UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

August 24, 2012

Mr. Larry Weber
Senior Vice President and
Chief Nuclear Officer
Indiana Michigan Power Company
Nuclear Generation Group
One Cook Place
Bridgman, MI 49106

SUBJECT: NRC INSPECTION REPORT NOS. 07200072/2011001(DNMS); 05000315/2011010(DNMS); 05000316/2011010(DNMS) – D.C. COOK NUCLEAR PLANT, UNITS 1 AND 2

Dear Mr. Weber:

On July 30, 2012, the U.S. Nuclear Regulatory Commission (NRC) completed its inspection of the dry cask storage pad design at the D.C. Cook Nuclear Plant. The enclosed report presents the inspection findings which were discussed on July 30, 2012, with Mr. M. Carlson and other members of your staff.

The inspection examined the dry fuel storage pad design, and connecting pathways, as it relates to the safe storage of dry fuel storage casks and compliance with the Commission's rules, regulations, and the conditions of your license. Specific 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, and interviews with personnel.

The inspection was conducted per NRC Inspection Manual 2690, "Inspection Program for Dry Storage of Spent Reactor Fuel at Independent Spent Fuel Storage Installations and Guidance for Title 10 of the Code of Federal Regulations (CFR) Part 71 Transportation Packages," and used portions of Inspection Procedure (IP) 60853 and IP 60856.

Based on the results of this inspection, the inspectors indentified one Severity Level IV violation of NRC requirements. However, because the violation was of very low safety significance, and was entered into your corrective action program, the NRC is treating the issue as a non-cited violation (NCV) in accordance with Section 2.3.2 of the NRC Enforcement Policy.

If you contest the subject or severity of the NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Regional Administrator, U.S. Nuclear Regulatory Commission - Region III, 2443 Warrenville Road, Suite 210, Lisle, IL 60532-4352; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the Resident Inspector Office at the D.C. Cook Nuclear Plant.

In accordance with 10 CFR 2.390, of the NRC's "Rules of Practice," a copy of this letter and the enclosed report 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.

Sincerely,

/RA Wayne J. Slawinski Acting for/

Christine A. Lipa, Chief
Materials Control, ISFSI, and
Decommissioning Branch
Division of Nuclear Materials Safety

Docket Nos. 072-00072; 050-00315; 050-00316
License No. DPR-58; DPR-74

Enclosure:
NRC Inspection Report Nos. 072-00072/2011001(DNMS)
and 05000315/2011010(DNMS); 05000316/2011010(DNMS)

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos.	072-00072; 050-00315; 050-00316
License No.	DPR-58; DPR-74
Report Nos.	07200072/2011001(DNMS); 05000315/2011010(DNMS); 05000316/2011010(DNMS)
Licensee:	Indiana Michigan Power Company
Facility:	D. C. Cook Nuclear Plant, Units 1 and 2
Location:	Bridgman, MI
Inspection Dates:	Onsite: January 18 – 19, 2012; In-Office review: January – July 30, 2012
Inspectors:	Vijay L. Meghani, Reactor Inspector Rhex A. Edwards, Reactor Inspector
Approved by:	Christine A. Lipa, Chief Materials Control, ISFSI, and Decommissioning Branch Division of Nuclear Materials Safety

Enclosure

EXECUTIVE SUMMARY

D. C. Cook Nuclear Plant, Units 1 and 2
NRC Inspection Report Nos. 07200072/2011001(DNMS); 05000315/2011010(DNMS); 05000316/2011010(DNMS)

The purpose of the inspection was to evaluate the design of a new Independent Spent Fuel Storage Installation (ISFSI) storage pad and haul path, at the D.C. Cook Nuclear Plant, to ensure compliance with regulations and design specifications. The review of the construction activities associated with the new pad was documented in Inspection Report Nos. 07200072/2009001(DNMS); 05000315/2009008(DNMS); 05000316/2009008(DNMS).

Review of Title 10 of the Code of Federal Regulation 72.212(b) Evaluations

- The inspectors identified a Severity Level IV NCV of very low safety significance of Title 10 of the Code of Federal Regulations (CFR) 72.212 (b)(5)(ii),"Conditions of general license issued under 72.210." Specifically, the inspectors identified two examples where the licensee's evaluations failed to demonstrate that the ISFSI pad was designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, soil liquefaction potential, or other soil instability due to vibratory ground motion. (Section 1.1)

- The licensee adequately evaluated the proposed transfer route for the expected dry cask loads. (Section 1.2)

Report Details

1.0 Review of 10 CFR 72.212(b) Evaluations: Review of ISFSI Storage Pad Design, Dry Cask Transfer Route, and Design Basis Events (IP 60856)

1.1 Site Characterization and Design of the ISFSI Pad

a. Inspection Scope

The objective of this inspection was to determine whether the requirements, as they relate to the ISFSI pad and haul path, specified in section 72.212 of 10 CFR, "Conditions of General License issued under 72.210," have been met by the D.C. Cook Nuclear Plant. In general, the inspection assessed the licensee's geologic, seismic, tornado, and flooding evaluations to verify the licensee's compliance with the Certificate of Compliance, 10 CFR 72 requirements, and industry standards. In-office reviews, walk-downs, and discussions with site personnel were conducted during the inspection.

b. Observations and Findings

The licensee constructed a reinforced concrete ISFSI storage pad east of the plant in what was the Upper Parking Lot. The dry cask storage system selected was the Holtec International HI-STORM 100S vertical cask storage overpack and the Holtec MPC-32 multi-purpose canister. The storage pad is designed to provide a storage capacity for 94 storage casks and is a reinforced concrete slab, 2-feet thick, placed on a 4-inch thick concrete mat foundation. The ISFSI pad is classified as Important to Safety, Category C.

Title 10 CFR 72.212(b)(5)(ii) requires that written evaluations be performed to establish that the cask storage pads and areas have been designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, soil liquefaction potential, or other soil instability due to vibratory ground motion.

Soil Analysis and Soil Liquefaction Analysis

The inspectors evaluated whether the reactor site soil structure differed from the soil structure under the ISFSI storage pad through in-office document reviews. Calculation No. 13090401-R-G-006, "Geotechnical Design Report for the Proposed Independent Spent Fuel Storage Installation," was reviewed and contained evaluations of the geotechnical investigation at the proposed ISFSI pad. The report included details of the sites subsurface condition, factor of safety against liquefaction, and settlement.

The licensee evaluated the potential for ISFSI pad soil liquefaction and post earthquake settlement in Calculation No. 13090401-G-03, "Liquefaction Analysis and Estimation of Post-Earthquake Settlements." U.S. NRC Regulatory Guide (RG) 1.198 was used with Cone Penetrant Testing data, to determine the factor of safety against liquefaction. The minimum factor of safety against liquefaction was estimated to be 1.5, with an estimated average of 1.7. Following a design basis earthquake, the ISFSI pad is expected to experience very little settlement, ranging from approximately 0.00 to 0.31 inches.

The inspectors reviewed evaluations that predict settlement of the pad while loaded with dry fuel storage casks. This evaluation was performed in Calculation No. 13090401-G-05, "ISFSI Pad Settlement." Once the pad is fully-loaded, the estimated settlement at the center of the pad is estimated to be approximately 1.7 inches and the maximum differential settlement is expected to be less than 1.3 inches.

Seismic Soil Structure Analysis and ISFSI Pad Structural Analysis

The inspectors reviewed the licensee's seismic analysis evaluation to determine if the site's safe shutdown earthquake accelerations were correctly considered at the ISFSI. This analysis was compared to the design basis specified in the Holtec HI-STORM 100S Final Safety Analysis Report (FSAR), Revision 7. Included in this review, the inspectors evaluated the site's conclusion regarding potential sliding and tipping of a storage cask during a seismic event. Additionally the inspectors reviewed the effects of pad settlement during static and seismic events, as well as, the effects of partial and full loads on the soil's bearing capacity. The site's soil-structure interaction analysis was reviewed to determine that the ISFSI storage pad will adequately support both static and dynamic loads, as required by 10 CFR72.212(b)(5)(ii) and 72.212(b)(6)

In order to demonstrate compliance with 10 CFR 72.212(b)(5)(ii) the licensee performed Calculation No. HI-2114917,"Dynamic Analysis of ISFSI Pad at DCCNPP," Revision 1. This calculation performed a seismic analysis and soil structure interaction analysis of the ISFSI pad in accordance with the requirements of American Society of Civil Engineers Standard (ASCE) 4-98, "Seismic Analysis of Safety-Related Nuclear Structures." The structural design of the ISFSI storage pad was performed in Calculation No. HI-2084227, "Structural Analysis of the ISFSI Pads at DC Cook," Revision 7, in accordance with the requirements in American Concrete Institute (ACI) 349 "Code Requirements for Nuclear Safety Related Concrete Structures," dated 2001.

The inspectors identified a Severity Level IV NCV of very low safety significance of 10 CFR 72.212 (b)(5)(ii),"Conditions of general license issued under 72.210."

Specifically, the inspectors identified two examples where the licensee's evaluations failed to demonstrate that the ISFSI pad was designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, soil liquefaction potential, or other soil instability due to vibratory ground motion.

(1) On July 26, 2011, Holtec Calculation No. HI-2114917, "Dynamic Analysis of ISFSI pad at DC Cook," Revision 1 was accepted and approved by the site. The seismic analysis was performed pursuant to ASCE 4-98. Section 3.1.3.1 of ASCE 4-98 requires that reinforced concrete elements be modeled as cracked or un-cracked depending on their stress level due to the most critical seismic load combination. In this calculation, an un-cracked concrete plate structure was assumed in the pad analysis but this assumption was not justified based on the calculation results. In response to the inspector's questions, a sensitivity analysis was performed to determine the effects of a cracked section that was consistent with ASCE 43-05, "Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities." Subsequent analysis indicated that the cask to pad interfacing forces could increase by as much as 40 percent when the effects of cracked concrete were taken into account. Thus a factor of 1.4 was

applied to forces in the horizontal and vertical direction to obtain bounding values used as input for the structural analysis of the pad.

The calculation was revised to address the change and the pad was found to be structurally adequate. The issue was entered in the licensee's corrective action program as AR 2012-4850.

(2) On July 29, 2011, the site accepted and approved Holtec Calculation No. HI-2084227, "Structural Analysis of ISFSI Pad at DC Cook." In this calculation, the site evaluated the pad for full, half, and quarter loading but did not address conditions where casks could be placed in a corner or along the edge of the pad that could result in a more critical loading. In response to inspectors' questions, the site indicated that corner or edge loading could result in an increase in the bending moment but there was adequate margin in the analysis. Subsequently, the calculation was revised to address additional loading conditions and to demonstrate an adequate safety margin in the design. Prior to the revision, the minimum calculated factor of safety (FS) was 1.66 for the full, half, and quarter loading. After the revision, the FS was reduced to 1.47 confirming that the worst case loading condition was not evaluated in the original calculation. The issue was entered in the licensee's corrective action program as AR 2012-10024.

The inspectors determined that the previously discussed issues were examples of a violation that warranted a significance evaluation. Consistent with the guidance in Section 2.2 of the NRC Enforcement Policy, ISFSIs are not subject to the Significance Determination Process and thus traditional enforcement will be used for these facilities. The inspectors determined that the violation was of more than minor significance using Inspection Manual Chapter 0612, Appendix E, "Examples of Minor Issues," Example 3i, because in response to inspector's questions, further analyses were required to demonstrate that requirements were met.

Consistent with the guidance in Section 2.6.D of the NRC Enforcement Manual, if a violation does not fit an example in the Enforcement Policy Violation Examples, it should be assigned a severity level: (1) Commensurate with its safety significance; and (2) informed by similar violations addressed in the Violation Examples. The inspectors determined that the violation could be evaluated using Section 6.5.d.1 of the NRC Enforcement Policy as a Severity Level IV Violation, in that the licensee failed to meet a regulatory requirement that has more than minor safety significance.

Title 10 CFR 72.212 (b)(5)(ii) requires, in part, that the licensee perform written evaluations prior to use, that establish that the cask storage pads and areas have been designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, soil liquefaction potential, or other soil instability due to vibratory ground motion.

Contrary to the above, on July 26 and July 29, 2011, the licensee's evaluations failed to demonstrate that the ISFSI pad was designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, soil liquefaction potential, or other soil instability due to vibratory ground motion. This is a violation of 10 CFR 72.212 (b)(5)(ii), "Conditions of a general license issued under 72.210." Because this matter was of very low safety-

significance (Severity Level IV), and has been entered into the licensee's corrective action program (AR 2012-4850 and AR 2012-10024), this violation is being treated as a NCV consistent with the NRC Enforcement Policy. (NCV 07200072/2011001-01).

Flooding Analysis

Calculation No. HI-2114936, "Environmental Hazards Evaluation for DC Cook," Revision 1, evaluated the potential for flooding or seiches from Lake Michigan. The evaluation concluded that the dry storage casks would remain approximately 43 feet above the maximum flood level and 32 feet above the maximum seiche water levels. Therefore, the evaluation concluded that the ISFSI pad is not susceptible to flooding or seiches from Lake Michigan. DC Cook Updated FSAR, section 2.4.3, "Summary of Conclusions," concludes that rainfall very rapidly infiltrates the sandy soils and therefore flooding conditions are non-existent.

Tornado Analysis

Calculation No. HI-2114936, "Environmental Hazards Evaluation for DC Cook," Revision 1, evaluated the HI-STORM 100S storage cask's ability to withstand the site specific design basis tornado. The inspectors reviewed the site's evaluations of the HI-STORM 100S, following a potential site specific tornado hazard and concluded that it was adequately bounded by the Holtec HI-STORM 100 FSAR, as required by 10 CFR 72.212(b)(6).

c. Conclusion

The inspectors identified a Severity Level IV NCV of very low safety significance of 10 CFR 72.212 (b)(5)(ii), "Conditions of general license issued under 72.210." Specifically, the inspectors identified two examples where the licensee's evaluations failed to demonstrate that the ISFSI pad was designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, soil liquefaction potential, or other soil instability due to vibratory ground motion.

1.2 Dry Cask Transfer Route

a. Inspection Scope

The inspectors reviewed the licensee's evaluation of the new transportation route from the auxiliary building to the ISFSI pad to verify that the licensee evaluated the proposed transfer route for the expected dry cask loads.

b. Observations and Findings

The dry cask transfer route, or haul path, is the pathway where a loaded HI-STORM is transported from the auxiliary building to the ISFSI pad. The inspectors noted that the licensee adequately determined that there were no safety-related buried utilities beneath the haul path.

c. Conclusion

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

2.0 Exit Meeting Summary

On July 30, 2012, the inspectors presented the inspection results to Mr. M. Carlson and other members of the licensee staff. The licensee acknowledged the issues presented and did not identify any information discussed as being proprietary in nature.

Attachment: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

* Michael H. Carlson – Vice President, Site Support Services
* Terry Brown – Director, Nuclear Projects
* Gary A. Weber – Program Manager, Dry Cask Storage
* John Pfabe – Licensing Lead, Dry Cask Storage
  Sam Bakhtiari – Dry Cask Storage Project Engineer

* Employees in Attendance during the July 30, 2012, ISFSI Interim Exit Meeting

INSPECTION PROCEDURES USED

IP 60853	On-Site Fabrication of Components and Construction of an ISFSI
IP 60856	Review of 10 CFR 72.212 (b) Evaluations, Appendix A, Review of ISFSI Storage Pad Design

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened:

07200072/2011001-01	NCV	Cask Storage Pad Evaluations did not meet 10CFR72.212(b)(5)(ii). (Section 1.1)

Closed:

07200072/2011001-01	NCV	Cask Storage Pad Evaluations did not meet 10CFR72.212(b)(5)(ii)

Discussed:

None		

LIST OF DOCUMENTS REVIEWED

The following is a partial list of documents reviewed during the inspection. Inclusion on this list does not imply that the NRC inspectors reviewed the documents in their entirety, but rather that selected sections of portions of the documents were evaluated as part of the overall inspection effort. Inclusion of a document on this list does not imply NRC acceptance of the document or any part of it, unless this is stated in the body of the inspection report.

Calculation No. HI-2114917; Dynamic Analysis of ISFSI Pad at DCCNPP; Revision 1

Calculation No. HI-2084227; Structural Analysis of the ISFSI Pads at DC Cook; Revision 7

Calculation No. HI-2084085; Cask Storage Pad Design Criteria; Revision 5

Calculation No. HI-2114936, “Environmental Hazards Evaluation for DC Cook,” Revision 1

Calculation No. 13090401-G-04; ISFSI Pad Overturning, Sliding, and Bearing Capacity analyses; Revision 6

Calculation No. 13090401-G-06; ISFSI One Dimensional Site Response analysis; Revision 3

Calculation No. 13090401-G-03; Liquefaction Analysis and Estimation of Post-Earthquake Settlements; Revision 2

Calculation No. 13090401-D-S-001; Design Criteria for ISFSI Engineering and Design; Revision 3

Calculation No. 13090401-R-G-006; Geotechnical Design Report for the Proposed Independent Spent Fuel Storage Installation (ISFSI); Revision 3

Calculation No. 13090401-G-05; ISFSI Pad Settlement; Revision 2

QI-1188; Holtec Quality Issue Form, Unverified Assumptions in Calculations HI-2114917 and HI-2084227; April 2, 2012

QI-1181; Holtec Quality Issue Form, Error in Calculation HI-2084227; March 14, 2012

AR 2012-4850; Holtec Report HI-2114917 Rev 2 ISFSI Pad Seismic Analysis; April 12, 2012

AR 2012-4851; Holtec Report HI-2084227 Rev 7 ISFSI Pad Structural Qual; April 12, 2012

AR 2012-2103; Holtec Report HI-2114917 correct Figure A-30 to A-43 Titles; February 15, 2012

AR 2012-10024; HI-2084227 (R7) did not evaluate ISFSI edge / corner loading; August 15, 2012

GT 2012-2454; HI-Storm Cask on ISFSI Pad – Post Environmental Phenomenon; February 23, 2012

GT 2012-2435; Placement of Hi-Storm Cask on ISFSI Pad; February 22, 2012

LIST OF ACRONYMS USED

ACI	American Concrete Institute
ADAMS	Agencywide Documents Access and Management System
ASCE	American Society of Civil Engineers
AR	Action Request
CFR	Code of Federal Regulations
DNMS	Division of Nuclear Materials Safety
FS	Factor of Safety
FSAR	Final Safety Analysis Report
IP	Inspection Procedure
ISFSI	Independent Spent Fuel Storage Installation
NCV	Non-Cited Violation
NRC	U. S. Nuclear Regulatory Commission
RG	U.S. NRC Regulatory Guide