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10CFR50.73
Ollie S. Bradham
Vice President
Nuclear Operations

January 8, 1990

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

SUBJECT: Virgil C. Summer Nuclear Station
Docket No. 50/395
Operating License No. NPF-12
LER 88-008, Revision 1

Gentlemen:

Attached is Revision 1 to Licensee Event Report (LER) No. 88-008 for the Virgil C. Summer Nuclear Station. This LER was originally submitted on July 7, 1988 pursuant to 10CFR50.73(a)(2)(v) and (a)(2)(vii). This revision documents the results of the completed steam propagation path evaluation.

Should there be any questions, please call us at your convenience.

Very truly yours,

O. S. Bradham

ARR/OSB:lcd
Attachment

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Virgil C. Summer Nuclear Station DOCKET NUMBER (2) 0500031915 PAGE (3) 1 OF 07

TITLE (4)
Steam Path Yielding Potential for Affecting Unqualified Equipment

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		DOCKET NUMBER(S)
06	07	88	88	008	01	01	08	90			05000
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OPERATING MODE (9) 3 THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more of the following) (11)

20.402(b)	<input type="checkbox"/>	20.408(e)	<input type="checkbox"/>	80.73(a)(2)(iv)	<input type="checkbox"/>	73.71(b)	<input type="checkbox"/>
20.408(a)(1)(ii)	<input type="checkbox"/>	80.36(e)(1)	<input checked="" type="checkbox"/>	80.73(a)(2)(v)	<input type="checkbox"/>	73.71(e)	<input type="checkbox"/>
20.408(a)(1)(iii)	<input type="checkbox"/>	80.36(e)(2)	<input checked="" type="checkbox"/>	80.73(a)(2)(vi)	<input type="checkbox"/>	<input checked="" type="checkbox"/> OTHER (Specify in Abstract below and in Text, NRC Form 306A)	
20.408(a)(1)(iv)	<input type="checkbox"/>	80.73(a)(2)(i)	<input type="checkbox"/>	80.73(a)(2)(vii)(A)	<input type="checkbox"/>	Special Report 10CFR21	
20.408(a)(1)(v)	<input type="checkbox"/>	80.73(a)(2)(ii)	<input type="checkbox"/>	80.73(a)(2)(vii)(B)	<input type="checkbox"/>		
20.408(a)(1)(vi)	<input type="checkbox"/>	80.73(a)(2)(iii)	<input type="checkbox"/>	80.73(a)(2)(viii)	<input type="checkbox"/>		
20.408(a)(1)(vii)	<input type="checkbox"/>	80.73(a)(2)(iv)	<input type="checkbox"/>	80.73(a)(2)(ix)	<input type="checkbox"/>		

LICENSEE CONTACT FOR THIS LER (12)

NAME W. R. Higgins, Supervisor, Regulatory Compliance TELEPHONE NUMBER 81013 34151-4101412

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS
				N					

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) NO

EXPECTED SUBMISSION DATE (15) MONTH DAY YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On June 7, 1988, with the plant at Mode 3, South Carolina Electric & Gas Company (SCE&G) was notified by Gilbert Associates, the architect engineer for the Virgil C. Summer Nuclear Station, of a design defect yielding the potential for a steam propagation path which could affect safe shutdown equipment. Both a direct steam path through floor penetrations and a more tortuous propagational path were identified. The tortuous steam path is the result of a steam break releasing steam which travels through several fire doors, up one elevation in a stairwell, and through several floor penetrations leading back down to the original elevation before arriving at the safe shutdown equipment.

Upon verification of the potential problem by SCE&G personnel, Operations personnel initiated taking the plant from Mode 3 to Mode 4. Various interior plant doors were opened to allow for the relief of pressure build-ups and another door was sealed to prevent moisture intrusion in the event of the postulated steam break. Ultimately several doors were structurally reinforced, several doors had sealing materials added to prevent steam flow or moisture intrusion and evaluations were performed to verify that the in-place fire barrier penetration seals would also serve as pressure retaining barriers. Other actions included modification to drain lines, ductwork, conduit and wall spaces to prevent steam intrusion.

As a result of installing the modification for reinforcing one of the doors which also serves as a rated fire assembly, the fire rating of that door would no longer be verified and a one hour roving fire watch was established. (The door has been considered inoperable as a fire rated assembly.) Because that fire door has been inoperable for a period of greater than seven days, this report also serves as a Special Report as required by section 3/4.7.10 of the plant Technical Specifications.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

PLANT IDENTIFICATION:

Westinghouse - Pressurized Water Reactor

EQUIPMENT IDENTIFICATION:

- Component Cooling Water Pumps (EIIS:CC)
- Control Room Evacuation Panels (EIIS:JL)
- Switchgear (EIIS:EB)
- Main Steam System (EIIS:SB)
- Chilled Water System (EIIS:KM)
- High Pressure Safety Injection Pumps (EIIS:BQ)
- Central Control Complex (EIIS:NA)
- Miscellaneous Buildings and Structures
- Environmental Control System (EIIS:UK)

IDENTIFICATION OF EVENT:

Unsealed steam propagation path yielding potential for affecting unqualified equipment.

DISCOVERY DATE:

June 7, 1988 at 1630 hours

REPORT DATE: January 8, 1990

This report was initiated by Off-Normal Occurrence Report 88-033 and is a supplement to the original report dated July 7, 1988.

This report also serves as a Special Report, required by Technical Specification 3/4.7.10, "Fire Rated Assemblies," to notify the NRC, Region II, of a fire door (IB 407) which remained inoperable for greater than 7 days as a result of implementing the corrective actions required by the identification of the steam path.

CONDITIONS PRIOR TO EVENT:

Power Level - 0% Mode 3

The plant was in hot standby completing work necessary to repair condenser tube leaks which had caused a forced outage.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

DESCRIPTION OF EVENT:

On June 7, 1988, at 1630 hours, SCE&G personnel were notified by Gilbert Associates, the architect engineer for the Virgil C. Summer Nuclear Station, of an unsealed steam propagation path which could potentially affect safety related equipment in the event of a postulated steam break outside containment. The applicable scenario for modes 3 thru 5 involved a main steamline break which occurs on the 430' elevation (room IB 36-02) of the Intermediate Building (IB) upstream of the main steam isolation valves. The steam from this break was postulated to go directly to room IB 63-01 via non pressure rated floor penetrations. The steam flow was also postulated to go through a non-safety fire door leading into a stairwell. Steam fills this stairwell and proceeds through another fire door (IB 407) at the 463' elevation of the IB leading to a corridor (room IB 63-03). From here steam can leak into the "A" Train Switchgear room (IB 63-01) through heavy, bullet resistant, but not pressure tight, double doors (IB 408). IB 36-01, which is below IB 63-01, also contains electrical equipment required to achieve and maintain safe shutdown ("B" Train Switchgear) and communicates with IB 63-01 through floor penetrations. From corridor IB 63-03 steam can also enter, through double doors similar to IB 408, room IB 63-02. Though IB 63-02 does not contain equipment required to shutdown the plant and maintain it shutdown, it is in direct communication, again through floor penetrations, with rooms IB 36-03, A, B, IB 36-04, IB 36-05, and IB 36-06 which do contain safe shutdown equipment. (Control room evacuation panels and electrical equipment for all three component cooling water pumps.) Therefore, rooms IB 36-01, IB 36-03, A, B, IB 36-04, IB 36-05, IB 36-06 and IB 63-01 are all subject to steam intrusion.

In addition a steam break (reheat steam jet) in the Turbine Building (TB) (modes 5 thru 2 with main steam isolation valves open) could enter IB 63-03 through door IB 409 and subsequently enter rooms IB 63-02 and IB 63-01 with the same results as described above.

Upon verification that this problem existed, the control room personnel proceeded to Mode 4 since all the component cooling water speed switches were in rooms affected by this potential scenario.

As a temporary measure to limit potential pressure buildups in the event of a steam break the following doors were blocked open: IB 405 from corridor 63-03 to the IB roof, IB 409 from corridor 63-03 to the TB, IB 403 from room 63-02 to the TB, and IB 313 from the stairwell to the TB. Applicable roving fire watches were also established. To limit moisture intrusion through IB 408 from corridor 63-03 to room 63-01 (switchgear room), all edges of the door were sealed with "Tuck" tape. In addition the main steam isolation valves were required to be closed in mode 3 as long as the doors between the Turbine and Intermediate Buildings were blocked open. Door IB 407 (from the stairwell into corridor IB 63-03) was reinforced to ensure it would remain closed in the event of the postulated breaks and was also sealed with a neoprene seal to ensure it remained leak tight.

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TEXT (if more space is required, use additional NRC Form 366A's) (17)

To allow for operation with the above stated doors closed, the silicone foam fire seals in the floors of IB 63-01 and IB 63-02 were verified to be capable of withstanding a peak pressure of 3 psig which is in excess of the peak pressures to be experienced during the postulated steam breaks. As added conservatism, seals in direct contact with IB 36-02 (where the steam break is postulated to occur) and one additional seal in the stairway at elevation 463' were caulked to further guard against steam leakage.

To enable operation above mode 3 with the main steam isolation valves open, door IB 409 between the Intermediate Building and the Turbine Building was braced to ensure it could withstand the force of a steam jet from within the TB. The latch was removed from door IB 405 leading from the IB to the roof of another portion of the IB to limit any unacceptable pressure buildup from steam flowing under door IB 409.

CAUSE OF EVENT:

The cause of this event is a design error. Discussions with the original design engineer revealed that these concerns had not been reviewed at the time of the initial design and appear to have been a design oversight.

ANALYSIS OF EVENT:

A harsh environment created by the above discussed postulated steam breaks could potentially disable the "A" and "B" train Class 1E switchgear, the "A", "B", and "C" Component Cooling Water pump speed switches and "C" transfer switch, and both Control Room Evacuation Panels.

As required by 10CFR21, Gilbert Associates notified the NRC of this event by a letter dated July 15, 1988. Subsequent to the issuance of the 10CFR21 report and the original LER, a thorough evaluation was performed to identify all possible pipe break steam paths into or out of mild environment areas. The approach taken was consistent with the original design approach where steam paths into mild environment areas were identified and designed to be steam tight. The steam intrusion paths assessed included doors, floor drains, penetrations, openings, and ductwork.

An attempt was made to qualify the existing paths and environmental conditions. When this was not possible (i.e., the room contained safety-related equipment which could not withstand the harsh environment), the condition was documented by a nonconformance notice (NCN) and interim or permanent repairs were initiated. The results of the unanalyzed steam propagation path evaluation determined that the areas described below posed a potential safety concern. Some additional repairs were made to other areas to retain the mild environment status of the areas (even though equipment in these other areas could function in the steam environment or was not required to function).

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

AB 63-01, AB 12-28

AB 63-01 contains Train B ESF switchgear and controls. AB 12-28 contains Train A ESF switchgear and controls. The original plant design for pipe rupture required that room AB 63-01 be steam tight but not AB 12-28, in accordance with Branch Technical Position APCSB 3-1 (November 25, 1975). Review of the as-built configuration of AB 63-01 revealed several unacceptable steam paths. As documented in NCN 2995, the paths into AB 63-01 were sealed by 1) providing perimeter seals on door AB 501A, 2) caulking around ductwork, 3) providing a loop seal in a one inch condensate drain pipe and sealing gaps between the pipe and drain with caulk, and 4) sealing the opening to room AB 63-02.

IB 63-01, IB 36-01

IB 63-01 contains Train A ESF switchgear. IB 36-01 contains Train B ESF switchgear. A steam line break could adversely affect electrical equipment in these rooms which is required for safe shutdown. Corrective actions for these rooms were as described in the original LER and are documented in NCNs 2976 and 2995. In addition, the path from the rattle space to IB 63-01 was sealed with silicone foam.

IB 51-01, IB 51-02

IB 51-01 contains the Train A ESF switchgear cooling unit. IB 51-02 contains the Train B ESF switchgear cooling unit. These rooms directly communicate with ESF switchgear rooms IB 63-01 and IB 36-01. Steam may enter these rooms through floor drains. The short term resolution (documented in NCN 2995) for this item was to plug the floor drains.

IB 12-12, IB 12-13A, IB 12-13B, IB 12-13C, IB 12-14 and IB 12-15

These rooms contain HVAC chilled water system pumps and chillers which maintain proper ambient conditions for safety-related equipment. These chiller rooms contain two floor drains that provide a potential path for steam intrusion. During a plant walkdown related to the steam intrusion issue, it was identified that the clapper valve on one of the common floor drains was missing and the clapper valve for the other drain was in an open position. This condition could allow steam ingress in the rooms causing unacceptable environmental conditions and potential chiller failure. The main impact of the chiller failure was determined to be excessive lube oil temperatures for the charging pumps which could threaten the functions of the pumps. The immediate corrective actions (documented in NCN 3348) performed were:

- 1) installation of a blank flange with a 1/4 inch drain hole for the drain missing a valve.
- 2) installation of a brace to ensure the clapper valve remained closed for the other drain.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Control Building

Control Building rooms adjacent to the Intermediate and Auxiliary Buildings were evaluated for steam intrusion effects. It was identified that door AB 303A was not steam tight and that steam could enter the Control Building from the southwest Auxiliary Building stairway (room 12-01).

This condition could create an unacceptable environment in the Control Building. As documented in NCN 2995, door AB 303A was repaired by using perimeter door seals on the frame and installing an automatic door bottom.

Unsealed Flexible Conduit

An evaluation was performed to assess the acceptability of using flexible conduit as a pressure boundary. It was determined that for pressure boundaries subject to significant pressures (several inches of water) which separate environmental zones that were assumed to be pressure tight, unsealed flexible conduit could provide a significant leakage path for steam. Five zone paths were identified as having unacceptable flexible conduit penetrations. This conduit provided a path whereby steam from a high energy line break in one zone could enter mild zone(s) containing safety-related equipment. The environmental zone pairs involved were IB-01/02 to IB-05, PAA-01 to AB-35, IB-08 to AB-39, PAA-03 to AB-38 and AB-39, and IB-01 to IB-06.

The affected conduit was sealed using silicone tape, caulk and/or foam as documented in NCN-3000.

IMMEDIATE CORRECTIVE ACTION:

Upon identification of the steam propagation path scenario, operations personnel initiated a plant shutdown from Mode 3 to Mode 4. The plant was maintained in Mode 4 subsequent to the initiation of the immediate corrective actions of opening doors to IB 63-03 to limit pressure buildups and sealing IB 408 to prevent moisture intrusion to IB 63-01.

During the course of the detailed evaluation when an additional area of concern was identified, an NCN was generated to document the condition and immediate repairs were made as described above.

ADDITIONAL CORRECTIVE ACTION:

To mitigate the consequences of the postulated steam breaks the following actions were completed:

- 1) Door IB 407 was reinforced and sealed to ensure it remained closed and prevented steam leakage in the event of a steam break.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

This temporary modification impacted the fire rating capability of the door and therefore a 1 hour roving fire watch was established for the door.

- 2) Door IB 408 was sealed to prevent moisture intrusion into IB 63-01.
- 3) Applicable silicone foam fire seals between the rooms in question were verified to be capable of withstanding pressures which would be experienced in the event of a postulated steam break.
- 4) Door IB 409 was reinforced to enable it to withstand a steam jet originating in the Turbine Building.
- 5) The latch on door IB 405 was removed to allow the door to open and relieve any pressure buildup in corridor IB 63-03 in the event of a Turbine Building steam break and the resulting leakage under door IB 409.

LONG TERM CORRECTIVE ACTION:

The following permanent actions are planned for completion of this item. Since the interim corrective actions identified previously provide adequate protection against steam intrusion, the actions listed below have been prioritized and ranked with other plant modifications and are scheduled for implementation at a later date.

1. Replace doors IB-403, 407 and 409 with pressure and fire rated safety-related doors.
2. Add a new pressure rated wall and door to room AB 63-02.
3. Add a new supply duct to room AB-63-02 through room AB 63-01. Permanently seal the duct opening in the wall of AB 63-01.
4. Install an orifice in the floor drain from elevation 451 of the IB (IB 51-01 and 02) to restrict steam flow.
5. Install blind flanges with drainage holes in the floor drains (2) to the IB 412 elevation sump (IB 12-12, 13A, 13B, 13C, 14 and 15).

PRIOR OCCURRENCES:

None.