

September 22, 2009

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

SUBJECT: NRC INSPECTION REPORT NO. 072-00068/09-01(DNMS);  
05000454/2009009; 05000455/2009009 - BYRON POWER STATION

Dear Mr. Pardee:

On September 9, 2009, 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 September 9, 2009, 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 related to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspectors performed reviews of calculations related to the storage pad including reviews to address Unresolved Items (URI) 07200068/2008001-01 and 07200068/2008001-02. 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, onsite walk-downs of specific areas, 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. However, inspectors identified two URIs pertaining to the pad design that require further review.

In accordance with 10 Code of Federal Regulations 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 NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC Web site at  
<http://www.nrc.gov/reading-rm/adams.html>

C. Pardee

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

Sincerely,

*/RA/*

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. 072-00068/09-01(DNMS);  
05000454/2009009; 05000455/2009009.

cc w/encl: Site Vice President - Byron Station  
Plant Manager - Byron Station  
Manager Regulatory Assurance - Byron Station  
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  
Document Control Desk - Licensing  
Assistant Attorney General  
Illinois Emergency Management Agency  
J. Klinger, State Liaison Officer,  
Illinois Emergency Management Agency  
P. Schmidt, State Liaison Officer, State of Wisconsin  
Chairman, Illinois Commerce Commission  
B. Quigley, Byron Station

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 Manager Licensing - Braidwood, Byron, and LaSalle  
 Associate General Counsel  
 Document Control Desk - Licensing  
 Assistant Attorney General  
 Illinois Emergency Management Agency  
 J. Klinger, State Liaison Officer,  
 Illinois Emergency Management Agency  
 P. Schmidt, State Liaison Officer, State of Wisconsin  
 Chairman, Illinois Commerce Commission  
 B. Quigley, Byron Station

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos. 072-00068; 050-00454;  
050-00455

License Nos NPF-37; NPF-66

Report Nos 072-00068/09-01(DNMS);  
05000454/2009009; 05000455/2009009

Licensee: Exelon

Facility: Byron Power Station

Location: 4450 North German Church Road  
Byron, IL 61010

Inspection Dates: In-office review from December 22, 2008  
through September 9, 2009

Exit Teleconference: September 9, 2009

Inspectors: Sarah Bakhsh, Reactor Inspector  
Vijay Meghani, Reactor Inspector

**EXECUTIVE SUMMARY**  
**Byron Power Station**  
**NRC Inspection Report 072-00068/09-01(DNMS)**

The purpose of the inspection was to evaluate the licensee's activities associated with design of the Independent Spent Fuel Storage Installation (ISFSI) pad to ensure compliance with the regulations and the design specifications. During this inspection period, the inspectors also reviewed the licensee's evaluation of the haul path and the buried utilities located along the spent fuel cask transportation route.

Review of 10 Code of Federal Regulations 72.212(b) Evaluations, Appendix A, Review of ISFSI Storage Pad Design

- The inspectors identified two technical issues pertaining to the ISFSI pad structural analyses that remain unresolved and require further review. Pending resolution, these issues will be treated as Unresolved Items. (Section 1.1)

Independent Spent Fuel Storage Pad Construction

- The inspectors determined that the licensee adequately evaluated the proposed transfer route for the expected dry cask loads. (Section 2.1)
- The inspector reviewed the licensee's evaluations pertaining to 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. The inspectors determined that the licensee adequately evaluated the discrepancies described in the URIs and they are considered closed. (Section 2.2)

## **Report Details**

### **1.0 Review of 10 Code of Federal Regulations (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**

###### **Seismic Soil Structure Analysis and ISFSI Pad Analysis**

The inspectors reviewed structural calculations related to the ISFSI pad. In calculation 2.4.3-BYR08-30, in lieu of performing a detailed dynamic analysis to determine seismic response of the cask, the licensee used the methodology described in the NUREG/CR6865, "Parametric Evaluation of Seismic Behavior of Free Standing Spent Fuel Dry Cask Storage System." NUREG/CR6865 documents results of parametric analyses in the form of nomograms. The licensee used the nomograms to determine the seismic response of the cask in terms of the maximum cask displacements including sliding and rotation, and used the results to determine the maximum loads for the pad structural analysis calculation 2.4.3-BYR08-27.

The inspectors noted that the Byron plant spectra with safe shutdown earthquake at 0.21g acceleration at ground surface level were used in the analyses. This acceleration value included amplification through soil with the foundation level acceleration being 0.2g. The ISFSI pad is placed on top of bed rock with approximately 3'-6" of structural fill under the pad. Structural analysis for the pad was performed in accordance with American Concrete Institute (ACI) code 318. The licensee also performed a Non-Mechanistic Tip-over analysis to demonstrate that the foundation satisfies the energy absorption requirements of the cask system Final Safety Analysis Report (FSAR). The tip-over analysis showed that the foundation stiffness is adequate to ensure that in case of a tip-over, the cask deceleration levels will remain below the FSAR design basis value. The licensee captured the inspector's questions in Action Request (AR) 957945 and AR 957981 and issued revised calculations to address the issues.

The inspectors identified that evaluations in calculation 2.4.3-BYR08-27 did not include the effect of partial/sequential loading on concrete design and the soil bearing pressure. The licensee entered this concern in AR 957945 and was in the process of revising the calculation. At the conclusion of this inspection, the licensee had not completed the calculation revision to address this issue. This issue will therefore remain unresolved pending further review and will be treated as Unresolved Item (URI) 07200068/2009001-01, Pad Structural Evaluation Revisions to Address Partial/Sequential Loading. In addition, the inspectors identified that in calculation 2.4.3-BYR08-30, the licensee's use of NUREG/CR6865 results in lieu of performing a dynamic analysis may be inappropriate. Based on discussions with the Nuclear Materials Safety and Safeguards (NMSS) staff, NUREG/CR6865 was intended to assist

staff in the study of the Dry Cask Storage System (DCSS) behavior under a design basis seismic event, and if necessary, to provide bases for revision to 10 CFR Part 71 and Part 72 regulations. The licensee entered the concern in AR 966751 but had not provided resolution of this concern by the conclusion of this inspection. This issue will therefore remain unresolved pending further review of the licensee response / revised analyses, and will be treated as Unresolved Item (URI) 07200068/2009001-02, Use of NUREG/CR6865 Results in Lieu of Dynamic Analysis.

c. Conclusion

The inspectors identified two technical issues pertaining to the ISFSI pad structural analyses that remain unresolved and require further review. Pending resolution, these issues will be treated as URI 07200068/2009001-01, Pad Structural Evaluation, Revisions to Address Partial/Sequential Loading and URI 07200068/2009001-02, Use of NUREG/CR6865 Results in Lieu of Dynamic Analysis.

**2.0 Independent Spent Fuel Storage Pad Construction (IP 60853)**

2.1 Dry Cask Transfer Route

a. Inspection Scope

The inspectors reviewed the licensee's heavy haul road design and underground utilities evaluation to verify that the licensee evaluated the proposed transfer route for the expected loads.

b. Observations and Findings

The licensee evaluated the haul path concrete roads and surrounding concrete pads for the maximum loading due to the moving transporter truck using the ultimate strength design in accordance with the ACI code 318 and the project design criteria. In order to avoid surface wear and tear, the construction and turning pads were designed using 7000 pounds per square inch strength concrete. All buried utilities including piping, conduits, duct banks, and culverts located along the haul path and the pads were evaluated for the heavy loads and the calculations were found to be adequate. However, the inspectors did identify a number of discrepancies in the calculations such as the use of incorrect soil cover values or pipe dimensions and inadequate explanation of key terms and expressions. The licensee revised the calculations to clarify and correct the discrepancies. The corrections did not change the conclusions. The licensee also entered these discrepancies into their corrective action program as AR 922194.

c. Conclusion

The inspectors determined that the licensee adequately evaluated the proposed transfer route for the expected dry cask loads.

2.2 Pad Construction Activities

a. Inspection Scope

The inspector reviewed the licensee's evaluations pertaining to URIs 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.

b. Observations and Findings

Placement of Reinforcing Steel and Concrete Field Tests

The licensee evaluated the rebar placement discrepancies pertaining to URI 07200068/2008001-01, Change to Tip-over Analysis to Incorporate Rebar Discrepancies. The discrepancies involved out of tolerance rebar spacing and rebar concrete covers identified in the field by the inspectors. The licensee had corrected some of the discrepancies and provided justification for acceptance for the remaining discrepancies. The inspectors reviewed the justification provided by the licensee for resolution of the discrepancies. The licensee's evaluation indicated that increased tolerances on rebar spacing were acceptable and did not affect the design provided that the total number of rebars was equal to or greater than the number required based on the applicable design drawing. The licensee's evaluation also concluded that the discrepancies regarding rebar concrete covers had insignificant or no impact on the design calculations. No calculation revisions were required as a result of these evaluations. The inspectors determined that the licensee had provided adequate justification to resolve this issue. This URI is considered closed.

The licensee also evaluated the concrete field tests discrepancies pertaining to URI 07200068/2008001-02, Change in Tip-over Analysis to Incorporate 28-Day Concrete Compressive Strength Test Discrepancies and revised the affected calculations. The discrepancy involved results of the 28-day concrete strength test indicating 4310 psi strength that exceeded the maximum strength limit of 4200 psi as specified by the design documents. The inspectors reviewed the affected licensee calculations including the tip-over analysis and the dynamic analysis. The inspectors noted that these calculations used a concrete strength value of 4500 psi, thus bounding the field test results of 4310 psi. The inspectors determined that the licensee had provided adequate justification to resolve this issue. This URI is considered closed.

c. Conclusion

The inspector reviewed the licensee's evaluations pertaining to 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. The inspectors determined that the licensee adequately evaluated the discrepancies described in the URIs and they are considered closed.

### **3.0 Exit Meeting Summary**

On September 9, 2009, 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

#### Licensee and Contractor Employees

\*John Anderson, Byron Project Manager  
\*Tim Spelde, Byron ISFSI Project Manager  
\*Tracey Hulbert, Byron NRC Coordinator  
\*Dave Gudger, Byron Regulatory Assurance Manager  
\*Gary Voss, Byron Engineer  
Bill Grundmann, Corporate Licensing, Cantera  
\*Scot Greenlee, Byron Engineering Director  
Ed Blondin, Byron Mechanical Design Manager

\*Licensee and Contractor Employees on the September 9, 2009 Exit Teleconference on ISFSI

### 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

<u>Opened</u>	<u>Type</u>	<u>Summary</u>
07200068/2009001-01	URI	Pad Structural Evaluation Revisions to Address Partial Sequential Loading
07200068/2009001-02	URI	Use of NUREG/CR6865 Results in Lieu of Dynamic Analysis.

#### Closed

07200068/2008001-01	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

#### Discussed

None

## **LIST OF DOCUMENTS REVIEWED**

Action Request Report No. AR 00922194; NRC Questions Regarding Design Analysis Nos. BYR07-095 & -101; May 20, 2009

Action Request Report No. AR 00957945; NRC Questions on Design Analysis No. 2.4.3-BYR08-027; August 26, 2009

Action Request Report No. AR 00957981; NRC Questions on Design Analysis No. 2.4.3-BYR08-030; August 26, 2009

Action Request Report No. AR 00966751; Use of NUREG/CR6865 in the Dynamic Analysis of the ISFSI Slab; September 18, 2009

Design Analysis BYR07-095; Evaluation of Buried Utilities Located Along the Transporter Haul Path for Dry Cask Storage; Revisions 0, 1, 4

Design Analysis BYR07-101; Foundation Design of the Reinforced Concrete Transporter Haul Path Between Reactor Building and ISFSI Pad; Revisions 0, 1

Design Analysis 2.4.3-BYR08-27; Structural Analysis of the ISFSI Pad at Byron and Braidwood; Revision 0, 1, 4

Design Analysis 2.4.3-BYR08-30; Dynamic Analysis of HI-STORM 100 Cask on Byron, Braidwood and LaSalle ISFSI Pads; Revisions 0, 1

Design Analysis 2.4.3-BYR08-32; Non-Mechanistic Tipover of the HI-STORM 100S Version B at Byron and LaSalle Power Station ISFSI Pads; Revision 0

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

EC 367119; Dry Cask Storage Project - Independent Spent Fuel Storage Installation (ISFSI) Haul Path; Revision 1

## **LIST OF ACRONYMS USED**

ACI	American Concrete Institute
ADAMS	Agencywide Documents Access Management System
AR	Action Request
CoC	Certificate of Compliance
CFR	Code of Federal Regulations
DCSS	Dry Cask Storage System
DNMS	Division of Nuclear Materials Safety
FSAR	Final Safety Analysis Report
ISFSI	Independent Spent Fuel Storage Installation
NMSS	Nuclear Materials Safety and Safeguards
NRC	Nuclear Regulatory Commission
PARS	Publicly Available Records
URI	Unresolved Item