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SERIAL: HNP-98-017

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United States Nuclear Regulatory Commission
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SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
ON THE SHEARON HARRIS IPEEE SUBMITTAL (TAC NO. M83627)

Dear Sir or Madam:

By letter dated December 15, 1997, the NRC requested that Carolina Power & Light Company (CP&L) respond to a request for additional information on the Shearon Harris Individual Plant Examination for External Events (IPEEE). This letter, received by CP&L on December 18, 1997, requested that the information be provided within 60 days of receipt of the letter to support the NRC review of the Shearon Harris IPEEE submittal.

A written report providing the requested information is provided in the enclosure to this letter. Questions regarding this matter may be referred to Mr. J. H. Eads at (919) 362-2646.

Sincerely,

W R Robinson

AEC/aec

Enclosure

230043

A011/1

c: Mr. J. B. Brady (NRC Senior Resident Inspector, HNP)
Mr. L. A. Reyes (NRC Regional Administrator, Region II)
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SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION ON THE SHEARON HARRIS IPEEE SUBMITTAL

I. SEISMIC

Request 1

In Appendix A, Sec. 6.2, of the Shearon Harris IPEEE, a high-confidence-low-probability-of-failure (HCLPF) evaluation for the low voltage switchgear is described. It is stated that the initial analyses indicated a HCLPF significantly less than 0.3 g due to the low margin between the Test Response Spectrum (TRS) and the Required Response Spectrum (RRS). It is further stated that clipping was applied to the peak in the floor response spectra to reduce the Review Level Earthquake (RLE) seismic demand, thereby resulting in a HCLPF of 0.35 g for the low voltage switchgear. Please provide the justification for applying the peak clipping to the floor response spectra and provide the details of the calculation.

Response 1

The low voltage switchgear were evaluated in accordance with Appendix Q, "Seismic Margin Capacity of Components Based Upon Seismic Testing," of EPRI NP-6041, "A Methodology for Assessment of Nuclear Power Plant Seismic Margin (Revision 1)." As discussed in Appendix Q, experimental observations indicate that narrow band frequency input is not as damaging as broad band frequency input. Since the design basis seismic qualification for this switchgear includes broad-frequency content spectra and the in-structure floor spectra have narrow frequency peaks, methodology from Appendix Q was applied. The most limiting case includes $B = 0.19$ (Equation Q-2) and $C_c = 0.55$ (Equation Q-6). The peak in-structure demand for the 0.3 g RLE was reduced from 3.624 g to 2.0 g (5% damping) for this case. Included as Attachment 1 to this enclosure is a copy of the design basis response spectrum used to determine B and C_c for the limiting case discussed above. Two additional details must also be discussed:

- The spectrum included in Attachment 1 is the design basis spectrum which was scaled to determine in-structure demand for the 0.3 g RLE. Refer to the Seismic IPEEE Report Appendix C for a discussion of the determination of scale factors.

- This spectrum is for 4% damping, but was conservatively used as 5% damping.

Request 2

In Appendix A, Sec. 6, the HCLPF capacities calculated for the Condensate Storage Tank (CST) and Refueling Water Storage Tank (RWST) were over 1.0 g, which is 100% higher than any capacity found in an ongoing database maintained by Lawrence Livermore National Laboratories in which HCLPF values (and other plant-specific fragilities) are reported from a variety of PRA sources (UCID-20571, "Compilation of Fragility Information from Available Probabilistic Risk Assessments," LLNL, Sept. 1985). Please provide the detailed HCLPF calculations for the CST and RWST tanks.

Response 2

Calculation 52214-C-007, "CP&L Shearon Harris IPEEE: HCLPF Capacity Calculations for 1X-SAB CST Tank and 1X-SN RWST Tank," is included as Attachment 2 to this enclosure.[1] Some key parameters are listed below for these tanks:

	CST	RWST
Number and Size of Anchors	80 - 3"ϕ cast in place anchors	76 - 3"ϕ cast in place anchors
Chair Plates	1" side and top plates 3 ½" bottom plate	1" side and top plates 3 ½" bottom plate
Chair Height	24"	24"
Tank Height	47'	45'
Tank Diameter	40'	45' - 9"
Shell Thickness for Base Ring	0.8125"	0.75"

[1] Inclusion of this calculation is not considered to constitute a commitment by CP&L. It is understood that this calculation may be subsequently revised in accordance with approved procedures and not resubmitted to the NRC in connection with this response.

<u>Request 3</u>

Section 5.6.2 of Appendix A describes the seismic evaluation of the main dam and auxiliary dam that were constructed to impound cooling water for SHNPP. Failure of these dams due to seismic motions will result in the loss of the supply of cooling water for the reactor, which, in turn, will lead to core melt down. As seismic category I structures, the dams had been designed for a Safe Shutdown Earthquake (SSE) of 0.2g. However, for a focused-scope plant, quantified evaluations in terms of HCLPF value are required for the dams against an RLE of 0.3g. The argument in the submittal that, based on the revised hazard curves, SHNPP should be in the reduced-scope category is not justified. Licensee should perform seismic evaluation of these dams against an RLE of 0.3g and provide a quantified evaluation in terms of a HCLPF for the dams. Please perform a seismic evaluation based on an RLE of 0.3g to determine a HCLPF for the dam and provide the results.

<u>Response 3</u>

In accordance with this request, further review of existing design basis results was performed. Information, as reported in Appendix 2.5D of the Harris FSAR, allows for a scaling analysis to determine a HCLPF. The results of the analysis show that the HCLPF is at least 0.31 g. These results are summarized in part below.

As discussed in the Seismic IPEEE Report, Section 5.6.2, two dams were constructed to impound cooling water for the Harris Nuclear Plant (HNP). The Main Dam impounds a reservoir used primarily for cooling tower makeup water. The Auxiliary Dam impounds a reservoir for emergency service water. The Main Reservoir also serves as a backup source of emergency service water. FSAR Section 2.5D.0.1 states that the HNP dams were evaluated for two cooling system designs. The first seismic analysis was for the original cooling system which included a 10,000-acre lake. After the HNP reservoir system was redesigned for cooling tower operation, the Main Reservoir size was reduced to approximately 4,000 acres. The normal lake level was dropped from elevation 250 feet to 220 feet. However, the Main Dam was constructed as originally designed for the larger reservoir. Tainter gates for the adjacent spillway were eliminated to allow the normal water level to be controlled by the ogee section. When the Main Dam was reanalyzed for the lower lake level, significant additional design margin was identified. Results of the reanalysis are summarized on the following page. Only the Main Dam is discussed as either the Main Reservoir or Auxiliary Reservoir is capable of supplying adequate cooling water. The Auxiliary Dam was not evaluated because the time to switch from the Auxiliary Reservoir to the Main Reservoir is expected to be only about ½ hour. Based on the configuration of the Auxiliary Dam, damage from the RLE is judged not to result in catastrophic failure. Any loss of inventory is expected to occur at a rate that more than adequately allows time to switch to the Main Reservoir.

As provided in FSAR Section 2.5D.3, the seismic analysis of the Main Dam included the following steps:

1. Determine the response of the dam/foundation to the accelerations of the rock below including the determination of the induced shears.
2. Represent the irregular cycles of shear stress induced in the dam foundation by determination of an equivalent number of uniform cycles of shear stresses.
3. Determine static stresses existing prior to the rock accelerations.
4. Determine cyclic shear stresses required to cause strains greater than 5×10^{-2} by tests or correlation with data for similar material.
5. Evaluate the seismic stability of the dams by comparing the shear stress in step (4) with the equivalent shear stresses induced by the rock accelerations.

The resulting minimum local factors of safety for the Main Dam were greater than 2.3 except for the rock fill shells. The minimum local factor of safety for the upstream rock fill shell is 1.45 and is considered greater than 2.0 for the downstream side. However, the analysis was performed with conservative material properties. Conservatisms were introduced due to the limited availability of cyclic strength data for this type of material.

Subsequent to the reanalysis for the revised lake level, triaxial tests were performed on material from the rock fill sections of the Main Dam (Reference: letter of transmittal for "Final Geologic Report on Foundation Conditions, Power Plant, Dams and Related Structures," M. A. McDuffie (CP&L) to H. R. Denton (NRC), dated August 24, 1983). Review of the tests indicate the cyclic strength to be greater than 2 times the values used previously. Therefore, the rock fill shells are considered not to be controlling for minimum local factor of safety determination.

As discussed in FSAR Section 2.5D.4.1, a conservative estimate of the HCLPF is made by applying the minimum local factor of safety to the design basis peak ground acceleration of 0.15 g. However, considering the recommended minimum factors of safety from EPRI NP-6041, Revision 1, Section 7 (i.e., 1.1 for conservatively determined properties), the HCLPF was determined to be at least:

$$\boxed{0.15\,g * 2.3 / 1.1 = 0.31\,g}$$

<u>Request 4</u>

The Charging and Safety Injection Pumps (CSIPs) are used in SHNPP for both normal charging and safety injection and are relied upon in both the primary and alternate success paths for RCS inventory control. It is stated in the IPEEE submittal that "Based on seismic evaluations for other plants, the pumps (i.e., CSIPs) are not expected to be a potentially limiting component for either path. Past studies have indicated median capacities for pumps on the order of 1.5mpga ($\beta C=0.45$). This converts to a HCLPF value of about 0.34g which exceeds the Shearon Harris review level earthquake." It is not clear from the submittal whether the above statement is used in the IPEEE as the primary basis for the screening of the CSIPs. Please discuss the applicability of the above data to the SHNPP CSIPs if this is the case, or discuss the basis used in the IPEEE for CSIP screening if this is not the case.

<u>Response 4</u>

The referenced information is located on page 7 of the Seismic IPEEE Report Appendix B "Success Path Logic Diagram." This information is extraneous to the screening evaluations performed for the Charging and Safety Injection Pumps. These pumps were screened out from further review in accordance with EPRI NP-6041, Revision 1, Appendix F "Checklists and Walkdown Data Sheets." The pumps meet the screening criteria and pass the anchorage and systems interaction checks.

II. FIRE

Request 1

The screening analysis of the turbine building appears to be incomplete, potentially resulting in premature removal from the analysis and exclusion of an important fire area. The summary description of the analysis findings for the turbine building on page 4-84 states that the only major fire threats to the offsite power cabling are from fires originating from the condensate booster pumps, turbine oil reservoir, and the MFW pumps. A fire originating in the turbine generator set itself should also contribute to the threat to offsite power cabling, and it should be associated with a higher value for probability of nonsuppression (this type of fire will in some cases result in energetic failure of the turbine generator set with corresponding failure of nearby suppression systems). In addition to excluding the risk associated with the turbine generator sets, the cumulative effect on risk of other fires in the turbine building has also been ignored -- the turbine building fire frequency of 6.4E-2 noted on page 4-71 has been reduced to 5.0E-3 on page 4-84, with no discussion of the risk associated with the eliminated fire events. Provide an analysis and documentation of fires associated with all combustible materials in the turbine building with particular emphasis on fires originating in the turbine generator sets.

Response 1

The quantitative screening of the turbine building was based on an evaluation of the area using plant documents (e.g., FSAR, plant drawings, procedures, etc.), generic fire data sources (e.g., NSAC Data Base, Reference 4), and confirmatory plant walkdowns. Potential fire initiators, including the turbine generator set and risk important targets, were identified and evaluated. It was concluded that the only risk significant fire sources were those capable of resulting in a loss of offsite power to both emergency buses. Furthermore, the only fire sources capable of causing such an effect, based on the location of the offsite power bus ducts relative to turbine building fire hazards, were determined to be the main feedwater pumps and the condensate booster pumps. Thus, only that fraction of the total turbine building fire frequency (6.4E-02/yr) which is attributable to the feedwater pumps and condensate booster pumps (5E-03/yr) was considered explicitly in the turbine building fire risk analysis.

A sensitivity analysis is presented below which addresses the risk from major turbine building fire sources including the potential damage from energetic turbine generator fires.

General Description of the Fire Area

Based on a review of the HNP FSAR, (HNP FSAR, page 9.5A-221 through page 9.5A-230), and walkdown observations, the area is an open structure of non-combustible, concrete/steel construction. The building floors, in elevation 240 ft. and 261 ft., walls between elevation 240 ft. and 261 ft. and structural columns supporting these floors are of reinforced concrete construction equivalent to 3-hour fire rating (HNP FSAR, page 9.5A-221). Above elevation

261 ft., the building is constructed of steel and concrete slab on steel frame and metal form decking, and has no walls or roof.

Stairways leading to elevation 240 ft. are enclosed within 2-hour fire rated construction and are provided with certified one and a half hour B label type fire rated doors.

Equipment containing combustible or flammable liquids is enclosed within curbs or sumps to retain the released oil and to route the releases to drainage systems.

Automatic fire detection systems are provided near major ignition sources in this fire area. The fire suppression systems for this fire area consists of two pre-action sprinkler systems provided below the operating floor with extensions to turbine bearings and five water spray systems for several areas on elevation 261 ft. (See figure 9.5A-35 of the HNP FSAR).

The two pre-action sprinkler systems are automatically actuated by thermal detectors installed at the ceiling level, for the cable vault and the charcoal filter room below elevation 261 ft., and under the turbine generator operating floor, respectively.

The water spray devices and curbed basins, installed at elevation 261 ft., are provided to serve the turbine lube oil reservoir, the condensate pumps, the main feedwater pumps, the condensate booster pumps and the hydrogen seal oil unit. The water spray is actuated when the thermal detectors register a temperature of 200° F.

Engineering Evaluation

a) Targets

The only equipment or cable credited in the PSA, which may be damaged as a result of fires in the turbine building, is associated with the main feedwater/condensate and the offsite power supply to the emergency buses.

Main feedwater components and associated power/control cables are located throughout the turbine building. No analysis has been performed to identify their specific locations and, as a result, it has been conservatively assumed that any significant fire within the turbine building will result in a non recoverable loss of main feedwater.

Offsite power supply cables from Start Up Transformers A and B (SUTA and SUTB) to their associated emergency buses, enter the east side of the turbine building above the 261 ft. floor elevation, traverse the turbine building floor at the same elevation and exit to the west side into the Auxiliary Building. The A and B supply cables are generally well separated.

b) Potential Damage Due to Hot Gas Layer Formation

Since the main turbine building is an open structure, there is no potential for hot gas layer development.

c) **Ignition Sources and Associated Fire Scenarios**

The total fire frequency for this fire area is 6.35E-02 per year (Reference 3) with major ignition sources and associated frequencies consisting of:

Turbine Generator Excitor	4.0E-03 per year
Turbine Generator Oil	1.3E-02 per year
Turbine Generator Hydrogen	5.5E-03 per year
Electrical Cabinets	1.3E-02 per year
Other pumps	6.3E-03 per year
Main Feedwater Pumps	4.0E-03 per year
Boiler	1.6E-03 per year
Welding	3.3E-03 per year
Transient Fires	1.3E-03 per year
Battery Charger	1.0E-03 per year
Air Compressors	3.7E-03 per year
Elevator Motor	1.1E-03 per year
Hydrogen Tanks	3.2E-03 per year

Notes:

a) Some minor ignition sources included in the total turbine fire frequency were excluded from this list. These include: welding induced cable fires, ventilation subsystems, fire protection panels, junction boxes, and miscellaneous hydrogen sources.
b) The condensate booster pump fire frequency is a fraction of the ignition source bin "other pumps," which encompasses the turbine building pumps except for Main Feedwater. These pumps were assigned a frequency of 1.0E-03/yr. Consequently, the combined fire frequency for main feedwater pumps and condensate booster pumps, referred to in the above request, is 5.0E-03/yr (4.0E-03 plus 1.0E-03).

The potential for each of these sources to result in degradation or loss of offsite power supplies and/or main feedwater is considered below:

Turbine Generator Excitor - The turbine generator excitor is located on the main turbine operating deck. There is no significant source of intervening combustible to provide a combustible pathway to the lower elevations of the main turbine building. Since there is no offsite power cable located on the operating deck, the worst possible damage as a result of this type of fire would be a loss of main feedwater.

Turbine Generator Oil - There are several components associated with the turbine generator oil system located on the 261 ft. floor elevation which may pose a potential threat offsite power cables, including the turbine oil reservoir, oil cooler and hydrogen seal oil cooler units, together with associated piping.

The turbine oil reservoir and coolers are located in the northeast quadrant of the floor and present a threat to the B train offsite power supply. Any oil leakage will be contained by diked areas and drained to safe remote storage. The piping area is also protected by an automatic water spray system.

The hydrogen seal oil cooler units are located between the A and B offsite power supplies. Oil spills from the unit will be contained by the diked area, which is protected by an automatic water spray system. Due to adequate spatial separation, this source is not considered to be a threat to either A or B offsite supplies.

Turbine Generator Hydrogen - The main turbine generator hydrogen source is located on the turbine deck, and for reasons similar to those discussed for the turbine excitor, presents no threat to the offsite power. The postulated damage as a result of this type of fire would be a loss of main feedwater.

Electrical Cabinets and Battery Charger - Major electrical cabinets and the battery charger fire sources are located in the Switchgear Room (elevation 261ft.) and the Electrical Room (elevation 286 ft.). These are separate, enclosed rooms constructed of concrete block masonry, equivalent to three-hour fire barrier construction. Floor and ceiling openings for handling equipment are protected by either concrete or metal hatch covers. These sources do not present a threat to offsite power supplies. The postulated damage as a result of this type of fire would be a loss of main feedwater.

Main Feedwater Pumps and Condensate Booster Pumps - The Main Feedwater and Condensate Booster Pumps are located on the west wall of the turbine building. At this point the A and B offsite power supplies are located within 30 ft. of each other and could be potentially damaged by a fire originating in either of these sources. Oil spills from the unit will be contained by the diked area which is protected by a water spray system.

Condensate Pumps - The Condensate Pumps are located on the east wall of the turbine building and present a potential threat to the offsite supply from SUTB only. Oil spills from the unit will be contained by the diked area which is protected by a deluge system.

Other Pumps - In addition to the Main Feedwater, Condensate and Condensate Booster Pumps, the 261 ft. elevation contains two heater drain pumps. These are located in the northwest quadrant of the turbine building at elevation 261 ft. and are well separated from the closest offsite power supply which is at least 40 ft. away. Therefore, these pumps do not represent a significant fire hazard to the offsite power sources. Pumps located on or below elevation 261 ft. would not impact offsite supplies due to the protection offered by the 261 ft. floor. Pumps located above the 261 ft. elevation would not represent a hazard to offsite power supplies due to the containment provided for oil leakage. The postulated damage as a result of this type of fire would be a loss of main feedwater.

Air Compressors - Two sets of air compressors are located at the turbine building 261 ft. floor elevation. One set is located in the southwest quadrant and the other in the southeast quadrant. The former are well separated from the closest offsite power supply (SUTA) which is at least 40 ft. away. However, the latter may result in potential damage to the SUTA offsite power supply.

Welding and Transient Fires - Welding and transient initiated fires may represent a potential threat to a single offsite power source but could only damage both sources as a result of the involvement of secondary combustible material. Since the major exposed combustible material within the area is IEEE 383 cable insulation, the possibility of a major secondary fire is considered minimal. For the purposes of this sensitivity analysis, twenty percent (20%) of the turbine building transient and welding fires will be assumed to represent a hazard to one of the offsite power supplies. Main feedwater is assumed to be at risk from welding and transient fires.

Boiler, Hydrogen Tank and Elevator Motor - These sources are not located on the 261 ft. turbine building elevation, and do not represent a potential fire hazard for either offsite power sources. The postulated damage as a result of this type of fire would be a loss of main feedwater.

d) Fire Induced Core Damage Frequency

The core damage frequency resulting from a particular fire source (CDFi) can be determined from the following expression:

$$CDF_i = F_i \times S_{fi} \times P_{fs} \times CCDP \text{ (Equation 1)}$$

where F_i is the ignition source frequency and S_{fi} is the severity factor for the ignition source. For the turbine building analysis, the severity factor is defined as the fraction of fires which did not self-extinguish or were not manually extinguished at an early stage (i.e., using manual fire extinguishers). The severity factors for individual ignition sources are derived in Appendix 1. P_{fs} is the probability of failure of automatic suppression. The failure probability of water spray systems (0.02) is taken from the EPRI Fire PSA Guidance (Reference 5). CCDP is the conditional core damage frequency given the postulated damage from an unsuppressed fire.

Based on the fire scenario discussion provided above, fire damage in the turbine building can be bounded by three possible damage states, defined as TB1, TB2 and TB3. Descriptions are as follows:

- TB1 results in non-recoverable loss of main feedwater.
- TB2 results in non-recoverable loss of main feedwater and loss of offsite power from SUTA or SUTB to the associated emergency bus.
- TB3 results in non-recoverable loss of main feedwater and loss of offsite power from SUTA and SUTB to the associated emergency buses.

Conditional core damage frequencies for each of these damage states were derived separately from this sensitivity analysis as part of the original IPEEE work.

The core damage frequency contribution arising from each of the ignition sources is evaluated in Table 1 on the following page, based on Equation 1.

Conclusion

The core damage frequency contribution from major turbine building fire sources, based on the bounding analysis documented above is 6.6E-07 per year, confirming the conclusion reached in the IPEEE that turbine building fires at HNP are not significant risk contributors. The possibility of energetic turbine generator fires, which could lead to suppression system damage, as referred to in the question, has been accounted for. Such fires would most likely occur on the operating deck and would not impact offsite power supplies which are located two floor elevations below.

Table 1: Contributors to Turbine Building CDF						
Fire Damage State	**Ignition Sources**	**Ignition Frequency (F_i)**	**Severity Factor (S_{fi})**	**Probability of Failure Automatic Suppression (P_{st})**	**Conditional Core Damage Probability (CCDP)**	**Core Damage Frequency (CDFi)**
TB1	T/G Excitor	4.0E-03	0.20	1.0	1.06E-05	8.5E-09
	T/G Hydrogen	5.5E-03	0.57	1.0	1.06E-05	3.3E-08
	Electrical Cabinet	1.3E-02	0.13	1.0	1.06E-05	1.8E-08
	Other Pumps (3)	4.3E-03	0.20	1.0	1.06E-05	9.1E-09
	Battery Charger	1.0E-03	0.1	1.0	1.06E-05	1.1E-09
	Air Compressor (1)	1.85E-03	0. 08	1.0	1.06E-05	1.6E-09
	Boiler	1.6E-03	0.25	1.0	1.06E-05	4.2E-09
	Elevator Motor	1.1E-03	0.13	1.0	1.06E-05	1.5E-09
	Hydrogen Tank	3.2E-03	1.0	1.0	1.06E-05	3.4E-08
	Welding (2)	3.3E-03 x 0.8	0.25	1.0	1.06E-05	7.0E-09
	Transient (2)	1.3E-03 x 0.8	0.29	1.0	1.06E-05	3.2E-09
					Total CDF for TB1	**1.22E-07**
TB2	T/G Oil	1.3E-02	0.44	0.02	4.03E-04	4.6E-08
	Condensate Pumps (3)	1.0E-03	0.20	0.02	4.03E-04	1.6E-09
	Air Compressor	1.85E-03	0.08	1.0	4.03E-04	6E-08
	Welding (2)	3.3E-03 x 0.2	0.25	1.0	4.03E-04	6.6E-08
	Transient (2)	1.3E-03 x 0.2	0.29	1.0	4.03E-04	3.0E-08
					Total CDF for TB2	**2.04E-07**
TB3	MFW Pumps	4.0E-03	0.45	0.02	8.4E-03	3.02E-07
	Condensate Booster Pumps (3)	1.0E-03	0.2	0.02	8.4E-03	3.4E-08
					Total CDF for TB3	**3.36E-07**
Total CDF due to all Fires in Turbine Building = 6.62E-07/yr						

Notes:

1) 20% of the turbine building transient and welding fires are assumed to be in a location capable of damaging the A or B offsite power supplies.
2) The air compressor fire frequency was split evenly between compressors in the SW and SE corners of the turbine building.
3) The Condensate and Condensate Booster Pump fire frequency is a fraction of the ignition source bin "other pumps," defined in Reference 3, which encompasses the turbine building pumps except for Main Feedwater. Each of these pump sets has been assigned a frequency of 1.0E-03 per year.

<u>Request 2</u>

The submittal states that in some fire scenarios, fires are credited with a probability to not progress beyond "the incipient stage," where the probability has been established by review of fire events in the Fire Events Database. Failure to progress beyond the incipient stage can be a result of self-extinguished fires (e.g., in cabinets), or by manual or automatic suppression (in some cases, it is not known how the fire has been extinguished). The potential exists, therefore, to double-count suppression in a scenario, if suppression is credited both implicitly (by application of probability to not progress beyond the incipient stage) and explicitly (by directly crediting suppression in the scenario). It is not possible to identify such scenarios by review of the information provided in the submittal. Identify any scenarios in which credit has been given to not progress beyond the incipient stage as a result of applying probabilities based on extinguishment by manual or automatic suppression (or if the basis of the extinguishment is not known), and direct credit has also been given to the same type of suppression. For these scenarios, re-analysis should be performed in which frequency reduction is obtained by only one method (either implicitly or explicitly).

<u>Response 2</u>

The methodology used in the HNP fire analysis avoided the potential for double counting of fire suppression. Specifically, the probability of a fire progressing beyond the incipient stage was evaluated by discounting only those fires in the Fire Event Data Base (Reference 4) which terminated due to self-extinguishment or due to the faulted component de-energizing (e.g., due to activation of some form of fault protection). Fires which were suppressed by manual or automatic means, or were extinguished by unknown means, were counted. For example, Table 2 on the following page presents a summary of the manner by which cabinet fires, reported in Reference 4, were terminated. In this case, the fraction of fires with potential to progress beyond the incipient stage was evaluated to be 0.69 [1- (26/84)]. This approach was used throughout the analysis to ensure that manually and automatically suppressed fires were included in determining the frequency of fires progressing beyond the incipient stage.

Table 2: The Mode of Fire Termination For Electrical Cabinet Induced Fires

Building	No. of Fires				
	De-Energized or Self - Extinguished	Manually Suppressed w/t Known Method	Manually Suppressed w/t Unknown Method	Automatic Suppression	Total
AUX. BLD	4	5	6	0	15
REACTOR BLD	8	10	6	0	24
DG RM	6	0	0	0	6
SWGR	5	6	6	2	19
CSR	0	4	0	0	4
TB	3	10	2	1	16
TOTALS	26	35	20	3	84

<u>Request 3</u>

The COMPBRN IIIe generic simulation of an oil spill fire addressed only a single event, i.e., a small spill of 1.5 gallons of oil. Unless the plant administrative controls limit the amount to 1.5 gallons, then the application of this amount for the fire assessment is considered to be optimistic. If the administrative control is greater than 1.5 gallons, re-analyze the COMPBRN simulations using the current maximum amount allowed by administrative controls. In addition, the resulting impact on the analysis should be assessed.

<u>Response 3</u>

The generic small oil spillage fire model referred to in the question was developed to address fire scenarios where the fire is postulated to originate in a fixed ignition source (such as a small pump). It was not used to address fire scenarios that involve transient combustibles such as those that are subject to the administrative control. The model is only used where justification could be provided that the amount of combustible available in the fixed source is bounded by the amount of oil assumed in the model. Based on a review of the HNP IPEEE, no scenarios were identified where the fire model in question was used inappropriately. The treatment of transient combustible ignition sources is discussed as part of individual fire area analyses in the HNP IPEEE (e.g., Section 4.6.2.1).

Request 4

The failure probability for automatic suppression applied values compatible with the FIVE methodology. This data is acceptable for systems that have been designed, installed, and maintained in accordance with appropriate industry standards, such as those published by the National Fire Protection Association (NFPA). Verify that automatic fire suppression systems at Shearon Harris meet NFPA standards.

Response 4

The automatic fire suppression systems at HNP meet industry codes, standards, and guidelines including the NFPA standards as documented in the FSAR. Specifically, FSAR Section 9.5.1.2.1, "Applicable Fire Protection Codes, Standards and Guidelines," subparagraph e), "National Fire Protection Association (NFPA)," lists pertinent standards used for design and installation of plant automatic fire protection systems including:

- Standard No. 12A-1980 - Halogenated Fire Extinguishing Agents Systems - Halon 1301
- Standard No. 13-1978 - Installation of Sprinkler System
- Standard No. 15-1977 - Water Spray Fixed Systems

In addition, FSAR Section 9.5.1.2.1, subparagraph f), cites the Nuclear Mutual Limited (NML) standard "Property Loss Prevention Standards for Nuclear Generating Stations."

Further information on the HNP fire suppression systems is given in FSAR Section 9.5.1.2.3, page 9.5.1-26a, "Fire Suppression Systems." Specifically:

> "Primary fire suppression systems for the plant discharge water through sprinkler heads, water spray nozzles, or, with the addition of foam solution, through foam making devices. Each system is designed, procured, installed and tested in accordance with applicable NFPA standards."

FSAR Section 9.5.1.4.1, "Inspection and Testing Requirements," states that "After installation, acceptance tests are performed in accordance with NFPA standards ..." Further, Section 9.5.1.4.2 describes the continuing plant operation period stating that "Operational integrity of the various components of the Fire Protection System provided as part of the plant design will continue to be assured through the implementation of Plant Administrative, Operating and Maintenance Procedures and Quality Assurance Program. These procedures will be based on the guidance given in applicable NFPA standards and regulatory guidelines."

References

1. Request for Additional Information (RAI) on the Shearon Harris IPEEE submittal, December 15, 1997.

2. Shearon Harris Nuclear Power Plant response to Generic Letter 88-20, Supplement 4 - Individual Plant Examination for External Events (IPEEE), June 3, 1995.

3. SHNPP COMPBRN Analysis File, No. 2Y57.F/08A, Revision 0, June, 1995.

4. NSAC/178L Fire Events Data Base for US Nuclear Power Plants, Revision 1, January 1993.

5. EPRI TR-105928, Fire PRA Implementation Guide, December, 1995.

6. Scientech, Inc. File No. 6562, Revision 0, "Response to NRC Request for Additional Information (RAI) Concerning the Shearon Harris NPP Fire IPEEE," January, 1998.

ATTACHMENT 1

Design Basis In-Structure Response Spectra Used for Determination of B and C_c for Peak Clipping (1 page)

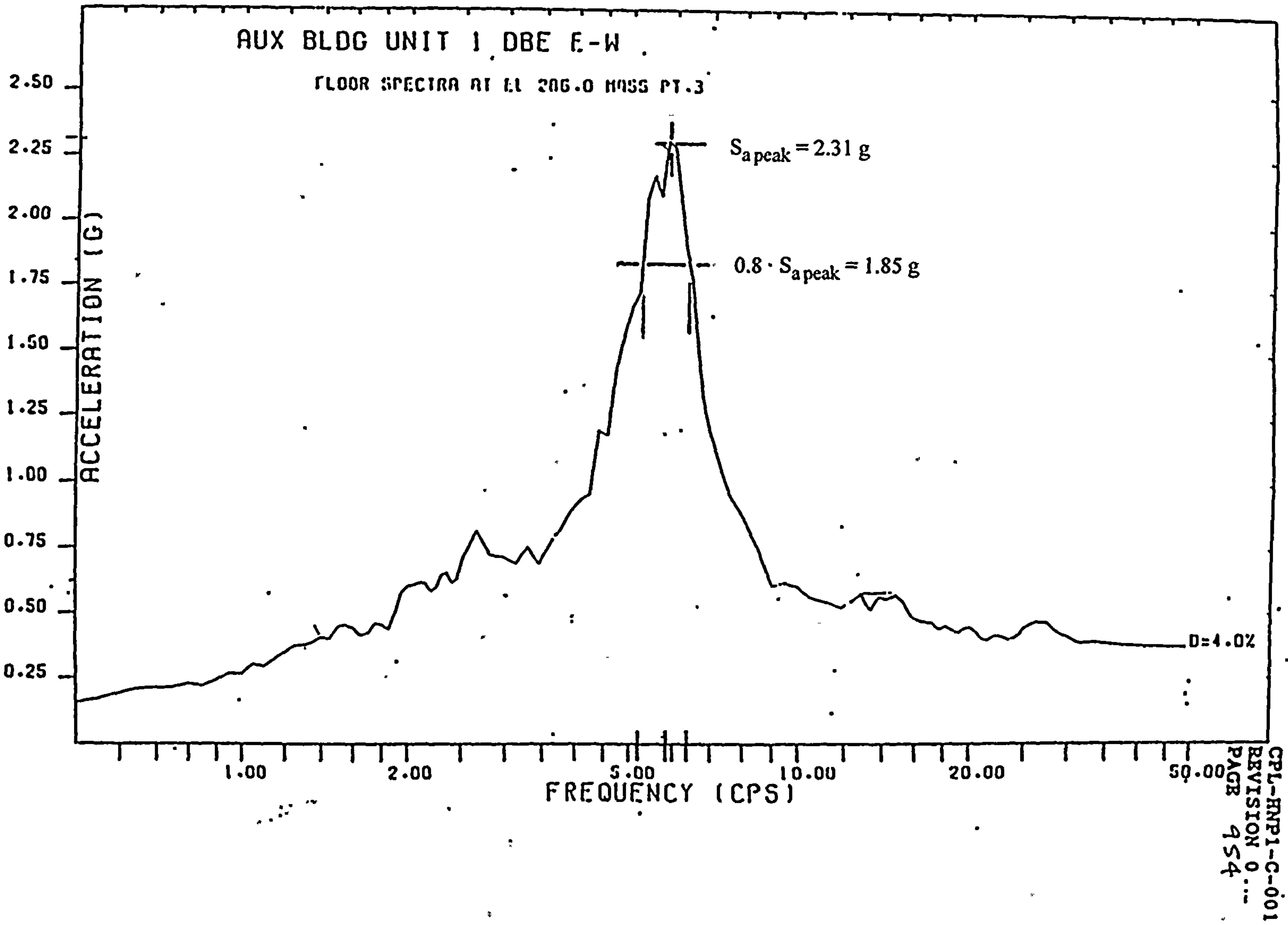
AUX BLDG UNIT 1 DBE E-W
FLOOR SPECTRA AT EL 286.0 MASS PT.3
$S_{a\,peak} = 2.31$ g
$0.8 \cdot S_{a\,peak} = 1.85$ g
D=4.0%
ACCELERATION (G)
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
1.00
2.00
5.00
10.00
20.00
50.00
FREQUENCY (CPS)
CPL-HNP1-C-001
REVISION 0
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FIG. 4-2