UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
612 EAST LAMAR BLVD, SUITE 400
ARLINGTON, TEXAS 76011-4125

April 7, 2011

Mr. Richard B. Provencher,
Manager
Department of Energy
Idaho Operations Office
1955 Fremont Ave., MS 1203
Idaho Falls, ID 83415

SUBJECT: THREE MILE ISLAND UNIT-2 ISFSI - NRC INSPECTION REPORT
072-020/2011-001 AND NOTICE OF DEVIATION

Dear Mr. Provencher:

A routine inspection of spent fuel storage activities at the U.S. Department of Energy's Three Mile Island Unit 2 (TMI-2) Independent Spent Fuel Storage Installation (ISFSI) was conducted on March 10, 2011. At the conclusion of the inspection on March 10, 2011, an exit briefing was conducted with members of your staff. The enclosed report presents the scope and results of the non-security portion of this inspection. A second inspection report issued March 22, 2011, and not publicly available, presented the security findings of this inspection.

The non-security portion of this inspection examined activities conducted under your license as they relate to public health and safety to confirm compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection included reviews of the ISFSI emergency response program, training, radiation protection, environmental monitoring, operations, organization, quality assurance, corrective action program, and safety reviews conducted by your staff.

During the tour of the ISFSI, observations were made of the condition of the concrete on the horizontal storage modules. These modules were originally designed for a 50 year service life when constructed in 1999, however, in the ten years they have been in use, the concrete is showing significant cracking and degradation. This issue has been recognized by your staff and several actions have been completed, including an analysis of the structural integrity of the horizontal storage modules to perform their safety function to provide radiation shielding and to protect the spent fuel rubble from adverse natural phenomena. Your staff's observations over the past several years have concluded that the degradation of the concrete is progressively becoming worse. This is a concern to the NRC. During this inspection, it was not clear that the remaining corrective actions identified in the recent engineering evaluation to stabilize the concrete have been approved and scheduled. Because the concrete modules are classified as important to safety, you are requested to provide the NRC with information on the actions that will be taken to stabilize the concrete degradation, when the actions will be completed, and the provisions that will be established to monitor and confirm that the actions taken were effective. This issue will be tracked as an open item.

Based on the results of this inspection, the NRC has determined that a deviation from a NRC commitment has occurred. The deviation was evaluated in accordance with the NRC Enforcement Policy. The current Enforcement Policy is included on NRC's web site at http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html. The deviation is cited in the enclosed Notice of Deviation (Notice) and the circumstances surrounding it are described in detail in the subject inspection report. This deviation is being issued due to your failure to maintain a previous NRC commitment within your emergency plan.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. If you have additional information that you believe the NRC should consider, you may provide it in your response to the Notice.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response (if any) 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). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room). To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

Should you have any questions concerning this inspection, please contact the undersigned at 817-860-8191 or Health Physicist Mr. Lee Brookhart at 817-276-6549.

Sincerely,
/RA/

D. Blair Spitzberg, PhD, Chief
Repository & Spent Fuel Safety Branch

Docket: 072-00020
License: SNM-2508

Enclosure:
(1) Notice of Deviation
(2) NRC Inspection Report 072-020/2011-001
w/attachment

cc w/enclosure:

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ML_____ includes Enclosure 2

SUNSI Review Completed: __LEB___ ADAMS: ■ Yes☐ No Initials: __LEB____
■ Publicly Available ☐ Non-Publicly Available
☐ Sensitive ■ Non-Sensitive

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NOTICE OF DEVIATION

United States Department of Energy
Three Mile Island Unit 2 ISFSI

Docket No. 072-020
No. SNM-2508

During a NRC inspection conducted on March 10, 2011, a deviation from a commitment made in a Response to Request for Additional Information (RAI), dated October 27, 2005, was identified. In accordance with the NRC Enforcement Policy, the deviation is listed below:

> Commitment #2 from the licensee's Response to NRC Request for Additional Information dated October 27, 2005, stated: "Upon NRC approval of the revised TMI-2 ISFSI emergency plan, DOE commits to add the following sentence to the end of Section 3.7 of the TMI-2 ISFSI emergency plan: The written agreement for offsite emergency medical services will be reviewed every five years and updated as needed."
>
> Contrary to the above, in Revision 1 to the TMI-2 ISFSI emergency plan, PLN-1610, effective December 10, 2007, the requirement to review the written agreements for offsite emergency medical services every five years and update as needed was deleted from the emergency plan, thereby removing the commitment made to the NRC on October 27, 2005.

Please provide a reply to this Notice of Deviation, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Regional Administrator, Region IV, in writing within 30 days of the date of this Notice. The reply should be clearly marked as a Reply to a Notice of Deviation; and should include: (1) the reason for the deviation, or if contested, the basis for disputing the deviation; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid further deviations; and (4) the date when your corrective action will be completed. Where good cause is shown, consideration will be given to extending the response time.

Dated this 7th day of April 2011

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket:	072-020
License:	SNM-2508
Report:	072-020/2011-001
Licensee:	United States Department of Energy
Facility:	Three Mile Island Unit 2 Independent Spent Fuel Storage Installation
Location:	Idaho Operations Office 1955 Fremont Avenue Idaho Falls, ID 83401
Dates:	March 10, 2011
Inspectors:	Vincent Everett, Senior Inspector Repository & Spent Fuel Safety Branch Lee Brookhart, Health Physicist Repository & Spent Fuel Safety Branch
Accompanied by:	Chris Staab, Project Manager Spent Fuel Storage and Transportation
Approved By:	D. Blair Spitzberg, PhD., Chief Repository & Spent Fuel Safety Branch
Attachment:	Supplemental Inspection Information

ENCLOSURE 2

EXECUTIVE SUMMARY

United States Department of Energy
NRC Inspection Report 072-09/11-01

The U.S. Department of Energy-Idaho Operations (DOE) was licensed by the U.S. Nuclear Regulatory Commission (NRC) to operate the Three Mile Island Unit 2 (TMI-2) Independent Spent Fuel Storage Installation (ISFSI) located at the Idaho National Laboratory (INL) site. DOE-ID continues to demonstrate the capability to maintain and operate the facility in compliance with NRC regulations and license requirements.

Away from Reactor ISFSI Inspection Guidance (60858)

- The ISFSI facility was toured and found to be properly posted and maintained in an acceptable physical condition, except for the ongoing degradation of the concrete on the horizontal storage modules (Section 1.2.a).

- The emergency planning program was being maintained current. Drills, exercises, and training were performed in accordance with requirements in the emergency plan. Training and participation in exercises were offered to offsite support agencies. Changes made to the emergency plan were reviewed to verify that the effectiveness of the plan had not been reduced. The licensee had removed a statement in their emergency plan that was made as part of a commitment to the NRC. The NRC is issuing a Notice of Deviation (NOD) due to the licensee failure to maintain the NRC commitment in the emergency plan. This will be tracked as Open Item 72-20/1101-01 (Section 1.2.b).

- The site environmental radiation protection program was being implemented to verify radiation conditions at the ISFSI were in compliance with NRC radiation standards. Environmental dosimeters were adequately located around the ISFSI to demonstrate compliance with exposure limits to the public. Radiological conditions at the facility had not changed since the last inspection (Section 1.2.c).

- Biennial reports were submitted to the NRC as required by 10 CFR 72.48(d)(2). Revisions to the safety analysis report (SAR) and technical specifications since March 2005 were reviewed. For the most part, changes were minor or editorial. The most significant change involved Technical Specification 3.1.1 and the vent housing seals. This change was submitted to the NRC for approval (Section 1.2.d).

- Operational activities associated with leak testing of vent housing seals, radiological surveys of the HEPA filters, and annual hydrogen gas sampling had been conducted in accordance with the requirements of technical specifications (Section 1.2.e).

- The ISFSI organization was in compliance with SAR requirements for staffing and qualifications of personnel. Required training had been performed and documented for site personnel. The safety review committee had met on an annual bases and reviewed issues consistent with requirements in the SAR and technical specifications (Section 1.2.f).

- The quality assurance program was based on the Quality Assurance Program Requirements (QARD) document. The quality assurance program used at TMI-2 was the same program implemented at Fort St. Vrain. Trending was being performed. No adverse trends were identified (Section 1.2.g).

- The corrective action system was being used to capture issues and document corrective actions. Deficiency reports were being adequately resolved (Section 1.2.h).

- Significant degradation of the horizontal storage modules had occurred over the recent years due to water intrusion and the annual thawing and freezing cycle. The licensee conducted an analysis in 2009 to evaluate the horizontal storage modules to verify the current condition had not reduced the effectiveness of the units. The analysis identified corrective actions to repair and stop the deterioration. However, to date, not all corrective actions have been completed. Completion of the remaining corrective actions will be tracked as Open Item 72-20/1101-02 (Section 1.2.i).

Review of 10 CFR 72.48 Evaluations (60857)

- All safety screenings had been performed in accordance with procedures and 10 CFR 72.48 requirements. No safety evaluations had been performed since the last inspection. A list of qualified screeners/evaluators was being maintained by the licensee (Section 2.2).

Report Details

Summary of Facility Status

The Three Mile Island Unit 2 (TMI-2) Independent Spent Fuel Storage Installation is located within the security perimeter of the Idaho Nuclear Technology and Engineering Center at the Idaho National Laboratory (INL) site. The storage system used at the TMI-2 ISFSI is the NUHOMS® - 12T cask system. A license was issued to the Department of Energy-Idaho Operations Office (DOE) by the U. S. Nuclear Regulatory Commission (NRC) on March 19, 1999. On March 31, 1999, the first dry shielded canister (DSC) containing TMI-2 core debris was moved from the test area north facility to the ISFSI. Each DSC contained 12 TMI-2 canisters. The TMI-2 canisters contained the rubble from the TMI-2 reactor core. The 29th, and final DSC, was loaded into the ISFSI on April 20, 2001. This completed the loading of the TMI-2 ISFSI. A tour of the ISFSI area and review of site records found the facility to be in acceptable physical condition, though degradation of the concrete on the horizontal storage modules (HSM) was evident. Radiation levels were within acceptable levels with most areas at or near background except within a few feet of the HSMs. The DOE staff had continued to maintain the spent fuel in a safe configuration and had established, through a strong procedural and quality assurance process, the necessary documentation and records to confirm compliance with NRC regulations and the site license. The licensee removed a statement in their emergency plan that was made as part of a commitment to the NRC. A Notice of Deviation (NOD) resulted, due to the licensee's failure to maintain the commitment as a requirement in the emergency plan.

1 Away from Reactor ISFSI Inspection Guidance (60858)

1.1 Inspection Scope

The ISFSI inspection included review of selected records and interviews with site personnel to verify ISFSI operations were in compliance with the TMI-2 license SNM-2508 certificate of compliance, technical specifications, Amendment 4, and the Safety Analysis Report (SAR), Revision 6. A tour of the ISFSI was conducted to confirm the facility was being maintained in an acceptable physical condition for the safe storage of the spent fuel. The TMI-2 ISFSI operational inspection reviewed selected aspects of their emergency response program, training, radiation protection, environmental monitoring, operations, organization, quality assurance, and corrective action program.

1.2 Observations and Findings

a. Site Tour of the ISFSI

A tour of the ISFSI was conducted to observe the condition of the HSMs and the ISFSI pad. The facility was well maintained. The HSM rear doors were pad locked and posted as "Radioactive Materials Area" and "Radiation Area." Dose rates around the ISFSI pad area were background levels of 15 - 20 μR/hr. A reading on contact with one of the HSM rear door panels, taken at the vent holes, read 250 μR/hr (0.25 mR/hr). Radiation levels near the HSMs measured during the tour were low, generally below 40 μR/hr. The front of the HSM was posted as "Radioactive Material Area."

The concrete on all but one of the HSMs had experienced damage from the freezing and thawing process over the years due to water getting into the space around the roof

anchor bolts resulting in cracks occurring in the concrete. The damage was extensive on several of the HSMs. Damage on the bottom of the HSM due to weathering was also occurring on several HSMs and had resulted in spalling with small chunks of concrete breaking off. The concrete degradation was showing new damage each year and was recognized by the licensee as a significant problem.

b. Emergency Planning

Since the last inspection in April 2005, DOE changed their emergency plan from being part of the INL site wide emergency plan to a stand-alone plan. The TMI-2 emergency plan, PLN-1610, "Three-Mile Island Unit 2 (TMI-2) Independent Spent Fuel Storage Installation (ISFSI) Emergency Response Plan (ERP)," Revision 0, was submitted to NRC Headquarters for acceptance on March 11, 2005 (not publicly available). On September 30, 2005, the NRC sent a request for additional information (ML052770222) to the licensee for clarity in order to determine compliance with regulatory requirements. The licensee responded to the NRC's request on October 27, 2005 (ML053070505). The response provided clarification and included four commitments to the NRC to place certain statements into the new emergency plan. After review of the licensee's response, the NRC issued a safety evaluation report on December 15, 2005 (ML053500073), accepting the new emergency response plan.

Revisions to the new emergency plan, PLN-1610, since its issuance were reviewed. The licensee's emergency plan had been revised three times prior to this inspection. Revisions #2 and #3 were found to not reduce the effectiveness of the emergency plan in accordance with 10 CFR 72.44(f). However, Revision 1, effective December 10, 2007, removed from the emergency plan one of the four commitments made to the NRC in the October 27, 2005 letter. The commitment by the licensee to place certain statements into the emergency plan, then later to remove one of the statements, meets the criteria for a Notice of Deviation in the NRC Enforcement Manual Section 2.2.A.2.(a), for failure to satisfy a written commitment. Specifically, commitment #2 made to the NRC in the October 27, 2005 letter, stated: "Upon NRC approval of the revised TMI-2 ISFSI emergency plan, DOE commits to add the following sentence to the end of Section 3.7 of the emergency plan: The written agreement for offsite emergency medical services will be reviewed every five years and updated as needed." Contrary to this commitment, Revision 1 to the emergency plan, with an effective date of December 10, 2007, removed the statement to review the written agreements for offsite emergency medical services every five years and update as needed. This failure of the licensee to maintain the written commitment as part of the emergency plan is classified as a deviation per the NRC Enforcement Policy and will be tracked as Open Item 72-10/1101-01.

The justification for the deletion of the 5-year review from the emergency plan was based on an already existing commitment in a different INL document, PLN-114 "INL Emergency Plan/RCRA Contingency Plan," that required the written agreements with the offsite emergency medical services to be updated as needed every 5 years. The licensee had verified with each of the hospitals within the five year period that all three memorandums of understanding (MOUs) were current. This was documented in an e-mail entitled "Status of NRC Facilities MOU with Supporting Organizations/Agencies," dated May 20, 2010. Since then Bingham Memorial Hospital has revised and signed a new MOU dated January 13, 2011. A new MOU was also in the process of review and approval with Eastern Idaho Regional Medical Center at the time of this inspection. An e-mail correspondence between DOE and Eastern Idaho Regional Medical Center

documented that the current MOU was to remain in effect until the new MOU was signed. The Portneuf Regional Medical Center MOU was last signed on October 27, 2009. The review performed on May 20, 2010 and the current status of the MOUs showed that the deletion of commitment #2 from the emergency plan had not decreased the effectiveness of the emergency plan, which would result in a violation of 10 CFR 72.44(f), but it was a failure to satisfy a written commitment to the NRC.

Required emergency drills were listed in Section 13.11 of the emergency plan. Required annually drills included a radiological/health physics drill, a medical drill, and a fire drill. Biennial exercises required by Section 14.0 were larger drills that validated all elements of the emergency management program by initiating responses to simulated, realistic emergency events and conditions in a manner that, as nearly as possible, replicated an actual event. Offsite response organizations were invited to participate in the biennial exercises. Drill packages for the medical/fire/radiological drill performed in May 2010, the medical drill performed in February 2009, the fire drill performed in June 2008, and the radiological drill performed in May of 2007 were selected for review. The biennial exercises for 2005, 2007, and 2009 were also selected. The selected drills and exercises met the objectives of the emergency plan. The exercise packages included an exercise purpose, scope, summary, evaluation, findings, and conclusion descriptions. Exercise deficiencies and areas for improvement were identified and placed into the licensee's corrective action program for resolution. Offsite support agencies documented as participants in the different exercises included the Portneuf Medical Center, Eastern Idaho Regional Medical Center, and Idaho Radiation Control Program.

A review of the emergency response personnel training records was conducted to verify that the licensee's emergency response organization was currently qualified. An Employee Training History dated March 10, 2011, was reviewed and selected personnel were verified as being current on their qualifications.

The licensee's emergency plan was verified to have a provision for notifying the NRC of emergencies as required by 10 CFR 72.75(a). This notification was specified in Section 6.1 of the emergency plan. Section 6.1 required initial notification to the NRC to be made within 15 minutes (not to exceed 1 hour) after event classification. Additionally, Section 11.2.4 stated that the DOE Facility Director of the TMI-2 ISFSI will ensure that reports of events and conditions resulting in the use of the TMI-2 ISFSI Emergency Response Plan are reported to the NRC in accordance with 10 CFR 72.75.

c. Radiological Environmental Monitoring

The annual radiological environmental monitoring reports since the last NRC inspection were reviewed to confirm that environmental conditions at the TMI-2 ISFSI had remained stable since the last inspection. The licensee was required by Technical Specification 5.5.3(c) to submit an annual report to the NRC within 60 days after January 1 of each year. Five reports had been submitted since the last inspection including the 2006 report dated February 26, 2007 (ML070650337), the 2007 report dated February 20, 2008 (ML080590359), the 2008 report dated February 11, 2009 (ML090560534), the 2009 report dated February 16, 2010 (ML100550053), and the 2010 report dated February 14, 2011 (ML110540307). Procedure MCP-2955 "ISFSI Radiological Environmental Monitoring Program," Revision 18 described the TMI-2 ISFSI environmental monitoring program. The program was designed to monitor two potential radiation exposure pathways inherent with the facility design. These were the

direct radiation from the stored spent fuel rubble and potential airborne radioactivity that could be released from the vented aspects of the canister design. Venting was required on the canisters containing the spent fuel rubble because of the potential for generation of hydrogen by water intermixed within the rubblized fuel. The airborne radioactivity release path was monitored by periodic contamination surveys conducted at the ISFSI and periodic airborne radioactivity sampling. The direct radiation exposure pathway was monitored using thermoluminescent dosimeters (TLD) located along the outer perimeter ISFSI fence. Contact radiation readings on the HSM rear panel doors and the canister purge and vent port filter housings were also performed annual per Technical Specification 3.2.

Twenty-two TLDs were located along the outer ISFSI fence. TLDs were collected monthly until 2008 at which time collection was changed to quarterly. The following table provides the annual average exposure rates reported in the annual environmental monitoring reports:

ANNUAL TLD RESULTS	
YEAR	**MEAN +/- MONTHLY STANDARD DEVIATION (mrem/day)**
2006	0.7 +/- 0.1
2007	0.8 +/- 0.3
2008	0.5 +/- 0.07
2009	0.5 +/- 0.04
2010	0.6 +/- 0.1

The 2006 and 2007 data was slightly higher than the other years. This was attributed to direct radiation from the south southwest side of the ISFSI due to the storage of non-NRC regulated mixed waste approximately 200 meters from the TMI-2 ISFSI. Several TLD readings during the months of May 2007 and June 2007 reached 1.4 mrem/day. Readings around the ISFSI returned to normal levels by the end of 2007. The environmental TLD data was consistent with data that had been collected in the past at the TMI-2 ISFSI indicating no unusual or unexpected environmental radiation levels have occurred due to facility operations.

Background radiation levels were measured during the drive out to the INL site. Background ranged from 10 – 20 μR/hr. Based on the environmental TLDs maintained around the TMI-2 ISFSI, radiation levels were approximately 20 - 25 μR/hr (0.5 to 0.6 mR/day). During the tour of the ISFSI, background radiation levels near the pad were 15 – 20 μR/hr. Near the HSMs, radiation levels were typically less than 40 μR/hr. A reading on contact with one of the HSM rear door panels, taken at the vent holes, read 250 μR/hr.

Air sampling was conducted each month at the ISFSI. Procedure MCP-2955 described the air monitoring program in Section 4.3. A low volume air sampler with a particulate filter collected air during a seven-day period. The air sampler was located between the two rows of the HSMs on the ISFSI pad. The air sample was analyzed for beta activity and an isotopic analysis was performed. Cs-137 activity was qualitatively evaluated. The isotopic analysis did not find the presence of any fission or activation products during the 5-year period and no Cs-137 levels above minimum detectable activity level were detected. No beta activity was measured above background levels with a minimum detectable activity ranging from 1.2E-4 to 1.0E-3 pCi/m^3.

Annual loose surface contamination surveys were performed at the vent and purge ports of each canister and the drain port of each HSM. Procedure MCP-2955 described the contamination survey program in Section 4.5. Analysis for beta contamination was performed on each sample. A composite gamma analysis was also performed and the presence of Cs-137 qualitatively determined. Minimum detectable activity reported for the equipment used by the licensee varied from year to year. For beta counting, the minimum detectable activity ranged from 24 to 99 dpm/100 cm^2. For the Cs-137 gamma counting, the minimum detectable activity ranged from 14 to 20 pCi. The licensee also performed alpha counting on the samples. The minimum detectable activity for the alpha counting ranged from 2 to 30 dpm/100 cm^2. For all contamination samples collected over the 5 year period, no contamination was found above the minimum detectable levels.

The results of the contamination surveys and the air sampling indicated that no breach of the canister confinement system or release of radioactive contamination had occurred during the monitoring period. Radiological conditions at the ISFSI had not changed since the last inspection.

d. Biennial Update Reports and SAR Revisions

Biennial reports for the period from March 2005 through March 2009 were reviewed. This period was covered by two reports dated March 15, 2007 (not publically available) and March 18, 2009 (ML100180288). These reports provided information related to revisions during the reporting period to the SAR, certain programs required by the technical specifications and discussed any safety evaluations performed.

The March 15, 2007 biennial report included Revision 5 to the SAR which contained a number of editorial changes including changing “INEEL” to “INL” throughout the SAR. Changes were made to Chapter 11 “Quality Assurance” to describe the new DOE organizational structure. Several additions to Chapter 4 “Operation Systems,” Chapter 7 “Radiation Protection,” and Chapter 8 “Analysis of Design Events” related to the seals on the vent and purge ports. This is discussed in more detail in the following section related to Technical Specification 3.1.1.

The March 18, 2009 biennial report included Revision 6 to the SAR. Only minor changes were made to Chapter 4 “Installation Design” and Chapter 9.5 “Emergency Planning.” There were no changes reported in the March 18, 2009 report to the technical specification basis document, radiological environmental monitoring plan, training program, and quality assurance program.

e. Technical Specification Compliance and SAR Requirements

(1) Technical Specification 3.1.1 “Leak Testing DSC Vent Housing Seals”

The March 15, 2007 biennial update report contained Revision 5 to the SAR which included additions to Chapter 4 “Operation Systems,” Chapter 7 “Radiation Protection,” and Chapter 8 “Analysis of Design Events” related to the seals on the vent and purge ports. SAR Section 4.3.1.1 “Major Components” was revised concerning the current metallic seals between the filter/purge housings and the canister surface. The interface between each vent housing and the canister has dual metallic seals applied between smoothly polished

surfaces of the canister and the vent housings. If a metallic seal failed the periodic testing required by Technical Specification 3.1.1, it would need to be reseated or replaced. As an alternative, the licensee applied for and received NRC approval to use an elastomeric seal as a replacement that would not be as sensitive to surface imperfections as the metallic seals. Approval for use of the elastomeric seal was included in the June 30, 2005 NRC Safety Evaluation Report (ML051810422) issued with Amendment 4 of the license. Technical Specification 3.1 "DSC Integrity" was changed to add Surveillance Requirement 3.1.1.2 to perform annual leak checks on any elastomeric seals used to replace the metallic seals. Technical Specification 3.1.1 was revised to require replacement of the elastomeric seals every 5 years. The licensee's determination that the elastomeric seal was a suitable replacement was documented in Engineering Design File (EDF) 6032 "Elastomeric O-Ring Evaluation," dated July 20, 2005, and EDF-5003 "TMI-2 ISFSI Alternate DSC Seal Evaluation" submitted to the NRC as an attachment to the January 31, 2005 License Amendment Request (ML050380446). Additional information was provided to the NRC in DOE's response to the NRC's request for additional information dated June 9, 2005 (ML051660260). The design reviews considered thermal aging effects, compression effects on the O-ring, chemical effects, and radiation effects.

SAR Section 8.1.4 "Storage with Detected Leakage of Vent and Purge Port Seal" was added to the SAR with Revision 5. This section evaluated the option of not replacing the leaking metallic seal. The TMI-2 canisters were already vented to the atmosphere through a high efficiency particulate air (HEPA) filter. This provided a pathway for venting any hydrogen generated within the fuel rubble stored in the canister. The loss of integrity of the metallic seals would provide a pathway that circumvented the filter. The licensee determined that any releases due to a failed seal would be negligible and that for the most part, the release pathway would continue to be through the HEPA filters. For a canister with a failed seal, contamination surveys would be increased to monthly and a written report would be submitted to the NRC describing the condition, an analysis of the situation, and any corrective actions being taken.

An option also evaluated was to move the canister to another HSM. One spare HSM (#15) was available at the ISFSI. SAR Section 7.4.1 "Operational Dose Assessment" reviewed the radiological aspects of replacing a seal versus moving the leaking canister to HSM #15 and not replacing the seal. The estimated exposures were 60 person-mrem to replace the seals and 80 person-mrem to move the canister to HSM #15.

(2) Technical Specification 3.2.2 "Vent System HEPA Filter Dose Rates"

Technical Specification 3.2.2 required annual radiation surveys of the HSM rear access door and surface dose rate surveys of each HEPA filter housing. Procedure TPR-7066 "Periodic HSM Monitoring, DSC Sampling, and Filter Housing Leak Tests," Revision 14 was used to perform the Technical Specification 3.2.2 compliance surveys. Appendix A "TMI-2 ISFSI Radiological Survey Report," of the procedure was used to document the results of the radiological surveys. Selected records for the June 2010 annual radiological surveys were reviewed as well as information provided in the 2006 through 2010 annual radiological environmental reports. The technical specification limit for

the rear access door was 100 mrem/hr. Measurements taken from 2006 through 2010 measured less than 5 mrem/hr on the rear door. The limit for the HEPA filter housing was 1,200 mrem/hr. Maximum readings on the HEPA filter housings ranged from 13 – 17 mrem/hr for 2008 thru 2010.

The licensee also provided data concerning the dose rates inside the purge and vent port housings that were accessible for each HSM. Dose rates typically ranged from less than 1 mrem/hr to a high of 100 mrem/hr with most readings in the 10 – 40 mrem/hr range. The highest reading was in 2009 for HSM # 22 with a reading of 105 mrem/hr.

(3) Technical Specification 3.2.3 "DSC Hydrogen Concentration"

Annual hydrogen gas sampling of the canisters was required by Technical Specification 3.2.3. The last annual hydrogen gas sampling of the 29 loaded canisters had been performed during the month of June 2010. The canisters were sampled using procedure TPR-7066 "Periodic HSM Monitoring, DSC Sampling, and Filter Housing Leak Tests," Revision 14. Documentation was selected for HSMs 1, 3, 5, 7, 9, and 19 for review. The lower explosive limit for hydrogen is 5.0 percent by volume. The limit for hydrogen in Procedure TPR-7066 was specified as 0.5 percent, which was 10 percent of the lower explosive limit. All gas samples found concentrations less than 0.5 percent by volume.

f. Organization and Training

Requirements for the ISFSI staffing were included in Section 9.1 of the SAR. The SAR Figure 9.1-1 showed an organizational tree of command. The licensee went through the organization's positions and named the individual associated with each position listed. Employee Training History Reports and Job Requirement Reports, both dated March 10, 2011, were reviewed to verify that the listed individuals were currently trained to perform the associated job duties. The training requirements were located in SAR Section 9.1.4.1. The individuals assigned to the following positions were identified as having current training: DOE ISFSI Quality Assurance Manager, the DOE TMI-2 Facility Director, the TMI-2 ISFSI Manager, and the TMI-2 Facility Safety Officer.

Section 9.1.3.1.1 of the SAR required an ISFSI safety review committee. The purpose of this committee was to evaluate the performance of the staff level safety committees; review performance indicators; review 72.48 evaluations; review changes to technical specifications, emergency procedure, and physical protection plan; approve license amendment requests; and review preparations for major change in operations. Membership on the safety review committee was updated in writing when changes were made. The most recent safety review committee update was dated March 7, 2011. Section 9.1.4.1 of the SAR listed the training requirements for committee members and alternates. The inspector verified through Employee Qualification Reports, dated March 9, 2011, that all individuals, except one recently appointed alternate (Critical Safety Alternate), had completed the required training listed in Section 9.1.4.1.

The safety review committee's charter was reviewed and verified to be consistent with Technical Specification 5.2.4 and SAR Section 9.1.3.1.1 related to the committee's functions and purpose. Technical Specification 5.2.4 required the safety review committee to meet at least once every twelve months with at least three committee

members (creating a quorum). Meeting minutes for the last three safety review committee meetings, dated August 13, 2008, August 4, 2009, and July 14, 2010, were reviewed. All meetings had at least 3 members, creating the required quorum. The issues discussed in the meetings were consistent to the objectives specified in the committee's charter, the SAR, and the technical specifications.

g. Quality Assurance and Audits

The quality assurance program was described in Chapter 11 of the SAR. The "Quality Assurance Requirements and Description (QARD) document," DOE/RW-0333P, Revision 10 was used to implement the quality assurance requirements in Chapter 11. The QARD had been developed and maintained by the DOE Office of Civilian and Radioactive Waste Management until closure of that office. On January 24, 2011, an interim policy was issued by Dae Chung, Principal Deputy Assistant Secretary for Environmental Management that directed the Office of Environmental Management to continue implementing the QARD in the revision that was currently being used by the field office. For the TMI-2 ISFSI (as well as Fort St. Vrain), Revision 10 was being implemented.

The DOE-ID had implemented an active audit, surveillance and inspection program since the last NRC inspection. Selected audit schedules were reviewed. Audits were being conducted in a broad range of areas such as the emergency planning program, safety review committee, records, procedures, spent fuel inventory control, security, operations & maintenance programs, and Part 21 reporting. The surveillance and inspection schedule included areas such as the radiation protection program, safety equipment, leak testing, housekeeping, trip & fall hazards, emergency preparedness, firearm safety, training program, control of flammables and the safety evaluation process.

The licensee had issued several audit reports since the last NRC inspection. Reviews were performed of the licensee's Independent Assessment Report (IAS) 06243 dated February 2007, Quality Assurance Management Assessment 06-ISFSI-S-007 dated November 28, 2006, annual Audit 06-ISFSI-AU-002 issued September 2006, and annual Audit 09-ISFSI-AU-002 issued September 2009. The audits and assessments had found that overall the programs met the QARD requirements. The audits reviewed specific requirements in the QARD and verified effective implementation.

An annual trending report was issued by DOE-ID. The trending report for calendar year 2010 was reviewed. The trending report noted that over the past 5-years, the most predominant cause of findings against the TMI-2 and Fort St. Vrain ISFSIs was human performance. However, in calendar year 2010, the primary cause shifted to management systems. Open duration of findings issued in calendar year 2010 was longer (322 days) compared to previous years. For example, calendar year 2009 open duration was 156 days, calendar year 2008 was 130 days, and calendar year 2007 was 155 days. The open duration for 2010 represents more than double the annual duration time compared to the previous three years. The trending report determined that there were no adverse quality trends and the DOE-ID ISFSI quality assurance program and the CH2M-WG Idaho, LLC (CWI) ISFSI quality assurance program were stable and adequately controlled the associated work scopes.

h. Deficiency Reports

The licensee provided a list of the deficiency reports initiated in the corrective action system since the last inspection for the TMI-2 ISFSI and the Fort St. Vrain ISFSI. The same program was used at both sites. Many of the deficiency reports were the results of quality assurance audits and surveillances. Issues included such topics as records retention, completeness of forms, training requirements, horizontal storage module concrete efflorescence, inspection of the vent access doors, and updates needed to the radiation protection procedures. All deficiency reports reviewed were adequately resolved.

i. Horizontal Storage Module (HSM) Concrete Degradation

During the site tour, the condition of the TMI-2 HSMs was observed. All but one of the HSMs (HSM-18) showed degradation due to concrete cracking. The cracking had been related to the annual freezing and thawing cycle at the site. Water had entered the anchor blockout holes on the roof of the HSMs and migrated into the concrete. The freezing and thawing cycles had resulted in the growth of the cracks. The problem was first recognized in 2000. At that time, the cracking was not significant and was determined to be cosmetic. However, in 2007 the licensee became concerned that the cracking was continuing and efflorescence growth due to calcium carbonate was being observed. Deficiency Report 102744 was opened June 26, 2007 to document the efflorescence deposits. An evaluation of the HSM concrete again determined that the problem was cosmetic and had an insignificant affect on the integrity of the HSMs.

By 2008, the licensee recognized that the continued cracking of the HSMs brought into question the ability of the HSMs to fulfill their originally planned 50 year service life as an important to safety component and appeared to be prematurely deteriorating. The HSMs were precast concrete components built in Washington State for Transnuclear West, Inc. and delivered to the INL site in 1999. The HSMs provided a structural storage unit to protect the canister containing the spent fuel rubble from adverse natural phenomena and to serve as shielding. The prefabricated modules consisted of two pieces, a body and a roof connected together with anchor bolts. All sections were a minimum of 2 feet thick. An evaluation was performed by WSI in June and July 2008 of all 30 HSMs. The evaluation recommended the development of an annual inspection plan for the HSMs and base mat and an examination of the inside of the HSMs. The evaluation also recommended that a firm experienced and qualified in testing and evaluating concrete be brought in to perform an evaluation of the HSMs and basemat concrete to determine the degradation mechanism and make recommendations for repair, including recommending an approach to preclude further degradation.

In 2009, a comprehensive evaluation of the HSMs and base mat concrete was performed by Wiss, Jamney, Elstner Associates and a report issued July 31, 2009. The evaluation included a field investigation and laboratory analysis to evaluate the concrete material quality, strength, and long term durability potential. The field investigation included (a) visual inspection of accessible sections of the HSMs and base mat to examine the extent and distribution of cracking (b) hammer sounding delamination survey of representative accessible concrete surfaces, (c) reinforcing steel surveys using covermeters and ground penetrating radar to determine the location of embedded reinforcing steel, (d) water percolation testing of anchor bolt blockouts in the roof slab, (e) removal of twelve concrete core samples for laboratory testing, and (f) non-destructive evaluation surveys to evaluate condition and uniformity of concrete in the

HSM wall and roof element. The laboratory analysis included photographing the samples and conducting tests on selected core samples for depth of carbonation, chloride content, and compression strength. Petrographic examinations were also conducted on selected samples. The 2009 evaluation found a noticeable increase in deterioration on the roof slabs since 2008, most pronounced on the northern corners of the roof. Little change was observed on the base of the HSMs. Corner cracking and spalling was the most common type of distress. Dislodged pieces of concrete, loss of concrete (fine spalls), wide cracks, and efflorescence were observed. Each HSM was rated based on the severity of the visible cracking. No visible distress was rated as 0 with severe distress rated as 3. Of the thirty HSMs, eight were rated as 3 based on visual inspections of the HSMs.

Efflorescence and water staining was common around cracks near the top corners. Efflorescence typically is calcium carbonate formed when calcium hydroxide in the concrete is dissolved by moisture and carried to the surface of the concrete where it reacts with carbon dioxide. It is a strong indicator of persistent moisture moving through the concrete. Water staining was also visible around the front and rear doors and below the drains at the rear of the HSMs. This indicates that the structures were not water-tight and that precipitation was entering the HSMs.

The compressive strength tests of five of the core samples taken showed an average strength of 7,570 psi with a range from 6,190 to 8,680 psi. The original 28-day design comprehensive strength was 5,000 psi minimum. The strengths measured in the aged concrete were consistent with the design strengths.

The analysis of the condition of the TMI-2 HSMs concluded that the roof slabs and base units still met their structural design loading capability, assuming the deterioration to the HSMs were limited to the observed cracking and spalling. Evaluation to determine if alkali-silica reactions and delayed ettringite formation were occurring that cause slow but long term and progressive failure of the concrete found these mechanisms were not the current cause of the concrete degradation. Chloride content was very low, indicating corrosion of embedded material was not a factor. The conclusion reached was that the freezing of trapped water that had entered through cracks and the anchor blockout holes was the primary mechanism causing the concrete problem. Several actions were recommended that have been either completed by the licensee or are scheduled. The anchor bolt blockout holes have been filled with polyurethane foam. Crack gauges at various locations on the HSMs have been installed and were being monitored. Planned activities, not yet completed, included the installation of protective caps, repair of the damaged concrete, and application of a seal coating to the HSMs. Completion of the remaining repairs will be tracked as Open Item 72-20/1101-02.

1.3 Conclusions

The ISFSI facility was toured and found to be properly posted and maintained in an acceptable physical condition, except for the ongoing degradation of the concrete on the horizontal storage modules.

The emergency planning program was being maintained current. Drills, exercises, and training were performed in accordance with requirements in the emergency plan. Training and participation in exercises were offered to offsite support agencies. Changes made to the emergency plan were reviewed to verify that the effectiveness of the plan had not been reduced. The licensee had removed a statement in their

emergency plan that was made as part of a commitment to the NRC. The NRC is issuing a Notice of Deviation (NOD) due to the licensee failure to maintain the NRC commitment in the emergency plan. This will be tracked as Open Item 72-20/1101-01.

The site environmental radiation protection program was being implemented to verify radiation conditions at the ISFSI were in compliance with NRC radiation standards. Environmental dosimeters were adequately located around the ISFSI to demonstrate compliance with exposure limits to the public. Radiological conditions at the facility had not changed since the last inspection.

Biennial reports were submitted to the NRC as required by 10 CFR 72.48(d)(2). Revisions to the safety analysis report (SAR) and technical specifications since March 2005 were reviewed. For the most part, changes were minor or editorial. The most significant change involved Technical Specification 3.1.1 and the vent housing seals. This change was submitted to the NRC for approval.

Operational activities associated with leak testing of vent housing seals, radiological surveys of the HEPA filters, and annual hydrogen gas sampling had been conducted in accordance with the requirements of technical specifications.

The ISFSI organization was in compliance with SAR requirements for staffing and qualifications of personnel. Required training had been performed and documented for site personnel. The safety review committee had met on an annual bases and reviewed issues consistent with requirements in the SAR and technical specifications.

The quality assurance program was based on the Quality Assurance Program Requirements (QARD) document. The quality assurance program used at TMI-2 was the same program implemented at Fort St. Vrain. Trending was being performed. No adverse trends were identified.

The corrective action system was being used to capture issues and document corrective actions. Deficiency reports were being adequately resolved.

Significant degradation of the horizontal storage modules had occurred over the recent years due to water intrusion and the annual thawing and freezing cycle. The licensee conducted an analysis in 2009 to evaluate the horizontal storage modules to verify the current condition had not reduced the effectiveness of the units. The analysis identified corrective actions to repair and stop the deterioration. However, to date, not all corrective actions have been completed. Completion of the remaining corrective actions will be tracked as Open Item 72-20/1101-02.

2 Review of 10 CFR 72.48 Evaluations (60857)

2.1 Inspection Scope

Changes to the facility and procedures since the last inspection in April 2005 were reviewed to determine if the licensee had performed the required evaluations in accordance with 10 CFR 72.48.

2.2 Observations and Findings

The safety screening program used at the TMI-2 facility was the same program applied to Fort St. Vrain with the exception that the reviewers/evaluators were trained on the TMI-2 design. A list of qualified screeners/evaluators was being maintained by the licensee. The list of screenings since 2005 was reviewed. No 72.48 safety evaluations had been initiated as a result of the screenings. Screenings had been performed as a result of procedure changes, SAR changes, audit findings, work orders associated with the inspection of the HSM concrete, and changes associated with the security system.

2.3 Conclusions

All safety screenings had been performed in accordance with procedures and 10 CFR 72.48 requirements. No safety evaluations had been performed since the last inspection. A list of qualified screeners/evaluators was being maintained by the licensee

3 Exit Meeting

The inspectors reviewed the scope and findings of the inspection during an exit meeting conducted at the conclusion of the onsite inspection on March 10, 2011. The licensee did not identify any information as proprietary that was provided to, or reviewed, by the inspectors.

SUPPLEMENTAL INSPECTION INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

B. Blyth, DOE TMI-2
D. Cochran, CWI Quality Assurance
R. Elwood, Manager of ISFSI Management
S. Haight, CWI ISFSI Management
G. Hall, CWI TMI-2 Facility Safety Officer
M. Hilberg, CWI TMI-2
K. Jensen, CWI Security
R. Kay, DOE Alternate Quality Assurance Manager
S. Murphy, DOE Quality Assurance
K. Whitham, DOE-ID Facility Director

INSPECTION PROCEDURES USED

IP 60857	Review of 10 CFR 72.48 Evaluations
IP 60858	Away From Reactor ISFSI Inspection Guidance

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

72-20/1101-01	NOD	Removal of a Commitment made to the NRC from the Emergency Plan
72-20/1101-02	IFI	Completion of HSM Concrete Repairs

Discussed

None

Closed

None

LIST OF ACRONYMS

cc/sec	Standard cubic centimeters per second
CFR	Code of Federal Regulations
CWI	CH2M-WG Idaho, LLC
DOE	Department of Energy
DSC	Dry Shielded Canister
HSM	Horizontal Storage Module
INL	Idaho National Laboratory
ISFSI	Independent Spent Fuel Storage Installation
MOU	Memorandum of Understanding
mR/hr	milliRoentgen per hour
NOD	Notice of Deviation
NRC	Nuclear Regulatory Commission
QARD	Quality Assurance Requirements and Description
SAR	Safety Analysis Report
TLD	Thermo-Luminescent Dosimeter
TMI-2	Three Mile Island Unit 2
µR/hr	microRoentgens per hour

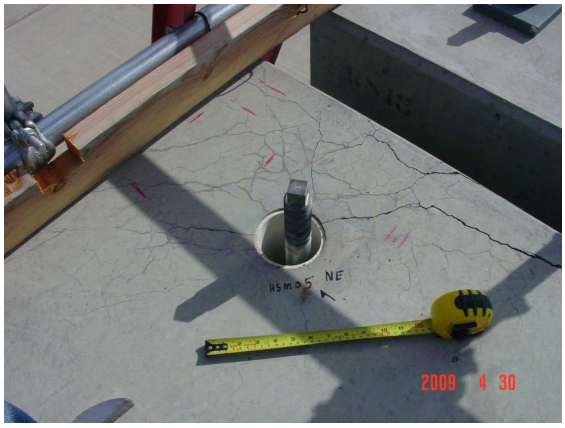

Figure 1: Roof Anchor Bolt

Figure 2: Roof Anchor Bolt Washer

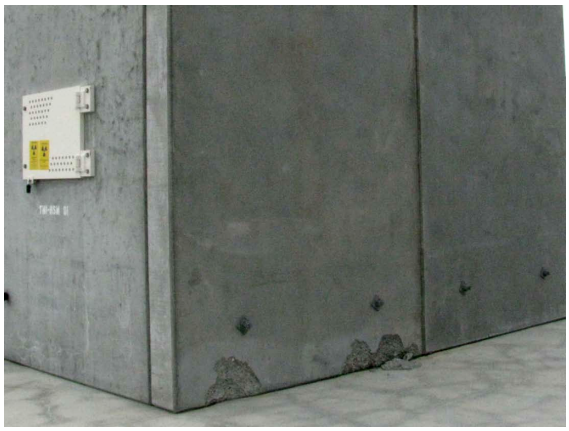

Figure 3: Spalling on End Wall

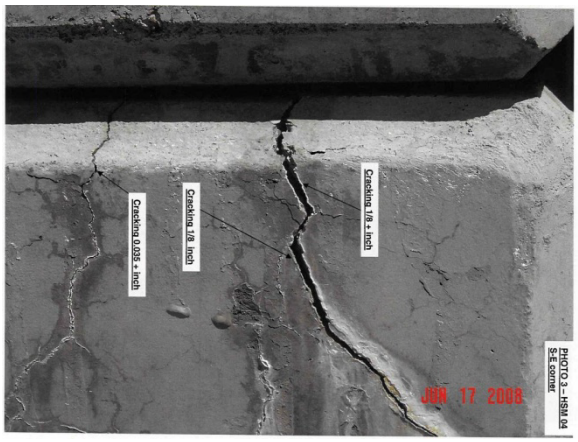

Figure 4: HSM #4

Figure 5: HSM #10

Figure 6: HSM #12

Figure 7: HSM #24

Figure 7: HSM #24

Figure 8: HSM #9

Figure 9: HSM #19

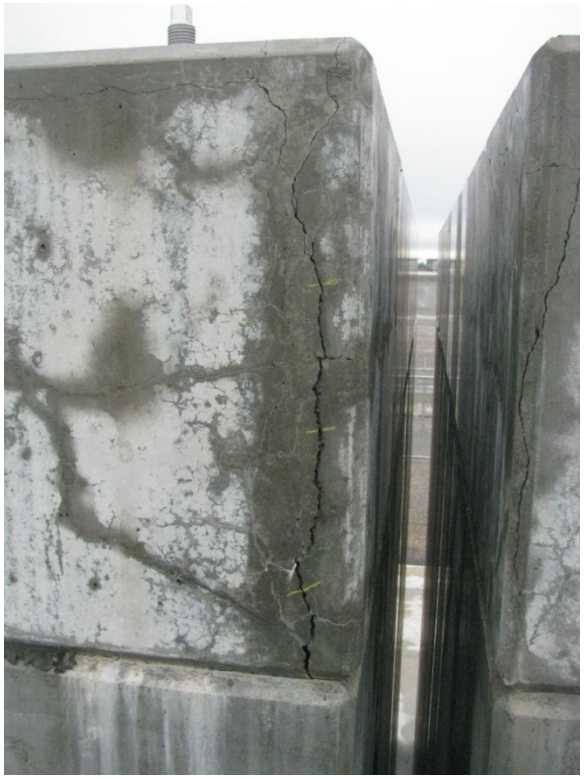

Figure 10: HSM # 6