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UNION ELECTRIC

October 30, 1992

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U.S. Nuclear Regulatory Commission
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Gentlemen: ULNRC-2714

CALLAWAY PLANT
DOCKET NUMBER 50-483
ADDITIONAL INFORMATION REGARDING
REVISION TO TECHNICAL SPECIFICATION TABLE 3.3-4,
"ENGINEERED SAFETY FEATURES ACTUATION SYSTEM
INSTRUMENTATION TRIP SETPOINTS"

Ref: 1. Union Electric letter to U.S. Nuclear Regulatory Commission, ULNRC-2539, December 20, 1991

Att: 1. Summary of Bechtel Power Corporation letter to Union Electric, BLUE-91-0004, "Callaway Nuclear Power Plant/Callaway Degraded Voltage Setpoints," November 14, 1991
2. Summary of Design Inputs of Revised Degraded Voltage Safety Analysis and Uncertainty Breakdowns
3. Summary of Union Electric Suggestion, Occurrence, and Solution (SOS) Report, SOS 91-0469

In Reference 1, Union Electric Company submitted the subject application for amendment to Facility Operating License Number NPF-30 for the Callaway Plant. This amendment application requests a revision to Technical Specification Table 3.3-4, Functional Unit 8.b, to revise the trip setpoint, allowable value, total allowance, sensor error, and "Z"-value of the "4 kV Undervoltage - Grid Degraded Voltage" protection function to agree with the required design values.

Union Electric herewith formally transmits information regarding the change to the plant degraded voltage setpoints. This additional information is provided at the request of Mark Pratte and Frank Ash of the NRC staff concerning the reasons for the change and impact on plant voltages.

Attachment 1 is a summary of Bechtel letter BLUE-91-0004. This letter describes the root cause, documents the safety significance of the error, and describes some of the analysis performed to produce the new setpoint. This analysis included performing new load flow analyses which examined relationship between the limiting voltages on the lower voltage levels, to the higher voltage level at which the degraded voltage sensing is present.

Further analysis was performed by Union Electric to calculate the setpoints by a detailed analysis of the loop uncertainties. The uncertainties were analyzed using ISA Standard DRP 67.04. Attachment 2 includes a summary of the important design inputs, a graph showing the degraded voltage loop uncertainty breakdown and a diagram of the setpoint uncertainty breakdown. Union Electric also performed plant wide load flows to ensure that the plant voltages were coordinated with the new setpoints and the loop uncertainties.

Attachment 3, SOS 91-0469, is the occurrence report of the setpoint error and documents analysis of the impact on the operability of the plant, interim actions, and subsequent corrective actions.

If you have any questions regarding the subject amendment application or this additional information, please contact us.

Very truly yours,

Donald F. Schnell

GAC/kea

Attachments

STATE OF MISSOURI)
)   S S
CITY OF ST. LOUIS)

Alan C. Passwater, of lawful age, being first duly sworn upon oath says that he is Manager, Licensing and Fuels (Nuclear) for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Alan C. Passwater
Alan C. Passwater
Manager, Licensing and Fuels
Nuclear

SUBSCRIBED and sworn to before me this 2nd day of November, 1992.

Barbara J. Pfaff
BARBARA J. PFAFF
NOTARY PUBLIC, STATE OF MISSOURI
MY COMMISSION EXPIRES APRIL 22, 1993
ST. LOUIS COUNTY

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SUMMARY OF BECHTEL LETTER
TO UNION ELECTRIC, BLUE-91-0004, NOVEMBER 14, 1991,
"CALLAWAY NUCLEAR POWER PLANT/
CALLAWAY DEGRADED VOLTAGE SETPOINTS"

The degraded voltage setpoints for the Callaway Plant were established in Calculation H-8 using Calculation B-17 as a reference. The basis for the setpoints was the minimum voltage at 4.16 kV buses NB01 and NB02 which would provide 92% of nominal motor rated voltage on critical Motor Control Centers (MCCs) as established in Calculation B-5. Calculation B-5, Revision 2 established the Load Center voltage needed to support the Motor Control Center voltage requirements. The load flow calculation performed in Calculation B-17 Revision 0 showed that in order to meet those load center voltages identified in Calculation B-5, required voltages at NB01 and NB02 were 3656 kV each. The degraded voltage setpoint was selected to be 3656/(4200/120 PT ratio) or 104.5 V.

Concurrent with the initial setpoint determination in March of 1984, the need to supply safety related loads with one ESF transformer out of service was also questioned. Studies performed at that time indicated that such a contingency could be handled with load reduction and by changing the taps above the 4.16kV level. Since a change of ESF transformer taps does not impact the relation between 4.16 kV and 480 V bus voltages, no alteration to the Load Shedding and Emergency Load Sequencing (LSELS) setpoints would have been required, and therefore, no change to the LSELS setpoint was required to address the contingency. The load flow studies were later revised in December 1984 (Calculation B-17, Revision 1) to show that with a higher design minimum switchyard voltage, safety related loads could be supported from one ESF transformer without the extensive load shedding dictated by Calculation B-17, Revision 0. Concerns over overvoltages during plant outages and revised load data dictated that the optimal tap settings, as determined in Calculation B-17, Revision 1, included a change in the load center taps, which did change the 4.16 kV-480 V bus voltage relationship.

Load flow studies performed as part of Calculation B-17, Revision 1, indicated that with the revised tap settings and design minimum voltage at the switchyard, adequate voltage would be maintained at the 480 V buses. The load flow results showed however, that the voltage on 4.16 kV buses NB01 and NB02 necessary to support the 480 V system had increased to 3704 V. The degraded voltage setpoint calculation (i.e., Calculation H-8) should have been revised to reflect this higher value.

The required setpoint for the existing tap conditions determined in B-17 Revision 1 were calculated using load data provided by UE. The Class 1E distribution system was modeled from the 4.16 kV buses down to the 480 V motor control centers using Bechtel's load flow program. The voltage at the 4.16 kV bus was adjusted until any one motor control center reached its voltage limit. These values were determined to be 3720 V (106.3 V LSELS input) for NB01 and 3716 V (106.2 V LSELS input) for NB02. This value of voltage represents the desired degraded voltage setpoint.

The components comprising the degraded voltage sensing circuit were examined to obtain the tolerance which should be applied to the setpoint. The errors associated with the analog sensing module of the LSELS panel are less than .25% (setting accuracy) plus 0.5% (drift, power supply and thermal effects). The potential transformer was specified to have an adequacy of 0.3% at standard burdens. In accordance with ISA guidelines (ISA DRP 67.04), the total uncertainty of these unrelated terms was determined by root-mean-square methodology, yielding a total uncertainty of .63%. In order to ensure that the LSELS bistable is set above the desired minimum, the recommended setpoint is 106.3 * 1.0063 or 106.97 for NB01 and 106.2 * 1.0063 or 106.87 for NB02. The LSELS bistables had previously been set at approximately 105.9 V (104.5 plus tolerance).

The significance of this discrepancy is that if a degraded voltage condition occurred wherein the 4.16 kV bus voltage dropped below 3704 V but not below 3656 V, with the bus loading used in Calculation B-17, the voltage available at the 480 V load centers motor control centers could fall below the baseline values used to establish that motors were operating within their rating and that MCC control circuits had sufficient voltage to pickup. Should motors be operated at less than 90% of nominal voltage, the currents drawn by the motors would increase proportionally. Since the difference in voltage in this case is very small, the effect, if any, would be a slight increase in motor temperature. As power plant motors generally do not operate at their nameplate values and since the effect, if any, of the reduced voltage would be long term and not sudden or catastrophic, the impact of the degraded setpoint on motor operability is considered insignificant.

In order to evaluate the impact of MCC voltages less than 92%, the calculation performed to establish maximum control circuit lengths (Calcula[illegible]-10) and the study to check control circuits against the calculated lengths, were reexamined as part of this evaluation. New permissible lengths were calculated to correspond to the lower voltage which could exist at an MCC should the 4.16 kV buses reach the previous degraded voltage setpoint. The new lengths were then compared to the totalized lengths for safety related circuits compiled in the earlier study. With one exception, all the scheduled circuit lengths were below the new permissible lengths.

The single exception, the circuit for diesel generator room supply fan DCGM01B had subsequently been modified by Union Electric for other reasons, at which time the addition of an auxiliary relay effectively reduced the critical control circuit length to a negligible value. In order to determine if, prior to the UE modification, a possible safety concern existed, the circuit in place prior to the modification was examined in detail. The actual cable lengths (determined by field verification) for this circuit were compared to those used in the circuit study. The study had used scheduled cable lengths known to often be conservatively long. The cable lengths determined through a field walkdown were significantly less than the scheduled lengths. The total control circuit length when recalculated with the actual cable lengths was well below the new permissible length discussed above.

To further ascertain proper operation of this circuit, a load flow case which modelled the system condition before the fan was starting was studied. The results of this case demonstrated that with 4.16 KV bus NB02 at the previous degraded voltage setpoint, the MCC loading without the DG room fan running was such that the voltage at MCC NG04D was greater than 92%.

Based upon the analyses described above, it was confirmed that the setpoint discrepancy did not cause a safety concern and, therefore, is not reportable to the NRC under the provisions of 10 CFR Part 21.

In conclusion, we feel that the failure to revise the LSELS setpoint calculation in response to a revision of a referenced calculation was an isolated instance of an oversight and is not representative of a generic problem. As discussed above this isolated setpoint discrepancy does not represent a reportable deficiency under 10 CFR 21.

DEGRADED VOLTAGE SETPOINT REVISION AND VOLTAGE SAFETY LIMIT ANALYSIS

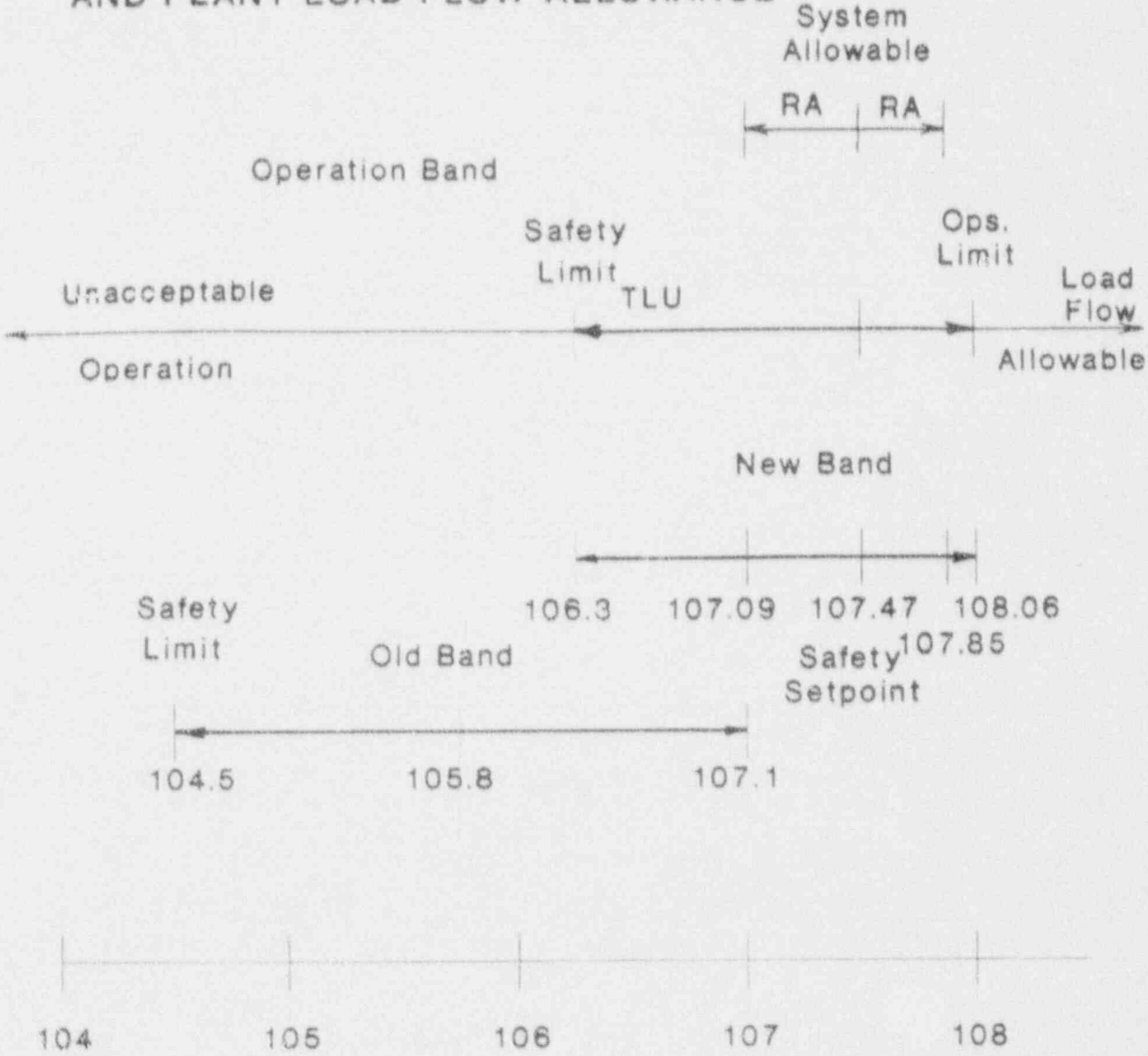
DESIGN CHANGE CMP 91-1034 REVISES THE DEGRADED VOLTAGE SETPOINT AND THE TOLERANCE FROM 104.5 +2.6/ - 0 VOLTS TO 107.47 +/- 0.38 VOLTS. THIS CHANGE INVOLVES A CHANGE TO THE PLANT TECHNICAL SPECIFICATIONS.

THIS SETPOINT CHANGE INCLUDES:

1) A REVISION IN THE ANALYSIS OF THE LOOP TOLERANCES USING ISA STANDARD DRP 67.04 --- CALLAWAY USES PROCEDURE J-U-GEN TO PERFORM THIS ANALYSIS.

2) A REVISION OF THE LOWER LIMIT OF THE DEGRADED VOLTAGE VOLTAGE SETPOINT BAND --- THIS IS CONSIDERED AS A SAFETY LIMIT. THIS VOLTAGE LIMIT IS PRODUCED USING LOAD FLOW TECHNIQUES. THE LOAD FLOW CONSERVATISMS BASED ON INITIAL DESIGN ASSUMPTIONS ARE BEING REVISED USING ACTUAL COMPONENT DATA AND OPERATIONAL CONSIDERATIONS. THE RESULTS OF THIS ANALYSIS IS USED AS THE SAFETY LIMIT.

DEGRADED VOLTAGE LOOP UNCERTAINTY BREAKDOWN AND PLANT LOAD FLOW ALLOWANCE

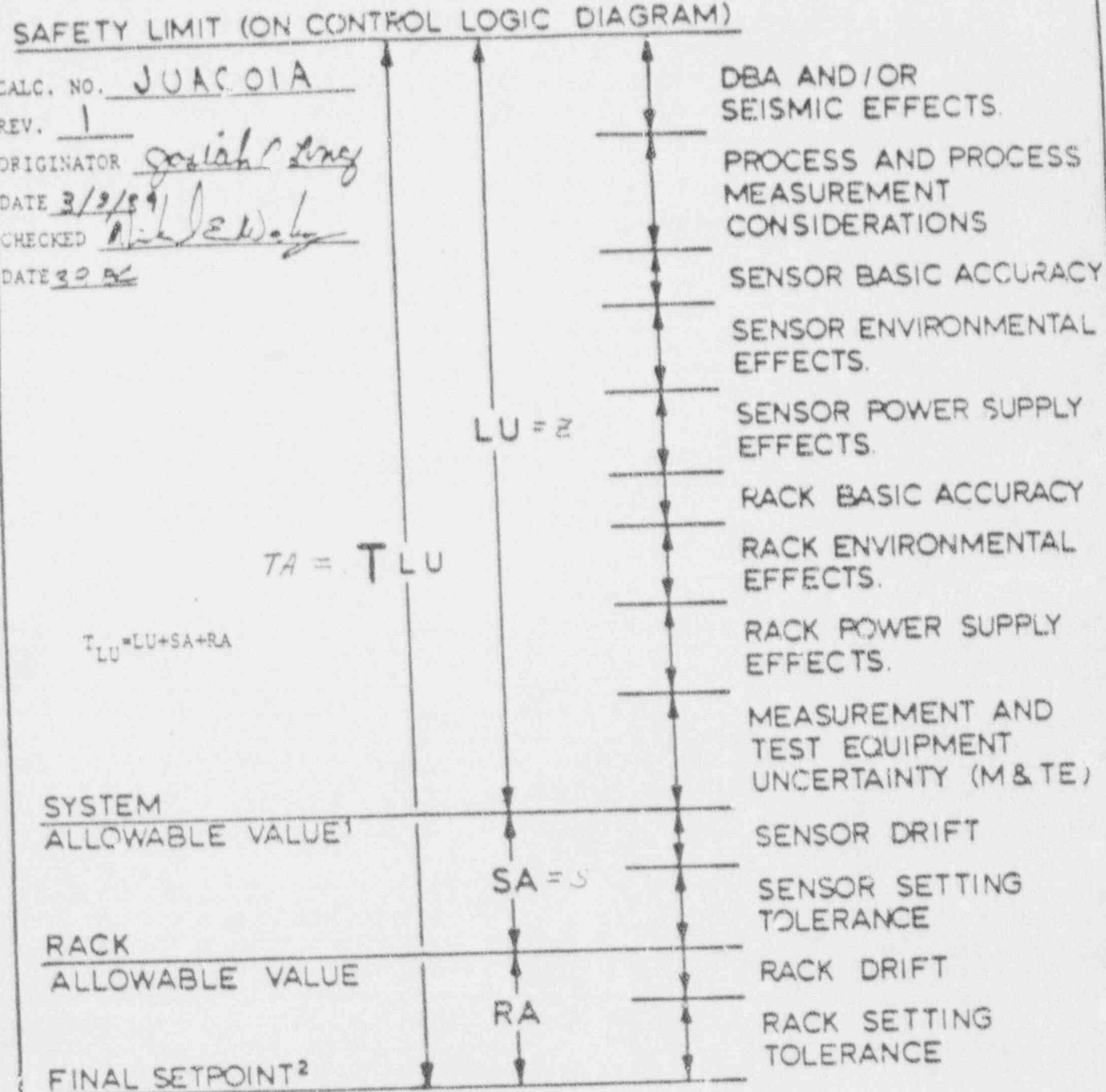


Job # 10884

Appendix A
Sheet 1 Of 1

BALANCE OF PLANT
SETPOINT UNCERTAINTY BREAKDOWN

CALC. NO. JUAC01A
REV. 1
ORIGINATOR Josiah C Long
DATE 3/9/89
CHECKED [illegible]
DATE 30 BC



1. TECHNICAL SPECIFICATION ALLOWABLE VALUE.
2. TECHNICAL SPECIFICATION TRIP SETPOINT.

NOTE: THIS DIAGRAM IS ONLY INTENDED TO ILLUSTRATE THE COMPONENTS CONSIDERED IN THE INSTRUMENT LOOP UNCERTAINTY AND THEIR RELATIONSHIP TO THE SAFETY LIMIT, TRIP VALUES, AND FINAL SETPOINT. UNDER NO CIRCUMSTANCE IS THIS DRAWING INTENDED TO IMPLY THE SPECIFIC COMBINATION OF THE COMPONENTS INVOLVED.

SUMMARY OF UNION ELECTRIC
SOS 91-0469

DESCRIPTION

During Union Electric's Electrical Distribution Safety Functional Assessment (EDSFA) of the Callaway Nuclear Plant, a concern was raised regarding the setting of the degraded voltage setpoint. The setting at that time was 104.5 volts whereas a setting of 106.2 volts was appropriate.

A degraded voltage setpoint of 104.5 volts was calculated in Calculation E-H-8 based on data taken from load studies in Calculations E-B-17 and E-B-5 which provide the NB bus voltage level at which the Motor Control Center (MCC) control circuits would be capable of functioning properly. Subsequent to the original issue of Calculation E-H-8, the NB bus voltage level data of Calculation E-B-17 was revised, but the revised data was not reflected in a revision to Calculation E-H-8. This failure to revise the degraded voltage setpoint means that given the specific abnormal equipment line-ups and assumptions of the load flow study case, a degraded voltage condition could exist on the MCC control circuits before the automatic protection functions to remove that source. This condition would not meet the requirements of NRC Branch Technical Position BSP-1. Using the values from the latest approved load flow analysis, Calculation ZZ-62 Revision 0, the setpoint should more appropriately be 106.2 volts.

OPERABILITY

The plant is considered operable for all past operations. This is demonstrated by an analysis of the plant electrical system using load flow techniques which shows, with the current analyzed loads, that at no time would the voltage at any service level drop to the point at which any component would become inoperable. Calculations ZZ-62 Revision 0, E-B-5 Revision 3, E-B-17 Revision 1, and E-B-18 Revision 0 present the analyzed load cases. They show that the minimum design switchyard voltage of 345 kV would be adequate when the NP busses are not tied together when LOCA loads are on the busses. The calculations show that if site loads are not transferred prior to tying the busses to one ESF transformer, a switchyard voltage of 350.4 kV would be adequate to support operability of all components. (This is a worst case abnormal line-up in which the plant enters a Tech Spec action statement because operation on the emergency diesel generator is not preferred and the bus' normal ESF transformer is not available). The following provides additional detail for the determination of past operability:

- Per Calculation E-B-17, the switchyard design values are currently 345.0 kV to 372.6 kV. Calculations ZZ-62 Revision 0, E-B-17 Revision 1, E-B-18 Revision 0 shows that the switchyard may be operated in that range, provided that the site load is transferred prior to tying both NB busses to one ESF transformer.

- Per Calculation E-B-18 Revision 1, the switchyard minimum voltage required would be 350.4 kV if no load transfers are completed prior to tying both NB busses to XNB02 and the minimum is 346.5 kV if no load transfers are completed prior to tying both NB busses to XNB01.

- At no time has Callaway entered action statement 3.8.3.1.A in which both busses are fed from one ESF transformer during Modes 1, 2, 3 of 4.

- At no time has Callaway failed the monthly surveillance in which the switchyard voltage is inspected to see that the voltage is between 353.62 to 372.6 kV. This lower value of 353.62 kV is conservative for the current design during any plant configuration.

  This value had been the minimum allowed in 1985 when transformer taps were being adjusted. It had not been changed to the lower value of 350.4 kV because the tolerances of the devices measuring were large for measuring the switchyard voltage. A better indication has since been provided but this conservatism has not yet been reduced.

- Logs of the switchyard voltage were reviewed for voltages recorded for the past two years. These logs show an hourly integrated averaged voltage for data read every two seconds. At no time was the voltage seen to drop below the required minimum switchyard voltage was 353.62 kV. The lowest indicated switchyard voltage was 355.6 kV. This indicates that the degraded voltage bistables would not have been challenged. The indicated mean voltage was 362.0 kV with a standard deviation of 1.87 kV. The lower confidence limit is 362.68 kV for a confidence factor of 99.9999426%. This indicates that the voltage would have been below 352.68 kV for a total of 2.3 minutes over a 7.5 year time span. The time needed to produce a trip on degraded voltage is approximately two minutes so it is very unlikely that a trip would have occurred.

The requirement to have a device to detect and remove the bus off of the degraded sour - is from NRC Branch Technical Position PSB-1. This equipment provides additional protection against circumstances not designed for, which may create inoperable equipment when a degraded voltage is present that is not sufficient for equipment to operate. Loss of this function would be a loss of a safety function and an improper setpoint would present a substantial safety hazard if found not to function before any equipment important to safety was made inoperable. This would be reportable under 10 CFR Part 21. Currently Bechtel believes that the old setpoint was adequate, however, most normal conservatisms would be removed or greatly reduced in demonstrating the adequacy of the old setpoint.

Other mitigating factors are:

- One safety-related 480 V bus undervoltage alarm on each train is currently set so that it would have alarmed prior to any equipment becoming inoperable. These are on busses NG01 and NG02.
- At no time have the existing degraded voltage bistables been actuated during normal service. This would have produced an ESF actuation that would have shed the loads from the affected train, started the emergency diesel generator and sequenced loads on the bus.

The facts and data presented above show that at no time would any device have misoperated due to low voltage. This means that all components providing a safety function were operable whether or not the bistable degraded voltage setpoint were proper. Also, at no time should the bistables have been called upon to operate.

CORRECTIVE ACTION TO PREVENT RECURRENCE

A recalculation of the degraded voltage setpoints was performed and shows that the minimum allowable voltage sensed off the NB busses must be at least 106.3 volts versus the old value of 104.5 volts.

As an interim solution, work requests were generated to increase the setpoint to be in the range of both tolerance bands. The settings were specified to be set from 106.3 to 107.1 volts, i.e., it was still in the current licensed values and in the new calculated values. Also, procedures were revised to contain the interim band, as a desired band, to which the overall loops should be calibrated. This was noted to be in effect until a design change could be completed which approved and licensed new values for the degraded voltage setpoints.

While the problem was not created from a UE design program, the UE program was checked for possible improvements. It appeared that the problem occurred when one calculation was revised, but another affected calculation was not.

A design basis program has been instituted that placed in a computer database sortable information that can cross-reference the design calculations to identify other affected calculations. This would aid the existing procedural requirement to review for and change any impacted calculation as necessary during the design change process. This was developed due to an earlier QA audit finding and has been found acceptable.

Additionally, management is implementing a program in which design guides are produced for those designs which are commonly made. These will present interfaces which may not be readily apparent, to supplement existing procedures and knowledge. It is expected that load flow, voltage drop and the degraded voltage setpoints will be addressed in one of these guides.

A modification is being implemented to change the LSELS bistable setpoints. A Tech Spec change will be processed and approved with the modification. The modification is expected to be final pending NRC approval of the Tech Spec change.