UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 Warrenville Road, Ste 210
Lisle, IL 60532-4362

December 23, 2010

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. 072-00072/09-01(DNMS); 050-00315/09-08; 050-00316/09-08 – D.C. COOK NUCLEAR POWER PLANT, UNITS 1 AND 2

Dear Mr. Weber:

On December 2, the U.S. Nuclear Regulatory Commission (NRC) completed its inspection of the dry cask storage pad construction activities at the D.C. Cook Nuclear 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 this time, the inspection of the construction phase is complete. However, the inspection of the dry cask storage pad design and haul path is ongoing. This inspection will be completed prior to placing spent fuel on the pad and documented in a separate report. The preliminary results of this inspection were provided with members of your staff during an interim exit meeting on December 2, 2010. 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 vibro-compaction activities and the placement of the structural fill, reinforcement, and concrete for 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 any violations of NRC requirements. The storage pad construction activities were conducted in accordance with applicable regulations and license conditions.

In accordance with Title 10 of the Code of Federal Regulations (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 NRC's Agencywide Documents Access and Management System (ADAMS), 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 George M. McCann Acting For/

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

Docket Nos.: 72-072; 50-315; 50-316
License Nos.: DPR-58; DPR-74

Enclosure:
Inspection Report Nos. 072-00072/09-01(DNMS);
050-00315/09-08; 050-00316/09-08

cc w/encl: Distribution via ListServ

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos:	72-072; 50-315; 50-316
License Nos:	DPR-58; DPR-74
Report Nos:	072-00072/09-01(DNMS); 050-00315/09-08; 050-00316/09-08
Licensee:	Indiana Michigan Power Company
Facility:	D. C. Cook Nuclear Power Plant, Units 1 and 2
Location:	Bridgman, MI
Inspection Dates:	On-site: June 23, 2010, June 29, 2010, September 13, 2010, and September 23, 2010 In-office review and preparation: June 2009 - December 2, 2010
Exit Meeting:	December 2, 2010
Inspectors:	Jeremy Tapp, Health Physicist Rhex 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 Power Plant, Units 1 and 2
NRC Inspection Report Nos. 072-00072/09-01(DNMS); 050-00315/09-08; 050-00316/09-08

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. The design review of the new pad and haul path has not begun, but will be completed prior to storing fuel on the pad to ensure compliance with the regulations and design specifications. This review will be documented in a separate inspection report.

ISFSI Pad Construction

- The licensee's site characterization and soil compaction activities were performed in accordance with specifications, design drawings, and industry standards.

- The inspectors concluded that 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. The licensee provided justifications for any discrepancies which were verified with the designer of the pad.

Report Details

1.0 Independent Spent Fuel Storage Installation Pad Construction (60853)

1.1 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 east of the plant in what was the Upper Parking Lot. The licensee graded the site and removed approximately five feet of soil, deeper where needed, to ensure removal of topsoil, organic, and all undesirable material. Rolling of the underlying in-situ material ensured that a suitable sub-grade existed under the pad area.

Following receipt of satisfactory compaction results for the sub-grade, the licensee backfilled the area with approximately 2 ½ feet of non-frost susceptible granular base material (engineered fill consisting of sand and gravel) and compacted the fill to 90 percent of the maximum dry density as indicated in American Society for Testing and Materials (ASTM) D1557. The inspectors observed the licensee place and compact the fill in layers of 6 inches.

The inspectors observed certified personnel perform field tests to verify that each individual lift met the minimum compaction, maximum dry density, and moisture content as specified in the design specifications. The inspectors verified the qualifications of the contractors performing the field tests, which included both nuclear moisture density gauge methods described in ASTM D6938 and Sand-Cone methods described in ASTM D1556. All wet and dry density, moisture content, and lift thickness, were performed correctly and within the frequencies required by the appropriate ASTM standards.

The site performed soil plate load tests for the engineered fill, prior to mud mat placement, to determine the value of the Young's Modulus. This parameter measures 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 would not exceed design requirements during a postulated non-mechanistic tip-over of the cask. The licensee's specifications required the Young's Modulus to be between 12 and 15 kilo-pound-force per square inch (ksi).

The licensee utilized ASTM D1196 to determine the Young's Modulus of the compacted fill. In this standard a load is incrementally applied to a test plate resting on the fill. The load is measured by a load cell and the deflection of the plate is measured to determine the settlement. From the amount of applied load and the corresponding settlement, the

Young's Modulus is determined. On June 29, the inspectors observed the conduct of the plate load test. The test was set up in the center of the ISFSI pad and conducted in accordance with ASTM D1196. The calculated results from this test indicated a greater than allowable Young's Modulus of 16.6 ksi. Following the test, the site began an investigation, documented in action request (AR) 2010-6436, into why the results were higher than the design specifications. A post test calibration of the load cell used on June 29 indicated that the load cell was damaged and was not providing accurate data. The plate load test was repeated with a new load cell on July 1 and the final calculated Young's Modulus was 13.4 ksi, within the specified 12 to 15 ksi.

No findings of significance were identified.

c. Conclusion

The licensee's site characterization and soil compaction activities were performed in accordance with specifications, design drawings, and industry standards.

1.2 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 changes (EC), design drawings, work orders, and applicable industry standards. The inspectors also reviewed select material, concrete documentation (batch plant tickets), and personnel certification records.

b. Observations and Findings

The dry cask storage system selected is 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.

Placement of Reinforcing Steel

After placement and satisfactory compaction of the engineered fill, the licensee placed a 4-inch concrete mat (mud mat) which provided a work surface to facilitate reinforcement bar (rebar) installation and concrete placement. The licensee then installed forms and placed rebar. The reinforced concrete was designed for a nominal compressive strength between 4,000 pounds per square inch (psi) and 5,000 psi at 28 days and the rebar conformed to ASTM A615 Grade 60 steel.

After placing the rebar and securing the forms for each section, the licensee performed inspections of the rebar and the pad general area prior to concrete placement. The NRC inspectors reviewed the design drawings and performed an independent walk down of the east section 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 and the correct size of rebar was verified to be installed. The inspectors measured the spacing between the rebar and found it to be per the design specifications.

Placement of Concrete for Storage Pad

The storage pad was constructed in accordance with American Concrete Institute (ACI) 349. An inspector observed concrete placement for the middle section of the main storage pad. The licensee deposited concrete in this section in one continuous placement. The licensee checked the concrete 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 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 to the pad, as required by the design, in order to achieve the appropriate surface friction factor.

Concrete Field Tests

The licensee's contractor obtained concrete samples approximately every 50 cubic yards, and when sample test cylinders were formed, to test air content, temperature, and slump. The inspectors observed the conduct of the field tests and noted that they were performed satisfactorily and in accordance with ASTM standards. During placement of the first third of the pad on September 15, one of the slump tests was greater than the maximum allowed of 8 inches. The site rejected the remaining portion of the load, in accordance with the site's contingency plan, and sampled the next two consecutive loads to ensure that the slump had returned to specification. The next two loads successfully passed the slump tests. The out of specification slump test was documented in the licensee's corrective action program as AR 2010-9635. The middle third of the pad was placed on September 23. One sample taken during placement was found to have air entrainment below the minimum required of five percent. The remaining load from this sample was rejected. The cause was determined to be from an obstruction in the pump truck which created sputtering from the discharge. The sputtering removed some of the air that was entrained in the concrete mix. After the obstruction was cleared, the next two loads were sampled and confirmed to have acceptable air entrainment. This issue was documented in the licensee's corrective action program under AR 2010-9982. The final third of the pad was placed on September 30 and all samples taken on that day were within specification.

In addition to the field tests, qualified individuals collected concrete samples in cylinders, one set of 8 cylinders approximately every 100 cubic yards of concrete placed, for the concrete strength tests. The cylinders were stored in accordance with ASTM standards. The cylinders were cured and tested 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 4,000 psi and maximum of 5,000 psi as specified by the design requirements.

Several 28-day test results exceeded the 5,000 psi maximum strength. However, no test results were below the 4,000 psi minimum required. The higher than expected test results are documented in AR 2010-12073. The results are still under review for acceptability and the site will resolve this issue prior to storing fuel on the pad.

In addition to field observations, the inspectors reviewed the batch tickets and all of the testing results from the placement of the ISFSI pad.

No findings of significance were identified.

c. Conclusion

The inspectors concluded that 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. The licensee provided justifications for any discrepancies which were verified with the designer of the pad.

2.0 Exit Meeting Summary

On December 2, 2010, the inspectors conducted an exit meeting via 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

* Michael H. Carlson – Vice President, Site Support Services
* Anna M. Doms – Licensing Activity Coordinator
* Helen L. Etheridge – Manager, Nuclear Regulatory Licensing
* John W. Flaherty – Project Manager, Dry Cask Storage
  Vernon N. Jorgensen – Construction Manager
* Randy Keppeler – Manager Maintenance
* David L. Morse – QA Lead, Dry Cask Storage
* John Pfabe – Licensing Lead, Dry Cask Storage
* Gary A. Weber – Program Manager, Dry Cask Storage
* Toby Woods – Director, Performance Assurance

* Persons present during the December 2, 2010 exit meeting.

INSPECTION PROCEDURES USED

IP 60853 Construction of an Independent Spent Fuel Storage Installation

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened	Type	Summary
None		

Closed

None

Discussed

None

LIST OF DOCUMENTS REVIEWED

AR 2010-6436; ISFSI Pad Plate Load Test Failed – Run Second Test; June 16, 2010

AR 2010-9635; ISFSI Slab – Pour 1 East – Concrete Non-Conformances; September 20, 2010

AR 2010-9982; ISFSI Slab – Pour 2 Middle – Concrete Non-Conformances; September 28, 2010

AR 2010-12073; ISFSI Slab – Concrete Strength Exceeds Max Requirement; November 9, 2010

LIST OF DOCUMENTS REVIEWED (CONTINUED)

Drawing No. 12-3611J; ISFSI Storage Pad Reinforcing Plan, Section and Details; April 14, 2010

EC-49519; ISFSI Design and Construction, Revision 0

Material Test Consultants, Inc.; Training and Certification Records; June 22, 2010

Material Test Consultants, Inc. letter; DC Cook Nuclear Plant Dry Cask Storage Young's Modulus determination and Plate Load Test; August 10, 2010

Material Test Consultants, Inc.; Report of Concrete Compression Test; October 13, 2010

Material Test Consultants, Inc. letter; DC Cook Nuclear Plant Dry Cask Storage Acceptance Criteria for Concrete Strength; November 3, 2010

Gerdau Ameristeel; Chemical and Physical Test Reports; August 6, 2010

Consumers Concrete Corporation; Batch Tickets from September 15, 2010 placement

Consumers Concrete Corporation; Batch Tickets from September 23, 2010 placement

Consumers Concrete Corporation; Batch Tickets from September 30, 2010 placement

LIST OF ACRONYMS USED

ACI	American Concrete Institute
ADAMS	Agencywide Documents Access and Management System
ASTM	American Society for Testing and Materials
AR	Action Request
CFR	Code of Federal Regulations
DNMS	Division of Nuclear Materials Safety
ISFSI	Independent Spent Fuel Storage Installation
ksi	kilo-pound-force per square inch
NRC	U. S. Nuclear Regulatory Commission
psi	Pounds per Square Inch
rebar	Reinforcement Bars

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

Sincerely,

/RA/ By George M. McCann Acting For/

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

Docket Nos.: 72-072; 50-315; 50-316
License Nos.: DPR-58; DPR-74

Enclosure:
Inspection Report Nos. 072-00072/09-01(DNMS);
050-00315/09-08; 050-00316/09-08

cc w/encl: Distribution via ListServ

Distribution:

Daniel Merzke		
Ray Wharton	Cynthia Pederson	Linda Linn
Pamela Longmire	Steven Reynolds	DNMSIII
RidsNrrDorlLpl3-1	Patrick Louden	DRPIII
Resource	Steven Orth	DRSIII
RidsNrrPMDCCook	Jared Heck	Patricia Buckley
Resource	Allan Barker	Tammy Tomczak
RidsNrrDirsIrib Resource	Carole Ariano	ROPreports Resource

DOCUMENT NAME: G:\DNMSIII\Work in progress\IR - Cook ISFSI Pad Construction rev 1.docx
☒ Publicly Available ☐ Non-Publicly Available ☐ Sensitive ☒ Non-Sensitive
To receive a copy of this document, indicate in the concurrence box "C" = Copy without attach/encl "E" = Copy with attach/encl "N" = No copy

OFFICE	RIII DNMS		RIII DNMS	E	RIII		RIII	
NAME	RAEdwards: jc		CALipa: GMM for					
DATE	12/22/2010		12/23/2010					

OFFICIAL RECORD COPY