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September 19, 1995
RC-95-0232

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: S. Dembek

Gentlemen:

Subject: VIRGIL C. SUMMER NUCLEAR STATION
DOCKET NO. 50/395
OPERATING LICENSE NO. NPF-12
RELIEF FROM BRANCH TECHNICAL POSITION EICSB 18
FOR XVG8133 A AND B (PRA 940001-1)

In a letter dated May 19, 1994, from J. L. Skolds to the Document Control Desk (RC-94-0142), South Carolina Electric & Gas Company (SCE&G) provided notification of a potential problem at the V. C. Summer Nuclear Station (VCSNS). The issue involved the spurious closure of valves XVG-8133A or B while the "B" Charging/SI pump is out of service and the "C" Charging/SI pump is aligned to "B" train. (Reference Attachment I for a simplified drawing.) A single failure of this type could possibly result in a loss of automatic high pressure injection flow. As discussed, VCSNS and Westinghouse considered this failure to be a low probability event and SCE&G requested concurrence from the NRC that no action is necessary. SCE&G has not received a written response to that letter and has performed additional reviews of the issue and determined that corrective actions to meet Branch Technical Position EICSB 18 are not justified when considering cost versus the possible safety benefit.

It is requested that the NRC review this issue in the light of Cost Beneficial Licensing Actions (CBLA) and the NRC Final Policy Statement on "Use of Probabilistic Risk Assessment in Nuclear Regulatory Activities" (effective date August 16, 1995). The policy statement states, in part, that "PRA and associated analyses (e.g., sensitivity studies, uncertainty analyses, and importance measures) should be used in regulatory matters, where practical within the bounds of the state-of-the-art, to reduce unnecessary conservatism associated with current regulatory requirements, regulatory guides, license commitments, and staff practices."

SCE&G has performed a detailed Probabilistic Risk Assessment (PRA) on the spurious closure of the XVG-8133A & B valves. The spurious closure of these valves has a Risk Reduction Worth (RRW) of 1.0, that is, when these valves were modeled with a spurious closure failure probability of 0.0 (valves never spuriously close), no discernible reduction in Core Damage Frequency (CDF) resulted. This indicates that any modification or administrative control to prevent spurious closure of these valves would not improve plant safety. It was also determined that there was no discernible increase in CDF when the spurious closure failure rates were increased by a factor of 100. (Details of this analysis are provided as Attachment II.) Branch

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Technical Position EICSB 18 states that "Where a single failure in an electrical system can result in loss of capability to perform a safety function, the impact on plant safety must be evaluated." This analysis found that spurious closure of these valves has negligible safety impact.

VCSNS also reviewed the cost of changes to comply with Branch Technical Position EICSB 18. A modification to install power lockouts to prevent spurious closure for these valves is estimated to cost $185,000. If this modification was not performed, then per Branch Technical Position EICSB 18, Operations personnel would be required to continue to remove power from each of these valves whenever the "B" charging pump was in test or maintenance and "C" pump was placed in standby. This operator "workaround" distracts Operations personnel from other more important tasks and in this case provides minimal safety benefit.

The PRA demonstrates that complying with Branch Technical Position EICSB 18 for these valves does not improve plant safety. Compliance would be costly and would not be justified as there is minimal safety benefit. Unlike the majority of other valves which have power lockouts to comply with EICSB 18, a "pre-accident" misalignment of these valves is unlikely. Spurious closure of either XVG-8133A or B would cause a loss of RCP seal injection, and be immediately detected by control room operators. Spurious closure would have to occur immediately prior to, or during, the injection phase of an accident to be significant.

Since submittal of the May 19 letter, VCSNS has established an administrative control to remove power from these valves when "C" pump is placed in standby. SCE&G requests that the NRC provide relief from Branch Technical Position EICSB 18 for these valves and permit the administrative control of these valves to be discontinued. If the NRC accepts this request, prior to discontinuing the administrative controls, VCSNS will revise the Emergency Operating Procedure to specifically address these valves during the verification step for SI alignment. This will ensure that actions are taken to restore proper system alignment in the unlikely event that a spurious closure should occur.

Should you have any questions about this issue, please call Mr. John Cobb at (803) 345-4213 at your convenience.

Very truly yours,

FOR GJT

Gary J. Taylor

JMC/GJT/nkk
attachment

c: J. L. Skolds
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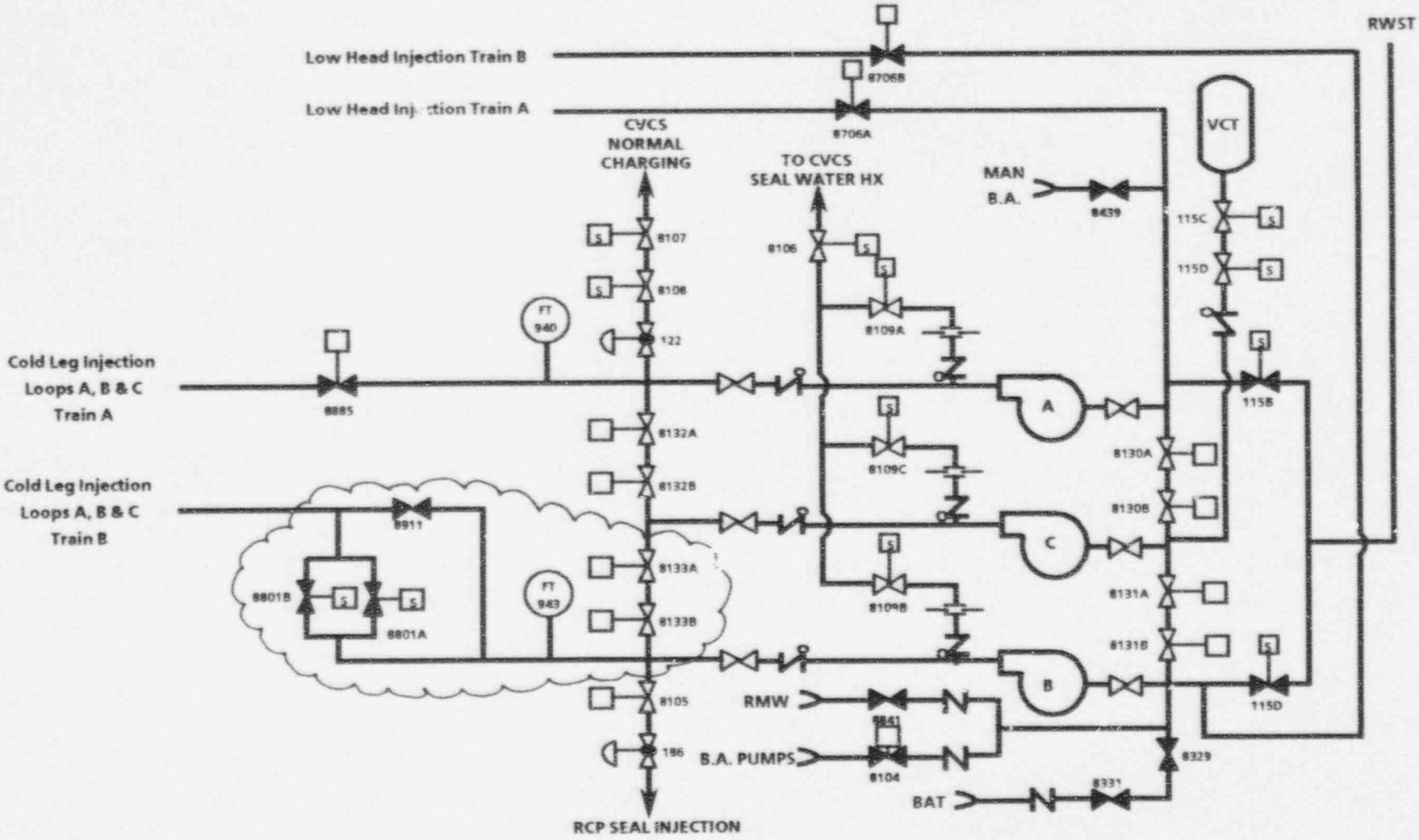
EMERGENCY CORE COOLING SYSTEM



PRA Analysis
Spurious Closure of Charging/SI Pump Discharge
Header MOVs (XVG 8133A or B)

A PRA analysis was performed to determine the risk impact of the spurious closure of valves XVG-8133A or B while the "B" Charging/SI pump is out of service and the "C" Charging/SI pump is aligned to "B" train. The purpose was to determine whether any significant safety benefit is associated with performing modifications to install power lockouts on these valves or implementing administrative controls to remove power from the operators when "B" pump is in test or maintenance.

SUMMARY OF RESULTS:

The key finding of this analysis was that when the spurious closure failure probabilities of these valves were set to 0.0 (valve never fails), no discernible reduction in Core Damage Frequency (CDF) resulted. This indicates that the modification or administrative controls would not measurably improve safety.

METHODOLOGY:

The analysis was performed using the PRA model for VCSNS and the IPE Post Processing Tool (PPT) software code. Multiple sensitivity runs were performed to evaluate the mode of interest and to check the PRA model to validate the analysis. The major steps in the review were as follows:

a) Identify affected basic events for spurious closure of XVG-8133A and B valves and test and maintenance (T&M) of "B" Charging/SI pump, XPP-0043B.

b) Run PPT with XVG-8133A and B valves spurious closure failure probabilities set to 0.0 (valves never spuriously close) to simulate possible benefit of changes.

c) Run PPT with XVG-8133A and B valves spurious closure failure probabilities set to 1.0 (valves always spuriously close) to check model for truncation or cutoff errors.

d) Perform various PPT runs to verify that errors in mission times, hourly failure rates, or amount of time "B" pump is in T&M do not invalidate results.

Details of the steps involved and their results follow. Table 1 summarizes the results from the PPT runs. A more detailed discussion is included in the text that follows the table.

Table 1 - Summary of Sensitivity Runs

(See text which follows for further discussion. Numbering of runs is taken from the text which follows.)

Sensitivity Run	PPT Result	Analysis
2) XVG-8133A and B valves spurious closure = 0.0 (valves never spuriously close)	No discernible change from base case CDF	There was no discernible reduction in CDF from the base model, therefore there is negligible improvement in plant safety if changes were made.
3) XVG-8133A and B valves spurious closure = 1.0 (valves always spuriously close)	199% increase from base case CDF	Checks that the failure modes are modeled and are not truncated or cutoff. Significant increase in CDF (199%) indicates that the model would identify risk if it existed.
4) XVG-8133A and B valves spurious closure increased by a factor of 10	No discernible change from base case CDF	Checks the NUREG/CR-2815 hourly failure rate and the mission time. An error in either multiplier by a factor of 10 would not change the results.
5) XVG-8133A and B valves spurious closure increased by a factor of 100	No discernible change from base case CDF	Further check on hourly failure rate and mission time. Demonstrates that an error in either multiplier by a factor of 100 (or each by a factor of 10) would not change results.
7) B pump T&M increased to maximum expected value of .33	0.3% increase from base case CDF	Provided as a reference point for comparison to the sensitivity runs that follow. Runs will be used to determine whether a large increase in pump T&M would affect results.
8) B pump T&M @ .33 and 8133 valves spurious closure = 0.0	No discernible change from pump only CDF (Run 7)	Confirms that even if the pump T&M was significantly increased that the changes would not measurably improve CDF.
9) B pump T&M @ .33 and 8133 valves spurious closure times 10	No discernible change from pump only CDF (Run 7)	Checks the hourly failure rate and the mission time if the pump T&M was significantly increased. Demonstrates that an error in either multiplier by a factor of 10 would not change the results.
10) B pump T&M @ .33 and 8133 valves spurious closure times 100	0.3% increase from pump only CDF (Run 7)	Further check on hourly failure rate and mission time if the pump T&M was increased. Demonstrates that an error in either multiplier by a factor of 100 adds 0.3% to the pump alone or 0.6% above base.

Note: The PPT returns the calculated total CDF with 3 significant digits. The base CDF for this analysis is 1.006E-4. "No discernible change in CDF" means that the value of 1.006E-4 was returned by the PPT. Small changes, less than 0.1%, may exist, but these are considered negligible.

1) Identify affected basic events for spurious closure of 8133 valves and test and maintenance (T&M) of "B" Charging/SI pump, XPP-0043B. The spurious closure hourly failure rate (2E-7 failures per hour), which is multiplied by the mission time to obtain the failure probability, is taken from NUREG/CR-2815, "Probabilistic Safety Analysis Procedures Guide", Vol. 1, Rev. 1, Aug. 1985.

2) Run PPT with XVG-8133A and B valves spurious closure failure probabilities set to 0.0 (valves never spuriously close). This is a conservative means of evaluating the impact on CDF if the power lockout modification or administrative controls to remove power from the valve operators was implemented. There was no discernible reduction in CDF from the base model therefore there is negligible improvement in plant safety if these changes were made. The reason why there is no discernible reduction in CDF is that the original spurious closure failure probability is so low that it is negligible within the other core damage sequences. As stated previously, the spurious closure failure rate is taken from NUREG/CR-2815.

3) Run PPT with XVG-8133A and B valves spurious closure failure probabilities set to 1.0 (valves are assumed to always fail). This run is a check that the failure modes are modeled and are not truncated or cutoff such that they would not appear in a sensitivity run. The resulting significant increase in CDF (199%) indicates that the model would identify risk if it existed.

4) Run PPT with XVG-8133A and B valves spurious closure failure probabilities increased by a factor of 10. This run provides a check on the NUREG/CR-2815 hourly failure rate and the mission time and demonstrates that an error in either multiplier by a factor of 10 would not change the results. It is an additional check that the changes would not measurably improve the CDF. Since increasing the failure probabilities by a factor of 10 did not measurably increase CDF, then the statement that "The reason why there is no discernible reduction in CDF is that the original spurious closure failure probability is so low that it is negligible within the other core damage sequences" is further supported.

5) Run PPT with XVG-8133A and B valves spurious closure failure probabilities increased by a factor of 100. This run provides a further check on the NUREG/CR-2815 hourly failure rate and the mission time. It demonstrates that even an error in either multiplier by a factor of 100 (or each multiplier by a factor of 10) would not change the results. It is an additional check that the modifications or administrative controls would not measurably improve the CDF.

6) Determine an appropriate, conservative (maximum expected) assumption for the amount of time "B" pump is in T&M and "C" pump is in standby, aligned to "B" train. The review to determine a conservative value for the amount of time "B" pump is in T&M and "C" pump is in standby, aligned to "B" train, found 1/3 of the year as a maximum expected value. The "normal" alignment is "A" pump in service providing charging flow with "B" pump in standby to provide SI flow if required. "C" pump is sometimes aligned to "A" train when "A" pump is in T&M, and is sometimes aligned to "B" train when "B" pump is in T&M. Since two of three pumps are normally in service, we can conservatively assume that the service hours are split equally among the three pumps giving a value of each

pump in service for 2/3 of the year or conversely, each pump is in test or maintenance for 1/3 of the year. Actual plant data shows that the "B" pump has been in test or maintenance much less than 1/3 of the year. Actual data shows that "B" pump has been in T&M for .06 (or 6%) of the year. The .06 value is used in the base PPT model. Sensitivity runs using the value of .33 are very conservative but provide a check that a large increase in "B" pump T&M does not invalidate the analysis results.

7) Run PPT with "B" pump T&M set to the maximum expected time. This run increased the "B" pump T&M to the maximum expected value of 1/3. This run resulted in an increase in CDF of 0.3% from the base model and is provided as a reference point for comparison to the sensitivity runs that follow.

Note: The following runs were performed to ensure that synergistic effects associated with an increase in "B" pump T&M and the XVG-8133A and B valves do not invalidate the previous results.

8) Run PPT with 8133 valves spurious closure failure probabilities set to 0.0 **and** "B" pump T&M set to maximum expected time. This run assumes that the 8133 valves never spuriously close and increases "B" pump T&M to .33. There was no discernible reduction in CDF from the run above. This confirms that even if the pump T&M was significantly increased that the changes would not measurably improve CDF.

9) Run PPT with 8133 valves spurious closure failure probabilities increased by a factor of 10 **and** "B" pump T&M set to maximum expected time. This run increases the spurious closure by a factor of 10 and increases "B" pump T&M to .33. It provides a check on the NUREG/CR-2815 hourly failure rate and the mission time if the pump T&M was significantly increased. There was no discernible reduction in CDF from the run above where the pump T&M was set at .33. It demonstrates that an error in either multipier by a factor of 10 would not change the results. It is an additional check that the changes would not measurably improve the CDF.

10) Run PPT with 8133 valves spurious closure failure probabilities increased by a factor of 100 **and** "B" pump T&M set to maximum expected time. This run increases the spurious closure by a factor of 100 and increases "B" pump T&M to .33. It found that if the pump T&M was increased significantly and there was a large error in the NUREG/CR-2815 hourly failure rate or mission time that only a slight increase (0.3% above the change with the pump T&M increased to .33)in CDF resulted.

CONCLUSION:

The results of the individual sensitivity studies are described above. The overall conclusion is that the spurious closure of the XVG-8133A and B valves are a low probability event that does not significantly contribute to Core Damage Frequency, and that if the spurious closures are modeled to never occur that no discernible improvement in CDF results. Additional sensitivity runs to verify the results did not identify any inconsistencies or errors of modeling. These checks found that the failure modes are modeled and respond appropriately (as anticipated) to large changes, and that large increases in the pump T&M times and errors in failure rate or

mission time do not invalidate the conclusion that plant changes would not have a measurable safety benefit.

DETERMINISTIC REVIEW:

While it may appear that the removal of a possible failure mode would result in an improvement in plant safety, this was found to be insignificant in the case of these particular valves. Using industry data on spurious closure of motor operated valves as a baseline, the PRA model showed no discernible improvement in CDF if this failure mode was completely eliminated for these particular valves.

This PRA analysis did not take credit for operator action if this failure mode did occur. A "pre-accident" misalignment of these valves is unlikely. Spurious closure of either XVG-8133A or B would cause a loss of RCP seal injection, and be immediately detected by the control room operators. Spurious closure would have to occur immediately prior to, or during, the injection phase of an accident to be significant. The 8133 valves are on the BISI (Bypassed and Inoperable Status Indication) display and operators are expected to respond and establish an alternate flow path if the automatic "B" train high head safety injection flow path was lost. Alternate cold leg injection is available via the "A" train path through valve XVG-8885. XVG-8885 was tested under the Generic Letter 89-10 Motor Operated Valve program and found to be capable of opening against Charging/SI pump shutoff head. No credit was taken for this action in this analysis as it would require operator action to establish this flow path.

REFERENCES:

1) IPE model PRA4A_MU as verified by TWR "Verification of TWR PRA1 EF1 2/21/95 Deletion of EFW Check Valves 1038 & 1039 A,B,C" , R. H. Lichtenstein, February 21,1995.

2) IPE Post Processing Tool Software, Version 1.0 dated 3/10/94 supplied by Westinghouse.

3) Design Calculation DC00300-005, PRA System Notebook - ECCS.

4) NUREG/CR-2815, "Probabilistic Safety Analysis Procedures Guide", Vol 1, Rev. 1, Aug. 1985.

5) Engineers Technical Work Record, "PRA Analysis of Spurious Closure of XVG-8133A or B," J. M. Cobb, August 28, 1995.

COMPUTER CODES:

Program	Version	Date	ISD Approved	Next Periodic Test
IPE	1.0	3/10/94	5/10/94	12/3/95