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SCE&G® A SCANA COMPANY

November 11, 2006
RC-06-0204

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

ATTN: Mr. R. E. Martin

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS)
DOCKET NO. 50/395
OPERATING LICENSE NO. NPF-12
RESPONSE TO NRC QUESTIONS REGARDING
RESPONSE TO GENERIC LETTER 96-06
(TAC NO. M96872)

References:
1. J. B. Archie (SCE&G) Letter to Document Control Desk (NRC), Response To NRC Generic Letter 96-06: Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions - Change to Commitment Implementation Schedule, October 8, 2006
2. R. E. Martin (NRC) Letter to J. B. Archie (SCE&G), VIRGIL C. SUMMER NUCLEAR STATION - REVIEW OF RESPONSE TO GENERIC LETTER 96-06 CONCERNING WATERHAMMER AND TWO-PHASE FLOW (TAC NO. M96872), August 22, 2006
3. J. B. Archie (SCE&G) Letter to Document Control Desk (NRC), Response to NRC Request for Additional Information Regarding SCE&G Response to Generic Letter 96-06, RC-05-0204, December 12, 2005

South Carolina Electric & Gas Company (SCE&G) received an NRC letter dated August 22, 2006 (Reference 2) presenting a request for additional information (RAI) regarding the VCSNS response to Generic Letter (GL) 96-06 submitted December 12, 2006 (Reference 3). SCE&G reviewed these questions in consideration of the activities conducted to address the GL 96-06 issues.

In Reference 3, SCE&G committed to implementation of plant modifications during the VCSNS refueling outage (RF-16) scheduled for October, 2006. This schedule was structured based on modification design being complete, including all necessary planning, prefabrication, needed materials and personnel resources available and dedicated to the planned modification.

Due to vendor delays, reduced personnel resources, and other challenging plant modifications being implemented during RF-16, SCE&G determined that implementation of the modification should be deferred until the subsequent VCSNS refueling outage (RF-17) scheduled for Spring 2008.

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VCSNS Management met with NRC VCSNS Project Management and the Generic Letter 96-06 technical reviewers on September 13, 2006, where continued plant safety and implementation status was discussed. There are no safety concerns related to this schedule change.

SCE&G is providing the attached response to address questions presented in Reference 2.

<u>Summary of Commitments</u>

SCE&G makes the following commitments as further discussed in the attachment to this letter:

VCSNS has initiated a plant modification that will accomplish three changes to the current plant configuration for Service Water (SW) discharge from the Reactor Building Cooling Units (RBCUs).

Engineering Change Request (ECR) 50567 has been initiated to develop, implement, and document the modification. The planned modification was discussed with NRR at a public meeting held in Washington, DC on September 13, 2006. SCE&G Management presented reasons for a change in commitment for implementation of the planned modification. The modification has been deferred to Refuel 17 (Spring 2008). This change in implementation schedule was further identified through an October 8, 2006 SCE&G letter to the Document Control Desk (Reference 1).

The planned modification that SCE&G commits to implement in the effort to mitigate waterhammer will include:

- Gate valves 3107A and 3107B will be replaced with fast closing butterfly valves that close in seven seconds upon de-energizing of Service Water Booster Pump (SWBP) A/B.
- The opening logic of valves 3107A and 3107B will be modified to have a 5 seconds delayed opening after the respective SWBP A/B starts.
- Vacuum relief valves will be installed downstream of valve 3107A and B.

These changes are not required to address any deficiencies in the ability of the plant to meet its current design and licensing basis, but they will reduce operator burden and increase design margins. These changes are currently scheduled for completion in RF-17 (Spring 2008).

If you have any questions or require additional information, please contact Mr. Robert Sweet at (803) 345-4080.

I certify under penalty of perjury that the information contained herein is true and correct.

11/11/06
Executed on

Jeffrey B. Archie
Vice President, Nuclear Operations

JT/JBA/dr

Attachment:

c: K. B. Marsh
S. A. Byrne
N. S. Carns
J. H. Hamilton (w/o Attachments)
R. J. White
W. D. Travers
R. E. Martin
NRC Resident Inspector
K. M. Sutton
NSRC
CER (C-02-3455)
File (815.14)
DMS (RC-06-0204)

South Carolina Electric & Gas Company (SCE&G)
Virgil C. Summer Nuclear Station (VCSNS)
Response to NRC Request for Additional Information (RAI)
Regarding SCE&G Response to Generic Letter (GL) 96-06

1. **The licensee's December 12, 2005, response (pages 5-7 of the Attachment) discusses boundary valve leakage considerations. The worst-case scenario for the GL 96-06 waterhammer event is discussed on pages 15 and 16 of the Attachment. The licensee's analyses of the GL 96-06 waterhammer event scenarios are valid for the specific conditions that have been assumed. If excessive boundary valve leakage occurs, a void could form on the upstream side of the RBCUs that has not been evaluated by the licensee. The licensee's response dismisses this as an incredible occurrence due to the large volume of water that would have to drain from the RBCUs before a void could actually form. However, some containment fan coolers are designed such that the cooling water supply piping enters at the top in order to keep the water from gravity draining should cooling water leak occur. The licensee has not established that the RBCUs at Summer will in fact gravity drain.**

   Aside from the RBCU design consideration, back-leakage through the SWBP discharge check valves could void the RBCU supply piping upstream of the RBCU supply check valves, resulting in a water column separation of about 63 feet in height (due to a loss of offsite power while cooling is being provided by the SWBPs). Also, because the industrial cooling (IC) cooling system is non-safety related, its integrity cannot be relied upon for loss-of-coolant accident (LOCA) mitigation and the IC system supply side check valves must be relied upon to prevent excessive back-leakage and void formation. However, this is less of a concern than leakage through the SWBP discharge check valves because the IC system is a relatively clean, closed loop system.

   On the discharge side of the RBCUs, the RBCU outlet isolation valves must also be relied upon to prevent excessive seat leakage in order to prevent voiding in the piping between the RBCUs and the RBCU discharge isolation valves. Again, the integrity of the IC system cannot be relied upon for LOCA mitigation.

   Given these considerations, it is the NRC staff's view that the RBCU boundary isolation valves must be credited for maintaining the water column in the upstream and (to some extent) in the downstream RBCU piping. This view is also consistent with the analysis that was performed by Sargent and Lundy and submitted by SCG&E in a letter dated May 11, 2000. Therefore, in order for the licensee's GL 96-06 waterhammer evaluation to remain valid over time, assurance must be established that the RBCU boundary valves will not leak excessively as the plant ages. This can be accomplished by explicitly crediting the technical specifications (TS) surveillance testing that is referred to on page 17 of the Attachment, and by revising the TS Bases accordingly. Alternatively, other programs for confirming that excessive RBCU boundary valve leakage does not exist can be credited, such as performing periodic valve seat leakage testing. Please discuss measures that will be taken to confirm that the excessive RBCU boundary valve seat leakage does not exist over time, and confirm that the Final Safety Analysis Report and the inservice testing program for Summer will be revised to properly reflect the importance of the closing function of the RBCU boundary

valves for preventing water column separation and voiding in the RBCU cooling water supply and outlet piping.

Response 1:

Reference: J. B. Archie (SCE&G) Letter to document Control Desk (NRC), Response to NRC Request for Additional Information Regarding SCE&G Response to Generic Letter 96-06, RC-05-0204, December 12, 2005

Refer to Figure 1 (p. 12) for simplified system flow diagram for RBCU cooling. Train A is depicted with Train B similar.

VCSNS has a Train A piping arrangement with two Reactor Building Cooling Units (RBCU) and a Train B piping arrangement also with two RBCUs. During normal plant operating conditions the RBCUs are aligned with the Industrial Cooling (IC) system with the use of three of the four RBCUs. Under accident conditions upon ESF activation, the RBCUs are aligned with the Service Water (SW) system with one RBCU from each train in use. Therefore, both trains are always in operation. This is important to note because voiding, and consequential waterhammer, can not occur while there is flow to the RBCUs.

The possibility of voiding due to back flow or back leakage through the valves in the RBCU supply piping during no flow conditions is evaluated in Appendix 1 (p. 3). During RBCU operations, no flow conditions occur during the switch over of RBCU cooling from the IC system to the SW system and vice versa. In addition, voiding could occur in the isolated system branch piping due to valve leakage back to the isolated system. It is concluded in Appendix 1 that column voiding of the size to create a significant waterhammer in the supply piping to the RBCUs during periods of no flow can not occur due to back flow or valve leakage back into the IC system or back into the SW system.

Appendix 2 (p. 10) contains a description of the function of each valve in the RBCU supply piping and the test program applicable to each valve.

In that the leakage through the valves can not create significant voids in the RBCU supply piping, an expanded test program from that detailed in Appendix 2 is not warranted.

The Final Safety Analysis Report and the system Design Basis Documents will be revised to reflect the closing function of the RBCU boundary valves for preventing water column separation and voiding in the RBCU cooling water supply and outlet piping.

RESPONSE 1, APPENDIX 1

Evaluation of possible voiding in the RBCU supply piping due to back flow or back leakage through the valves during no flow conditions

Valve designations and descriptions (Refer to Figure 1, page 12):

XVB03106A(B)	-	SW System isolation and containment isolation valve; motor operated butterfly valve
XVC03135A(B)	-	SW System check valve
XVB03110A(B)	-	IC System isolation and containment isolation valve; motor operated butterfly valve
XVC03136A(B	-	IC System check valve
XVC03137A(B)	-	Common SW and IC system redundant check valve in RBCU supply header piping

These valves are all within the safety related, ASME Code class piping boundaries and can be relied upon to perform their function.

NOTE: The time in which a train is removed from service for maintenance is not considered. The fill and vent of the piping after the maintenance is considered to be a normal activity of the steps required for the maintenance.

- RBCUs aligned with the Industrial Cooling (IC) system during normal operations:

  This is the normal operating configuration for the operational RBCUs. During this alignment, the SW system supply piping is isolated by the closed butterfly valve XVB03106A(B) and closed check valve XVC03135A(B). Continuous flow exists from the IC system provided by the IC pumps. The IC system is a closed loop system. IC system inventory is maintained by an unvented expansion tank (XTK0116) with level indication and automatic continuous makeup provided from the Filtered Water System. The IC system is a non safety related system but can be relied upon during normal plant operations. Therefore, with continuous flow, no voiding is possible in the IC system supply piping and the supply header to the RBCUs.

  During the RBCU alignment with the IC system, no flow exists in the Service Water (SW) system supply piping. However, voiding can not occur in this piping for the following reasons:

  1) SW system Isolation valve XVB03106A(B) and SW system check valve XVC03135A(B) are closed, thereby preventing back flow into the SW system
  2) Valve XVB03106A(B) is a containment isolation valve with a high reliability in regards to leak tightness to prevent back-leakage into the SW system.
  3) The SW pumps (SWPs) are running which maintains a pressure of approximately 60 psig at the SW booster pump (SWBP) outlet. The elevation difference between the RBCUs and SWBPs is 107.6 feet, and the associated water column head is 46.5 psi at 66°F. Thus, SWP pressure is more than sufficient to keep the SW supply piping filled and prevent back-leakage into the SW system.

- RBCUs aligned with the IC system, then switched over to the SW system during a LOOP.

  The following timeline occurs:

  0 second
  - RBCUs aligned with the IC system with IC System flow through the supply piping
  - SW system isolation valve XVB03106A(B) closed
  - IC system isolation valve XVB03110A(B) open
  - LOOP occurs

  0 + seconds
  - Check valves XVC03137A(B), XVC03135A(B), XVC03136A(B) close

  11.5 seconds
  - Diesel Generator starts
  - SWPs starts

  41.5 seconds
  - SWBP starts
  - SW system isolation valve XVB03106A(B) starts to open
  - IC system isolation valve XVB03110A(B) starts to close
  - Flow in pipe to RBCUs commences

  Prior to 11.5 seconds between the commencement of the LOOP and the start of the SWPs, the isolation valve XVB03106A(B) and the check valves XVC03137A(B), XVC03135A(C), and XVC03136A(B) are closed and prevent back flow from occurring in the RBCU supply piping. During this short period of time, the closed containment isolation valve XVB03106A(B) is relied upon to prevent back-leakage into the SW system. Back-leakage into the IC system could occur through check valves XVC03136A(B) and XVC03137A(B). However, as explained in the referenced letter, pages 5 and 6 of 34, in response to a previous RAI, within this short period of time, it is impossible to achieve a back-leakage with a flow rate of sufficient magnitude to void even a small portion of the RBCU supply piping. It is noted that the explanation provided in the referenced letter considers the hypothetical case that the RBCUs are voided due to drain back into the supply piping. It has been confirmed that the supply enters the RBCU coils at the bottom of the unit. Therefore, if drain back into the supply piping occurs, voiding of the coils will result.

  After 11.5 seconds, no flow exists in the RBCU supply piping. However, the SWPs are running which maintains a pressure of approximately 60 psig at the SWBP outlet. At 41.5 seconds, the SWBPs start and initiate flow to the RBCUs. The elevation difference between the RBCUs and SWBPs is 107.6 feet, and the associated water column head is 46.5 psi at 66°F. Thus, SWP pressure is more than sufficient (with a 10+ psi margin) to keep the RBCU supply piping filled, prevent back-leakage into the SW system, and to compensate for any back-leakage into the IC system.

- RBCU aligned with the IC system then switched over to the SW system during normal operations.

  Per procedure, the following operations occur:

  - Initial Conditions
    - RBCUs are aligned with the IC system with IC flow through the supply piping.
    - IC system isolation valve XVB03110A(B) open
    - Check valves XVC03137A(B) open
      Check valves XVC03136A(B) open
      Check valves XVC03135A(B) closed
    - SW system isolation valve XVB03106A(B) closed

  - Close IC system isolation valve XVB03110A(B).
    - IC system flow to RBCUs stops
    - Check valves XVC03137A(B) close
      Check valves XVC03136A(B) close

  - Start SWBPs

  - SW system isolation valve XVB03106A(B) opens automatically on SWBP start.
    - SW system flow commences in the RBCU supply piping.

In order to maintain Reactor Building temperature limits, the time in which there is no flow to the RBCUs must be kept to a very short duration. During this short time period, two system isolation valves in addition to the three check valves prevent back flow to either the IC system or the SW system. Also, during this time, the SWPs are running which maintains a pressure of approximately 60 psig at the SWBP outlet. The elevation difference between the RBCUs and SWBPs is 107.6 feet, and the associated water column head is 46.5 psi at 66°F. Thus, SWP pressure is more than sufficient (with a 10+ psi margin) to keep the RBCU supply piping filled and prevent back-leakage into the SW system. In regards to the IC system supply piping, with isolation valve XVB03110A(B) closed, leakage can not occur through valve XVC03136A(B) that could form a column void in the piping between the two valves since both these valves are at the same elevation. In addition, a back pressure is maintained on the upstream side of valve XVC03136A(B) because the IC system is a closed loop system in which inventory is maintained by an unvented expansion tank (XTK0116) with level indication and automatic continuous makeup provided from the Filtered Water system.

- RBCU aligned with the IC system then switched over to the SW system during ESF activation.

  The following automatic sequence occurs:

  0 seconds
  - ESF activation.
  - SW system isolation valve XVB03106A(B) closed.
  - SW system check valve XVC03135A(B) closed.
  - IC system isolation valve XVB3110A(B) starts to close, terminates flow from IC system.
  - SWPs remain in operation.

  0 +seconds
  - Check valves XVC03136A(B) and XVC03137A(B) close.

  31.5 seconds
  - SWBP starts.
  - XVB03106A(B) starts to open, SW system flow initiates

  During the 31.5 seconds between the commencement of the ESF activation and the start of the SWBPs in which there is no flow to the RBCUs, the SW system Isolation valve in addition to the three check valves prevent back flow to either the IC system or the SW system and prevent the formation of a void in the supply piping. Also, during this time, the SWPs are running. As noted previously, these pumps maintain a pressure at the SWBP outlet which is more than sufficient to keep the RBCUs supply piping filled, prevent back-leakage into the SW system and to compensate for any back-leakage into the IC system.

- RBCU aligned with the SW system.

  This configuration for cooling the RBCUs occurs during quarterly testing and after ESF activation. During this alignment, the IC system supply piping is isolated by the closed butterfly valve XVB03110A(B) and closed check valve XVC03136A(B). Continuous flow exists from the SW system provided by the SWBPs. SW system inventory is maintained by an open path to the SW pond. Therefore, with continuous flow, no voiding is possible in the SW system supply piping and the supply header to the RBCUs.

  During the RBCU alignment with the SW system, no flow exists in the IC system supply piping. However, voiding can not occur in this piping for the following reasons:

  1) IC system Isolation valve XVB03110A(B) and IC system check valve XVC03136A(B) are closed thereby preventing back flow into the IC system.
  2) Valve XVB03110A(B) is a containment isolation valve with a high reliability in regards to leak tightness to prevent back-leakage into the IC system.
  3) With isolation valve XVB03110A(B) closed, leakage can not occur through valve XVC03136A(B) that could form a column void in the piping between the two valves since both these valves are at the same elevation.

- RBCU aligned with the SW system during a LOOP.

0 seconds

- LOOP occurs.
- SWPs and SWBPs stop. SW system flow terminates.
- IC system isolation valve XVB3110A(B) closed
- IC system check valve XVC03136A(B) closed.
- SW system isolation valve XVB03106A(B) stays open.

0 + seconds

- Check valve XVC03135A(B) close.
- Check valve XVC03137A(B) close.
-

11.5 seconds

- DG starts, restores power to XVB03106A(B).
- SW system isolation valve starts to close.
- SWPs start.

41.5 seconds

- SWBPs start.

55 seconds

- XVB03106A(B) fully closes, starts to reopen (45 second opening time)
- XVC03135A(B) closed

During this time sequence, there are three periods of time during which there is no flow to the RBCUs. Back flow into the IC or SW system is prevented by the closed check valves. Back-leakage through the check valves to the SW system or the IC system could occur during these time periods that could form a void in the supply piping.

- The first period is the 11.5 second duration after the LOOP but before the DG starts and power is restored to the SWPs. Back-leakage into the IC system is prevented by the closed IC system isolation valve XVB03110A(B) which is a containment isolation valve with a high reliability in regards to leak tightness. Back-leakage into the SW system is prevented by closed check valves XVC03135A(B) and XVC03137A(B). However, as explained in the referenced December 12, 2005 letter, pages 5 and 6 of 34, within this short period of time it is impossible to achieve back-leakage through two check valves with a flow rate of sufficient magnitude to void even a small portion of the RBCU supply piping.
- The second is a period of time after the SWPs start and before the SWBPs start. During this time, the SWPs are running. As noted previously, these pumps maintain a pressure at the SWBP outlet which is more than sufficient to keep the RBCUs supply piping filled, prevent back-leakage into the SW system and to compensate for any back-leakage into the IC system.
- The third period is when valve XVB03106A/B fully closes during its open to close to open cycle. During the brief period of time when at or near fully closed (probably less than 15 seconds), the valve chokes and stops the flow. Due to back pressure caused by the operation of the SWBPs, back-leakage into the SW system is not possible. Back-leakage into the IC system is

prevented by the closed IC system isolation valve XVB03110A(B) which is a containment isolation valve with a high reliability in regards to leak tightness.

- RBCU aligned with the SW system then switched over to the IC system during normal operations.

  Per procedure, the following operations occur:

  - Initial Conditions
    - RBCUs are aligned with the SW system with SW flow through the supply piping.
    - SW system isolation valve XVB03106A(B) — open
    - Check valves XVC03137(B) — open
      Check valves XVC03135A(B) — open
      Check valves XVC03136A(B) — closed
    - SW system isolation valve XVB03110A(B) — closed

  - Stop SWBPs
    - SW system isolation valve XVB03106A(B) starts to close.
    - SW system flow to RBCUs terminates.
    - Check valve XVC03137A(B) — close
      Check valve XVC03135A(B) — close
      Check valve XVC03136A(B) — close

  - Open IC system isolation valves.

  - Start IC system pump
    - IC system flow commences in the RBCU supply piping.

In order to maintain Reactor Building temperature limits, the time in which there is no flow to the RBCUs must be kept to a very short duration. During this short time period, two system Isolation valves in addition to the three check valves prevent back flow to either the IC system or the SW system. Also, during this time, the SWPs are running. As noted previously, these pumps maintain a pressure at the SWBP outlet which is more than sufficient to keep the RBCUs supply piping filled and prevent back-leakage into the SW system. In regards to the IC system supply piping, with isolation valve XVB03110A(B) closed, leakage can not occur through valve XVC03136A(B) that could form a column void in the piping between the two valves since both these valves are at the same elevation. In addition, a back pressure is maintained on the upstream side of valve XVC03136A(B) because the IC system is a closed loop system in which inventory is maintained by an unvented expansion tank (XTK0116) with level indication and automatic continuous makeup provided from the Filtered Water system.

- RBCU aligned with the SW system during ESF activation.

  The following automatic sequence occurs:

  0 seconds
  - ESF actuation.
  - SWBPs stay on. SW system isolation valve stays open flow terminates.
  - SW system isolation valve stays open.
  - SW system flow continues without stopping to the RBCUs.

  Refer to discussion above of RBCU aligned with the SW system.

  The following conclusions are drawn from the evaluation above:

  - For the vast majority of the time, both trains to the RBCUs are in operation with flow to the RBCUs from either the SW or IC system. During this time, no voiding is possible in the supply piping header to the RBCUs.
  - For the idle system branch with no flow, back-leakage is prevented by a containment isolation valve with a high reliability in regards to leak tightness.
  - Redundancy exists with two check valves or an isolation valve and a check valve to prevent back flow into either the SW system or the IC system.
  - There are short periods of time (less than 11.5 seconds) when there is no flow through the RBCUs and the SWPs are not running in which the supply piping check valves are relied upon to prevent back-leakage into the SW or IC system. However, it is impossible to achieve back-leakage through two check valves with a flow rate of sufficient magnitude to void even a small portion of the RBCU supply piping.
  - There are periods of time when the SWBPs are not running and there is no flow through the RBCUs, but the SWPs are running. The SWPs maintain a pressure at the SWBP outlet which is more than sufficient to keep the RBCU supply piping filled, prevent back-leakage into the SW system and to compensate for any back-leakage into the IC system.
  - During the time in which the IC system is isolated, leakage can not occur through IC system check valve XVC03136A(B) that could form a column void in the piping between the check valve and the IC isolation valve since both these valves are at the same elevation.

Based on the conclusions noted, there is no period of time in which back flow or back-leakage through the valves could create a column void in the RBCU supply piping of sufficient size to cause a significant waterhammer.

RESPONSE 1, APPENDIX 2

Valve test and inspection program

XVC03137A(B) - Common SW and IC system redundant check valve in RBCU supply header piping:

Valves XVC03137A(B) perform an active safety function in the OPEN position. These 16" check valves normally open to allow IC flow to the RBCUs. During an accident, the flow is automatically transferred to safety-related SW for cooling. These valves open to supply flow from either source. In the closed position, these valves also function to prevent back flow and void formation due to gravity drain down in the RBCUs supply header piping during times of no flow to the RBCUs. Full flow ASME Code check valve testing is performed quarterly under VCSNS surveillance test procedure STP-223.002A, "Service Water Pump Test," at a post accident minimum design basis flow of 2000 gpm. These normally open check valves are closed tested each refueling outage under STP-230.006G, "Service Water Check Valve Testing". The closure test is performed at refuel frequency because an external pressure is required to confirm closure of the valve disc. Since these valves are located in containment, it is impractical to perform the closed exercise test at quarterly or cold shutdown frequencies. The valves have been evaluated under Appendix II of the ASME OM Code and are in the process of being incorporated into the site check valve conditioning monitoring program. This will result in an effective plan for closely assessing the true condition of each valve.

XVC03135A(B) - SW system check valve:

Valves XVC03135A(B) are normally closed valves that perform an active safety function in the OPEN position. These valves must open to allow SW flow to the RBCUs. During an accident, the flow is automatically transferred to safety-related SW cooling flow, by SWBP auto start, discharge check valve opening and isolation of IC flow. In the closed position, these valves also function to prevent back flow and void formation due to gravity drain down in the RBCUs supply header piping during times of no flow to the RBCUs. Full flow ASME Code check valve testing is performed quarterly under STP-223.002A, "Service Water Pump Test," at a post accident minimum design basis flow of 2000 gpm to ensure both opening and closing. The procedure also instructs that the SWBP discharge check valves be locally observed for disc integrity during booster pump start-up. The valves are provided with an adjustable dashpot which controls the opening and closing speed of the disc for prevention of waterhammer affects. In the closed position, the valve prevents the diversion of IC into the SW system. This is an operational function since IC is not a safety-related system.

XVC03136A(B) - IC system check valve:

These normally open 12" check valves have a CLOSED safety position. The IST Program calls for these valves to be exercised both opened and closed on a cold shutdown frequency per STP-130.005J, "SW Valve Operability Testing (Mode 5)." These check valves are located in the IC system lines supplying the RBCUs. The valves remain in the open position during plant operation allowing passage of cooling water flow. They must be capable of closure to prevent the loss of SW during post accident operation. In addition, in the closed position, these valves also function to prevent back flow and void formation due to gravity drain down in the RBCUs supply header piping during times of no flow to the RBCUs. They serve as backup isolation for downstream motor operated IC system isolation valves, XVB03110A(B). Exercising either of these valves to the closed position during operation at power would require depressurizing the common IC supply header, hence the cold shutdown test frequency.

An Appendix II ASME OM Code "Performance Improvement Plan" has been prepared for these valves, requiring disassembly of one valve in the group to complete analysis in accordance with II-3000 of Appendix II.

XVB03106A(B) - SW system isolation and containment isolation valve (CIV):

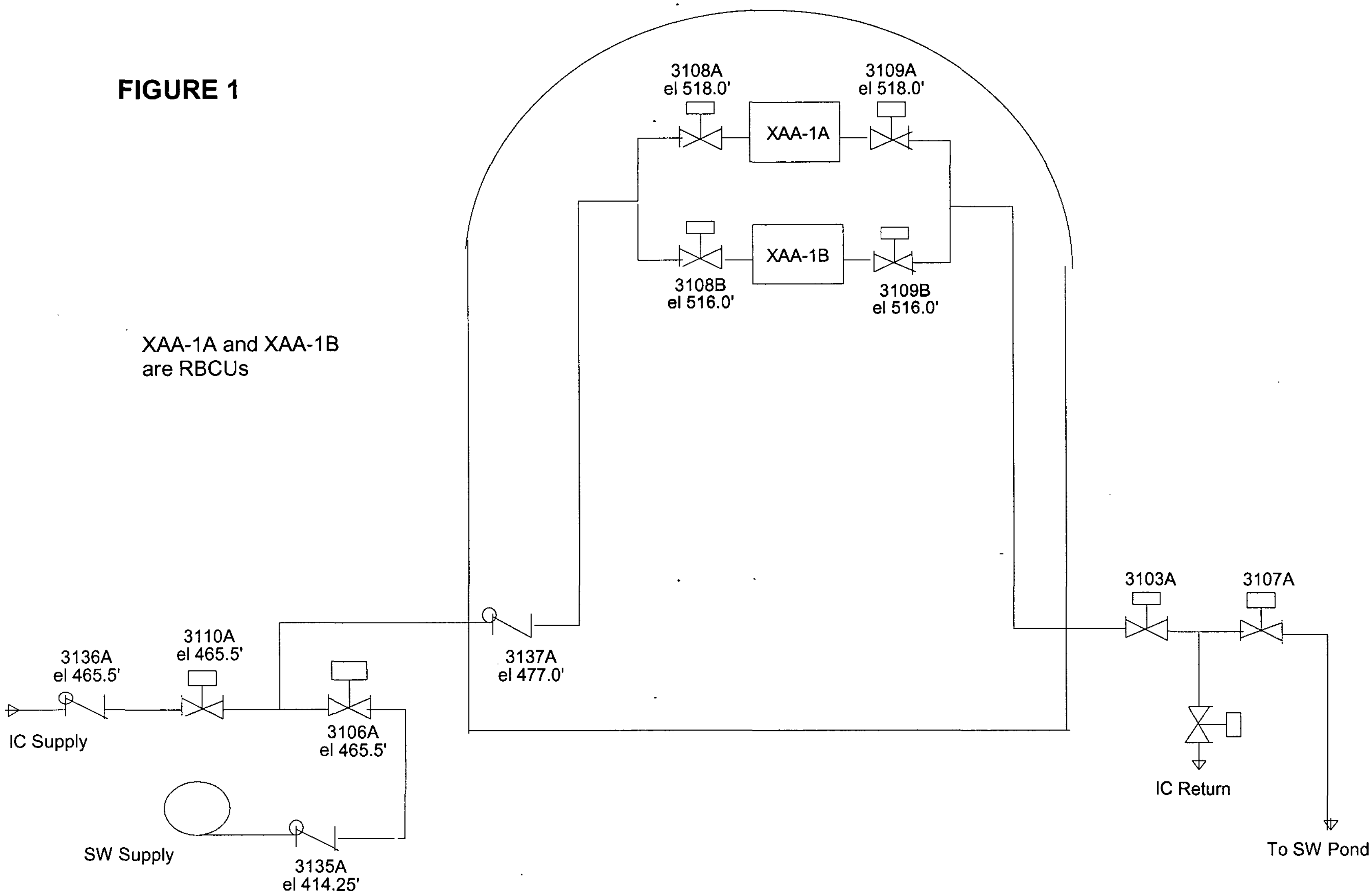
These 16" power operated butterfly CIVs have both OPEN and CLOSED safety positions. Under the IST Program, the SW Pump Test (STP-223.002A) is used to demonstrate the operability of these valves by performing quarterly open and closed stroke timing, in addition to position indication verification once every 2 years. Valve XVB03106A is also tested in accordance with the VCSNS Local Leakage Rate Testing Program based on the 10 CFR 50, Appendix J, Option B frequency per STP-215.004, "Containment Isolation Valve Leakage Test For The AC, CC, DN, FS, and SW Systems."

XVB03110A(B) - IC system isolation and containment isolation valve:

These normally open 12" butterfly valves have a CLOSED safety position. In accordance with the IST Program, the valves are stroke time tested quarterly in the closed direction per STP-123.003A(B), "Train A(B) SW System Valve Operability Test." The position indication verification is also performed using this procedure at least once every two years. XVB03110A is also local leak rate tested at the Appendix J, Option B frequency. Site procedure STP-215.004, "Containment Isolation Valve Leakage Test for the AC, CC, DN, FS, and SW Systems," is used for this test.

NOTE: XVB03106B and XVB03110B do <u>not</u> have requirements under the Local Leakage Rate Testing Program per the FSAR.

FIGURE 1



XAA-1A and XAA-1B
are RBCUs

2. **As discussed in the December 12, 2005, response (page 2 of the Attachment), the RBCU cooling water outlet isolation valves are relied upon for preventing the formation of the second void that forms between the RBCUs and their cooling water outlet isolation valves during certain waterhammer event scenarios. Explain how postulated single failures associated with the RBCU cooling water outlet isolation valves were resolved in order to assure elimination of the second void.**

Response 2:

The intent of a single failure analysis is to identify whether a fluid or electrical system has sufficient redundancy of components to accommodate any single failure and still perform the system safety function. VCSNS has four RBCUs. These RBCUs are divided into two separate fluid and electrical trains with two RBCUs per train. Only two RBCUs are required for containment cooling during postulated accident events. Therefore, one train can perform the intended safety function. Each train is designed to be separate and distinct from the other in regards to fluid system source, electrical power source, instrumentation and controls. This provides the redundancy required of the single failure analysis. Any postulated failure associated with a RBCU cooling water outlet isolation valve is limited to the train containing the valve. These failures are resolved by the other unaffected redundant train which will perform the RBCU safety function.

3. The December 12, 2005, response (page 16 of the Attachment) indicates that modifications will be made to: (i) add vacuum breakers to vent the RBCU cooling water piping downstream of the RBCU cooling water outlet isolation valves, (ii) replace the RBCU cooling water outlet isolation gate valves with fast closing butterfly valves, and (iii) delay the opening of the RBCU cooling water outlet isolation valves for five seconds after the SWBP is started. While page 11 of the Attachment to the December 12 response indicates that existing TS requirements are adequate, more detailed information is required to explain: (i) what specific TS requirements apply to these new features, (ii) how existing TS Surveillance Requirements will assure that these features function in accordance with the acceptance criteria that have been established for demonstrating operability, (iii) how the existing TS allowed outage times will be applied, and (iv) where in the TS Bases operability considerations that pertain to these features are discussed.

Response 3:

The addition of vacuum breakers and replacement of RBCU cooling water outlet valves is to alleviate the effects of waterhammer within the SW system piping downstream of the RBCUs imposed by certain scenarios that were not identified as part of GL 96-06. These waterhammer scenarios are to be added to the SW system design basis as load conditions to be mitigated by the piping. The addition of the waterhammer loads to the design basis of the SW piping does not have any affect on the fluid process or the operation of the SW system mentioned in VCSNS Technical Specifications (TS) Section 3/4.7.4, "Service Water System". However, the loads will affect the structural integrity of the SW piping. TS addresses the structural integrity of the Reactor Coolant System (RCS) piping in Sections 3/4.4.10, 5.4, and 5.7. The waterhammer loads are in the SW piping at great pipe lengths away from any RCS pressure boundary piping or components. Sufficient piping anchors and pipe supports separate the dynamic influence of the SW piping from the RCS piping or components. Therefore, the modification will not affect the RCS piping and will not require a change to any TS limit for RCS structural integrity.

TS Table 3.3-5 requires that the ESF Response time for the RBCUs for any required initiating signal be 76.5/86.5 seconds (with/without Offsite Power available). The current timing sequence allows a maximum stroke time of 45 seconds for the RBCU cooling water outlet valves in order to establish full SW flow through the RBCUs. The existing motor-operated gate valve has an opening time of 42 seconds. The new air-operated butterfly valve will have an opening time of 25-32 seconds. Therefore, the faster opening valves will not affect the TS requirement.

The new and redesigned valves of this modification will have testing and inservice inspection that complies with the ASME Code as prescribed by TS 4.0.5.

(i) As discussed above, specific TS requirements that apply to the SW system due to the planned modification are:

TS 3/4.7.4	PLANT SYSTEMS - SERVICE WATER SYSTEM
TS 3/4.3.2	Table 3.3-5 - ENGINEERED SAFETY FEATURES RESPONSE TIMES
TS 4.0.5	INSERVICE INSPECTION AND TESTING OF ASME CODE CLASS COMPONENTS

(ii) As discussed above, the TS requirements will not change, therefore the existing Surveillance Requirements will continue to demonstrate operability of the valves within the existing prescribed acceptance limits.

(iii) As discussed above, the TS requirements will not change, therefore the Action prescribed by the existing LCO will continue to be applicable within the existing allowed outage times.

(iv) Operability considerations for these features are discussed in TS BASES 3/4.3.1 and 3/4.3.2 REACTOR TRIP AND ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION. Additional operability considerations are discussed in TS BASES 4.0.5.

4. The December 12, 2005, response (page 12 of the Attachment) establishes a regulatory commitment to complete the planned modifications during Refuel 16. Because the Summer plant will continue to operate for some months before the planned modifications are fully implemented, a more extensive regulatory commitment is required to include implementation of the interim actions (licensee's first and second phases) that are referred to in the December 12 response on page 15 of the Attachment. Clarification that the regulatory commitment applies to all of the modifications that are referred to in the December 12 response on page 16 of the Attachment is also required. Finally, please confirm that the necessary reinforcements have been made to the two marginal pipe supports associated with RBCU Train B (referred to in the August 4, 2004, response).

Response 4:

SCE&G continues to pursue a two-phase approach to mitigate the affects of waterhammer on the piping system. As discussed in the December 12, 2005, SCE&G response, the first is an interim phase that provides administrative and procedural controls over the use of the SW system for cooling to the RBCUs. The second is a modification to change valve closing and opening times and their corresponding initiating logic to permanently eliminate the waterhammer concerns. These two phases were outlined by SCE&G in detail in the December 12, 2005 response (pages 15 and 16 of 34).

Currently, SCE&G continues to implement the first phase. In the first phase until the plant modification is implemented, the procedure for SW system operation, SOP-117, "Service Water System", has been revised to include a special set of initial conditions prior to aligning the system to the RBCUs. These conditions are intended to minimize the risk for a LOOP during the SW alignment, minimize the time duration the RBCUs are aligned to the SW system and to remind operators of the potential for a waterhammer in the event of a LOOP. These intial conditions are summarized as follows:

- In Modes 1 through 4, SW shall only be supplied to the RBCUs, when one or more of the following conditions are met:
  a. Post Accident or High Containment Pressure Conditions.
  b. Loss of Non-ESF power.
  c. Loss of IC.
  d. During testing.

- In Modes 1 through 4, when SW is being supplied to the RBCUs, all the following conditions shall be met:
  a. No planned work is allowed in the switchyard.
  b. The dispatcher confirms that no transmission system work is planned that would decrease the reliability of the off site power supplies.
  c. There is no severe weather predicted in South Carolina for the expected duration of the testing.
  d. If for surveillance testing or post maintenance testing, the testing has been approved as if it were a (Yellow) MODERATE Risk Activity.
  e. If for any other reason, the testing has been approved as if it were an (Orange) ELEVATED Risk Activity.

Engineering Change Request (ECR) 50567 has been initiated to develop, implement, and document the modification that will achieve the second phase. The planned modification was discussed with NRR at a public meeting held in Washington, DC on September 13, 2006. SCE&G presented reasons for a change in commitment for implementation of the planned modification. The modification has been deferred to Refuel 17 (Spring 2008). This change in implementation schedule was further identified through an October 8, 2006 SCE&G letter to the Document Control Desk.

The planned modification that SCE&G commits to implement in the second phase of the effort to mitigate waterhammer will include:

- The replacement of gate valve 3107A/B with a fast closing butterfly valve that closes in seven seconds upon de-energizing of SWBP A/B. The fast valve closure will trap water in the high points above the valve and prevent void formation from gravity drain-down of the water to the SW pond. This will prevent any waterhammer event that would have occurred upon re-energizing the SWBPs and a consequential rapid collapse of the void.

- The opening logic of valve 3107A(B) will be modified to have a 5 seconds delayed opening after SWBP A(B) start. The delayed start of the valve opening will assure that additional void formation in the RBCU piping inside containment will not occur upon re-energizing the SWBP.

- The addition of vacuum relief valves downstream of valve 3107A(B). Any vacuum void downstream of closed valve 3107A(B) that may be formed due to gravity drain-down of water to the SW pond will be replaced with air by these valves. Upon the opening of valve 3107A(B) and the re-start of SWBP A(B), the air in the piping will act as a cushion to minimize any waterhammer affects that could occur at that time. Also, these relief valves will eliminate the need to manually vent the piping downstream of valve 3107A(B) immediately after the transfer of RBCU cooling from the SW system alignment to the IC system as noted in the preceding review discussion.

ECR 50576 was initiated to modify and reinforce the two pipe supports on Train B SW piping from the RBCUs. This modification was completed and closed out on July 27, 2005.