December 19, 2008

Mr. Charles G. Pardee
President and Chief Nuclear Officer (CNO), Exelon Nuclear
Chief Nuclear Officer, AmerGen Energy Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: BYRON POWER STATION
NRC INSPECTION REPORT NO. 072-00068/08-01(DNMS)

Dear Mr. Pardee:

On December 11, 2008, the U.S. Nuclear Regulatory Commission (NRC) completed its inspection of the dry cask storage pad construction activities at the Byron Power Station. The purpose of the inspection was to determine whether the dry cask storage pad design and construction activities were conducted safely and in accordance with NRC requirements and design specifications. At the conclusion of the inspection on December 11, 2008, during an exit teleconference, the inspectors discussed the inspection findings with members of your staff. The enclosed report presents the results of this inspection.

The inspection was an examination of the dry fuel storage pad construction activities as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Specifically, the inspectors observed placement of structural fill, reinforcement, and concrete for the storage pad and HI-STORM 100 overpacks. The inspectors also performed an in-office review of calculations related to the storage pad. Areas examined during the inspection are identified in the enclosed report. Within these areas, the inspection consisted of selected examinations of procedures and representative records, observations of activities, and interviews with personnel.

Based on the results of these inspections, the inspectors did not identify violations of NRC requirements. The storage pad construction activities were conducted in accordance with applicable regulations and license conditions.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). The NRC's document system is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

We will gladly discuss any questions you may have regarding this inspection.

Sincerely,

/RA by William G. Snell, acting for/

Christine A. Lipa, Chief
Materials Control, ISFSI and
Decommissioning Branch

Docket Nos. 72-068; 050-454; 50-455
License Nos. NPF-37; NPF-66

Enclosure:
Inspection Report No. 072-00068/08-01(DNMS)

cc w/encl: Site Vice President - Byron Station
Plant Manager - Byron Station
Regulatory Assurance Manager - Byron Station
Chief Operating Officer and Senior Vice President
Senior Vice President - Midwest Operations
Senior Vice President - Operations Support
Vice President - Licensing and Regulatory Affairs
Director - Licensing and Regulatory Affairs
Manager Licensing - Braidwood, Byron, and LaSalle
Associate General Counsel
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Assistant Attorney General
Illinois Emergency Management Agency
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Letter to Charles G. Pardee from Christine A. Lipa dated xxx

SUBJECT: BYRON POWER STATION
NRC INSPECTION REPORT NO. 072-00068/08-01(DNMS)

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No.	072-00068
License Nos.	NPF-37; NPF-66
Report No.	072-00068/08-01(DNMS)
Licensee:	Exelon
Facility:	Byron Power Station
Location:	4450 North German Church Road Byron, IL 61010
Inspection Dates:	Onsite: May 21, 2008; June 26, 2008, August 5, 2008, August 27, 2008; and September 18, 2008. In-office review completed on December 11, 2008
Exit Teleconference:	December 11, 2008
Inspectors:	Sarah Bakhsh, Reactor Inspector Bruce Bartlett, Senior Resident Inspector Matthew Learn, Reactor Engineer in training
Approved by:	Christine A. Lipa, Chief Materials Control, ISFSI and Decommissioning Branch Division of Nuclear Materials Safety

Enclosure

EXECUTIVE SUMMARY
Byron Power Station
NRC Inspection Report 072-00068/08-01(DNMS)

The purpose of the inspection was to observe and evaluate the licensee's activities associated with construction of a new Independent Spent Fuel Storage Installation (ISFSI) pad. During this inspection period, the inspectors also reviewed the design of the new pad to ensure compliance with the regulations and the design specifications.

Review of 10 CFR 72.212(b) Evaluations, Appendix A, Review of ISFSI Storage Pad Design

- The inspectors concluded that the licensee adequately characterized the subsurface conditions for the new ISFSI site. The ISFSI pad was designed in accordance with the Certificate of Compliance, 10 CFR Part 72 requirements, and industry standards. (Section 1.1)

Independent Spent Fuel Storage Pad Construction

- The licensee's engineering evaluation of the in-situ soil was adequate. The soil compaction activities were being performed in accordance with technical specifications and industry standards. (Section 2.1)

- The inspectors concluded that most of the construction activities for the ISFSI concrete storage pad complied with specifications contained in the licensee's approved Engineering Change package, design drawings, Civil Construction Specifications, Work Orders, and applicable industry standards. Two issues pertaining to the Tip Over Analysis required additional NRC evaluation and will remain unresolved pending further review. Pending resolution by the NRC, the issues will be treated as Unresolved Item (URI) 07200068/2008001, Change to Tip Over Analysis to Incorporate Rebar Discrepancies and URI 07200068/2008002, Change in Tip Over Analysis to Incorporate 28-day Concrete Compressive Strength Test Discrepancies. (Section 2.2)

Report Details

1.0 Review of 10 CFR 72.212(b) Evaluations, Appendix A, Review of ISFSI Storage Pad Design (IP 60856)

1.1 Site Characterization and Design of the ISFSI Pad

a. Inspection Scope

The inspectors evaluated the licensee's soil and engineering design evaluations in preparation for a new dry cask storage pad to verify the licensee's compliance with the Certificate of Compliance (CoC), 10 CFR Part 72 requirements, and industry standards.

b. Observations and Findings

Soil Analysis

A total of six borings were drilled within the general vicinity of the ISFSI facility to determine the site subsurface conditions. The inspectors reviewed the licensee's report and the soil boring test results. Based on the soil sample analysis, the subsurface soil profile for the ISFSI consists of approximately 4 inches of asphalt followed by 12 inches of granular subbase or 2 to 3 inches of organic topsoil. Both were underlain by dense to very dense silty sand with crushed gravel. Bedrock was approximately 3 to 6 feet (ft.) below the existing grade, with the existing grade at approximately 873.6 ft. Rock cores were taken to depths ranging from 13 to 16 ft. There was no groundwater collected within the borings prior to the addition of water to facilitate rock coring. The groundwater surface varied, but was at approximately 840 ft. at the plant site and 740 ft. one mile northeast of the site. Groundwater was at approximately 60 ft. to 75 ft. below the area of the ISFSI.

Soil Liquefaction Analysis

The boring logs performed by the licensee's contractor indicated the presence of dense to very dense soils as demonstrated by the high Standard Penetration Test blow counts. High blow counts are indicative of high resistance to liquefaction. In addition, at approximately 3 feet below grade, the soil strata was limestone rock which is not susceptible to liquefaction.

Flooding Analysis

The plant probable maximum precipitation was approximately 870.8 ft., which is the governing water elevation for the plant site. The ridge line of pad runs east to west. The lower edge of the pad (thickness of 2 ft.) was at elevation 875 ft. which sloped from the top elevation of 875 ft. 3 inches. Thus the pad was located on the upstream side of the flood path which can aid in lowering the flood water depth. The water drains from the east side (main road to the plant) to a ditch on the west side which drains to the river. To address any frost heave concerns during cold weather, the licensee placed a frost free granular material under the pad.

c. Conclusion

The inspectors concluded that the licensee adequately characterized the subsurface conditions for the new ISFSI site. The ISFSI pad was designed in accordance with the Certificate of Compliance, 10 CFR Part 72 requirements, and industry standards.

2.0 Independent Spent Fuel Storage Pad Construction (IP 60853)

2.1 Excavation and Soil Compaction Activities

a. Inspection Scope

The inspectors evaluated the licensee's site characterization, and observed soil compaction activities for the new dry cask storage pad to verify the licensee's compliance with its specifications, design drawings, and industry standards.

b. Observations and Findings

The licensee constructed a reinforced concrete ISFSI storage pad to the south of the plant. The ISFSI pad was designed to hold 96 dry fuel storage casks. The licensee excavated 3 feet of soil, ensuring removal of topsoil, organic, and all undesirable material until bedrock was reached. There was a lot of hard rock identified at very shallow depths and in order to ensure the required 3 ft. of engineered fill be placed, the licensee raised the final elevation of the top of the pad by 1 ft. 6 inches to approximately 875 ft.

Rolling of the underlying in-situ material ensured that a suitable subgrade existed under the pad area. Following receipt of satisfactory compaction results for the subgrade, the licensee backfilled the area with 3 ft. of non-frost susceptible granular base material (gravel/sand) and compacted the fill to a minimum of 95 percent of the maximum dry density as indicated in American Society for Testing and Materials (ASTM) D 1557. The inspectors observed the licensee place and compact the fill in layers of six inches.

The inspectors observed certified personnel perform field tests using a moisture density gauge to verify that each individual lift met the minimum compaction, maximum dry density and moisture content as specified in technical specifications and established during laboratory tests. The licensee's contractor obtained this data by performing field tests which included wet and dry density, moisture content, and lift thickness in accordance with the appropriate ASTM standards.

The licensee performed soil plate load tests for the engineered fill to determine the value of the Young's Modulus. This parameter measured the stiffness of the material and was calculated using field tests. There is both a lower and upper limit required to ensure the pad's structural qualifications are met. The lower limit of the Young's Modulus was the minimum required for the strength of the pad while the upper limit was to ensure that the deceleration values of the fuel assemblies do not exceed design requirements during a non-mechanistic tipover of the cask.

The licensee committed to follow the ASTM D1194 standards in its Civil Construction Specification and Engineering Change package for the plate load tests which required the use of at least three test locations. However, the specification contradicted this by stating that "at least one Soil Plate Load Test shall be performed near the center of the pad location." The inspectors highlighted this discrepancy to the licensee. The licensee used three test locations and revised the specification to state "at least one Soil Plate Load Test shall be performed for the installation of each section of the ISFSI pad."

The licensee and the designer of the proposed pad (Holtec) indicated that although they did plan to use three test locations, they were not required to do so because the standard was to be used as a guidance document. The inspectors explained the need for the licensee to emphasize adherence to codes and standards and the inspectors' understanding that there needs to be full compliance to documents that the licensee committed to in their design documents. The licensee modified its documents to better reflect their intent to use the standards as guidance documents. Discrepancies would be submitted to Owner's Engineering for evaluation and to obtain acceptance from Holtec prior to proceeding with construction.

The results for the three tests were forwarded to Holtec to determine the Young's modulus. The initial test results were outside the 7.5 kips per square inch (ksi) to 15 ksi range specified in the design documents. Since there is hard rock at very shallow depths and only 3 ft. of backfill, Holtec recommended changing the plate size used in the test from a 2x2 to a 1x1. Changing the plate size ensured that the data was representative of the engineered fill without significant contribution from the in-situ rock beneath the fill. The values for the Young's modulus were then within the specified range for the three test locations.

c. Conclusion

The licensee's engineering evaluation of the in-situ soil was adequate. The soil compaction activities were being performed in accordance with technical specifications and industry standards.

2.2 Pad Construction Activities

a. Inspection Scope

The inspectors evaluated whether construction activities for the ISFSI concrete storage pad complied with specifications contained in the licensee's approved Engineering Change package, design drawings, Work Orders, and applicable industry standards. The inspectors also reviewed select material, and batch plant tickets.

b. Observations and Findings

The inspectors reviewed an approved Engineering Change package which provided specifications for the pad construction activities. The storage pad was designed to be a 198 ft. long, 116 ft. wide, and 2 ft. thick reinforced concrete slab. The storage pad was supported by a 6 inch thick concrete mat foundation set on top of 3 ft. of dense graded aggregate.

Placement of Reinforcing Steel

After placement and satisfactory compaction of the engineered fill, the licensee installed forms and placed reinforcement bars (rebar). The reinforced concrete was designed for a nominal compressive strength between 3,000 pounds per square inch (psi) and 4,200 psi at 28 days and the rebar conformed to ASTM A615 Grade 60 steel.

After placing the rebar and securing the forms, the licensee performed an inspection of the first third of the proposed pad prior to concrete placement. The inspectors reviewed the design drawings and performed an independent walk down of the proposed first third of the pad. The pad area was free of debris and excessive moisture. The rebar was placed in two upper and lower layers joined by U-shaped bars. The licensee placed the correct size of rebar. The inspectors measured the spacing between the rebar and identified some instances where the spacing was outside the allowed tolerance specified in the design drawing. The inspectors also identified instances in which the requirements for the concrete cover between the rebar and the forms as well as the top and bottom of the pad differed from design drawings. Thus a number of field changes were performed to address the existing field conditions which deviated from the prescribed drawings. Where it was not practical, the licensee obtained justification from Holtec to leave the rebar in the as built condition as documented in Holtec's September 2, 2008, letter to the licensee. The licensee entered this into its corrective action program as Action Request (AR) Report 00812028. The licensee will address these discrepancies in a calculation which is still pending completion. The inspector will review the calculation upon receipt to ensure adherence to the design requirements. This issue requires additional NRC evaluation and will remain unresolved pending further review. Pending resolution by the NRC, this issue will be treated as Unresolved Item (URI) 07200068/2008001-01, Change to Tip Over Analysis to Incorporate Rebar Discrepancies.

Placement of Concrete for Storage Pad

The storage pad was designed in accordance with American Concrete Institute (ACI) 318 and constructed in accordance with ACI 301. The inspectors observed concrete placement for the second third of the main storage pad. The licensee deposited concrete in this section in one continuous placement. The licensee checked the batch tickets for every truck to confirm that each concrete batch was mixed as specified in the mix design and the mixing time and number of drum revolutions satisfied code requirements to ensure the concrete was suitable for placement. The inspectors observed that the concrete was transported by conveyor belt and deposited in the areas of placement as indicated by the forms. The inspectors noted that the contractor staff maintained careful control of the discharge hose and ensured that concrete had an unrestricted vertical drop to the point of placement to prevent segregation of the aggregate. The contractor used a systematic pattern of vibration to ensure proper consolidation, thereby preventing voids in the concrete slab. The proposed ISFSI pad was constructed in three segments allowing three separate continuous placements of concrete. The licensee applied a broom finish as required by the design to the pad after placement in order to achieve the appropriate surface friction factor.

Concrete Field Tests

The licensee's contractor obtained concrete samples approximately every 50 cubic yards to test air content, temperature, and slump tests. The field tests were satisfactory and within the allowed acceptance criteria with a few exceptions. During placement of the first third of the proposed pad, the concrete from one of the trucks arriving from the batch plant had a nominal slump of 1.5 inches which was outside the 3 inches to 5.5 inches specified in the Civil Construction Specifications. The licensee added water to the concrete mix and performed high-speed mixing of the truck drum. After stopping the drum the counter displayed 347 revolutions which exceeded 300 specified in ASTM C94. However, engineering judgment could be used and if the concrete was placed within 90 minutes of its stay time in the truck, the standard allowed for deviations from the 300 revolutions. The licensee placed the concrete approximately an hour after it was batched and with a final slump of 3 inches. The licensee entered this into its corrective action program as Issue Report No. 00817907. There were a few other trucks in which the concrete did not meet the requirements of slump. This was attributed to the rain that the batch plant received the night before. The licensee contacted the batch plant and rejected trucks with the slumps outside tolerance and increased sampling to every truck until consistency and quality of concrete were within specifications after which every six trucks were sampled as required by the specifications. The licensee entered this issue into its corrective action program as AR 00816039.

In addition to the field tests, the qualified individuals collected concrete samples in cylinders for the concrete strength tests. The cylinders were adequately stored in accordance with ACI and ASTM standards. The cylinders were cured and tested initially after 7 days and then after 28 days by an independent laboratory to measure the compressive strength of the concrete. The inspectors reviewed the 28-day concrete compressive strength test results taken from the storage pad to ensure they met the minimum strength of 3,000 psi and maximum of 4,200 psi as specified by the design requirements. There were several 28-day test results that exceeded the 4,200 psi maximum strength, the highest one being at 4310 psi. The licensee will address these discrepancies and acceptance of these test result deviations in a calculation which is still pending completion. The inspector will review the calculation upon receipt to ensure adherence to the design requirements. This issue requires additional NRC evaluation and will remain unresolved pending further review. Pending resolution by the NRC, this issue will be treated as URI 07200068/2008001-02, Change in Tip Over Analysis to Incorporate 28-day Concrete Compressive Strength Test Discrepancies.

In addition to field observations, the inspectors reviewed the rebar certification which could affect the quality of the concrete pad and its design function. The inspectors also reviewed documentation regarding the batch plant certification which was certified in accordance with the Illinois Department of Transportation.

Placement of Concrete for HI-STORM 100 Overpacks

The inspectors attended the licensee's pre-job brief prior to construction of the overpacks. The project manager discussed the concrete placement procedures and safety precautions when placing concrete in the overpack shells. Holtec representatives had direct supervision over the work activities and the licensee provided additional oversight.

The inspectors inspected three of the six fabricated HI-STORM 100 overpack shells to verify they were clean and free of debris. The inspectors observed that concrete was delivered in truck agitator units and discharged through a trunk that ensured an unrestricted vertical drop to prevent aggregate segregation. In addition, the vertical drop was minimized to prevent aggregate segregation and air entrainment. The staff placed the concrete in layers that were two ft. in elevation. After completion of each layer in the four quadrants of the circle, the workers used a vibrator to ensure proper consolidation of the concrete. During the placement of the concrete, personnel performed unit weight, temperature, and slump tests as specified by the applicable ACI standards. Selected tests were observed by the inspectors.

c. Conclusion

The inspectors concluded that most of the construction activities for the ISFSI concrete storage pad complied with specifications contained in the licensee's approved Engineering Change package, design drawings, Civil Construction Specifications, Work Orders, and applicable industry standards. Two issues pertaining to the Tip Over Analysis required additional NRC evaluation and will remain unresolved pending further review. Pending resolution by the NRC, the issues will be treated as Unresolved Item (URI) 07200068/2008001-01, Change to Tip Over Analysis to Incorporate Rebar Discrepancies and URI 07200068/2008001-02, Change in Tip Over Analysis to Incorporate 28-day Concrete Compressive Strength Test Discrepancies.

3.0 Exit Meeting Summary

On December 11, 2008, the inspectors conducted an exit teleconference to present the results of the inspection. The licensee acknowledged the findings presented and did not identify any information discussed as being proprietary in nature.

Attachment: Supplemental Information

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

*Brad Adams	Plant Manager
*John Anderson	Project Management Manager
*Jerry Barger	Project Manager
*Ed Blondin	Design Engineering Mechanical
*Terry Eckert	Contract Project Manager
*Bill Grundmann	Regulatory Assurance Manager
Harish Patel	Lead project Engineer Dry Cask Storage Project
*Bill Perchiazzi	Design Engineering Manager
*Tim Spelde	Exelon Project Mananger

* Persons present during the December 11, 2008, exit teleconference.

INSPECTION PROCEDURE USED

IP 60853	Construction of an Independent Spent Fuel Storage Installation
IP 60856	Review of 10 CFR 72.212 (b) Evaluations, Appendix A, Review of ISFSI Storage Pad Design

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened	Type	Summary
07200068/2008-001-01	URI	Change to Tip Over Analysis to Incorporate Rebar Discrepancies
07200068/2008-001-02	URI	Change in Tip Over Analysis to Incorporate 28 day Concrete Compressive Strength Test Discrepancies

Closed

None

Discussed

None

Attachment

LIST OF DOCUMENTS REVIEWED

Byron Independent Spent Fuel Storage Installation Civil Construction Specification; Specification No. 127324-BYR-001; Revision 0

Byron Independent Spent Fuel Storage Installation Civil Construction Specification; Specification No. 127324-BYR-001; Revision 2

Byron Independent Spent Fuel Storage Installation Civil Construction Specification; Specification No. 127324-BYR-001; Revision 3

Drawing R1; ISFSI Foundation Plan; dated April 22, 2008

Drawing R2; Construction Pad Foundation Plan; dated May 5, 2008

Drawing No. S-2232; ISFSI Pad Plan, Details, and Sections; dated March 20, 2008

Drawing No. S-2238; Dry Fuel Storage Project Cask Storage Pad Details; dated March 20, 2008

Drawing No. S-2239; Dry Fuel Storage Project Grading Sections; dated February 22, 2008

Engineering Change Number 367118; Dry Cask Storage Project Independent Spent Fuel Storage Installation (ISFSI) Pad; Revision 3

Gerdau Ameristeel Chemical and Physical Test Report

Holtec International BYNPS ISFSI Pad Plate Load Tests Letter; Document ID 1676024; dated July 11, 2008

Holtec International BYNPS ISFSI Pad Plate Load Tests Results Letter; Document ID 1676026; dated July 28, 2008

PSI Geotechnical Engineering Services Report; dated November 16, 2007

PSI Geotechnical Engineering Services Report Letter; dated December 9, 2008

Terracon Concrete Compressive Strength Test; 7-day Test Reports for North Third of ISFSI Pad; dated September 17, 2008

Terracon Concrete Compressive Strength Test; 7-day Test Reports for South Third of ISFSI Pad; dated September 26, 2008

Terracon Concrete Compressive Strength Test; 7-day Test Reports for Middle Third of ISFSI Pad; dated October 2, 2008

Terracon Concrete Compressive Strength Test Report; 28-Day Test Report for North Third of ISFSI Pad, sample dated September 9, 2008

Terracon Concrete Compressive Strength Test Report; 28-Day Test Report for South Third of ISFSI Pad, sample dated September 18, 2008

Terracon Concrete Compressive Strength Test Report; 28-Day Test Report for Middle Third of ISFSI Pad, sample date September 24, 2008

Terracon Report Number 19081017.0022; Dry Cask Storage-Byron; dated June 26, 2008

Terracon Plate Bearing Test Results-ASTM D 1194; dated July 23, 2008, July 24, 2008, and July 25, 2008

WR-BY-PF-10; Effect of Local Probable Maximum Precipitation (PMP) at Plant Site; EC 367118; Revision 4D

LIST OF ACRONYMS USED

ACI	American Concrete Institute
ADAMS	Agencywide Documents Access Management System
ASTM	American Society for Testing and Materials
AR	Action Report
CFR	Code of Federal Regulations
CoC	Certificate of Compliance
ft	Feet
ISFSI	Independent Spent Fuel Storage Installation
kips	kilopounds
ksi	kips per square inch
NRC	Nuclear Regulatory Commission
psi	pounds per square inch
URI	Unresolved Item