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**Annual Radiological Environmental Monitoring
Program Report for the Three Mile Island, Unit 2
Independent Spent Fuel Storage Installation**

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ABSTRACT

This report presents the results of the 2015 Radiological Environmental Monitoring Program conducted in accordance with 10 CFR 72.44 for the Three Mile Island, Unit 2, Independent Spent Fuel Storage Installation. A description of the facility and the monitoring program is provided. The results of monitoring the two predominant radiation exposure pathways, potential airborne radioactivity releases and direct radiation exposure, indicate the facility operation has not contributed to any increase in the estimated maximum potential dose commitment to the general public.

SUMMARY

The purpose of this report is to present the results of the Radiological Environmental Monitoring Program (REMP) conducted during 2015 for the Three Mile Island, Unit 2, (TMI-2), Independent Spent Fuel Storage Installation (ISFSI). TMI-2 core debris was transferred to the ISFSI between March 1999 and April 2001 and remains in interim storage at the ISFSI.

The REMP was implemented from January through December 2015. Results of the loose surface radioactive contamination surveys indicated no increase in either beta or Cs-137 radioactivity attributed to the facility operation. The results of the airborne radioactivity sampling did not indicate releases of airborne particulate radioactivity from the loaded Horizontal Storage Modules (HSM) that would contribute to an increase in the estimated maximum potential dose commitment to the general public. The results of the environmental dosimetry network did not indicate an increase in radiation levels above pre-operational background attributed to the facility operation.

The monitoring program results support the conclusion reached in the Final Environmental Impact Statement that operation of the facility will not result in a significant dose commitment to the Maximum Exposed Individual.

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INTRODUCTION

The Three Mile Island, Unit 2, Independent Spent Fuel Storage Installation (TMI-2 ISFSI) is a spent fuel dry storage facility designed for interim storage of the TMI-2 core debris. The TMI-2 ISFSI, located within the Idaho Nuclear Technology and Engineering Center (INTEC) at the Idaho National Laboratory (INL), is operated by CH2M - WG Idaho, LLC for the Department of Energy (DOE). The TMI-2 ISFSI was licensed on March 19, 1999 by the Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 72 for authorization to receive, possess, store, and transfer spent fuel and fuel debris, resulting from the 1979 TMI-2 accident, for a twenty-year term.^{1,2}

The TMI-2 ISFSI is a modified NUHOMS spent fuel storage system, designated NUHOMS-12T. Each of the thirty NUHOMS-12T modules within the facility provide for the horizontal dry storage of up to twelve TMI-2 stainless steel canisters inside a dry shielded canister (DSC) which is placed inside a concrete horizontal storage module (HSM). The NUHOMS-12T modification includes venting of the DSC through high efficiency particulate air (HEPA) grade filters during storage. The vent system allows for release of hydrogen gas, generated due to radiolysis, and monitoring and/or purging of the system during operation.

The TMI-2 core debris which had been stored in stainless steel canisters in a fuel pool at the Test Area North (TAN) site within the INL has been transferred to the TMI-2 ISFSI for interim storage. A Settlement Agreement entered into by the State of Idaho, the Department of Energy, and the Department of the Navy in October 1995 established a schedule for commencing core debris transfers by March 31, 1999, and completing such transfers by June 1, 2001.³ The first core debris transfer was completed on March 31, 1999. Nine additional transfers were completed during 2000. The remaining nineteen transfers were completed during 2001, with the last one completed on April 20, 2001.

A Radiological Environmental Monitoring Program (REMP) was developed for the TMI-2 ISFSI and implemented in accordance with 10 CFR 72.44. This report presents the REMP results during the TMI-2 ISFSI operation in 2015.

PROGRAM DESCRIPTION

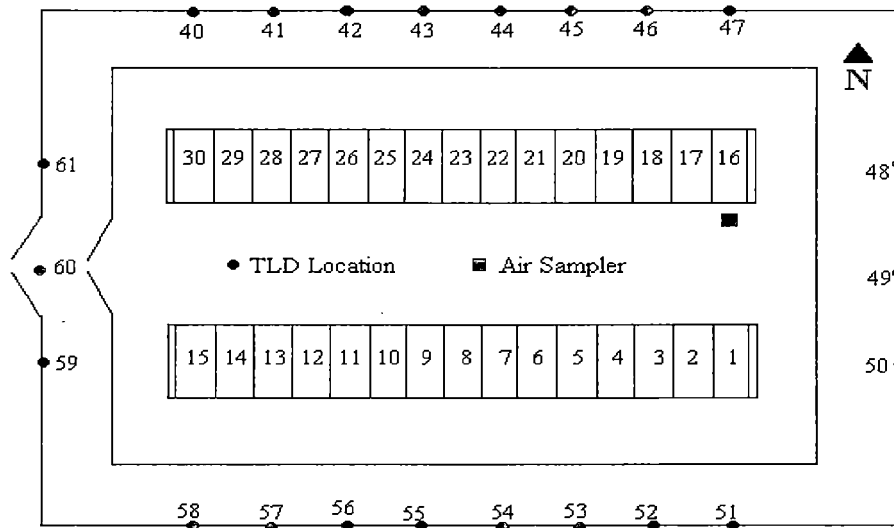
The REMP is designed to monitor the two predominant radiation exposure pathways inherent with the facility design: potential airborne radioactivity releases and direct radiation. The airborne radioactivity release pathway is monitored using a combination of loose surface radioactive contamination surveys and periodic airborne radioactivity sampling. The direct radiation exposure pathway is monitored using environmental dosimetry located along the outer perimeter fence of the TMI-2 ISFSI.

Loose surface radioactive contamination surveys are performed at the vent and purge ports of each DSC as well as the drain port of each loaded HSM. The survey frequency was monthly during the first year, quarterly during the second through fifth years, and is now annually. The frequency coincides with the radiation monitoring surveillance schedule required by the TMI-2 ISFSI Technical

Specifications.⁴ Sample media is analyzed for beta radioactivity. Depending on the amount of beta radioactivity detected, gamma isotopic analysis is either performed for each sample or for an annual sample composite. The presence of Cs-137 is qualitatively determined (or quantitatively as necessary) during the gamma isotopic analysis.

Twenty-two dosimetry stations are located and maintained along the outer perimeter fence of the TMI-2 ISFSI. The dosimetry station locations are noted in Figure 1. Dosimetry is changed out on a quarterly frequency. The minimum detectable dose is no greater than 10 mrem. Since the TMI-2 ISFSI is located among other non-licensed DOE nuclear facilities, there is no specific control dosimetry station for the TMI-2 ISFSI. The INL Radiological Environmental Monitoring Program does have 27 control dosimetry stations located outside the INL boundary.

Figure 1. TMI-2 ISFSI Dosimetry Station Locations.



A low-volume air sampler is used to collect air through a particulate filter during a seven-day period each month. The air sampler is located between the two rows of HSMs inside the TMI-2 ISFSI. Each air particulate sample is analyzed for beta radioactivity with a Lower Limit of Detection (LLD) no greater than 0.01 pCi/m³. Depending on the amount of beta radioactivity detected, gamma isotopic analysis is either performed for each air particulate sample or for an annual sample composite. The presence of Cs-137 is qualitatively determined (or quantitatively as necessary) during the gamma isotopic analysis. Independent airborne radioactivity monitoring stations are maintained off-site of the INL by the INL Environmental Surveillance Program (one station in Howe, ID), the Idaho Department of Environmental Quality INL Oversight Program (three distance stations at Crater of the Moon National Monument, Fort Hall, ID and Idaho Falls, ID), and the Environmental Protection Agency, Region 10 (one station in Boise, ID). These stations are relied upon as control air sampling stations; the sampling results of which are used for comparison purposes when necessary.

RESULTS

The loose surface contamination survey results for the purge, vent, and drain ports were less than the Minimum Detectable Activity (MDA), 47 dpm/100 cm² beta/gamma and 17 dpm/100 cm² alpha,

calculated in accordance with NUREG/CR-1507.⁵ The gamma isotopic results for the purge, vent, and drain port contamination survey composite samples from the HSMs indicated no fission product radioactivity. Cs-137 radioactivity was less than MDA which averaged 1.6E-2 nCi/sample; well below the required LLD of 5 nCi/sample.

Monthly air sampling beta radioactivity results for the TMI-2 ISFSI are presented in Table 1. Beta radioactivity was not detected above the established threshold of 4E-14 $\mu\text{Ci/cc}$ (0.04 pCi/m³) on each monthly sample collected during January through December. Gamma spectroscopy results of the composited air samples collected throughout the year did not indicate the presence of fission or activation product activity.

Table 1. TMI-2 ISFSI Air Sample Results (pCi/m³).

Sample Date	Beta	Sample Date	Beta
January	0.03	July	0.02
February	0.02	August	0.02
March	0.01	September	0.02
April	0.02	October	0.02
May	0.01	November	0.03
June	0.02	December	0.02

Dosimetry results are presented in Table 2 in units of mrem/d. Dosimetry results for the first three quarters include an artificial phantom backscatter correction of 3% to express the results in dose equivalent units. Quarterly standard deviations were 0.2 mrem/d. Analysis of variance results indicated quarterly variances were equal to the pre-operational baseline variance measured in March 1999. T-test results indicated quarterly mean dosimetry responses were in all cases significantly lower than the pre-operational baseline mean measured in March 1999 due to introduction of a new environmental dosimeter and processing system in June 1999 and again in October 2015.⁶ Mean dosimetry responses ranged from 0.6 to 1.2 mrem/d. Radiation monitoring at other locations within the 100 meter perimeter was not performed due to extremely low building occupancy factors. There were no dosimeters unaccounted for during the monitoring period.

Table 2. TMI-2 ISFSI Dosimetry Results (mrem/d).

LOCATION	Q1	Q2	Q3	Q4	MEAN
40	0.8	0.8	0.8	0.8	0.8
41	0.7	0.7	0.8	0.7	0.7
42	0.7	0.6	0.7	0.8	0.7
43	0.7	0.6	0.7	0.7	0.7
44	0.6	0.6	0.6	0.7	0.7
45	0.7	0.6	0.6	0.6	0.6
46	0.7	0.6	0.7	0.6	0.6
47	0.6	0.6	0.6	0.5	0.6
48	0.6	0.6	0.6	0.6	0.6
49	0.7	0.7	0.7	0.7	0.7
50	0.8	0.8	0.8	0.7	0.8
51	0.9	0.9	0.9	1.0	0.9
52	0.9	0.9	0.9	0.9	0.9
53	1.0	1.0	1.0	1.0	1.0
54	1.0	1.0	1.0	1.0	1.0

Table 2. TMI-2 ISFSI Dosimetry Results (mrem/d) (continued).

LOCATION	Q1	Q2	Q3	Q4	MEAN
55	1.1	1.0	1.1	1.0	1.1
56	1.2	1.1	1.1	1.2	1.2
57	1.2	1.1	1.2	1.3	1.2
58	1.2	1.2	1.2	1.4	1.2
59	1.1	1.1	1.1	1.2	1.1
60	1.0	0.9	1.0	1.2	1.0
61	1.0	0.9	1.0	1.0	1.0
MEAN	0.9	0.8	0.9	0.9	0.9

DISCUSSION

The TMI-2 ISFSI REMP was conducted in accordance with established procedures. One change was made to the TMI-2 ISFSI REMP during 2015; a transition from a thermoluminescent dosimeter to an optically stimulated luminescence dosimeter from October through December.

The loose surface radioactive contamination survey results indicate there has been no measurable release of radioactive material from the DSCs stored in the HSMs at the ISFSI above and beyond that projected in the Final Environmental Impact Statement (EIS).⁷ Radioanalytical results are not significantly different from pre-operational results as well as those projected in the EIS.

The airborne radioactivity sampling results indicate there has been no measurable release of radioactive material from the DSCs stored in the HSMs at the ISFSI above and beyond that projected in the EIS.

The radiation dosimetry results indicate there has been no measurable increase in ambient background radiation levels outside the TMI-2 ISFSI perimeter fence attributed to storage of the TMI-2 core debris. The absence of any significant increase in radiation levels outside the TMI-2 ISFSI perimeter fence also supports conclusions reached in the EIS.

Calibration and quality control of instrumentation used for beta analysis of surface contamination and airborne radioactivity sample media is maintained in accordance with procedures used by the Idaho Cleanup Project (ICP) Radiological Control Program.⁸ Radioactivity sources used for instrumentation calibration and quality control are traceable to the National Institute of Standards and Technology (NIST).

CONCLUSION

Airborne radioactivity releases and direct radiation exposure from the facility during 2015 did not contribute to any increase in the estimate of maximum potential dose commitment to the general public; characterized as 2.7E-3 mrem/y to the Maximum Exposed Individual reported in the EIS. There were no radioactive liquid effluents released from the facility, hence no radionuclides to report.

REFERENCES

1. Materials License SNM-2508 for the Three Mile Island, Unit 2, Independent Spent Fuel Storage Installation (TAC No's L22283 and L22800), March 19, 1999, Docket No. 72-20.
2. 10 CFR 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste," *Code of Federal Regulations*, Office of the Federal Register, October 2004.
3. Settlement Agreement between the State of Idaho, Department of the Navy, and the Department of Energy, October 16, 1995.
4. Technical Specifications and Bases for the INL TMI-2 Independent Spent Fuel Storage Installation.
5. NUREG/CR-1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions," December 1997.
6. P. E. Ruhter, *New Environmental Dosimeter Response*, letter PER-17-99, July 29, 1999.
7. NUREG-1626, "Final Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation to Store the Three Mile Island Unit 2 Spent Fuel at the Idaho National Engineering and Environmental Laboratory," Docket No. 72-20, March 1998.
8. ICP, *Radiological Control Manuals 15B and 15C*.