TU ELECTRIC

Log # TXX-88601
File # 10130
IR 88-29/88-25
IR 87-37/87-28
IR 87-19/87-15

William G. Counsil
Executive Vice President

August 24, 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
REVISIONS REGARDING RESPONSES TO
NRC DESIGN VALIDATION PROGRAM INSPECTIONS

REFERENCE:
1) TU Electric letter dated March 21, 1988 from Mr. W. G. Counsil to the NRC (Response to NRC IR Nos. 50-445/87-19, 50-446/87-15)
2) TU Electric letter dated April 11, 1988 from Mr. W. G. Counsil to the NRC (Response to NRC IR Nos. 50-445/87-37, 50-446/87-28)
3) TU Electric letter dated May 27, 1988 from Mr. W. G. Counsil to the NRC (Response to NRC IR Nos. 50-445/88-29, 50-446/88-25)
4) TU Electric letter dated June 20, 1988 from Mr. W. G. Counsil to the NRC (Commitment Revisions Regarding Responses to NRC Design Validation Program Inspections)
5) TU Electric letter dated August 18, 1988 from Mr. W. G. Counsil to the NRC (Commitment Revisions Regarding Responses to NRC IR Nos. 50-445/88-29, 50-446/88-25)

Gentlemen:

In references (1), (2), and (3) we provided responses to the NRC open items from your inspection of the CPSES Design Validation Program. As a result of additional discussions with the NRC, we have prepared revised responses to the following items:

Mechanical/Fluid Systems open items F-1, 4, 6, 17, 18, 20, 28, 31, 33, 35, 36, 37, 44, 48, and 50;

Electrical open items E-3 and 11.

The revisions are denoted by a change bar in the right hand margin.

Reference (4) indicated that the commitment for Civil/Structural open item C/S-35 should be revised to be completed by 12/31/88. The correct open item should be C/S-55.

D029

Civil/Structural open item C/S-51 has a commitment to revise DBD-CS-081, General Structural Design Criteria. This revision depends on input from the high energy line break analysis, which is scheduled to be completed by March 27, 1989, for Unit 1 (see reference 5). The DBD will be revised by April 28, 1989.

Mechanical/Fluid Systems open item F-27 and Instrumentation and Control open item I-20 had a commitment to revise Design Basis Document (DBD)-ME-229, Component Cooling Water System. When the DBD was revised these open items were not addressed. The DBD will be revised by September 15, 1988 to address these open items.

Very truly yours,

W. G. Counsil

By: John W. Beck
John W. Beck
Vice President,
Nuclear Engineering

JCH/grr

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

OPEN ITEM F-1

Document Number: Calculation 16345-ME(B)-169, Revision 0, Containment Spray Flow Rates

Calculation for NPSH in injection mode:

1. DBD-ME-232 is used to reference flowrates to other components (ECCS); however, the DBD does not delineate flow assumed in this calculation. EFE did not address.

2. 120°F RWST temperature was assumed; DBD states a 100°F RWST maximum temperature. EFE addressed.

RESPONSE

The primary source for the ECCS flow rate used in calculation 16345-ME(B)-169 was WPT-3358, "RWST Level Setpoints and ECCS Switchover" dated July 16, 1980. DBD-ME-232 was not intended to be the reference for flow rates. When calculation 16345-ME(B)-169 was being prepared, attachments from a related containment spray calculation were used as part of calculation 16345-ME(B)-169. Reference numbers were not changed to reflect the attachment and the reference for the flow value in DBD-ME-232 due to administrative errors.

New calculation 16345-ME(B)-236, which supercedes 16345-ME(B)-169 has been completed and properly references the source for the maximum allowable ECCS flow rates when determining NPSHs.

DBD-ME-232 identifies RWST water temperature correctly in the design requirements section (Section 4.3), but incorrectly in Section 5.3. RWST temperature in Section 5.3 has been corrected to 120°F, in Revision 1 of DBD-ME-232.

SIGNIFICANCE/EXTENT

The attachment which was the source of the incorrect reference was only utilized for this calculation. Therefore, the use of an incorrect reference identified in the open item is limited to this calculation and is considered isolated. This was an administrative error and had no safety significance.

An inconsistency in maximum flow rates between DBD-ME-260 and Westinghouse letter WPT-3358 was noted during the NRC inspection. This inconsistency is due to the DBD correctly stating a single train flow requirement whereas the Westinghouse letter addressed two train operation for input to DBD-ME-232. The Westinghouse letter is the appropriate input for the subject calculation. DBD-ME-232, Containment Spray System, will be revised to incorporate the information contained in Westinghouse letter WPT-3358 by September 15, 1988.

OPEN ITEM F-1

SIGNIFICANT/EXTENT (Continued)

The inconsistency between RWST temperatures identified in the open item is not a safety concern because the correct temperature was used in the calculations. However, the open item is relevant to other mechanical DBDs. Sections 1 through 4 of thirteen DBDs (which describe system design criteria) were being revised at the time the open item was identified. Sections 5 through 10 of these DBDs (which describe how the system meets the design criteria) are scheduled to be updated to reflect the results of the validation effort by December 31, 1988. These DBDs are DBD-ME-003, 011, 013, 079, 202, 203, 206, 215, 229, 232, 233, 235, and 241.

OPEN ITEM F-4

Document Number: Calculation 16345-ME(B)-169, Revision 0, Containment Spray Flow Rates

Containment Spray flow analysis neglects spray additive eductor hydraulics. EFE did not address.

RESPONSE

The eductor was not modeled because its contribution to the flowrates was judged to be negligible. There is no impact on the calculation results and the engineering judgement is correct although not documented in Calculation 16345-ME(B)-169. Eductor flow rates specific to CPSES are contained in test data provided by Dayton T. Brown Inc. for eductor tests performed for Permutit Co. Inc. on August 28 and 29, 1979 and have been reviewed against calculation 16345-ME(B)-236 which supersedes calculation 16345-ME(B)-169. Acceptable results have been achieved.

SIGNIFICANCE/EXTENT

There is no safety concern since acceptable results are achieved in calculation 16345-ME(B)-236. This open item is limited to the containment spray eductors (calculations 16345-ME(B)-169 and 16345-ME(B)-057) which are the only safety-related eductors.

These calculations have since been superseded by calculation 16345-ME(B)-236 and calculation 16345-ME(B)-276.

OPEN ITEM F-6

Document Number: Calculation 16345-ME(B)-169, Revision 0, Containment Spray Flow Rates

Attachment B - Piping and Fitting Losses

Page B4 - Combining flow path resistances in parallel (equivalent header resistance calculations) - Calculation method given is only valid for parallel flow paths originating and discharging to the same HGL (Hydraulic Grade Line). Spray header parallel flow calculations originate at the same node, but discharge to nodes having different HGL. EFE addressed this.

Page B3 - 24" suction header, CS/ECCS flow is 26,000 GPM per reference 7/page 4, but the reference does not give this flow rate. EFE did not address.

Page B3 - RWST Sparger is not accounted for in the hydraulic resistance calculations. EFE did not address.

RESPONSE

Page B4 - This calculation used a combined equivalent flow path to calculate head loss. Spray header elevation differences need not be taken into account because it was assumed that the balancing orifices in each of the spray header risers are sized to counteract the effects of different elevations. Calculation 16345-ME(B)-236, which supersedes calculation 16345-ME(B)-169, addresses header elevation differences by using the most restrictive header flow path. During the closure of confirmatory items in this calculation, the effect of any calculational changes will be evaluated and it is expected that there will still be adequate NPSH available.

Page B3(1) - This item is identical to Open Item F-1, No. 1.

Page B3(2) - Calculation 16345-ME(B)-169 did account for RWST sparger hydraulic resistance by stating in the engineering judgement that it was negligible. Calculation 16345-ME(B)-236 models sparger hydraulic resistance. This calculation shows that NPSH during injection for the containment spray pumps is adequate and that the hydraulic resistance effects due to the sparger are negligible.

The vendor has confirmed that the values used in the calculation for "NPSH Required" are correct.

OPEN ITEM F-6 (Continued)

SIGNIFICANCE/EXTENT

The open items relate to the technical justification for calculation assumptions and methods and are limited to calculation 16345-ME(B)-169 and calculation 16345-ME(B)-057. Revised calculations 16345-ME(B)-236 and 16345-ME(B)-276, which address these open items, verify that the calculation results are correct.

OPEN ITEM F-17

Document Number: Calculation 16345-ME(B)-053, Auxiliary Feedwater System Performance

Several design basis items were not adequately addressed within the calculations:

For all evaluated cases of a faulted steam generator, friction of high energy piping upstream of the steam generator was included in the calculations. This causes nonconservative spill flowrates with respect to CST inventory requirements and pump runout flowrates.

The DBD states that maximum runout flow of 700 GPM is precluded by flow restricting orifices within the system. This calculation indicates flowrates exceeding this value. When actual pump retesting is performed, test data should be obtained for operating points beyond all normally expected flowrates to verify acceptable pump operations, NPSH, etc.

The DBD presents pump test head/capacity acceptance criteria. This condition represents a worn pump that provides less capacity than the original new pump. The calculations are performed with new pump test curve input data, and do not illustrate that pumps meeting the DBD acceptance criteria will meet system function criteria. Allowable pump wear margins, and pump periodic testing acceptance criteria should be factored into the subject system performance calculation.

In addition, the calculation did not account for the pressure loss due to the steam generator inlet sparger pipe.

RESPONSE

The following response addresses the four items noted above in the same order:

a. Although the friction losses upstream of the steam generators were judged to be inconsequential, calculation 16345-ME(B)-053 was revised to exclude this term. The new flowrate is 0.08 percent greater than the original flowrate. There is no impact on containment overpressurization or CST inventory.

   The results of the reanalysis confirms the initial assumption.

b. The calculation is correct. Sections 5 through 11 of DBD-ME-206 will be revised to reflect the calculation results by October 15, 1988. Also, manufacturers data or pump test data will be referenced in the DBD to identify the correct pump runout flow.

OPEN ITEM F-17

RESPONSE (Continued)

c. Calculation 16345-ME(B)-053 was performed to determine system performance with new pumps only. As part of the SWEC CAP validation program, the surveillance requirements of the Technical Specifications are reviewed, including ASME Section XI. Actual test data and Technical Specification requirements are reviewed against calculation results for all safety-related pumps to assure sufficient margin exists for worn pump conditions. On a case-by-case basis, if insufficient margin exists, calculation requirements will be evaluated and revised to provide additional margin for pump wear.

d. Per Westinghouse Drawing 1105J07, there is no sparger on the auxiliary feedwater inlet of the steam generators. It is an open path; therefore, the exit loss is one (1) per Crane Technical Paper No. 410. Calculation 16345-ME(B)-053, Revision 0, uses the value "1" for this loss. The next revision to this calculation will add a reference to the Westinghouse drawing.

Calculation 16345-ME(B)-241 has been completed.

SIGNIFICANCE/EXTENT

There is no safety concern since the calculations verify that the Auxiliary Feedwater System can meet its performance requirements. As part of the review of CPSES Technical Specifications and the CPSES retest procedures for safety systems, acceptance criteria are established by calculation and test results are reconciled.

OPEN ITEM F-18

Document Number: Calculation 16345-ME(B)-054, Auxiliary Feedwater Pump NPSH

The calculation utilizes pump rated flows for NPSH requirements instead of maximum expected flows, such as would occur just before pressure is reached which allows use of the RHR system.

For the case of spill flow to a faulted steam generator, common suction piping would experience flowrates in excess of those assumed for this analysis (see Run 4A).

RESPONSE

For conservatism, calculation 16345-ME(B)-054 was revised to use pump flow rates for the case which includes spill flow to a faulted Steam Generator. Sufficient NPSH margin exists.

SIGNIFICANCE/EXTENT

There is no safety concern because the use of maximum calculated pump flow rather than rated flow is conservative. All NPSH calculations consider the most conservative combinations of physical parameters as listed below:

a) Maximum pump flow rates,

b) Suction tank/vessel or sump liquid level and static pressure,

c) Suction fluid vapor pressure, and

d) Maximum coincident flows to other pumps or systems which share the same (or portions of the same) suction piping flow path.

OPEN ITEM F-20

Document Number: Brown and Root, Inc. Piping Isometric BRP AF-1-SB-027B, Auxiliary Feedwater

A temperature element (TE-2472) is installed to allow detection of back leakage of hot feedwater into the auxiliary feedwater system. This aids in precluding possible steam binding or overheating of the auxiliary feedwater system. However, the thermowell is placed too close (about 4 feet) to the main feedwater piping, therefore, it will probably give spurious high temperature readings and thus be ineffective in performing its intended function.

RESPONSE

BRP AF-1-SB-027B had not been validated at the time of the audit. It has since been reviewed as part of the design validation of flow diagram 2323-M1-0206 and this item was identified.

Calculation 16345-ME(B)-333 was prepared and shows that TE-2472 will not give spurious high temperature readings. If the check valves are tight and no back leakage occurs, the fluid temperature at TE-2472 will be lower than the maximum temperature reading of the vertical indicator which has a scale of 0-200°F. There are no alarms provided for this temperature element. An increasing temperature or temperature near full scale would indicate back leakage.

SIGNIFICANCE/EXTENT

There is no safety concern because the temperature element will not give spurious high temperature readings.

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 diesel generator vendor has provided heat rejection rates for the diesel generator based on shop testing. This information will be used to calculate the minimum required service water flow rate to the diesel jacket water heat exchangers at the maximum anticipated service water temperature. Preliminary estimates indicate that the calculated service water flow rate to the jacket water heat exchangers (2179 gpm) will exceed the minimum required flow rate.

Section 9 of DBD-ME-011 will be revised to reflect the service water heat removal requirement. DBD-ME-233 will be revised to include the diesel generator heat rejection rate requirement in Section 4. DBD-ME-233 will also be revised to include the required flow rates in Sections 5 through 11. This will be accomplished when the DBDs are revised (December 31, 1988).

SIGNIFICANCE/EXTENT

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

It was noted by the NRC reviewer that the vendor's calculation of minimum required flow contained several errors. These errors were found to have an insignificant effect on the required flow rate. Generally, the vendors do not provide SWEC with this type of performance calculations. It is usually provided in a specification data sheet, vendor drawings, or technical manual without supporting calculations. SWEC reviews all such information to assure that it is reasonable, meets SWEC interface requirements, and is generally in the range of expected values. Based on these reviews, it has been found that vendor data submittals have been accurate and acceptable on CPSES to date.

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 unanalyzed 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 will be revised to provide justification that a flowrate of 3200 gpm (or another appropriate flowrate) satisfies the requirement for detecting loss of flow to a spent fuel pool.

The low flow alarm is not intended to assure that flowrates meet or exceed minimum flow requirements. The flowrates required for heat removal are variable and dependent on heat sink temperatures and spent fuel decay heat. Therefore, a high temperature alarm is provided for each pool to assure that fuel pool heat removal requirements are satisfied.

The low flow alarm is part of a common trouble alarm for the spent fuel pool cooling system (i.e., pump trips, low flows, high differential pressures, etc.). The alarm logic is that at least one spent fuel pool cooling pump should be providing flow to each pool. Flow may be split between the pools. Pump trips or valve misalignment would result in an alarm, as appropriate, on the local panel and in the control room by the common trouble alarm. Therefore, a low flow alarm setpoint of 3200 gpm is adequate for the alarm to perform its intended function.

SIGNIFICANT/EXTENT

There is no safety concern because the low flow alarm setpoint serves no safety related function.

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 of 0.0003 for both sides of the CCW heat exchanger surface. The data was selected from HEI Standard for Power Plant Heat Exchangers. This value, coupled with the monitoring program described below, is considered adequate for the evaluation of the existing design to ensure that the necessary heat removal capability exists. 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.

The results indicate that the maximum CCW temperature is acceptable with respect to the design ratings of the cooled components.

The component cooling water heat exchanger performance will be monitored using a testing program which is being developed. The instrumentation accuracies will be evaluated by standard error analysis to assure that the monitoring program accurately predicts heat exchanger performance. The test data obtained will be analyzed to correlate to a fouling factor for the heat exchanger. This fouling factor will be compared to a set of curves which provide acceptable fouling factors corresponding to SSW inlet temperatures. If the fouling factor is determined to be unacceptable, then the affected component cooling water system train will be declared INOPERABLE and the appropriate Technical Specification requirements satisfied. The CCW heat exchanger tubes will be cleaned. A retest of the performance will be made to verify an acceptable fouling factor.

OPEN ITEM F-33

RESPONSE (Continued)

The testing program is scheduled to be available for your review by December 31, 1988.

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 have been completed and Calculation 16345/6-NU(B)-023 has been revised. There is no safety concern since the calculated temperatures, although slightly higher, are within the existing acceptance criteria for equipment design and safety analysis results.

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 doe 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 a revised analysis, assuming the entire 1,000 Bhp results in heat input to the CCW. Also included in the revised analysis are the higher fouling factors discussed in Open Items F-10 and F-33. The calculated load is 2.55 x 10^6 BTU/hr per pump, which, combined with the LOCA heat load of 367.85 x 10^6 BTU/hr and flow of 14,757 gpm results in a maximum CCW temperature which is acceptable with respect to the design ratings of the cooled components. Revision 1 of calculation 16345-NU(B)-023 satisfactorily resolved this issue.

SIGNIFICANCE/EXTENT

The affected heat load analyses now address the effect of the additional CCW pump heat load and the revised fouling factors of Open Items F-10 and F-33. Although slightly higher, the calculation temperature is within the existing acceptance criteria for equipment design and safety analysis results. Therefore, there is no safety concern.

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-233, Revision 1, the maximum SSI operating temperature has been deleted from Section 4. DBD-ME-233 will be revised to describe the maximum, normal operating temperature of 102°F in Sections 5 through 11 when it is updated to reflect the results of the validation effort.

The diesel generator vendor has provided heat rejection rates for the diesel generator based on shop testing. This information will be used to calculate the minimum required service water flow rate to the diesel jacket water heat exchangers at the maximum anticipated service water temperature. Preliminary estimates indicate that the calculated service water flow rate to the jacket water heat exchangers (2179 gpm) will exceed the minimum required flow rate.

Section 9 of DBD-ME-011 will be revised to reflect the service water heat removal requirement. DBD-ME-233 will be revised to include the diesel generator heat rejection rate requirement in Section 4. DBD-ME-233 will also be revised to include the required flow rates in Sections 5 through 11. This will be accomplished when the DBDs are revised to incorporate the results of design reconciliation (December 31, 1988) (See response to NRC open item F-28).

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.

During the inspection, the NRC reviewer noted that the operator could routinely close the diesel cooling isolation valves to increase flow to the CCW heat exchanger to compensate for reduced CCW heat exchanger performance. The fouling concerns of NRC Item F-33 could then be masked by additional normal flow which would not be available during accident conditions. As committed in the response to F-33, TU Electric will implement a performance monitoring program for the CCW heat exchanger. This program will account for varied normal service wate flow rates in determining CCW heat exchangers performance and will judge the performance based on the flow which will be available during the accident mode.

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-44

Document Number: Calculation 16345-ME(B)-196, Rev. 0, dated 12/31/87, "CCW Worst Case Non-Seismic Pipe Break"

The calculation assumes two guillotine breaks in 10-inch non-seismic piping to and from ventilation chillers. The breaks are downstream of a butterfly valve that is assumed to be only 32° open. Since the valve is the main point restricting the flow and also in non-seismic piping, the postulated break does not represent the "worst case." A "worst case" break should be postulated just downstream of the class break from class 3 to class 5 pipe. Non-seismically designed components may fail during a seismic event. Therefore, any non-seismic piping connected to seismic portions of the CCW system should be assumed to fail next to the class break point. For a single Comanche Peak unit, this represents four places in the CCW system, i.e., the entrance to and exit from the non-seismic portions servicing the ventilation chillers and the instrument air compressors. The surge tank capacity and available NPSH should be calculated for the larger flows.

The currently calculated maximum leak rate for this scenario is about 3000 gpm, whereas it appears that leak rates of about three times this value are possible if no artificial restrictions are assumed within the system.

RESPONSE

Calculation 16345-ME(B)-196, Rev. 0 postulates and analyzes the worst case break at the seismic/non-seismic interface. Non-nuclear safety (NNS) piping downstream of a Safety Class/NNS class boundary is seismically designed up to the first support or anchor. The piping and valve XCC-080 in question, are seismically designed up to the ventilation chiller nozzle (Stress Problem Number 1-063A). Therefore, no break is postulated upstream of valve XCC-080 Valve position was based on the flow required for chiller operation during plant operating conditions when the break must be postulated. Valve position will not be set at 32° open which cannot be set accurately in the field. Instead, the valve position will be adjusted based on flow requirements such that the flow required for chiller operation is obtained during system flow balancing. Administrative controls, as described in the response to Item F-49, will be implemented by TU Electric to restrict valve operation.

The system is designed to remain operable during and after a worst case non-seismic piping failure. This position is technically acceptable and agrees with industry practice and ANS 56.11 Draft 3, (March 1987) "Criteria to Accommodate Compartment Flooding in Light Water Reactors" which states in part:

> Postulation of one break at a time in non-seismic piping systems is consistent with the latest draft of ANS 58.2 regarding protection against pipe rupture and consistent with current industry and regulatory practice. It also appears to be consistent with actual industry experience, such as Seismic Qualification Utility Group (SQUG) walkdowns, since piping systems evaluated in industrial facilities following actual earthquake events have been shown to be very unlikely to experience significant damage.

OPEN ITEM F-44 (Continued)

SIGNIFICANCE/EXTENT

There is no safety concern since the worst case piping failure required to be postulated has been evaluated with acceptable results.

OPEN ITEM F-48

Document Number: Calculation 16345-ME(B)-255, dated November 25, 1987, "Effects of Residual Heat Removal and Spent Fuel Pool Operation on Component Cooling Water Pump Performance"

The calculation addresses only the steady state flowrates existing before and after the switchover from one flow alignment to another. On examining flow resistances and valve operating times, it appears that there is a possibility of very large system flow rates occurring during the transient phase of system switchover from one operating mode to another. For the case of transition from normal operation to a LOCA alignment with a single component cooling water pump, flowrates approaching 25,000 gpm may occur. This is far in excess of presently defined maximum runout conditions.

Manufacturers of large pumps typically recommend that pump discharge valves be brought to a restricted (partly closed) position before startup to avoid undesirable flow conditions. For some plants, the sequencing times for motor operated valves have been coordinated to avoid runout conditions during these transient conditions.

RESPONSE

This open item postulates an S-signal followed immediately by a P-signal, coincident with the single failure of the standby CCW pump to start. At this time the safeguards loops isolation valves start to close, the non-safeguards loop isolation valves start to close, and the RHR and Containment Spray valves start to open. These valves are large motor-operated butterfly valves (24 in. and 18 in.) with stroke times of 30 seconds (maximum). The running pump, at approximately 15 seconds into this scenario, will tend to run out due to these valves all passing at their mid-stroke position.

Due to the design of these pumps, and the short duration of this flow condition, no damage to the CCW pump would result. A transient condition of very high flow is a unique occurrence and would be of short duration (15 to 30 seconds). It would have no effect on the component cooling water pumps after the transient is finished. By the nature of their design and construction, a short period of excess flow accompanied by loss of suction pressure represents less of a threat to pump performance than the conditions present during conventional shop testing for NPSH values. Verification that these effects are acceptable was obtained from the pump vendor.

The pumps do not trip on thermal overload (overloads alarm only). Due to motor characteristics, the motor does not trip on pump runout, but will trip on an electrical fault such as locked rotor current. Thus, these pumps will not trip on the postulated runout flow condition.

SIGNIFICANCE/EXTENT

There is no safety significance since the CCW pumps can withstand this transient and function properly.

OPEN ITEM F-50

Document Number: 16345-ME(B)-166, Rev. 2, dated 2/25/88, "Effect on Component Cooling Water System of a Thermal Barrier Tube Rupture"

This analysis shows more than 65 cubic feet per second of hot steam/water mixture entering the 8-inch pipe with virtually no effect on this piping. The following questions should be addressed for this scenario:

a) Since the blowdown flow arrests the flow from connected intact thermal barrier pipes, is it possible that flow in the 8-inch pipe is also arrested?

b) Could pressures/temperatures within the 8-inch pipe be higher than current piping ratings?

c) It is assumed that the blowdown flow is quenched by the component cooling water in the 8-inch pipe. How much of a steam bubble must enter the 8-inch pipe in order to satisfy transport (energy transfer) equations? Could waterhammer/steamhammer conditions be cause for concern?

d) If the blowdown steam/water flow pervades further into the component cooling water system, what is the effect of this void formation on surge tank piping frictional losses, surge tank pressure, and system pressures?

RESPONSE

The existing analysis evaluated a steady state condition where flow in the 8-inch header created a steam plume of sufficient size and heat transfer capability to allow mixing. The analysis did not consider the initial transient effect of the steam/water flow which will enter the pipe with enough velocity and momentum to stagnate flow in the 8 inch header. If mixing does not occur, the steam will simply push water down the CCW headers and the steam pressure in the 4 inch header could rise above that previously calculated.

This initial transient is difficult to analyze and predict with a high degree of accuracy. Lengthy, complicated analysis of the transient and water hammer effects would be required. As an alternative, the pipe was arbitrarily assumed to fail and the radiological effects of a CCW pipe failure outside containment were investigated. Evaluation of this event indicates that the doses from this release of reactor coolant would be within the NRC guidelines (10 percent of the 10CFR100 dose limit) presently committed in FSAR Chapter 15 for "Small LOCA Outside Containment." The calculated dose presently reported in the FSAR is from a letdown line break and would have to be revised to a slightly higher value. In lieu of further transient analysis, water ha[illegible] analysis, and changes to FSAR radiological results, a design change i[illegible]ing implemented to automatically iso[illegible]e the event rather than relying on [illegible]r manual action. Redundant, automatic isolation valves and detection instrumentation will provide timely isolation to limit the amount of steam entering CCW and eliminate any significant effects on the safeguards portion of the system.

OPEN ITEM F-50 (Continued)

SIGNIFICANCE/EXTENT

There is no safety concern since the radiological release from the worst possible consequences (piping failure) of a thermal barrier rupture is within the NRC guidelines committed in the CPSES FSAR.

OPEN ITEM E-3

Document Number: Calculation 16345-EE(B)-053, Revision 0, Sizing Verification - Class 1E Batteries and Battery Chargers

The design basis document states that the battery normal voltage is 125 V dc, with a range of 105 V (minimum) and 140 V dc (maximum). The battery vendor manual, "Stationary Battery Installation and Operating Instructions," requires that the battery be kept at a float charge level of 2.17 - 2.25 V dc per cell. This will result in a normal dc system voltage of 130.2 - 135 V dc for a 60-cell battery. This higher voltage could lead to a loss of life for the equipment designed for the DBD required 125 V dc normal voltage.

RESPONSE

IEEE Standard 946, "IEEE Recommended Practice for the Design of Safety-Related DC Auxiliary Power Systems for Nuclear Power Generating Stations," states that nominal voltages of 250, 125, 48, and 24 volts are generally utilized in station battery systems. The standard goes on to list operating voltage ranges of equipment typically connected to a nominal 125 V dc system.

All 125 V dc system loads are specified for operation with a maximum input voltage of 140 V dc in accordance with CPSES FSAR Section 8.3.2.1b.

A review of all Class 1E, 125 V dc schematics has established that only the following types of devices are exposed to battery equalizing voltage of 139.8 (~ 140) V dc for the duration of equalizing charge.

1. ASCO solenoid operated valves
2. Borg-Warner solenoid operated valves
3. Target Rock solenoid operated valves
4. Humphry products solenoid operated valves
5. ITE protective relays
6. GE protective relays
7. Battery charger voltage sensor board 'DSL' relay
8. Westinghouse auxiliary relays
9. Potter & Brumsfield control relays
10. Syracuse time delays relays
11. Agastat time delay relays
12. ASCO automatic transfer switch
13. NEI Peebles Elec. DC Contactor

OPEN ITEM E-3 (Continued)

Adequacy of the above listed devices for continuous 140 V dc operations was justified by one or more of the following methods detailed below:

1. Vendor Documentation

   Detailed review of applicable vendor documents including procurement specification fill-in data, vendor correspondence and test/qualification records to confirm operability at 140 V dc.

2. Plant Operation and Maintenance Records

   Plant operation and maintenance and battery equalizing charge records review to verify dc device adequacy under battery equalizing voltage levels. For this review, it was assumed that service systems which have been accepted by start-up were operational during and after Unit 1 hot functional tests conducted in May 1983 and November 1984.

   Battery equalizing periods subsequent to these hot functional test dates have subjected the dc devices of accepted systems to equalizing voltage levels of 139.8 (~ 140) V dc. Plant maintenance records did not identify any dc device failures attributable to battery equalizing.

3. Onsite Testing

   Site testing was performed to supplement vendor data and confirm operability at 140 V dc of certain relays from the above list. Test procedures and results indicated successful operation after extended application of 140 V dc.

The evaluation summary for adequacy justification for each of the dc devices is attached.

The comprehensive evaluation performed above demonstrates the capability of the dc devices to operate satisfactorily during equalizing voltage conditions.

SIGNIFICANCE/EXTENT

There is no safety concern because all components have been specified to operate with a maximum voltage of 140 V dc and no evidence of malfunctions determined to be caused by overvoltage as a result of equalizing voltage has been identified in the review to date.

ATTACHMENT TO OPEN ITEM E-3

EVALUATION SUMMARY

NO.	DEVICE TYPE	ADEQUACY JUSTIFICATION	REMARKS
1.	Automatic Switch Co. SOV's NPX 8320A186V NPX 8320A186E NP 8321A2E NP 8320A182V NP 8320A186E NP 8320A184V NP 8320AGE NP 831654E NP 831654V NP 831655E	1. Vendor document review confirms adequacy of device for continuous operation at 140 V dc.	Note 1
2.	Borg-Warner SOV's BDR 38878 - 1 & 3	1. Vendor document review confirms adequacy of device for continuous operation at 140 V dc.	-
3.	Target Rock SOV's TAR 11388RA	1. Vendor document review confirms adequacy of device for continuous operation at 140 V dc.	Note 2
4.	Humphry Products SOV's	1. Vendor document review confirms adequacy of device for continuous operation at 140 V dc.	-
5.	ITE Protective Relays 51E (22353341) GR-5 (202D6141) 51M (22358542) 50D (22888541) 51M (22388541) 51L (22385340) 27D (211B4175) 27H (211B0175) 59D (211C4175) 51E (22353340) 27H (211B0175)	1. Vendor document review confirms adequacy of device for continuous operation at 140 V dc. 2. Plant operation & maintenance records review has not identified any failure of these devices attributable to battery equalizing voltage to which these devices have been exposed.	Note 3

ATTACHMENT TO OPEN ITEM E-3

EVALUATION SUMMARY

NO.	DEVICE TYPE	ADEQUACY JUSTIFICATION	REMARKS
6.	GE Protective Relays 12NGV18A2A 12NGV29A2A	1. Vendor document review confirms adequacy of device for continuous operations at 140 V dc. 2. Plant operation & maintenance records review has not identified any failure of these devices attributable to battery equalizing voltage to which these devices have been exposed.	Note 3
7.	Battery Charger Voltage Relay DSL V120T2-1		Note 4
8.	Westinghouse Auxiliary Relays ARD440SR ARD880SR	1. Vendor document review confirms adequacy of device for continuous operation at 140 V dc. 2. On-site test has confirmed operability at 140 V dc.	
9.	Potter & Brumfield Auxiliary Relays P&B KUP17D14 KUP17D15	1. On-site test has confirmed operability at 140 V dc.	
10.	Allen - Bradley Control Relays 700 DC-N400-Z1	1. Vendor document review confirms adequacy of devices for continuous operation at 140 V dc. 2. On-site test has confirmed operability at 140 V dc.	

ATTACHMENT TO OPEN ITEM E-3

EVALUATION SUMMARY

NO.	DEVICE TYPE	ADEQUACY JUSTIFICATION	REMARKS
11.	Syracuse Relays TER03803NL	1. Vendor document review confirms adequacy of device for continuous operation at 140 V dc. 2. On-site test has confirmed operability at 140 V dc.	
12.	Agastat Time Delay E7012-PD002	1. Vendor document review confirms adequacy of device for continuous operation at 140 V dc. 2. On-site test has confirmed operability at 140 V dc.	
13.	Automatic Transfer Switch 302B1232C	1. Vendor document review confirms adequacy of device for continuous operation at 140 V dc.	
14.	D.C. Contactor (NEI Peebles)	1. Vendor document review confirms adequacy of device for continuous operation at 140 V dc.	Note 5

NOTES:

1. ASCO information confirms that the solenoids prefixed "N" are nuclear grade and have class H insulation suitable for continuous duty such as wider voltage ranges encountered in battery charging circuits.

2. Target-Rock uses ASCO solenoids which are nuclear grade.

3. The ITE protective relays are part of the AC system which was in operation when the battery charger was equalizing. These d.c. relays in the AC distribution system were therefore subjected to equalizing voltages.

4. This relay was selected for its intended application by the battery charger manufacturer and therefore suitable for higher voltage which battery charger is required to provide.

5. This is part of the Static Exciter-Voltage Regulatory System of Diesel Generator Unit.

OPEN ITEM E-11

Document Number: Calculation 16345-EE(B)-007, Revision 0, 480 V ac Motor Control Center (MCC) Starter Coil Pickup Analysis

The calculation on Page 4 assumes "Minimum Sustained Voltage at an MCC Bus will be 422 V." This assumption is very important and forms the basis for the whole calculation. The basis of the assumption should be documented and included in the DBD. SWEC intends to confirm this assumption as well as some others in the calculation. However, the calculation indicates that assumptions need to be verified, without identifying specific ones.

RESPONSE

In order to validate the existing voltage profiles calculation, a voltage profile calculation was prepared in parallel. Since existing voltage profile conclusions were not validated information, 422 V at the MCC bus was used as the target minimum sustained voltage that other ac system voltage calculations would aim towards.

The cover sheet of the calculation called for confirmation of all inputs. The 422 volts was an assumption which would be confirmed later by the results of Calculation 16345-EE(B)-073, Revision 1. The preparer recognized that the bus voltages would be determined in other calculations and ultimately compared against each case. If bus voltage fell below the 422 V, a new calculation would be performed for the affected circuits.

Revision 2 of Calculation 16345-EE(B)-007 has been prepared and now uses a revised minimum voltage at the MCC based upon results obtained from Calculation 16345-EE(B)-073, Station Service Study - Voltage Profile of Class 1E Systems Down to 480 V MCCs.

This is reflected in DBD-EE-053, Revision 2.

SIGNIFICANCE/EXTENT

There is no safety concern because the assumptions used in the calculation required confirmation.