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June 14, 2005

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Additional Information Supporting the Request for License Amendment Related to Onsite Spent Fuel Storage Expansion

Reference: Letter from Keith R. Jury (AmerGen Energy Company, LLC) to U. S. Nuclear Regulatory Commission, "Request for Technical Specification Change to Support Onsite Spent Fuel Storage Expansion," dated August 18, 2004

In the referenced letter, AmerGen Energy Company, LLC (AmerGen) requested a change to the Technical Specifications for Clinton Power Station (CPS), Unit 1, to reflect the addition of fuel storage capacity in the fuel cask storage pool and increased fuel storage capacity in the spent fuel pool. Specifically, the proposed expansion will increase the total storage space at CPS from 2,512 to 4,159 fuel assemblies. This extra capacity is expected to allow operation without loss of full core discharge capability until the 15th refueling outage (i.e., C1R15) in the year 2016.

In a request, provided electronically from Kahtan N. Jabbour (U. S. NRC) to Timothy A. Byam (AmerGen) on March 4, 2005, the NRC requested additional information to support their review of the referenced letter. Attachment 1 to this letter provides this requested information.

The regulatory commitments contained in this letter are provided in Attachment 2.

AmerGen has reviewed the information supporting a finding of no significant hazards consideration that was previously provided to the NRC in Attachment 1 of the referenced letter. The supplemental information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration.

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If you have any questions concerning this letter, please contact Mr. Timothy A. Byam at (630) 657-2804.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 14th day of June 2005.

Respectfully,

Keith R. Jury

Keith R. Jury
Director – Licensing and Regulatory Affairs
AmerGen Energy Company, LLC

Attachments:

1. Additional Information Supporting the Request for License Amendment Related to Onsite Spent Fuel Storage Expansion
2. Commitments

ATTACHMENT 1

Additional Information Supporting the Request for License Amendment Related to Onsite Spent Fuel Storage Expansion

Request 1:
The spent fuel storage expansion will increase the number of assemblies present in the pool from previous discharge for the bounding cases. This increase in previously discharged fuel should be accompanied by an increase in the associated decay heat. The heat load associated with the fuel being offloaded from the core during the refueling will remain about the same for the full core offload case and increase by about 50% for the normal offload case since the batch size is being increased from 208 assemblies in the USAR to 312 assemblies in the fuel storage expansion amendment. Therefore for the bounding case, which assumes all storage locations are filled, it would be expected that the total heat load and corresponding maximum bulk pool temperature for both the normal and full core discharges would increase.

a) *In the section 9.1.3.3.1 of the current USAR, for the most limiting design basis scenario (a planned full core offload with a single active failure), the maximum decay heat load to the fuel pool is given as 46.2 Mbtu/hr. The corresponding peak pool temperature for the same case is given as 140 °F (USAR section 9.1.3.3.3). The result for the same limiting case for the expanded fuel pool is given in Table 5.4.1 of Attachment 5 to the licensee August 18, 2004 license amendment request. Table 5.4.1 indicates for the full core discharge scenario a maximum coincident decay heat of 40.0 Mbtu/hr and a SFP maximum bulk temperature of 134.95°F. Please explain why the maximum heat load and peak temperature is reduced for the pool after completion of the fuel storage expansion.*

b) *In the section 9.1.3.3.1 of the current USAR, for the most limiting design basis scenario (a planned full core offload with a single active failure), for an assumed loss of all pool cooling, the time to boil is given as 3.7 hours and the corresponding peak boil off rate is given as 96 gpm. The result for the same limiting case for the expanded fuel pool is given in Table 5.4.2 of Attachment 5 to the licensee August 18, 2004 license amendment request. Table 5.4.2 indicates for the full core discharge scenario a time to boil of 3.25 hours and a corresponding maximum water loss of 85.9 gpm. Since Table 5.4.1 shows both a reduction in heat load and peak pool temperature relative to current licensing basis values a reduction in the time to boil would not be expected. Please explain why the time to boil is reduced despite the lower initial temperature and heat load that will exist at the time that loss of cooling is assumed to occur. Also discuss what make-up sources are available and what rates of makeup they can provide for the spent fuel pool or please provide an appropriate reference.*

Response 1:
a) The spent fuel storage expansion decay heat evaluation employs the precision computer code ORIGEN2 to compute the radioactive energy release from irradiated spent nuclear fuel. This procedure avoids empirical methods (i.e., Branch Technical Position ASB 9-2, "Residual Decay Energy for Light-Water Reactors for Long-Term Cooling") deployed in the Clinton Power Station (CPS) Updated Safety Analysis Report (USAR) that provide conservative estimates of decay heats. Although the quantity of fuel to be stored in storage expansion

application is increased, the calculated decay heat load and maximum bulk temperature that results from the increased quantity of spent fuel is more than offset by removal of excessive conservatisms.

b) The time-to-boil evaluation for the spent fuel storage expansion employs highly conservative assumptions for computing the thermal inertia of the pool. These assumptions include the following.

i) Neglect of the fuel rack thermal inertia
ii) Neglect of the water in the fuel racks
iii) Complete neglect of thermal inertia of cask pit racks and water
iv) No credit for makeup water

Although the decay heat and initial temperatures for the spent fuel expansion are lower than the CPS USAR values, the shorter time-to-boil result is conservatively compensated for by the considerable understatement of pool thermal inertia.

The Fuel Pool Cooling and Cleanup (FC) system is designed to remove the decay heat from the fuel assemblies and maintain water level in the spent fuel pool. As described in CPS USAR Section 9.1.3.3.3, makeup water during normal operation is supplied from the cycled condensate system. Redundant loops of the shutdown service water system, which are classified as Seismic Category I, can also be used as an emergency source of makeup water to the spent fuel pool in case of failure of the normal makeup water system. The makeup flow rate from the normal makeup system is 230 gpm while the makeup flow rate from the shutdown service water system is 100 gpm from each division.

Request 2:
The submittal states that physical travel limits of the Fuel Building Crane preclude use of the main hook over the east end of the spent fuel pool, and that a low profile crane will be required to install and remove racks along the east wall. It also states that the temporary crane will be used to lift racks from the pool floor and move the racks horizontally with a limited lift height above the pool floor, and that the temporary crane will have a sufficient rated lifting capacity to lift each of the new and old racks, including any additional lifting hardware.

a) A description of the low profile temporary crane was not included in the submittal. Please provide a description of the proposed temporary crane. The description should include the key design characteristics, mounting details, any special design features that will reduce the risk of load drops, and the crane's range of travel. Identify the location to be used for assembly and testing of the temporary crane.

b) On page 7 of Attachment 1, it is stated that safe handling of heavy loads by the Fuel Building crane and temporary crane will be ensured by following the defense-in-depth approach guidelines of NUREG-0612. Please discuss in detail *how the temporary crane conforms to the guidance of Section 5.1.1 of NUREG-0612.*

c) *Discuss the design capacity of the lifting system, and any testing criteria that will be used to support and verify reliability of the system and associated devices. Include specific discussions on the test that will be performed prior to use of the crane but after assembly of the crane at the plant.*

Response 2:

a) The Fuel Building Crane (FBC) will only be used for Phase 1 of the spent fuel storage capacity expansion project. Phase 1 consists of the installation of two new racks in the fuel cask storage pool. The temporary crane will be used in the second phase of the project. Phase 2 consists of the installation of new racks in the spent fuel pool.

Holtec Report HI-2033124, "Spent Fuel Storage Expansion at Clinton Power Station," Attachment 5 to Reference 1, describes the temporary crane as "low profile". Discussion in the report and the No Significant Hazards Consideration provided in Attachment 1 to Reference 1, states that the racks will be placed into the spent fuel pool using the FBC and then shuffled horizontally to the final position using the temporary crane. This installation process, which requires changing the load from the FBC hook to the temporary crane hook, remains feasible for most of the reracking operations. However, subsequent to the completion of the design of this crane and during preparation of report HI-2033124, CPS completed a refueling outage that discharged a partial core of fuel to the spent fuel pool. This additional stored fuel now encroaches on some areas previously expected to be used by the divers to perform underwater manipulation of the rack rigging to exchange the lifting device from the FBC to the temporary crane. Therefore, the temporary crane has been redesigned to eliminate the requirement to use the FBC to lower every rack into the pool and then perform subsequent rigging change out to the temporary crane for each rack to be placed into its final position. The FBC will now be used only as an alternative method to initially introduce racks into the pool. This change necessitated that the new temporary crane be taller to support the need for lifting the rack from the operating deck and then lowering the rack into the pool with a single crane. The temporary crane is now designed as a double gantry bridge crane, similar to the temporary crane used at V.C. Summer and described in their letter dated July 2, 2002 (Reference 2). The crane will have sufficient height to lift racks from the operating deck and place them directly into the pool without need for the FBC to be used. While the FBC does not provide access to the east end of the spent fuel pool, the temporary crane will provide access to all areas of the spent fuel pool and fuel cask storage pool. Use of this style crane (i.e., double gantry crane) in place of the low profile crane and FBC will reduce the number of crane lifts required and eliminate the need to transfer loads between cranes. The gantry crane provides the ability to carry the racks above the pool operating deck and avoids interferences with the racks already in place. The installation plan will continue to employ safe load paths and a sequence of fuel movements to prevent carrying the racks directly over other racks containing spent fuel.

The crane is designed in accordance with Crane Manufacturer's Association of America (CMAA) Specification #70, "Specifications for Top Running Bridge & Gantry Type Multiple Girder Electric Overhead Traveling Cranes." The design capacity of the temporary crane is 25,000 pounds (lbs), which exceeds the maximum weight of the new and existing racks, plus rigging. The vertical legs and the top bridge assembly are manufactured from carbon steel and painted to protect against corrosion and surface contamination. A 22.5-ton electric hoist is connected to a top running bridge trolley, which rides on two parallel rails fastened to the top bridge assembly. The hoist braking system shuts off in the closed braking position upon loss of power, which reduces the risk of a load drop. In the case of a failed braking system, pendant controls can be used to activate the hoist motor in order to control the load until safely landed.

The temporary crane will be assembled and tested in the Fuel Building truck bay, after which it will be lifted using the FBC and mounted directly on the fuel handling platform rails. When the temporary crane is installed, the fuel handling platform will be positioned against the rail stops to the west, which will give the temporary crane full access to the spent fuel pool.

b) The temporary crane and its usage conforms to the guidance of Section 5.1.1 of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants, Resolution of Generic Technical Activity A-6," as follows.

(1) Safe load paths - Safe load paths will be included in project specific procedures to ensure that heavy loads shall not be carried over stored fuel in the spent fuel pool (SFP). Safe load paths will maximize the benefits of strategic fuel shuffles that allow for the greatest distance between a suspended rack and stored fuel while the suspended load is at a height above the stored fuel. Suspended racks or any other heavy loads that are handled as part of the fuel storage capacity expansion project will not be moved over stored fuel assemblies. Additionally, new racks being installed into the SFP will be lowered using the temporary crane to a minimal height just above the SFP floor as soon as the rack safely clears the pool perimeter and any pool wall protrusions. As part of the defense-in-depth approach, the action of lowering the rack to a height just above the pool floor prior to commencing any horizontal movement reduces the amount of time that the rack is in a position of any substantial elevation above the pool floor.

(2) Procedures - All steps involving the handling of heavy loads in and around the spent fuel pool shall be governed and controlled by a project specific procedure. As suggested in NUREG-0612, this procedure will include the safe load paths that will be used for heavy loads traveling over or near the spent fuel pool. Additionally, the procedure will include

detailed exhibits showing the rigging configurations for lifting each heavy load. Each rigging exhibit will include the minimum ratings required for each rigging component to comply with NUREG-0612. In general, all steps and quality oversight of the handling of heavy loads will be included as part of the procedure.

(3) Crane Operators - In further compliance with the defense-in-depth approach of NUREG-0612, training will be performed with the crew in order to educate them on the many tasks and the associated governing procedures and regulations. Crane operators will get a training session on the functions of the cranes and the new parameters that are introduced by the allowance of travel over the spent fuel pool. In addition, a training session is given to offer a general overview of the tasks, associated safe load paths, and the applications of NUREG-0612 with respect to the many tasks that will be completed during the project.

(4) Special lifting devices – In accordance with the guidelines of NUREG-0612, special lifting devices have been developed to lift the old and new racks as required and transport them into or out of and around the spent fuel pool area. The lift rigs used to lift and transport the new and existing racks are designed to American National Standards Institute (ANSI) Standard N14.6-1978, "Standard for Special Lifting Devices for Shipping Container Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials." Additionally, the lift rigs have been designed with dual load paths, meeting the definition of NUREG-0612 as a single failure proof design. The dual load paths are built into the design of the lift rigs via four independent load paths. There are four separate eye pads as well as four separate lifting rods. The design of the lift rigs allows for the failure of one load path while still maintaining a 5:1 safety factor in each of the remaining load paths. Thus, the failure of one load path will not result in uncontrolled swinging of the suspended load. Finally, in accordance with ANSI Standard N14.6-1978, each lift rig is proof load tested to 300% of its rated load. The lift rig rated load is equal to the weight of the heaviest rack to be lifted.

(5) Lifting devices that are not specially designed - All rigging used for the handling of heavy loads in and around the spent fuel pool and fuel cask storage pool areas shall comply with the guidelines of NUREG-0612. In accordance with Section 5.1.6 regarding single-failure-proof handling systems, the lift rigs used to handle the racks are designed with redundant load paths, thereby removing the ability for a single failure of a sling or shackle to cause a failure in suspending the heavy load. The slings and shackles are rated such that a 5:1 safety factor relative to the load suspended is maintained even after an accident event in which one load path is defeated.

(6) Temporary crane - The temporary crane is designed to meet the applicable criteria of CMAA-70. It is to be load tested to 125% of its rated load in accordance with appropriate standards. The trolley hoist to be used on the temporary crane structure shall be rated accordingly to meet the guidelines of NUREG-0612 regarding a 10:1 safety factor on rigging components in a non-redundant load path.

During the installation and removal of the temporary crane, the crane itself will never be carried over fuel and rigging used to handle the temporary crane for these movements will comply with the guidelines of NUREG-0612. Once the crane is in place on the rails and in operation, the crane structure is wider than the pool opening. Therefore, a drop of the entire crane into the pool is not a postulated event.

c) The design capacity of the temporary crane is 25,000 lbs, which exceeds the maximum weight of the new and existing racks, plus rigging. The hoist to be used on the temporary crane structure shall be rated accordingly to meet the guidelines of NUREG-0612 regarding a 10:1 safety factor on rigging components in a non-redundant load path. After assembly of the temporary crane in the truck bay, and prior to its use, the crane will be load tested to 125% of its rated capacity (i.e., 31,250 lbs). Load testing will be performed in the truck bay area, as opposed to on the fuel handling platform rails, because of the space limitations above the spent fuel pool and the risks associated with handling heavy loads above stored fuel and safety-related equipment. While being tested in the truck bay, the crane will be mounted on rail sections to simulate the exact boundary conditions during normal operation. The test load will be applied at the approximate center span and held for a minimum of ten minutes. Before removing the load, the trolley hoist shall travel the full length of the bridge assembly.

Request 3:

Both the Fuel Building crane and the low profile temporary crane will be used in the installation and removal of racks in the spent fuel pool.

a) *In section 3.5 of Attachment 5 to the licensee August 18, 2004 license amendment request, it is stated that a temporary hoist is to be used to maintain the main hoist in a dry condition and lift racks into the pool and that it will be selected to provide an adequate load capacity to comply with NUREG-0612. Use of a temporary hoist defeats the single failure proof features of the fuel building crane. Describe how the safe load paths for load handling will be established and how the use of the crane conforms to the guidelines of section 5.1.2 of NUREG 0612.*

b) *Discuss the potential impact of a load drop for these cranes including the drop of a spent fuel storage rack onto a rack with stored fuel and the drop of a spent fuel storage rack onto the liner of the spent fuel pool.*

c) *Describe any compensatory measures that would be implemented to minimize and manage the damage from the drop.*

Response 3:

a) The design of the gantry-type temporary crane (see response to Request 2.a above) eliminates the need to use a temporary hoist to maintain the FBC hook in a dry condition. Since the gantry crane has full access to the spent fuel pool and is capable of lifting the racks above the spent fuel pool deck, all racks will be lowered into the pool and lifted out of the pool using the temporary crane. A temporary hoist will be used in combination with the FBC hook only as a contingency in the event that the temporary crane is inoperable.

The use of the temporary hoist conforms to the guidelines of Section 5.1.2 of NUREG-0612, and more specifically Section 5.1.6(1)(b), in that the hoist is rated for twice what is required to meet the guidelines of ANSI B30.9-1971, "Slings" (i.e., it has a safety factor greater than 10).

Safe load paths will be established as described above in the response to Request 2.b.

b) The potential impact of a spent fuel rack drop from these cranes is minimal. In the case of the Fuel Building Crane, a rack drop is not credible because of its single-failure-proof design. Moreover, the Fuel Building Crane will not be used to carry racks above the spent fuel pool, except as a contingency if the temporary crane is not functioning. The temporary crane, on the other hand, is not single-failure proof, and therefore the possibility of a load drop cannot be completely ruled out. The drop of a spent fuel storage rack onto a rack with stored fuel, however, is precluded by the establishment of safe load paths. Suspended racks or any other heavy loads that are handled as part of the fuel storage capacity expansion project are never to be carried over stored fuel assemblies (see the response to Request 2.b above for further discussion of safe load paths). A drop of a spent fuel rack onto the SFP liner, while unlikely, would not result in an uncontrollable loss of SFP water or lead to a catastrophic failure of the reinforced concrete slab. This conclusion is based on Holtec's experience performing rack drop analyses for other nuclear plants and the fact that the CPS SFP floor is not only founded on grade, but is also 9'-8" thick. At V.C. Summer Nuclear Station, calculations have been performed which show that a 45-foot drop of a much heavier spent fuel rack (36,300 lb vs. less than 17,200 lb for CPS) onto a 5'-11¾" thick floor slab causes only local damage to the SFP liner and underlying concrete (Reference 3).

c) Besides the general defense-in-depth approach recommended by NUREG-0612, the potential damage from a rack drop onto the SFP liner is further mitigated by the project specific procedures in place that govern the rack movement activities. These procedures direct the immediate lowering of new spent fuel racks to a minimal height just above the SFP floor as soon as the rack safely clears the pool perimeter and any pool wall protrusions. This action reduces the amount of time that the rack is in a position of any substantial elevation above the pool floor.

Request 4:
Subsequent to the above requests, a followup request was provided and clarified in a conference call between Kahtan N. Jabbour (U. S. NRC) and Timothy A. Byam (AmerGen) on April 25, 2005. Specifically, the request concerned the potential errors in KENO V.a and the impact these errors may have on the CPS rerack analysis.

Response 4:
Recently, Oak Ridge National Laboratory has discovered a potential error in KENO V.a with respect to use of cylindrical holes with shared boundaries. The CPS criticality analysis did not make use of KENO V.a or any other version of KENO. The only codes used in the CPS criticality analysis were CASMO and MCNP. Therefore, this error notice is not applicable to the CPS rerack analysis.

Request 5:
In addition to the above, the NRC has also requested additional information concerning the process CPS uses for loading a cask in the fuel cask storage pool and whether criticality analyses have been performed for a full cask stored in the fuel cask storage pool.

Response 5:
CPS currently does not own a fuel cask and has no immediate plans to utilize a fuel cask for storage or transport of spent nuclear fuel. The first opportunity to move spent fuel into casks would occur sometime after the year 2016. As noted in Reference 1, 2016 is the year that spent fuel storage capacity as proposed in the CPS storage expansion amendment request is estimated to be exceeded. However, when CPS does determine a need to load a fuel cask in the fuel cask storage pool, a criticality analysis will be performed based on the type and quantity of fuel loaded into the cask. These analyses will be available for NRC review and inspection onsite.

References:
1. Letter from Keith R. Jury (AmerGen Energy Company, LLC) to U. S. Nuclear Regulatory Commission, "Request for Technical Specification Change to Support Onsite Spent Fuel Storage Expansion," dated August 18, 2004

2. Letter from Stephen A. Byrne (South Carolina Electric & Gas Company) to U. S. Nuclear Regulatory Commission, "Technical Specification Amendment Request – TSP 99-0090 Spent Fuel Pool Storage Expansion – Supplemental Letter – Response to RAI Dated June 20, 2002," dated July 2, 2002

3. Letter from Stephen A. Byrne (South Carolina Electric & Gas Company) to U. S. Nuclear Regulatory Commission, "Technical Specification Amendment Request TSP 99-0090 Spent Fuel Pool Expansion," dated July 24, 2001

ATTACHMENT 2

Commitments

LIST OF COMMITMENTS

The following table identifies those actions committed to by AmerGen Energy Company, LLC (AmerGen), in this document. Any other statements in this submittal are provided for information purposes and are not considered commitments.

COMMITMENT	Due Date/Event
(1) Perform criticality analysis prior to loading fuel assemblies in a spent fuel cask in the fuel cask storage pool. This analysis shall take into account the type and quantity of fuel to be loaded into the cask.	Prior to loading spent fuel into cask in fuel cask storage pool