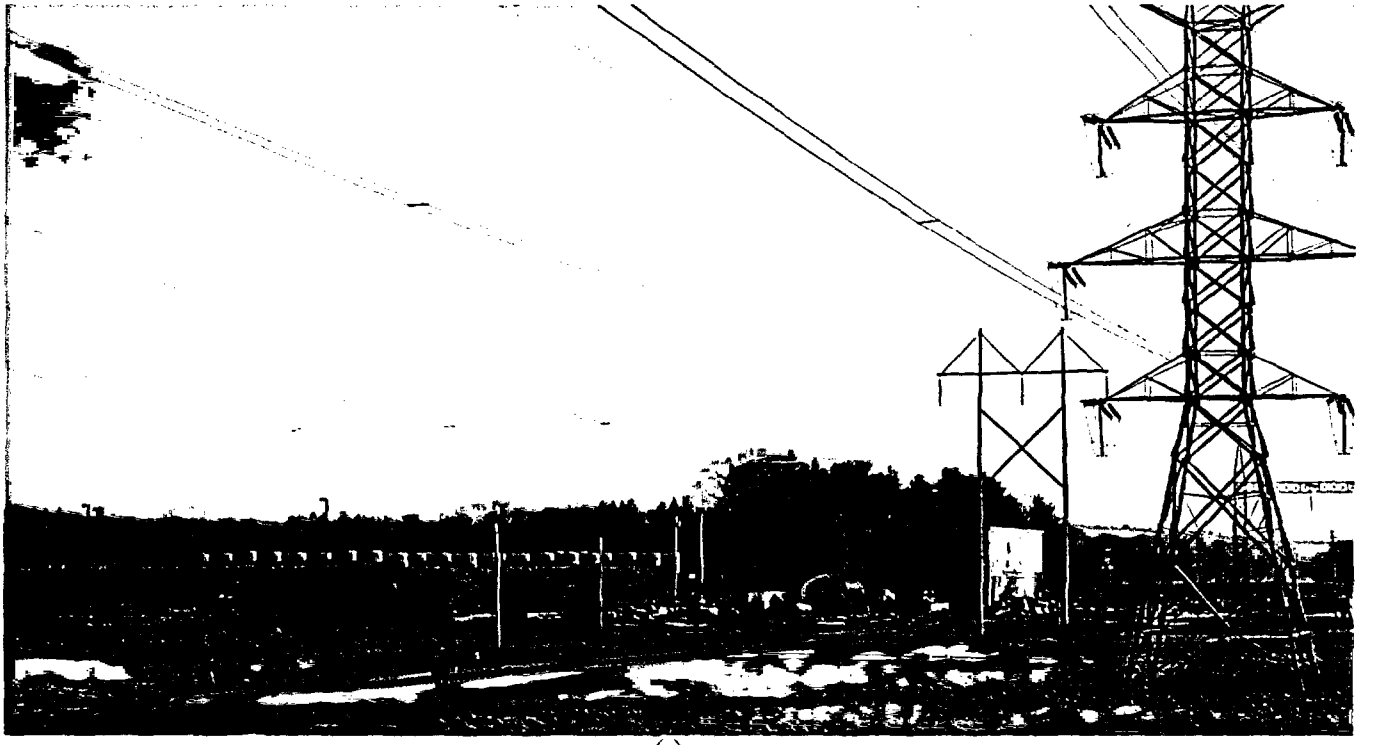
MAINE YANKEE INDEPENDENT SPENT FUEL STORAGE INSTALLATION

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

January - December 2005



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EXECUTIVE SUMMARY

During 2005, as in all previous years of facility operation, a radiological environmental monitoring program was conducted for the Maine Yankee Independent Spent Fuel Storage Installation (ISFSI) to assess the levels of radiation or radioactivity in the Maine Yankee environment. More than 150 samples were collected (including TLDs) over the course of the year, with over 680 radionuclide or exposure rate analyses being performed. The samples collected as part of this program include weekly estuary water and direct radiation measurements.

Low levels of radioactivity from naturally-occurring, fallout were detected. Most samples had measurable concentrations of K-40, Th-232 or Radon daughter products. These are the most common of the naturally-occurring radionuclides. In many cases, the samples indicated the presence of Mo-99, which is typically seen in the medical industry. However, the nuclide is perceived to exist by gamma spectroscopy equipment when analyzing samples for environmental levels of radioactivity when the counting equipment is influenced by neutron/gamma interactions that take place within the detector shell. This occurred at Maine Yankee due to the close proximity of the gamma spectroscopy equipment in relation the ISFSI yard. All samples taken were collected in the immediate vicinity of the Independent Spent Fuel Storage Installation.

The Maine Yankee Independent Spent Fuel Storage Facility (ISFSI) has been in operation since 2001. The facility contains fuel element assemblies and irradiated components from the site's former reactor internals. Until June of 2005, the site was in the process of finalizing the decommissioning of the former Maine Yankee Nuclear Power Station. This process took place in strict conformance with USNRC regulations and with oversight from the State of Maine. Environmental Monitoring was in place during this decommissioning process and described / reported in the 2005 Annual Radiological Environmental Monitoring Report prepared by Framatone-ANP for the six month period. The report provided here is a summary of the radiological environmental activities and analysis that is specific to the Maine Yankee ISFSI for the full year of 2005.

During 2005, there were minor changes to the ISFSI radiological environmental monitoring program. In the 1st quarter of 2005, Maine Yankee made the decision to transport soil from the former plant footprint that contained low levels of radioactive contaminants to an isolated area within the bounds of the ISFSI land. The soil was placed there to facilitate the decommissioning process until it could be shipped by rail later in the year. Although not required by the Maine Yankee Offsite Dose Calculation Manual (ODCM), additional estuary water samples were added to the ISFSI's Radiological Environmental Monitoring Program to monitor the adjacent estuary for plant radionuclides that could potentially infiltrate the environment.

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1.0 INTRODUCTION

This report summarizes the findings of the Radiological Environmental Monitoring Program (REMP) conducted by Maine Yankee in the vicinity of the Independent Spent Fuel Storage Installation in Wiscasset, Maine during the calendar year 2005. It is submitted annually in compliance with Appendix A, of the Offsite Dose Calculation Manual (ODCM). The remainder of this report is organized as follows:

Section 2: Provides an introduction to the background radioactivity and radiation that is detected in the Maine Yankee environs.

Section 3: Provides a brief description of the Maine Yankee site and its environs.

Section 4: Provides a description of the overall REMP design. Included is a summary of the ODCM requirements for REMP sampling, tables listing routine sampling and TLD monitoring locations with compass sectors and distances from the plant, and maps showing the location of each of the sampling and TLD monitoring locations. Tables listing Lower Limit of Detection requirements and Reporting Levels are also included.

Section 5: Consists of the summarized data as required by the ODCM, in the format specified by the NRC Branch Technical Position on Environmental Monitoring (Reference 1). Also included are complete environmental TLD data.

Section 6: Provides the results of the 2005 monitoring program. The performance of the program in meeting ODCM requirements is discussed, and the data acquired during the year is analyzed.

Section 8: Summarizes the requirements and the results of the 2005 Land Use Census.

Section 9: References

2.0 NATURALLY OCCURRING AND MAN-MADE BACKGROUND RADIOACTIVITY

Radiation or radioactivity potentially detected in the Maine Yankee environment can be grouped into three categories. The first is "naturally-occurring" radiation and radioactivity. The second is "man-made" radioactivity from sources other than the Maine Yankee facility. The third potential source of radioactivity is due to emissions from the Maine Yankee ISFSI. For the purposes of the Maine Yankee REMP, the first two categories are classified as "background" radiation, and are the subject of discussion in this section of the report. The third category is the one that the REMP is designed to detect and evaluate.

2.1 Naturally Occurring Background Radioactivity

Natural radiation and radioactivity in the environment, which provide the major source of human radiation exposure, may be subdivided into three separate categories: "primordial radioactivity," "cosmogenic radioactivity" and "cosmic radiation." "Primordial radioactivity" is made up of those radionuclides that were created with the universe and that have a sufficiently long half-life to be still present on the earth. Included in this category are the radionuclides that these elements have decayed into. A few of the more important radionuclides in this category are Uranium-238 (U-238), Thorium-232 (Th-232), Rubidium-87 (Rb-87), Potassium-40 (K-40), Radium-226 (Ra-226), and Radon-222 (Rn-222). Uranium-238 and Thorium-232 are readily detected in soil and rock, whether through direct field measurements or through laboratory analysis of samples. Radium-226 in the earth can find its way from the soil into ground water, and is often detectable there. Potassium-40 comprises about 0.01 percent of all natural potassium in the earth, and is consequently detectable in most biological substances, including the human body. There are many more primordial radionuclides found in the environment in addition to the major ones discussed above (Reference 2).

The second category of naturally-occurring radiation and radioactivity is "cosmogenic radioactivity." This is produced through the nuclear interaction of high energy cosmic radiation with elements in the earth's atmosphere, and to a much lesser degree in the earth's crust. These radioactive elements are then incorporated into the entire geosphere and atmosphere, including the earth's soil, surface rock, biosphere, sediments, ocean floors, polar ice and atmosphere. The major radionuclides in this category are Carbon-14 (C-14), Hydrogen-3 (H-3 or Tritium), Sodium-22 (Na-22), and Beryllium-7 (Be-7).

The third category of naturally-occurring radiation and radioactivity is "cosmic radiation." This consists of high energy atomic or sub-atomic particles of extra-terrestrial origin and the secondary particles and radiation that are produced through their interaction in the earth's atmosphere. The primary radiation comes mostly from outside of our solar system, and to a lesser degree from the sun. We are protected from most of this radiation by the earth's atmosphere, which absorbs the radiation. Consequently, one can see that with increasing elevation one would be exposed to more cosmic radiation as a direct result of a thinner layer of air for protection. This "direct radiation" is detected in the field with gamma

spectroscopy equipment, high pressure ion chambers and thermoluminescent dosimeters (TLDs).

2.2 Man-Made Background Radioactivity

The second source of "background" radioactivity in the Maine Yankee environment is from "man-made" sources not related to the Maine Yankee ISFSI. The most recent contributor to this category was the fallout from the Chernobyl accident in April of 1986, which was detected in the Maine Yankee environment and other parts of the world. A much greater contributor to this category, however, has been fallout from atmospheric nuclear weapons tests. Tests were conducted from 1945 through 1980 by the United States, the Soviet Union, the United Kingdom, China and France, with the large majority of testing occurring during the periods 1954-1958 and 1961-1962. (A test ban treaty was signed in 1963 by the United States, the Soviet Union and the United Kingdom, but not by France and China.) Atmospheric testing was conducted by the People's Republic of China as recent as October 1980. Much of the fallout detected today is due to this explosion and the last large scale one, done in November of 1976 (Reference 3).

The radioactivity produced by these detonations was deposited worldwide. The amount of fallout deposited in any given area is dependent on many factors, such as the explosive yield of the device, the latitude and altitude of the detonation, the season in which it occurred, and the timing of subsequent rainfall which washes fallout from the troposphere (Reference 4). Most of this fallout has decayed into stable elements, but the residual radioactivity is still detectable at low levels in environmental samples worldwide. The two predominant radionuclides are Cesium-137 (Cs-137) and Strontium-90 (Sr-90) and can be found in soil and in vegetation.

Other potential "man-made" sources of environmental "background" radioactivity include other nuclear power plants, coal-fired power plants, national defense installations, hospitals, research laboratories and industry. These collectively are insignificant on a global scale when compared to the sources discussed above (natural and fallout).

3.0 GENERAL ISFSI AND SITE INFORMATION

The Maine Yankee Independent Spent Fuel Storage Installation (ISFSI) is located in the town of Wiscasset, Lincoln County, Maine, approximately six miles northeast of Bath, Maine. The site vicinity is rural and lightly populated.

The ISFSI site is located near Bailey Point, a peninsula bounded to the east by the Back River and to the west by a shallow inlet known as Bailey Cove, both of which are part of the Montsweag Bay-Sheepscot River Estuary. Bailey point is an elongated bedrock ridge with flat or gently rolling topography rising to an average elevation of about 25 feet above sea level (Reference 5).

The Radiological Environmental Monitoring Program (REMP) for the ISFSI began pre-operational measurements in the 4th quarter of 1999, approximately 2 years prior to ISFSI operation. The ISFSI REMP has been in continuous operation since that date.

4.0 PROGRAM DESIGN

The Radiological Environmental Monitoring Program (REMP) for the Maine Yankee ISFSI was designed with the following specific objectives in mind. These objectives will continue to be in force, to varying degrees, throughout its operation.

- To provide an early indication of the appearance or accumulation of any radioactive material in the environment caused by ISFSI operation.
- To provide assurance to regulatory agencies and the public that the station's environmental impact is known and within anticipated limits.
- To provide standby monitoring capability for rapid assessment of risk to the general public in the event of unanticipated or accidental releases of radioactive material.

The REMP is a requirement of the ISFSI ODCM. The detailed sampling requirements of the REMP are given in the ODCM. This table is summarized in this report as Table 4.1.

The required sampling locations are identified in the ODCM. The locations actually monitored in 2005 are shown on Tables 4.2, as well as Figures 4.1 through 4.2 of this report. The locations in these tables and figures consist of the required locations specified in the ODCM. The reference point chosen for direction and distance of the REMP sample locations was the centerline of the ISFSI yard that stores the Vertical Concrete Casks (VCC's).

4.1 Monitoring Zones

The REMP is designed to allow comparison of levels of radioactivity in samples from the area possibly influenced by the ISFSI to levels found in areas not influenced by the ISFSI. The first area is called Zone 1, and its monitoring locations are called "indicators." The second area is called Zone 2, and its monitoring locations are called "controls." The distinction between the two zones is based on relative direction from the plant and distance. Analysis of survey data from the two zones aids in determining if there is a significant difference between the two areas. It can also help in differentiating between radioactivity or radiation due to releases and that due to other fluctuations in the environment, such as seasonal variations in the natural background.

4.2 Pathways Monitored

Based on the design of the ISFSI, only two exposure pathways are monitored by the REMP. They are the direct radiation, and waterborne pathways. Each of these categories is monitored by the collection of the sample media listed below, and are described in more detail in this section:

Waterborne Pathways;

Estuary Water Sampling

Direct Radiation Pathway;

TLD Monitoring

4.3 Descriptions of Monitoring Programs

4.3.1 Estuary Water Sampling

Although not required by the Maine Yankee ODCM, semi-annual grab samples were collected at the potential discharge pathway into Young's Brook (Outfall-018), which is located northwest of the ISFSI. The sample were collected as directed by the station's REMP procedure and were analyzed for the gamma emitters listed in Table 4.3 of this report.

4.3.2 Direct Radiation

Direct gamma radiation exposure was continuously monitored with the use of thermoluminescent dosimeters (TLDs). Dosimeters' at each monitoring location are sealed in plastic bags and attached to an object such as a tree, fence or utility pole. The TLDs are posted and retrieved on a quarterly basis. All TLDs are provided and processed by a NVLAP Certified Vendor.

The TLDs are placed within 350 meters of the Independent Spent Fuel Storage Insulation (ISFSI). This type of monitoring was implemented for the ISFSI in the fourth quarter of 1999, which is approximately two years prior to the start of ISFSI operations (i.e. the initial source term (reactor internals) was placed at the ISFSI in the fourth quarter of 2001). The ISFSI is located approximately 450 meters NE of the former Maine Yankee containment dome. The ISFSI TLDs are classified as TL-I-# in Table 5.3 of this report.

4.3.3 Special Monitoring

On occasion, special samples are taken that are not required as a part of the Radiological Environmental Monitoring Program (REMP) or the ODCM. The sample locations vary from year to year and do not appear in Table 2.3 of the Offsite Dose Calculation Manual, nor do they appear in Table 4.1 or 4.2 of this report. Eighty-seven of the estuary water samples summarized in this report were not required by the ODCM, and with exception to the semi-annual estuary water samples stated above, are characterized as special monitoring type samples. These samples were collected to monitor the effects to the environment from potential infiltration of radionuclides from the debris pile that was stored on the ISFSI land. Table 5.1 of this report includes the "mean" concentration and "range" values from these samples.

TABLE 4.1

ISFSI Radiological Environmental Surveillance Program
(as required during 2005 by ODCM Table 2.3)

Exposure Pathway and/or Sample Media	Collection			Analysis	
	Number of Sample Locations	Routine Sampling Mode	Collection Frequency	Analysis Type	Analysis Frequency
1. Direct Radiation (TLD)	Total Locations: 18 (16 around perimeter of the site and 2 offsite control locations)	Continuous	Quarterly	Gamma dose	Each TLD

TABLE 4.2

ISFSI Radiological Environmental Monitoring Locations (TLD) in 2005

Station Code	Station Description	Zone*	Distance From ISFSI (km)	Direction From ISFSI
TL-36	Boothbay Harbor Fire Station (O)**	2	12.2	SSE
TL-38	Dresden Substation (O)**	2	20.1	N
TL-I-01	Spent Fuel Storage (I)**	1	< 0.35	N
TL-I-02	Spent Fuel Storage (I)**	1	< 0.35	NNE
TL-I-03	Spent Fuel Storage (I)**	1	< 0.35	NE
TL-I-04	Spent Fuel Storage (I)**	1	< 0.35	ENE
TL-I-05	Spent Fuel Storage (I)**	1	< 0.35	E
TL-I-06	Spent Fuel Storage (I)**	1	< 0.35	ESE
TL-I-07	Spent Fuel Storage (I)**	1	< 0.35	SE
TL-I-08	Spent Fuel Storage (I)**	1	< 0.35	SSE
TL-I-09	Spent Fuel Storage (I)**	1	< 0.35	S
TL-I-10	Spent Fuel Storage (I)**	1	< 0.35	SSW
TL-I-11	Spent Fuel Storage (I)**	1	< 0.35	SW
TL-I-12	Spent Fuel Storage (I)**	1	< 0.35	WSW
TL-I-13	Spent Fuel Storage (I)**	1	< 0.35	W
TL-1-14	Spent Fuel Storage (I)**	1	< 0.35	WNW
TL-I-15	Spent Fuel Storage (I)**	1	< 0.35	NW
TL-I-16	Spent Fuel Storage (I)**	1	< 0.35	NNW

*2 = Control TLD; 1 = Indicator TLD

**I = Inner Ring TLD; O = Outer Ring TLD

TABLE 4.3

Environmental Lower Limit of Detection (LLD) Sensitivity Requirements

Analysis	Water (pCi/l)
Mn-54	15
Fe-59	30
Co-58,60	15
*Zr-Nb-95	15
Cs-134	15
Cs-137	18

TABLE 4.4

Reporting Levels for Radioactivity Concentrations In Environmental Samples

Analysis	Water (pCi/l)
Mn-54	1000
Fe-59	400
Co-58	1000
Co-60	300
*Zr-Nb-95	400
Cs-134	30
Cs-137	50

Figure 4.1

Direct Radiation Monitoring Locations (within 0.350 km)

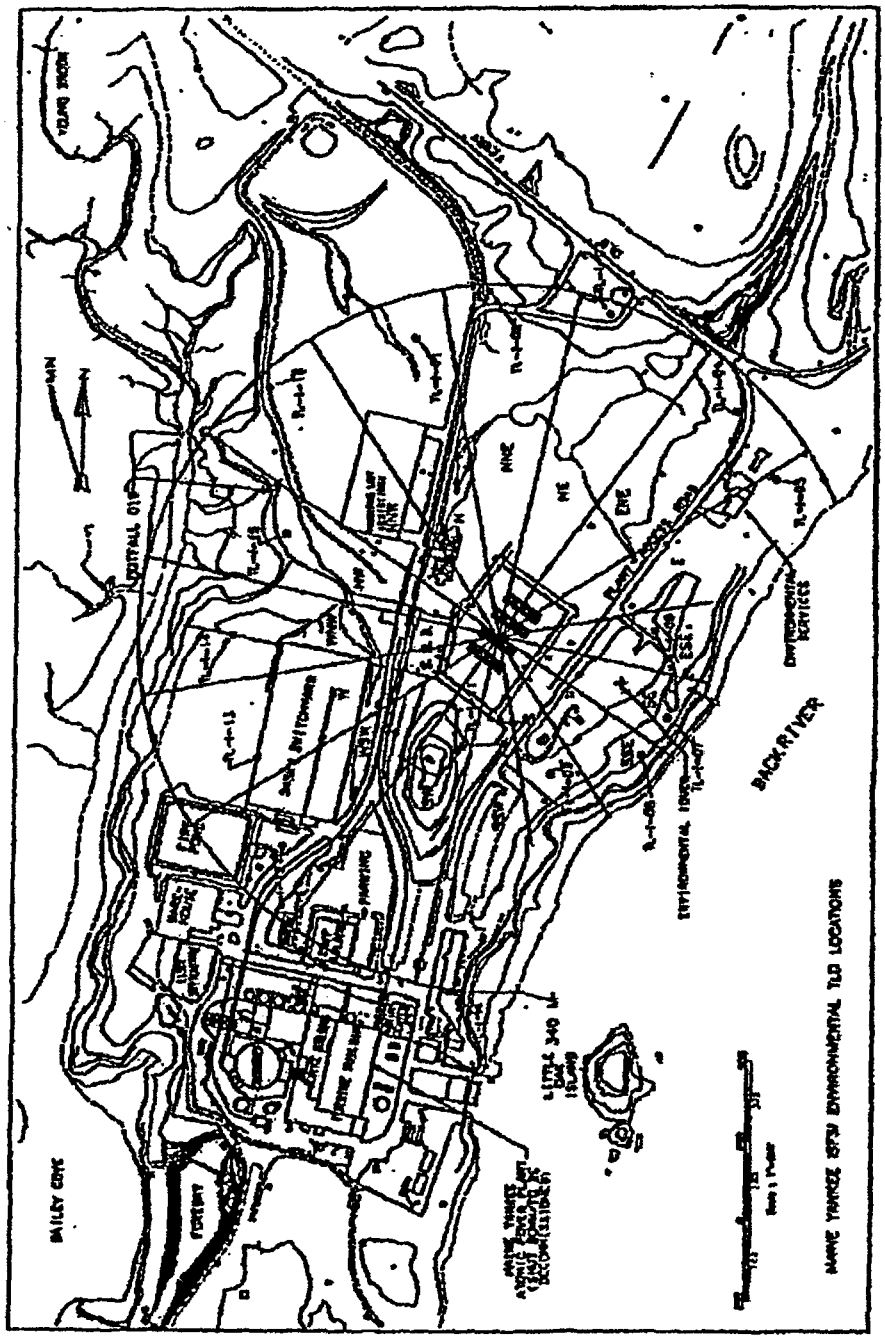
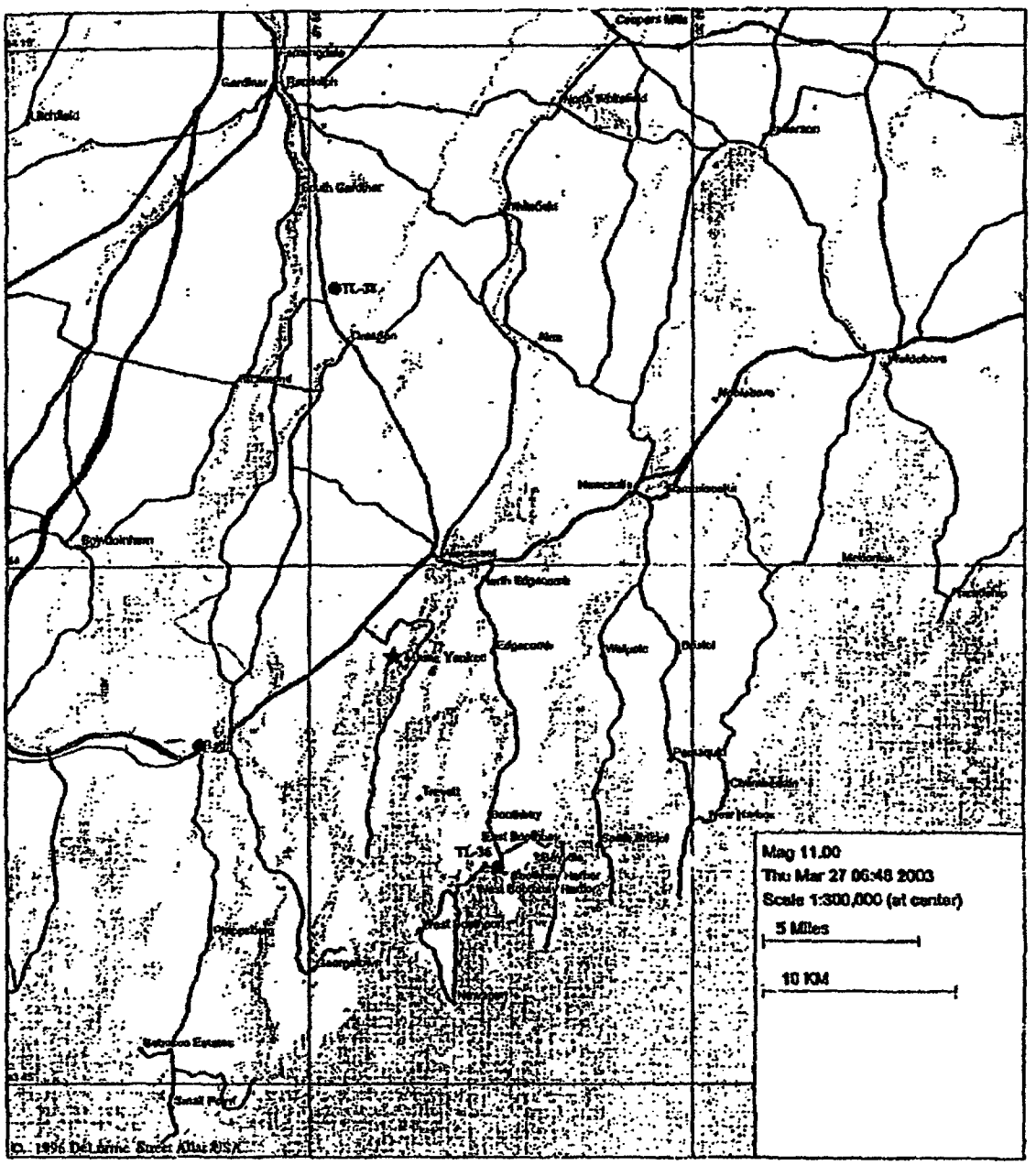


Figure 4.2

Direct Radiation Monitoring Locations (outside 1km)



5.0 RADIOLOGICAL DATA SUMMARY TABLES

This section summarizes the analytical results of the environmental samples, which were collected during 2005. These results, shown in Table 5.1, are presented in a format similar to that prescribed in the NRC's Radiological Assessment Branch Technical Position on Environmental Monitoring (Reference 1). The results are ordered by sample media type and then by radionuclide. The units for each media type are also given.

The left-most column contains the radionuclide of interest, the total number of analyses for that radionuclide in 2005, and the number of measurements which exceeded the Reporting Levels found in Table 2.5 of the ODCM. Measurements exceeding the Reporting Levels are classified as "Non-Routine" measurements. The second column lists the required Lower Limit of Detection (LLD) for those radionuclides that have detection capability requirements as specified in the ODCM Table 2.4. The absence of a value in this column indicates that no LLD is specified in the ODCM for that radionuclide in that media. The target LLD for any analysis is typically 10-15 percent of the most restrictive required LLD. Occasionally, the required LLD is not met. This is usually due to low sample volume. Such cases, if any, are addressed in Section 6.2.

For each radionuclide and media type, the remaining three columns summarize the data for the following categories of monitoring locations: (1) the indicator or Zone 1 stations, which are within the range of influence of the ISFSI and which could conceivably be affected by its operation; (2) the station which had the highest mean concentration during 2005 for that radionuclide; and (3) historical control or Zone 2 stations, which are beyond the influence of the ISFSI. Environmental TLD or direct radiation monitoring stations are grouped into either an Inner Ring, an Outer Ring, or Control category.

In each of these columns, for each radionuclide, the following statistical values are given:

- The mean value of all concentrations, including negative values and values considered "not detectable".
- The lowest and highest concentration (LLD values included).
- The number of detectable measurements divided by the total number of measurements. For example, (4/20) would indicate that 4 of the 20 samples collected in 2005, for that sample type and that radionuclide, contained detectable radioactivity.

A sample is considered to yield a "detectable measurement" when the concentration exceeds three times its associated standard deviation. The standard deviation on each measurement represents only the random uncertainty associated with the radioactive decay process (counting statistics), and not the

propagation of all possible uncertainties in the analytical procedure.

The radionuclides reported in this section represent those that: 1) had an LLD requirement in Table 2.4 of the ODCM, or a Reporting Level listed in Table 2.5, or 2) had a positive measurement of radioactivity, whether it was naturally-occurring or man-made; or 3) were of specific interest for any other reason. The radionuclides routinely analyzed and reported for a gamma spectroscopy analysis are: Ac-228, Ag-110m, Be-7, Ce-144, Co-57, Co-58, Co-60, Cr-51, Cs-134, Cs-137, Fe-59, K-40, Mn-54, Nb-95, Ru-103, Rh-106, Sb-124, Sb-125, Zn-65 and Zr-95. In no case did a non-natural radionuclide shown in Table 5.1 appear as a "detectable measurement" during 2005.

Data from direct radiation measurements made by a TLD are provided in Table 5.2 in a format essentially the same as above. The complete listing of quarterly TLD data is provided in Table 5.3.

Table 5.1
ISFSI Radiological Environmental Program Summary
Maine Yankee, Wiscasset, ME (January - December 2005)

MEDIUM: Estuary Water (WE) UNITS: pCi/L

Radionuclides* (No. Analyses) (Non-Routine**)		Required LLD	Indicator Stations Mean Range (No. Detected***)	Station	Station With Highest Mean Mean Range (No. Detected***)	No control stations were established for 2005
K-40	(89)		2.3E +2	18	2.4E +2	N/A
	(0)		(2.3 E+1 - 4.56 E+2) (45/ 89)		(9.61E+1 - 3.96E+2) (15/ 30)	
Mn-54	(89)	15	1.2E +1	18	1.4E +1	
	(0)		(0.51 - 1.35)E+1 (0/ 89)		(-9.52 - 1.34)E+1 (0/ 30)	N/A
Co-58	(89)	15	1.2E +1	18	1.4E +1	
	(0)		(0.48 - 1.33)E+1 (0/ 89)		(-9.13 - 1.24)E+1 (0/ 30)	N/A
Co-60	(89)	15	1.3E +1	18	1.5E +1	
	(0)		(0.54 - 1.46)E+1 (0/ 89)		(1.03 - 1.46)E+1 (0/ 30)	N/A
Zr-95	(89)	15	2.0E +1	18	2.3E +1	
	(0)		(0.829 - 2.19)E+1 (0/ 89)		(1.49 - 2.19)E+1 (0/ 30)	N/A
Cs-134	(89)	15	1.3E +1	18	1.5E +1	
	(0)		(0.54 - 1.47)E+1 (0/ 89)		(1.01 - 1.44)E+1 (0/ 30)	N/A
Cs-137	(89)	18	1.3E +1	18	1.5E +1	
	(0)		(0.51 - 1.43)E+1 (0/ 89)		(-9.58 - 1.37)E+1 (0/ 30)	N/A

* The radionuclides reported in this table are those that: 1) had an LLD requirement in ODCM Table 2.4, or a Reporting Level in ODCM Table 2.5, or 2) had a positive measurement of radioactivity, whether it was naturally occurring or man-made; or 3) were of specific interest for any other reason.

**Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table 2.5.

*** The fraction of sample analyses yielding detectable measurements (i.e. >3 standard deviations) is shown in parentheses.

NOTE:

(1) estuary water sample from the "special sample" categorydid not meet the required LLD for analysis. The MDA value was included in the "mean" of the above table, but not the "range". The achieved LLD in comparison to the required LLD is explained further in the "Sample Deviations" section of this report.

TABLE 5.2

ENVIRONMENTAL TLD DATA SUMMARY
MAINE YANKEE NUCLEAR POWER STATION, WISCASSET, ME
(JANUARY - DECEMBER 2005)
(μR/hr)

OUTER RING TLD'S INNER RING TLDs	(CONTROL TLD'S)	STATION WITH HIGHEST MEAN	
MEAN (RANGE) (NO. MEASUREMENTS)*	MEAN (RANGE) (NO. MEASUREMENTS)*	STA. NO.	MEAN (RANGE) (NO. MEASUREMENTS)*
10.14 (6.8 – 21.7) (64)	8.8 (7.8 – 10.9) (8)	TL-I-11	18.4 (14.2 – 21.7) (4)

* Each "measurement" is based on quarterly readings
NOTE: S.D. = standard deviation.

TABLE 5.3

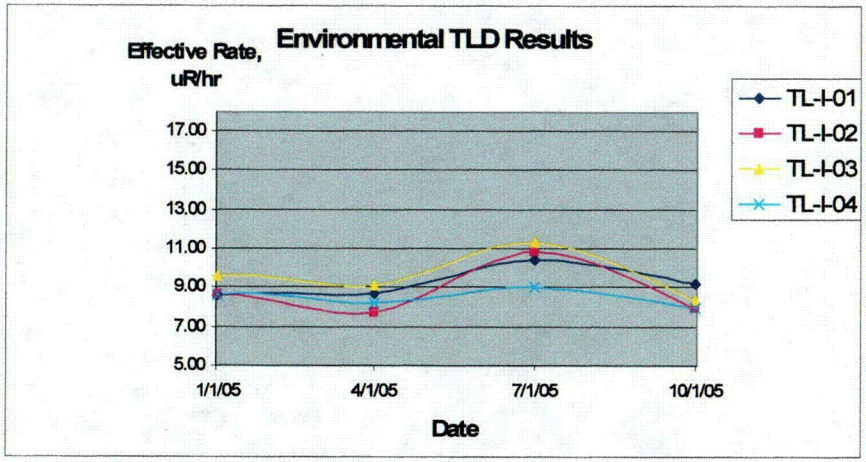
2005 Environmental TLD Measurements
(Micro-R per hour)

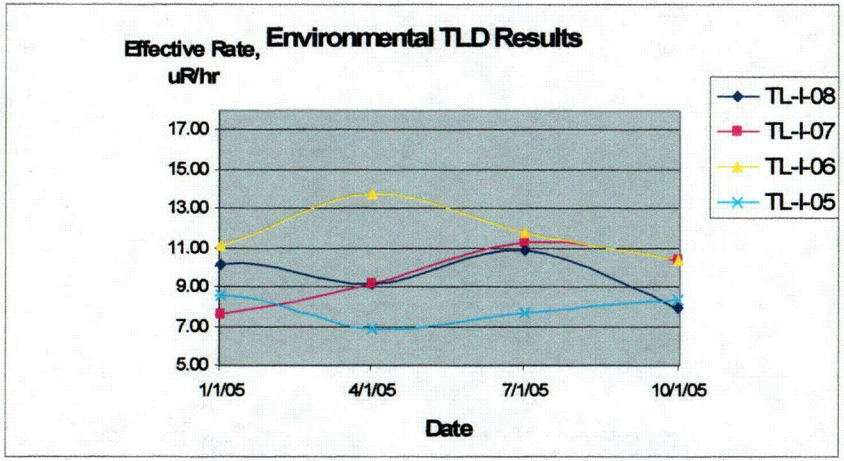
Sta. No.	Description	1st Quarter Exp.	1st Quarter S.D.	2nd Quarter Exp.	2nd Quarter S.D.	3rd Quarter Exp.	3rd Quarter S.D.	4th Quarter Exp.	4th Quarter S.D.	Annual Ave. Exp.
TL-I-01	N	8.6		8.7		10.4		9.2		9.2
TL-I-02	NNE	8.6		7.8		10.9		8.0		8.8
TL-I-03	NE	9.6		9.1		11.3		8.4		9.6
TL-I-04	ENE	8.6		8.2		9.1		8.0		8.5
TL-I-05	E	8.6		6.8		7.7		8.4		7.9
TL-I-06	ESE	11.1		13.7		11.8		10.4		11.7
TL-I-07	SE	7.6		9.1		11.3		10.4		9.6
TL-I-08	SSE	10.1		9.1		10.9		8.0		9.5
TL-I-09	S	13.1		12.8		13.6		10.4		12.5
TL-I-10	SSW	8.1		8.2		10.0		8.0		8.6
TL-I-11	SW	17.0		14.2		21.7		20.7		18.4
TL-I-12	WSW	7.6		8.7		9.1		8.8		8.5
TL-I-13	W	7.1		10.0		9.1		10.0		9.0
TL-I-14	WNW	10.6		9.6		10.4		10.0		10.1
TL-I-15	NW	9.1		10.5		11.8		9.6		10.2
TL-I-16	NNW	8.1		11.4		10.4		10.4		10.1
Control Stations										
TL-I-36	Boothbay Harbor	8.1		8.7		10.0		8.0		8.7
TL-I-38	Dresden Substation	7.8		8.7		10.9		8.4		8.9

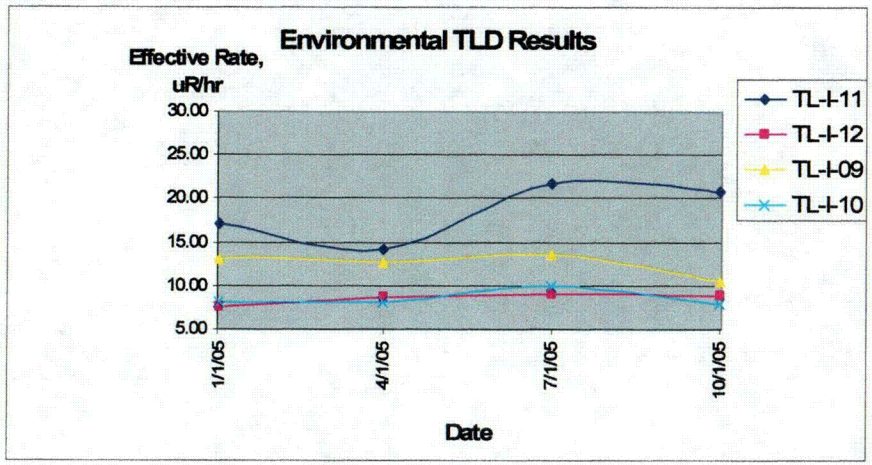
FIGURE 5.1

2005 Environmental TLD Measurements

(TL-I-1 THRU TL-I-16)







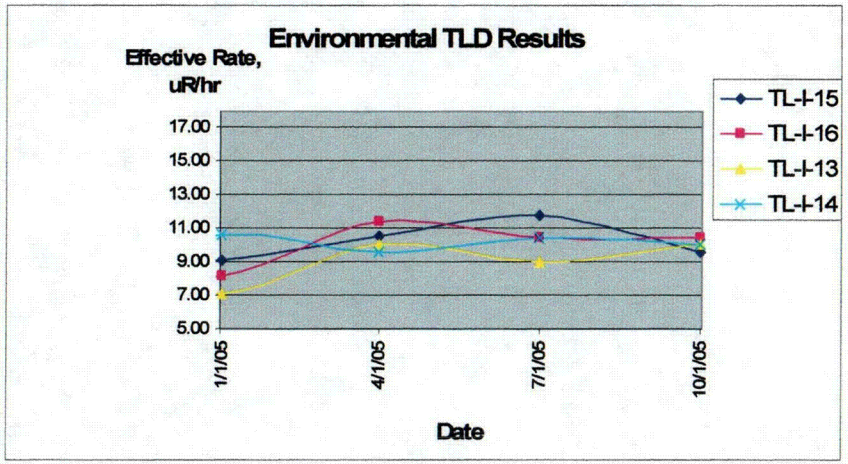


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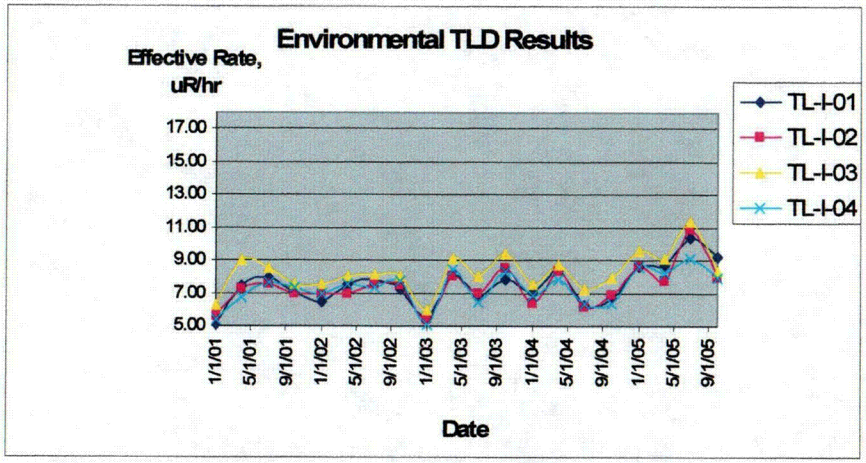
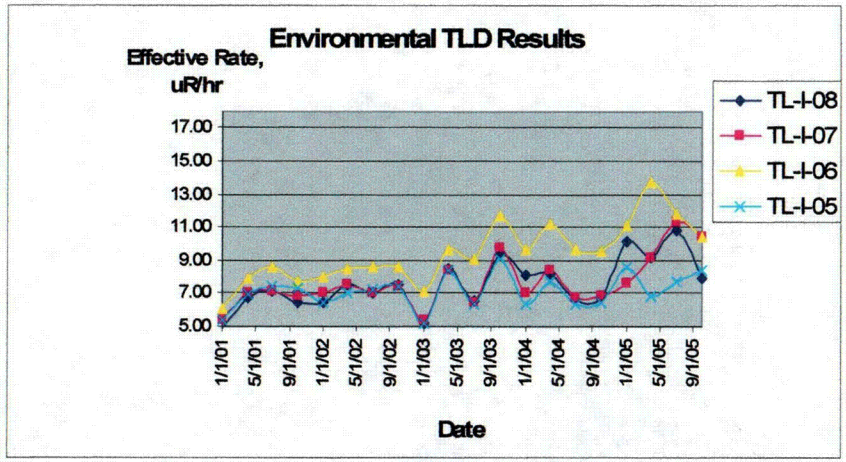
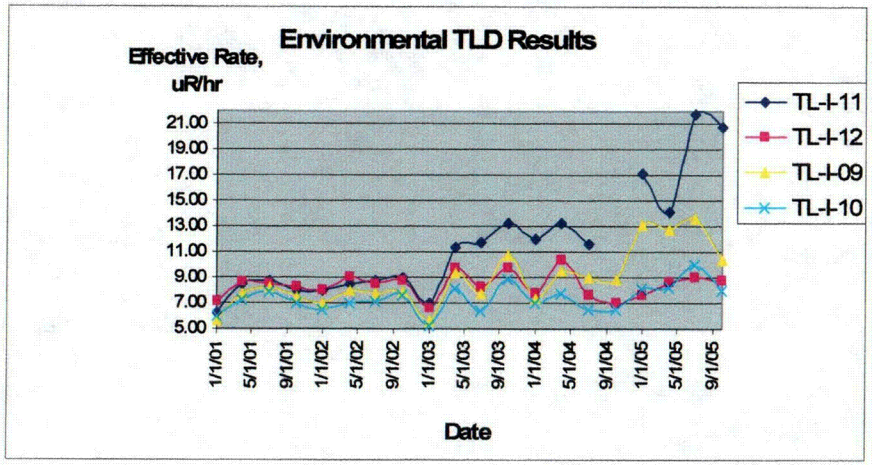
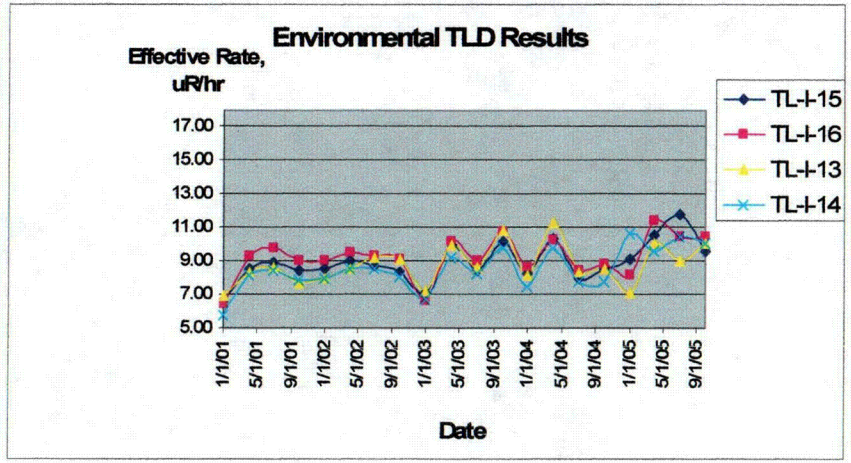
FIGURE 5.2

Historical Trend of ISFSI Environmental TLD Measurements
(Micro-R per hour)







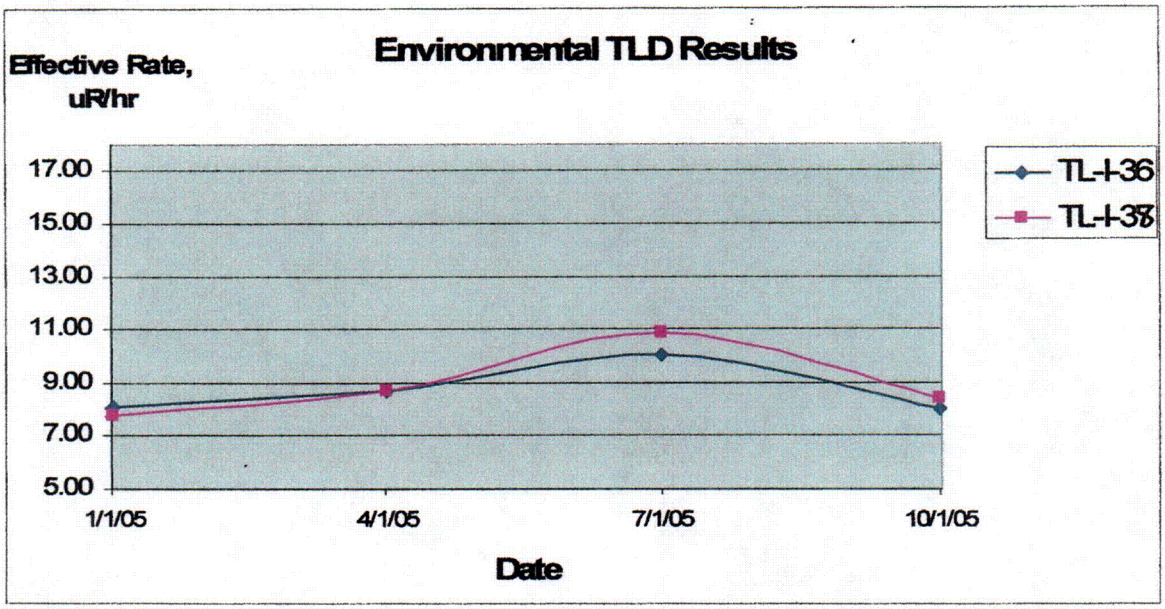


Background correction is not applied

FIGURE 5.3

2005 Environmental Control Location (Background)

TLD Measurements



C-03

6.0 ANALYSIS OF ENVIRONMENTAL RESULTS

6.1 Sampling Program Deviations

Table 2.3 of the Offsite Dose Calculation Manual (ODCM) allows for deviations in the REMP sampling schedule "if samples are unobtainable due to hazardous conditions, to seasonal unavailability or to malfunction of sampling equipment." Such deviations do not compromise the program's effectiveness and in fact are considered insignificant with respect to what is normally anticipated for any radiological environmental monitoring program.

No deviations of the ODCM sampling requirements occurred in the year 2005.

6.2 Comparison of Achieved LLDs with Requirements

Table 2.4 of the ODCM gives the required Lower Limits of Detection (LLDs) for environmental sample analyses. (This table is duplicated in Table 4.4 of this report.) Occasionally an LLD is not achievable due to a situation such as a low sample volume caused by sampling equipment malfunction. In such a case, ODCM Appendix C, Section 1 requires a discussion of the situation. The target LLD for any analysis at Maine Yankee was at minimum 10-15 percent of the most restrictive required LLD.

For each analysis having an LLD requirement in ODCM Table 2.4, the *a posteriori* (after the fact) LLD calculated for that analysis was compared with the required LLD. During 2005, over 700 analyses had an LLD requirement listed in Table 2.4. The following samples did not meet the required LLD:

- For the May 17th, 2005 estuary water sample at Outfall-018, the LLD for Co-60 (1.5 pCi/L), Cs-134 (1.5 pCi/L), and Cs-137 (1.8 pCi/L) was not met. The LLD was not achieved due to insufficient count time during sample analysis. As a result, the achieved LLD was a factor of 5 higher than the most restrictive required LLD (i.e. 80 pCi/L vs 15 pCi/L) However other sample locations (Outfall-019 and 018a) in close proximity to this sample location resulted in no detectable activity at the required LLD. Although this sample was not required by the ODCM, a discussion pertaining to the comparison of the required LLD is relevant.
- The LLD for Zr-95 was not met for any of the samples analyzed (20 pCi/L vs. 15).

6.3 Comparison of Results against Reporting Levels

Section 2.4.3.3 of the ODCM requires the notification of the NRC (via the Annual Radioactive Effluent Release Report) whenever a Reporting Level in ODCM Table 2.5 is exceeded. Reporting Levels are the environmental concentrations that relate to the ALARA design dose objectives of 10 CFR 50, Appendix I. It should be noted that environmental concentrations are averaged over calendar quarters for the purposes of this comparison, and that Reporting Levels apply only to measured levels of radioactivity due to effluents.

During 2005, no Reporting Levels were exceeded.

6.4 Data Analysis by Media Type

The 2005 REMP data for each media type is discussed below. Whenever a specific measurement result is presented, it is given as the concentration plus or minus one standard deviation. This standard deviation represents only the random uncertainty associated with the radioactive decay process (counting statistics), and not the propagation of all possible uncertainties in the analytical procedure. A sample is considered to yield a "detectable measurement" when the concentration exceeds three times its associated standard deviation.

6.4.1 Waterborne Pathways

6.4.1.1 Estuary Water

Although not specifically required by the ODCM, weekly grab samples were collected at the discharge point of Outfall-018 into Young's Brook as well as Outfall-019 and a natural drainage area just south of these locations, known as Outfall-18a in this report. These samples were collected in addition to the semi-annual estuary water sample collected at Outfall-018 in accordance with the REMP Table 5.1 shows that naturally-occurring K-40 was detected in samples collected at these locations, as is typical with estuary water. The samples were collected for gamma spectroscopy analysis. All concentrations are included in Table 5.1 regardless of whether they are considered "detectable" or "not detectable". When a activity is not detected, the LLD value is used for the sample concentration.

6.4.2 Direct Radiation Pathway

Direct radiation is continuously measured at 16 locations surrounding the Maine Yankee ISFSI using thermoluminescent dosimeters (TLDs). These dosimeters are collected every calendar quarter for readout at the dosimetry services vendor and compared against the (2) offsite control location dosimeters.

As can be seen in Table 5.3, there is a distinct annual cycle at both indicator and control locations. The lowest point of the cycle occurs during the winter months. This is due primarily to the attenuating effect of the snow cover on radon emissions and on direct irradiation by naturally-occurring radionuclides in the soil. Differing amounts of these naturally-occurring radionuclides in the underlying soil, rock or nearby building materials result in different radiation levels between one field site and another.

7.0 LAND USE CENSUS

Maine Yankee ODCM section 2.4.4 requires that a Land Use Census be conducted annually. The Census identifies the locations of the nearest milk animal, the nearest residence and the nearest garden of greater than 500 square feet producing fresh leafy vegetables in each of the 16 meteorological sectors within a distance of five miles of the plant. The annual Land Use Census was conducted during September of 2005.

Pursuant to Section 2.4.4 of the ODCM, a dosimetric analysis is performed, using site specific meteorological data, to determine which milk animal locations would provide the optimal sampling locations. If any location has twice the potential dose commitment of a currently-sampled location, the new location is added to the routine environmental sampling program in replacement of the location with the lowest calculated dose (which is eliminated from the program). For the 2005 Census, no such new milk animal location was identified. Consequently, no changes were made to the sampling program.

The results of the 2005 Land Use Census are included in this report in compliance with ODCM Section 2.4.4.3 and ODCM Appendix C, item 1. The locations identified during the Census may be found in Table 7.1.

TABLE 7.1

2005 LAND USE CENSUS LOCATIONS

SECTOR	NEAREST RESIDENCE km (miles)	NEAREST GARDEN km (miles)	NEAREST MILK ANIMAL km (miles)
N	1.26 (0.78)	1.86 (1.16)	*
NNE	2.23 (1.38)	2.40 (1.49)	2.7(1.7) (Cows)
NE	1.27 (0.79)	1.47 (0.91)	*
ENE	0.92 (0.57)	1.25 (0.78)	*
E	0.90 (0.56)	0.9 (0.56)	*
ESE	0.70 (0.43)	2.64 (1.64)	*
SE	0.70 (0.43)	0.9 (0.56)	*
SSE	0.9 (0.56)	0.9 (0.56)	*
S	1.7 (1.06)	1.7 (1.06)	*
SSW	3.0 (1.86)	5.0 (3.11)	*
SW	1.50 (0.93)	4.0 (2.48)	*
WSW	0.96 (0.60)	1.94 (1.20)	1.9 (1.2) (Cows)
W	0.81 (0.50)	2.71 (1.68)	*
WNW	1.90 (1.18)	1.87 (1.16)	*
NW	1.93 (1.20)	1.93 (1.20)	*
NNW	1.06 (0.66)	1.18 (0.73)	*

* No location was identified within 5 miles of the plant.

8.0 REFERENCES

1. USNRC Radiological Assessment Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program," Revision 1, November 1979.

2. NCRP Report No. 94, *Exposure of the Population in the United States and Canada from Natural Background Radiation*, National Council on Radiation Protection and Measurements, 1987.

3. *Ionizing Radiation: Sources and Biological Effects*, United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), 1982 Report to the General Assembly.

4. Kathren, Ronald L., *Radioactivity and the Environment - Sources, Distribution, and Surveillance*, Harwood Academic Publishers, New York, 1984.

5. NRC Generic Letter 89-01, Subject: Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program. Dated January 31, 1989.

6. USNRC Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977.