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U.S. Nuclear Regula:ory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Edwin I. Hatch Nuclear Plant
Response to Request for Additional Information on
Spent Fuel Pool Regulatory Analysis

Gentlemen:

By letter dated May 9, 1997, and as a followup to the NRC's meeting with Southern Nuclear Operating Company (SNC) staff on April 9 and 10, 1997, concerning the spent fuel pool regulatory analysis, the NRC requested additional information to aid in the completion of that analysis. The enclosure to this letter contains SNC's response to the five questions contained in the NRC's May 9, 1977, letter. A transcription of the NRC question precedes each SNC response.

If you have any further questions, please contact this office.

Sincerely,

Lewis Sumner

H. L. Sumner, Jr.

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OCV/eb 270050

Enclosure: Response to Request for Additional Information on Spent Fuel Pool Regulatory Analysis

Attachment: Dose Rate on Refueling Floor vs. Pool Water Depth Figure

cc: (See next page.)

cc: *Southern Nuclear Operating Company*
Mr. P. H. Wells, Nuclear Plant General Manager
NORMS

U.S. Nuclear Regulatory Commission, Washington, D.C.
Mr. N. B. Le, Licensing Project Manager - Hatch

U.S. Nuclear Regulatory Commission, Region II
Mr. L. A. Reyes, Regional Administrator
Mr. B. L. Holbrook, Senior Resident Inspector - Hatch

Enclosure

Edwin I. Hatch Nuclear Plant
Response to Request for Additional Information on
Spent Fuel Pool Regulatory Analysis

1. *NRC Question*:

For those components in the Unit 1 Reactor Building (RB), does your Environmental Qualification (EQ) list (Central File) include mild environment safety-related equipment? If not, it is conceivable that safety-related equipment designated "mild" and located in the Unit 1 RB could be exposed to an environment that exceeds their design due to a sustained pool boil. This equipment may have been overlooked because they were not identified using the search criteria you described (i.e., if they were mild environment equipment, they may not be on your EQ list).

SNC Response:

The Unit 1 and 2 Environmental Qualification (EQ) list (Central File) does not include mild environment safety related equipment.

There is safety related equipment in the reactor building that is not qualified for a harsh environment, but this equipment is not needed to mitigate the postulated fuel pool boiling scenario. The design basis of the plant does not include spent fuel pool boiling coupled to an accident where safety related equipment would be needed to prevent or mitigate that accident. Safety related equipment relied upon for ECCS injection, containment isolation, reactor scram, and decay heat removal is qualified for a harsh environment. Equipment associated with secondary containment isolation and SGTS may already be performing their safety function due to the high radiation environment on the refueling floor. It is important to know that even though SGTS may be running and secondary containment isolated, no credit was taken in the radiological analysis of this event.

In conclusion, should the reactor building be exposed to a harsh environment from a sustained pool boiling event, safety related equipment necessary to ensure (i), the integrity of the reactor coolant pressure boundary, (ii) the capability to shutdown the reactor and maintain it in a safe shutdown condition, and (iii) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures in excess of 10 CFR 100 guidelines, would remain operable per the requirements of 10 CFR 50.49.

2. *NRC Question*:

What is the function of the DP switch(es) 1(2) T46-DPT-N005A(&D) (other than to provide indication to the control room recorders)? If the switch were to fail, would their failure affect other adjacent safety-related equipment (electrically)? Is adequate fault protection provided on the equipment's power supply circuit in the event of an electrical failure?

SNC Response:

Differential pressure transmitters 1(2)T46-DPT-N005A&D provide input to main control room (MCR) recorders 1(2)T46-DPR-R604A&B which are set to alarm a low dP between the refueling floor and the outside air under normal plant operation. These instruments can also be used to confirm the required dP between the reactor building and the outside air during secondary containment surveillance testing. (Alternatively, a manometer can be used to measure the dP. The plant procedure allows both methods.)

Fuses protect power supplies to the transmitters. The subject dP transmitters are connected in series with other standby gas treatment system (SGTS) components, such as recorders and power supply units, in low voltage instrument loops. A failure of the transmitters can result in faults, such as hot shorts, short to ground, and open circuit of conductors. These faults may lead to erroneous readings and alarms; however, the faults will not prevent operation of the SGTS.

In summary, failure of dP transmitters 1(2)T46-DPR-R604A&B will not compromise any safety function.

3. *NRC Question*:

Will the spent fuel pool (SFP) boiling produce high radiation levels on the refueling floor (RF) before significant inventory boil-off? If so, what is the expected source of high radiation levels on the RF during a boiling event (prior to any significant lowering of pool level), and what radiation levels do you expect at various points during a pool boiling event (in mr/hr)?

SNC Response:

The dose rate at the refueling floor is attributed to the stored fuel assemblies. The source of the radiation on the refueling floor is the radioactive decay of fission products in the fuel assemblies.

Spent fuel pool boiling will release insignificant amounts of volatile radioactive species dissolved in the spent fuel pool water. If the spent fuel pool were to boil and water level not change significantly, no notable change in refueling floor dose rates will result, because the change in pool water density will not result in an appreciable change in the shielding effect of the pool water on the stored fuel assemblies.

The dose rates on the refueling floor following a pool boiling event, without makeup water, are presented in the attached figure. The dose rates were calculated assuming a full-core offload with 150 hours decay. The dose rates, which range from 3.6E-4 mR/hour with 21 ft of water to 2.3E8 with no water above the spent fuel, are essentially at elevation 228 ft, in the line of sight of the pool. Dose rates away from the pool will obviously be less than those provided in the attached figure.

As shown in the figure, significant radiation levels on the refueling floor are not reached until water level decreases to approximately 10 ft above the fuel. Therefore, fuel pool boiling will not produce high radiation levels on the refueling floor before significant pool boiloff occurs.

4. *NRC Question*:

Standby gas treatment system equipment may be required to transport hot, humid RF vapor during a pool boiling event. Provide a discussion of the performance of the standby gas treatment system (SGTS) under boiling spent fuel pool conditions. Include the length of time the system could be expected to function assuming that the recovery of spent fuel cooling systems are uncertain (i.e., extended feed and boil cooling).

SNC Response:

The operation of the SGTS during a pool boiling event is desirable to remove the hot and humid air from the refueling floor, but is not required to achieve a safe shutdown of the operating unit. SGTS may start automatically on receipt of high radiation from the refueling floor as a result of the postulated event of spent fuel pool boiling or may be manually started from the main control room at the option of the operator.

The SGTS components are qualified to 120°F. The charcoal filter efficiency is likely to degrade at humidities higher than 90%. However, the relative humidity (RH) is expected to decrease with time in the SGTS room for the pool boiling event as the temperature on the refueling floor increases. It is estimated that, from the beginning of the pool boiling event, i.e., when temperature reaches 212°F in the spent fuel pool, the temperature in the SGTS room will reach 120°F in less than one hour. This is conservatively estimating the initial temperature in the room to be 105°F. Under actual conditions, and during refueling outages, the time to boiling from a total loss of cooling is approximately 4 hours with the gates between the pool and the reactor vessel installed. With the gates removed, the time increases to over 10 hours. Thus, if the operator chooses to manually initiate SGTS to transport the hot humid vapor, he may do so before pool boiling (212°F) actually begins. Furthermore, reaching 120°F in the SGTS does not necessarily mean that the SGTS will fail, but only that the components have reached the limit of their temperature qualification. The qualification temperature is indicative of a shortening of component lifetime. Therefore, based on engineering judgment, it is reasonable to conclude that the equipment would function for an extended period of time beyond 120°F.

The offsite analysis for thyroid dose due to spent fuel pool boiling conditions conservatively did not take credit for the operation of the SGTS and was based on ground level release. The calculated 0-4 day thyroid dose is a fraction of the 10 CFR Part 100 limits. Doses with SGTS in operation (without taking credit for filtration through the charcoal filter) will provide still lower doses due to elevated release through the stack. Hence, the degraded performance of charcoal will not have any impact on the results of the analysis and offsite doses will be well within acceptable limits.

5. *NRC Question*:

Provide a discussion of the capability of the building drain collection system(s) under SFP boiling conditions. For ease of analysis and conservatism, assume that 100 percent of boil-off condenses on the RB walls and is directed to the floor drainage system. Where does this drainage system collect? What is the capacity of the sump, pump, and the processing system? Does the pump have a safety-related power supply? If the pump were to fail (or be overwhelmed), is there any safety-related equipment in the vicinity that may experience flooding? How long would it take to threaten this equipment?

SNC Response:

The drainage system for the refueling floor at el 228 ft 0 in. consists of collection points, collection piping valves, and two dirty radwaste (DRW) sumps per unit. The refueling floor is sloped downward toward the collection points. The openings/hatches in the refueling floor are provided with a minimum of a 4 in. high curb to prevent spillage to lower levels or into the pool. The collected water is gravity fed into the sumps located below el 87 ft 0 in. in the N-E and N-W corner rooms in Unit 1, and in the S-E and S-W corner rooms in Unit 2. Each sump is equipped with two 50 gal/min capacity sump pumps that discharge into a common header connected to a floor drain collection tank located in the Radwaste Building. The pumps do not have safety related power supplies. One of the two sump pumps is started and stopped automatically on the rise and fall of sump level. If the water level in the sump reaches 41 in., the second pump automatically starts, and the Hi-Hi sump level is alarmed in the MCR. If the water level in the sump reaches 51 in., the drainage paths from the other corner rooms; i.e., the high pressure coolant injection (HPCI) room and torus rooms at el 87 ft 0 in., to the sumps are automatically isolated by closing the isolation valves in the drainage system to avoid the potential for flooding the rooms. The valve closure is alarmed in the MCR. The discharge header is equipped with a radiation monitor, and high radiation levels sensed in the discharge line automatically shutoff the sump pumps; this prevents pumping high level contaminants into the radwaste building. As previously stated only insignificant amounts of volatiles would be entrained in the steam and isolation of the discharge lines would not be expected.

a. Equipment Details

Sump volume: 360 ft^3
Sump pump capacity: 50 gal/min
Floor drain collection tank capacity: 12000 gal
Power supply: Nonsafety related
Backup power: Unit 1 - All four pumps have diesel backup.
Unit 2 - One pump for each sump has diesel backup.
Setpoint for first sump pump to start: 32 in.
Setpoint for second sump pump to start: 41 in. (also alarms in MCR)
Setpoint for closing the isolation valves: 51 in.

b. Analysis of the Capability of Unit 1 and Unit 2 Floor Drain Systems Under SFP Boiling Conditions

Assuming a full-core offload 150 hours after reactor shutdown, the time to reach SFP boiling is 4 hours. The heat load will be 31.09 MBtu/hour, and the boiling rate is 8.93 ft^3/min. Drainage from the refueling floor is gravity fed into two sump pumps in each unit. Assuming the drainage is equally distributed between the units and the sumps, the maximum drainage into each sump is 2.24 ft^3/min. or 16.7 gal/min. The drainage rate during the SFP boiling transient is considerably less than the pumping capacity of the sump pump.

Assuming the pumps fail to automatically start or shut off upon a high radiation signal from the radiation monitor on the discharge line, and water level in the sump reaches 32 in. (worst case), the remaining sump capacity will be 199.8 ft^3, and the time to fill the sump will be 1 hour and 28 min.

As stated previously, the sumps are equipped with Hi-Hi alarms set at 41 in. The Hi-Hi level alarms at 20 min from the start of SFP boiling (4 hours and 20 min into the transient). The drainage path from other corner rooms; i.e., the HPCI room and torus rooms, to the sumps is isolated at 40 min from the start of SFP boiling (4 hours and 40 min into the transient). The sump becomes full at 1 hour and 28 min from the start of SFP boiling (5 hours and 28 min into the transient).

d. Flooding Evaluation

If SFP boiling and condensation continue after the sumps are full, water enters the corner rooms at el 87 ft 0 in. through the 2 1/2 in. diameter vent in the sump cover. The following equipment located in these corner rooms may be threatened in the event of flooding:

1.) Unit 1 N-E Corner Room

1E21-C001B - Core spray (CS) pump
1E11-C002B - Residual heat removal (RHR) pump
1E11-C002D - RHR pump
1E21-C002B - Jockey pump

When the water level in the Unit 1 N-E corner room sump reaches 51 in., the other corner rooms are isolated automatically by closing the isolation valves in the floor drainage system. Hence, RHR pumps 1E11-C002A&C and CS pump 1E21-C001A, which are located in the Unit 1 S-E corner room, are not affected by flooding. Thus, one loop of RHR and CS is available for the safe shutdown of the plant.

The isolation system for the corner rooms was originally designed to detect and protect a flooding originating at floor el 87 ft, not the refueling floor. If the flooding originates in one corner room, the isolation valves will close when the sump reaches the high level point. This effectively isolates the corner rooms from each other. Therefore, for the scenario where the flooding originates in a corner room, isolation valves for each corner room are not needed.

2.) Unit 2 S-E Corner Room

2E11-C002B - RHR pump
2E11-C002D - RHR pump
2E21-C001B - CS pump
2E21-C002B - Jockey pump
2E21-C003B - Jockey pump

When the water level in the Unit 2 S-E corner room sump reaches 51 in., the other corner rooms are isolated automatically by closing the isolation valves in the floor drainage system. RHR pumps 2E11-C002A&C and CS pump 2E21-C001A, which are located in the Unit 2 N-E corner room, are not affected by flooding. Thus, one loop of RHR and CS is available for the safe shutdown of the plant.

3.) Unit 1 N-W Corner Room

P70-C001A&B - Drywell pneumatic compressors
P70-B001 - Aftercooler
P70-D002 - Dryer
P70-D006 - Filter
P70-A006 - Receiver

The above-listed compressors and associated components that were part of the drywell pneumatic system are located at floor el 87 ft 0 in. This equipment was disabled and is no longer in service.

However, particulate filters P70-D008A&B and D009A&B, and nitrogen backup supply valves P70-F001A&B, which are also part of the drywell pneumatic system, are still in service. They are located at floor el 87 ft 0 in. and may be threatened in the event of flooding.

The drywell pneumatic system supplies motive gas to the following equipment located inside the drywell:

- Recirculation system sample line isolation valves.
- RPV head vent valves.
- CS system injection bypass valves.
- Plant service water (PSW) system control valves.
- RHR system low pressure coolant injection (LPCI) bypass valves.
- Nuclear boiler system safety relief valves (SRVs) and main steam isolation valves (MSIVs).

Except for the SRVs, pneumatically-operated devices in the drywell are designed for the fail-safe mode and do not require a continuous gas supply under emergency and abnormal conditions. In case of an interruption in gas supply, the safety-related SRV and MSIV pneumatic supply requirements are satisfied by individual accumulators provided for each automatic depressurization system (ADS) and non-ADS SRV, and each inboard MSIV. Additionally, emergency nitrogen bottles, located outside the drywell, are available to supply motive force to the SRVs and MSIVs. These bottles are connected via manual operator action to one of two supply manifolds. Once connected they supply either 5 SRVs or 6 SRVs and the inboard MSIVs. Therefore, flooding of the N-W corner room and the resulting loss of the drywell pneumatic system will have no adverse impact on the safe shutdown of the plant.

Nonsafety related recirculation flow instrument racks H21-P161-P162 are also located in this room and may be threatened. These racks are not required for the safe shutdown of the plant. In addition, nonsafety-related clean radwaste (CRW) sump pumps 1G11-C007A&B are located in the Unit 1 N-W corner room. However, these pumps are not required for the safe shutdown of the plant.

4.) Unit 2 S-W Corner Room

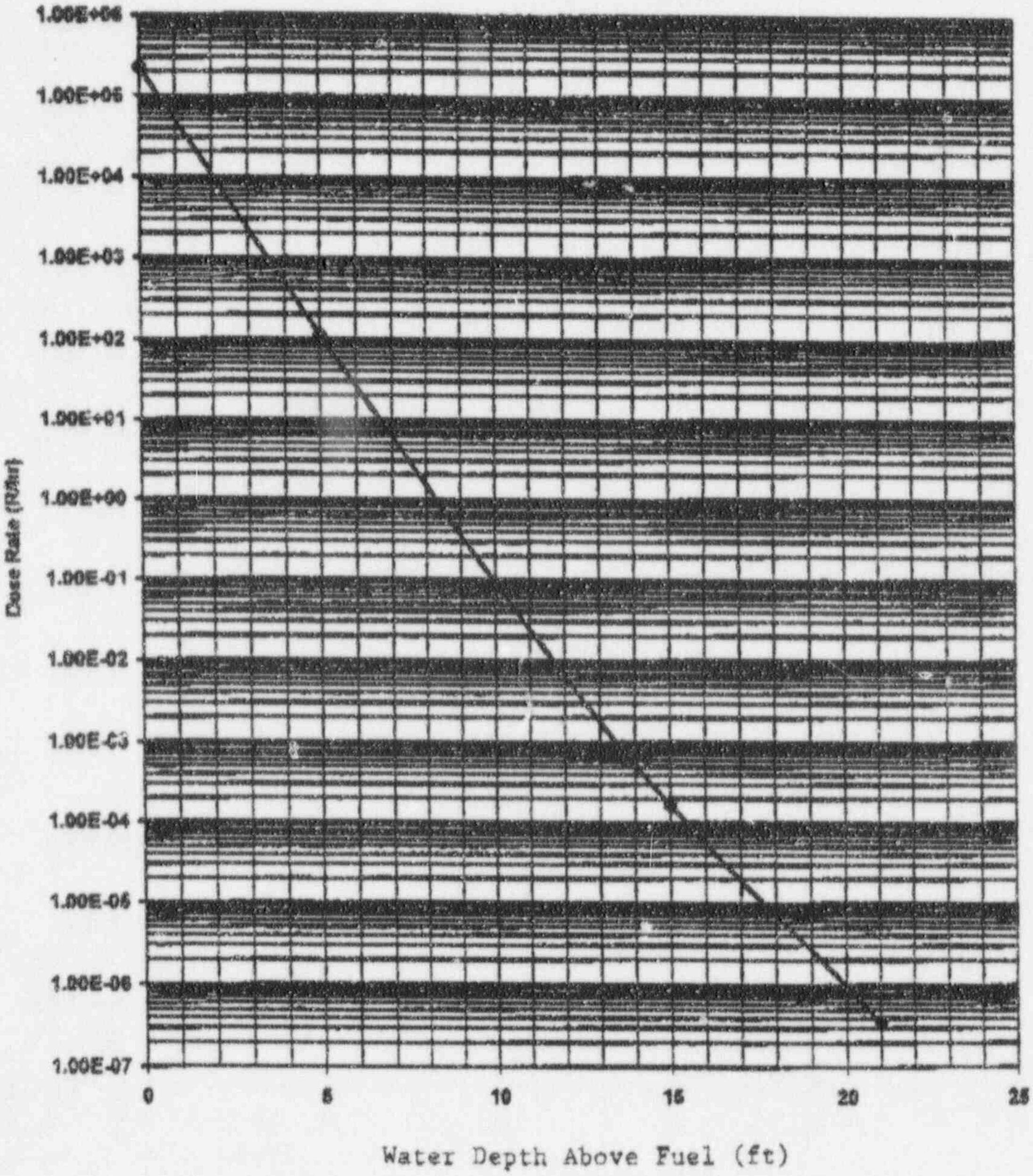
The following nonsafety-related equipment is located at floor el 87 ft 0 in. in the Unit 2 S-W corner room. However, this equipment is not required for the safe shutdown of the plant.

2G51-C001 - Torus drainage pump
2G11-C007A - CRW sump pump
2G11-C007B - CRW sump pump
2G11-B002 - CRW heat exchanger

If the DRW sump pumps do not trip and continue to discharge into the floor drain collection tank in the Radwaste Building, a flooding situation in the Radwaste Building may occur. However, no safety-related equipment required for the safe shutdown of the plant is located in the Radwaste Building.

Attachment to Enclosure

Dose Rate on Refueling Floor vs. Pool Water Depth Figure



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