April 21, 2000

Mr. Oliver D. Kingsley, President
Nuclear Generation Group
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 500
Downers Grove, IL 60515

SUBJECT: BYRON AND BRAIDWOOD - CORRECTION TO AMENDMENTS ON SPENT FUEL STORAGE RACKS (TAC NOS. MA5150, MA5149, MA5070, AND MA5071)

Dear Mr. Kingsley:

On March 1, 2000, the U.S. Nuclear Regulatory Commission (Commission) issued Amendment No. 112 to Facility Operating License No. NPF-37 and Amendment No. 112 to Facility Operating License No. NPF-66 for the Byron Station, Unit Nos. 1 and 2 (Byron), respectively, and Amendment No. 105 to Facility Operating License No. NPF-72 and Amendment No. 105 to Facility Operating License No. NPF-77 for the Braidwood Station, Unit Nos. 1 and 2 (Braidwood), respectively. Subsequently, selected portions of the Safety Evaluation related to this amendment have been found to contain errors or to need clarification.   The changes do not alter the NRC staff's conclusions as stated in the amendments regarding installation of new spent fuel storage racks at Bryon and Braidwood. The changed areas are annotated by margin bars on the corrected pages enclosed.

Please replace the previous pages with the corrected copies.   We regret any inconvenience this may have caused.

Sincerely,

/RA/

George F. Dick, Jr., Sr. Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-454, STN 50-455,
STN 50-456, STN 50-457

Enclosures: Corrected pages

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burnup and enrichment combination outside of the acceptable areas in TS Figure 3.7.16-4, which could lead to an increase in reactivity. For such events, credit may be taken for the presence of at least 300 ppm of soluble boron in the pool required by TS 3.7.15 for the Holtec racks, since the staff does not require the assumption of two unlikely, independent, concurrent events to ensure protection against a criticality accident (double contingency principle). The reduction in k_{eff} caused by the boron more than offsets the reactivity addition caused by credible accidents. In fact, calculations show that for the most severe accident condition, a soluble boron concentration of 220 ppm boron would be adequate to maintain k_{eff} less than 0.95 for the Holtec racks.

3.1.4 Technical Specifications

Changes to TSs 3.7.15, 3.7.16, and 4.3 have been proposed as a result of the requested spent fuel pool reracking. Based on the above evaluation, the staff finds these changes acceptable as well as the associated Bases changes. During the installation of the new Holtec spent fuel storage racks, both Holtec racks and the existing Joseph Oat racks will be in the spent fuel pool at the same time. Therefore, the proposed TS changes address the requirements for both the new Holtec racks and the existing Joseph Oat racks. When shuffling fuel during the rack change-out, the current fuel assembly burnup, enrichment, and decay curve requirements applicable to the Joseph Oat racks, as well as the new burnup and enrichment curve requirements applicable to the Holtec racks, will be met. The soluble boron minimum concentration requirement of 2000 ppm currently required for the Joseph Oat racks will be maintained during the entire racks change-out process, thereby ensuring that k_{eff} will remain less than 0.95.

3.1.5 Summary

Based on the review described above, the staff finds that the criticality aspects of the proposed modifications to the Byron and Braidwood spent fuel pool storage racks are acceptable and meet the requirements of GDC 62 for the prevention of criticality in fuel storage and handling.

3.2 Spent Fuel Pool Cooling

The SFP cooling system removes decay heat from fuel stored in the SFP through the heat exchanger to the component cooling (CC) system. The essential service water system, in turn, removes heat from the CC water system. The SFP cooling system consists of two complete cooling trains and is a Safety Category I system. The Category I make-up circuit is provided by the 3-inch piping from the refueling water storage tank to the refueling water purification pumps, its associated piping and valves, and a 2-inch line from the discharge of the refueling water purification pump to the SFP.

Each cooling train includes one heat exchanger and pump, one purification loop with demineralizer and filter, and associated piping, valves, and flow indication instruments. Each cooling train is designed to maintain the bulk fluid temperature of the SFP below 140 degrees Fahrenheit for a normal one third of the reactor core discharge during refueling operations. Two additional sources of makeup water are provided to cool the SFP: (1) a backup Safety Category I makeup system, which takes suction from the Safety Category I fire protection system and injects water into the SFP, and (2) a non-Category I primary water makeup system, which takes suction from both primary water storage tanks and routes non-borated water through the SFP water filter, and the return header.

3.2.1 Decay Heat Load

The licensee performed decay heat load calculations in accordance with the provisions of NRC methodology Branch Technical Position ASB 9-2, "Residual Decay Energy for Light Water Reactors for Long Term Cooling," Revision 2 (July 1981), to determine the maximum bulk pool temperature, to determine the time to boil after a loss of decay heat cooling for different fuel discharge conditions to ensure that SFP makeup is available, and to ensure that adequate time exists for corrective action.

To determine the bounding case for maximum decay heat evaluation, the licensee conservatively assumed the following:

- A full SFP condition, in which a total of 2,864 and 2,821 fuel assemblies would be accumulated from previous discharges in the Byron and Braidwood Station SFPs, respectively. Additional fresh full-core discharge of 193 fuel assemblies is added to increase the maximum fuel inventory to 3,057 and 3,014 fuel assemblies, respectively.

- An 18 months fuel cycle is used for both Byron and Braidwood stations.

- The building housing the SFP is assumed to have the maximum ambient air temperature of 104 degrees Fahrenheit and an increase in relative humidity to 100 percent which results in a conservative evaporative heat loss.

- The thermal heat exchanger performance of the SFP cooling system is assumed to be fouled to its design basis level to minimize heat rejection capacity.

- The CC water temperature is assumed to be at 105 degrees Fahrenheit.

- Thermal inertia of the SFP is limited to the quantity of water in the pool.

Three discharge scenarios were considered for bulk pool thermal-hydraulic evaluation: (1) a normal discharge of one-third of the reactor core (84 fuel assemblies) 100 hours after a reactor shutdown, (2) a normal full-core discharge (193 fuel assemblies) 100 hours after a reactor shutdown, and (3) an abnormal back-to-back discharge scenario in which a normal discharge is followed by a full-core discharge 17 days later with a 100-hour in-vessel hold time after a reactor shutdown.

3.2.2 Normal Discharge Scenarios

Refueling operations at Byron and Braidwood are routinely performed with either an approximate one-third core offload or a full-core temporary offload in which approximately two-thirds of the fuel assemblies are returned to the reactor vessel, along with the new fuel upon the completion of the refueling operations. The Byron and Braidwood Updated Final Safety Analysis Reports (UFSARs) indicate that with the Joseph Oat rack configuration, the bulk pool temperature is maintained below 138 degrees Fahrenheit for the one-third core discharge and

3.8.1 Hoisting System

The licensee stated that rack removal and installation will be performed in accordance with NUREG-0612 and ANSI N14.6 -1978, “Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials.” The rack change-out will be performed using the 125-ton Fuel Building double girder bridge crane. The licensee stated that the crane is designed in accordance with requirements of the Crane Manufacturers Association of America (CMAA), “Specification No. 70 for Electric Overhead Traveling Cranes,” and American National Standard Institute (ANSI) B30.2-1976, “Overhead and Gantry Cranes (Top Running Bridge and Multiple Girder).” The maximum shipping weight to be lifted with the crane is approximately 26,000 pounds.

A temporary hoist (lifting device) will be attached to the overhead crane to avoid submerging and contaminating the crane hook in the water in the SFP. The lifting rig will be remotely engaged and interposed between the crane hook and the rack and is specifically designed to lift the new spent fuel rack modules. It is designed and tested in accordance with the guidelines in NUREG-0612 and requirements in ANSI N14.6 -1978. It consists of four independently loaded lift rods and configured such that failure of a single rod will not result in uncontrolled lowering of the rack. As stated by the licensee, both the stress design and the load testing of the lifting rig satisfies guidelines in Section 5.1.6(1) of NUREG-0612 and ANSI N14.6-1978, respectively. Accordingly, the lift rods are designed as follows: (1) with the appropriate stress design factor as specified in ANSI N14.6 (safety factor of 5 to 1), (2) load tested to 300 percent of the maximum weight to be lifted, and (3) after load testing, the integrity of the critical weld joints will be examined using a liquid penetrant. Non-customized lifting devices (i.e., slings) will be used in accordance with NUREG-0612 and ANSI B30.9-1971, “Slings.” Therefore, the slings must be proof tested at a minimum of 1.5 times their rated capacity in accordance with Section 9.3.3 in ANSI B30.9.

The staff concludes that the crane coupled with the design and testing of the lifting rig and other lifting devices will enable the licensee to handle heavy loads with little to no risks to the safety of the rerack operation.

3.8.2 Load Paths and Heavy Loads Handling Accident Analysis

The licensee stated that all handling, installation and removal of the spent fuel storage racks will be performed in accordance with NUREG-0612 guidelines. Safe load paths will be developed for moving the racks into and out of the fuel building. Spent fuel in the pool will be shuffled into racks that are not in the travel path of a rack to be moved. Therefore, the new racks and lifting rig will not be carried over or near active fuel. Furthermore, the racks will be lifted such that the center of gravity of the lift points will be aligned with the center of gravity of the load. In addition, administrative controls for the crane will be used to prevent any crane travel or load movement over fuel. The crane and bridge operators are to be trained in accordance with ANSI B30.2-1996 and plant specific training surveillance and inspections of the rack installation will be performed throughout the process.

The licensee considered load handling accidents involving “shallow” and “deep” drops of a spent fuel assembly and its handling tool during the rerack operation. The shallow drop is a vertical drop to the top of the rack from a lift height of 36 inches. The deep drop is a straight vertical drop onto the baseplate of the rack module. Neither accident scenario would result in any damage to the spent fuel pool liner. As a result, a loss of inventory in the SFP would not occur due to the drop of a spent fuel assembly. The licensee analyzed the potential for a cask drop accident and found that, when the cask is moved by the crane, the crane and cask travel will not occur over the SFP because crane interlocks will limit the crane travel. Consequently, the probability and consequences of a cask drop are unaffected by the replacement of the existing racks.

NUREG-0612 recommends that licensees provide an adequate defense-in-depth approach to maintaining safety during the handling of heavy loads near spent fuel and cited four major causes of accidents: (1) operator errors, (2) rigging failures, (3) lack of adequate inspection, and (4) inadequate procedures. The licensee plans to implement measures using administrative controls and procedures to preclude load drop accidents in these four areas. They will: (1) provide comprehensive training to the rerack installation crew, (2) use redundantly designed lifting rigs, (3) perform inspection and maintenance checks on the cranes and lifting devices prior to the rerack operation, and (4) use specific procedures that cover the entire rerack effort, including the identification of required equipment, inspection, acceptance criteria prior to load movement, defining safe load paths, and steps and precautions for proper load handling and movement.

The staff agrees with the licensee that the use of the crane in conjunction with administrative procedures and controls focused on, but not limited to, the areas noted above will enable the licensee to maintain safety during the rerack operation.

3.8.3 Summary

Based on the evaluation of the licensee’s submittal, the staff accepts the use of administrative controls in accordance with NUREG-0612 to improve the removal and installation of the racks in the SFP. The measures to be implemented will enable the licensee to move the racks while preventing any damage to spent fuel and the SFP structure if a crane failure or load drop was to occur. Therefore, the proposed considerations for moving heavy loads are acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Illinois State official was notified of the proposed issuance of the amendments. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32, and 51.35, an Environmental Assessment and Finding of No Significant Impact has previously been prepared and published in the Federal Register on February 29, 2000 (65 FR 10841).