December 28, 2007

Mr. Dennis R. Madison
Vice President - Hatch
Edwin I. Hatch Nuclear Plant
11028 Hatch Parkway North
Baxley, GA 31513

SUBJECT: EDWIN I. HATCH NUCLEAR PLANT, UNIT NOS. 1 AND 2 (HNP), REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING ALTERNATE SOURCE TERM APPLICATION (TAC NOS. MD2934 AND MD2935)

Dear Mr. Madison:

By letter to the Nuclear Regulatory Commission dated August 29, 2006, Southern Nuclear Operating Company, Inc., proposed to revise the HNP licensing and design basis with a full scope implementation of an alternative source term. We have reviewed your application and have identified a need for additional information on human factors aspects as set forth in the Enclosure.

We discussed this issue with your staff on December 19, 2007. Your staff indicated that it plans to submit a response to this issue within sixty (60) days of receipt of this letter.

Sincerely,

/RA/

Robert E. Martin, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-321 and 50-366

Enclosure:
RAI

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION (RAI)
CONCERNING IMPLEMENTATION OF
AN ALTERNATIVE SOURCE TERM APPLICATION
FOR EDWIN I. HATCH NUCLEAR PLANT, UNIT NOS. 1 AND 2 (HNP)

1.0 INDICATIONS/ALARMS WHICH PROMPT ACTION

1.1. In your license amendment request (LAR), drywell high radiation is utilized to prompt operators to take actions in response to a design-basis loss-of-coolant accident (DBLOCA). Describe this in more detail, to include:

1.1.1. What specific drywell radiation indications and/or alarms will prompt operator action?

1.1.2. Where are the specific high drywell radiation indications/alarms located?

1.1.3. In accordance with Regulatory Guide (RG) 1.97, "Instrumentation for Light water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," Revision 3, this new use for drywell high radiation will provide the primary information needed to permit operators to take manual actions for which no automatic control is provided. As such, the drywell high radiation indications/alarms used to prompt the operator actions are defined by RG 1.97 as a type A category 1 variable.

Do the indications and/or alarms for high drywell radiation meet the requirements for a type A category 1 variable as presented in RG 1.97?

1.1.4. Are the same high drywell radiation indications/alarms used to prompt all four operator actions explicitly requested for credit in your DBLOCA analysis (i.e., initiating the standby liquid control system (SLCS), initiating drywell spray, placing the main steam isolation valve (MSIV) alternate leakage treatment (ALT) path in-service, and starting turbine building ventilation)?

2.0 INITIATING SLCS

2.1. The assumed 2-hour operator action time for initiating SLCS using the control room hand switch appears acceptable. However, should the SLCS hand switch fail, it is not clear to the NRC that jumpers can be installed to initiate SLCS within 2 hours. Please describe, in detail, how the jumpers will be installed, to include: panels to be opened/location that the jumpers will be installed, whether the jumpers will be pre-staged, whether the jumper locations will be clearly labeled, how many jumpers will be installed, type of jumpers to be installed (e.g., alligator clips), any electrical safety precautions which should be taken, and who will be installing the jumpers, etc.

2.2. In your LAR, you assumed that SLCS would inject until complete (inject for 1.5 hours). Are there any plant conditions and associated procedure steps which would occur during a

DBLOCA which would cause an operator to not inject SLCS or to stop injecting SLCS before it is complete? For example, boiling water reactor (BWR) emergency operating procedures (EOPs) typically direct operators to maintain reactor pressure vessel (RPV) water level within a specified level band. Would operators stop SLCS prior to adequate injection of boron, to stay within the specified RPV water level band, if you include realistic assumptions regarding RPV injection from other sources (e.g., core spray, residual heat removal (RHR))? Also, there are a few plant conditions at a BWR where the EOPs typically direct not injecting from sources outside containment, or stopping injection from sources outside the containment, e.g., high torus water level, outside the drywell pressure limit curve. Please review your EOPs and expected plant conditions for a DBLOCA with a loss of offsite power (LOOP), and discuss any steps or cautions that could prevent or stop SLCS injection. Discuss any steps or cautions that might require changes, such that SLCS injection will occur until completion.

2.3. Describe any additional training related to SLCS, including training for installing SLCS hand switch jumpers, and training considering its new function of adding boron for pH control during a DBLOCA. Include in your description any training prior to implementing this amendment and any periodic refresher training.

2.4. What assumptions does your LAR make concerning the use of RHR loops during a DBLOCA? The Nuclear Regulatory Commission (NRC) needs clarification, although it appears that, including a LOOP:

(1) One RHR pump will be placed into drywell spray at 15 minutes after a DBLOCA starts (to be discussed later).

(2) One RHR pump in the same loop will be placed in suppression pool cooling, for the assumed mixing of suppression pool boron from SLCS.

Is this correct?

2.5. If you are crediting one RHR pump in suppression pool cooling as part of the SLCS success path, there are more questions to be answered. (Note: Placing RHR into suppression pool cooling is credited in your current Updated Final Safety Analysis Report (UFSAR) at 10 minutes for containment heat removal, but not for suppression pool mixing of boron).

2.5.1. Considering its new function of boron mixing during a DBLOCA, will any new alarms/indications be used to prompt the operators to place RHR into suppression pool cooling? Where are these alarms/indications located? Do they meet the requirements for type A, category 1 variables as presented in RG 1.97?

2.5.2. Considering its new function of boron mixing during a DBLOCA, will plant procedures contain any new direction to place RHR into suppression pool cooling?

2.5.3. For how long will RHR be running in suppression pool cooling, such that adequate boron mixing occurs?

2.5.4. Are there any plant conditions and associated procedure steps which would occur during a DBLOCA which would cause an operator to stop RHR suppression pool cooling, such that the assumed mixing of boron for the duration of the DBLOCA would not be met? For example, BWR EOPs typically specify to prioritize RHR for core cooling prior to using RHR for suppression pool cooling. Also, BWR EOPs typically have warnings related to RHR net positive suction head (NPSH) and vortex limits. Operators may also be directed by the EOPs to place RHR into shutdown cooling, and operators also may be prompted to secure suppression pool cooling once suppression pool temperature has been adequately reduced. Please review your EOPs and expected plant conditions for a DBLOCA with a LOOP, and discuss any steps or cautions that could stop RHR suppression pool cooling. Discuss any steps or cautions that might require changes, such that placing RHR into suppression pool cooling will not be stopped prior to achieving adequate boron mixing.

2.5.5. Describe any additional training related to placing RHR into suppression poolcooling, considering its new function of boron mixing during a DBLOCA. Include in your description any training prior to implementing this amendment and any periodic refresher training.

2.6. From your LAR, SLCS boron mixing also assumes that a single core spray (CS) pump floods the RPV.

2.6.1. For how long will CS be running, such that adequate boron mixing will occur throughout a DBLOCA?

2.6.2. Are there any plant conditions and associated procedure steps which would occur during a DBLOCA which would cause an operator to stop CS prior to achieving adequate mixing of boron? For example, BWR EOPs typically direct operators to maintain RPV water level within a specified level band. Would operators stop CS prior to achieving adequate mixing of boron, to stay within the specified RPV water level band? Does the RPV water level band specified by the EOPs ensure sufficient spillage from the RPV, such that adequate mixing of boron will occur? Also, BWR EOPs typically have warnings related to CS NPSH and vortex limits. Please review your EOPs and expected plant conditions for a DBLOCA with a LOOP, and discuss any steps or cautions that could prematurely stop CS. Discuss any steps or cautions that might require changes, such that CS will not be stopped prior to achieving adequate boron mixing.

2.6.3. Describe any additional training related to CS, considering its new function of boron mixing during a DBLOCA. Include in your description any training prior to implementing this amendment and any periodic refresher training.

3.0 INITIATING DRYWELL SPRAY

3.1. The NRC assumes that manual initiation of drywell spray will be based on the same high drywell radiation indications/alarms (200,000 rem/hr) as used to prompt manual injection of SLCS. Please verify this, or discuss which indication/alarms will be used to prompt the manual initiation of drywell spray.

3.2. How will the actions to initiate drywell spray be incorporated into plant procedures, considering its new function of boron mixing during a DBLOCA?

3.3. What switch manipulations will be required to initiate drywell spray? Include any equipment which will be secured prior to initiating drywell spray in accordance with your EOPs (e.g., reactor recirculation pumps, drywell cooling fans). Assume the appropriate initial line-up of plant systems and RHR following DBLOCA, based on what your UFSAR currently credits. (It appears that your UFSAR assumes one RHR pump is placed into suppression pool cooling at 10 minutes after a LOCA, and that the other RHR pump is secured.)

3.4. In your LAR, you credited drywell spray at 15 minutes following the start of a DBLOCA. You also stated that the high drywell radiation alarm would occur within 15 minutes of the start of a DBLOCA. It is not clear to the NRC whether you allowed enough time between the high drywell radiation indication/alarm and for completing the manual actions necessary to initiate drywell spray. In addition, for a DBLOCA, ANSI/ANS 58.8-1994, "Time Response Design Criteria for Safety-Related Operator Actions," specifies a minimum operator diagnosis time of 20 minutes prior to crediting any operator action, however, in lieu of this 20-minute time, empirical human performance data may be used. Given these concerns regarding the operator action time for initiating drywell spray, and the previously stated concern of installing SLCS hand switch jumpers within 2 hours, the NRC requests you perform timed operator validation runs for four crews of licensed operators, using the HNP control room simulator, as specified below:

The operators may be briefed and trained on the credited operator actions and any proposed procedure revisions associated with this LAR's DBLOCA analysis, but out of a sense of realism, any training must occur at least 7 days prior to performing the timed simulator validation runs.

Simulator set-up: normal operating conditions at 100% power, pre-insert the necessary simulator malfunctions for the DBLOCA (recirculation line double-ended break), to include a LOOP, a loss of one division of Class 1E electrical power, and a failure of the SLCS hand switch (to be overridden when the SLCS hand switch jumpers are properly installed). Also, model as best as possible the radioactivity release from the core into containment, as assumed in your LAR's DBLOCA analysis, such that the alarms/indications of high drywell radiation occur at the appropriate time.

- Prior to the timed simulator validation runs, the simulator scenario as discussed above may be prepared, dry-run, and validated as appropriate for use. Do <u>not</u> report to the NRC any operator response times associated with preparing the simulator scenario.

- For realism, the operators performing the simulator validation runs shall not know beforehand what malfunctions they will be responding to.

- While performing the simulator validation runs, have the operators use plant procedures which include any planned revisions associated with this LAR. This will give you the opportunity to validate any procedure revisions.

- Perform the simulator validation runs on four crews of licensed control room operators, using the technical specification minimum control room staffing level. During the simulator validation runs, record the time of key events, including:

(1) Time that the DBLOCA/LOOP/Class 1E bus loss occurs (or record as time zero).

(2) Time that the high drywell radiation alarm occurs (either as a result of modeling the core reactivity release, or as inserted from the simulator booth at the appropriate time).

(3) Time that the operators successfully initiate drywell spray with at least one RHR pump.

(4) Time that at least one RHR pump is placed in suppression pool cooling (if suppression pool cooling is required for adequate boron mixing).

(5) Time that the operators successfully initiate SLCS, using the SLCS hand switch jumpers.

(6) The total run time for the scenario should be less than 2 hours (for SLCS initiation). Check that SLCS, drywell spray, suppression pool cooling, and CS are still in operation at the end of the scenario, as assumed in the LAR.

- Upon completion of the simulator validation runs, submit the results and recorded times to the NRC for review.

3.5. Are there any plant conditions and associated procedure steps which would occur during a DBLOCA which would cause an operator to <u>not</u> initiate drywell spray or to <u>stop</u> drywell spray prior to the 24-hour assumed time in your LAR? For example, BWR EOPs typically direct that containment conditions be inside the drywell spray initiation curve prior to initiating drywell spray, and to not use RHR pumps needed for adequate core cooling. Additionally, BWR EOPs typically direct operators to stop drywell spray prior to containment pressure dropping too low, and typically the EOPs contain cautions regarding RHR NPSH and vortex limits. Operators may also be directed by the EOPs to place RHR into shutdown cooling. Please review your EOPs and expected plant conditions for a DBLOCA with a LOOP, and discuss any steps or cautions that could prevent or stop drywell spray. Discuss any steps or cautions that might require changes, such that initiating drywell spray will not be prevented, nor stopped, prior to the 24-hour assumed time in your LAR.

3.6. In your current UFSAR, Unit 1 credits containment overpressure for providing adequate long-term NPSH for CS and RHR. Please verify that adequate NPSH will still be present for the running CS and RHR pumps, assuming drywell spray running continuously for 24 hours.

3.7. Describe any additional training related to drywell spray, considering its new function of removing airborne particulates, and that drywell spray is proposed to be credited in the UFSAR for containment temperature and pressure reduction. (Operators are currently directed by the EOPS to use drywell spray for containment temperature and pressure reduction, but this is not <u>credited</u> in the current UFSAR). Include in your description any training prior to implementing this amendment and any periodic refresher training.

4.0 PLACING MSIV ALTERNATE LEAKAGE TREATMENT (ALT) IN- SERVICE

Note: MSIV ALT has already been approved by the NRC for Unit 2.

4.1. What alarms/indications will prompt the operators to place the MSIV ALT path into service? Will operators be prompted by the same high drywell radiation indications/alarms as used to prompt SLCS injection and initiating drywell spray? Where are these alarms/indications located? Do they meet the requirements for type A, category 1 variables as presented in RG 1.97?

4.2. How will the actions to place the MSIV ALT path into service be incorporated into plant procedures?

4.3. It appears to the NRC that the operator actions to establish the MSIV ALT path on Unit 1 are (1) open one valve from the control room (motor operated valve (MOV) 1B21-F021, supplied Class 1E electrical power), and (2) close all the boundary valves listed in your LAR (from Enclosure 1, Section 2.7.1.1, and see below). Is this correct?

The NRC has the following questions regarding closing the boundary valves listed below:

(1) Reactor feed pump turbine stop valves 1N11-F177 and 1N11-F178
(2) Steam to second stage moisture separator reheaters MOVs 1N38-F101A and 1N38-F101B
(3) Steam to the steam jet air ejectors MOVs 1N11-F001A and 1N11-F001B
(4) Steam jet air ejector drain valves 1N11-F039 and 1N11F041
(5) Seal steam MOVs 1N33-F012 and 1N33-F013
(6) Reactor feed pump steam line drain valves 1N11-F043 and 1N11-F044

4.3.1. As discussed in your LAR (Enclosure 1, Section 2.7.1.1), for a DBLOCA with a LOOP, please verify that the turbine-driven reactor feed pumps will automatically trip, and that the reactor feed pump turbine stop valves 1N11-F177 and 1N11-F178 will automatically close, thus requiring no operator action.

4.3.2. Assuming a DBLOCA with a LOOP, which of the remaining boundary valves for Unit 1 (valves (2)-(6) above) will be closed locally? Which will be closed from the main control room? (It appears that with a LOOP, all of the remaining ten boundary valves must be manually closed locally. Is this correct?)

4.3.3. Are there any special tools or additional equipment required to close the local valves for Unit 1? In answering this question, include equipment such as ladders or already installed chain operators (for valves that are elevated off the floor), keys that may be necessary to access the areas of the valves or to unlock the valve hand wheels, gloves or radiation protection clothing, and any other additional equipment used to actually manipulate the valves. For additional equipment that is not already installed, describe where the operators will obtain this equipment.

4.4. How will plant operators verify that the MSIV ALT path has been successfully placed in-service? (This may rely on valve position indications, but perhaps other indications may be used, such as rising condenser vacuum, etc.)

4.5. What is the limiting amount of time for operators to place the MSIV ALT path in-service for Unit 1? The NRC postulates two bases for establishing time limits for operator actions:

(1) A time limit, such that the transport of radioactivity that leaks by the MISIVs (during a DBLOCA with a LOOP) results in the release pathways assumed by your LAR, i.e., MSIV leakage experiences holdup and retention in the main steam lines, the ALT path, and the condenser and the release is primarily from the condenser, with a small fraction of the release from the high pressure turbine, with no release via the MSIV ALT path boundary valves.
(2) If the Unit 1 local boundary valves must be closed out in the plant, a time limit (or limits) based on expected dose or other inhospitable environmental conditions (temperature/humidity)

that in-plant operators would be exposed to, assuming a DBLOCA with a LOOP. For example, after a DBLOCA, it is expected that radiation levels in the ALT path will at first be very low, and then increase with time due to MSIV leakage. There may therefore exist a time limit, or a separate time limit for operating each valve, such that in-plant operators will not receive in excess of 5 rem total effective dose equivalent (TEDE) (the limit from RG 1.183 and NUREG-0737) while establishing the MSIV ALT path.

4.6. In your response dated June 22, 2007, to a previous NRC RAI, you provided an estimated time of 22 minutes for operating the local boundary valves. The NRC has further questions regarding this estimated time.

4.6.1. Did this estimated time include valves that would be required to be closed locally given a LOOP? Which valves were included in the estimated time of 22 minutes?

4.6.2. Have you conducted plant walk-downs to validate this estimated time?

4.6.3. Does the estimated time of 22 minutes include the time required to obtain and operate any special tools or additional equipment, as specified in question 4.3.3?

4.6.4. During the estimated 22 minutes that the local boundary valves will not all be closed, is your radioactive release model for MSIV leakage still valid? See question 4.5.(1) above, concerning the limiting time(s) for operator action.

4.7. Describe any additional training related to the MSIV ALT path for Unit 1. Include in your description any training prior to implementing this amendment and any periodic refresher training.

5.0 STARTING TURBINE BUILDING VENTILATION

5.1. In your LAR, you propose to credit starting turbine building ventilation (one exhaust fan with an operable exhaust pathway to the reactor building vent) within 9 hours for three different accidents - DBLOCA, control rod drop accident (CRDA), and main steam line break (MSLB). For <u>each</u> accident, assuming a concurrent LOOP, what alarms/indications will prompt the operators to start turbine building ventilation? Where are these alarms/indications located? Do they meet the requirements for type A, category 1 variables as presented in RG 1.97?

5.2. In starting turbine building ventilation, you also propose to restore offsite power. What alarms/indications will prompt the operators that offsite power has been lost? What alarms/indications will prompt the operators that offsite power has become available and can be restored to the plant? Where are these alarms/indications located? Do they meet the requirements for type A, category 1 variables as presented in RG 1.97?

5.3. How will the action(s) to start turbine building ventilation be incorporated into plant procedures? Also, please describe the plant procedure(s) for restoring offsite power (see below regarding control manipulations).

5.4. What is the success sequence for starting turbine ventilation, assuming a LOOP and possible loss of service instrument air? The NRC assumes that offsite power will be restored first, and that turbine building ventilation will be started with service instrument air (if it is available), or without service instrument air (if it is not available) via a proposed plant modification (see below).

Is this the correct sequence?

5.5. What control manipulations are required to restore offsite power to the degree necessary to start turbine building ventilation? Please describe the control manipulations required, in accordance with plant procedures, to restore offsite power from a single offsite line, assuming power is not available on the other lines, and repeat this description for each offsite line.

5.5.1. In restoring offsite power, where will the control manipulations occur? Who will perform these manipulations?

5.5.2. Will any of the manipulations to restore offsite power occur locally out in the plant? If so, evaluate the effects of any potential harsh or inhospitable environmental conditions (temperature/humidity, radiation dose) that an in-plant operator may be exposed to while traveling to/from the location(s) and at the location(s) where the manipulation(s) will occur, discuss the available plant lighting and/or emergency lighting that would be present assuming a LOOP, and discuss any special equipment which may be required to perform the local actions.

5.5.3. What indications will operators use to verify that offsite power has been restored to the degree necessary to start turbine building ventilation? Where are these indications located?

5.6. Assuming service instrument air <u>is</u> available, what control manipulations will be required to start turbine building ventilation (one turbine building exhaust fan running with the exhaust path established to the reactor building vent plenum)? Where will the control manipulations occur? Who will perform these manipulations?

5.6.1. Assuming service instrument air <u>is</u> available, will any of the manipulations to start turbine building ventilation occur locally out in the plant? If so, evaluate the effects of any potential harsh or inhospitable environmental conditions (temperature/humidity, radiation dose) that an in-plant operator may be exposed to while traveling to/from the location(s) and at the location(s) where the manipulation(s) will occur, and discuss any special equipment which may be required to perform the local actions.

5.6.2. What indications will operators use to verify that turbine building ventilation has been successfully started? Where are these indications located?

5.7. Assuming service instrument air is <u>not</u> available, your LAR (Enclosure 1, pg. 56) stated that "A modification will be completed to ensure that a loss of air event does not render both turbine building exhaust systems incapable of operating."

Please describe this proposed modification, including a system description, seismic qualification, reliance on offsite power, and whether operator actions will be required in order for the proposed modification to establish the turbine building exhaust path. If there are operator actions associated with the proposed modification, then answer the following additional questions:

5.7.1. What alarms/indications will prompt the operators to operate the modification, such that the turbine building exhaust path can begin to be established without service instrument air? Do they meet the requirements for type A, category 1 variables as presented in RG 1.97?

5.7.2. How will the actions to operate the modification be incorporated into plant procedures?

5.7.3. What specific components (control switches, valves, dampers, etc.) must the operators manipulate to place the modification in service, such that the turbine building exhaust path will be established without service instrument air? Where are these components located? Who will perform these manipulations?

5.7.4. Will any of the manipulations occur locally out in the plant? If so, evaluate the effects of any potential harsh or inhospitable environmental conditions (temperature/humidity, radiation dose) that an in-plant operator may be exposed to while traveling to/from the location(s) and at the location(s) where the manipulation(s) will occur, and discuss any special equipment which may be required to perform the local actions.

5.7.5. What indications will operators use to verify that operating the modification, such that the turbine building exhaust path has been established without service instrument air, has been successful?

5.7.6. Describe any additional training associated with this modification to establish the turbine building exhaust path without service instrument air. Include in your description any training prior to implementing this amendment and any periodic refresher training.

5.8. The NRC understands that the total time required for starting turbine building ventilation is within 9 hours. What, if any, are the assumed times for: (1) electrical power being available from an offsite line after its loss, (2) restoring offsite power to the plant, and (3) restoring service instrument air?

5.9. Describe any additional training related to restoring offsite power and starting turbine building ventilation, given that these two actions are proposed to be credited in the UFSAR, in order to meet the radiation dose requirements for the main control room. Include in your description any training prior to implementing this amendment and any periodic refresher training.

6.0 INTEGRATED RESPONSE

In accordance with your LAR, during a DBLOCA the NRC's understanding is that the following operator actions are assumed to occur within the specified time frames:

(1) Initiating SLCS within 2 hours, to include installing SLCS hand switch jumpers, should the hand switch fail.
(2) Placing one RHR pump into suppression pool cooling within 4 hours. (This is currently credited to occur at 10 minutes following a DBLOCA in your UFSAR.)
(3) Placing another RHR pump into drywell spray within 15 minutes.
(4) Placing the MSIV ALT path in service, in an unspecified amount of time.
(5) Restoring offsite power and starting turbine building ventilation within
9 hours.

1) Can all of these operator actions be completed in the assumed times, assuming technical specification minimum shift staffing? Please discuss which individual(s) on a shift crew will be performing which task(s).

cc:

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