April 20, 2010

Mr. Tom Joyce
President and Chief Nuclear Officer
PSEG Nuclear LLC
P.O. Box 236
Hancocks Bridge, NJ 08038

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR HOPE CREEK GENERATING STATION

Dear Mr. Joyce:

The U.S. Nuclear Regulatory Commission staff has reviewed the Severe Accident Mitigation Alternatives analysis submitted by Public Service Enterprise Group Nuclear, LLC regarding its application for license renewal of the Hope Creek Generating Station, and has identified areas where additional information is needed to complete its review. Enclosed is the staff's request for additional information.

We request that you provide your responses to these questions within 45 days of the date of this letter, in order to maintain the environmental review schedule. If you have any questions, please contact me at 301-415-8537 or by e-mail at charles.eccleston@nrc.gov.

Sincerely,

Charles Eccleston, Project Manager ***/RA/***
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-354

cc w/encl: See next page

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DATE	04/13/10	04/16/10	04/16/10	04/20/10

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Letter to Tom Joyce from C. Eccleston, dated April 20, 2010.

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR HOPE CREEK GENERATING STATION

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Request for Additional Information
Regarding the Analysis of Severe Accident Mitigation Alternatives
for the Hope Creek Generating Station

1. Provide the following information regarding the probabilistic risk assessment (PRA) used for the severe accident mitigation alternative (SAMA) analysis:

    a. Provide a brief summary of the most significant changes made to the individual plant examination (IPE) to obtain PRA Model 0.

    b. Sections E.2.1.3, E.2.1.4, E.2.1.5, E.2.1.9 and E.2.1.10 provide very detailed descriptions of the changes made to the various Hope Creek Generating Station (HCGS) revisions. Since Models 1.1, 1.2 and 1.3 were described as minor revisions, identify which of the model changes listed in Sections E.2.1.3 through E.2.1.5 most impacted the change in core damage frequency (CDF) from Model 1.0 to Model 1.3. For Models 108A and 108B, identify the model changes listed in Sections E.2.1.9 and E.2.1.10 that most impacted the change in CDF.

    c. Provide the contribution to the internal event CDF due to anticipated transients without scram and due to station blackout (SBO).

    d. Provide additional information on the 2008 peer review including the composition of the review team, and the status and impact on the SAMA analysis of the supporting requirements that only met Capability Category I. Describe any other internal and external reviews of the Level 1 (including internal flooding) and Level 2 PRA model, significant review comments and their resolution, and the impact of unresolved comments on the results of the SAMA analysis.

    e. Confirm that any plant modifications or operating changes made since the freeze date for the Model 108B PRA do not have any effect on the conclusions of the SAMA assessment.

    f. Briefly describe the overall quality assurance program applicable to the HCGS Level 1 and 2 PRA and its updates.

2. Provide the following information relative to the Level 2 analysis:

    a. Provide a brief history of the development of the current HCGS Level 2 PRA, including for example, its relationship to the IPE level 2 model and the model status relative to the various peer reviews.

    b. Section E.3.5 states that "representative [Modular Accident Analysis Program (MAAP)] cases for each of the release categories were chosen based on a review of the Level 2 model cutsets and the dominant types of scenarios that contribute to the results." Describe in more detail the process and criteria used to assign the containment event tree end states to release categories and to select the MAAP case to represent each release category.

    c. Table E.3-5 indicates that for ST5 (loss of containment heat removal with subsequent wetwell failure) the cesium iodine release fraction is 0.36 while for ST7 (loss of containment heat removal with subsequent drywell failure) the release fraction is only 0.057. This appears counterintuitive. In addition, the start time of Plume 1 in Table E.3-6 for ST5 (H/L) and ST7 (M/I) appear to be rounded differently (i.e., 36 h versus 35 h, respectively but should be the same per Table E.3-5). Describe the assumptions and/or phenomena that lead to these results.

3. Provide the following information with regard to the treatment and inclusion of external events in the SAMA analysis:

    a. For both the internal fire and seismic assessments, it is indicated that the 2003 update used the conditional core damage probabilities (CCDPs) based on the 2003 internal event PRA revision. However, on page E-87 it is stated that the underlying system and plant response models that these analyses rely upon have not been updated since the completion of the [individual plant examination of external events (IPEEE)] in 1997." Clarify the meaning of the latter statement. It would appear that using CCDPs from the 2003 PRA is using updated system models.

    b. Describe the meaning of the column headings in Table E.5.4. Clarify whether the values in the column titled "HCGS Seismic IPEEE HEP" are those used in the original seismic IPEEE or the 2003 update. If from the IPEEE, then the modifications described in the final column appear to represent no change from the IPEEE, rather then eliminating "the non-conservative nature of the original seismic analysis" as stated on page E-98.

    c. For seismic risk contributor %IE-SET37, the seismic hazard frequency is given on page E-99 as 5.5E-08 per year versus a value of 6.8E-08 per year given in Table 3-8 of the IPEEE. Explain why the values are different.

    d. A liquefied natural gas (LNG) terminal has been approved for construction in Logan Township, New Jersey. Discuss the status of this facility and the potential impact of the transportation of LNG to this facility on HCGS during the license renewal period.

4. Provide the following information concerning the MACCS2 analysis:

    a. Section E.3.2 states that SECPOP2000 census data from 1990 to 2000 were used to determine the population growth factor, and that the population growth was averaged over each ring and applied uniformly to all sectors within each ring. Using an average growth over a ring mixes growth rates from significantly different regions. For example, portions of Kent County, Delaware; Chester County, Pennsylvania; and Cumberland County, New Jersey will lie on similar rings. Between years 2000 and 2003, they had population growths of 6.1 percent, 5.5 percent and 2.0 percent, respectively (http://www.epodunk.com/top10/countyPop/coPop8.html, http://www.epodunk.com/top10/countyPop/coPop39.html, and http://www.epodunk.com/top10/countyPop/coPop31.html). Provide an assessment of the potential impact on population dose risk (PDR) and offsite economic cost risk (OECR) if a wind-direction-weighted growth estimate for each sector were used.

    b. Section E.3.2 does not discuss transient population. Clarify whether transient population was considered in the analysis. If a transient population was not considered, provide a justification/rationale for not including it.

c. Section E.7.3.4 describes a population sensitivity case in which the 2040 population was uniformly increased by 30 percent in all sectors of the 5-mile radius. Section E.3.2 states that SECPOP2000 census data from 1990 to 2000 were used to determine the 10 year population growth factor. It is unclear if the 30 percent sensitivity case bounds the population growth rate if updated population growth estimates are used (see request for additional information (RAI) 4a). Provide an assessment of the impact on PDR and OECR using currently available population growth estimates for the surrounding counties and states.

d. Section 3.1.2 identifies the allowable fuel burnup and enrichment for HCGS. Clarify if this is consistent with the core inventory used in the SAMA analysis.

5. Provide the following with regard to the SAMA identification and screening process:

a. For most Table E.5-1 initiating events (e.g., %IE-SWS, %IE-TE, %IE-MS, %IE-TT, %IE-S2-WA) it is stated that “this initiator event is a compilation of industry and plant specific data (No specific SAMA identified).” Provide assurance that for each of these initiating events there is not a dominant contributor for which a potential SAMA to reduce the initiating event frequency or mitigate the impact of the initiator would not be viable. For example, while the above statement is made for initiator %IE-SWS, potential SAMAs were in fact identified for event NR-IE-SWS, Non-recovery of the loss of SWS initiator.

b. For Table E.5-1 event NR-IE-SWS, Non-recovery of the loss of SWS initiator, two potential SAMAs were identified. Since the loss of service water system (SWS) initiating event frequency is input as a basic event rather than derived from a model of the HCGS SWS system, it is not clear that the SAMAs identified (a back up air compressor or cross-tieing the residual heat removal (RHR) pumps) would lead to recovery. Discuss these identified SAMAs and the potential for other mitigation strategies.

c. For Table E.5-1 event SAC-XHE-MC-DF01, Dependent failure of miscalibration of temperature controller HV-2457S, it is indicated that because of the low probability of this event and the existing procedural guidance for calibration there is limited opportunity for improvement. Assess whether a redundant controller using diverse components and calibration techniques would reduce the importance of this event.

d. For Table E.5-1 events CAC-AOV-CC-11541, Pneumatic supply to HV-11541 fails; CAC-AOV-CC-4964, Pneumatic supply to HV-4964 fails; CAC-XHE-FO-LVENT, Local venting through 12” line fails; NR-VENT-5-03, Failure to initiate containment vent given SPC hardware failure; and NR-RHRVENT-INIT, Failure to initiate vent given failure to initiate RHR in SPC, assess whether a modification to change the venting system to a passive design (e.g., through use of a rupture disk) would be a feasible alternative.

e. For Table E.5-1 event %FL-FPS-5302, Internal flood outside lower relay room, assess whether flood barriers are a potential SAMA to mitigate this event.

f. For a significant number of Table E.5-1 events, such as DCP-BDC-ST-DF01, CSS-MDP-TM-PAC, and %IE-SACS, no SAMAs were identified based on low contribution to Level 1 and Level 2, and engineering judgment that the anticipated implementation costs of hardware modifications associated with mitigating the event would likely exceed the expected cost-risk benefit. This criterion for identifying potential SAMAs is not in accordance with the stated criteria for selection and screening and does not account for the potential for procedural changes or the impact of uncertainty. Provide assurance for each of the events for which no SAMAs were identified on the above, or similar, basis that no SAMAs are feasible that merit further consideration. This assessment should also account for the impact of uncertainty.

g. For Table E.5-1 event SWS-MOV-VF-SPRA, Flood–spray causes MOV failure in RACs compartment, it is stated that there is no feasible SAMA to mitigate the potential for MOV failure due to spray damage. Discuss the feasibility of installing a spray shield to address this failure.

h. For Table E.5-2 event CNT-DWV-FF-MLTFL, Drywell (DW) shell melt-through failure due to containment failure, assess whether a barrier or curb to protect the DW shell would be a feasible alternative to reduce the probability of early failure due to DW shell melt-through.

i. For Table E.5-2 events CIS-DRAN-L2-OPEN, Valves open automatically for drainage normally open, and CIS-XHE-FO-DRN-E, Operator fails to locally close equipment drain and floor drain MOV in RB-early, replacing the MOVs with fail closed AOVs is identified as a more costly alternative to SAMA 5, Restoring AC power with onsite gas turbine generator. While the alternative may be more costly, it also might be more effective and have a larger cost-risk reduction. Provide a further evaluation of the costs and benefits for this alternative.

j. The external events multiplier and review of potential seismic-related SAMAs were based on use of the Electric Power Research Institute (EPRI) seismic hazard curve for HCGS (in contrast to the Lawrence Livermore National Laboratory (LLNL) seismic hazard curve used for Salem Generating Station SAMA analysis). It appears that use of the LLNL seismic hazard curve or U.S. Geological Survey 2008 seismic hazard data would result in larger estimated benefits for SAMAs, and possibly additional, potentially cost-beneficial SAMAs for HCGS. Provide an assessment of the impact on the SAMA identification and screening process if the seismic CDF and external event multiplier were based on use of the LLNL seismic hazard curve rather than the EPRI curve.

k. Table E.5-3 includes 23 Phase 1 SAMAs numbered from 1 through 40. The missing numbers were presumably identified early in the process and discarded for some reason. Provide further information on the development of the Phase 1 SAMA list, the numbering of the SAMA candidates, and any candidates screened out prior to this list.

l. It appears that the SAMA identification process eliminated many potential SAMAs by not explicitly considering the generic list of SAMAs included in NEI 05-01 and by using the excessive implementation cost criteria in screening the PRA importance lists (see RAI 5.f). Justify that the Phase 1 SAMA identification and screening process has produced a comprehensive and sufficiently complete set of SAMAs for consideration, given that 13 of the 23 Phase 1 SAMAs were ultimately determined to be potentially cost-beneficial.

m. The industry SAMA review discussed in Section 5.1.3.1 for Susquehanna Steam Electric Station (Susquehanna) indicated (under Industry Site SAMA ID 6) that HCGS already includes a SAMA to automate alignment of the portable generator. No such SAMA is included in Table E.5-3. It is further stated (under Industry Site SAMA ID 5) that auto alignment of the 480V AC portable generator is addressed by SAMA 5. While SAMA 5, Restore AC power with onsite gas turbine generator, addresses loss of AC power, the utilization of the 480V AC generator (with or without automatic alignment) could mitigate other situations and have benefits different then SAMA 5. Provide an evaluation of a SAMA to automatically align the 480V AC portable generator.

n. Table E.5-3 indicates that SAMA 38, Enhance FWS and ADS for long-term injection, was screened out on the basis that a procedure has been implemented to address the actions associated with this SAMA. However, as discussed in Section E.5.1.7.2.2, this SAMA requires enhancement to the feedwater system (FWS), including strengthening the fire water tanks. It is not clear whether/how enhancements to the FWS have been addressed as part of the implementation of the current procedure. Provide additional discussion regarding this SAMA.

o. Table E.5-3 indicates that SAMA 14, Alternate room cooling for SW rooms, originated from the HCGS Level 1 importance list. Identify the basic event(s) that is the source for this SAMA. Based on the description of this SAMA – to provide alternate means of opening Torus Vent Valves – it is not clear how the SAMA relates to providing alternate room cooling for SW rooms. Explain this discrepancy. Also, this SAMA was subsumed into SAMA 4 and subsequently not retained for the Phase 2 evaluation. Clarify the logic for subsuming this SAMA into SAMA 4.

p. Section E.5.1.2 implies that Table E.5-2 provides the large early release probability (LERF) (release category H/E) basic events having a risk reduction worth (RRW) greater than or equal to 1.006. This section also states that a review of cutsets from all non-intact release categories was performed, however results of that review are not presented. Given that non-LERF release categories dominate the population dose-risk (i.e., H/I, M/E, and M/I), provide documentation of Public Service Electric & Gas Co. (PSEGs) review of potential SAMAs for the risk-dominant non-intact release categories (e.g., a listing of the basic events having a RRW greater than or equal to 1.006, the applicable SAMA(s) for each of the events, and an evaluation of any new SAMAs.

q. Section E.5.1.3.7 identifies SAMA 11 as having been identified from the review of selected industry analyses. However this SAMA is not included in the list of Phase 1 SAMAs (Table E.5-3) and it was not evaluated in the environmental report (ER). Furthermore, the disposition of James A. Fitzpatrick Nuclear Power Plant SAMA 62 in Section E.5.1.3.3 states that a SAMA to develop a procedure to open the door of [emergency diesel generator (EDG)] buildings upon high temperature alarm (i.e., HCGS SAMA 11) was not included due to the small contribution to HCGS risk. Clarify this discrepancy and provide an evaluation of SAMA 11, if applicable.

r. PSEG's review of the Duane Arnold Energy Center (Duane Arnold) SAMAs in Section E.5.1.3.5 did not address Duane Arnold SAMA 117, "increase boron concentration or enrichment in the standby liquid control SLC system," which was determined to be potentially cost-beneficial in the uncertainty analysis. Review this SAMA for applicability to HCGS and provide an evaluation of this SAMA, if applicable.

6. Provide the following with regard to the Phase 2 cost-benefit evaluations:

a. Section E.6 states that plant personnel developed HCGS-specific implementation cost estimates for each of the SAMAs. Provide a description of: the process PSEG used to develop the SAMA implementation costs, the level of detail used to develop the cost estimates (e.g., general cost categories such as hardware design, procurement, installation, and testing, procedure development, quality assurance and licensing support, etc.), and how the calculations are documented. Specifically discuss whether the cost estimates include replacement power costs during outages required to implement the modifications, contingency costs for unforeseen difficulties, and inflation.

b. The cost estimate for SAMA 5 ($2.05M) seems high for what is stated to be procedure changes and operator training. Provide justification for the cost estimate.

c. In Section E.6.4, the benefit of utilizing the gas-turbine generator (SAMA 5) was assessed by reducing the probability of failure to cross tie the HCGS EDGS. This assumption does not provide credit for the gas turbine in the situation where all the emergency generators are unavailable. Discuss the impact of this omission.

d. The implementation cost for SAMA 10 ($100K) was based on the estimated cost of a procedure change. However, the plant modification for SAMA 10 is described as including the addition of a new pump. Provide justification for the cost estimate.

e. SAMA 16, which involves replacing one of the four Switchgear Room cooling fans with a fan having a different design, was estimated to cost $400K. Provide justification for the cost estimate. In addition, the description of this SAMA notes that an alternate means of cooling could involve use of multiple portable fans. Clarify whether this is a potentially lower cost alternative to SAMA 16 and, if so, provide an evaluation of a SAMA using multiple portable fans.

f. SAMA 31 is similar to Salem SAMAs 21and 22 in that each involves installing fire barriers to prevent the propagation of a fire between cabinets. HCGS SAMA 31 has an estimated cost of $1.2M (one cabinet) compared to $3.23M (48 cabinets) and $1.6M (three cabinets) for Salem SAMAs 21 and 22, respectively. Clarify why the cost of installing fire barriers in one cabinet (HCGS SAMA 31) is only 25 percent less than the cost for three cabinets (Salem SAMA 22) and only half the cost of 48 cabinets (Salem SAMA 21).

g. In Section E.6.17, it is stated that SAMA 35 was conservatively assumed to eliminate 99 percent of the risk associated with basic event %IE-FIRE38. However, the estimated total averted cost-risk is calculated using a reduction of only 90 percent. Clarify this discrepancy.

h. The cost estimate for SAMA 36 ($270K) seems high for what appears to be a procedure change. Provide justification for the cost estimate.

i. Provide the assumptions and PRA modeling changes used to model SAMAs 39 and 40 in Sections E.6.20 and E.6.21.

j. SAMA 40, which involves providing procedural guidance to bypass the reactor core isolation cooling (RCIC) turbine exhaust pressure trip, was estimated to cost $620K. This cost is appreciably higher than the cost estimate of $250K for Duane Arnold SAMA 166. The Duane Arnold SAMA is also similar to, and the source of the HCGS SAMA 40. Provide justification for the implementation cost estimate for SAMA 40.

k. SAMAs 33 and 34, which involve cross-tying the 480V AC buses at HCGS, are each estimated to cost $1.32M. Wolf Creek SAMA 3 and Susquehanna SAMA 2a, which also involve cross-tying 4kV AC buses, are estimated to cost $328K and $656K, respectively.

Provide a more detailed description of both the modification and the implementation cost estimate for HCGS SAMAs 33 and 34.

7. For certain SAMAs considered in the ER, there may be lower-cost alternatives that could achieve much of the risk reduction at a lower cost. In this regard, provide an evaluation of the following SAMAs:

    a. Establishing procedures for opening doors and/or using portable fans for sequences involving room cooling failures (SAMAs 14, 16, 17, and 18).

    b. Extending the procedure for using the B.5.b low pressure pump for non-security events to include all applicable scenarios, not just SBOs. Clarify if this is the intent for SAMA 10 or not.

    c. Utilizing a portable independently powered pump to inject into containment.

8. PSEG's cost-benefit analysis showed that nine of the SAMA candidates (SAMAs 1, 3, 4,10, 17, 18, 30, 35, and 39) were potentially cost-beneficial in the baseline analysis and that an additional four SAMAs (SAMAs 8, 32, 36, and 37) were potentially cost-beneficial based on the results of the sensitivity analysis. In view of the significant number of potentially cost-beneficial SAMAs, it is likely that several of these SAMAs address the same risk contributors. As such, implementation of an optimal subset of these SAMAs could achieve a large portion of the total risk reduction at a fraction of the cost, and render the remaining SAMAs no longer cost-beneficial. In this regard: identify those SAMAs that PSEG considers highest priority for implementation, provide a revised cost-benefit analysis assuming these high priority SAMAs are implemented, and identify those SAMAs that would no longer be cost-beneficial given implementation of the high-priority SAMAs. Also, provide any specific plans/commitments regarding implementation of the high priority SAMAs.