Department of Energy
Idaho Operations Office
1955 Fremont Avenue
Idaho Falls, ID 83415

February 14, 2011

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Submittal of the Annual Radiological Environmental Monitoring Report per 10 CFR 72.44(d) (3), for the Three Mile Island Unit 2 Independent Spent Fuel Storage Installation, Docket 72-20), and for the Ft. St. Vrain Independent Spent Fuel Storage Installation, Docket 72-09 (EM-FMDP-11-019)

Dear Sir or Madam:

The Department of Energy, Idaho Operations Office hereby submits the Annual Radiological Environmental Monitoring Report per 10 CFR 72.44(d) (3) for the Three Mile Island Unit 2 (TMI-2) Independent Spent Fuel Storage Installation (ISFSI) (Docket 72-20), and the Fort St. Vrain (FSV) ISFSI (Docket 72-09). These reports cover operations at both ISFSIs for calendar year 2010.

If you have any questions please call me at (208) 526-5381.

Sincerely,

Bradley J. Davis
NRC Licensed Facilities Director

Enclosures

cc: U.S. NRC Region IV (TMI-2 and FSV ISFSI Reports)
Steve Tarlton, Colorado Dept. of Public Health (FSV ISFSI Report)
U.S. EPA - Region 8, Denver Co (FSV ISFSI Report)
R. Elwood, CWI

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DOE/ID-10742 (2010)

Annual Radiological Environmental Monitoring Program Report for the Fort St. Vrain Independent Spent Fuel Storage Installation

J. R. Newkirk
F. J. Borst, CHP

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Idaho National Laboratory
Idaho Nuclear Technology and Engineering Center
Idaho Falls, Idaho 83415

Prepared for the
U. S. Department of Energy
Assistant Secretary for
Environmental Management
Under DOE Idaho Operations Office
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ABSTRACT

This report presents the results of the 2010 Radiological Environmental Monitoring Program conducted in accordance with 10 CFR 72.44 for the Fort St. Vrain Independent Spent Fuel Storage Installation. A description of the facility and the monitoring program is provided. The results of monitoring the predominant radiation exposure pathway, 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 2010 for the Fort St. Vrain (FSV) Independent Spent Fuel Storage Installation (ISFSI). The results of the thermoluminescent dosimetry network did not indicate an increase in radiation levels above post-loading ambient background attributed to the facility operation. The monitoring program results support the conclusion reached in the Safety Analysis Report that operation of the facility will not result in a significant dose commitment greater than 0.15 mrem/y to the nearest resident.

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Annual Radiological Environmental Monitoring Program Report for the Fort St. Vrain Independent Spent Fuel Storage Installation

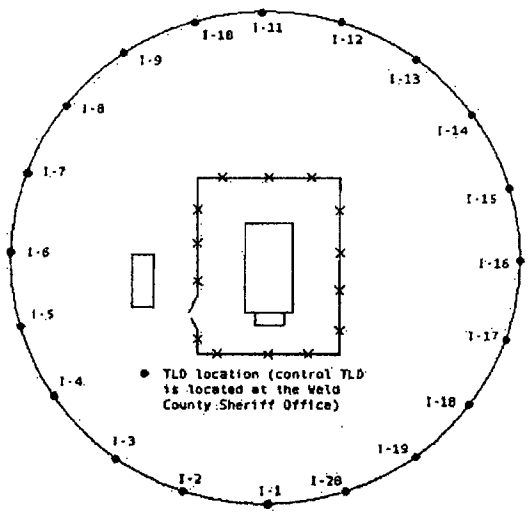
INTRODUCTION

The Fort St. Vrain (FSV) Independent Spent Fuel Storage Installation (ISFSI) is a spent fuel dry storage facility located near Platteville, Colorado. The FSV ISFSI is operated by CH2M - WG Idaho, LLC (CWI) for the Department of Energy (DOE). The FSV ISFSI is licensed (SNM-2504) by the Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 72 for authorization to store spent nuclear fuel from the Fort St. Vrain Nuclear Generating Station.[1] Spent fuel from the FSV reactor was transferred to the FSV ISFSI between December 26, 1991 and June 10, 1992. The FSV ISFSI license was transferred from Public Service Company of Colorado (PSCo) to the U.S. Department of Energy, Idaho Operations Office (DOE-ID) on June 4, 1999. A Radiological Environmental Monitoring Program (REMP) has been implemented for the FSV ISFSI in accordance with 10 CFR 72.44. This report presents the REMP results for 2010.

PROGRAM DESCRIPTION

The REMP is designed to monitor the predominant radiation exposure pathway inherent with the facility design: direct radiation. The direct radiation exposure pathway is monitored using thermoluminescent dosimetry (TLD) located along the 100 meter perimeter fence of the FSV ISFSI. Monitoring locations are identified in Figure 1. A control station is located at the Weld County Sheriff Office in Greeley, Colorado, approximately 17 miles NNE from the FSV ISFSI. Twenty TLDs are located around the 100 meter perimeter fence to monitor direct radiation from the FSV ISFSI. One third of the perimeter fence TLDs are changed out and processed each month. The control station TLD is changed out and processed each month. TLD processing services are provided by the Idaho National Laboratory (INL).

Figure 1. FSV ISFSI Radiological Environmental Monitoring Locations



RESULTS

TLD results for the FSV ISFSI are presented in Table 1 in units of mR/d. The mean exposure rate of 0.39 +/- 0.03 mR/d measured at the ISFSI perimeter fence is comparable to the pre-operational background exposure rate of 0.34 +/- 0.03 mR/d and is consistent with the five-year historical operation mean exposure rate of 0.39 +/- 0.05 mR/d last reported by Colorado State University (CSU).[2, 3] Additionally, the control station TLD responses (0.36 +/- 0.02 mR/d) are consistent with historical values associated with the control station location. Therefore, both the perimeter fence and control TLD responses are consistent with historical values.

Table 1. FSV ISFSI Exposure Rates (mR/d)

Location	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean
I-1	0.37			0.39			0.39			0.41			0.39
I-2		0.33			0.39			0.39			0.37		0.37
I-3			0.36			0.44			0.40			0.44	0.41
I-4	0.38			0.41			0.41			0.43			0.41
I-5		0.34			0.41			0.42			0.38		0.39
I-6			0.37			0.40			0.38			0.43	0.40
I-7	0.37			0.39			0.39			0.39			0.39
I-8		0.34			0.37			0.41			0.41		0.38
I-9			0.37			0.42			0.38			0.44	0.40
I-10	0.41			0.42			0.39			0.42			0.41
I-11		0.35			0.39			0.41			0.41		0.39
I-12			0.36			0.41			0.37			0.45	0.40
I-13	0.38			0.39			0.40			0.38			0.39
I-14		0.34			0.36			0.41			0.38		0.37
I-15			0.35			0.38			0.37			0.44	0.39
I-16	0.35			0.39			0.39			0.40			0.38
I-17		0.30			0.36			0.42			0.42		0.38
I-18			0.34			0.39			0.36			0.41	0.38
I-19	0.37			0.39			0.39			0.40			0.39
I-20		0.32			0.38			0.38			0.42		0.38
Mean	0.38	0.33	0.36	0.40	0.38	0.41	0.39	0.41	0.38	0.40	0.40	0.44	0.39
Control	0.37	0.33	0.35	0.38	0.34	0.35	0.36	0.38	0.32	0.38	0.36	0.40	0.36

DISCUSSION

The FSV ISFSI REMP was successfully implemented during 2010. There was no loss of radiological monitoring data. There were no sampling location changes. There were no deviations from the established sampling schedule. Therefore, the radiation dosimetry results indicate there has been no measurable increase in ambient background radiation levels beyond the FSV ISFSI perimeter fence attributed to storage of the FSV fuel. There were no radioactive liquid effluents released from the facility, hence no radionuclides to report. There are no sources of radioactive material that may become airborne during normal operations, hence no radionuclides to report.

CONCLUSION

Direct radiation exposure from the facility during 2010 did not contribute to any increase in the maximum potential dose commitment (0.15 mrem/y) to the nearest resident (located 797 meters from the ISFSI) projected in the FSV ISFSI Safety Analysis Report.[4]

REFERENCES

1. 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, August 1988.

2. Results of ISFSI Site Background Radiation Study, Department of Radiology and Radiation Biology, Colorado State University, November 2, 1990.

3. Fort St. Vrain Independent Spent Fuel Storage Installation (ISFSI) Radiological Environmental Monitoring Program (IREMP), Summary Report for the Period January 1 to December 31, 1997, Department of Radiological Health Sciences, Colorado State University, February 26, 1998.

4. Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report, Section 7.5, Estimated Offsite Collective Dose Assessment.

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

D. F. Barker
G. G. Hall, CHP

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Idaho National Laboratory
Idaho Nuclear Technology and Engineering Center
Idaho Falls, Idaho 83415

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Assistant Secretary for
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ABSTRACT

This report presents the results of the 2010 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 2010 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 2010. 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 thermoluminescent 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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Annual Radiological Environmental Monitoring Program Report for the Three Mile Island, Unit 2, Independent Spent Fuel Storage Installation

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 2010.

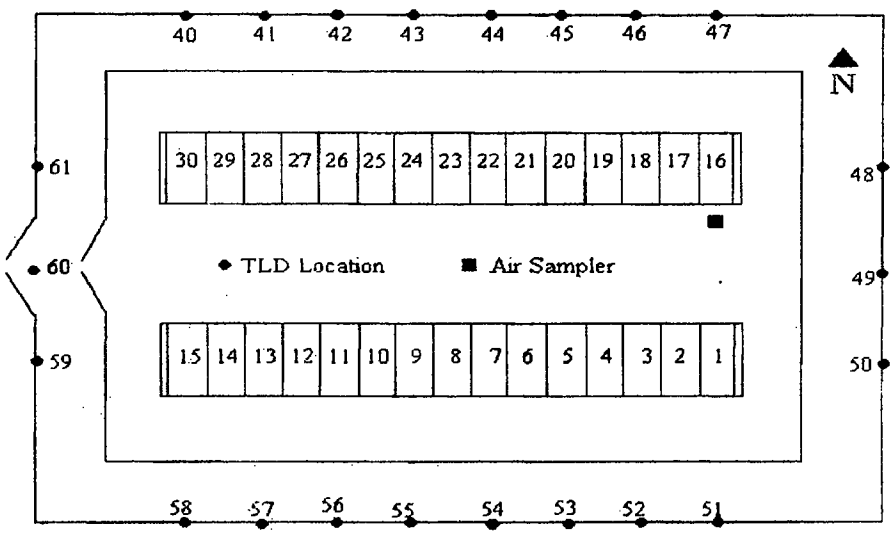
PROGRAM DESCRIPTION

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 thermoluminescent dosimetry (TLD) located along the outer perimeter fence of the TMI-2 ISFSI. Contact radiation levels on the HSM rear panel doors and DSC purge and vent port filter housings are also measured during regularly scheduled surveillances performed in accordance with the Technical Specifications.

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 TLD stations are located and maintained along the outer perimeter fence of the TMI-2 ISFSI. The TLD 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.

Figure 1. TMI-2 ISFSI TLD 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 an LLD no greater than 0.01 pCi/m^3. 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.

RESULTS

The radiation levels measured on the HSM rear panel doors during 2010 were all less than 5 mrem/h; well below the Technical Specification limit of 100 mrem/h. The radiation levels measured on the DSC purge and vent port filter housings during 2010 were all less than or equal to 14 mrem/h; well below the Technical Specification limit of 1,200 mrem/h. Radiation levels for HSMs 4 and 22 include 1 to 5 mrem/h neutron radiation attributed to either spontaneous fission of Pu-240 or AmBeCm neutron startup source material. The highest gamma radiation levels measured in the purge and vent port filter housing access areas during 2010 are summarized in Table 1.

Table 1. Highest Radiation Level Summary Inside HSM Rear Panel Doors (mrem/h)*.

HSM/DSC	Dose Rate	HSM/DSC	Dose Rate	HSM/DSC	Dose Rate
1/29	25	11/12	22	21/9	16
2/28	25	12/19	35	22/5	100
3/26	13	13/15	20	23/16	7
4/1	14	14/17	37	24/11	19
5/24	6	15	Empty	25/13	35
6/23	28	16/2	<1	26/7	25
7/22	10	17/3	38	27/8	10
8/21	15	18/20	40	28/10	4
9/25	25	19/18	50	29/27	11
10/6	20	20/4	70	30/14	60

The loose surface contamination survey results for the purge, vent, and drain ports were less than the Minimum Detectable Activity (MDA), 24 dpm/100 cm^2 beta/gamma and 14 dpm/100 cm^2 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 2 pCi/sample; well below the required LLD of 5 nCi/sample (5,000 pCi/sample).

Monthly air sampling beta radioactivity results for the TMI-2 ISFSI are presented in Table 2. Beta radioactivity was not detected above the established threshold of 4E-14 μCi/cc (0.04 pCi/m^3) on the monthly samples. Gamma spectroscopy results of the composited air samples collected throughout the year did not indicate the presence of fission or activation product activity.

Table 2. TMI-2 ISFSI Air Sample Results (pCi/m^3).

Sample Date	Beta	Sample Date	Beta
January	0.029	July	0.017
February	0.018	August	0.021
March	0.003	September	0.021
April	0.011	October	0.023
May	0.001	November	0.023
June	0.023	December	0.019

TLD results are presented in Table 3 in units of mrem/d. TLD results include an artificial phantom backscatter correction of 3% to express the results in dose equivalent units. Quarterly standard deviations were generally ≤0.1 mrem/d. Analysis of variance results indicated quarterly variances were in all cases different than the pre-operational baseline variance measured in March 1999. T-test results indicated quarterly mean TLD 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.[7] Mean TLD responses were 0.5 to 0.6 mrem/d. Radiation monitoring at other locations within the 100 meter perimeter was not performed due to extremely low building occupancy factors.

* Gamma and neutron

Table 3. TMI-2 ISFSI TLD Results (mrem/d).

LOCATION	MAR	JUN	SEP	DEC	MEAN
40	0.5	0.5	0.6	0.5	0.5
41	0.5	0.5	0.6	0.5	0.5
42	0.5	0.5	0.6	0.5	0.5
43	0.5	0.5	0.5	0.5	0.5
44	0.5	0.5	0.5	0.5	0.5
45	0.5	0.5	0.5	0.5	0.5
46	0.5	0.5	0.5	0.5	0.5
47	0.5	0.5	0.5	0.4	0.5
48	0.5	0.5	0.5	0.5	0.5
49	0.5	0.5	0.5	0.5	0.5
50	0.5	0.5	0.5	0.5	0.5
51	0.5	0.5	0.6	0.6	0.6
52	0.5	0.5	0.6	0.6	0.6
53	0.5	0.6	0.6	0.7	0.6
54	0.5	0.6	0.6	0.7	0.6
55	0.5	0.6	0.7	0.7	0.6
56	0.5	0.6	0.7	0.7	0.6
57	0.5	0.6	0.7	0.8	0.6
58	0.5	0.6	0.7	0.8	0.7
59	0.5	0.6	0.7	0.7	0.6
60	0.5	0.5	0.6	0.6	0.6
61	0.5	0.5	0.6	0.6	0.6
MEAN	0.5	0.5	0.6	0.6	0.6

DISCUSSION

The TMI-2 ISFSI REMP was conducted in accordance with established procedures. Analytical results of composited loose surface contamination survey media indicated no fission or activation product activity. Minor changes were made to the TMI-2 ISFSI REMP during 2010. Optimum background and sample counting times were established for beta radioactivity analysis. Qualitative gamma spectroscopy was established as the primary method for radionuclide identification.

The loose surface radioactive contamination survey and vent port radiation survey results (stable trends) neither indicate a build up of radioactivity in the vent port HEPA filters, nor a breach of DSC containment. The loose surface radioactive contamination surveying and 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 Final Environmental Impact Statement (EIS), estimated for 40 CFR 61 reporting purposes, and summarized in Table 4.[7,8,9] Radioanalytical results are not significantly different from pre-operational results as well as those projected in the EIS and reported in accordance with 40 CFR 61.

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.

Table 4. TMI-2 ISFSI Estimated Airborne Radioactive Material Releases (Ci/y).

Radionuclide	Release	Radionuclide	Release	Radionuclide	Release
Cs-137	1.7E-2	Co-60	9.0E-5	H-3	2.3E+2
Sr-90	1.4E-2	Pu-239	3.5E-4	Eu-155	1.9E-5
Pu-241	7.1E-3	Sm-151	2.6E-4	Pu-238	8.2E-5
Kr-85	1.7E+3	Pu-240	1.8E-4	Sb-125	3.0E-6
Pm-147	3.3E-5	Ni-63	1.6E-4	Cs-134	4.3E-7
Am-241	4.1E-5[†]	Eu-154	5.3E-5	I-129	3.3E-2

The radioanalytical laboratory that provides gamma spectroscopy services for composite sample quantitative analysis participated in the Mixed Analyte Performance Evaluation Program (MAPEP) conducted by the DOE Radiological and Environmental Sciences Laboratory (RESL) in 2010. The intercomparison results for the sample geometry used for composite samples of surface contamination survey media conducted during 2010 are summarized in Table 5. The evaluation criteria are described at the MAPEP website (www.inl.gov/resl/mapep). The evaluation results for Cs-137 identification indicate the General Engineering Laboratory, LLC (GEL) had a conservative, but unacceptable reporting bias (greater than 30%). Such conservatism could cause one to question the presence of any reported radionuclides in field samples. Qualitative gamma spectroscopy is being used to augment the quantitative gamma spectroscopic analyses in accordance with documented guidance.[10]

Table 5. Gamma Spectroscopy Intercomparison Results for GEL (Bq/sample).

Sample (Date)	Radionuclide	GEL Value	RESL Value	Bias (%)	Evaluation
MAPEP-10-RdF22 (March 2010)	Cs-134	4.323	2.13	103.0	Not Acceptable
	Cs-137	3.070	1.53	100.7	Not Acceptable
	Co-57	0.0002	0	N/A	Acceptable
	Co-60	5.187	2.473	109.7	Not Acceptable
	Mn-54	6.483	3.02	114.7	Not Acceptable
	Zn-65	-0.106	0	N/A	Acceptable

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.[11] Radioactive 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 2010 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.

[†] This release value from the TMI-2 ISFSI SAR, Table 7.2-3 accounts for Am-241 in-growth.

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. 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities," *Code of Federal Regulations*, Office of the Federal Register, October 2002.

9. G. G. Hall, *Projected Radionuclide Emissions from the TMI-2 ISFSI*, Engineering Design File 3420, February 25, 2003.

10. G. G. Hall, *A Proposed Gamma Spectroscopic Analysis Alternative for the TMI-2 ISFSI*, Engineering Design File 9929, January 11, 2011.

11. ICP, *Radiological Control Manuals 15B and 15C*.