Joseph H. Plona
Site Vice President

6400 N. Dixie Highway, Newport, MI 48166
Tel: 734.586.5910 Fax: 734.586.4172

DTE Energy

10 CFR 50.90
10 CFR 50.82(a)(9)
10CFR50.71(e)

June 29, 2011
NRC-11-0036

U.S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, D.C. 20555

References:
1) Enrico Fermi Atomic Power Plant, Unit No. 1
NRC Docket No. 50-16
NRC License No. DPR-9

2) Detroit Edison Letter to NRC, "Proposed License Amendment License Termination Plan", NRC-09-0017, dated 03/25/2009

3) NUREG-1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions", 1998

Subject: Enrico Fermi Atomic Power Plant, Unit 1 License Termination Plan, Revision 4

Please find attached the revisions to the Fermi 1 License Termination Plan. Attached is the copy of the changed pages 1-7, 1-8, 2-1 through 2-6, 2-19 through 2-28, 2-31, 2-32, 2-35 through 2-64, 5-39, 5-40, 5-47 and 5-48 for Revision 4 to the Enrico Fermi Atomic Power Plant, Unit No. 1 License Termination Plan (LTP), which was submitted to the NRC for review in Reference 2. Revisions 1, 2, and 3 to the LTP have been previously submitted to the NRC under separate transmittals. The LTP revision incorporates the deletion of maintaining worker Total Effective Dose Equivalent (TEDE) to less than 1 Rem/year in Chapter 1, changes to the License Termination Characterization data, hydrogeological discussion, and background due to fallout in Chapter 2, updated Table of Contents for Chapter 2, and correction to Table 5-11 and Section 5.4.2.5.1.

The Chapter 1 revision change removing the 1 Rem/year TEDE criteria does not affect the commitment to maintain worker TEDE "As Low As Reasonably Achievable" (ALARA). The level of specificity of 1 Rem/year does not allow for special circumstances where dose extensions are necessary to complete decommissioning work; therefore the statement pertaining to worker TEDE of less than 1 Rem/year and the reference to Fermi 2 MRP03, "Personnel Radiation Monitoring" procedure will be deleted.

The revision to Chapter 2 of the LTP incorporates changes to the License Termination Characterization data to incorporate updated instrument efficiencies calculated since the initial characterization was performed using the methodology in NUREG-1507 (Reference 3) for calculating surface beta activity. The revision addresses the efficiency calculation converting counts per minute (cpm) to disintegrations per minute (dpm). Characterization data was reported by Final Status Survey instrumentation in counts per minute and remains unchanged.

Section 2.2, "Hydrogeological Investigations" is revised to incorporate the updated Site Conceptual Groundwater Model and additional information being separately submitted to the NRC.

Section 2.3.4, "Ambient and Background" is being revised to add information from the National Council on Radiation Protection & Measurements (NCRP) report on Cs-137 deposition from fallout and expected deposition in this region of the country.

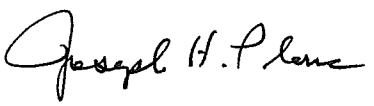
References to the NCRP report and the updated Site Conceptual Model are being added to Section 2.6 of the LTP.

A typographical error was corrected on page 2-28 and the Table of Contents in Section 2 was revised to reflect corrected page numbers.

A revision to Chapter 5 corrects Table 5-11 source-to-detector distance from inches to centimeters in accordance with NUREG-1507 Table 4.5, "Source-to-Detector Distance Effects for β Emitters" and Table 4.6, "Source-to-Detector Distance Effects for α Emitters". Although the proposed revision reflects distances measured in centimeters, the correct stand-off distances were used in calculating efficiencies for Characterization and Final Status Survey data. The revision to Chapter 5, Section 5.4.2.5.1 changes the detector-to-ground distance for SPA-3 open land scans from within 2.5 to 5 centimeters to ~6 cm or 2.5 in. to more accurately reflect the specifications in MARSSIM, Section 6.4.2.1.

Should you have any questions or require additional information, please contact Lynne Goodman, at (734) 586-1205.

Sincerely,



Joseph H. Plona
Site Vice President, Nuclear Generation

JHP/NT/can

Attachments (2)

cc: NRC Regional Administrator, Region III
T. Smith, NRC (Washington, D.C.)
NRC Resident Inspector- Fermi 2
P. Lee, NRC Region III
Michigan Department of Natural Resources & Environment
(yalek@michigan.gov)

I, Joseph H. Plona., do hereby affirm that the foregoing statements are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

Joseph H. Plona
Site Vice President, Nuclear Generation

On this 29th day of June, 2011 before me personally appeared Joseph H. Plona, being first duly sworn and says that he executed the foregoing as his free act and deed.

Notary Public

STACY OAKES
NOTARY PUBLIC, STATE OF MI
COUNTY OF MONROE
MY COMMISSION EXPIRES Jul 26, 2012
ACTING IN COUNTY OF MONROE

Enrico Fermi Atomic Power Plant, Unit No.1 LTP Revision 4 Replacement Pages

The listing below provides the replacement pages for Revision 4 of the LTP. The listing below only identifies the LTP pages that result in changes to pages from Revision 0 of the March 2009 LTP. The replacement pages are based on double-sided pages.

Chapter 1: Remove Revision 0, page 1-7 and page 1-8, and replace with page 1-7, revision 0 and page 1-8, revision 4.

Chapter 2:
Remove Revision 0, pages 2-1 through 2-6, and replace with page 2-1 through 2-5, revision 4 and page 2-6, revision 0.

Remove Revision 0, pages 2-19 through 2-28, and replace with page 2-19, revision 0, 2-20 through 2-24 revision 4, page 2-25 revision 0, pages 2-26 through 2-28 revision 4.

Remove Revision 0 pages 2-31 and 2-32, and replace with pages 2-31 and 2-32 revision 4.

Remove Revision 0 pages 2-35 through 2-64 and replace with pages 2-35 through 2-37 revision 4, page 2-38 revision 0, pages 2-39 through 2-41 revision 4, page 2-42 revision 0, page 2-43 revision 4, page 2-44 revision 0, pages 2-45 through 2-48 revision 4, page 2-49 revision 0, and pages 2-50 through 2-64 revision 4.

Chapter 3: None

Chapter 4: None

Chapter 5: Remove Revision 0, pages 5-39, 5-40, 5-47 and 5-48, and replace with pages 5-40 and 5-47 revision 0 and pages 5-39 and 5-48 revision 4.

Chapter 6: None

Chapter 7: None

Chapter 8: None

Glossary of Terms: None

Pointe Mouillee State Game Area is a 4,000 acre spit of land approximately 4 miles northeast of the Fermi 1 site at the northwest corner of Lake Erie, which jets into Lake Erie near the Huron River. It is owned by the Michigan Department of Natural Resources. Pointe Mouillee is one of the largest fresh water marsh restoration projects in the world, consisting of wetlands, diked marshes and river bayous. Most of Pointe Mouillee is open to public hunting.

Wm. C. Sterling State Park, the only Michigan state park on Lake Erie, consists of 1,300 acres of state-owned lands with recreational swimming, fishing, camping, hiking and wildlife viewing. Sterling State Park is approximately 5.2 miles southwest of the Fermi 1 site on Brest Bay. The bay sits just north of where the Raisin River spills into Lake Erie. The park is situated in Monroe County just south of Detroit Beach/Sandy Creek and north of the city of Monroe.

Bodies of Water: The Fermi 1 site sits on the western shore of Lake Erie. Lake Erie consists of 9,910 square miles of water surface area, 871 miles of shoreline. Lake Erie provides sport fishing, recreational boating, swimming, water skiing and scuba diving for the local and surrounding population. Lake Erie empties into the Niagara River and the Welland Canal.

Farms: Monroe County has an area of about 550 square miles of which approximately 70% is farmland. The majority of crops grown on the farms in the area are corn, winter wheat and soybeans.

Water Supplies: Currently potable water is supplied to the Fermi 1 complex from the Frenchtown public water supply. Chapter 8 of the LTP discusses water use and potential impact of decommissioning on water quality. Wells in the vicinity of EF1 are depicted in Figure 1-3.

Population: Monroe County, in which Fermi 1 is located, extends about 10 miles north, 25 miles west, and 20 miles south-west of the site and has a population of about 146,000. The only substantially populated communities within a 10 mile radius are Newport, which lies within Berlin Township, located approximately 3.5 miles away with a population of about 11,000 and Monroe (consisting of Frenchtown Township, the City of Monroe and Monroe Township) located approximately 8 miles away with a population of about 54,800. The closest residence to EF1 is located approximately 0.71 mile in a straight line.

1.4 Decommissioning Approach

1.4.1 Overview

The objective of decommissioning EF1 is to reduce the level of residual radioactivity to levels that permit unrestricted use of the site and allow for the termination of the 10 CFR Part 50 license. The EF1 license will be terminated with the buildings remaining. Decommissioning involves the systematic removal of Systems, Structures and Components that comprise the radioactive portions of the site. DTE conducts decommissioning activities in accordance with the EF1 10 CFR Part 50 license, approved work requests, and approved procedures.

Contaminated material may be released as non-contaminated material after decontamination, shipped to a licensed offsite processor for disposition, or shipped to an offsite low-level waste (LLW) disposal site (i.e., Clive Utah site). Qualified workers package LLW for transport and disposal in accordance with applicable NRC and Department of Transportation (DOT) regulatory requirements. EF1 continues to implement its Radiological Controls Program. The objectives of the Radiological Controls Program are to control radiation hazards, avoid accidental radiation exposures and maintain doses to workers and the public As Low As Reasonably Achievable (ALARA). The philosophies, policies, and objectives of the Radiological Controls Program are based on federal regulations and associated regulatory guidance. EF1's ALARA policy maintains management's commitment to control exposures to workers and the public ALARA. This commitment is contained in the F1SAR and is implemented by plant administrative procedures and Radiation Protection Department implementing procedures.

The integrated approach to decommissioning includes support from DTE employees and outside contractors, as required, to complete the project. The Decommissioning organization provides project management and has developed administrative work controls to implement decommissioning activities. The use of trained individuals, adherence to approved procedures and established institutional controls, will ensure that the risk to the public is minimal and risk to worker health and safety is minimized. Risks associated with the transportation of LLW are also minimal.

The environmental assessment, discussed in Chapter 8 of this LTP, determined that the environmental effects from decommissioning of EF1 are minimal, and there are no adverse effects outside the bounds of NUREG-0586 "Final Generic

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2.0 SITE CHARACTERIZATION

2.1 Historical Site Assessment Summary

2.1.1 Introduction

The Historical Site Assessment (HSA) describes the site's physical configuration, identifies the radioactive constituents of site contamination, assesses the migration of contaminants, identifies contaminated media and classifies impacted areas.

Detroit Edison (DECo) has conducted the HSA of its Fermi 1 (EF1) site in accordance with the guidance of NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," in support of the ultimate decommissioning and license termination of the facility. The HSA formally began in 2007, following several preliminary assessments of the impact of facility operations on the remediation required prior to the performance of the Final Status Survey(s) (FSS). These preliminary surveys were conducted beginning in 1997 with the meeting of previous employees followed by another meeting in 2002. An initial characterization survey was performed in 2004. The HSA was formally compiled in 2008. The purpose of the HSA is to document a comprehensive investigation identifying, collecting, organizing and evaluating historical information relevant to the EF1 site. The HSA focuses on open land areas and those structures that will remain at the time of final status survey.

The HSA consisted of a review of:

- License and Technical Specifications
  - Technical Specification Changes
  - License Amendments and Revisions
  - Fermi 1 Manual
  - F1SAR
- Original Plant Design
  - Function and purpose of systems and structures
  - Plant operating parameters
  - Plant operating procedures
  - PRDC Technical Information and Hazards Summary Report
- Original Plant Construction Drawings and Photographs
  - Specifications for systems and structures
  - Field Changes/as built drawings
  - Site Conditions
- Plant Operating History
  - Reports
  - Plant Operating Procedures Regarding Spills and Unplanned Releases
  - Shift Supervisor Logbooks
  - Radiological Environmental Monitoring Program and Golder Report on Groundwater Characterization
  - Monthly Plant Operational Reports

2.1.8.2 SGB-01 – Steam Generator Building

The Steam Generator Building is located south of the Reactor Building and north of the Detroit Edison turbine structure. The building housed the steam generators, secondary sodium pumps and piping components of the secondary coolant system. The equipment components were located at the operating floor at elevation 590'-0". The basement of the building housed the storage tanks and miscellaneous piping and equipment components of the Secondary Sodium Services System. The structure and equipment components were supported through a system of structural steel columns to a reinforced concrete base slab resting on bedrock. The basement floor of the building is divided into five sectors. An east-west concrete block firewall was installed the full length of the building extending between the basement floor and the operating floor. The remaining structure is of conventional design, that is, steel and corrugated asbestos walls.

Modes and vectors for transmigration of contaminants include:

- Movement or removal of radioactive material for shipment.
- Tritium in some residual sodium
- Movement into and out of the RRA of personnel and equipment at the RRA entrance from the Steam Generator Building.

Survey area SGB-01 has an area footprint of approximately 1527 square meters.

Characterization data from past surveys proved to be insufficient for FSS planning activities.

A Characterization effort was implemented on August 21, 2008 to include smears, scans and fixed-point measurements in SGB-01. An ambient correction[1] was achieved by taking shielded readings at five locations on each level and the Mean of those data was calculated for each fixed-point location. Smears indicated no smear result greater than MDA.

Table 2-5 represents the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated greater than background.

[1] Ambient readings were taken in structures to evaluate the gamma influence of the operation of Fermi 2 on the readings taken at EF1. A discussion of the methodology for taking the ambient readings is found in Section 2.3.4

Table 2-5
SGB-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
BASEMENT		1st FLOOR		2nd FLOOR	
CHAR-SGB-01-001-F-M	2445	CHAR-SGB-01-016-F-M	2874	CHAR-SGB-01-031-F-M	3697
CHAR-SGB-01-002-F-M	2590	CHAR-SGB-01-017-F-M	2599	CHAR-SGB-01-032-F-M	3520
CHAR-SGB-01-003-F-M	2603	CHAR-SGB-01-018-F-M	2893	CHAR-SGB-01-033-F-M	2255
CHAR-SGB-01-004-F-M	2806	CHAR-SGB-01-019-F-M	2854	CHAR-SGB-01-034-F-M	2137
CHAR-SGB-01-005-F-M	2563	CHAR-SGB-01-020-F-M	2972	CHAR-SGB-01-035-F-M	2288
CHAR-SGB-01-006-F-M	2491	CHAR-SGB-01-021-F-M	2854	CHAR-SGB-01-036-F-M	2117
CHAR-SGB-01-007-F-M	2426	CHAR-SGB-01-022-F-M	2723	CHAR-SGB-01-037-F-M	2052
CHAR-SGB-01-008-F-M	2353	CHAR-SGB-01-023-F-M	3234	CHAR-SGB-01-038-F-M	1901
CHAR-SGB-01-009-F-M	2740	CHAR-SGB-01-024-F-M	3024	CHAR-SGB-01-039-F-M	2150
CHAR-SGB-01-010-F-M	2616	CHAR-SGB-01-025-F-M	2697	CHAR-SGB-01-040-F-M	2537
CHAR-SGB-01-011-F-M	2649	CHAR-SGB-01-026-F-M	2906	CHAR-SGB-01-041-F-M	2209
CHAR-SGB-01-012-F-M	2609	CHAR-SGB-01-027-F-M	2906	CHAR-SGB-01-042-F-M	2124
CHAR-SGB-01-013-F-M	1672	CHAR-SGB-01-028-F-M	2946	CHAR-SGB-01-043-F-M	2550
CHAR-SGB-01-014-F-M	2694	CHAR-SGB-01-029-F-M	2546	CHAR-SGB-01-044-F-M	3081
CHAR-SGB-01-015-F-M	2360	CHAR-SGB-01-030-F-M	2684	CHAR-SGB-01-045-F-M	2603
Mean Ambient	2015	**Mean Ambient**	1203	**Mean Ambient**	1891
Ct. Mean	2508	**Ct. Mean**	2847	**Ct. Mean**	2482
Ct. Median	2590	**Ct. Median**	2874	**Ct. Median**	2255
Ct. Std. Dev.	266	**Ct. Std. Dev.**	176	**Ct. Std. Dev.**	542

F-M = Fixed measurement

Based on the fixed-point measurements the average measurements in SGB-01 were ~500 to 1650 dpm/100cm^2 greater than the ambient levels. These measurements are lower than the most restrictive radionuclide Derived Concentration Guideline Level (DCGL) present, (Co-60).

Based upon the findings of materials reviewed, personnel interviews and of data acquired during characterization, SGB-01 is classified as a Class 3 area.

2.1.8.3 CTB-01 – Control Building

This structure had, as its primary purpose, the protection of personnel working inside, from the elements of weather and radioactive streaming. In addition, it served as protection for the equipment installed to control the operation of the whole plant. In order for the shielding function to be performed, the walls adjacent to the Containment Building are 40 inch thick, reinforced concrete, and the roof was designed to eliminate the effect of sky shine on the control room located on the third floor of the building.

Modes and vectors for transmigration of contaminants include:

- Migration of contamination from the radwaste storage area on the 3rd level of the Turbine Building to the Control Building.

Survey area CTB-01 has an area footprint of approximately 2,075 square meters.

Characterization data from past surveys proved to be insufficient for FSS planning activities. A Characterization effort was implemented on August 11, 2008 to include smears, scans and fixed-point measurements in CTB-01. An ambient correction was achieved by taking shielded readings at five locations on each floor and the Mean of those data was calculated. Table 2-6 represents the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. Smears indicated no smear result greater than MDA. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated greater than background.

Table 2-6
CTB-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
1st FLOOR		2nd FLOOR		3rd FLOOR	
CHAR-CTB-01-001-F-M	2432	CHAR-CTB-01-016-F-M	2605	CHAR-CTB-01-031-F-M	2127
CHAR-CTB-01-002-F-M	2445	CHAR-CTB-01-017-F-M	2042	CHAR-CTB-01-032-F-M	1761
CHAR-CTB-01-003-F-M	2334	CHAR-CTB-01-018-F-M	1866	CHAR-CTB-01-033-F-M	1767
CHAR-CTB-01-004-F-M	1731	CHAR-CTB-01-019-F-M	1983	CHAR-CTB-01-034-F-M	1748
CHAR-CTB-01-005-F-M	2347	CHAR-CTB-01-020-F-M	1990	CHAR-CTB-01-035-F-M	1866
CHAR-CTB-01-006-F-M	2609	CHAR-CTB-01-021-F-M	1833	CHAR-CTB-01-036-F-M	2284
CHAR-CTB-01-007-F-M	2367	CHAR-CTB-01-022-F-M	2088	CHAR-CTB-01-037-F-M	1970
CHAR-CTB-01-008-F-M	2432	CHAR-CTB-01-023-F-M	1885	CHAR-CTB-01-038-F-M	1833
CHAR-CTB-01-009-F-M	2117	CHAR-CTB-01-024-F-M	1938	CHAR-CTB-01-039-F-M	2154
CHAR-CTB-01-010-F-M	2308	CHAR-CTB-01-025-F-M	1780	CHAR-CTB-01-040-F-M	1918
CHAR-CTB-01-011-F-M	2412	CHAR-CTB-01-026-F-M	1820	CHAR-CTB-01-041-F-M	1977
CHAR-CTB-01-012-F-M	2530	CHAR-CTB-01-027-F-M	1303	CHAR-CTB-01-042-F-M	1774
CHAR-CTB-01-013-F-M	2334	CHAR-CTB-01-028-F-M	1172	CHAR-CTB-01-043-F-M	1839
CHAR-CTB-01-014-F-M	2491	CHAR-CTB-01-029-F-M	2376	CHAR-CTB-01-044-F-M	1604
CHAR-CTB-01-015-F-M	2294	CHAR-CTB-01-030-F-M	2317	CHAR-CTB-01-045-F-M	1990
Mean Ambient	1798	Mean Ambient	1782	Mean Ambient	1746
Ct. Mean	2346	Ct. Mean	1933	Ct. Mean	1907
Ct. Median	2367	Ct. Median	1938	Ct. Median	1866
Ct. Std. Dev.	205	Ct. Std. Dev.	365	Ct. Std. Dev.	180

F-M = Fixed measurement

Fixed-point measurements were at or slightly above the ambient radiation levels in the building.

Based upon the findings of materials reviewed, personnel interviews and of data acquired during characterization, CTB-01 is classified as a Class 3 area.

2.1.8.4 TBN-01 – Turbine Building

Steam once produced in the three steam generators located within the Steam Generator Building passed to the adjacent Turbine Building and was used to operate the turbine. The turbine was a tandem-compound, single flow machine. Four stages of feed water heating were used. The turbine and support equipment, feedwater heaters, main condenser and associated piping and pumps are/were located in the Turbine Building. The Turbine Building is a steel frame structure which is tied together with standard riveted or bolted connections. Steel beams support the concrete or grating floors. The exterior walls consist of a 4-foot high apron wall constructed of 8-inch cinder block except in the region behind the transformer and the hydrogen storage platform, where reinforced concrete is used to provide a positive fire barrier. Non-insulated, corrugated, asbestos-cement siding which is fastened to steel channel girts that run the full height of the building is installed above the apron wall. Open web steel joists support the standard ribbed galvanized steel roof deck.

Modes and vectors for transmigration of contaminants include:

- Movement and storage of Radwaste on the 1st and 3rd floors of TBN-01.

Survey area TBN-01 has an area footprint of approximately 6235 square meters.

Characterization data from past surveys proved insufficient for FSS planning activities. A Characterization effort was implemented on August 13, 2008 to include smears, scans and fixed-point measurements in TBN-01. An ambient measurement was achieved by taking shielded readings at five locations on each floor and the Mean of those data was calculated. Tables 2-7 and 2-8 represent the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. Smears indicated no smear result greater than MDA. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated greater

than background. Gamma scans were performed in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated greater than background with the exception of the areas on the 3rd floor that were attributed to the presence of waste boxes awaiting shipment.

Table 2-7
TBN-01 Characterization Data (1st, 2nd & 3rd Floors)

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
1st FLOOR		2nd FLOOR		3rd FLOOR	
CHAR-TBN-01-001-F-M	2799	CHAR-TBN-01-016-F-M	2203	CHAR-TBN-01-031-F-M	2439
CHAR-TBN-01-002-F-M	2485	CHAR-TBN-01-017-F-M	2465	CHAR-TBN-01-032-F-M	2190
CHAR-TBN-01-003-F-M	2216	CHAR-TBN-01-018-F-M	2996	CHAR-TBN-01-033-F-M	2530
CHAR-TBN-01-004-F-M	2334	CHAR-TBN-01-019-F-M	2806	CHAR-TBN-01-034-F-M	2773
CHAR-TBN-01-005-F-M	2124	CHAR-TBN-01-020-F-M	2196	CHAR-TBN-01-035-F-M	2806
CHAR-TBN-01-006-F-M	2426	CHAR-TBN-01-021-F-M	2439	CHAR-TBN-01-036-F-M	2826
CHAR-TBN-01-007-F-M	2203	CHAR-TBN-01-022-F-M	2465	CHAR-TBN-01-037-F-M	2570
CHAR-TBN-01-008-F-M	2288	CHAR-TBN-01-023-F-M	2583	CHAR-TBN-01-038-F-M	2839
CHAR-TBN-01-009-F-M	2321	CHAR-TBN-01-024-F-M	2150	CHAR-TBN-01-039-F-M	3114
CHAR-TBN-01-010-F-M	2268	CHAR-TBN-01-025-F-M	3697	CHAR-TBN-01-040-F-M	3153
CHAR-TBN-01-011-F-M	1927	CHAR-TBN-01-026-F-M	3370	CHAR-TBN-01-041-F-M	2819
CHAR-TBN-01-012-F-M	2393	CHAR-TBN-01-027-F-M	2924	CHAR-TBN-01-042-F-M	2688
CHAR-TBN-01-013-F-M	2465	CHAR-TBN-01-028-F-M	2996	CHAR-TBN-01-043-F-M	2793
CHAR-TBN-01-014-F-M	2406	CHAR-TBN-01-029-F-M	1809	CHAR-TBN-01-044-F-M	2550
CHAR-TBN-01-015-F-M	2262	CHAR-TBN-01-030-F-M	1744	CHAR-TBN-01-045-F-M	2603
Mean Ambient	1648	**Mean Ambient**	1525	**Mean Ambient**	2213
Ct. Mean	2328	**Ct. Mean**	2590	**Ct. Mean**	2713
Ct. Median	2321	**Ct. Median**	2465	**Ct. Median**	2773
Ct. Std. Dev.	194	**Ct. Std. Dev.**	548	**Ct. Std. Dev.**	247

F-M = Fixed measurement

Table 2-8
TBN-01 Characterization Data (4th, 5th & 6th Floors)

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
4th FLOOR		5th FLOOR		6th FLOOR	
CHAR-TBN-01-046-F-M	2649	CHAR-TBN-01-061-F-M	3081	CHAR-TBN-01-076-F-M	3048
CHAR-TBN-01-047-F-M	2419	CHAR-TBN-01-062-F-M	3042	CHAR-TBN-01-077-F-M	2826
CHAR-TBN-01-048-F-M	2819	CHAR-TBN-01-063-F-M	2996	CHAR-TBN-01-078-F-M	2865
CHAR-TBN-01-049-F-M	2537	CHAR-TBN-01-064-F-M	2865	CHAR-TBN-01-079-F-M	3212
CHAR-TBN-01-050-F-M	2491	CHAR-TBN-01-065-F-M	3330	CHAR-TBN-01-080-F-M	2773
CHAR-TBN-01-051-F-M	2288	CHAR-TBN-01-066-F-M	3330	CHAR-TBN-01-081-F-M	2878
CHAR-TBN-01-052-F-M	2419	CHAR-TBN-01-067-F-M	3193	CHAR-TBN-01-082-F-M	2845
CHAR-TBN-01-053-F-M	2360	CHAR-TBN-01-068-F-M	3068	CHAR-TBN-01-083-F-M	2963
CHAR-TBN-01-054-F-M	2649	CHAR-TBN-01-069-F-M	2891	CHAR-TBN-01-084-F-M	3048
CHAR-TBN-01-055-F-M	2563	CHAR-TBN-01-070-F-M	3278	CHAR-TBN-01-085-F-M	2930
CHAR-TBN-01-056-F-M	2563	CHAR-TBN-01-071-F-M	3225	CHAR-TBN-01-086-F-M	3193
CHAR-TBN-01-057-F-M	2262	CHAR-TBN-01-072-F-M	2917	CHAR-TBN-01-087-F-M	3153
CHAR-TBN-01-058-F-M	2360	CHAR-TBN-01-073-F-M	3081	CHAR-TBN-01-088-F-M	3363
CHAR-TBN-01-059-F-M	2399	CHAR-TBN-01-074-F-M	3199	CHAR-TBN-01-089-F-M	2812
CHAR-TBN-01-060-F-M	2393	CHAR-TBN-01-075-F-M	2858	CHAR-TBN-01-090-F-M	3003
Mean Ambient	1766	**Mean Ambient**	1996	**Mean Ambient**	1976
Ct. Mean	2478	**Ct. Mean**	3090	**Ct. Mean**	2994
Ct. Median	2419	**Ct. Median**	3081	**Ct. Median**	2963
Ct. Std. Dev.	152	**Ct. Std. Dev.**	164	**Ct. Std. Dev.**	174

F-M = Fixed measurement

Fixed-point measurements were slightly above the ambient radiation levels in the building. Based upon the findings of information reviewed, personnel interviews and data acquired during characterization, TBN-01 is classified as a Class 3 area. The radwaste storage area on the 3rd floor and the rollup door area on the 1st floor are classified as Class 1 areas because of the presence of stored radwaste.

2.1.8.5 OFB-01 – Office Building

The Office Building is located on the west side of the Control Building and is outside the confines of the Controlled Area. This structure housed the offices, conference rooms and dining room for the project. The structure is of reinforced concrete and structural steel design. The outer walls are made of lightweight concrete block and the remainder of corrugated cement asbestos siding backed up by gypsum board and hard board.

Characterization data from past surveys proved insufficient for FSS planning activities. A Characterization effort was implemented on October 28, 2008 to include smears, scans and fixed-point measurements in OFB-01. This characterization was performed to the rigors of FSS so the data could be utilized for survey area release if the result supported the release. An ambient measurement was achieved by taking shielded readings at five locations on each floor and five locations on the roof; and the Mean of those data was calculated. Tables 2-9 and 2-10 represent the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. Smear results indicated no smear result greater than MDA. One-square meter beta scans were taken at each fixed-point location. No beta scan indicated results greater than background. Gamma scans were taken in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated results greater than background.

Table 2-9
OFB-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
1st FLOOR		1st FLOOR (Cont'd)	
CHAR-OFB-01-003-F-M	1211	CHAR-OFB-01-032-F-M	1656
CHAR-OFB-01-004-F-M	1316	CHAR-OFB-01-033-F-M	2972
CHAR-OFB-01-005-F-M	1892	CHAR-OFB-01-034-F-M	1826
CHAR-OFB-01-006-F-M	1211	CHAR-OFB-01-035-F-M	1708
CHAR-OFB-01-007-F-M	1578	CHAR-OFB-01-036-F-M	1558
CHAR-OFB-01-008-F-M	1519	CHAR-OFB-01-037-F-M	1623
CHAR-OFB-01-009-F-M	1466	CHAR-OFB-01-038-F-M	2232
CHAR-OFB-01-010-F-M	1362	CHAR-OFB-01-039-F-M	1538
CHAR-OFB-01-011-F-M	1735	CHAR-OFB-01-040-F-M	1630
CHAR-OFB-01-012-F-M	1532	CHAR-OFB-01-041-F-M	1951
CHAR-OFB-01-013-F-M	1512	CHAR-OFB-01-042-F-M	1434
CHAR-OFB-01-014-F-M	2612	CHAR-OFB-01-043-F-M	3129
CHAR-OFB-01-015-F-M	1303	CHAR-OFB-01-044-F-M	1839
CHAR-OFB-01-016-F-M	2232	CHAR-OFB-01-045-F-M	1375
CHAR-OFB-01-017-F-M	1636	CHAR-OFB-01-046-F-M	2010
CHAR-OFB-01-018-F-M	1918	CHAR-OFB-01-047-F-M	1244
CHAR-OFB-01-019-F-M	1918	CHAR-OFB-01-048-F-M	1257
CHAR-OFB-01-020-F-M	1460	CHAR-OFB-01-049-F-M	1617
CHAR-OFB-01-021-F-M	2736	CHAR-OFB-01-050-F-M	1571
CHAR-OFB-01-022-F-M	3037	CHAR-OFB-01-051-F-M	1525
CHAR-OFB-01-023-F-M	2121	CHAR-OFB-01-052-F-M	1892
CHAR-OFB-01-024-F-M	2396	CHAR-OFB-01-053-F-M	2121
CHAR-OFB-01-025-F-M	3090	CHAR-OFB-01-054-F-M	1669
CHAR-OFB-01-026-F-M	1852	CHAR-OFB-01-055-F-M	1722
CHAR-OFB-01-027-F-M	2494	CHAR-OFB-01-056-F-M	1708
CHAR-OFB-01-028-F-M	2088	CHAR-OFB-01-057-F-M	1682
CHAR-OFB-01-029-F-M	1676	CHAR-OFB-01-058-F-M	1434
CHAR-OFB-01-030-F-M	1283	CHAR-OFB-01-059-F-M	1532
CHAR-OFB-01-031-F-M	1257	CHAR-OFB-01-060-F-M	1918
		Mean Ambient	1664
		Ct. Mean	1807
		Ct. Median	1672
		Ct. Std. Dev.	487

F-M = Fixed measurement

Table 2-10
OFB-01 Characterization Data

Location	Result (dpm/100cm²)	Location	Result (dpm/100cm²)	Location	Result (dpm/100cm²)
2nd FLOOR		2nd FLOOR (Cont'd)		ROOF	
CHAR-OFB-01-001-F-M	1957	CHAR-OFB-01-018-F-M	2710	CHAR-OFB-01-001-F-M	2291
CHAR-OFB-01-002-F-M	2252	CHAR-OFB-01-019-F-M	2036	CHAR-OFB-01-002-F-M	2690
CHAR-OFB-01-003-F-M	1689	CHAR-OFB-01-020-F-M	1970	CHAR-OFB-01-003-F-M	2749
CHAR-OFB-01-004-F-M	1447	CHAR-OFB-01-021-F-M	1551	CHAR-OFB-01-004-F-M	2337
CHAR-OFB-01-005-F-M	2075	CHAR-OFB-01-022-F-M	1767	CHAR-OFB-01-005-F-M	3063
CHAR-OFB-01-006-F-M	2010	CHAR-OFB-01-023-F-M	1767	CHAR-OFB-01-006-F-M	3581
CHAR-OFB-01-007-F-M	2350	CHAR-OFB-01-024-F-M	1708	CHAR-OFB-01-007-F-M	3031
CHAR-OFB-01-008-F-M	1892	CHAR-OFB-01-025-F-M	1270	CHAR-OFB-01-008-F-M	2782
CHAR-OFB-01-009-F-M	2265	CHAR-OFB-01-026-F-M	1905	CHAR-OFB-01-009-F-M	3116
CHAR-OFB-01-010-F-M	1492	CHAR-OFB-01-027-F-M	2494	CHAR-OFB-01-010-F-M	2926
CHAR-OFB-01-011-F-M	1623	CHAR-OFB-01-028-F-M	1826		
CHAR-OFB-01-012-F-M	1656	CHAR-OFB-01-029-F-M	1879		
CHAR-OFB-01-013-F-M	2612	CHAR-OFB-01-030-F-M	1578		
CHAR-OFB-01-014-F-M	2180	CHAR-OFB-01-031-F-M	1872		
CHAR-OFB-01-015-F-M	2219	CHAR-OFB-01-032-F-M	1794		
CHAR-OFB-01-016-F-M	1708	CHAR-OFB-01-033-F-M	2527		
CHAR-OFB-01-017-F-M	1761				
		Mean Ambient	2129	**Mean Ambient**	2413
		Ct. Mean	1935	**Ct. Mean**	2857
		Ct. Median	1879	**Ct. Median**	2854
		Ct. Std. Dev.	349	**Ct. Std. Dev.**	381

F-M = Fixed measurement

Fixed-point measurements were at, slightly below or slightly above the ambient radiation levels in the office building.

Based upon the findings of information reviewed, personnel interviews and of data acquired during characterization, OFB-01 is classified as a Class 3 area. Based upon the result of the Data Quality Assessment (DQA) this characterization may be used as part of the FSS for this survey area.

2.1.8.6 NOL-01 – Open Land Area Inside the Controlled Area

Survey Area NOL-01 consists of the open land area inside the EF1 Controlled Area. Survey area NOL-01 contains about 2392 square meters of surface area made up of soils, asphalt, gravel and concrete.

NOL-01 is bounded by the Controlled Area fence and OOL-01 on the north and west and a portion of the eastern boundary. FRB-01 forms a

portion of the eastern boundary and NAB-01, IGB-01 form a portion of the western boundary. NOL-01 lies entirely within the open land Class 3 survey area OOL-01. Survey Area NOL-01 is designated a Class 2 area acting as a buffer between the Class 1 and Class 3 areas. Subsurface systems that traverse or connect within NOL-01 include:

- Health Physics/Chemistry Building drain system
- Underground vent ducts
- Waste gas lines
- Sump pump system

Survey area NOL-01 represents the secondary travel path for personnel and equipment entering and leaving EF1. NOL-01 included the primary travel path for personnel and equipment until approximately 10 years ago when the existing path was created. Systems present in survey area NOL-01 that may contain residual radioactivity are the Health Physics/Chemistry Building waste discharge, vent lines, gas lines and the FARB liquid discharge line. Contamination of survey area NOL-01 may have resulted from traffic of contaminated personnel, equipment and material.

Events and activities that may have contaminated survey area NOL-01 include:

- Leak in Waste Gas drain line (8/01/67).
- Leak in Waste Gas discharge line (4/30/68).
- Fire in the Reactor Building Basement (5/20/08).

Characterization data from past surveys proved insufficient for FSS planning activities. Few soil samples had been taken in this survey area and no samples were analyzed for HTD radionuclides.

Characterization plan EF1-CHAR-NOL-01 was implemented on June 25, 2008. Seventeen samples were collected with two split samples sent to an off-site lab to be analyzed for HTD radionuclides. Table 2-11 represents the sample results for NOL-01. Because of ambient levels associated with the operation of Fermi 2, gamma scans were not performed in survey area NOL-01 at the time of the characterization survey.

HTD radionuclides with the focus on Co-60, Cs-137, Sr-90 and H-3. Additional characterization was performed in September through October of 2008 to include smears, scans and fixed-point measurements on the operating floor (590' elevation) of RXB-01. An ambient correction was achieved by taking shielded readings at five locations around the inner annulus and operating floor (on the floor and up to 6 feet on the walls) and the Mean of those data was calculated. Table 2-12 provides a summary of the survey results for the fixed-point readings taken on the floors and walls during this survey effort. Smears were taken at each fixed-point location. Smears indicated no smear result greater than MDA. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated results greater than background.

Table 2-12
RXB-01-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
590' FLOOR		590' <6' WALLS		590' >6' WALLS	
CHAR-RXB-01-01-001-F-M	2163	CHAR-RXB-01-01-011-F-M	1259	CHAR-RXB-01-01-021-F-M	1200
CHAR-RXB-01-01-002-F-M	2098	CHAR-RXB-01-01-012-F-M	1156	CHAR-RXB-01-01-022-F-M	1600
CHAR-RXB-01-01-003-F-M	7237	CHAR-RXB-01-01-013-F-M	1207	CHAR-RXB-01-01-023-F-M	1403
CHAR-RXB-01-01-004-F-M	2285	CHAR-RXB-01-01-014-F-M	1194	CHAR-RXB-01-01-024-F-M	1305
CHAR-RXB-01-01-005-F-M	1821	CHAR-RXB-01-01-015-F-M	1369	CHAR-RXB-01-01-025-F-M	1265
CHAR-RXB-01-01-006-F-M	3151	CHAR-RXB-01-01-016-F-M	1311	CHAR-RXB-01-01-026-F-M	1527
CHAR-RXB-01-01-007-F-M	2544	CHAR-RXB-01-01-017-F-M	1291	CHAR-RXB-01-01-027-F-M	1718
CHAR-RXB-01-01-008-F-M	2460	CHAR-RXB-01-01-018-F-M	1091	CHAR-RXB-01-01-028-F-M	1514
CHAR-RXB-01-01-009-F-M	2214	CHAR-RXB-01-01-019-F-M	1149	CHAR-RXB-01-01-029-F-M	1554
CHAR-RXB-01-01-010-F-M	2402	CHAR-RXB-01-01-020-F-M	1394	CHAR-RXB-01-01-030-F-M	1560
				CHAR-RXB-01-01-031-F-M	1318
				CHAR-RXB-01-01-032-F-M	1475
				CHAR-RXB-01-01-033-F-M	1390
				CHAR-RXB-01-01-034-F-M	1580
				CHAR-RXB-01-01-035-F-M	1737
Mean Ambient	1814	Mean Ambient	1814	Mean Ambient	1767
Ct. Mean	2837	Ct. Mean	1242	Ct. Mean	1476
Ct. Median	2344	Ct. Median	1233	Ct. Median	1514
Ct. Std. Dev.	1585	Ct. Std. Dev.	99	Ct. Std. Dev.	160

F-M = Fixed measurement

Characterization plan EF1-CHAR-RXB-01-02 was implemented on October 20, 2008 to survey the reactor building 552' elevation annulus. Table 2-13 provides a summary of the survey results for the fixed-point readings taken on the floors and walls during this survey effort. Smears were taken at each fixed-point location. Smears indicated no smear result greater than MDA. One-square meter beta scans were performed

at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated results greater than background.

Table 2-13
RXB-01-02 Characterization Data

Location	Result (dpm/100cm^2)
ANNULUS	
CHAR-RXB-01-02-001-F-M	2098
CHAR-RXB-01-02-002-F-M	846
CHAR-RXB-01-02-003-F-M	2163
CHAR-RXB-01-02-004-F-M	983
CHAR-RXB-01-02-005-F-M	2727
CHAR-RXB-01-02-006-F-M	2622
CHAR-RXB-01-02-007-F-M	2432
CHAR-RXB-01-02-008-F-M	2353
CHAR-RXB-01-02-009-F-M	1121
CHAR-RXB-01-02-010-F-M	1842
CHAR-RXB-01-02-011-F-M	1311
CHAR-RXB-01-02-012-F-M	1101
CHAR-RXB-01-02-013-F-M	1724
CHAR-RXB-01-02-014-F-M	1010
CHAR-RXB-01-02-015-F-M	1731
Mean Ambient	1042
Ct. Mean	1738
Ct. Median	1731
Ct. Std. Dev.	644

F-M = Fixed measurement

Fixed-point measurements were at, slightly above or below the ambient radiation levels in the floor areas and walls to a height of 6 feet on the 590' elevation, however, since considerable decommissioning work has yet to be completed (reactor vessel removal) the basement, floor and walls up to a height of 6' on the 590' elevation remain Class 1 areas. The fixed-point readings on the walls 6' and above on the 590' elevation were at approximately ambient levels and therefore are classified as Class 2 areas. Characterization survey performed in the reactor annulus provided data at approximately ambient levels. Therefore, the results show the annulus was minimally impacted during operations and decommissioning activities. The reactor building 552' annulus is classified as a Class 3 area.

2.1.8.8 FRB-01 – Fuel and Repair Building (FARB)

Table 2-14
FRB-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
MAINTENANCE PIT		590' <6' FLOORS AND WALLS	
CHAR-FRB-01-001-F-M	2169	CHAR-FRB-01-016-F-M	4458
CHAR-FRB-01-002-F-M	9038	CHAR-FRB-01-017-F-M	3711
CHAR-FRB-01-003-F-M	2118	CHAR-FRB-01-018-F-M	4904
CHAR-FRB-01-004-F-M	3357	CHAR-FRB-01-019-F-M	2583
CHAR-FRB-01-005-F-M	2137	CHAR-FRB-01-020-F-M	3081
CHAR-FRB-01-006-F-M	3906	CHAR-FRB-01-021-F-M	2747
CHAR-FRB-01-007-F-M	2182	CHAR-FRB-01-022-F-M	3901
CHAR-FRB-01-008-F-M	3506	CHAR-FRB-01-023-F-M	2845
CHAR-FRB-01-009-F-M	2260	CHAR-FRB-01-024-F-M	2871
CHAR-FRB-01-010-F-M	2750	CHAR-FRB-01-025-F-M	2655
CHAR-FRB-01-011-F-M	1930	CHAR-FRB-01-026-F-M	2176
CHAR-FRB-01-012-F-M	2569	CHAR-FRB-01-027-F-M	3081
CHAR-FRB-01-013-F-M	1976	CHAR-FRB-01-028-F-M	2406
CHAR-FRB-01-014-F-M	2473	CHAR-FRB-01-029-F-M	3219
CHAR-FRB-01-015-F-M	1846	CHAR-FRB-01-030-F-M	8713
Mean Ambient	1246	**Mean Ambient**	3443
Ct. Mean	2948	**Ct. Mean**	3557
Ct. Median	2260	**Ct. Median**	3081
Ct. Std. Dev.	1795	**Ct. Std. Dev.**	1616
MEZZANINE		**590' >6' WALLS**	
CHAR-FRB-01-031-F-M	3912	CHAR-FRB-01-046-F-M	2557
CHAR-FRB-01-032-F-M	4545	CHAR-FRB-01-047-F-M	2616
CHAR-FRB-01-033-F-M	5171	CHAR-FRB-01-048-F-M	3625
CHAR-FRB-01-034-F-M	4132	CHAR-FRB-01-049-F-M	3186
CHAR-FRB-01-035-F-M	3874	CHAR-FRB-01-050-F-M	2773
CHAR-FRB-01-036-F-M	2931	CHAR-FRB-01-051-F-M	2753
CHAR-FRB-01-037-F-M	3719	CHAR-FRB-01-052-F-M	4943
CHAR-FRB-01-038-F-M	3958	CHAR-FRB-01-053-F-M	4268
CHAR-FRB-01-039-F-M	6082	CHAR-FRB-01-054-F-M	8116
CHAR-FRB-01-040-F-M	3757	CHAR-FRB-01-055-F-M	5546
CHAR-FRB-01-041-F-M	5952	CHAR-FRB-01-056-F-M	2163
CHAR-FRB-01-042-F-M	10420	CHAR-FRB-01-057-F-M	2596
CHAR-FRB-01-043-F-M	6178	CHAR-FRB-01-058-F-M	3193
CHAR-FRB-01-044-F-M	4506	CHAR-FRB-01-059-F-M	2393
CHAR-FRB-01-045-F-M	3583	CHAR-FRB-01-060-F-M	2445
Mean Ambient	3769	**Mean Ambient**	3443
Ct. Mean	4848	**Ct. Mean**	3545
Ct. Median	4132	**Ct. Median**	2773
Ct. Std. Dev.	1827	**Ct. Std. Dev.**	1605

F-M = Fixed measurement

Based upon the information reviewed, personnel interviews and data acquired during characterization, the classifications of FRB-01 are as follows:

1. The floor and walls of the decay and cut-up pools are Class 1 areas.
2. The floors, walls and ceiling of the transfer tank room and steam cleaning chamber are Class 1 areas.
3. The floors and walls, up to a height of 6 feet, in all other areas of FRB-01 are Class 1 areas.
4. The walls greater than 6 feet in the areas referenced in #3 are Class 2 areas.

2.1.8.9 TRW-01 – Trestle way

The trestle way is located to the north and adjacent to the Reactor Building and functioned as a connection between the Reactor Building and the FARB. The substructure consists of reinforced concrete. The superstructure consists of structural steel with corrugated asbestos siding and a corrugated steel roof. The fuel transport machine, or cask car, unloaded irradiated fuel from the reactor via the transfer rotor, transported the irradiated fuel in finned pots from the Reactor Building to the FARB via the trestle way and unloaded the pots into the transfer tank rotor.

Modes and vectors for transmigration of contaminants include:

- Transport of radioactive material associated with decommissioning of the trestle way and adjacent buildings.
- Sodium fire that occurred on May 20th 2008 in the basement of the Reactor Building.
- Minor leaks in the Trestle way which occurred at unknown dates during operation.

Characterization data from past surveys proved insufficient for FSS planning activities.

A Characterization effort was implemented on September 15, 2008 to include smears, scans and fixed-point measurements in TRW-01. An ambient correction was achieved by taking shielded readings at five locations in the Trestle way, and the Mean of the data was calculated. Table 2-15 represents the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. Smears indicated no result greater than MDA. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan

indicated results greater than background. There is a section of the TRW-01 where there is contamination that is painted over. This section will require the paint removed and that area surveyed.

Table 2-15
TRW-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
CHAR-TRW-01-001-F-M	3841	CHAR-TRW-01-013-F-M	2976
CHAR-TRW-01-002-F-M	3564	CHAR-TRW-01-014-F-M	2085
CHAR-TRW-01-003-F-M	2944	CHAR-TRW-01-015-F-M	2208
CHAR-TRW-01-004-F-M	4151	CHAR-TRW-01-016-F-M	2092
CHAR-TRW-01-005-F-M	3441	CHAR-TRW-01-017-F-M	2130
CHAR-TRW-01-006-F-M	3467	CHAR-TRW-01-018-F-M	2253
CHAR-TRW-01-007-F-M	3054	CHAR-TRW-01-019-F-M	2479
CHAR-TRW-01-008-F-M	2950	CHAR-TRW-01-020-F-M	2531
CHAR-TRW-01-009-F-M	3654	CHAR-TRW-01-021-F-M	2195
CHAR-TRW-01-010-F-M	3467	CHAR-TRW-01-022-F-M	2692
CHAR-TRW-01-011-F-M	3990	CHAR-TRW-01-023-F-M	3499
CHAR-TRW-01-012-F-M	4435	CHAR-TRW-01-024-F-M	6004
		Mean Ambient	1713
		Ct. Mean	3171
		Ct. Median	3015
		Ct. Std. Dev.	929

F-M = Fixed measurement

Based on the information reviewed, personnel interviews and data acquired during characterization, the floors and walls up to a height of 6 feet are Class 1 areas and the walls greater than 6 feet are Class 2 areas.

2.1.8.10 NAB-01 – Sodium Building

The Sodium Building is adjacent to the Reactor Building and is connected by an underground concrete tunnel. The Sodium Building housed the equipment used for storing and purifying the primary sodium. The Sodium Building, Waste Gas Building and the Inert Gas Building form one structural complex. The Sodium Building is divided into four sections:

1. The primary sodium storage tank room is a concrete structure comprised of 30 inch thick cast concrete walls and a 30 inch thick combination pre-cast and poured concrete roof. The room contains the three 15,000 gallon primary sodium storage tanks.

2. The cold trap room has 6-foot thick external concrete walls as well as a 6-foot thick concrete ceiling. Additionally, the cell has a 4-foot thick internal wall separating it from the storage tank room. This room contained the equipment necessary to determine and maintain the purity of the primary sodium.

3. The sodium-potassium (NaK) room is comprised of reinforced concrete floor, walls and ceiling and access is provided via a steel door located in the west wall of the room and a stairway on the east side. The NaK room contained the ventilation equipment and the air-to-NaK heat exchanger equipment for the cold trap.

4. The valve control room occupies the second story region of the Sodium Building and is constructed of concrete block walls and a steel roof deck structure. The valve control room contained the sodium service hand wheels and motors for the valves, electric panels supporting the induction heating for the piping, and the control panel.

Additionally, the mezzanine level and secondary portion of the Inert Gas Building are covered in this section since they are open to the Sodium Building areas and are separate from the Inert Gas Tank Room

Survey area NAB-01 has an area footprint of approximately 1,116 square meters.

Modes and vectors for transmigration of contaminants include:

- Transport of radioactive material associated with decommissioning of the Sodium Building.
- Processing activities performed in the cold trap room.

Characterization data from past surveys proved insufficient for FSS planning activities.

A Characterization effort was implemented on September 23, 2008 to include smears, scans and fixed-point measurements in NAB-01. An ambient correction was achieved by taking shielded readings at five locations in each room and the Mean of those data was calculated. Tables 2-16 and 2-17 represent the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. Smears indicated no result greater than MDA. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in the general areas (except

the tank room) as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated results greater than background.

Because of ambient levels associated with the sodium storage tanks, gamma scan surveys were not performed in the tank room at the time of the characterization survey.

Table 2-16
NAB-01 Characterization Data

Location	Result (dpm/100cm²)	Location	Result (dpm/100cm²)	Location	Result (dpm/100cm²)
TANK ROOM		NaK ROOM		VALVE ROOM	
CHAR-NAB-01-001-F-M	2767	CHAR-NAB-01-021-F-M	3586	CHAR-NAB-01-041-F-M	3331
CHAR-NAB-01-002-F-M	9093	CHAR-NAB-01-022-F-M	5389	CHAR-NAB-01-042-F-M	2912
CHAR-NAB-01-003-F-M	8450	CHAR-NAB-01-023-F-M	2708	CHAR-NAB-01-043-F-M	3202
CHAR-NAB-01-004-F-M	10528	CHAR-NAB-01-024-F-M	3219	CHAR-NAB-01-044-F-M	3170
CHAR-NAB-01-005-F-M	7683	CHAR-NAB-01-025-F-M	2399	CHAR-NAB-01-045-F-M	3092
CHAR-NAB-01-006-F-M	30890	CHAR-NAB-01-026-F-M	2432	CHAR-NAB-01-046-F-M	2925
CHAR-NAB-01-007-F-M	16370	CHAR-NAB-01-027-F-M	3566	CHAR-NAB-01-047-F-M	2860
CHAR-NAB-01-008-F-M	40750	CHAR-NAB-01-028-F-M	4366	CHAR-NAB-01-048-F-M	3176
CHAR-NAB-01-009-F-M	13374	CHAR-NAB-01-029-F-M	2537	CHAR-NAB-01-049-F-M	3041
CHAR-NAB-01-010-F-M	23653	CHAR-NAB-01-030-F-M	2314	CHAR-NAB-01-050-F-M	3176
CHAR-NAB-01-011-F-M	11958	CHAR-NAB-01-031-F-M	2039	CHAR-NAB-01-051-F-M	3254
CHAR-NAB-01-012-F-M	35335	CHAR-NAB-01-032-F-M	3062	CHAR-NAB-01-052-F-M	2963
CHAR-NAB-01-013-F-M	12508	CHAR-NAB-01-033-F-M	2380	CHAR-NAB-01-053-F-M	2214
CHAR-NAB-01-014-F-M	20513	CHAR-NAB-01-034-F-M	2662	CHAR-NAB-01-054-F-M	2440
CHAR-NAB-01-015-F-M	13557	CHAR-NAB-01-035-F-M	2471	CHAR-NAB-01-055-F-M	2453
CHAR-NAB-01-016-F-M	27999	CHAR-NAB-01-036-F-M	2196	CHAR-NAB-01-056-F-M	2163
CHAR-NAB-01-017-F-M	13610	CHAR-NAB-01-037-F-M	2353	CHAR-NAB-01-057-F-M	2234
CHAR-NAB-01-018-F-M	34562	CHAR-NAB-01-038-F-M	3370	CHAR-NAB-01-058-F-M	1737
CHAR-NAB-01-019-F-M	9991	CHAR-NAB-01-039-F-M	2471	CHAR-NAB-01-059-F-M	2350
CHAR-NAB-01-020-F-M	9912	CHAR-NAB-01-040-F-M	2839	CHAR-NAB-01-060-F-M	2879
Mean Ambient	11112	**Mean Ambient**	2040	**Mean Ambient**	2138
Ct. Mean	17675	**Ct. Mean**	2918	**Ct. Mean**	2779
Ct. Median	13465	**Ct. Median**	2599	**Ct. Median**	2918
Ct. Std. Dev.	10807	**Ct. Std. Dev.**	821	**Ct. Std. Dev.**	454

F-M = Fixed measurement

Table 2-17
NAB-01 Characterization Data (Mezzanine)

Location	Result (dpm/100cm^2)
MEZZANINE	
CHAR-NAB-01-061-F-M	2649
CHAR-NAB-01-062-F-M	2878
CHAR-NAB-01-063-F-M	2681
CHAR-NAB-01-064-F-M	2629
CHAR-NAB-01-065-F-M	2688
CHAR-NAB-01-066-F-M	2727
CHAR-NAB-01-067-F-M	2386
CHAR-NAB-01-068-F-M	2327
CHAR-NAB-01-069-F-M	2550
CHAR-NAB-01-070-F-M	2314
Mean Ambient	1724
Ct. Mean	2583
Ct. Median	2639
Ct. Std. Dev.	186

F-M = Fixed measurement

The cold trap room is still posted as a contaminated area and has a great deal of equipment removal left, therefore the cold trap room has not been surveyed. Therefore, based upon the information reviewed, personnel interviews and data acquired during characterization the classifications for NAB-01 are as follows:

1. The cold trap room and also the storage tank room are classified as Class 1.

2. The valve room, NaK room and the mezzanine are classified as Class 2.

2.1.8.11 VNB-01 – Ventilation Building

The Ventilation Building consists of a steel reinforced concrete floor with concrete block walls. The roof consists of a structural steel framework covered by corrugated steel. The Ventilation Building housed equipment for the Reactor Building Ventilation System including the supply and exhaust blowers, valves for water supply to the under floor cooling heat exchangers, a control panel, Freon refrigeration equipment for above floor cooling, and space for future equipment additions, such as dehumidifiers. The restricted area fence has been modified to extend past the east doors of the building.

Modes and vectors for transmigration of contaminants include:

- Transport of radioactive material associated with decommissioning of the adjoining structures.
- Sodium fire that occurred on May 20th 2008 in the basement of the Reactor Building.

Characterization data from past surveys proved insufficient for FSS planning activities.

A Characterization effort was implemented on September 16, 2008 to include smears, scans and fixed-point measurements in VNB-01. An ambient correction was achieved by taking shielded readings at five locations within the survey area and the Mean of those data was calculated. Table 2-18 represent the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. Smears indicated no result greater than MDA. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated results greater than background.

Table 2-18
VNB-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
CHAR-VNB-01-001-F-M	2609	CHAR-VNB-01-011-F-M	2026
CHAR-VNB-01-002-F-M	1947	CHAR-VNB-01-012-F-M	2537
CHAR-VNB-01-003-F-M	3035	CHAR-VNB-01-013-F-M	3153
CHAR-VNB-01-004-F-M	2406	CHAR-VNB-01-014-F-M	2708
CHAR-VNB-01-005-F-M	2649	CHAR-VNB-01-015-F-M	2104
CHAR-VNB-01-006-F-M	2288	CHAR-VNB-01-016-F-M	2249
CHAR-VNB-01-007-F-M	2190	CHAR-VNB-01-017-F-M	1986
CHAR-VNB-01-008-F-M	1967	CHAR-VNB-01-018-F-M	2865
CHAR-VNB-01-009-F-M	2609	CHAR-VNB-01-019-F-M	2563
CHAR-VNB-01-010-F-M	2065	CHAR-VNB-01-020-F-M	2485
		Mean Ambient	2005
		Ct. Mean	2422
		Ct. Median	2445
		Ct. Std. Dev.	360

F-M = Fixed measurement

Based upon information reviewed, personnel interviews and data acquired during characterization the floor

and walls up to a height of 6 feet are Class 1. The walls above 6 feet are Class 2.

2.1.8.12 NAT-01 – Sodium Tunnel

The Sodium Tunnel consists of a subsurface reinforced concrete structure lined with a ¼" thick carbon steel plate. The tunnel runs from the northwest corner of the Reactor Building annulus to the Cold Trap Room of the Sodium Building. The structure contained some of the primary sodium service system piping and was heated by a 60 cycle induction heating system replacing heat losses when the piping was at 400 degrees Fahrenheit with a 100 degree Fahrenheit ambient temperature. Access to this tunnel is via one of two manholes located between the Cold Trap Room and the Trestleway.

The area of the footprint of NAT-01 is approximately 50 square meters.

Modes and vectors for transmigration of contaminants include:

- Any contamination encountered during the removal or modification of piping within NAT-01.

Characterization data from past surveys proved insufficient for FSS planning activities.

A Characterization effort was implemented on October 6, 2008 to include smears, scans and fixed-point measurements in NAT-01. An ambient correction was achieved by taking shielded readings at five locations in the sodium tunnel and the Mean of those data was calculated. Table 2-19 represent the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. Smears indicated no result greater than MDA. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated results greater than background.

Table 2-19
NAT-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
CHAR-NAT-01-001-F-M	4877	CHAR-NAT-01-011-F-M	9603
CHAR-NAT-01-002-F-M	2860	CHAR-NAT-01-012-F-M	7534
CHAR-NAT-01-003-F-M	2906	CHAR-NAT-01-013-F-M	8359
CHAR-NAT-01-004-F-M	1977	CHAR-NAT-01-014-F-M	3594
CHAR-NAT-01-005-F-M	1591	CHAR-NAT-01-015-F-M	6212
CHAR-NAT-01-006-F-M	1139	CHAR-NAT-01-016-F-M	3600
CHAR-NAT-01-007-F-M	4039	CHAR-NAT-01-017-F-M	6736
CHAR-NAT-01-008-F-M	6408	CHAR-NAT-01-018-F-M	3155
CHAR-NAT-01-009-F-M	4680	CHAR-NAT-01-019-F-M	6264
CHAR-NAT-01-010-F-M	2906	CHAR-NAT-01-020-F-M	3338
		Mean Ambient	5365
		Ct. Mean	4589
		Ct. Median	3819
		Ct. Std. Dev.	2337

F-M = Fixed measurement

As a result of historical information, decommissioning activities performed and planned, and characterization data, NAT-01 is classified as a Class 2 area.

2.1.8.13 ESG-01 – East Sodium Gallery

The east sodium gallery consists of three chambers (North, Center and South) which held the secondary sodium lines. Access to the three east sodium gallery chambers is via horizontal steel doors just above ground level. The east sodium gallery's walls and base slab are of conventional reinforced concrete construction resting on concrete filled pilasters. The roof is constructed of an 8 inch thick precast concrete slab covered with a 10 inch thick concrete layer all of which is beneath approximately 5 feet of earth. Included in this area is the Fission Product Detector (FPD) Building. The FPD building is located due east of the reactor building, directly above the East Sodium gallery (north chamber). This is a small partially buried room; a portion of it below ground level, which contained the gaseous fission product detector and piping. Access to the FPD building is through a manhole in the roof of the building. The building is constructed of steel reinforced concrete.

The area of the footprint of ESG-01, including the FPD building, is approximately 98 square meters.

Modes and vectors for transmigration of contaminants include:

- Any contamination encountered during the removal of piping within ESG-01.

Characterization data from past surveys proved insufficient for FSS planning activities.

A Characterization effort was implemented on October 13, 2008 to include smears, scans and fixed-point measurements in ESG-01. An ambient correction was achieved by taking shielded readings at five locations inside the east sodium gallery and the Mean of those data was calculated. Additionally, an ambient correction was achieved by taking shielded readings at five locations in the FPD building and the Mean of those data was calculated. Table 2-20 represent the results of the fixed-point readings taken on the floors and walls during this survey effort. Smears were taken at each fixed-point location. Smears indicated no result greater than MDA. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated results greater than background.

Table 2-20
ESG-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
EAST SODIUM GALLERY		FISSION PRODUCT DETECTOR (FPD) BLDG.	
CHAR-ESG-01-001-F-M	1990	CHAR-ESG-01-021-F-M	1790
CHAR-ESG-01-002-F-M	1944	CHAR-ESG-01-022-F-M	1744
CHAR-ESG-01-003-F-M	1852	CHAR-ESG-01-023-F-M	1711
CHAR-ESG-01-004-F-M	1826	CHAR-ESG-01-024-F-M	1973
CHAR-ESG-01-005-F-M	1682	CHAR-ESG-01-025-F-M	1809
CHAR-ESG-01-006-F-M	1846	CHAR-ESG-01-026-F-M	1750
CHAR-ESG-01-007-F-M	2154	CHAR-ESG-01-027-F-M	1370
CHAR-ESG-01-008-F-M	2599	CHAR-ESG-01-028-F-M	2176
CHAR-ESG-01-009-F-M	2370	CHAR-ESG-01-029-F-M	2340
CHAR-ESG-01-010-F-M	2402	CHAR-ESG-01-030-F-M	2635
CHAR-ESG-01-011-F-M	2114		
CHAR-ESG-01-012-F-M	1892		
CHAR-ESG-01-013-F-M	2042		
CHAR-ESG-01-014-F-M	2127		
CHAR-ESG-01-015-F-M	1957		
CHAR-ESG-01-016-F-M	2101		
CHAR-ESG-01-017-F-M	2802		
CHAR-ESG-01-018-F-M	2415		
CHAR-ESG-01-019-F-M	2127		
CHAR-ESG-01-020-F-M	2140		
Mean Ambient	1962	**Mean Ambient**	1263
Ct. Mean	2119	**Ct. Mean**	1930
Ct. Median	2108	**Ct. Median**	1800
Ct. Std. Dev.	279	**Ct. Std. Dev.**	364

F-M = Fixed measurement

As a result of historical information, decommissioning activities performed and planned, and characterization surveys performed, ESG-01 is classified as a Class 2 area.

2.1.8.14 WSG-01 – West Sodium Gallery

The west sodium gallery consists of two chambers (north and south) which held the secondary sodium lines. The west gallery supplied the No. 3 steam generator. Access to the south compartment of the west sodium gallery chamber is via a horizontal steel door just above ground level. Access to the north compartment is via a tunnel from the Reactor Building annulus or a horizontal door which was sealed with a steel plate, concrete and stone fill to prevent water intrusion. The west sodium gallery's walls and base slab are of conventional concrete resting on concrete filled pilasters.

The area of the footprint of WSG-01 is approximately 67 square meters.

Modes and vectors for transmigration of contaminants include:

- Any contamination encountered during the removal of piping within WSG-01.

Characterization data from past surveys proved insufficient for FSS planning activities.

A Characterization effort was implemented on October 16, 2008 to include smears, scans and fixed-point measurements in WSG-01. An ambient correction was achieved by taking shielded readings at five locations inside the west sodium gallery and the Mean of those data was calculated. Table 2-21 represent the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. Smears indicated no result greater than MDA. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated results greater than background. Gamma scans were performed in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated results greater than background.

Table 2-21
WSG-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
CHAR-WSG-01-001-F-M	2075	CHAR-WSG-01-011-F-M	1846
CHAR-WSG-01-002-F-M	2180	CHAR-WSG-01-012-F-M	1852
CHAR-WSG-01-003-F-M	2036	CHAR-WSG-01-013-F-M	1964
CHAR-WSG-01-004-F-M	2108	CHAR-WSG-01-014-F-M	2121
CHAR-WSG-01-005-F-M	2271	CHAR-WSG-01-015-F-M	2239
CHAR-WSG-01-006-F-M	2239	CHAR-WSG-01-016-F-M	1610
CHAR-WSG-01-007-F-M	2219	CHAR-WSG-01-017-F-M	2042
CHAR-WSG-01-008-F-M	2193	CHAR-WSG-01-018-F-M	1754
CHAR-WSG-01-009-F-M	1951	CHAR-WSG-01-019-F-M	1911
CHAR-WSG-01-010-F-M	1872	CHAR-WSG-01-020-F-M	2088
		Mean Ambient	1160
		Ct. Mean	2029
		Ct. Median	2059
		Ct. Std. Dev.	180

F-M = Fixed measurement

Based on the information reviewed, personnel interviews and data acquired during characterization, WSG-01 is classified as a Class 3 area.

2.1.8.15 WGB-01 – Waste Gas Building

The Waste Gas Building housed the waste gas disposal system that removed waste gases from the plant by a process which included storage until the gases decayed to a suitable level, dilution below the maximum permissible concentration in air and dispersion into the atmosphere through a stack. Piping, valves, and mechanical equipment were housed in chambers below grade; the holdup tanks were housed above grade in shielded cells of the building. Piping transported the waste gas to the FARB where it exited to the atmosphere via a waste gas stack. The holdup tank chambers are inside the Fermi 1 Controlled Area, while the below grade chamber and the grade level valve operating room are outside the Fermi 1 Controlled Area boundary. Construction of the Waste Gas Building includes reinforced concrete walls 12-18 inches thick, with the exception of the concrete block walled valve room. The roof is constructed of reinforced concrete 2 feet thick.

The area of the footprint of WGB-01 is approximately 303 square meters.

Modes and vectors for transmigration of contaminants include:

- Any contamination encountered during the removal of piping within WGB-01.

Characterization data from past surveys proved insufficient for FSS planning activities.

A Characterization effort was implemented on October 1, 2008 to include smears, scans and fixed-point measurements in WGB-01. An ambient correction was achieved by taking shielded readings at five locations in each room and the Mean of those data was calculated. Tables 2-22 and 2-23 represent the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. Smears indicated no results greater than MDA. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in the general areas as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated results greater than background.

Table 2-22
WGB-01 Characterization Data

Location	Result (dpm/100cm²)	Location	Result (dpm/100cm²)	Location	Result (dpm/100cm²)
TANK ROOM 1		TANK ROOM 2		VALVE ROOM	
CHAR-WGB-01-021-F-M	2786	CHAR-WGB-01-031-F-M	2834	CHAR-WGB-01-041-F-M	2409
CHAR-WGB-01-022-F-M	2957	CHAR-WGB-01-032-F-M	2847	CHAR-WGB-01-042-F-M	2769
CHAR-WGB-01-023-F-M	2891	CHAR-WGB-01-033-F-M	2841	CHAR-WGB-01-043-F-M	2278
CHAR-WGB-01-024-F-M	2891	CHAR-WGB-01-034-F-M	2991	CHAR-WGB-01-044-F-M	2494
CHAR-WGB-01-025-F-M	2819	CHAR-WGB-01-035-F-M	2782	CHAR-WGB-01-045-F-M	2180
CHAR-WGB-01-026-F-M	2727	CHAR-WGB-01-036-F-M	2684	CHAR-WGB-01-046-F-M	1983
CHAR-WGB-01-027-F-M	3029	CHAR-WGB-01-037-F-M	2572	CHAR-WGB-01-047-F-M	2147
CHAR-WGB-01-028-F-M	2983	CHAR-WGB-01-038-F-M	2651	CHAR-WGB-01-048-F-M	2278
CHAR-WGB-01-029-F-M	1999	CHAR-WGB-01-039-F-M	2769	CHAR-WGB-01-049-F-M	2180
CHAR-WGB-01-030-F-M	2445	CHAR-WGB-01-040-F-M	2743	CHAR-WGB-01-050-F-M	2173
Mean Ambient	1701	**Mean Ambient**	1678	**Mean Ambient**	1506
Ct. Mean	2753	**Ct. Mean**	2771	**Ct. Mean**	2289
Ct. Median	2855	**Ct. Median**	2775	**Ct. Median**	2229
Ct. Std. Dev.	312	**Ct. Std. Dev.**	118	**Ct. Std. Dev.**	221

F-M = Fixed measurement

Table 2-23
WGB-01 Lower Level Characterization Data

Location	Result (dpm/100cm²)	Location	Result (dpm/100cm²)
572' ROOM 1		572' ROOM 2	
CHAR-WGB-01-001-F-M	2229	CHAR-WGB-01-011-F-M	2432
CHAR-WGB-01-002-F-M	2294	CHAR-WGB-01-012-F-M	2419
CHAR-WGB-01-003-F-M	2327	CHAR-WGB-01-013-F-M	2465
CHAR-WGB-01-004-F-M	2163	CHAR-WGB-01-014-F-M	2445
CHAR-WGB-01-005-F-M	2203	CHAR-WGB-01-015-F-M	2150
CHAR-WGB-01-006-F-M	2255	CHAR-WGB-01-016-F-M	2399
CHAR-WGB-01-007-F-M	2170	CHAR-WGB-01-017-F-M	2026
CHAR-WGB-01-008-F-M	1777	CHAR-WGB-01-018-F-M	1960
CHAR-WGB-01-009-F-M	2052	CHAR-WGB-01-019-F-M	2393
CHAR-WGB-01-010-F-M	2176	CHAR-WGB-01-020-F-M	2242
Mean Ambient	1489	**Mean Ambient**	1672
Ct. Mean	2165	**Ct. Mean**	2293
Ct. Median	2190	**Ct. Median**	2396
Ct. Std. Dev.	157	**Ct. Std. Dev.**	187

F-M = Fixed measurement

As a result of historical information, decommissioning activities performed and planned, and characterization survey results, WGB-01 is classified as a Class 2 area.

2.1.8.16 IGB-01 – Inert Gas Building

The Inert Gas Building housed the compressors, vapor trap, hold-up and vacuum tanks, valves, piping and other associated equipment for the purification and distribution of the argon cover gas system to the primary, secondary, and FARB cover gas systems. The Inert Gas Building has a first story of concrete construction and a second story of cinder block construction located immediately adjacent to the Sodium Service Building valve room. The Inert Gas Tunnel is part of this Survey Area.

The area of the footprint of IGB-01(including the tunnel) is approximately 466 square meters.

Modes and vectors for transmigration of contaminants include:

- Any contamination encountered during the removal of piping and components within IGB-01.

Characterization data from past surveys proved insufficient for FSS planning activities.

A Characterization effort was implemented on October 7, 2008 to include smears, scans and fixed-point measurements in IGB-01. An ambient correction was achieved by taking shielded readings at five locations in the tank room and the Mean of those data was calculated. Additionally, an ambient correction was achieved by taking shielded readings at five locations inside the tunnel and the Mean of those data was calculated. Table 2-24 represent the results of the fixed-point readings taken on the floors, walls and ceiling during this survey effort. Smears were taken at each fixed-point location. Smears indicated no result greater than background. One-square meter beta scans were performed at each fixed-point location. No beta scan indicated greater than background. Gamma scans were performed in general areas (with the exception of the tunnel areas where gamma scans were inaccessible) as well as locations where cracks and wall-to-floor junctures were present. No gamma scan indicated results greater than background.

Table 2-24
IGB-01 Characterization Data

Location	Result (dpm/100cm^2)	Location	Result (dpm/100cm^2)
TANK ROOM		TUNNEL	
CHAR-IGB-01-001-F-M	3638	CHAR-IGB-01-021-F-M	2363
CHAR-IGB-01-002-F-M	3507	CHAR-IGB-01-022-F-M	2101
CHAR-IGB-01-003-F-M	2163	CHAR-IGB-01-023-F-M	2239
CHAR-IGB-01-004-F-M	2144	CHAR-IGB-01-024-F-M	2193
CHAR-IGB-01-005-F-M	2229	CHAR-IGB-01-025-F-M	2317
CHAR-IGB-01-006-F-M	2124	CHAR-IGB-01-026-F-M	2088
CHAR-IGB-01-007-F-M	2570	CHAR-IGB-01-027-F-M	2330
CHAR-IGB-01-008-F-M	2249	CHAR-IGB-01-028-F-M	2212
CHAR-IGB-01-009-F-M	3114	CHAR-IGB-01-029-F-M	2239
CHAR-IGB-01-010-F-M	3350	CHAR-IGB-01-030-F-M	2402
CHAR-IGB-01-011-F-M	2190	CHAR-IGB-01-031-F-M	2134
CHAR-IGB-01-012-F-M	2058	CHAR-IGB-01-032-F-M	1990
CHAR-IGB-01-013-F-M	2196	CHAR-IGB-01-033-F-M	2271
CHAR-IGB-01-014-F-M	1973	CHAR-IGB-01-034-F-M	2049
CHAR-IGB-01-015-F-M	2249	CHAR-IGB-01-035-F-M	2487
CHAR-IGB-01-016-F-M	2281	CHAR-IGB-01-036-F-M	1990
CHAR-IGB-01-017-F-M	2255	CHAR-IGB-01-037-F-M	2625
CHAR-IGB-01-018-F-M	2334	CHAR-IGB-01-038-F-M	2108
CHAR-IGB-01-019-F-M	2098	CHAR-IGB-01-039-F-M	2461
CHAR-IGB-01-020-F-M	2412	CHAR-IGB-01-040-F-M	2127
Mean Ambient	1994	**Mean Ambient**	1762
Ct. Mean	2457	**Ct. Mean**	2236
Ct. Median	2249	**Ct. Median**	2226
Ct. Std. Dev.	509	**Ct. Std. Dev.**	172

F-M = Fixed measurement

Fixed-point measurements inside the Inert Gas Building and tunnel were less than the most restrictive site-specific DCGL. As a result of historical information, decommissioning activities performed and planned and characterization surveys performed, IGB-01 is classified as a Class 2 area.

2.1.9 HSA Findings

EF1, like all commercial U.S. nuclear power plants, was designed with multiple boundaries to contain the unit's radioactive contents within its many systems, components, and structures. Many of these systems and structures have been impacted due to routine operations and maintenance activities during the operational and post-operational history of the plant. All structures at EF1 have been impacted, however, due to the nature of a sodium cooled plant; the structures were minimally impacted during plant operations. Ancillary systems (feedwater, condensate, steam and oil) were essentially isolated from the primary sodium system by a double boundary during plant operations. Portions of these systems

were surveyed and found to have no plant related activity; therefore these systems are classified as non-impacted and require no further survey effort. Since there is little evidence to suggest that plant-related activity is present in the interior areas of the structures above 6 feet in height (reinforced by the historical analysis and characterization surveys), the MARSSIM classification of these areas will be less restrictive.

2.1.10 HSA Conclusions

The EF1 HSA provides sufficient evidence to support an Impacted Area classification for all structures and open land areas. EF1 ancillary systems shall be classified as Non-Impacted Areas and excluded from further investigation and survey actions. Table 2-3 summarizes the classifications for each area.

2.2 Hydrogeological Investigations

The information contained in Section 2.2 of the LTP contains a brief summary description of the Conestoga-Rover & Associates report, "Site Conceptual Model Fermi 1, Rev. 1", the Golder Associates report "Report on Groundwater Characterization, Enrico Fermi 1 License Termination" and additional information being docketed in response to questions.

Detailed information on the Golder Report can be found in NRC Agency Document and Management System (ADAMS) ML081080041 and ML 081080043.

2.2.1 Methods

From November 2003 through December 2006, Golder Associates Inc. (Golder) and the Detroit Edison Company conducted a groundwater characterization program to test for possible historical radiological contamination in groundwater within Areas of Concern (AOC) at EF1. The characterization efforts included the following:

- installation of monitor wells;
- measurement of the hydraulic conductivity of the fill and natural geologic formations in which the monitor wells are set;
- measurements of groundwater elevations, and
- collection and analysis of groundwater samples for possible radionuclides of concern.

The work was performed in accordance with the "Work Plan for Groundwater Characterization", through Revision 2, August 2005 (Golder, 2005). The work plan specifies the following:

- Areas of Concern (AOC) with respect to possible historical releases of radioactive fluids and other possible contaminants to the subsurface based on former EF1 operations and waste routing systems.

- Locations of monitor wells in relation to the AOC.
- Field methods that included drilling, well installation, hydraulic testing, and groundwater sampling.
- The Quality Assurance and Quality Control methods that were used to conduct the characterization.
- Schedule.

In 2010, an updated site conceptual groundwater model was developed by Conestoga-Rover & Associates, which was documented in Reference 2.6.17.

2.2.2 Site Geology and Hydrology

2.2.2.1 Hydrogeologic Characteristics

1. The pre-construction geological profile at EF1 consists of the following unconsolidated native sediments and the bedrock sequence:

   - 575 feet datum to 568 feet datum (0 – 7 feet): Soft black muck and peat.
   - 568 feet datum to 563 feet datum (7 – 12 feet): Glaciolacustrine laminated gray clay and silt, with traces of humus (Glacial Lake Clay).
   - 563 feet datum to 557 feet datum (12 – 18 feet): Hard gray to yellowish sandy clay (Glacial Till).
   - < 557 feet datum (>18 feet): Dolomitic bedrock of the Bass Islands Group.

   During construction of the reactor building in 1956, approximately 27 feet of clay and crushed stone fill was added to the top of the bedrock in order to bring the ground up to elevation of near 590 feet MSL. Outside the Controlled Area, approximately 10 feet of fill was added, bringing the existing ground elevation up to approximately 583.5 feet.

2. Outside the major building structures, the current geologic units at the Station, in descending order, are approximately as follows:

   - 586 to 566 feet datum: Clay Fill
   - 566 to 563 feet datum: Glacial Lake Clay
   - 563 to 557 feet datum: Glacial Till
   - < 557 feet datum: Dolomite bedrock (Bass Islands Group)

3. Immediately around major Station structures, more Permeable Fill is present. Fermi 1 drawings indicate the designed placement of Permeable Fill materials, including sand and crushed stone, from the surface to depths below the top of bedrock adjacent to some of the deeper structures such as the FARB and Reactor Building.

4. Groundwater elevations (and conversely, the periodic occurrence of dry wells) in the shallow wells indicate that the groundwater table in the shallow zone is perched on top of the clay fill. As such, continuous lateral flow does not occur in the shallow zone. Overall, the shallow zone groundwater elevations are higher than Lake Erie's and the site bedrock wells' water levels, indicating that the potential is for shallow groundwater to slowly penetrate downward.

5. The flow of groundwater is primarily downward percolation in the permeable fill surrounding Station structures.

6. Groundwater flow in the bedrock changes. It varies from being towards the south-south-east to being towards the south-south-west quadrant as described in Reference 2.6.17.

2.2.3 Groundwater Analytical Results

1. Based on a review of radionuclide concentrations detected in water samples collected at sumps, monitoring wells and background wells, impacts from Station operations are not likely present in waters beneath the Station.

2. Three intermediate wells and two additional deep wells were installed in 2011 to obtain additional data, since little monitoring was performed to the south-southwest of the facility or in the intermediate zone (e.g., Glacial Till or Glacial Lake Clay). Initial onsite laboratory analysis of new samples did not detect plant isotopes.

2.3 Site Characterization Survey

2.3.1 Initial Characterization Surveys

In support of the decommissioning activities at the Fermi 1 facility, radiological characterization surveys were contracted for selected areas in and around the facility, and performed during the months of October and November 2004. The purposes of these surveys were as follows:

a) evaluating the increase in ambient background radiation levels caused by Fermi 2 power operation and the resulting impact on detection levels and ability for performing decommissioning survey with Fermi 2 in operation, and

b) characterizing radiological conditions for selected areas in and around Fermi 1 that were more likely to exhibit little to no contamination, commonly referred to as non-impacted or Class 3 MARSSIM areas.

An initial set of surveys were performed at Fermi 1 in late October with Fermi 2 at essentially full power operations. This set of data was to baseline the levels that reflected the influence from Fermi 2, predominantly from the ^{16}N sky shine component. Following the Fermi 2 shutdown on November 6, 2004, follow-up surveys were performed for the same areas. These two data sets – one reflecting the impact from Fermi 2 operations and the second without – provide meaningful data for evaluating the overall impact that the increase in ambient radiation levels from Fermi 2 operations may have on performing the decommissioning surveys at Fermi 1. The type of surveys performed were those typical for a decommissioning project. Surface beta scans were performed for floor and roof areas. These scans predominantly examine surface contamination (within top few mm of the surface). Where volumetric contamination is the primary source of interest (such as top 15 cm for surface soil contamination), gamma walkover scans were performed. Outside grassy and gravel areas were surveyed for gamma radiation levels.

The areas included in the surveys were:

- Fuel and Repair Building (FARB) roofs (three total, beta surface scans),
- Steam Generator Building roof (beta surface scans)
- Waste Gas Decay Tank Room (general floor area beta surface scans)
- Sodium Building roof (beta surface scans)
- Turbine Building roof (beta surface scans)
- Outside areas, within the Radiologically Restricted Area (RRA) (gamma walkover scans)
- Outside areas, outside the RRA (gamma walkover scans)
- Turbine Building (general floor area beta surface scans)
- Fuel and Repair Building Interior
  - Fuel Pools (general floor area beta surface scans)

- Truck Bay (general floor area beta surface scans)
- Trestle-way (cast car corridor between reactor building and FARB, general floor area beta surface scans)
- Warm Room (Radiation Protection count room) exterior walls (beta surface scans)
- Vent Room interior walls (beta surface scans)

Tables 2-25 and 2-26 provide a summary of the results of this characterization effort. Appendix 2-C provides detailed results of this survey effort.

Table 2-25
Comparison of Ambient Levels for Beta Scans

Building/Surface	Fermi-2 Operating (cpm)	Fermi-2 Shutdown (cpm)	Net Increase (power over shutdown)	
			(cpm)	(percent)
FARB 1st Floor Roof	4773 ± 542	3285 ± 304	1488 ± 621	45 ±19%
FARB 2nd Floor Roof	6371 ± 783	3257 ± 275	3114 ± 830	96 ± 25%
FARB 3rd Floor Roof	6429 ± 845	2964 ± 392	3465 ± 932	117 ± 31%
Steam Generator Bldg. Roof	3660 ± 294	1741 ± 112	1910 ± 315	110 ± 18%
Waste Gas Tank Room Floor	2160 ± 147	1952 ± 121	208 ± 190	11 ± 9.7%
Sodium Bldg. Roof	3874 ± 465	2685 ± 217	1189 ± 513	44 ± 19%
Turbine Bldg. Roof	2802 ± 227	1955 ± 129	847 ± 261	43 ± 13%
Turbine Bldg. Driveway	2347 ± 227	1249 ± 180	1098 ± 290	88 ± 23%
Turbine Bldg. 3rd Floor, HP Turbine	1963 ± 114	1571 ± 145	392 ± 184	25% ± 12%
FARB East Fuel Pool Area	2602 ± 335	2530 ± 244	72 ± 414	2.8 ± 16%
FARB West Fuel Pool Area	2407 ± 139	2344 ± 161	63 ± 213	2.7 ± 9.1%
FARB Truck Bay	4006 ± 767	2867 ± 1039	1139 ± 1291*	40 ± 45%
Trestle-way	3430 ± 353	2987 ± 1430	443 ± 1473*	15 ± 49%

* The area with elevated measurements for the shutdown survey results in a relatively high standard deviation value. These elevated measurements were not detected during the at-power survey. Removing these elevated measurements would provide a better dataset for comparison.

Table 2-26
Comparison of Ambient Levels for Gamma Scans

Outside Area	Fermi-2 Operating (cpm)	Fermi-2 Shutdown (cpm)	Net Increase (power over shutdown)	
			(cpm)	(percent)
East Courtyard	23,245 ± 4734	4824 ± 813	18,421 ± 4803	380 ± 96%
Turbine Bldg. Lawn	19,667 ± 1797	6670 ± 945	12,997 ± 6908	190 ± 100%

2.3.2 Recent Characterization Surveys

2.3.2.1 Organization and Responsibilities

The site Radiation Protection Technicians, under the direction of the License Termination Manager, performed the site characterization. The Characterization Surveys were preformed in accordance with EF1 "Radiological Site Characterization Plan". The EF1 Health Physicist is

responsible to ensure that the Characterization Survey Plan is supported and implemented by the EF1 employees. The EF1 Health Physicist is responsible for ensuring that all decommissioning survey activities are performed by qualified personnel in accordance with approved procedures and implemented in coordination with, and support of, ongoing decommissioning activities. The Decommissioning Superintendent supplies the craft to support the Decommissioning Survey effort and coordinates activities with the Radiation Protection Supervisor (Operations). Figure 2-1 Depicts the EF1 Organizational Chart as it applies to the Characterization Survey.

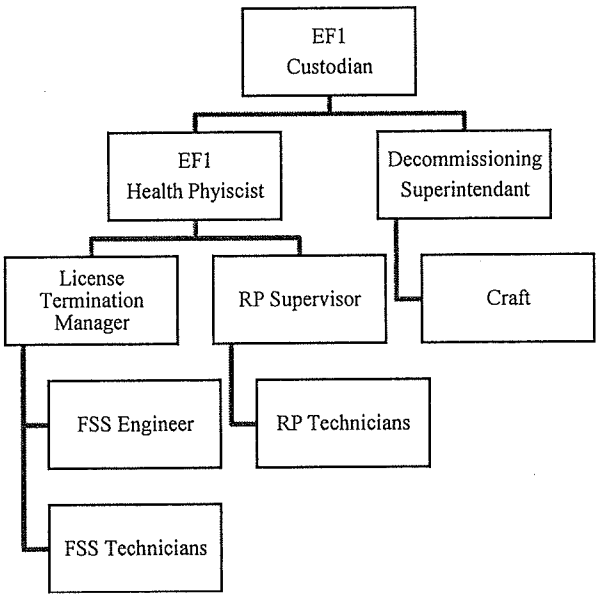


Figure 2-1 EF1 License Termination Org. Chart

2.3.2.2 Characterization Data Categories

One of the objectives of the characterization surveys was to be able to classify survey areas. As shown in Table 2-3 in Section 2.1.7.3 of this chapter, areas have been designated as: 1) Class 1 if residual radioactivity was greater than the DCGL or would likely be present based upon historical information, 2) Class 2 if residual radioactivity was present but less than the DCGL, and 3) Class 3 if residual radioactivity was not present or present at a small fraction of the DCGL.

2.3.2.3 Characterization Survey Design

The EF1 FSS Engineer designed the characterization surveys based on the Site Characterization Data Quality Objectives (DQOs) (see Appendix 2-B for the survey maps and results). Instrumentation used was identical to that which is planned to be used during FSS with similar MDCs. Gas proportional detectors were used for most of the surface measurements and scans. The detectors have a Mylar™ window which is sensitive to the average beta energy emitted from the radionuclide mixture found in the various media. Additionally, volumetric samples of soil and concrete were also collected and counted using HPGe detectors with MDCs set at 10% of the DCGLs. NaI detectors were used to perform scans and direct measurements of soil, asphalt and some concrete areas. These surveys were used to identify regions of potentially contaminated soil and surfaces.

The actual dispositioning of systems at EF1 occurs on a case-by-case basis, with additional data collected when necessary during dismantlement activities to support the dispositioning decision-making. This method of real-time waste management has proven to be cost-effective, much more so at EF1 than if an extensive characterization effort had been undertaken prior to beginning dismantlement. The decision was also made to begin the characterization effort to support the license termination process (remediation and eventually Final Status Survey) when areas were more accessible and could be directly surveyed (after system removal). Remediation and dismantlement tasks are scheduled and reviewed by EF1 personnel. Current and past radiological conditions that could affect the dismantlement or remediation processes are examined. Additionally, the area physical conditions that have or could have been affected radiologically are examined. Instructions and survey objectives are provided for adequate documentation of the characterization surveys and performance of dismantlement activities. The process data quality objectives include but are not limited to, instructions that delineate the types of surveys, samples and action levels for the tasks, and instructions and guidance for the remediation or dismantlement activities.

2.3.2.4 Instrument Selection, Use and Minimum Detectable Concentrations (MDCs)

Instrumentation used for characterization surveys were the same type that are planned to be used for FSS. Count times and scan rates were the same as those that will be used during FSS thus ensuring adequate MDCs. Table 2-27 lists the types of instruments that were used for characterization surveys along with the MDCs achieved. Table 2-28 provides the vendor laboratory minimum detectable activity (MDA) values.

Table 2-27
Typical Survey Instrumentation Sensitivities

Instruments and Detectors	Radiation	Background Count Time (minutes)	Background (cpm)	Instrument Efficiency	Count Time (minutes)	Static MDC	Scan MDC
Model 43-68	Alpha	1	2	0.087	1	26	N/A
Model 43-68	Beta-Gamma	1	243	0.2705	1	454	1082
Model 43-37	Beta-Gamma	1	607	0.2399	1	204	635
LN-177	Beta-Gamma	N/A	N/A	0.10	N/A	N/A	N/A
Model SPA-3	Gamma	1	8000	0.62	0.04	N/A	4.73
HPGe	Gamma	Up to 60	N/A	0.40 relative	10-60	0.05 pCi/g volumetric	0.15-0.30 pCi/g vol.
Tennelec Low Bkg. Counter	Alpha Beta	10 10	0.1 1.0	0.35 0.48	1-10	11 16	N/A N/A

Table 2-28
Vendor Lab. Methods and MDAs

Test	Technique	Method	MDA (pCi/g)
Gamma radionuclides	Gamma Spectroscopy	LANL EM-9	0.1
Alpha	Gas Flow Proportional	EPA 900.0	4.0
Beta	Gas Flow Proportional	EPA 900.0	10.0
H-3	Liquid Scintillation	EPA 906.0 Mod	11-55
C-14	Liquid Scintillation	EPA EERF C	1.2-6.0
Fe-55	Liquid Scintillation	DOE RESL Fe-1	1000-5000
Ni-59	Low Energy Gamma Spectroscopy	DOE RESL Ni-1	1100-5500
Ni-63	Liquid Scintillation	DOE RESL Ni-1	210-1050
Sr-90	Gas Flow Proportional	EPA905.0 Mod	0.17-0.85
Tc-99	Liquid Scintillation	DOE EML HASL 300	1.90-9.50
Pu-238-240	Alpha Spectroscopy	DOE EML HASL 300	0.23-1.25
Pu-241	Liquid Scintillation	DOE EML HASL 300	7.2-36.00
Am-241	Alpha Spectroscopy	DOE EML HASL 300	0.21-1.05
Cm-242&243	Alpha Spectroscopy	DOE EML HASL 300	16-80
Cm-243	Alpha Spectroscopy	DOE EML HASL 300	0.32-1.60

2.3.2.5 Quality Assurance

Instrumentation used for characterization surveys was calibrated by an off-site vendor using NIST-traceable sources of energies similar to those emitted by the nuclide fractions for the various media surveyed. Instrumentation was source checked before and after survey measurements were made in accordance with approved site procedures. The FSS Engineer, prior to accepting the data for characterization, evaluated instruments not passing a source check. Laboratory instruments were calibrated following the approved Fermi 2 Radiation Protection procedures. A fraction of the volumetric samples were collected as split samples for quality control purposes. 10% of the volumetric samples were designated as recounts. Split sampling and sample recounts were in accordance with EF1 procedure MEF201, "Final Status Survey Quality Assurance Project Plan (QAPP)."

2.3.2.6 Data Quality Objectives

Data Quality Objectives (DQOs) were implemented for Characterization surveys in a similar manner as anticipated for Final Status Surveys, however, the goal of the characterization is contamination quantification and delineation of the nuclide suite, whereas the FSS goal is comparison of data against the Null Hypothesis. Characterization surveys were designed to gather the appropriate data using the DQO process as outlined in MARSSIM, Appendix D. The seven steps in the DQO development process are:

1) State the problem,
2) Identify the decision,
3) Identify inputs to the decision,
4) Define the study boundaries,
5) Develop a decision rule,
6) Specify limits on decision errors, and
7) Optimize the design for obtaining data.

The DQOs for site characterization included identifying the types and quantities of media to collect. Since the scenarios used for dose modeling were the Building Occupancy and Resident Farmer scenarios, sample collection was concentrated on structure materials and surrounding soils. Building concrete was sampled by obtaining volumetric samples (additional volumetric sampling will be performed when the areas of interest become available). Soils were also sampled volumetrically. Enough measurements (typically 10 to 15 measurements per area) were obtained to achieve statistically significant results so that the mean and maximum activity as well as the sample standard deviation could be determined. Direct measurements and scans of concrete surfaces were also made using the same instruments and MDCs as those that are planned to be used for FSS. A percentage of samples of each

type of media were sent for HTD radionuclide analysis. Samples were also collected from the interior surfaces of ancillary piping.

2.3.3 Survey Findings and Results

Survey categories consist of surfaces, structures and environs present at EF1. Several areas of the site were specifically targeted for detailed sampling and surveys. The areas were either known or suspected to have been contaminated by plant operations or decommissioning. The remainder of the site received general sampling and surveys to determine whether structures or soils were contaminated and to what extent. Appendix 2-B illustrates the survey areas and locations described in this chapter.

2.3.3.1 Surfaces, Structures and Soils

Surfaces and structures include building interiors and exteriors of the associated structures and if applicable, the exterior surfaces of systems or components because these surfaces have the same potential for residual levels of radioactive material as the building surfaces in which they are located. Land areas were surveyed and sampled to detect the presence and extent of soil contamination.

- Over 1332 beta scan and direct measurements have been taken in EF1 during the 2008 characterization survey.
- 40 soil samples were taken from open land areas within and outside of the EF1 Controlled Area. Five of these samples were sent off-site to a laboratory for analysis of HTD radionuclides.
- A concrete sample taken from the inner Biowall concrete was sent off-site for analysis of HTD nuclides as well as counted on site for activation.

All samples submitted to the vendor laboratory were analyzed for the entire nuclide suite. The nuclide suite includes those nuclides found in Chapter 6 of this LTP.

Groundwater analysis results from the site monitoring wells were provided in Section 2.2.4.

2.3.3.2 Ancillary Systems

Due to the nature of a Liquid Metal Fast Breeder Reactor (LMFBR) ancillary systems such as the feedwater, condensate, steam, and lubricating oil systems are not expected to be impacted by plant operations. In an effort to verify the non-impacted classification of these systems, a survey was performed consisting of scans, volumetric sampling and smears. The ancillary systems were accessed at various

locations throughout the turbine building. No scan or volumetric sample identified the presence of plant-related contamination.

2.3.4 Ambient and Background

The National Council on Radiation Protection & Measurements (NCRP) addresses deposition of Cs-137 from fallout in Reference 2.6.16, Section 3.2. Using the values in the NCRP report, with conservative assumptions, the expected mean deposition of Cs-137 in this region of the country is 0.35 pCi/g to 1.2 pCi/g, depending on depth of the sample.

Additionally, Big Rock Point (BRP) performed a study in northern Michigan which would be reasonably representative of the levels found at EF1. As a result of the 2000 BRP study, Cs-137 average activity 0.48 pCi/g to 0.54 pCi/g with a log-normal standard deviation of 0.79 pCi/g would be expected in Michigan. Adjusting the reported data for radioactive decay to 2008 results in current background values of 0.39 pCi/g to 0.44 pCi/g.

Soil samples collected and analyzed during site characterization within or adjacent to the Controlled Area showed a mean Cs-137 activity 0.11 pCi/g and a maximum Cs-137 activity 0.45 pCi/g. For purposes of decommissioning, background Cs-137 activities in soil should be considered to be approximately 0.39 pCi/g to 1.2 pCi/g.

Ambient radiation levels are present at EF1 due to the operation of Fermi 2. As can be seen by the data comparison shown in section 2.3.1, the ambient influence due to Fermi 2 operation can contribute significantly to the readings taken at EF1. Readings within the interior of buildings are not impacted as significantly as the reading taken exterior to the structures. As a result of this ambient contribution from Fermi 2 operation, beta scans and fixed-point measurements will be compensated by the use of ambient correction. A series of shielded beta readings will be taken at various locations within a room or building and the mean value will be subtracted from the unshielded readings taken. For gamma scans (with SPA-3 sodium iodide detector), portable shielding or other methods of reducing the ambient levels will be utilized as needed. Ambient gamma radiation from the operation of Fermi 2 and the methodology for the ambient correction are further explained in Section 5.4.3.1 of this LTP.

2.3.5 Waste Volumes and Activities

Chapter 3 of this LTP presents the waste volumes and activities.

2.4 Continuing Characterization

As previously stated, characterization data will be collected as necessary throughout the project. Results of future characterization sample analyses will be evaluated to determine the impact, if any, on the radionuclide identities, nuclide fractions and the classification of structures, soils and other site media.

2.5 Summary

The characterization data collected and analyzed to date are of sufficient quantity and quality to provide the basis for the initial classification of survey areas, planning remediation activities, estimating radiological waste types and volumes, and for the development of DCGLs. However, characterization is an ongoing process that will continue as necessary during decommissioning.

2.6 References

2.6.1 Big Rock Point Nuclear Plant, *License Termination Plan,* Section 2.3.3, April 2003

2.6.2 C&M Department Maintenance

2.6.3 Chesapeake Nuclear Services, Inc., *Fermi 1 Radiological Characterization Surveys,* March 2005

2.6.4 Enrico Fermi Atomic Power Plant, Unit 1, *Fermi 1 Safety Analysis Report,* November 2006

2.6.5 Enrico Fermi Atomic Power Plant, Unit 1, *Fermi 1 Manual*

2.6.6 Enrico Fermi Atomic Power Plant, Unit 1, *Historical Site Assessment*

2.6.7 Fermi 1 Decommissioning Evaluation Report, June 1997

2.6.8 Fermi 1 Shift Logs, August 1963 to September 1995

2.6.9 Fermi 1 Operating Reports, August 1963 to December 1975

2.6.10 Golder Associates, Inc., *Report on Groundwater Characterization,* June 2007

2.6.11 Power Reactor Development Company, *Technical Information and Hazards Summary Report*

2.6.12 Technical Based Document, (TBD) NESF-08-0018, *Radionuclide Selection for DCGL Development*

2.6.13 U.S. Nuclear Regulatory Commission NUREG-1575, Revision 1, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM),* August 2000

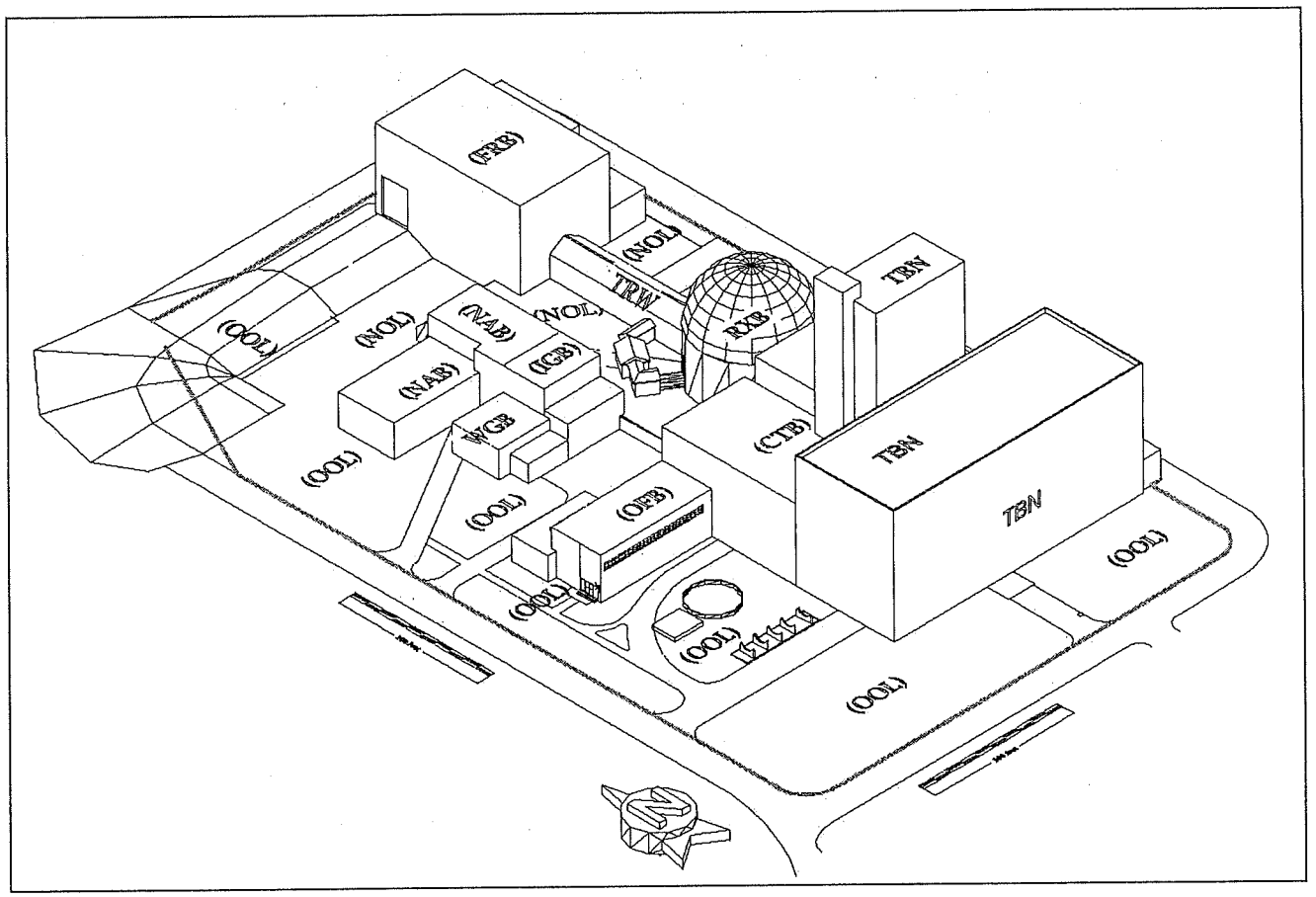
2.6.14 U.S. Nuclear Regulatory Commission NUREG/CR-2082 – *Monitoring for Compliance with Decommissioning Termination Survey Criteria*

2.6.15 U.S. Nuclear Regulatory Commission NUREG-0586, *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities (FGEIS),* August 1988

2.6.16 National Council on Radiation Protection & Measurements, NCRP Report No. 154, *Cesium-137 in the Environment: Radioecology and Approaches to Assessment and Management,* 2007

2.6.17 Conestoga-Rovers & Associates, *Site Conceptual Model Fermi 1, Revision 1,* January 2011

Figure 2-2 EF1 Survey Area Designations



surface activity DCGLs. Direct measurements can then be performed on the underlying surface after removal of the coating.

The thickness of the layer of building surface to be removed as a sample should be consistent with the development of the EF1 site model and the DCGLs (i.e. <10mm in depth).

5.4.2.5 Soils

Soil will receive scan surveys at the coverage level described in Table 5-4 and volumetric samples will be taken at designated locations. Surface soil samples will normally be taken at a depth of 0 to 15 cm. Samples will be collected and prepared in accordance with approved procedures.

5.4.2.5.1 Scans

Open land areas are scanned for gamma emitting nuclides. The gamma emitters are used as surrogates for the HTD radionuclides. Sodium iodide detectors are typically used for scanning. For detectors such as the SPA-3, the detector is held close to the ground surface (~6 cm or 2.5 in.) and is moved at a speed of 0.5 m/sec, traversing each square meter 3 times. The area covered by scan measurements is based on the survey unit classification as described in Section 5.3.2.

5.4.2.5.2 Volumetric Samples

Soil materials are analyzed by gamma spectroscopy. Soil samples of approximately 1,500 grams are normally collected from the surface layer (top 15 cm). Sample preparation includes removing extraneous material, homogenizing, and drying the soil for gamma isotopic analysis. Separate containers are used for each sample and each container is moved through the analysis process following site procedures. Samples are split when required by the applicable quality control procedures. If a survey area has already been excavated and remediated to the soil DCGL, this area will be treated as surface soil, and the FSS will be performed on the excavated area. Soil samples will be collected to depths at which there is high confidence that deeper samples will not result in higher concentrations. Alternatively, a sodium-iodide detector of sufficient sensitivity to detect DCGL concentrations may be utilized to identify the presence or absence of subsurface contamination, and the extent of such contamination. If the detector identifies the presence of contamination at a significant fraction of the DCGL, confirmatory investigation and analyses of soil samples of the suspect areas will be

performed. All subsurface sampling will be performed in accordance with the guidance in Section G.2.1 of NUREG-1757, Volume 2. The sample size for subsurface samples will be determined using the same methods described for surface soil. Per NUREG-1757, Volume 2, scanning is not applicable to subsurface areas; however, EF1 Final Status Surveys will employ scanning techniques commensurate with the survey unit classification. Scanning subsurface soils, where accessible, as an excavated surface, will demonstrate compliance with site release criteria.

5.4.3 Specific Survey Area Considerations

5.4.3.1 Pavement-Covered Areas

Survey of paved areas will be required along the roadways providing ingress and egress to EF1 (e.g. FARB, west yard entrance, turbine building entrance, etc.). The survey design of paved areas will be based on soil survey unit sizes since they are outdoor areas where the exposure scenario is most similar to direct radiation from surface soil. The applicable DCGL will be the soil DCGL. Scan and static gamma and beta-gamma surveys are determined by the survey unit design. Samples will be obtained of not only the asphalt, but of the soil present under the asphalt. Paved areas may be separate survey units or they may be incorporated into surveys of adjacent open land areas of like classification.

5.4.3.2 Stored Bulk Materials

Excavated soil may be reused onsite. Prior to reuse, excavated soil will be characterized to determine its suitability. Any surface scanning or volumetric analyses will be directly compared with DCGL values. Controls will be instituted to prevent mixing of soils from more restrictive survey area classifications (e.g., Class 2 material could be used in either Class 1 or 2 areas and Class 1 material could only be used in Class 1 areas). Soils satisfying the criteria for unrestricted release may be stockpiled for use as EF1 onsite backfill material.

The one area that would need to be separately evaluated is if the decision is made to leave sand, steel shot or other materials within or outside of existing structures. There are no plans to dispose of concrete building rubble onsite as part of Fermi 1 decommissioning, since the buildings will remain standing. However, there are materials such as sand and steel shot that were sealed behind walls or in penetrations during plant operations. Some needed to be removed to gain access to areas for equipment removal. Sand will need to be removed because the walls it

$$MDC_{structural\ surface\ scan}(dpm/100cm^2) = \frac{1.38\sqrt{B}}{\sqrt{p}\ e_i\ e_s\ \left(\frac{A}{100}\right)t}$$

Equation 5-8

where:

B = number of background counts during the count interval t,
p = surveyor efficiency,
e_i = instrument efficiency for the emitted radiation (cpm per dpm),
e_s = source efficiency (intensity) in emissions per disintegration,
A = sensitive area of the detector (cm2), and
t = time interval of the observation while the probe passes over the source (minutes).

The numerator in Equation 5-8 represents the minimum detectable count rate that the observer would "see" at the performance level represented by the sensitivity index. The surveyor efficiency (p) will be taken to be 0.5, as recommended by Section 6.7.1 of NUREG-1507. The factor of 100 corrects for probe areas that are not 100 cm². In the case of a scan measurement, the counting interval is the time the probe is actually over the source of radioactivity. This time depends on scan speed, the size of the source, and the fraction of the detector's sensitive area that passes over the source; with the latter depending on the direction of probe travel. The source efficiency term (e_s) in Equation 5-8 may be adjusted to account for effects such as self absorption, as appropriate.

5.4.4.4.3 Total Efficiency (e_t) and Source Efficiency (e_s) for Concrete Contamination

The source term inventory on contaminated concrete appears to be primarily located within the top few millimeters of the concrete surface. The practical application of choosing the proper instrument efficiency may be determined by averaging the surface variation (peaks and valleys narrower than the length of the detector) and adding 0.5 inches, the spacing that should be maintained between the detector and the highest peaks of the surface. Selection of the source to detector distance is based on Table 5-11 that best reflects the predetermined geometry.

Table 5-11 Sources to Detector Distance Effects on Instrument Efficiencies for α/β Emitters

Source to Detector Distance (cm)	Instrument Efficiency e_i	
	Tc-99 Distributed	Th-230 Distributed
Contact	(1)(2π eff)	(1) (2π eff)
0.5 cm	(0.803) (2π eff)	(0.761) (2π eff)
1 cm	(0.701) (2π eff)	(0.579) (2π eff)
2 cm	(0.503) (2π eff)	(0.099) (2π eff)

Source efficiency (e_s), reflects the physical characteristics of the surface and any surface coatings. The source efficiency is the ratio between the number of particles emerging from surface and the total of particles released within the source. The source efficiency accounts for attenuation and backscatter. Source efficiency (e_s), is nominally 0.5 (no self-absorption/attenuation, no backscatter) backscatter increases the value, self-absorption decreases the value. Source efficiencies may either be derived empirically or simply selected from the guidance contained in ISO 7503-1. ISO 7503-1 takes a conservative approach by recommending the use of factors to correct for alpha and beta self-absorption/attenuation when determining surface activity. However, this approach may prove to be too conservative for radionuclides with max beta energies that are marginally lower than 0.400 MeV, such as Co-60 with a β_{max} of 0.3 14 MeV. In this situation, it may be more appropriate to determine the source efficiency by considering the energies of other beta emitting radionuclides. Using this approach it is possible to determine weighted average source efficiency. For example, a source efficiency of 0.375 may be calculated based on a 50/50 mix of Co-60 and Cs-137. The source efficiencies for Co-60 and Cs-137 are 0.25 and 0.5 respectively, since the radionuclide fraction for Co-60 and Cs-137 is 50% for each, the weighted average source efficiency for the mix may be calculated in the following manner:

$(.25)(.50) + (.50)(.50) = 0.375$