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A SCANA COMPANY

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

Attention: Ms. K. R. Cotton

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS)
DOCKET NO. 50/395
OPERATING LICENSE NO. NPF-12
RESPONSE TO NRC BULLETIN 2003-01, POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER REACTORS

The U. S. Nuclear Regulatory Commission (NRC) issued NRC Bulletin 2003-01 to inform licensees of the potential for additional adverse effects due to debris blockage of flowpaths necessary for Emergency Core Cooling System (ECCS) and Reactor Building Spray System (SP) recirculation and containment drainage. These additional adverse effects were based on NRC-sponsored research that identified the potential susceptibility of pressurized-water reactor (PWR) recirculation sump screens to debris blockage in the event of a high energy line break (HELB) that would require ECCS and SP operation in the recirculation mode.

All licensees have been requested to provide a response to the NRC Bulletin by either: 1) stating that the ECCS and SP recirculation functions have been analyzed with respect to the potentially adverse post-accident debris blockage effects identified in the NRC Bulletin, and are in compliance with 10 CFR 50.46(b)(5) and all existing applicable regulatory requirements (Option 1), or 2) describing any interim compensatory measures that have been or will be implemented to reduce the risk which may be associated with the potentially degraded or nonconforming ECCS and SP recirculation functions until an evaluation to determine compliance has been completed (Option 2).

South Carolina Electric & Gas Company (SCE&G) acting for itself and as agent for South Carolina Public Service Authority, hereby submits the attached in response to Option 2 of the NRC Bulletin.

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Should you have questions, please call Mr. Ron Clary at (803) 345-4757.

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

8/6/03
Executed on

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Senior Vice President, Nuclear Operations

AMM/SAB/dr
Attachment

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File (815.02)
DMS (RC-03-0164)

NRC Bulletin 2003-01 Response

This response addresses Option 2 of the requested information in NRC Bulletin 2003-01 until an evaluation to determine compliance with the applicable regulations is completed. This response discusses: 1) the interim compensatory measures that have been implemented as of the submittal date of the response, 2) plant specific measures implemented that are not discussed in the bulletin, 3) plant specific measures not implemented as of the submittal date and a schedule for implementation, 4) plant specific measures that cannot be implemented until the next refueling outage and the reason that they cannot be implemented, and 5) measures discussed in the bulletin that will not be implemented and the justification for not implementing them.

The following interim compensatory measures have been implemented as of the submittal date of the response:

1. Operator Training on Indications of and Responses to Sump Clogging

Operators are provided with instructions for switchover from injection to recirculation in EOP-2.2. At VCSNS the switchover from injection to recirculation is semi-automatic. At a Refueling Water Storage Tank (RWST) level of 18%, the Reactor Building (RB) recirculation sump isolation valves are automatically opened. Each Residual Heat Removal (RHR) pump and each Containment Spray System (at VCSNS identified as the Reactor Building Spray System (SP)) pump has an independent suction line and separate sump screen. The operator completes the switchover manually. Switchover is completed when the RHR and SP pumps are taking suction directly on the RB recirculation sumps (with RWST suction isolated) and the Charging/Safety Injection (SI) pumps are taking suction from the RHR pump discharge. Crossties between the Charging/SI pumps are also closed to establish train separation. Additional detail on the switchover is provided in Table 6.3-3 of the VCSNS FSAR.

After the switchover is complete, Step 11 of EOP-2.2 specifically instructs the operator to monitor the RHR pumps for signs of sump blockage. This is a continuous action step. Pump discharge pressure and motor current are monitored. If there are indications of sump blockage the operators are instructed to throttle RHR pump flow. If recirculation is lost or becomes severely degraded, the operators enter EOP-2.4 for loss of recirculation flow. The following Control Board Indications are provided to the operator to monitor long term cooling and pump operation.

Process Variable	Channel Number	Control Board
RB Recirculation Sump Level	LI-1963/1964	XCP-6106
RHR (low-head SI) Pump Flow	FI-605A/B	XCP-6106
RHR (low-head SI) Pump Discharge Pressure	PI-600A/B	XCP-6106
RHR (low-head SI) Pump Motor Current	N/A	XCP-6106
Containment Spray Pump Flow	FE-7368/7378	XCP-6105
Containment Spray Pump Discharge Pressure	PI-7367/7377	XCP-6105
Containment Spray Pump Motor Current	N/A	XCP-6105
Charging/SI Pump Flow	FI-943/940	XCP-6107
Charging/SI Pump Discharge Pressure	PI-934	XCP-6107
Charging/SI Pump Motor Current	N/A	XCP-6107

Training on switchover and loss of recirculation (EOP-2.2 and EOP-2.4) is included in the baseline curriculum and schedules for Reactor Operators (ROs) and Senior Reactor Operators (SROs). These topics are also taught at least every two years in the Licensed Operator Requalification (LOR). The program includes classroom training on the RB recirculation sump design and simulator scenarios that specifically address sump blockage and the subsequent transfer to EOP-2.4 for loss of recirculation flow. The simulator scenarios are LOR-ST-070, RO-ST-070 and SRO-ST-070. Simulator training modules for sump blockage have been in place since 1992. Additionally, sump blockage has been used in site-wide training drills and annually evaluated exercises in 1995, 1997 and 1998 as documented in EPD-95-004, EPD-97-003 and EPD-98-001, respectively.

2. Procedure Actions that Delay the Switchover to Containment Sump Recirculation

The VCSNS Emergency Operating Procedures (EOPs) currently have direction for operators to reduce ECCS flows as a symptom based response.

After an event initiation, the operators enter EOP-1.0, Reactor Trip/Safety Injection Actuation. For a Primary or Secondary Coolant break the operators will transition to EOP-2.0, Loss of Reactor or Secondary Coolant. Step 10 of EOP-2.0 is a symptom-based decision. If Reactor Coolant System (RCS) pressure is above the RHR discharge pressure (200 psig) and the RCS is sub cooled, this step will transfer the operators to EOP-1.2, SI Termination. EOP-1.2 provides actions to cooldown and depressurize the RCS to reduce the break flow, thereby reducing the injection flow necessary to maintain RCS sub cooling and inventory. The operating SI pumps are sequentially stopped to reduce injection flow, based on pre-established criteria that maintain core cooling,

resulting in reduced outflow from the RWST. For smaller Loss of Coolant Accidents (LOCA), it is possible to cooldown and depressurize the RCS to cold shutdown conditions before the RWST is drained to the switchover level. Therefore, cold leg recirculation alignment is not required, and sump blockage is not an issue.

3. Procedure Actions that Delay RWST Inventory Depletion

Guidance to delay depletion of the RWST after switchover to sump recirculation is currently contained in EOP-2.4. This EOP provides actions to reduce the outflow from the RWST to preserve the RWST inventory once it has been determined that a loss of sump recirculation capability exists. EOP-2.4, "Loss of Emergency Coolant Recirculation," can be considered to determine the actions for delaying RWST inventory depletion, while ensuring that adequate core cooling flow and containment heat removal, as necessary, are maintained.

4. Procedure Actions to Refill the RWST

The operators are provided with instructions to refill the RWST in response to a loss of recirculation cooling. This is covered in EOP-2.4, Loss of Emergency Coolant Recirculation. The EOP directs the operators to the normal system operating procedures for the refill. VCSNS has two resources to refill the RWST. The first is the normal RWST makeup from the Boron Recovery System/Chemical and Volume Control System (BRS/CVCS). The second source is the Spent Fuel Cooling System. The Spent Fuel Pool depth is maintained above the minimum 23 ft required. This excess may be transferred to the RWST.

There is margin in the contained volume in the RWST. Switchover from injection to recirculation is initiated at the 18% level. With the current operator response times, switchover is completed when the RWST level reaches about 11%. This allows a 5.06% worst-case instrument uncertainty to the RWST empty alarm of 6% (FSAR Section 6.3.2.6). This conservatively assumes a Reactor Building pressure of 0 psig. If a more realistic post-LOCA Reactor Building pressure were used in the analysis, RWST outflow during the switchover would be limited to the charging pumps. Almost the entire 18% would be available to the operator.

So, the actual RWST level after switchover is complete is expected to be in the range of 11% up to almost 18%. This volume would be immediately available to the operator should recirculation from the sump be lost or become degraded. Only under the worst-case analysis instrument uncertainty could the RWST level indicate an RWST empty level of 6%.

5. Program to Control Potential Sources of Debris

The VCSNS Foreign Material and Debris Control program (FME) is covered in station administrative procedure SAP-363. Personnel are provided FME awareness training as a part of Site Orientation Training (SOT). FME training covers responsibilities, types of foreign materials and operating experience.

Operators are provided with additional training on sump blockage prevention.

- The design of the RHR sumps and spray sumps are discussed in handouts AB-7, RHR; and AB-8, RB Spray. These topics are taught in every auxiliary operator (AO) and RO initial training program and are periodically reviewed in LOR.

- On-The-Job Training (OJT) and Task Performance Evaluation (TPE) are conducted for AOs and SROs on closeout of the RB in accordance with STP-109.001. This OJT/TPE is reflected in the following:
    - Task 103.006.02.04, Perform RB closeout inspection, for AOs. This task is included in the initial training program via OJT guideline AO-OJT-AB-13; which means that they will receive formal training and evaluation on the task. Each AO must also obtain an oral checkout on this subject via Enabling Objective #6450, Perform a RB closeout inspection.
    - Task 345.027.02.02, Perform Containment inspection, is included in every SRO initial training program via OJT guideline SRO-OJT-MISC. Each SRO must complete both OJT and TPE for this task prior to obtaining an NRC license.
    - STP-109.001 is a Referenced Document in the task analysis and on the OJT guidelines.

Following an outage, the containment closeout is completed by Operations per surveillance test procedure (STP)-109.001. The walk down is completed prior to entering Mode 4 when all maintenance activities have been completed. The procedure directs the operator to confirm the RB is free of loose debris (rags, trash, clothing, etc.), which could be transported to the RB recirculation sumps, causing restriction of the pump suctions during LOCA conditions. The Shift Supervisor will initiate necessary corrective action and will direct additional inspections until the cleanliness conditions of the RB meet the acceptance criteria.

After the Operations closeout, the Quality Control (QC) Department is formally notified that the RB is ready for QC walk down. The QC department then independently performs and documents a walk down of the RB to confirm foreign materials and debris have been removed as appropriate. The QC walk down procedure has recently been enhanced and issued under quality systems procedure (QSP)-522. After the QC walk down is completed, the entire RB is maintained as an FME area.

VCSNS is scheduled for a fall refueling in 2003. Engineering personnel cognizant for the sump clogging issues covered by GSI-191 will augment the QC walk down team during the next outage.

At power RB entries are controlled under procedure OAP-108.1. At power entries treat the RB as an FME area. Following the planned activities, a walk down is completed by Operations per STP-109.001. Due to ALARA considerations and the use of an FME area, QC does not perform an independent walk down for at power RB entries.

A potential source of debris has been identified as equipment tags that may be displaced as a consequence of SP actuation. At VCSNS, all equipment tags located within the RB are stainless steel attached with stainless steel wire. Equipment tags (including tag material) are controlled under general maintenance procedure GMP-113.000, which specifically requires stainless steel for use in the Reactor Building.

6. Containment Cleaning

VCSNS has maintained a rigorous cleaning routine of the RB since plant startup to maintain radiation levels as low as possible consistent with our ALARA program. As detailed under the FME program, RB closeout is completed by Operations to procedure STP-109.001 prior to entering Mode 4. Operators are trained on RB closeout and instructed to inspect for debris that may clog the RB recirculation sump. After operations has completed the RB closeout, QC completes an independent RB walk down to confirm materials that may have an adverse effect on the sump are removed from the RB. This walk down is covered by procedure QSP-522.

7. Ensuring Containment Drainage Paths are Unblocked

Floor drain lines are provided on each of the operating levels inside the VCSNS RB. Should these drains become plugged for any reason, the water is free to flow down stairwells to the lower elevations until finally reaching the RB recirculation sump. VCSNS uses a limited number of mesh gates inside the RB to preclude unauthorized entry into high radiation areas. These locations are for compartments outside the bio-shield wall that will not be subject to debris generation. Therefore, there is no potential for debris-induced blockage between compartments.

As discussed in Section 6.2 of the FSAR, there are three areas where RB spray flow and/or reactor blowdown may collect.

- The refueling canal at the 426' 10" elevation is provided with an 8-inch flange connection to drain flow outside the bio-shield wall and to the RB recirculation sumps. A blind flange is in place during refueling operations. Prior to startup the blind flange is removed. As a part of the RB closeout procedure, STP-109.001, Operations confirms the blind flange has been removed. An attachment to the procedure requires signature and date to document the confirmation.

- The refueling canal at the 437' 2-3/4" elevation may drain to the reactor cavity through the reactor cavity seal ring area. However, once the reactor cavity is full, it will spill to the RB 412' elevation through an opening in the bio-shield wall at elevation 415'. The refueling cavity is considered in the containment flooding calculation, so the water volume to fill the vessel cavity is taken into account.

- There is a third means of diverting water away from the sump when the flood elevation reaches the 415' elevation. If the reactor cavity is not full, water will spill into the cavity. However, as stated above, the reactor cavity is taken into consideration for RB recirculation sump flooding.

A further conservatism with respect to sump flooding level is that no credit is currently taken for sump water elevation above the containment floor elevation of 412' in the NPSH calculations for the RHR and CS pumps. The RHR pump has a 9-foot NPSH margin. The SP pumps have an 8-foot NPSH margin.

8. Inspections Ensuring Sump Screens are Free of Adverse Gaps and Breaches

As required by VCSNS Technical Specification Surveillance 4.5.2.d.2, the RB recirculation sumps are inspected during each refueling outage (or 18 months). The inspection is completed in accordance with procedure STP-406.002. The procedure instructs the personnel to check for structural distress, corrosion, blockage and gaps. Prior to the sump inspection, a pre-job brief is held. The pre-job brief will be used to discuss operating experience regarding gaps found at other facilities to ensure a thorough inspection is completed.

The following plant specific measures not discussed in the bulletin have been implemented:

1. Termination of SP

If SI termination criteria are not met in EOP-2.0 Step 10, then the operator in Step 11 of EOP-2.0 determines if SP flow may be terminated. The SP actuation setpoint at VCSNS is 12.05 psig (Tech Spec Table 3.3-4). If containment pressure has reduced to below 11 psig, the operators are directed to consult with the Technical Support Center (TSC) staffed by engineering to evaluate spray termination. VCSNS licensing basis does not allow termination of spray flow for two hours after initiation for DBA LOCA conditions, unless SI termination criteria have been met. After the two hour run time, the decision to terminate SP is based on the RB temperature and pressure profile for the Equipment Qualification (EQ) program. If the RB temperature and pressure profile are met, both SP pumps are stopped (one at a time while monitoring containment pressure).

VCSNS is provided with two safety-related reactor building cooling units (RBCUs) for SI conditions. Operation of both RBCUs increases the likelihood that RB temperature and pressure requirements will be met without operation of the SP for an extended period. Additionally, the RB temperature and pressure curves are based on conservative analysis under limiting large break LOCA and single failure assumptions. Small and medium break LOCAs will be less likely to challenge the long-term RB temperature and pressure requirements.

SP termination at 2 hours will likely occur after the switchover from RWST injection to containment recirculation has been accomplished. Termination of SP operation at this point in the event will decrease the wash down of latent debris and lower the total recirculation flow to reduce transport. V.C. Summer uses stainless steel Reflective Metal Insulation (RMI) for RC piping and components. There is only a small amount of

fibrous insulation material inside the RB for Steam Generator level reference lines and HVAC ducts in the upper levels of the pressurizer cubicle. FSAR Section 6.3.2.6.1 provides a detailed discussion. All installations are above the maximum flood level. Termination of SP will reduce degradation of fibrous material that is sitting on floor grating or floating on top of the water in the RB.

2. Inspection of Fire Barriers Inside the Reactor Building

Fire barriers inside the RB at VCSNS employ both Kaowool and M-board. All applications inside the RB are enclosed with stainless steel to preclude the material from becoming dislodged and potentially transporting to the sump. The Kaowool and M-board applications inside the RB are periodically inspected as a part of the Fire Protection Plan per surveillance test procedure STP-728.030. The inspections specifically confirm (1) no exposed Kaowool or M-Board and (2) stainless steel covers are in place with no missing or loose attaching devices.

The following measures will not be implemented at the time of the response to the bulletin:

1. TSC Systems Engineer Guide Update

In addition to the EOPs and operator training, guidelines are provided for the Technical Support Center Systems Engineer. These guidelines are provided in plant support engineering guideline PSEG-08, Technical Support Center Duties. PSEG-08 is currently undergoing an update to include a response to sump clogging. The need for the update had been captured under the VCSNS corrective action program before the issuance of IB 2003-01 (CER 02-0089).

The following measures will not be implemented until the next refueling outage:

1. NEI 02-01 Walk downs

Containment walk downs in support of GSI-191 resolution will be completed in the Fall 2003 refueling outage at VCSNS. The walk downs will visually confirm location of fibrous insulation, collect data for latent debris, and evaluate transport paths.

2. Repair/Replacement of damaged coatings

VCSNS has a qualified paint program covered by procedures CMP-500.001, CMP-500.002 and CMP-500.004. The program includes painter qualifications and application requirements. For the upcoming refueling outage (Fall 2003) VCSNS is developing a degraded paint remediation plan to identify and repair degraded and failed coatings inside the RB. Two areas where degraded qualified paint inside containment (CER 02-1110 and CER 02-2529) were identified at the end of the last refueling outage will be repaired during the next outage.

3. Permanent Storage Location for Scaffolding and Lead Blankets

During the next refueling outage (Fall 2003), a permanent storage location is being installed for scaffolding and lead blankets used for shielding. Currently, this material is not stored in the RB during plant operation. The storage boxes will be located outside the bio-shield wall, on the 436' operating level, in the eastern section of the Reactor Building. The RB recirculation sumps are located on the 412' elevation in the south and southwest sections of the Reactor Building. The installation will preclude impingement or blockage of the RB recirculation sumps by scaffolding and/or lead shielding blankets.

The following measures will not be implemented:

1. ECCS and/or SP Early termination of one train

The interim compensatory measure to shutdown one train of ECCS and/or SP early in the event presents complicated changes to the symptom based operator response structure of the Westinghouse Emergency Response Guidelines. While there are positive risk based improvements with respect to recirculation sump clogging, there are also adverse risk based impacts associated with this change. These include the increased likelihood of operator error, increased failure of switchover from injection to recirculation and increased operator response times for other events. Given these significant un-quantified risks, a change to the VCSNS EOPs based on an overall risk improvement cannot be justified without appropriate industry review of the issue.

Changes to the emergency response guidelines (ERGs) and emergency preparedness guidelines (EPGs) are evaluated by formal Owners Group specific maintenance programs. The process and schedule to change and issue revisions to the ERGs and EPGs to address RB recirculation sump blockage issues will be completed by March 31, 2004. If the generic guidance is approved and issued, VCSNS will determine if the implementation is appropriate for an overall risk reduction.

The compensatory action to take pre-emptive operator action to shut off one train of ECCS and/or SP would result in the potential violation of VCSNS licensing commitments. VCSNS must complete the switchover from RWST injection to recirculation from the RB recirculation sump without interruption of injection or spray assuming a limiting single failure. If one train were shut off prior to switchover, the single failure of a RB recirculation sump isolation valve to open may result in an interruption of flow until operators could start and align the other train. Therefore, if implementation does appear appropriate after the industry review, it will involve a licensing change.