gpm as the minimum required flowrate to the diesel generator cooling heat exchangers, which is below the 2,179 gpm flowrate described above.

SIGNIFICANCE/EXTENT

There is no safety concern because the system design is adequate to perform its safety function.

OPEN ITEM F-37

Document Number: Design Basis Document DBD-0233, Revision 0, Station Service Water System

DBD Section 4.3, page 15, Functional Requirements, states "All components have a continuous flow...regardless of operating status." Section 4.3.1, page 23, Mechanical Equipment Requirements, describes diesel generator cooling system isolation valves (HV 4393, 4394), which open automatically on a diesel start signal. These statements appear to conflict. No basis for the provision of these diesel cooling isolation valves is given. The DBD should discuss the reasons for their existence in addition to reasons why similar motor-operated isolation valves are not provided for other cooled components within the system.

RESPONSE

The original normal operating mode for the station service water system was to have flow to the diesel generator isolated (1-HV-4393 and 4394 normally closed) in order to reduce station service water flow requirements. In order to avoid stagnant pipe runs, the normal operating mode is being changed to provide flow continuously to all components. The automatic diesel generator isolation valves remain in the system for operational flexibility and receive confirmatory open signals upon diesel generator start.

The DBD-ME-233 Rev. 1 section 4.3.1.2 has been revised to read "The emergency diesel generator isolation valves are motor operated valves that are normally open. In the automatic position, if the valves are closed, they are required to open upon receipt of a generator start signal."

SIGNIFICANCE/EXTENT

There is no safety concern because the system operates properly and the DBD has been revised to reflect normal system operation.

OPEN ITEM F-38

Document Number: Design Basis Document DBD-0233, Revision 0, Station Service Water System

DBD Section 5.2, pages 37 and 38, System Modes of Operation, states that manual throttling to attain balanced flowrates is required. Section 5.4, page 43, System Limitations and Precautions, states "Performance is predicated on accurate balancing of flow in all piping branches," and that "off design flow distribution will limit functional ability to perform the required duty..."

It should be assured that realistic methods which consider measurement errors, plus other variables or uncertainties, are available to accomplish the stated goals of flow balancing. Administrative controls to ensure the maintenance of throttle valve set positions also should be ensured. The system flow diagram (Drawing No. 2323-MI-0233, Rev. CP11) does not currently indicate any intermediate positions for valves and does not show any locking provisions for the valves.

The provision of automatically opened diesel generator cooling valves (DBD Section 4.3.1) implies that large disturbances in the system flow balance may occur if these valves are closed during normal operation. This is of concern due to the relatively small margin in the existing service water pumps, which are operated close to runout conditions during normal operation.

RESPONSE

The results of the design validation indicate that the system limitations and precautions regarding accurate flow balancing discussed in Section 5 of Revision 0 of the DBD are no longer required. These items will be deleted when Sections 5-11 of the DBDs are revised (June 30, 1988).

Calculation 16345-ME(B)-088 (Computerized Flow Balance) was prepared assuming all valves in the system were fully open. Computed flows to all branches have been confirmed to be adequate to meet design cooling requirements (see response to Open Item F-28) with no valve throttling.

The automatically opened diesel generator cooling valves were provided in the original design. They are not required for flow balancing considerations in any of the system operating modes.

As discussed in Open Item F-42, the range of stable performance for these pumps envelopes the system requirements

SIGNIFICANCE/EXTENT

There is no safety concern because the results of the system validation show that the system is flow-balanced and meets design cooling requirements without valve throttling.

OPEN ITEM F-39

Document Number: Design Basis Document DBD-0233, Revision 0, Station Service Water System

DBD Section 6.3, Service Water System Monitoring, states "the CCW heat exchanger alarms when the pressure differential between service water and component cooling water is low enough to indicate a tube leak in the exchanger." It is not clear how a tube leak would be indicated by this alarm.

RESPONSE

At the time of the audit the design description sections of the DBDs had not been updated to reflect the results of the design validation. Upon review of this design feature, it was concluded that only a severe leak in the heat exchanger could reduce the differential pressure sufficiently to actuate this alarm. Other system abnormalities could also cause this indication. For example, tube leakage in the CCW heat exchanger could be detected by CCW surge tank level changes. When DBD-ME-233 Sections 5-11 are revised to incorporate the results of the validation effort, the function of the differential pressure alarm will be corrected. (June 30, 1988).

SIGNIFICANCE/EXTENT

There is no safety concern because the results of the system validation indicates that the CCW heat exchanger differential pressure alarm is not required to detect a tube leak in the heat exchanger.

OPEN ITEM F-40

Document Number: Design Basis Document DBD-ME-0233, Revision 0, Station Service Water System

DBD Section 9.0, System Interface, describes cooling water flow requirements for each cooled component within the system. Every flowrate is stated to be "approximately-gpm." However, the allowable error band for flowrates is not quantified. The minimum allowable system flowrates, as established by evaluation of system heat removal performance, should be used to define system flowrate requirements. The determination of minimum acceptable cooled component flowrates should consider allowable variation of input loads, variation of fluid flowrates on the cooled component subsystem, and the allowable band of heat exchanger performance permitted.

RESPONSE

The SSW system design validation evaluated flow rates for cooled components. This evaluation considered the variation of heat loads, SSW flow, and heat exchanger performance. The validation results confirm that minimal acceptable cooling water flow rates to cooled components are met or exceeded.

The SSW flow rates discussed in DBD-ME-0233 Section 9 are referred to as approximate because this section is describing expected flowrates for each cooled component. The design (minimum) flowrates, as established by evaluation of system heat removal requirements, are listed in Section 4, Table 1 of DBD-ME-0233 and are used to validate the SSW flowrates during the various system operating modes for component performance requirements. When DBD-ME-0233 is revised to incorporate the results of validation, Section 9.0 will be reviewed and revised by June 30, 1988 to be consistent with the validated design.

SIGNIFICANCE/EXTENT

There is no safety concern because the design flowrates were properly determined. They were developed considering allowable variation of loads, variation of flowrates on the cooled component subsystem and the permissible band of heat exchanger performance.

OPEN ITEM F-41

Document Number: Design Basis Document DBD-0233, Revision 0, Station Service Water System

DBD Section 10.1, Equipment List and Specifications, page 65, gives the piping and valve design temperature of 150°F. Consideration of the flowrate (DBD Table I, page 16) and heat load (DBD Table II, page 18) gives a piping temperature of about 156°F, which exceeds the design temperature. There may be a potential for higner temperatures after consideration of Opcn Items F-33, F-34, F-35, and F-42.

RESPONSE

Calculation 16345-ME(B)-035, Revision 0 determines maximum Station Service Water (SSW) piping temperatures. Results of this calculation indicate that temperature up to 170°F are experienced in some piping sections. 170°F is less than the maximum allowable temperature for Category 150 piping. Therefore, the system piping design temperature will be revised to 170°F. The results of the calculation were to validate the input used in the pipe stress/support reconciliation effort for the SSW system and were used to evaluate temperature/pressure design parameters. Minimum acceptable flowrates for cooled components were evaluated taking into account variation in heat loads, variation of SSW flowrate, heat exchanger performance and SS! temperature.

Sections 1-4 of DBD-ME-233 contain the criteria to validate the SSW system. The results of validation, including calculation results, etc. will be added to the DBD when Section 5-11 are updated by June 30, 1988.

The responses to Items F-33, 34, 35, and 42 discuss the impact of SSW system temperatures on SSW system temperatures.

SIGNIFICANCE/EXTENT

There is no safety concern because the results of the system validation confirm the adequacy of the system design.

OPEN ITEM F-42

Document Number: Design Basis Document DBD-0233, Revision 0, Station Service Water System

DBD Attachment 2, Service Water Pump performance Curve, shows a pump Best Efficiency Point (BEP) at 14,000 gpm. This corresponds to the rated flowrate for the component cooling water heat exchanger only. DBD Table I, page 16 shows this pump normally operating at about 17500 gpm, and with a tolerance to allow for variation in the SSI level, plus unavoidable balancing flow tolerances, it can be expected that the pump may normally operate at about 18500 gpm. This operation approaches the limit of pump test data and corresponds to operation at about 130 percent of BEP flowrate.

DBD Section 10.2, Equipment Design Criteria, lists the service water pump design flow at 17,000 gpm. It is not clear whether this pump was originally specified with the 17000 gpm design flow. If not, the currently envisioned operating flows for the pump may cause undesirable characteristics related to vibration, cavitation, NPSH, or vortex problems, all of which could be aggravated with a worn pump.

RESPONSE

The SSW pumps were originally specified as "Capacity at normal operation - 15,000 gpm; capacity at design point and rated speed - 17,000 gpm." A review of the shop test data confirms that the best efficiency flow occurs in the 14,000 gpm to 15,000 gpm range. The pump was apparently selected to minimize power consumption as well as ensure that the higher required flows are within any runout flow limitations.

The original design flow of 15,000 gpm was based on normal operation. Due to changes in system operating practice to control corrosion, the normal pump operating flow requirement now is predicted to be 17,600 gpm by flow balance calculation 16345-ME(B)-088, Revision 2. Operation at or near 18,000 gpm will not expose the pumps to cavitation or vortex-related problems. Significant margins exist for NPSH and submergence requirements of the pumps over all operating conditions from minimum flow up to runout flows. The shop tested runout flows are above the maximum calculated system flowrates. The range of stable performance for these pumps envelopes the system requirements with no limitation due to suction conditions or capability.

SIGNIFICANCE/EXTENT

There is no safety concern because the results of the system validation indicate that the range of stable performance for these pumps envelopes the system requirements with no limitation due to suction conditions or capability.

OPEN ITEM I-5

Document Numbers: DBD-ME-003, Revision 0, Control Room Habitability
DBD-ME-304, Revision 0, Control Room Air Conditioning System

The FSAR Section 6.5.2 Table 6.4-4 does not address the potential leakage paths created by piping from the supplementary air conditioning units which penetrate the west wall (Col. Line A-A). Also DBD-ME-304 does not state that this piping is seismic.

RESPONSE

The piping from the supplementary air conditioning units which penetrate the west wall of the control room pressure boundary are small bore (1 inch diameter or smaller) copper tubing, and are expected to deform substantially and collapse prior to rupture. Calculation 16345/6-ME(B)-239, "Control Room Complex -Supplemental," states that leakage due to rupture of these lines is negligible.

Calculation 16345/6-ME(B)-279, "Control Room Area Freon 22 Concentration," analyzes the postulated rupture of all lines from the supplemental air conditioning units, thus releasing the entire freon inventory to the room atmosphere. This calculation concludes that, assuming such an event, control room habitability is not affected.

As a design basis event, the Safe Shutdown Earthquake is not assumed to occur simultaneously with accidents. Therefore, certain control room pressure boundary components, such as this piping, are not required after a seismic event to ensure control room habitability. These components are not classified as seismic Category I.

SIGNIFICANCE/EXTENT

There is no safety concern because control room habitability is not affected.

OPEN ITEM I-6

Document Numbers: DBD-ME-003, Revision 0, Control Room Habitability
DBD-ME-304, Revision 0, Control Room Air Conditioning System.

The drawings in Table 1 do not provide sufficient information to indicate whether personnel can pass from the Train "A" to Train "B" mechanical equipment room without exiting the control room pressure boundary. This could be a problem if radiation levels are above normal.

RESPONSE

Manual action may be required in mechanical equipment Rooms 150 and 150A (Train "A" and Train "B", respectively) during postulated radiological accidents. The access path from the control room to the mechanical equipment rooms is through the control room pressure boundary via Door E-29 (as shown on architectural drawing 2323-M1-0509 and FSAR Figure 1.2-33) to the stairwell EC-2, up to Elevation 854' 4", and through the pressure boundary into Room 150. As shown on architectural drawing 2323-M1-0510 and FSAR Figure 1.2-34, access to Room 150A is via Room 151, which is not included in the control room pressure envelope. However, there are no contained sources in Room 151, and the time required for passage through this room is small; therefore, radiation doses incurred inside Room 151 would be negligible.

Due to the small amount of time spent outside the pressure envelope, radiation exposures to personnel performing the manual actions tasks would be controlled by activities inside the pressure envelope, not by sources encountered while en route to the rooms. In addition, if appropriate, personnel dispatched for work under these conditions would don protective clothing and/or breathing apparatus to further reduce radiation exposure.

SIGNIFICANCE/EXTENT

There is no safety concern because, due to the small amount of time spent outside the pressure envelope, radiation exposures to personnel performing the manual action tasks would be negligible compared to radiation exposures to personnel within the control room pressure boundary.

OPEN ITEM I-10

Document Number: DBD-ME-0229, Revision 0, Component Cooling Water System

The mechanical equipment requirements section lists two pumps rated at 14,700 gpm at 226 ft. TDH (Total Dynamic Head). Table 4-1 shows heat load and flow requirements of 302 million BTUs and 27,900 gpm at four hours after shutdown. At this time, the non-safeguards loop subtotal is shown as 11,700 gpm. Information in the DBD does not include a scenario for isolating the non-safeguards loop should one safeguards loop fail. The required flow rates for safeguards and non-safeguards loops with one pump in service are not given nor is there any information on required automatic or manual control operations to restore the system to adequate cooling conditions.

RESPONSE

As part of the CCW system validation, the scenario discussed above has been analyzed.

Isolation of the non-safeguards loop is not required. Calculation 16345-ME(B)-255 has concluded that the remaining CCW pump can supply the required flow without any operator actions.

For continued operation in this condition, manual action is recommended to isolate unnecessary loads, thereby reducing CCW pump flow rate.

A description of this scenario will be provided in the DBD when Sections 5-11 of the DBD are updated to reflect the results of the validation (June 30, 1988).

SIGNIFICANCE/EXTENT

There is no safety concern since the transient described has been analyzed and the system can supply the required flow with one CCW pump without any operator action.

OPEN ITEM I-11

Document Number: DBD-ME-0229, Revision 0, Component Cooling Water System

Isolation of the non-safeguards loop could remove instrument air compressors and thermal barrier coolers from operation for a long time period. It is not clear that sufficient compressed air is available to perform safety-related functions during such a time period or if prolonged loss of thermal barrier protection will damage the reactor coolant system pumps.

RESPONSE

Loss of the instrument air compressors will result in loss of operation of many air operated valves. In order to ensure operability of the valves, the following methods are employed to perform safety-related functions during the time period that the instrument air compressors are unavailable:

1. Valve positions are fail-open or fail-closed depending on the position important to safety.

2. Where required to perform a safety function, air accumulators are installed to provide a backup source of instrument air to ensure valve operability.

3. Where required, handwheels are installed to provide the capability to manually operate the valve as required.

Loss of CCW flow to the reactor coolant pump thermal barriers is acceptable and will not damage the pumps in the short term as long as seal injection from the Chemical and Volume Control System is not interrupted. Westinghouse recommends that flow be reestablished within 24 hours or the pumps be shut down.

SIGNIFICANCE/EXTENT

There is no safety concern because the valves fail to their position of greater safety, the system design provides air supplies for the valves that are required to perform safety-related functions, and handwheels are provided to permit manual operation.

OPEN ITEM I-12

Document Number: DBD-ME-0229, Revision 0, Component Cooling Water System

The Spent Fuel Pool Cooling Heat Exchanger CCW flowrate is listed as 4,000 gpm in DBD-ME-0235, Rev. 0 dated June 25, 1987, "Spent Fuel Pool Cooling and Cleanup System". Table 4-1 in DBD-ME-0229 (CCW DBD) lists this flowrate as 3000 gpm. This inconsistency needs to be corrected.

RESPONSE

The table in DBD-ME-229 was incorrect. CCW design flow to the Spent Fuel Pool Heat Exchanger is 4000 gpm per vendor data. DBD-ME-235 is correct. Since the "Heat Load and Flow Requirements" table only listed design information and did not provide design criteria, it has been deleted in Revision 1 of DBD-ME-229. Actual heat load and flow rate information will be provided in Section 5 when Sections 5-11 are updated to reflect the results of the validation (June 30, 1988).

SIGNIFICANCE/EXTENT

There is no safety concern since the CCW design calculations used the correct flow rate for the Spent Fuel Pool Cooling Heat Exchanger.

OPEN ITEM I-13

Document Number: Drawing No. 2323-M1-2229, ICDs for CCW System - 9 Sheets
Drawing No. 2323-M1-2230, ICDs for CCW System - 2 Sheets
Drawing No. 2323-M1-2231, ICDs for CCW System - 7 Sheets

Instrumentation and controls are provided for the CCW system which result in automatic isolation of the non-safeguard loop from both safeguard loops on receipt of a containment isolation signal. The resulting zero flows in the non-safeguards loop will activate more than 20 alarms. The alarms will be unimportant to the operator, but they must be acknowledged.

The concern about operator "data overload" during critical periods is a generic one. The team was informed that a control room design review in accordance with NUREG 0700 has been completed by TU Electric. The results of the alarm system review were not available to the SWEC project team at the time of this audit. These results should be evaluated pertinent to the above "data overload" example.

RESPONSE

A Phase A Containment Isolation Signal (CIA) will result in only three low flow alarms - flow to letdown chillers, the excess letdown heat exchanger and the reactor coolant drain tank heat exchanger. Acknowledgment of these three alarms will not result in "operator data overload."

A Phase B Containment Isolation Signal (CIB), initiated by containment spray actuation, may result in 22 low flow alarms caused by the isolation of CCW to non-essential components. Control Room operators with extensive training in emergency operating procedures will respond to these alarms when they are actuated. This is not considered to be an overly stressful situation for the operators.

During accident conditions, multiple alarms from many systems will be initiated. Under these conditions, the operators will follow station emergency response procedures. These annunciator alarms will be silenced by the operator but response to the alarm will not be initiated until the plant has been stabilized in accordance with the emergency response procedures.

SIGNIFICANCE/EXTENT

There is no safety concern because acknowledgement of the three low flow alarms following a CIA will not present the operators with data overload. In the event of a CIB signal, emergency response procedures will assure that the plant condition is stable before response to alarms is initiated.

OPEN ITEM I-14

Document Numbers: Calculations 16345-IC(B)-016, Revision 0, CCW Surge Tank Level Lo-Lo, Hi, Empty 1-LB-4500 A/B, A1/B1 and 16345-IC(B)-015, Revision 0, CCW Surge Tank Level Lo-Lo, Hi, Empty 1-LB-4501 A/B, A1/B1

Despite the fact that both calculations had the signatures of one preparer, two reviewers, and one independent reviewer, the following errors were found.

a. On pages 3 and 17 of both calculations, the descriptions of the reset points are incorrect for the four bistables. The calculations show "incr" (increasing) when they should show "decr" (decreasing) and vice versa.

b. On pages 3 and 15 of Calculation 16345-IC(8)-15), a total of 14 tag number errors were identified.

The above errors are non-substantive. As such, the team would expect them to have been identified even by a cursory review. The fact that they were not identified by several reviewers may indicate a programmatic problem with calculation reviews.

RESPONSE

Calculations 16345-IC(B)-015 and 016 have been revised to correct the deficiencies. The majority of the deficiencies occurred because one calculation was being utilized to represent redundant instrument loops with unique tag numbers. The errors were transcription errors which occurred when copying the calculation for the redundant instrument loop.

SIGNIFICANCE/EXTENT

There is no safety concern. A random sample of similar Class I setpoint calculations was performed, which revealed no tag number or reset description errors. Therefore, it is determined that no programmatic problem with calculation reviews exist and that the deficiencies found are limited to calculations 16345-IC(B)-015 and 016.

OPEN ITEM I-15

Document Numbers: Drawing No. 2323-M1-2200, Sheet 1, Revision CP-2, and
Drawing No. 2323-M1-2200, Sheet 3, Revision CP-3

Wiring diagrams are intended to implement the logic shown on the ICDs. The team reviewed wiring diagrams which implemented the above ICDs for the CCW system, including the implementation of the "Maintained Memory" symbol. Rather than using latching relays or other bistable devices, the wiring diagrams show seal-in circuits. Other ICDs should be reviewed to determine if this is a generic problem. For each identified case where seal-in circuits are used even though the ICD specifies "maintained memory," the review should determine whether the system can meet its safety function.

RESPONSE

Other ICDs were reviewed that contained "maintained memory" symbols. Their respective wiring diagrams were reviewed to determine the consequences of a power failure where seal-in circuits were used in place of maintained memory devices. All the reviewed devices that are operated by seal-in circuits are fail-safe because they will reposition to the de-energized position which is safe.

During the drawing validation program all Class I elementary diagrams were reviewed against their associated ICDs to verify that the design of control circuits satisfy safety requirements during loss of control power.

All devices that utilized seal-in circuit were reviewed for the consequences of a power failure. The fail-safe position of the device was reviewed to assure that it would not prevent the system from performing its safety function.

SIGNIFICANCE/EXTENT

There is no safety concern because the seal-in circuits will not prevent the systems from performing their safety functions.

OPEN ITEM I-16

Document Numbers: Calculation 16345/6-IC-001, Revision 1, Instrument Tubing, Minimum Wall Thickness - ASME III and Specification CPES-I-1018, Revision 1, Installation of Piping/Tubing and Instrumentation Class I

The installation specification does not define localized tubing damage. As a result, field installers and inspectors have no acceptance criteria for such tubing.

RESPONSE

CPES-I-1018, Section I, Page 5, Item Y defines damage as "any physical alteration in characteristic of an item which could impair the function or performance of the item or which renders the quality of the item indeterminate." Section II, Page 8 describes "damage" and the extent of acceptable tubing damage. Two of these conditions are further illustrated by sketch 1018-8, Appendix B. Appendix D (QC Inspection Attributes), paragraphs 6.17, 6.18, and 6.19 provides the inspectors with acceptance criteria for damage. The QC inspection attributes listed above fully define localized damage.

SIGNIFICANCE/EXTENT

There is no safety concern because localized damage is defined in the tubing installation specification.

OPEN ITEM I-17

Document Number: DBD-ME-0229 Section 5.4, System Limitations and Precautions

Normal operation of the system cross connects safety-related loops 1 and 2 through the non-safeguards loop. This would likely cause one side of the surge tank to continuously spill to the other side because the pump suction pressures cannot be balanced for all loads. Should the levels in the surge tank be below the spillover point, leakage into or out of the CCW system may not be detected as a change in level of a single compartment. Rather, both compartment levels may rise and fall together. Further, it is likely a large leak anywhere in the CCW system would result in the actuation of both surge tank compartment "empty" signals within a few seconds of each other. Both of these concerns relate to the above FSAR commitment on leakage detection.

RESPONSE

The CCW system design meets the FSAR requirements related to leakage detection. The CCW system normally operates with cross connected flow paths. Therefore, leakage into the system from any point will affect both sides of the surge tank barrier. Level instrumentation with high level alarms is provided on each side of the barrier. The operator will be immediately aware of high level on either side and when inleakage results in high level on both sides, the operator will then be informed that significant inleakage is occurring, not just water spillover from one side of the barrier to the other. This method of detection provides the operator with the knowledge that total water volume is increasing.

With the system normally cross connected, a large outleakage will result in the loss of surge tank level on both sides which will then automatically actuate isolation of the safety trains from one another and from the nonsafety CCW portion of the system.

SIGNIFICANCE/EXTENT

There is no safety concern because CCW leakage can be detected.

OPEN ITEM I-18

Document Number: DBD-ME-0229 Section 5.4, System Limitations and Precautions

The total CCW system thermal contraction and expansion is on the order of 1600 gallons. As a result, it is not clear how small leaks and their locations are to be identified when the CCW loops are not isolated from each other.

RESPONSE

Makeup is provided automatically to the surge tank based on level. Frequent makeup, which is indicated in the control room, over a period of time would be indicative of small system outleakages. This is the only method of detecting small leaks and is not significantly affected by whether or not the loops are cross connected. Once detected, the loops would be isolated from one another in order to determine which loop is leaking. Larger leaks would be more quickly identified by the level instruments.

SIGNIFICANCE/EXTENT

There is no safety concern because small leaks do not affect the required CCW operation because of automatic makeup and would be detected based on frequent makeup over a significant period of time.

OPEN ITEM I-19

Document Number: DBD-ME-0229 Section 5.4, System Limitations and Precautions

The CCW system high-high alarm on one side of the surge tank may always be on and as such result in a human factors concern.

RESPONSE

During normal operating modes, crossflow in the surge tank can occur resulting in a constant HI-HI level signal on the standby CCW train side of the surge tank. If inleakage occurs, the operating train level will increase and alarm (Refer to Open Item I-17 Response). Eventually, the inleakage will result in both sides of the surge tank alarming on HI-HI level. This indication will alert the operator to system inleakage.

SIGNIFICANCE/EXTENT

There is no safety concern because the alarm on the operating train side of the CCW surge tank will alarm in the case of system leakage. It is also noted that these alarms do not perform a safety function.

OPEN ITEM I-20

Document Numbers: Drawing No. 2323-EI-0050, Sh. 26, Rev. CP-1, Sh. 27, Rev. CP-1, Sh. 47, Rev. 2, and Sh. 49, Rev. 3

The DBD considers valves HV 4631A, HV 4631B, FV 4650A, and FV 4650B to be active valves. They are required to operate during the various operating modes that the system must perform in order to shut down the plant and maintain the plant in a safe shutdown condition. The DBD gives no information as to how the valves contribute to the safe shutdown of the plant. In fact, the DBD gives conflicting information as to the required conditions for operation of the valves. For example, Table 5-3, CPSES Component Cooling Water System Required Flow Rates, shows the valves open for all plant conditions including an S-signal. However, DBD Sections 6.4e and 6.4i indicate that the valves will close on an S-signal.

RESPONSE

The discrepancies identified in Sections 5 and 6 of DBD-ME-229 will be corrected when Sections 5-11 of the DBDs are updated (6/30/88).

These valves have been designated as "Active," as defined in the DBD, and receive train related actuation signals to close in order to isolate selected portions of the nonsafety loop. The valve classifications and actuation signals were specified to enhance the reliability of CCW system. Automatic closure of these valves is not required for safe plant shutdown and is not needed for the CCW system to perform its safety functions because other redundant, safety-related isolation valves are provided to automatically isolate the CCW safety-related loops from the nonsafety loops.

SIGNIFICANCE/EXTENT

There is no safety concern because the valves described above do not perform a safety function.

OPEN ITEM I-21

Document Number: Drawing No. 2323-EI-0050, Sh. 26, Rev. CP-1, Sh. 27, Rev. CP-1, Sh. 47, Rev. 2, and Sh. 49, Rev. 3

The DBD lists Criterion 44 of 10CFR50 Appendix A as part of the Design Basis. This criterion addresses cooling water systems including "...suitable redundancy in components and features.... shall be provided to ensure that... the system safety function can be accomplished assuming a single failure."

Isolation of component cooling water to the vent chillers, while listed in the DBD as being required to operate to safely shut down the plant, is actuated only by Train B. The cooling water source is common to cooling water Trains A and B. A single failure could block the isolation function.

Isolation of the component cooling water to the process sampling system is also listed in the DBD as being required to operate to safely shut down the plant. It is actuated only by Train A of the ESFAS. The cooling water source is common to cooling water Trains A and B. A single failure could block the isolation function.

As indicated in Open Item I-20, the rationale for establishing the closing of valves FV 4650A, FV 4650B, HV 4631A, and HV 4631B as required for the safe shutdown of the plant is not clearly identified. In addition, the above single failure issue needs to be addressed.

RESPONSE

As discussed in Open Item I-20, portions of the nonsafety loop can be isolated to enhance reliability of the cooling water supply to selected non-safety related components, including those listed above. The components supplied from this portion of the nonsafety loop are not required to safely shutdown the plant as described in DBD-ME-229. MOVs 4524, 4525, 4526, and MOV 4527 perform the safety/nonsafety loop isolation function. They are designed to perform this function and to meet single failure requirements. The response to Open Item I-20 addresses valves FV 4650A/B and HV 4631A/B.

SIGNIFICANCE/EXTENT

There is no safety concern because valves FV 4650A/B and HV 4631A/B do not perform a safety function.

OPEN ITEM I-22

Document Numbers: Calculations 16345-IC(B)-029, Revision 0, Station Service Water Supply Header Pressure Lo Channel 1-PIS-4250 and 16345-IC(B)-030, Revision 0, Station Service Water Supply Header Pressure Lo Channel 1-PIS-4251

The maximum pressure at which the ITT Barton Switches (1-PIS-4250 and 1-PIS-4251) will reset may be above the normal service water pump discharge pressure. As a result, there may be conditions where there is satisfactory service water pressure, but the low pressure alarm, the service water pump auto start signal, and the component cooling water pump auto start signal will not clear. The calculations show a maximum reset point that is not a true maximum reset point. Rather, it is the maximum reset point when the switch has been recently calibrated. The true maximum reset point is 10% (deadband) above the maximum calculated pressure at which the switch may actuate. For these switches, the true maximum reset point is 23.1 psig (upper setpoint limit) + 4.5 psig (total expected error) + 6 psig (maximum deadband) or 33.6 psig. Normal operating pressure of the system is shown as 30.2 psig.

DBD-EE-037 "BOP Safety-Related Setpoints" does not address reset points as affected by overall long term inaccuracy of instrument setpoints. It considers only reset points as affected by minimum and maximum adjusted setpoints. Therefore, the design criteria in the DBD are deficient in this regard. For the above cases, the instruments selected may be unsuitable for the service. Previously completed setpoint calculations should be rechecked to determine if the worst case reset point could interfere with the intended operation of equipment/systems.

RESPONSE

Calculation 16345-ME(B)-230, Revision 1, will be revised to lower the process allowable value to 12 psig. This will produce a maximum reset point of: 16.5 psig (adjusted setpoint) + 4.5 psig (total expected error) + 6 psig (maximum deadband) or 27.0 psig which is below the operating pressure of 30.9 psig (per next revision of Calculation 16345-ME(B)-230). Based on the above, setpoint calculations 16345-IC(B)-029 and -030 will be revised by June 30, 1988.

DBD-EE-037, Revision 1, "BOP Safety-Related Setpoint," will be revised to include the following statement: "For all instruments having fixed or non-adjustable deadband maximum, reset point (based on maximum possible actuation point) will be determined and checked to assure that it does not adversely affect system operation."

SIGNIFICANCE/EXTENT

There is no safety concern because the safety funct. n of this device is not affected by the reset point. The setpoint calculations for the remaining 24 ITT Barton switches were reviewed and will be revised to establish maximum reset points by June 30, 1988. None of the remaining switch setpoints would have adversely affected system operations.

OPEN ITEM I-23

Document Numbers: Drawing No. 2323-M1-0231, Re.. CP8, Flow Diagram CCW System, Sheet 7 of 8, and Drawing No. 2323-E1-0050, Sh. 40 and 41, Rev. 5

The flow diagram shows one automatic isolation valve outside the containment on the cooling water line to the in-containment excess letdown and reactor coolant drain tank heat exchangers. It also shows one automatic isolation valve outside the containment on the cooling water line from these heat exchangers. The heat exchangers and the cooling water piping form a closed system. The isolation valves form the second barrier to fission product release. Wiring diagrams for valves HV-4710 and HV-4711 show actuation from only train B. Containment isolation systems are generally built with redundant isolation valves, each actuated by a separate Engineered Safety Features Actuation System (ESFAS) train. Failure to actuate valves HV-4710 and HV-4711 from redundant trains needs to be addressed in the context of meeting Criterion 57 valve operation requirements.

RESPONSE

Valves HV-4710 and HV-4711 are outside containment isolation valves and are both actuated from the same train to ensure operation of the loop and closure, when required. General Design Criterion 57 requires only one automatic isolation valve (in the inlet and outlet lines) outside containment for closed systems. This design complies with GDC-57. The piping serves as the redundant barrier in the event of a Train B failure.

SIGNIFICANCE/EXTENT

There is no safety concern because the CCW system containment isolation provisions are properly designed to comply with GDC-57.

OPEN ITEM E-17

Document Number: DBD-EE-052, Revision 0, Cable Philosophy and Sizing Criteria

Paragraph 5.3 in the DBD correctly states, "...with insulation thickness based on 133 percent voltage level". This is clearly stated for the 8 kV cable, where the system is low resistance grounded. However, for the 480 Vac system, which is a high resistance grounded system, the DBD does not relate insulation thickness to the 173% voltage level.

RESPONSE

Design Basis Document DBD-EE-052 Rev. 1 states that low voltage power cable is specified for use on the 480 V, 3 phase, 60 Hz, high resistance grounded system. The specification has been reviewed and is in agreement with the DBD.

The standard, ICEA S-68-516 does not address ungrounded systems under 2000 Volts. The voltage levels below 2000 volts are addressed without reference to grounded or ungrounded systems and require an insulation thickness to the 133 percent voltage level. Therefore, the cables supplied have appropriate insulation thicknesses.

The cable manufacturer has verbally confirmed that the 600 V power cable is capable of operating with 480V (phase to phase) impressed across the insulation without a time limit. The cable manufacturer has committed to document this by May 31, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the cables supplied for the 480 V ac system have appropriate (133 percent voltage level) insulation, per ICEA Standard S-68-516.

OPEN ITEM E-18

Document Number: Calculation 16345-EE(B)-052, Revision 0, Firestop Cable Ampacity Derating Factors

As per Calculation 16345-EE(B)-052, page 33, when passing through firestops, all cables cannot simultaneously carry 125 percent full load current. (Refer to Item b. above.) This limitation is inconsistent with the above (item b) DBD requirement.

RESPONSE

All cables are sized to be capable of carrying 125 percent of full load current. In addition, a cable derating factor has been calculated for each cable which passes through a firestop. This derating factor is calculated based on the heat load caused by all cables in the firestop area passing 100 percent of full load current simultaneously. Use of full load current for calculation of the derating factor is conservative because not all cables passing through the firestops will be carrying 100 percent of full load current simultaneously. Most cables will be carrying less than 100 percent full load capacity. This derating factor is applied to the cable in addition to the 125 percent full load criteria.

SIGNIFICANCE/EXTENT

There is no safety concern because the cable current carrying capacity is consistent with the DBD requirements.

OPEN ITEM E-19

Document Number: Calculation 16345-EE(B)-052, Revision 0, Firestop Cable Ampacity Derating Factors

The calculation on page 34 concludes that no derating is required for cable sizes no. 4 AWG and smaller. This conclusion is based on the assumption that it is "... not practical to consider all cables operating at 1.25 x Ifl, ...". This is not in compliance with Criterion 2b above.

The calculation uses the following documents as the basis for the above conclusion:

a. "Ampacity of Cables in Trays With Firestops", IEEE Transactions on Power Apparatus and Systems, Vol. PAS-100, No. 7, July 1981.

b. "Ampacity Test of a Silicone Foam Firestop in a Cable Tray", IEEE Transactions on Power Apparatus and Systems, Vol. PAS-100, No. 11, November 1981.

The above technical papers do not appear directly applicable to Comanche Peak because:

1) The data is based on the use of much larger cables, i.e., 4/0, 2 AWG and 6 AWG, as opposed to 4 AWG and smaller for Comanche Peak.

2) The cables used in test were aluminum cables, as opposed to copper for Comanche Peak. Even though the aluminum test cables have a lower thermal conductivity than copper, they utilize larger cross-sectional area for the same ampacity.

3) The cables were carefully placed in the tray to ensure contact between the cables and to minimize air pockets, which is not consistent with general field installations.

In addition these above differences, Reference a. indicates that, for a 9" to 12" thick silicone foam firestop, the temperature rise could be 12°C to 19°C higher than the temperature rise without the firestop. Reference b. States that for smaller cables the temperature rise could be up to 40°C higher with these firestops.

Based on the above discussion, the calculations do not provide adequate basis for the conclusion (on pages 34 and 35) that, "For random filled cables sizes no. 4 AWG and smaller - no derating need be applied".

OPEN ITEM E-19 (Continued)

RESPONSE

The FSAR Section 8.3.3.1 states that power cable trays will be loaded to 30% of maximum fill. On a case by case basis, exceptions are allowed based on the criteria described in FSAR Section 8.3.3.1. All power cable trays have a depth of 3 inches above the rung to the top of the side rail. Application of the 30% fill criteria yields an effective cable depth of fill of 1.15 inches. The statement in the calculation that the No. 4 AWG and smaller cable need not be derated was based on use of 1.5 inches as the effective cable depth of 1.5 inches. Additionally, it was assumed that all cables were sized for 125% of full load amps and they were carrying 100% with no diversity. Use of 1.5 inches cable depth is a conservative assumption which results in lower cable ampacity. Additional calculations have been performed to determine cable ampacity at a cable depth of 1.5 inches. Hence the original calculation was conservative. DBD-EE-052 has been revised to reflect the 30% cable fill criteria; all cable calculations have been revised to reflect the revised criteria and appropriate firestop derating factors have been included.

SIGNIFICANCE/EXTENT

There is no safety concern because the original calculations were conservative.

OPEN ITEM E-20

Document Number: DBD-EE-040, Revision 0, 6.9 kV Electrical Power System

When discussing the fast transfer scheme, the DBD states, "...permits fast transfer if the startup source voltage is at or above 85 percent of the rated bus voltage ... and normal and startup voltages are not out of phase by more than 40 degrees." Assurance needs to be provided that the 40 degrees out-of-phase transfer condition will not damage any of the connected motors.

RESPONSE

Adequate assurance has been provided that the design is acceptable. ANSI C50.41-1982, American National Standard for polyphase induction motors for power stations, addresses this subject in Section 15, which includes the following statement:

> "To limit the possibility of damaging the motor or driven equipment or both, it is recommended that the power supply system be designed so that the resultant vectorial volts per hertz between the motor residual volts per hertz and the incoming source volts per hertz at the instant the transfer or reclosing is completed does not exceed 1.33 per unit volts per hertz on the motor rated voltage and frequency bases."

The 1.33 per unit volts per hertz value translates into a maximum phase angle difference between motor residual voltage and incoming source voltage of:

$2 \times \sin^{-1} (1.33/2)$ or 83.36 degrees.

The 40 degree angle permitted by the DBD is very conservative, in order to allow for small initial phase angle difference between normal and startup sources and for phase angle drift motor voltage decay during a dead-bus time of up to 6 cycles. It should be noted that only the non class 1E buses have a fast transfer. The class 1E buses have only a slow transfer.

SIGNIFICANCE/EXTENT

There is no safety concern because adequate assurance has been provided that the 40 degrees out-of-phase transfer condition will not damage any of the connected motors.

OPEN ITEM E-21

Document Number: DBD-EE-040, Revision 0, 6.9 kV Electrical Power System

Section 4.3.2.1.8 of the DBD states, "A control voltage of 90 V dc to 130 V dc is required for the operation of the closing coil ..." This should be 90 V dc to 140 V dc as discussed in the Open Item E-9.

RESPONSE

As stated in the response to Open Item E-9 (see TXX-88303 dated March 31, 1988), Gould, Inc. was contacted subsequent to the inspection and responded with a letter stating that the equipment voltage rating of 90-140 volts dc was correct.

We have requested that Gould, Inc. submit additional information to resolve the conflicting information concerning spring charging motor operation up to 140 V dc by May 27, 1988. After the submitted data is reviewed, the DBD will be revised as necessary.

SIGNIFICANCE/EXTENT

There is no safety concern because the spring charging motor will operate per specification.

OPEN ITEM E-22

Document Number: DBD-EE-040, Revision 0, 6.9 kV Electrical Power System

The DBD describes the 6.9 kV electrical power system as a low resistance grounded system. When the system is connected to the offsite power system through the station service auxiliary transformers, the grounding resistors at the transformers provide a low resistance path for the ground fault current. When the plant is operating in this mode, the 6.9 kV cable insulation thickness (for the 133 percent voltage level) is in accordance with the industry standard.

However, when the safety buses are powered by the diesel generators, i.e., on loss of offsite power, the only system grounding is through the diesel generator grounding system. In this mode, the 6.9 kV system operates as a high resistance grounded system. The 6.9 kV cable insulation thickness requirement (173 percent voltage level) has not been addressed in the DBD.

The 6.9 kV electrical distribution system is undergoing a major redesign effort which includes the addition of new station service auxiliary transformers. Because of the significance of this change, the following documents will be reviewed later in order to assess compliance with the design criteria.

a. 6.9 kV and 480 Vac one-line diagram
b. Elementary diagrams for 6.9 kV bus transfer schemes
c. Station service voltage regulation calculation
d. 6.9 kV short circuit calculation
e. DBD-EE-040, 6.9 kV Electrical Power System (revised)
f. Validation of diesel generator loading capability
g. DBD-EE-62, Containment Electrical Penetration Protection
h. Calculation No. 17, electrical penetration protection
i. Electrical penetration protection problem resolutions

RESPONSE

As described in DBD-EE-040, the 6.9 kV system, powered by the diesel generators, operates ungrounded during a loss-of-coolant accident (LOCA). Alarm indication is provided to detect a line to ground fault. If indications of a ground fault exist during loss of offsite power, the diesel generator will be tripped to clear the ground fault.

The 8 kV cable utilized has 140 mils of insulation. Under a line to ground fault, the voltage stress across the insulation is 6900 Volts/140 mils or 49 V/mil. In accordance with NEMA standard ICEA S-68-516 requirements for 173% insulation level, we have consulted the cable manufacturer regarding insulation thickness. The manufacturer has stated that the insulation system is capable of continuously operating at 49 V/mil (average stress). The cable manufacturer will confirm this in writing by May 31, 1988. DBD-EE-052, Cable Philosophy and Sizing Criteria, and 8 kV Cable Specification 2323-ES-13A will be revised to address this cable operating condition by June 30, 1988.

OPEN ITEM E-22 (Continued)

SIGNIFICANCE/EXTENT

There is no safety concern because the insulation system is capable of continuously operating at 49 V/mil (average stress). This open item is limited to DBD-EE-052.

OPEN ITEM E-23

Document Number: DBD-EE-057, Revision 0, Separation Criteria

Section 6.5.1.7 OF DBD-EE-057 states that the minimum separation of 1 inch between control and instrumentation cable trays is permitted in cable spreading areas. Further, Section 6.5.2.7 states that the same separation is permitted in general plant areas.

The IEEE Standard and the Regulatory Guide require these distances to be:

a. 1 ft. Horizontal x 3 ft. Vertical (Cable Spreading Room)

b. 3 ft. Horizontal x 5 ft. Vertical (General Plant Area)

We were unable to find adequate testing and/or analysis to justify 1" separation as stated in the DBD.

Further, these criteria are applicable to separation between Class 1E and non-Class 1E trays. In the case of non-Class 1E trays more than one cable can be carrying fault current simultaneously. This reduced clearance needs to be justified for this situation.

RESPONSE

The DBD has been revised to permit a separation distance of 1 inch between redundant control and instrument trays with a single enclosure. The adequacy of this arrangement has been demonstrated by testing (as demonstrated in Wyle Lab Test Report 48037-02). This test indicated 1 inch between cables without enclosure was sufficient.

The regulatory guide values are now reflected in the later revision of the DBD. When Revision 0 of the DBD was issued, evaluation of separation testing which had been previously performed was in progress. The completed evaluation showed that the reduced separation values were substantiated and the DBD was revised accordingly.

SIGNIFICANCE/EXTENT

There is no safety concern because the test has indicated that reduced separation is justified.

OPEN ITEM E-24

Document Number: DBD-EE-057, Revision 0, Separation Criteria

Section 6.1 in the DBD requires color code letters as follows: "O" for Train A and Associated Train A cables, and "G" for Train B and Associated Train B cables.

Section 4.5.(1) in the IEEE Standard requires that the associated circuits be uniquely identified. Regulatory Guide 1.75 endorses this requirement. The DBD does not satisfy this requirement.

RESPONSE

All cable have 7-digit cable identification numbers marked on them. The number begins with a letter 'E' for all safety-related cables followed by the color code letter 'O' or 'G' for the two trains. For associated circuit cables, all cable numbers begin with the letter 'A' followed by the color code letter 'O' or 'G' for the two trains. The rest of the 7-digit number uniquely identifies the cable.

The table in Section 6.1 of DBD-EE-057 has been revised to reflect CPSES design.

SIGNIFICANCE/EXTENT

There is no safety concern because the DBD revision was for clarification to document past practices.

OPEN ITEM E-25

Document Number: DBD-EE-057, Revision 0, Separation Criteria

Report No. 17666-02, Electrical Separation Verification Testing Report for the Beaver Valley Power System, indicates that tests for power cable fault testing used #6 AWG cable as the worst case heat source. We were unable to find any analyses and/or justification that #6 AWG fault cable is the worst case heat source, e.g., compared to the larger cables, e.g., 2/0, 500 MCM, etc.

RESPONSE

Included with the Letter of Submittal No. 2NRC-5-081 dated June 4, 1985 for Docket 50-412 (Beaver Valley 2) is a separate justification for consideration of the #6 AWG as the worst case. This is based on maximum cable jacket temperatures measured when fault currents were applied to different cable sizes. The duration of fault current application is based on the conductor fusing time. A brief explanation of the justification follows.

Heat Rise Tests were included as part of the test program for Beaver Valley 2 to assure that the cables capable of generating the worst case electrical fault were used in configuration tests.

For the Heat Rise Tests, five sizes of triplexed power cable were selected; each cable test was performed with the cable in an open ladder type tray in a horizontal plane. The maximum overload current, locked rotor amperes, to which each size cable could be subjected was determined and that overload current was then applied until stable temperatures were achieved, complete ignition of cable or the cable fused open. Wyle Labs made plots of the fault cable maximum jacket temperatures.

The results of these tests indicated that extremely long durations would be required to cause ignition of the cable or fusing of the conductor at the tested locked rotor currents. These durations were considered to be neither realistic nor credible when evaluated on the basis of either previous industry testing or our experience with regard to cable failures in power plants.

Based on further review and on discussions with various motor manufacturers, it was decided that the most realistic cause of failure would be a motor pigtail failure, since, in general, pigtail size is smaller than the motor feeder. Assuming the failure to be at the motor pigtail, and using the result of the Heat Rise Tests, more realistic circuit failure times were developed. These were based on applying the locked rotor current until the calculated time, at which the motor pigtail conductor would melt open, was reached. As a further step in simulating credible conditions, it was decided to apply short circuit current at the end of the calculated time.

Calculation 12241-E111, titled "Determination of 480 V Motor Pigtail Failure Times", served as a basis for determining the sustained fault duration.

The following is a tabulation of durations and maximum jacket temperatures for each cable.

OPEN ITEM E-25

RESPONSE (Continued)

Heat Rise Test	Cable	LRA	Duration (min.)*	Max Temp Jacket of Fault Cable
1	500 MCM	1780	16.8	300 F
2	250 MCM	1579	13.5	360 F
3	4/0	1184	9.5	400 F
4	#2	501	8.3	460 F
5	#6 AWG	315	8.4	850 F

Based on these tests, the triplex No. 6 AWG cable had the highest jacket temperature, and was selected as being representative of the worst case cable for BVPS-2.

The cable sizes used at CPSES are larger for identical motor sizes. This resulted in lower locked rotor currents for identical cable sizes at CPSES. The highest locked rotor current for a motor connected to a cable size of #6 AWG is 185.2A at CPSES compared to 315A at Beaver Valley 2. Because the cable sizing at CPSES is more conservative, the results obtained from the Beaver Valley 2 tests can be applied to CPSES for the purpose of this analysis.

SIGNIFICANCE/EXTENT

There is no safety concern because due to the conservative CPSES cable sizing, the results obtained from the Beaver Valley 2 tests may be applied to the CPSES design for the purpose of this analysis.

OPEN ITEM E-26

Document Number: DBD-EE-057, Revision 0, Separation Criteria

Report No. 48037-02, Raceway Separation Verification Testing for Comanche Peak, in part, uses 105 Amperes (A) for #12 AWG cable as the worst case fault current. In portions of tests, we found higher currents, e.g., 120A and 135A, producing higher insulation jacket temperatures. No justification was apparent for using 105A as the worst case test current.

RESPONSE

The worst case installed configuration was established as a single conductor of #12 AWG in a full tray. The approach was to (1) determine the current to produce a stabilized, rated conductor temperature of 90°C and (2) to then increase the current by 15 amp increments and allow the temperature to stabilize or the conductor to fuse. In the above case, the final current was 105 amps. In other configurations, which require higher currents to cause conductor fusing, a current was applied to stabilize the conductor temperature at 90°C and then the test was started at 105 amps with currents increasing in 15 amp increments until the temperature stabilized or the conductor fused.

SIGNIFICANCE/EXTENT

There is no safety concern because the worst case test current for other configurations was developed as described above and in the test report.

OPEN ITEM E-27

Document Number: DBD-EE-057, Revision 0, Separation Criteria

The IEEE standard requires that, for reduced separation, the circuits will be run in enclosed raceways that qualify as barriers. Section 6.4.1 in DBD-EE-057 permits a protective wrap of woven silicon dioxide as equivalent to a metal enclosed raceway. It is not clear that such a protective wrap serves the same barrier function as a metal enclosed raceway. When any cable is faulted and gases are generated in the insulation, the glass tape could rupture. In addition, handling during installation and time related aging may compromise the barrier. These aspects need to be addressed.

RESPONSE

Based on testing, when the glass tape is installed in accordance with the electrical installation specification, 2323-ES-100, the glass tape barrier does not rupture, as documented in Wyle Labs Test Report No. 17666-02. Aging is not a concern for the Siltemp wrap because of its inorganic composition. For glass tape, the vendor has evaluated the tape for its thermal rating relative to 40 years. Based on 70°C intermittent temperature, the vendor justified the life to be 40 years. The tape retains its electrical/mechanical properties after exposure to 1 x 10E9 rads.

SIGNIFICANCE/EXTENT

There is no safety concern because the glass tape installation depicted in the installation specification has been qualified by the vendor.

OPEN ITEM E-28

Document Number: DBD-EE-057, Revision 0, Separation Cr'' 'ia

Position C6 in Regulatory Guide 1.75 indicates that all circuits which utilize lesser separation distances and are accepted on the basis of analyses and testing should be identified. Because of their significant damage potential, all power circuits which utilize analysis/testing for justification of lesser separation should be identified. This has not been accomplished.

RESPONSE

Comanche Peak does not utilize the lesser separation distances discussed in Position C6 for power cables.

For power cables, the one inch minimum separation is used in conjunction with two enclosures (conduit, Siltemp protective wrap, tray with cover top and bottom) which is in accordance with R.G. 1.75.

SIGNIFICANCE/EXTENT

There is no safety concern because Comanche Peak does not utilize the lesser separation distances discussed in Position C6 in Regulatory Guide 1.75.

OPEN ITEM E-29

Document Number: DBD-EE-057, Revision 0, Separation Criteria

Section 4.1.3 in DBD-EE-057 states, "Lack of isolation device shall be justified by analysis". We found that analyses and justifications were prepared for the power level circuits. Similar analyses for the control and instrumentation circuits were not available.

We also reviewed the disposition of various field identified problems (Refer to documents listed under 1.f through 1.s.) These have been adequately dispositioned in accordance DBD-EE-057.

RESPONSE

Refer to Amendment 68 FSAR Section 8.3.1.2.1, paragraph 7.B and C for analyses of isolation devices for control and instrumentation circuits. In addition, "current transformers" will be added to the list of acceptable isolation devices in the FSAR in an upcoming amendment.

SIGNIFICANCE/EXTENT

There is no safety concern because the FSAR change documents analyses of isolation devices for the control and instrumentation circuits.

OPEN ITEM E-30

Document Number: Calculation 16345-EE(B)-048, Revision 0, Protection and Ampacity of Electrical Containment Penetration

This calculation addresses protection for twenty-three classes of electrical penetration circuits. Of these twenty-three, the calculation shows that nineteen do not meet one or more of the three established criteria. Based on these results, it is stated in the calculation that these non-compliance circuits will be further evaluated. However, there was no indication as to specific evaluation/resolution plans or actions to ensure these circuits comply with the design criteria.

RESPONSE

Calculation 16345-EE(B)-048, Revision 1, addresses all the control and power penetrations and resolves all noncompliant circuits.

SIGNIFICANCE/EXTENT

There is no safety concern because the revised calculation fully addresses the subject circuits.

OPEN ITEM S-1

Document Number: DBD-ME-105, Revision 0, Missile Postulation and Effects

Attachment A-1 Elimination Equation (Missiles from pumps, compressor and turbines) indicates that a realistic pump missile is assumed to be a wedge-shaped sector of the impeller having a sector angle of 134 degrees which yields the maximum translational missile energy (velocity). No justification or reference is provided for the 134 degree sector angle yielding the maximum translational missile energy.

Missile Trajectory: Criteria are provided in the DBD for determination of trajectories of postulated missiles, based upon missile type. These criteria are consistent with the FSAR and industry practice and are presented such that they will be clearly interpreted.

Design Bases for Targets: The DBD provides criteria for evaluation of targets, both functionally and structurally. The single failure criterion is invoked in the functional evaluation of potential missile targets. The DBD also provides guidance in evaluating both local and overall effects of missile interactions. The criteria presented in this section are consistent with the FSAR and Standard Review Plans and conform to industry practice.

Evaluation Program: A program outline is provided in the DBD for evaluation of missile interactions. The program outline denotes requirements for documentation and requires as-built verification. The evaluation program appears to be adequate to ensure the identification, evaluation and operability of essential systems, structures and components.

RESPONSE

The reference to 134 degrees in Attachment 1 of DBD-ME-105, "Missile Postulation and Effects" was deleted in Revision 1 of the DBD. The intent of the following statement,

> A realistic pump missile is an impeller (disk) which is assumed to be wedge-shaped sectors of the disk having a sector angle that yields the maximum translational missile energy (velocity)."

is to provide technical justification for the conservative assumption that the maximum velocity of the missile is the velocity of the impeller at the tip of the impeller, as shown by equation (3) in Attachment 1 of the DBD.

Attachment 1 of the DBD further states that the potential missile that results in the largest energy is assumed to be a sphere, where the volume is equal to the weight of the missile divided by the density of the missile. Ebasco-SIP conservatively assumes the weight and density of the missile to equal that of the impeller. Therefore, the statement pertaining to the "wedge shape sector" does not factor into the missile energy equation (equation [7] of Attachment 1 of the DBD), except for technically justifying the maximum velocity used in the equation.

OPEN ITEM S-1 (Continued)

SIGNIFICANCE/EXTENT

This open item concerned clarification of the technical justification for a conservative assumption utilized in the development of the missile elimination equation developed in DBD-ME-105. Due to the fact that this clarification did not result in a revision to the missile elimination equation, this item does not impact the missile analyses performed to date.

OPEN ITEM S-2

Document Number: DBD-ME-005, Revision 0, Seismic/Non-Seismic Systems Interaction Program

DBD Section 1.3.9 states that non-seismically supported conduit 2 in. diameter and under are not considered as non-seismic sources. In addition, this section includes as non-seismic sources 2 in. diameter and under non-seismic piping with line-mounted equipment, as well as threaded fire protection piping 2 in. diameter and under. It appears that non-seismically designed, non-threaded small bore piping without line-mounted equipment is not addressed in this evaluation program. Section 4.4.3 seems to indicate that 2 in. diameter, non-seismically design conduit and non-threaded piping are to be included in the interaction walkdown.

A discussion with the applicant indicates that non-seismic 2 in. diameter and under conduit and non-threaded piping without line-mounted equipment are, in fact, being evaluated for interactions with seismic structures, systems and components under another program. The DBD should be clarified to state which commodities are evaluated under other seismic/non-seismic interaction evaluation programs.

Identification of Seismic Components: Criteria for determining the locations of seismic Category I equipment and components are provided.

RESPONSE

Non-safety/non-seismic components exempted from being considered as "sources" in the seismic/non-seismic program will be included in the Exempt Commodity Log in accordance with TU Electric Engineering procedure ECE 2.24, Rev. 1. This log will provide a justification for commodities not being considered as a "source", including reference to other programs where such commodities are being evaluated. This Exempt Commodities Log will be part of DBD-ME-005. A discussion on exempt commodities has been included in Section 4.2.3 of DBD-ME-005, Rev. 1. The programs that are performing above mentioned evaluations are as follows:

1. Architectural features not included in DBD-ME-005 are addressed by the Stone & Webster Corrective Action Program.

2. Impell Corporation - Seismic Qualification Program for Train 'C' 2" diameter and under conduits.

3. TU Electric - Seismic Qualification Program for Class 5 2" diameter and under piping - this will include threaded and non-threaded piping with or without line mounted equipment.

SIGNIFICANCE/EXTENT

This open item identified a lack of clarification concerning exempt commodities in the seismic/non-seismic analysis. There are no extensive or generic concerns associated with this item. Although the DBD reviewed was not clear in the discussion of exempt commodities and how they are evaluated, these commodities are being evaluated in other site corrective action programs. This clarification has no significance on the seismic/non-seismic program.

OPEN ITEM S-3

Document Number: DBD-ME-005, Revision 0, Seismic/Non-Seismic Systems Interaction Program

DBD Section 1.3.3 defines Seismic Category II structures, systems, or components as those items whose continued function is not required following a seismic event, but whose failure could reduce the functioning of a Seismic Category I system or component to an unacceptable safety level, and commits to design and construction of these structures, systems and components such that the SSE would not cause such failures.

The DBD further defines non-seismic sources as structures, systems and components that are not specifically identified as seismically designed.

It is unclear from the DBD how Seismic Category II structures, systems, and components are treated under the Seismic/Non-Seismic Interaction evaluation program.

Interaction Evaluation Criteria: The DBD provides various criteria and the methodology for evaluating and resolving identified interactions. Dynamic impact criteria are provided in Section 4.3.4 whereby an interaction may be evaluated as acceptable by the walkdown team members, via an engineering inspection, without calculation. Seven general criteria are provided for this evaluation and the criterion used for resolution of any specific item is noted as part of the walkdown documentation. The applicant should assure that the walkdown team members posses sufficient experience levels to allow them to properly make such determinations. To preclude misapplication, the dynamic impact criteria will be validated at the end of the interaction program via calculations performed on a random sample of interactions.

RESPONSE

Seismic Category II classification is associated with non-Nuclear Safety Related (NNS) components and electrical non-1E components. Upgrading of NNS and non-1E components from non-seismic to Seismic Category II classification enables the resolution of 'Source-Target' interactions because the source component is seismically restrained in terms of its structural integrity and support/anchorage and therefore would not be considered as a source under the Seismic/Non-Seismic Interaction evaluation program. Structural integrity of the component is assured analytically, through vendor Seismic Qualification Test Reports or by the use of Earthquake Experience Data Base.

SIGNIFICANCE/EXTENT

This open item identified a lack of clarification concerning the review of Seismic Category II commodities in the seismic/non-seismic analysis. There are no extensive or generic concerns associated with this item. The response provided is a clarification of existing criteria and documents previous practice. This observation does not represent a significant condition.

OPEN ITEM S-4

Document Number: DBD-ME-005, Revision 0, Seismic/Non-Seismic Systems Interaction Program

DBD Section 4.4.5 discusses the validation of the dynamic impact criteria via a random sampling technique and indicates in Item 2 of that section that a sample size will be calculated such that the criteria validity may be investigated to a high degree of probability. The DBD should provide some detail or reference as to how the sample size will be determined.

RESPONSE

Section 4.4.5 of DBD-ME-005 has been rewritten in Rev. 1 referencing a project document (CPRT Program Plan, Appendix D) that provides guidance and a basis for selection and size of a random sample. Minimum sample size for a 95/5 screen is 60 per Attachment 1 of the above referenced document. The 95/5 screen indicates from a random sample of 60 items examined, if no items are found to belong to the classification of interest (i.e., deficiency), there is 95 percent confidence that less than 5 percent of the population will be in this classification.

SIGNIFICANCE/EXTENT

This open item identified a lack of detail or reference concerning the validation of the dynamic impact criteria using a random sampling technique. Due to the fact this validation has not yet been performed and an acceptable method was readily available in another project document, this item did not have any safety significance.

OPEN ITEM S-5

Document Number: DBD-ME-005, Revision 0, Seismic/Non-Seismic Systems Interaction Program

DBD Section 4.4.5(5) states that "established methods of resolutions as outlined in this DBD shall be utilized if any of the criteria prove invalid." The DBD should provide additional details as to how it will be determined that a particular dynamic impact criterion is invalid and, if so, what steps will then be taken for the population of interactions that utilize the invalid criterion.

The use of dynamic impact criteria is recognized as a valid way to simplify the resolution of seismic/non-seismic interactions and the validation program will add control over their use. The specific impact criteria provided in the DBD are reasonable compared with current industry practice. Criterion 7 deals with sources impacting cable trays and the deleterious effect on the cables within the trays. Based on its experience that cable trays cannot withstand much outside loading and stay within qualification limits, the team suggests that this area receive special emphasis in the program implementation.

Other criteria for evaluating and resolving identified interactions are provided, such as detailed structural calculations, the use of industry data such as the Earthquake Experience Data Base and use of the provisions of NUREG 1030. These methods are acceptable and consistent with industry practice.

The team concludes that the criteria contained within the Design Basis Document, with the exceptions noted above, form the basis for an evaluation program which, if properly implemented, will be adequate to ensure the operability of essential structures, systems, and components following a seismic event and meet the intent of Regulatory Guide 1.29, position C.2.

RESPONSE

Section 4.4.5 of DBD-ME-005, Rev. 1 provides a reference (CPRT Program Plan Appendix D) according to which selection and acceptability of a random sample will be determined. Acceptance criteria with provisions for sample expansion is discussed in Attachment 4 of the above mentioned reference. If the initial or expanded sample does not meet the acceptance criteria, all affected interactions (resolved by use of Dynamic Impact Criteria) will require corrective action in accordance with Section 4.5 of DBD-ME-005, Rev. 1 and measures discussed therein will then be implemented.

OPEN ITEM S-5 (Continued)

SIGNIFICANCE/EXTENT

This open item identified a lack of detailed instruction concerning validating the dynamic impact criteria and the lack of an action plan should a particular point of the criteria prove to be invalid. At the time of the observation, validation of the dynamic impact criteria had not yet been required.

Since a recognized random sampling method for use in validating the dynamic impact criteria was readily available in another project document, this item did not have any safety significance.

OPEN ITEM S-6

Document Number: DBD-ME-007, Revision 0, Pipe Break Postulation and Effects

Attachment 2, "Moderate Energy Jet Spray Distance," provides a matrix of moderate energy jet spray distance, based on pressure in the source line and distance from the floor. Section 5.4 of the DBD references this Attachment, but does not describe what the data represents or how it is to be used. A discussion with the applicant indicates that the matrix provides the maximum horizontal distance from the broken pipe that could be wetted at floor level, based on a moderate energy crack oriented 45 degrees vertically. The DBD Section 5.4 and/or Attachment 2 require additional explanation such that the data may be properly utilized for evaluating moderate energy line breaks.

Attachment 4 provides a procedure for the calculation of plastic hinge location for use in evaluating pipe whip potential. The procedure is useful in the evaluation of pipe breaks but is incomplete as discussed below.

RESPONSE

The following clarification was provided in Section 5.4 of DBD-ME-007 via Revision 1, issued January 8, 1988.

"Essential equipment located in a room or area containing moderate energy lines will be listed, and the potential for flood damage or spray wetting will be evaluated. A spray will be considered capable of wetting any targets under the jet path that are not protected by a wall or barrier, unless specifically demonstrated otherwise by analysis. The distance the jet spray will travel is a function of the piping pressure and elevation with respect to the floor. The distances of jet spray travel for piping of various pressures (25 psi -275 psi) and elevations with respect to the floor (5, 10, 15 and 20 ft.) are tabulated in Attachment 2. Wetting is also possible by dripping from unprotected overhead surfaces."

In addition, procedure CP-EB-FVM-SI-35, "Moderate Energy Line Break Interaction Identification," provides guidance to walkdown personnel with regard to utilizing Attachment 2.

SIGNIFICANCE/EXTENT

This open item identified the need for clarification of the data contained in Attachment 2 of DBD-ME-007. As discussed above, procedure CPE-EB-FVM-SI-35 provides guidance to walkdown personnel with regard to utilizing the Attachment. Therefore, this item does not have generic implications or impact the moderate energy line break analysis.

OPEN ITEM S-7

Document Number: DBD-ME-007, Revision 0, Pipe Break Postulation and Effects

Attachment 4 provides a procedure for locating a plastic hinge (i.e., the point about which a pipe begins to whip) following a pipe break. The team's review of the equations for plastic moment capacity and distance of plastic hinge from center line of broken run determined there were significant missing portions. The team determined that the missing portions could not be typed on a normal keyboard and were to be manually added by the author. The applicant advised that no evaluations have been completed and released that where based on this procedure.

Shutdown Logic Diagrams: Criteria are provided for shutdown logic diagram development, which describe the functions, systems and components necessary to mitigate the consequences of a postulated pipe break and achieve plant shutdown. The spectrum of breaks has been classified into five families of break types. The classification is logical based upon systems required for mitigation and the potential effects of the breaks. Each of the five break types were reviewed by the team and the basic systems and operations listed as required for mitigation and shutdown appear correct and complete. Loss of offsite power was assumed for all break types, even those in which a plant trip is not a direct consequence of the break.

RESPONSE

During the revision process, the procedure for locating a plastic hinge was changed from Attachment 4 to Attachment 3. The missing portions of equations (1) and (2) were added in Revision 1 of DBD-ME-007, issued January 8, 1988, as follows:

1) Calculate plastic moment capacity (Mp) of the straight pipe under consideration as below:

   $Mp = (4/3) \quad (1.1 \quad y) \quad [(R_o)^3 - (R_i)^3]$

   Where y = Static yield stress of the pipe material
   R_o = Outside radius of the pipe
   R_i = Inside radius of the pipe

OPEN ITEM S-7

RESPONSE (Continued)

2) Calculate the location of plastic hinge (Lp) using the following formula:

$$Lp = 1.5\ (Mp/F)\ [1+ \quad 1 + (8/3)\ (F/Mp)\ \ (M/m)\ \ ]$$

Where Lp = Distance of plastic hinge from center line of the broken run.

Mp = Plastic moment capacity of straight pipe as calculated above.

F = Blowdown force due to pipe rupture = K P A

Where K = Thrust Coefficient based on the fluid state and the amount of subcooling per ANSI 58.2 Procedure.

P = Pressure of fluid inside the pipe.

A = Inside area of the pipe.

M = Total pipe mass from first elbow to break point plus any additional masses due to a valve that may exit between these two points.

m = Mass per unit length of pipe.

SIGNIFICANCE/EXTENT

All of the Ebasco pipe rupture calculations were reviewed to determine if any hinge locations were calculated using the incomplete formula in DBD-ME-007. The results of this review concluded that there were no calculations utilizing the incomplete formula. Therefore, this error did not pose an adverse impact on the Ebasco pipe rupture analysis.

OPEN ITEM S-8

Document Number: DBD-ME-007, Revision 0, Pipe Break Postulation and Effects

DBD Section 6.4 discusses a matrix of systems and functional modes necessary for the mitigation of each break type and the criteria for modeling each function into the shutdown logics, and indicates that this data may be found in DBD Section 1.5. Review of the DBD indicates that this data has not been included.

The team concludes, based on the review of this DBD, that sufficient criteria are presented to form the basis of an adequate evaluation program to review the varied effects of postulated pipe ruptures, such as pipe whip, jet impingement, flooding and environmental effects, subject to resolution of Open Items S-6 through S-8.

RESPONSE

Reference to Section 1.5 was an error in Revision 0 of DBD-ME-007 caused by deletion of that section during the interdiscipline review process. This error was corrected in Revision 1 of the DBD by deleting the reference to Section 1.5.

Section 1.5 was originally intended to identify the deliverables to be completed by Ebasco for TU Electric. The "Shutdown Evaluation for Pipe Breaks" is documented via calculation CPE-SI-CA-0000-665, Rev. 0. This calculation contains a detailed description of the safe shutdown logic diagrams of the systems that are required to mitigate the consequences of postulated pipe breaks. In addition, this calculation contains a matrix of required systems for pipe break mitigation and break types as well as the functional modes necessary for break mitigation. The intent of the statement in question was to identify the "Shutdown Evaluation for Pipe Breaks" as a deliverable product. Since deliverable products are not required to be identified in the DBD, Section 1.5 and references to it were deleted.

SIGNIFICANCE/EXTENT

This open item identified an incorrect reference in Section 6.4 of DBD-ME-007. As discussed above the intent of this reference was to identify a deliverable product, which is based on the criteria contained within the DBD. Therefore, this error is considered not to be significant. The "Shutdown Evaluation for Pipe Breaks" is documented via calculation CPE-SI-CA-0000-665, Rev. 0.

OPEN ITEM S-9

Document Number: Jet Attenuation, CPE-SI-CA-0000-645, Revision 0

The calculation claims (Pg. 2) that ANSI/ANS-58.2-1980 (Ref. 1) does not address the attenuation of the jet. The team believes that Reference 1 does address the attenuation of the jet, although it does not appear as an explicit coefficient. Any attempt to develop an additional attenuation coefficient is inappropriate.

RESPONSE

TU Electric is performing analyses to validate the high energy jet impingement loads presently being utilized at CPSES. The methodologies for these analyses (which are revised from those used previously in calculation CPE-SI-CA-0000-645) are discussed in our letter TXX-88342 dated March 28, 1988.

SIGNIFICANCE/EXTENT

Jet loads which are not conservative with respect to the revised methodology will be individually assessed for their effect on target response.

OPEN ITEM S-10

Document Number: Jet Attenuation, CPE-SI-CA-0000-645, Revision 0

The procedure uses a method recommended by Reference 1 based on jet axial velocity, pressure and temperature profiles developed in Reference 2 instead of using Eq. D-2 and D-3 as prescribed in Reference 1. However, this method is applicable to gaseous jets and can be used for steam water mixture jets, if the quality beyond the asymptotic plane is greater than 90%. The subject document, however, uses this approach without any restriction on the quality of the jet fluid. Actually, the lower quality mixture behaves very differently from perfect gas, and because of the relatively higher density of the two phase fluid, the jet will attenuate at a significantly slower rate compared to the gaseous jets. This suggests that the method used in the document is not conservative for low-quality jets. In most cases of flashing water jets (both for primary and secondary coolant systems), the quality of the jet fluid is significantly lower than 90%. The assumption that water substantially separates out before the asymptotic plane resulting in a high quality steam beyond that plane cannot be justified.

RESPONSE

TU Electric is performing analyses to validate the high energy jet impingement loads presently being utilized at CPSES. The methodologies for these analyses (which are revised from those used previously in calculation CPE-SI-CA-0000-645) are discussed in our letter TXX-88342 dated March 28, 1988.

SIGNIFICANCE/EXTENT

Jet loads which are not conservative with respect to the revised methodology will be individually assessed for their effect on target response.

OPEN ITEM S-11

Document Number: Jet Attenuation, CPE-SI-CA-0000-645, Revision 0

The postulation (on page 13) that the force that the jet can impart to a target is proportional to $p + \rho v^2/2$ is not correct. The impingement force should be proportional to (P -p), where P is the local stagnation pressure and p is the local static pressure and they are related by the following expression:

$$P = p \quad 1+ \qquad M^2$$

M is the local Mach number.

It is to be noted that beyond the asymptotic plane, local static pressure (p) remains constant and is equal to the pressure surrounding the jet.

RESPONSE

TU Electric is performing analysis to validate the high energy jet impingement loads presently being utilized at CPSES. The methodologies for these analyses (which are revised from those used previously in calculation CPE-SI-CA-0000-645) are discussed in our letter TXX-88342 dated March 28, 1988.

SIGNIFICANCE/EXTENT

Jet loads which are not conservative with respect to the revised methodology will be individually assessed for their effect on target response.

OPEN ITEM S-12

Document Number: Jet Attenuation, CPE-SI-CA-0000-645, Revision 0

In a free jet the total momentum of the jet beyond the asymptotic plane remains constant along the axis of the jet. As the jet entrains more and more of the ambient fluid, its velocity and temperature profiles become flatter. But if the target is large enough to intercept the entire jet, the impingement force does not drop even though the stagnation pressure at the jet axis has decayed substantially.

The calculation interprets Figure D.7 in Reference 1 as a plot of variation of local static pressure with distance. It is actually a plot of $(P - p)/P_e$ vs. distance, where p_e is the exit plane pressure of the jet.

This figure is the same as Figure 5 of Reference 2. It is to be noted that (P -p) is measured at the jet centerline. The incorrect use of this figure in the document under review has led to the conclusion that there is an additional attenuation factor. It is suggested that Ref. 2 be consulted in case further clarification is needed.

The work done by the jet fluid on the surrounding air and the exchange of molecular kinetic energy do not result in any reduction of momentum of the entire jet including the entrained fluid, and any attenuation effect resulting from the work done by the jet and energy exchange cannot be justified.

RESPONSE

TU Electric is performing analyses to validate the high energy jet impingement loads presently being utilized at CPSES. The methodologies for these analyses (which are revised from those used previously in calculation CPE-SI-CA-0000-645) are discussed in our letter TXX-88342 dated March 28, 1988.

SIGNIFICANCE/EXTENT

Jet loads which are not conservative with respect to the revised methodology will be individually assessed for their effect on target response.

OPEN ITEM S-13

Document Number: Jet Attenuation, CPE-SI-CA-0000-645, Revision 0

Figure 6 of Reference 2 represents the decay of temperature difference ratio (Tm/ Te). The subject document uses this figure inappropriately as temperature ratio (T*) on Page 11. The error due to this might be significant for the temperature range of interest.

RESPONSE

TU Electric is performing analyses to validate the high energy jet impingement loads presently being utilized at CPSES. The methodologies for these analyses (which are revised from those used previously in calculation CPE-SI-CA-0000-645) are discussed in our letter TXX-88342 dated March 28, 1988.

SIGNIFICANCE/EXTENT

Jet loads which are not conservative with respect to the revised methodology will be individually assessed for their effect on target response.

OPEN ITEM S-14

Document Number: Jet Attenuation, CPE-SI-CA-0000-645, Revision 0

The document determines the attenuation factor " " in somewhat arbitrary fashion. First, it claims that this factor should follow the decay of P*, and then, since the decay of P* is excessive, it considers the decay of V* as the acceptable attenuation. Since this factor has been applied to the impingement force on a target using Reference 1, the credit due to the attenuation of jet has been double-counted, and the results are unacceptable.

RESPONSE

TU Electric is performing analyses to validate the high energy jet impingement loads presently being utilized at CPSES. The methodologies for these analyses (which are revised from those used previously in calculation CPE-SI-CA-0000-645) are discussed in our letter TXX-88342 dated March 28, 1988.

SIGNIFICANCE/EXTENT

Jet loads which are not conservative with respect to the revised methodology will be individually assessed for their effect on target response.

OPEN ITEM S-15

Document Number: Jet Attenuation, CPE-SI-CA-0000-645, Revision 0

Considering the misinterpretation of some terms (discussed in Open Items S-12 and S-13 above) derived from Reference 2, and limitations (discussed in Open Items S-10 and -S-11) in the theory, the results presented in the document appear to be erroneous. Hence, any conclusions based on this document may not be acceptable.

RESPONSE

TU Electric is performing analyses to validate the high energy jet impingement loads presently being utilized at CPSES. The methodologies for these analyses (which are revised from those used previously in calculation CPE-SI-CA-0000-645) are discussed in our letter TXX-88342 dated March 28, 1988.

SIGNIFICANCE/EXTENT

Jet loads which are not conservative with respect to the revised methodology will be individually assessed for their effect on target response.

OPEN ITEM C/S-16

Document Numbers: DBD-CS-083, Revision 0, Containment Concrete Internals, DBD-CS-084, Revision 0, Other Seismic Category I Concrete Structures, and DBD-CS-085, Revision 0, Seismic Category I Structural Steel

Each design basis document defines the loads, load combinations and codes and standards to be used in the design. The definition of pipe reaction loads Ro and Ra has been extended to include other system and component reactions. The definition of pipe reaction loads Ro and Ra should be consistent in all design basis documents. An FSAR revision may be required to include the extended definition of these loads in the design basis documents.

RESPONSE

DBD-CS-083, -084, and -085 have been revised (Revision 1) to clarify the definitions of the Ro and Ra loadings. The descriptions of Ro and Ra loadings are consistent with the FSAR definition which includes only pipe reactions.

DBD-CS-081, General Structural Design Criteria, will be revised (Revision 1) to clarify the definitions of the Ro and Ra loadings. The descriptions of Ro and Ra loadings will be consistent with the FSAR definition which includes only pipe reactions.

DBD-CS-081 will be revised to incorporate the above definitions by June 30, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the appropriate allowances have been used in the evaluation of the concrete structures and structural steel. The definition and treatment of loads discussed above resulted in a DBD clarification.

OPEN ITEM C/S-17

Document Number: Calculation 16345-CS(C)-073, Revision 0, Floor Slab at El. 831'6" (Safeguards Building)

In determining the effects of the horizontal earthquake on the equipment on page 12, only one horizontal direction is considered in calculating the overturning moment at the base of the equipment. No justification could be found for omitting the effects of the second horizontal earthquake.

RESPONSE

The purpose of the calculation of equipment loads was to determine a reasonable load to evaluate the supporting slab capacity. Consideration of the one controlling horizontal direction seismic overturning moment applied to the critical span of the slab was an appropriate assumption and produced results consistent with the purpose of the calculation. Confirmation of the equipment loading should have been indicated.

The equipment load will be available from contractors and this validated load will be used to evaluate and confirm the adequacy of the slab.

SIGNIFICANCE/EXTENT

There is no safety concern because the judgement made was appropriate based on the purpose of the calculation. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmations and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-18

Document Number: Calculation 16345-CS(C)-073, Revision 0, Floor Slab at El. 831'-6" (Safeguards Building)

The overturning moment of 50,200 ft/lb was calculated at the base of the M-G set for a single horizontal earthquake on page 11, but was subsequently omitted in actual design of slab "A" on pages 14 and 15. No justification could be found for omission of this load.

RESPONSE

The judgement to omit the loading for overturning moment should have been documented in the subject calculation. "Confirmation" should have been indicated for the equipment loading. Calculation 16345-CS(C)-073 (Rev. 0) will be revised to include an explanation of the method used to evaluate the slab when the validated equipment load is available from other contractors as part of the confirmation removal program.

SIGNIFICANCE/EXTENT

There is no safety concern because the judgement made was appropriate based on the purpose of the calculation. The planned calculation review associated with the confirmation acitivity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-19

Document Number: Calculation 16345-CS(C)-121, Revision 0, Beams at El. 831'-6" (Safeguards Building)

Beam B-15 supports a wall 24 in. to 36 in. thick and 20 ft-high. In calculating the loads on the wall, the designer did not include the 25 psf attachment loads as required by Section 4.8 of DBD-CS-081. The omission of attachment loads further reduced their seismic inertia load as required by Section 5.3.3 of DBD-CS-081.

RESPONSE

The criterion of the DBD-CS-081 Rev. 0 was not implemented in calculation 16345-CS-121. These loads were not included in the calculation because the additional moments and shears generated by these 25 psf vertical and horizontal loads together with seismic inertia effects are negligible when compared to the capacity of the structural elements.

SIGNIFICANCE/EXTENT

There is no safety concern because the 25 psf load was negligible. The extent is limited to C/S structural concrete building calculations. These calculations will be revised during confirmation removal to incorporate these loads.

OPEN ITEM C/S-20

Document Number: Calculation 16345-CS(C)-121, Revision 0, Beams at El. 831'-6" (Safeguards Building)

The calculation for negative moment Mu on page 22 showed that the additional external moment on the beam caused by the wall due to seismic acceleration perpendicular to the wall was also omitted. Additionally, seismic inertia load parallel to the wall was not addressed. DBD-CS-081, Section 5.3.3, last paragraph states, "Reactions from these inertial loads shall be considered in the design of the supporting structual elements."

A sample review of other beam designs (e.g., beams B-12, B-13, B-14, B-16, B-17, etc.) indicates that omissions similar to Open Items C/S-19 and C/S-20 exist throughout the calculation.

RESPONSE

Beam validation calculation 16345-CS(C)-121, Revision 0 included the dead and vertical seismic inertia loads from the wall above. A review of this calculation substantiated that the additional moments and shears generated by the two horizontal seismic inertia loads have a negligible effect on the capacity of the beams. Calculation 16345-CS(C)-121, Revision 0, will be revised to document the effect of the wall horizontal seismic inertia loads on the beam during the removal of confirmation. The expected completion date is August 15, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the judgement made was appropriate based on the purpose of the calculation. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-21

Document Number: Calculation 16345-CS(C)-074, Revision 0, Floor Slab @ El. 810'-6" (Safeguards Building)

The slab strip supporting the portion of the shield wall spanning in the eastwest direction has not been evaluated.

RESPONSE

Slab design calculation 16345-CS(C)-074 was based on the strip load which included the north-south wall and the heat exchanger. A review of the calculation for the loads from east-west wall distribution on the slab revealed that the north-south analysis controls the design.

SIGNIFICANCE/EXTENT

There is no safety concern because the judgement made was appropriate based on the purpose of the calculation. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-22

Document Number: Calculation 16345-CS(C)-074, Revision 0, Floor Slab at El. 810'-6" (Safeguards Building)

The vertical seismic load due to the mass of the letdown heat exchanger is considered in the design but horizontal seismic forces are neglected.

RESPONSE

These loads were considered to be insignificant and therefore were not used in the calculation. A review of this calculation confirmed that the horizontal seismic effect of the Letdown Heat Exchanger equipment weight is negligible when compared to the values used in the design of the slab. Thus, neglecting these loads in the calculation was acceptable.

This calculation will be revised by August 15, 1988 during the confirmation removal activity to document the horizontal seismic effects of the equipment.

SIGNIFICANCE/EXTENT

There is no safety concern because the judgement made was appropriate based on the purpose of the calculation. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-23

Document Number: Calculation 16345-CS(C)-074, Revision 0, Floor Slab @ El. 810'-6" (Safeguards Building)

Wall attachment loads of 25 psf (Section 4.8, DBD-CS-081) and their seismic inertia load (Section 5.3.3, DBD-CS-081) are not included in the design. This item is similar to Open Item C/S-19 for the beam designs.

RESPONSE

These loads were not used in the calculation because their effects on the structural element is negligible. Additional moments and shears generated by these 25 psf vertical and horizontal loads together with seismic inertia effects are small when compared to the capacity of the structural elements.

SIGNIFICANCE/EXTENT

There is no safety concern because the 25 psf loads are negligible. The extent is limited to C/S structural concrete building calculations. These calculations will be revised during confirmation removal to incorporate these loads.

OPEN ITEM C/S-24

Document Number: Calculation 16345-CS(C)-074, Revision, 0, Floor Slab @ El. 810'-6" (Safeguards Building)

The slab moment calculation does not include additional external moment caused by wall horizontal seismic inertia loads. A similar item was identified for beam design as Open Item C/S-20.

RESPONSE

The evaluation of the slab in calculation 16345-CS(C)-074 considered the external moments caused by the vertical seismic inertia loads from the wall above. However, horizontal seismic inertia loads due to the wall were not applied to the slab in question. This engineering judgement was not documented. A review of this calcuiation substantiates that the additional moments and shears generated by the two horizontal seismic inertia loads have a negligible effect on the slab. Calculation 16345-CS(C)-074 will be revised by August 15, 1988 to document the effect of the wall horizontal seismic inertia loads on the slab during the removal of confirmation activity.

SIGNIFICANCE/EXTENT

There is no safety concern because the judgement made was appropriate based on the objective of the calculation. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-25

Document Number: Calculation 16345-CS(C)-129, Revision 0, Reactor Building - Unit 1 -Containment Analysis

Pages 12 and 42 indicate that this calculation is not complete in scope (i.e. other than load verification) and states that a further phase of analysis is to take place. This requirement is not indicated: in the Objective of Calculation, Conclusions, or Records of Confirmations sections of this calculation. There was no evidence of a system to identify phased type calculations to insure that follow-up rework or replacement calculations are carried through and that other dependent calculations are modified as appropriate.

RESPONSE

The note on page 12 states that "Load combination 2 is not a governing combination." The note on page 42 states that the load resulting from the rotating platform support "has mostly local effects." The notes document the technical judgements that neither item controls the design of the structure. These assumptions should have been designated as requiring confirmation and listed on the Record of Confirmations sheet.

Evaluations were performed in Revision 1 of calculation 16345-CS(C)-129 to substantiate these judgements and the confirmations were removed.

The body of all Civil/Structural calculations will be compared with the Record of Confirmations to identify any required confirmations which were not listed on the Record of Confirmations. This review will be complete by May 31, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the judgements made were appropriate based on the objective of the calculation. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-26

Document Number: Calculation 16345-CS(C)-129, Revision 0, Reactor Building - Unit 1 -Containment Analysis

Loads requiring confirmation listed on sample pages 10, 42 and 80 have not been listed in the Record of Confirmations sheet (Page 5). The calculation should be checked for completeness and accuracy of confirmation requirements.

RESPONSE

Not all items requiring confirmation had been identified on the Records of Confirmation sheet (page 5) of calculation 16345-CS(C)-129, Revision 0. This calculation has been revised to identify all items requiring confirmation on the Records of Confirmation sheet.

The body of all C/S calculations will be compared with the Record of Confirmations to identify any required confirmations which were not transferred to the Record of Confirmations. This review will be completed by May 31, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the inputs requiring confirmation were identified in the body of the calculation. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-27

Document Number: Calculation 16345-CS(C)-127, Revision 0, Reactor Building - Mat Analysis - Unit 1

Pages 45 and 45a classify this calculation as "Preliminary". The Objective of Calculation, Conclusions or Records of Confirmation sections of this calculation do not qualify the limit or use of this calculation or identify that additional work is required to make it complete for final application in other calculations. There is no evidence of a system to indicate the use of this type of calculation and its relationship to other calculations.

RESPONSE

Calculation 16345-CS(C)-127, Revision 0 is a finite element analysis of the containment mat. At the time Revision 0 was performed various loads had not been validated. Thus the analysis was performed using preliminary (non-validated) loads as input. The title page correctly identifies this calculation as requiring confirmation and refers to page 5 which lists the various items requiring confirmation. The objective of this calculation indicates the loads used in the analysis are preliminary, i.e., "Finite element analysis of the above structural elements to be performed based on preliminary loads."

Thus, while inputs to the calculation have not been validated and may change in the future, the calculation has been properly identified as "requiring confirmation," consistent with project Procedure PP-009. The users of data from this calculation are aware that the calculation is subject to confirmation and changes to this data, resulting from incorporation of "confirmed" input will need to be evaluated in the future for impact on their calculations.

SIGNIFICANCE/EXTENT

There is no safety concern because the calculation was properly issued in accordance with project procedures which provide a system to indicate the use of this type of calculation and its relationship to other calculations.

OPEN ITEM C/S-28

Document Number: Calculation 16345-CS(C)-127, Revision 0, Reactor Building - Mat Analysis - Unit 1

Attachments 4 and 5 are the development of the significant containment internal loads used as input into the mat analysis (Page 93). Neither of these documents are identified as having been checked. The validity of these documents should be established.

RESPONSE

Attachments 4 and 5 relate to the dead load, live load, and seismic load reactions on the mat due to the reinforced concrete internal structures.

Attachment 4 is a load transmittal document which was used as input to calculation 16345-CS(C)-127. The load data contained in this transmittal was based on unissued calculations. Hence, this data should have been identified in Calculation 16345-CS(S)-127 as requiring confirmation and listed on the Record of Confirmations sheet.

Attachment 5 should have been included in the body of the calculation and checked.

As part of Revision 2 of this calculation the analysis which had previously been in Attachment 5 was made part of the body of the calculation and checked. The data taken from Attachment 4 was identified as requiring confirmation.

SIGNIFICANCE/EXTENT

There is no safety concern because the loads and analyses contained in attachments 4 and 5, which have been incorporated into calculation 16345-CS(C)-127, were developed correctly. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-29

Document Number: Calculation 16345-CS(C)-127, Revision 0, Reactor Building - Mat Analysis - Unit 1

Crane loads requiring confirmation (Page 48) have not been logged into the record of items requiring confirmation.

RESPONSE

The data on page 48 which was identified as requiring confirmation ("Bridge, Trolley and Hoist = 1285 kips") should have also been listed in the Record of Confirmations (page 5). A revision of calculation 16345-CS(C)-127 will either utilize confirmed data (if available at that time) or correct the "Record of Confirmations."

The body of all C/S calculations will be compared with the Record of Confirmations to identify any required confirmations which were not listed on the Record of Confirmations. This review will be completed by May 31, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the inputs requiring confirmation were identified within the body of the calculation and would have been addressed during the confirmation removal acti15ty.

OPEN ITEM C/S-30

Document Number: Calculation 16345-CS(C)-083, Revision 0, Safeguard Buildings - Unit 1 - Wall Design - East-West

The mechanism (and resultant forces in slabs) to transfer seismic loads to walls are not addressed in this calculation 16345-CS(C)-083, Revision 0 or in calculations of slabs (16345-CS(C)-070, Revision 0 thru 16345-CS(C)-076, Revision 0).

RESPONSE

Calculation 16345-CS(C)-083, Revision 0 addresses the evaluation of wall section strength and not the global transfer of seismic forces to the walls. An assumption was made that the mechanism for the transfer of loads to the walls is provided by in-plane shear through the slabs. The slab calculations 16345-CS(C)-070 through 16345-CS(C)-076 will be revised to incorporate a discussion of in-plane shear transfer capability of the slabs.

SIGNIFICANCE/EXTENT

There is no safety concern because the slabs do transfer loads to the walls. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-31

Document Number: Calculation 16345-CS(C)-009, Revision 0, Development of Dynamic Model and Seismic Profile for the Safeguard Building

DBD-CS-092, "Seismic Design Parameters," which was referenced in Section 5.0 of DBD-CS-081, was not available, and the team was verbally advised that it would not be prepared. SWEC should provide an alternate means for documenting seismic design parameters.

RESPONSE

DBD-CS-081, Revision 0, "General Structural Design Criteria," referenced DBD-CS-092 as a source of discussion of the methods used in seismic analysis of structures to generate data presented in DBD-CS-081. The reference was intended to provide information only and not design related input. DBD-CS-092 was cancelled and DBD-CS-081 has been revised to delete reference to DBD-CS-092. Calculation 16345-CS(C)-009 provides reference to all seismic parameters required to perform the analysis. The seismic design parameters are provided in the FSAR. The input for seismic analysis of systems, structures and components is documented in CPSES Specification CPES-S-1032G, "Amplified Response Spectra," Revision 0.

SIGNIFICANCE/EXTENT

There is no safety concern because DBD-CS-081 establishes the seismic requirements and Calculation 16345-CS(C)-009 provides reference to all required seismic parameters.

OPEN ITEM C/S-32

Document Number: Calculation 16345-CS(C)-009, Revision 0, Development of Dynamic Model and Seismic Profile for the Safeguard Building

The seismic model does not consider structure below El. 790.5'. The stiffness properties of the beam between node points 3 and 4 are not adjusted to account for omission of lower structure.

RESPONSE

The founding level of the Safeguards Building is not uniform and the structure is founded at seven discrete elevations ranging from a high point of 806.5 feet to a low point of 767.33 feet. The mean founding level of the structure is located just below the lowest mass point in the model. The soil springs are attached to the model at elevation 784.83 feet. The exterior walls of the Safeguards Building below grade are poured against the surrounding rock, and will move as a unit with the rock. Thus, for modeling purposes the walls below El. 790.5 feet can be reasonably assumed to be rigid and no adjustment to the stiffness properties for the beam between nodes 3 and 4 is necessary. Consequently, use of the model in calculation 16345-CS(C)-009 to validate the results of the previous analysis is reasonable and conservative. The calculation will be revised to document and clarify this assumption.

SIGNIFICANCE/EXTENT

There is no safety concern because the seismic model was adequate. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-33

Document Number: Calculation 16345-CS(C)-128, Revision 0, Reactor Building - Unit 1 - Mat Design

Page 286 indicates that this calculation is not final. The incompleteness of this calculation is not recorded in the Purpose, Method, Assumptions, Applicability, Conclusion or Record of Confirmation sections of this calculation. Shear key design confirmation on page 286 is not listed in the record of required confirmations list. The status of calculations should be identified with respect to completeness and what is required to make the conclusions final.

RESPONSE

Confirmation of the shear key design was identified on page 286 and should have been identified on page 13, "Record of Confirmations."

Revision 1 of this calculation resolved this item by confirming the adequacy of the shear key. This item no longer requires confirmation

Calculations, when issued, are complete for the purpose stated in the objective. Therefore, no calculation status program is required.

The body of all C/S calculations will be compared with the Record of Confirmations to identify any required confirmations which were not listed on the Record of Confirmations. This review will be completed by May 31, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the items requiring confirmation were identified in the body of the calculation and would have been addressed during the confirmation removal activity.

OPEN ITEM C/S-34

Document Number: Calculation 16345-CS(B)-028, Revision 0, Reactor Containment Building Liner Analysis Units 1 & 2

This liner calculation only requires that the assumed shell deflection under seismic (page 61) be confirmed to validate or update the derived stresses and strains. As presented, the confirmation will be considered valid based on the direct substitution of the single location displacement value.

The shell properties and resultant behaviors under the seismic loadings were based on gross, uncracked concrete properties which will become cracked to various degrees under the combined load cases which include accident pressures. The actual behavior of the shell under the combined seismic and accident pressure cases will be somewhat different than the utilized gross, uncracked concrete sections.

The deflection, behavioral and sectional properties assumed and conclusions derived should be verified by comparing the behavioral characteristics obtained from the finite element shell analyses (cracked, uncracked, partial cracked) with, as a minimum, the three locations used as evaluators in this calculation. The finite element analysis results should envelop all relative values in this calculation as a contingent part of confirming of the calculation conclusions.

RESPONSE

Calculation 16345-CS(B)-028 contained an evaluation of the following three locations:

1. The junction of the containment cyclindrical shell and the containment mat. This area was assumed to provide a total constraint of the liner in the circumferential direction.

2. The mid-height of the containment cyclindrical shell. This area is the membrane region of the cylindrical which is not influenced by the mat or the dome.

3. The junction of the containment cylindrical shell and the containment dome. This area provides the discontinuity between a cylinder and a hemispherical dome.

The analysis demonstrates that the worst case strain due to the containment internal design pressure and temperature is developed at the junction of the cylinder and the mat. Thus this governing location for the liner analysis was expanded to consider the effects of other load conditions; i.e. wind, seismic, etc., on the cylinder/mat junction as required by the loading combinations of DBD-CS-074.

OPEN ITEM C/S-34 (cont'd.)

The seismic effects were developed by assuming a deflection of the cylinder with the deflection identified as confirmation required. The deflection was used, in conjunction with the gross uncracked properties of the concrete, to determine the maximum forces and moments at the cylinder/mat junction. The uncracked gross properties of the concrete results in the maximum rigidity of the containment shell, thus the maximum forces and moments at the cylinder/mat junction. The strains in the liner developed from these maximum forces and moments were then combined with the strains determined for other load conditions to establish the maximum strain in the liner.

The containment shell was evaluated using the computer program SHELL 1 which is a finite difference shell analysis program. This analysis was performed using a model of the containment shell which accounted for cracking of the concrete but did not include the strength of the liner. The results of this evaluation are documented in calculation 16345-CS(C)-130.

The liner analysis, calculation 16345/6-CS(B)-028, was developed prior to the containment shell analysis (calculation 16345-CS(C)-130). Thus when the liner analysis is reviewed for removal of "confirmation required", the analysis for the concrete shell will be considered in the three locations as discussed above.

SIGNIFICANCE/EXTENT

There is no safety concern because the assumptions made were properly identified as "Confirmation Required".

OPEN ITEM C/S-35

Document Number: DBD-CS-081, Revision 0, General Structural Design Criteria

The criteria for equipment/system attachment loads on the walls need further clarification since they are not applied uniformly and are apparently misunderstood in many design calculations.

RESPONSE

Section 4.8 of DBD-CS-081, Revision 0 provided a criterion for the application of a 25 psf load normal to a wall surface. This criterion was not properly implemented in calculations 16345-CS(C)-057, -066, -083, -090, and 16345-CS(B)-022.

DBD-CS-081, Revision 1 was revised to include a method for the application of the 25 psf vertical and horizontal loads together with their seismic inertia effects to the wall elements which are subjected to equipment/systems attachment loads.

A review of the subject calculations was performed to evaluate the effects of the application of 25 psf in accordance with the criteria of DBD-CS-081, Revision 1. The additional moments and shears generated by these loads are negligible in comparison to the capacities of the structural elements. The structural integrity of the wall elements and the structure will not be impacted by the application of the 25 psf loads.

The calculations listed above will be revised to document the application of the 25 psf horizontal and vertical loads with the seismic effects in accordance with the criteria of DBD-CS-081, Revision 1, during the removal of confirmation.

SIGNIFICANCE/EXTENT

There is no safety concern because the 25 psf loads are negligible. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-36

Document Number: Calculation 16345/6-CS(B)-178, Revision 0, Auxiliary Building Platform at El. 821'-6"

Load Combination No. 7 with the safe shutdown earthquake is considered "not critical" on page 11 based on the comparison that 0.5 SSE > (1.0/1.6) SSE. This comparison should be based on 0.5 SSE > (1.5/1.6) SSE where 1.5 is the strength factor for load case with 0.5 SSE or Operating Basis Earthquake (Reference DBD-CS-085, Load Combination, Section 4.3.1.1). Further investigation is needed to prove that Load Combination No. 7 is not the most critical combination for structural steel design.

RESPONSE

Calculation 16345-CS(B)-178 has been revised to correct the determination of the critical load combination for the structural steel design. The conclusion of the calculation did not change, i.e., the structure is adequate.

SIGNIFICANCE/EXTENT

There is no safety concern because the structures analyzed by the calculations are adequate. Structural steel calculations that utilized the above load combination were reviewed for this deficiency. One other calculation was found to contain the deficiency and was also corrected.

OPEN ITEM C/S-37

Document Number: Calculation 16345-CS(B)-040, Revision 0, Equipment Hatch, Personnel and Emergency Air Locks Anchorage and Reinforcing Plate Analysis

The calculation conclusions and Record of Confirmation portray the contained work as conclusive regarding the "adequacy of the penetrations to withstand pressure loads as per DBD-CS-074" and do not identify that the calculation requires additional analysis and design to address all required areas of loading and load combinations. Calculations which are partially completed or limited in scope should be adequately identified to establish the value of their use and conclusions.

RESPONSE

At the time of the development of calculation 16345-CS(B)-040 Rev. 0, the design criteria for the liner and hatches specified in the FSAR and DBD-CS-074 were in the process of being revised to clearly address the licensing commitments of Regulatory Guide 1.57 and the ASME B&PV code Section III, Division I, Class MC. Because the criteria were in the process of changing, it was decided to address only the pressure loading case. The pressure case is the only major load affecting the locks and hatches embedment. All other loads were judged to be insignificant in comparison, although they could not be documented because DBD-CS-074 was not finalized. Therefore, calculation 16345-CS(B)-040 was limited in scope by the objective which states "To demonstrate the ability of anchorages for the equipment hatch, personnel air lock, and emergency air lock to resist bearing loads and punching shear due to positive and negative pressure loads." The text of the calculation provides the technical justification for the conclusions which states "The embedded anchorages for the equipment hatch, personnel air lock and emergency air lock are adequate to withstand pressure loads as per DBD-CS-074." The intent was to address the additional load combinations after issuance of the DBD.

Subsequent to the issuance of Amendment 68 to the FSAR and Revision 1 of DBD-CS-074, calculation 16345-CB(B)-040 was revised to address all loads in accordance with the design basis document.

SIGNIFICANCE/EXTENT

There is no safety concern because the calculation specified its applicability, the results were correct, and the calculation has now been revised to address all loads in accordance with the revised criteria.

OPEN ITEM C/S-38

Document Number: Calculation 16345-CS(B)-180, Revision 0, Reactor Coolant Pump Access Platform at El. 833'-3"

Load combination no. 10 of DBD-CS-085, Section 4.3.1.1 is the only combination investigated in this calculation. There was no documented evidence that other load combinations were addressed in determining the critical load combination.

RESPONSE

As stated in the objective of this calculation, calculation 16345-CS(B)-180, Revision 0, was performed to evaluate the steel platform at elevation 833'-3" for the severe environmental loading combination equation number 10.

This platform design was validated in calculation 16345-CS(B)-214 which satisfied the requirements of the DBD-CS-085.

Calculation 16345-CS(B)-180 will be revised to provide a reference for the validation calculation 16345-CS(B)-214, during the confirmation removal activity.

SIGNIFICANCE/EXTENT

There is no safety concern because the other load combinations have been validated in Calculation 16345-CS(B)-214.

OPEN ITEM C/S-39

Document Number: DBD-ME-215, Revision 0, Design Basis Document Diesel Generator Fuel Oil Storage and Transfer System and drawing 2323-S-0306, Revision 2

The criteria for the Fuel Oil Storage Tank does not list the requirement for the in-ground tanks to stay in place during a heavy and soaking rain which would saturate the tank backfill. The concern is that, in the absence of adequate drainage or anchored ballasting, one or both storage tanks could become buoyant thereby damaging the pipelines and preventing their transfer of fuel oil. Corrosion protection or prevention for the tanks, anchor straps, saddles or anchor bolts has not been identified as a design requirement in the DBD.

Calculations 16345-CS(B)-073 and 16345-CS(B)-176 have been identified as work underway which will substantiate the adequacy of the buried tank system to perform the required design function for the specified design life of the plant. These calculations and DBD-ME-215 should address the above concerns.

RESPONSE

The requirement of evaluation of the saturated soil condition has been addressed in the design of Fuel Oil Storage Tank foundation. Calculation 16345-CS(B)-073, Revision 0, considers a maximum uplift (buoyance condition) with ground water table at grade elevation 810'-0". Refer to page numbers 8 through 13A of calculation 16345-CS(B)-073 for the development of design loads for the buoyant condition. A review of the anchor bolt design indicates that their capacity exceeds the net uplift condition for the tank. This calculation will be revised to include the anchor bolts capacity by June 30, 1988.

Corrosion protection has been addressed in DBD-ME-215 Section 5.1.1. External coating is provided in accordance with specification 2323-MS-67A and supplemented by cathodic protection as shown on drawings 2323-E1-1049 and -1050.

SIGNIFICANCE/EXTENT

There is no safety concern because the calculations generated validate the existing design and DBD-ME-215 adequately addresses the corrosion protection. This is the only safety-related buried tank.

OPEN ITEM C/S-40

Document Number: Calculation 16345-CS(B)-025, Revision 0, Penetration Anchorage Analysis - Unit 1

The allowable punching shear stress has been calculated using 1977 ASME Section III, Div. 2, Subsection CC-3421.6 (Page 13). This issue of the ASME code has not been authorized by DBD-CS-074 or the current revision of the FSAR.

In addition, the effect of biaxial tension has not been accounted for in calculating the allowable shear stress and therefore the penetration anchorage capacities have been overestimated.

RESPONSE

The code invoked by the FSAR was the April, 1973 proposed ASME B&PV Code Section III, Division 2, Subsection CC. Punching shear was not addressed in this code. To address punching shear, calculation 16345-CS(B)-025, Rev. 0 used the criteria specified in the 1977 edition of the code. Subsequent to issuance of calculation 16345-CS(B)-25, Revision 0, FSAR Amendment 68 was issued which invoked Section 11.10 of the ACI 318-71 code. Revision 1 of calculation 16345-CS(B)-025 reflects the current FSAR commitment.

Design Basis Document DBD-CS-073 Concrete Containment Structure has been revised to require ACI 318-71 as the proper code. This is the correct DBD to specify concrete punching shear design.

A report by Cornell University entitled "Peripheral (Punching) Shear Strength of Biaxially Tensioned Reinforced Concrete Wall Elements" dated 1981, provides justification for using the equation of ACI 318-71 in areas of biaxial membrane tension. Therefore, the estimation of the penetration anchorage capacities is adequate.

SIGNIFICANCE/EXTENT

There is no safety significance because punching shear was addressed and the DBD/FSAR provide the required criteria. In addition, the test report discussed above had provided the appropriate justification for the use of the equation of ACI 318-71 in areas of biaxial membrane tension.

OPEN ITEM C/S-41

Document Number: Calculation 16345-CS(B)-040, Revision 0, Equipment Hatch Personnel and Emergency Air Locks Anchorage and Reinforcing Plate Analysis

The allowable punching shear stress has been calculated using 1977 ASME Section III, Div. 2, Subsection CC-3421.6 (Page 25). This issue of the ASME Code has not been authorized by DBD-CS-074 or the current revision of the FSAR.

In addition, the effect of bi-axial tension has not been accounted for calculating the allowable shear stress and therefore the penetration anchorage capacity has been overestimated (Page 10).

RESPONSE

The code invoked by the FSAR was the April, 1973 proposed ASME B&PV Code Section III, Division 2, Subsection CC. Punching shear was not addressed in this code. To address punching shear, calculation 16345-CS(B)-040, Rev. 0, used the criteria specified in the 1977 edition of the code. Subsequent to issuance of calculation 16345-CS(B)-40, Revision 0, FSAR Amendment 68 was issued which invoked Section 11.10 of the ACI 318-71 code. Revision 1 of calculation 16345-CS(B)-040 reflects the current FSAR commitment.

Design Basis Document DBD-CS-073 Concrete Containment Structure has been revised to require ACI 318-71 as the proper code. This is the correct DBD to specify concrete punching shear design.

A report by Cornell University entitled "Peripheral (Punching) Shear Strength of Biaxially Tensioned Reinforced Concrete Wall Elements" dated 1981, provides justification for using the equation of ACI 318-71 in areas of biaxial membrane tension. Therefore, the estimation of the penetration anchorage capacities is adequate.

SIGNIFICANCE/EXTENT

There is no safety significance because punching shear was addressed and the DBD/FSAR provide the required criteria. In addition, the test report discussed above had provided the appropriate justification for the use of the equation of ACI 318-71 in areas of biaxial membrane tension.

OPEN ITEM C/S-42

Document Number: Calculation 16345-CS(B)-067, Revision 0, Moment Distribution for Beams and Columns in Floors @ El. 832'-6, 860'-0, and 905'-9" (Containment Concrete Internal Structures)

The fixed end moment (FEM) moment distribution coefficients were developed for full span uniform loads only. The description of usc on Page 4 and 29 indicate that the coefficients are good for any load on the span and should be clarified to state that FEM is based on a full uniform load only.

Clarification is needed on page 29 to explain what is meant by the term "for simple beam" for calculating the FEM.

If the coefficients marked with (*) are for information only, it is not clear what moments are to be used to check the member on the non-column side.

RESPONSE

Calculation 16345-CS(B)-067, Rev. 0 did not adequately describe the limitations and use of the results given on page 29. The coefficients presented on page 29 were derived based on full span uniform loads. The fixed end moments (FEM) for this condition are equal at each end of the span. Therefore, any span load condition that produces equal FEM's at each end of the span, can utilize the resulting coefficients on page 29 to determine the actual moments at each end of the beam and columns.

The term "simple beam" used in describing the summary of results on page 29 with respect to FEM's was intended to mean FEM's calculated based on a "prismatic" beam.

The moments to be used on the non-column side of the beam are documented in the vertical load distribution calculations for the internal structure perimeter slabs (see below) which were performed by conservatively assuming that the radial slab/beams spanning from the Steam Generator Compartment (SGC) walls to the outside perimeter columns were fixed at the S.G.C. wall and pinned at the column end. This maximized reactions at the S.G.C. wall end of the beam. However, to determine an appropriate value of bending moment and axial load (beam shear) for review of the columns, calculation 16345-CS(B)-067 was performed such that the reactions at the column end of the beam are maximized. Therefore, coefficients calculated at the S.G.C. wall end of the beam were marked (*) for information only to identify that they should not be used to design that end of the beam.

Vertical load distribution calculations:

16345-CS(B)-088, Rev. 0
-089, Rev. 0
-090, Rev. 0
-091, Rev. 0
-096, Rev. 0

OPEN ITEM C/S-42

RESPONSE (Continued)

To close this issue, calculation 16345-CS-067 will be revised to provide an adequate description of the limitation and use of the results given on page 29 as indicated above by October 15, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because this open item was limited to clarification of the descriptive material in this calculation.

OPEN ITEM C/S-43

Document Number: Calculation 16345-CS(B)-029, Revision 0, Analysis and Capacity Evaluation of Beams and Slabs for Floor Elevation 832'-6" (Containment Concrete Internal Structures)

DBD-CS-081 (Section 4.8) and -083 (Section 4.3.1.11.1) define Ro as a dead load to be represented by 50 psf. However, this has not been consistently implemented in the calculation. Ro is also defined on Page 13 of the calculation in equation 3 with a live load factor of 1.7. Page 19 utilizes the 50 psf as a dead load. In equation 4, Ro is not specifically identified for the 50 psf as in equation 3.

RESPONSE

The note on page 13 which indicated a load allowance of 50 psf for Ro in equation 3 was not intended to indicate that the load factor of 1.7 should be applied. The note as written is erroneous.

The analyses performed in this calculation accounted for Ro and Ra by including a load allowance of 50 psf in the dead load. This is consistent with the design criteria specified in DBD-CS-081 and 083 Revision 0.

This calculation has been revised to eliminate the note on page 13 and to provide an additional discussion of how the Ro and Ra loadings were accounted for.

SIGNIFICANCE/EXTENT

Similar calculations listed below were reviewed and no additional erroneous notes were identified.

Therefore, this open item is limited to calculation 16345-CS(B)-029, Rev. 0.

Calculations reviewed:

16345-CS(B)-072, Rev. 2
16345-CS(B)-075, Rev. 1
16345-CS(B)-076, Rev. 1
16345-CS(B)-077, Rev. 0

There is no safety concern because the 50 psf load allowance was used correctly in the calculation.

OPEN ITEM C/S-44

Document Number: Calculation 16345-CS(C)-122, Revision 0, Beam Analysis - Floor El. 810'-6" (Safeguards Building)

The wall attachment load of 25 psf is not addressed in the design of beam B-29. This item is similar to Open Items C/S-19 and 23.

RESPONSE

The criterion of the DBD-CS-081, Rev. 0, was not implemented in calculation 16345-CS(C)-122. These loads were neglected in the calculation because of the small magnitude.

Additional moments and shears generated by these 25 psf vertical and horizontal loads together with seismic inertia effects are small when compared to the capacity of the structural elements.

SIGNIFICANCE/EXTENT

There is no safety concern because the 25 psf loads are negligible. The extent is limited to Civil/Structural concrete building calculations. These calculations will be revised during the confirmation removal activity to incorporate these loads.

OPEN ITEM C/S-45

Document Number: Calculation 16345-CS(C)-122, Revision 0, Beam Analysis - Floor El. 810'-6" (Safeguards Building)

The equipment load due to electrical switchgears is omitted in the design of beams B-6 through B-13.

RESPONSE

The evaluation of beams B-6 through B-13 in calculation 16345-CS(C)-122 included a slab live load of 300 psf over the entire surface area of the slab. The distributed equipment load for the Electrical Switchgear was determined in calculation 16345-CS(C)-074, page 8, which produced a load intensity of 125 psf. Therefore, the load under this equipment is less than the applied live load of 300 psf. Thus, the Electrical Switchgear load breakdown was not documented in calculation 16345-CS(C)-122 for the beam designs. Calculation 16345-CS(C)-122 will be revised to document the intensity of load under the Electrical Switchgear and its comparison to the live load during the confirmation removal activity.

SIGNIFICANCE/EXTENT

There is no safety significance because the slab is adequate as designed. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-46

Document Number: Calculation 16345-CS(C)-130, Revision 0, Reactor Building - Containment Shell Design

Horizontal shear ties (radial in the dome) have been used to develop radial shear capacity in the containment shell. ASME CC-3521.2.3 equation (11) has been used to determine reinforcement requirements (pages 137 to 143).

Since the majority of the shell experiences horizontal and vertical membrane cracking (radial in the dome), horizontal (or radial) shear ties will be essentially in the plane of cracking and therefore will not offer any shear resistance by bridging of the cracks. Radial shear capacity of the containment shell has not been established for cases involving membrane tension cracks.

RESPONSE

The equation identified in the calculation, i.e., ASME CC-3521.2.3 equation 11, is the correct equation determining the required amount of shear reinforcement perpendicular to the containment surface for radial shear forces. ASME CC-3411.4.1(c) equation 5 was used to reduce the allowable shear carried by the concrete, to account for membrane tension.*

However, shear resistance horizontal/across potential horizontal (radial in the dome) cracks in the areas of the shear ties should have been evaluated even though this unique condition is not addressed by the ASME design code. This is developed by the shear friction mechanism. The radial shear in these areas away from the cylinder/mat discontinuity is such that the required shear friction clamping force developed by the vertical (meridional) reinforcement steel results in additional rebar stress. This stress is within allowables when added to the maximum calculated vertical rebar stresses (Calculation 16345-CS(C)-130). Therefore, radial shear capacity of the containment shell has been properly established for cases involving membrane tension cracks.

Calculation 16345-CS(C)-130 will be revised to incorporate the additional stress by May 31, 1988.

*Note that the criteria were taken from the "Proposed Standard Code for Concrete Reactor Vessels and Containments, Section III, Division 2, ASME Boiler and Pressure Vessel Code (1973)" which is the code CPSES is committed to in the FSAR. Additionally, the criteria for addressing radial shear in the latest version of the code is identical to that which was used in the calculation (i.e., CC-3421.4 and CC-3521.2.3 of the 1986 ASME B&PV Code Section III, Division 2).

SIGNIFICANCE/EXTENT

There is no safety concern because in this unique case, the radial shear capacity has been properly established. This open item is limited to the analysis of the containment structure.

OPen ITEM C/S-47

Document Number: Calculation 16345-CS(C)-130, Revision 0, Reactor Building - Containment Shell Design

Gibbs & Hill drawings SI-0507 and SI-0514 show details for terminating the meridional reinforcing at the apex of the dome. This design concept utilizes a vertical ring plate to which "B" series CADWELD splice sleeves are welded to terminate the meridional bars in hoop tension. The vertical plate (1 1/2 in. thick) is welded to a thickened (1 in. thick) section of the liner. A 1-in. thick plate is welded across the top of the ring and 1-in. thick plate, forming a cruciform, is welded across the center. General notes (#3, Dwg. SI-0503) indicate that all welding is to be full penetration. No details are given to describe what is acceptable full penetration welding of this closed section. This apex anchor weldment is also part of the anchorage system for the rotating platform.

No calculations have been identified as being scheduled to verify the strength of this critical weldment nor has the confirmation record been used to identify this as an open item requiring further work to make the calculation complete. Page 145 does not identify the apex anchorage as requiring confirmation.

Calculations to determine the adequacy of this apex reinforcement anchorage assembly should take into account the attachment interface and stiffness of the liner plate with respect to imparting stresses and strains within the ASME Code allowances.

Calculations also are not identified (and are required) for the weldment anchorage shown on drawing SI-0503, Detail-14A which transfers load for a significant number (84) of #18 meridional bars.

RESPONSE

Drawing 2323-S1-0511 (note 8) identifies that all welds for this assembly are to be full penetration unless otherwise noted. Compliance with this requirement is shown on Chicago Bridge & Iron (CB&I) drawings 58, Revision 3, and 70, Revision 3 (contract no. 74-2427). The details on the CB&I drawings show that the welds provided are full penetration.

The validation of the details for terminating the meridional reinforcing at the apex of the dome (shown on drawings S1-0507 and S1-0514) had not been completed prior to the audit. The evaluations have since been completed and will be incorporated into Revision 1 of calculation 16345-CS(B)-130 by May 31, 1988. The evaluations validate the adequacy of these details.

The details for the anchorage of the rotating platform support are evaluated in calculation 16345-CS(B)-026, Revision 1, which was in preparation at the time of the audit.

OPEN ITEM C/S-47 (Continued)

RESPONSE

Anchorage Detail 14A on drawing S1-0503 had not been validated prior to the inspection review of calculation 16345-CS(C)-130 Revision 0. These evaluations have since been completed and will be incorporated into Revision 1 to calculation 16345-CS(C)-130 by May 31, 1988. The evaluations validate the adequacy of these anchorage details.

SIGNIFICANCE/EXTENT

There is no safety concern because the evaluations, which were in progress at the time of the inspection, have been completed and they properly address the items discussed above.

OPEN ITEM C/S-48

Document Number: Calculation 16345-CS(C)-130, Revision 0, Reactor Building - Containment Shell Design

The dome hoop bars are assembled as the outside layer of reinforcement. As the hoops progress up the meridional bars from the spring line, they develop a force component away from the shell surface. This component must be resisted to prevent the hoop bars from spalling (popping) off the top. Membrane cracking of the outer concrete surface must be considered in developing the hoop anchorage. The ability of the dome hoop bars to remain in place under the pressure cases should be established.

RESPONSE

The "spalling or popping" off of hoop bars was not considered to be a critical detail for the loadings analyzed in calculation 16345-CS(C)-130. The calculation will be revised and is expected to demonstrate that no additional reinforcing is required to maintain the hoop bars in place and adequate bond exists between the concrete and rebars to resist the load which would tend to spall concrete. This calculation will be revised by May 31, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because spalling off of hoop bars was not a critical detail for the loadings analyzed in calculation 16345-CS(C)-130.

OPEN ITEM C/S-49

Document Number: Calculation 16345-CS(C)-130, Revision 0, Reactor Building - Containment Shell Design

Pages 145, 146, and 148 calculate the development lengths required for bars not terminating with hooks, bends, or mechanical anchorages. A factor of 1.25 (+25%) has been identified as an ASME code requirement where biaxial tension exists in the termination zone.

In calculating the acceptability of meridional and diagonal bar anchorages in the foundation mat (page 146), the biaxial requirement has not been included, and the full development of a bar cannot be justified based on the actual length embedded. Specific values should be given to demonstrate the anchorage capacity based on the maximum bar stress. The termination of the added meridional bars and transfer of axial load at the base of the cylinder also should be addressed in relating the value of maximum, actual bar stresses.

The development of the shear items on page 148 does not include the biaxial stress factor for development length, nor are the No. 6 and No. 7 diagonal shear bars checked. A more detailed presentation should be given as to the determination of development acceptability. The reference to "#6 ties being bent around the main rebars by means of hooks or bends" does not fit the code requirement of 180° bends (#6 bars have 90° bends) as a means of anchorage. Even if the fabrication drawings state that the bars are to be bent around the main reinforcing, this does not ensure that bars (even 90° bars) were placed to hook behind the main bars.

RESPONSE

The anchorage capacity of reinforcing bars should be based on the maximum bar stress; the basic development length should be increased by 25 percent in areas of biaxial tension (per the ACI-ASME 359 code). The originator of calculation 16345-CS(C)-130, Revision 0 was aware of both of these requirements (see page 145). On page 146 the basic development lengths required and development lengths provided were calculated for both the vertical and diagonal reinforcing bars. It was also noted that the bars were not fully stressed and the development lengths provided were adequate. To more clearly demonstrate the adequacy of the development lengths provided, a quantitative justification based on actual bar stresses will be provided in the next revision of this calculation (May 31, 1988).

Development of the radial shear reinforcement (no. 6 rebars) was evaluated on page 148 using the acceptance criteria from Section CC-3532.1.1(a) of the ACI ASME-359 Code, i.e., a standard hook plus an effective embedment of 0.5. l_D. The effective embedment of a stirrup leg shall be taken as the distance between the mid-depth of the member d/2 and the start of the hook (point of tangency).

The configuration of the radial shear bars meets the above criteria, and is considered to be fully developed.

DAP ITEM C/S-49 (Continued)

SIGNIFICANCE/EXTENT

There is no safety concern because the judgement made was appropriate based on the objective of the calculation.

OPEN ITEM C/S-50

Document Number: Calculation 16345-CS(C)-130, Revision 0, Reactor Building - Containment Shell Design

The confirmation required on page 117 entails a revision to FSAR Section 3.7.1.4.5 and/or ASME code clarification.

RESPONSE

Calculation 16345-CS(C)-130, Revision 1, will include an analysis that addresses the design for inplane shears, which was previously designated "confirmation required."

As a result of the revised calculation, this item will no longer require confirmation nor will an FSAR change be required. The expected completion date of the calculation is May 31, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the analysis was adequate and the revised calculation will not require an FSAR change.

OPEN ITEM C/S-51

Document Number: Calculation 16345-CS(C)-086, Revision 0, Column Design - Safeguards Building

Unlike walls and floors, system and component attachment loads are not considered in the design validation of columns in DBD-CS-081. The load verification program will cover only a limited number of columns picked at random for verification. Due to the many different columns sizes and reinforcing, many column types may remain unverified for significant attachment loads and/or pipe whip and rupture loads. The design criteria and load verification program should provide assurance that each type of column is verified for its design adequacy for all load combinations such that the commitments made in FSAR Sections 3.8.3.3 and 3.8.4.3 are systematically met.

RESPONSE

The design criteria and the load verification program provide assurance that each type of column is verified for design adequacy for all committed load combinations which are specified in the FSAR, Section 3.8.3.3 and 3.8.4.3 as follows:

- The CPSES structural elements, including columns, are evaluated for the pipe whip restraint loads. These loads are tabulated in the DBD-CS-081, Attachment No. 4.

- Final design jet impingement loads will be included in a revision of DBD-CS-081, Attachment No. 5. The expected completion date is August 31, 1988. The CPSES structural elements, including columns, will be evaluated for these loads.

- Final design inputs for evaluating structures for impacts due to pipe breaks will be included in a revision of DBD-CS-081, Attachment 6. The expected completion date is August 31, 1988. The CPSES structural elements, including columns, will be evaluated for these loads.

- Commodity attachment design uniform loads for walls and floors, which are given in DBD-CS-081, results in column axial forces and bending moments which are included in the evaluation of each column.

- Each column will be evaluated for given pipe whip restraint loads. Moreover, the load verification program will have random samples of column elements with more than five (5) significant attachment loads (exclusive of pipe whip restraint loads) per Project Procedure PP-210.

SIGNIFICANCE/EXTENT

There is no safety concern because the program described above provides assurance that each type of column is verified for design adequacy.

OPEN ITEM C/S-52

Document Number: Calculation 16345-CS(C)-084, Revision 0, Safeguards Building Foundation Mat Analysis

Soil properties used in calculating soil spring values have uncertainties and may vary. SWEC is performing analysis of the mat of the Safeguards Building with varying soil properties. The results of the analysis should be used to reconcile the effect of soil variation on the mat design.

RESPONSE

In Revision 0 of calculation 16345-CS(C)-084, the Safeguards Building foundation mat was analyzed using a finite element analysis based on the best estimated soil properties. The effects of soil properties variation on the mat analysis were assessed based on the information obtained from the seismic analyses of the Safeguards Building using various soil properties. Revision 0 concluded that it was appropriate to evaluate the mat based on the "best estimated" soil properties.

The calculation has been revised to include evaluations of the mat using upper and lower bound soil properties as input to the finite element analysis. The results, based upon upper and lower bound soil properties, demonstrate that the design of the mat is adequate.

SIGNIFICANCE/EXTENT

There is no safety concern because evaluations of the mat using upper and lower bound soil properties have shown that the design of the mat is adequate.

OPEN ITEM C/S-53

Document Number: Calculation 16345-CS(C)-084, Revision 0, Safeguards Building Foundation Mat Analysis

Maximum soil pressure is not calculated. SWEC is in the process of calculating soil pressure under different loading conditions. Dynamic soil pressure on walls of the Safeguards Building is not considered in the mat analysis. Justification is required for neglecting the dynamic soil pressure on walls.

RESPONSE

In performing Revision 0 of calculation 16345-CS(B)-084, the dynamic soil loading on the Safeguards Building walls above the mat was judged to have an insignificant effect on the mat design. Revision 1 of the calculation incorporated these loads and demonstrated the adequacy of the judgement made.

SIGNIFICANCE/EXTENT

There is no safety concern because the judgement was appropriate and the mat analysis is adequate. The planned calculation review associated with the confirmation activity is in progress and identifies and adequately addresses required confirmation and documentation for the basis of engineering judgements for all Civil/Structural calculations.

OPEN ITEM C/S-54

Document Number: Calculation 16345-CS(C)-084, Revision 0, Safeguards Building Foundation Mat Analysis

The seismic force distribution on walls and columns is based on the gross moment of inertia of all wall and column elements about the center of gravity of wall and column areas. This will introduce shear and moments in floor slabs connecting all elements. This shear distribution on walls and columns has not been addressed. (This item is similar to Open Item C/S-30.)

RESPONSE

Calculation 16345-CS(C)-084 did not determine shear distribution in walls and columns. Shear distribution on walls and columns was determined in Revision 0 of calculations 16345-CS(C)-081 and -079. The results from the above calculations were used as input in calculation 16345-CS(C)-084 for the analysis of the mat.

SIGNIFICANCE/EXTENT

There is no safety concern because the shear distribution was addressed in calculations 16345-CS(C)-079 and -081 which were used as inputs to calculation 16345-CS(C)-084.

OPEN ITEM C/S-55

Document Number: Calculation 16345-CS(C)-086, Revision 0, Column Design - Safeguards Building

Page No. 4f of the calculation states that load combinations 11, 12, and 13 will be checked later. The record of required confirmations on page 5 does not identify the work to be performed later upon the receipt of remaining loads.

RESPONSE

Page 4f indicates that load combinations 11 through 13 will be completed upon receipt of the accident loads. This statement was omitted on the Record of Confirmations page. The body of all C/S calculations will be compared with the Record of Confirmations to identify any required confirmations which were not listed on the Record of Confirmations page. This review will be completed by May 31, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the inputs requiring confirmation were identified in the body of the calculation and would have been addressed during the confirmation removal activity.

OPEN ITEM C/S-56

Document Number: Calculation 16345-CS(B)-171, Revision 0, Condensate Storage Tank and Refueling Water Storage Tank

Confirmation is required that the "coupled" loadings used actually provide enveloping element forces throughout the tank structure. Confirmation should include an evaluation based on "true" dynamic loading behavioral input to the computer analysis. The effect of vertical seismic force on the lateral pressure should be addressed.

RESPONSE

In Revision 0 of the calculation, element forces resulting from seismic excitation of the contained fluid were approximated by modeling the fluid as an equivalent weight of concrete attached to the walls. Horizontal accelerations (seismic loading) were applied and the element forces were determined using the SHELL-1 computer code. The effect of vertical seismic force on the lateral pressure was considered to be negligible. Conservatively, the maximum structural seismic acceleration (at the roof level) was applied over the entire height of the structure. This method results in a good approximation for the determination of the element forces in the walls of the tank.

The calculation will be revised to include more rigorous evaluations to confirm the adequacy of the method used to approximate the dynamic fluid loads, including the assumption that vertical seismic force on the lateral pressure was negligible. This calculation is anticipated to be revised by August 1, 1988.

SIGNIFICANCE/EXTENT

There is no safety concern because the method of analysis was appropriate. The extent of this condition includes a similar analysis, calculation 16345-CS(B)-172, which will also be revised by August 1, 1988.

OPEN ITEM M-3

Pressure Differential Indication Switches are provided to alarm low air flow. Setpoints given are for pressures lower than the pressure associated with normal flow. These alarm switches would not alarm low air flow conditions due to a closed or partially closed damper before the fan or due to a closed or partially closed damper after the fan. This applies to DBDs-ME-304, 312, and 313 as well.

CLARIFICATION

The previous response (see reference (3)) addressed an Ebasco to SWEC letter EB-T-3603 dated October 14, 1987 that described the installation of pitot tubes or the relocation of pressure taps to resolve the potential problem of "no-flow condition" detection.

There have been slight changes since that letter was written and they are described in letter EB-T-3777 dated December 4, 1987.

The minor changes are:

a. The Turbine Building Ventilation, Office and Service Area Air Conditioning and Containment Pre-access Filtration Systems have been deleted from this list. They are not safety-related and will be reviewed for this concern at a later date.

b. The ESF Filtration Units of the Primary Plant Ventilation System, and the Emergency Pressurization Filtration Units of the Control Room HVAC System will have their pressure taps relocated instead of having pitot tubes installed.

OPEN ITEM M-6

Neither the DBD nor DC-304 require maintaining the relative humidity during other than normal plant operation (Section 4.3a, Page 16). FSAR Section 9.4.1.2, Page 9.4-8 commits to maintaining relative humidity (as given in Table 9.4-2) in the Control Room Complex during all modes of operation.

CLARIFICATION

The previous response to this open item (see reference (3)) was based on a proposed FSAR change request issued from Ebasco to TU Electric. The intent was to depict normal operating conditions and emergency conditions in table 9.4-2 of the FSAR. However, the project position was to indicate the normal operating conditions in the table and utilize the text to describe any emergency or abnormal conditions.

A new FSAR change request will be generated to insert the applicable information regarding the maximum relative humidity experienced in the control room complex during an emergency or abnormal condition.

OPEN ITEM M-11

Open Item M-11: The team noted the following examples where sections of the DBD either contradicted the above requirements or indicated that the SWIS Ventilation System relied upon a non-safety component to perform a safety function.

Sections 2.2 and 2.3.2 on Page 9 and Section 4.2 on Page 12 require maintaining the Intake Structure Heating System operational only during normal modes of plant operation and state the heating system is non-nuclear safety; therefore, it cannot be relied upon during emergency modes.

Sections 2.3.3 Page 10, 4.2 Page 12 and 5.2.1.3 Page 21 state the Diesel Fire Pump Room Exhaust System is required to operate only during normal modes of plant operation and then only during operation of the Electric Motor-Driven Fire Pump.

Sections 5.12 Page 18 and 5.3.1 Page 23 discuss situations when the Service Water Pump Temperatures are well above 122°F and state the equipment is qualified to operate at a maximum temperature of 131.8°F.

CLARIFICATION

The original response to this open item (M-11) (see reference (3)) was based on a proposed FSAR change request submitted from Ebasco to TU Electric. In that proposed change, Ebasco submitted normal and cooldown conditions along with emergency conditions.

However, the project's position was to include cooldown under normal operating conditions and utilize the text to describe emergency or abnormal conditions. The change was included in Amendment 68 to the FSAR.