
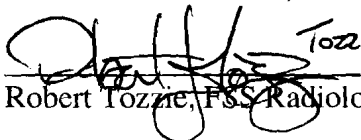


YANKEE NUCLEAR POWER STATION
FINAL STATUS SURVEY REPORT


REPORT NO.: YNPS-FSS-OOL-07-00

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Appendix A – YNPS-FSSP-OOL-07, *“Final Status Survey Planning Worksheets*

Appendix B – YA-REPT-00-015-04, *“Instrument Efficiency Determination for Use in Minimum Detectable Concentration Calculations in Support of the Final Status Survey at Yankee Rowe”*

Appendix C – YA-REPT-00-003-05, *“Generic ALARA Review for Final Status Survey of Soil at YNPS”*

Appendix D – ALARA Evaluations, OOL-07

List of Attachments

Attachment A – Maps and Posting Plots

Attachment B – Data Quality Assessment Plots and Curves

Attachment C – Instrument QC Records

Attachment D – ORTEC Direct Measurement Data

(In the electronic version, every Table of Contents, Figures, Appendices and Attachments, as well as every mention of a Figure, Appendix or Attachment is a hyperlink to the actual location or document.)

List of Abbreviations and Acronyms

AL	Action Level
ALARA	As Low As Reasonably Achievable
c/d	Counts per Disintegration
DCGL	Derived Concentration Guideline Level
DCGL _{EMC}	DCGL for small areas of elevated activity
DCGL _W	DCGL for average concentration over a wide area, used with statistical tests
DQO	Data Quality Objectives
EMC	Elevated Measurement Comparison
ETD	Easy-to-Detect
FSS	Final Status Survey
FSSP	Final Status Survey Plan
GPS	Global Positioning System
H ₀	Null Hypothesis
HSA	Historical Site Assessment
HTD	Hard-to-Detect
ISOCS	<i>In-situ</i> Object Counting System [®]
LBGR	Lower Bound of the Grey Region
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	Minimum Detectable Activity
MDC	Minimum Detectable Concentration
PAB	Primary Auxiliary Building
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCA	Radiological Controlled Area
RP	Radiation Protection
RSS	Reactor Support Structure
SFP	Spent Fuel Pool
VC	Vapor Container
VCC	Vertical Concrete Cask
VSP	Visual Sample Plan
YNPS	Yankee Nuclear Power Station

1.0 EXECUTIVE SUMMARY

A Final Status Survey (FSS) was performed of Survey Area OOL-07 in accordance with Yankee Nuclear Power Station's (YNPS) License Termination Plan (LTP). This FSS was conducted as an open land area FSS with soil DCGLs.

1.1 Identification of Survey Area and Units

OOL-07 Survey Area is comprised of three Survey Units. OOL-07-01 was used to identify a pile of soil that was released under AP-0052 from the YNPS industrial area during the construction of the ISFSI pad and placed in Survey Area OOL-07 (the mid-level parking lot). Prior to release from the industrial area, the soil pile was extensively sampled and analyzed by gamma spectroscopy. In April 2005, the mid lot soil pile was moved from Survey Area OOL-07 to Survey Unit OOL-04-04 to prepare the mid-level parking lot for thermal desorption of PCB-contaminated soil. OOL-07-01 was surveyed as a Class 2 Survey Unit.

OOL-07-02 and OOL-07-03 are Class 1 open land Survey Units adjacent to each other, which at one time served as a personnel parking area and were used to stockpile soil, from excavations in the industrial area, awaiting thermal desorption. A map of the Survey Area and Survey Units in relation to the site is found in Attachment A.

1.2 Dates of Surveys

Table 1 Dates of Surveys

Survey Unit	Survey Start Date	Survey End Date	DQA Date
OOL-07-01	6/30/2006	7/22/2006	8/8/2006
OOL-07-02	6/10/2006	6/10/2006	7/24/2006
OOL-07-03	6/9/2006	6/10/2006	7/24/2006

1.3 Number and Types of Measurements Collected

Final Status Survey Plans (FSSP) were developed for these Survey Units in accordance with YNPS LTP and FSS procedures using the MARSSIM protocol. The planning and design of the survey plan employed the Data Quality Objective (DQO) process, ensuring that the type, quantity and quality of data gathered was appropriate for the decision making process and that the resultant decisions were technically sound and defensible. A total of 56 statistical direct measurements were taken in the Survey Area, providing data for the non-parametric testing of the Survey Area. In addition to the direct measurements, 50% of OOL-07-01 was scanned with a SPA-3, and 100% of OOL-07-02 and OOL-07-3 were scanned with a SPA-3.

1.4 Summary of Survey Results

Following the survey, the data were reviewed against the survey design to confirm completeness and consistency, to verify that the results were valid, to ensure that the survey plan objectives were met and to verify Survey Unit classification. Direct measurement surveys indicated that none of the systematic measurements exceeded the DCGL_w, depicted in Attachment B. Retrospective power curves were generated and demonstrated that an adequate number of samples were collected to support the Data Quality Objectives. Therefore, the null hypothesis (H_0) (that the Survey Unit exceeds the release criteria) is rejected.

1.5 Conclusions

Based upon the evaluation of the data acquired for the FSS, OOL-07 meets the release requirements set forth in the YNPS LTP. The Total Effective Dose Equivalent (TEDE) to the average member of the critical group does not exceed 25 mRem/yr, including that from groundwater. 10CFR20 Subpart E ALARA requirements have been met as well as the site release criteria for the administrative level DCGLs that ensure that the Massachusetts Department of Public Health's 10 mRem/yr limit will also be met.

2.0 FSS PROGRAM OVERVIEW

2.1 Survey Planning

The YNPS FSS Program employs a strategic planning approach for conducting final status surveys with the ultimate objective to demonstrate compliance with the DCGLs, in accordance with the YNPS LTP. The DQO process is used as a planning technique to ensure that the type, quantity, and quality of data gathered is appropriate for the decision-making process and that the resultant decisions are technically sound and defensible. Other key planning measures are the review of historical data for the Survey Area and the use of peer review for plan development.

2.2 Survey Design

In designing the FSS, the questions to be answered are: "Does the residual radioactivity, if present in the Survey Area, exceed the LTP release criteria?" and "Is the potential dose from this radioactivity ALARA?" In order to answer these questions, the radionuclides present in the Survey Area must be identified, and the Survey Units classified. Survey Units are classified with respect to the potential for contamination: the greater the potential for contamination, the more stringent the classification and the more rigorous the survey.

The survey design additionally includes the number, type and locations of direct measurements/samples (as well as any judgmental assessments required), scanning requirements, and instrumentation selection with the required sensitivities or detection levels. DCGLs are developed relative to the surface/material of the Survey

Unit and are used to determine the minimum sensitivity required for the survey. Determining the acceptable decision error rates, the lower bound of the gray region (LBGR), statistical test selection and the calculation of the standard deviation and relative shift allows for the development of a prospective power curve plotting the probability of the Survey Unit passing FSS.

2.3 Survey Implementation

Once the planning and development has been completed, the implementation phase of the FSS program begins. Upon completion of remediation and final characterization activities, a final walk down of the Survey Unit is performed. If the unit is determined to be acceptable (i.e. physical condition of the unit is suitable for FSS), it is turned over to the FSS team, and FSS isolation and control measures are established. After the Survey Unit isolation and controls are in place, grid points are identified for the direct measurements/samples, using Global Positioning System (GPS) coordinates whenever possible, consistent with the Massachusetts State Plane System, and the area scan grid is identified. Data is collected and any required investigations are performed.

2.4 Survey Data Assessment

The final stage of the FSS program involves assessment of the data collected to ensure the validity of the results, to demonstrate achievement of the survey plan objectives, and to validate Survey Unit classification. During this phase, the DQOs and survey design are reviewed for consistency between DQO output, sampling design and other data collection documents. A preliminary data review is conducted to include: checking for problems or anomalies, calculation of statistical quantities and preparation of graphical representations for data comparison. Statistical tests are performed, if required, and the assumptions for the tests are verified. Conclusions are then drawn from the data, and any deficiencies or recommendations for improvement are documented.

2.5 Quality Assurance and Quality Control Measures

YNPS FSS activities are implemented and performed under approved procedures, and the YNPS Quality Assurance Project Plan (QAPP) assures plans, procedures and instructions have been followed during the course of FSS, as well as providing guidance for implementing quality control measures specified in the YNPS LTP.

3.0 SURVEY AREA INFORMATION

3.1 Survey Area Description

OOL-07 Survey Area is comprised of three Survey Units. Survey Unit OOL-07-01 consists of a pile of soil that was released under AP-0052 from the YNPS industrial area during the construction of the ISFSI pad and placed in Survey Area OOL-07.

OOL-07-02 and OOL-07-03 are open land areas which at one time served as a personnel parking area and contained an accumulation of Industrial Area/ISFSI soil (mentioned above), generated during decommissioning. Subsurface systems that traverse or connect within OOL-07 include Administration building sanitary sewer system and active leaching field. OOL-07-02 and OOL-07-03 consists of the Mid-lot land area that lies within survey area OOL-06.

3.2 History of Survey Area

Prior to release from the industrial area, the ISFSI soil was extensively sampled and analyzed by gamma spectroscopy. The results were evaluated using a protocol developed to provide assurance that plant-related radioactivity was not present. The acceptance criteria were: (1) Cs-137 concentrations in the soil samples did not exceed background and (2) no other gamma emitting plant-related radionuclides were present. These acceptance criteria were consistent with the requirement of no detectable plant-related activity in AP-0052. In addition to the pre-excavation sampling program, aggregate surveys were performed in accordance with radiation protection procedures for each truckload of soil that left the YNPS Industrial Area.

In April 2005, the mid lot soil was moved from Survey Area OOL-07 to Survey Area OOL-04 to prepare the mid-level parking lot for thermal desorption of PCB-contaminated soil. The mid lot soil was located in Survey Unit OOL-04-04. At the time of placement in OOL-04-04, the mid lot soil occupied an area of approximately 1,687 m² (18,167 ft²). In June 2005, a portion of the mid lot soil pile (approximately 30 truckloads) was removed and used as back fill for the Screen Well House. The area where the soil was removed from the pile had been reshaped to facilitate FSS for the remaining soil pile. The re-shaped pile occupied approximately 1,597 m² (17,195 ft²) and, because of the new dimensions, it was necessary to recalculate the grid spacing and revise the systematic grid overlay and the MDCR/MDC table.

The initial excavation and movement of the soil via truckloads from the industrial area to Survey Area OOL-07 and the subsequent re-excavation and trucking of the soil from Survey Area OOL-07 to the current location, where the soil was blended further via bulldozing, was assumed to have resulted in a high degree of mixing (homogeneity) of the soil. Therefore, the results from FSS surface soil samples were applicable to the entire volume of soil.

Approximately 1,740 ft² (162m²) along the south perimeter of the soil pile (initially included as part of the targeted scan area) could not be scanned because of the close proximity of stored Radwaste boxes. Ten biased soil samples were collected along the south perimeter to replace scanning. Scanning in other targeted areas (i.e., north perimeter and the top) was increased to assure that at least 50% of the soil pile was scanned as originally planned. The original sampling frequency was 1 soil sample per approximately 100m². Collecting 10 soil samples from approximately 162m² along the south perimeter represents a 6-fold increase in the original sampling frequency.

3.3 Division of Survey Area into Survey Units

The OOL-07 Survey Area is divided into three Survey Units; OOL-07-01 which is a Class 2 Survey Unit, OOL-07-02 which is a Class 1 Survey Unit, and OOL-07-03 which is also Class 1 Survey Unit. A map of the Survey Area and Unit divisions are found in Attachment A.

4.0 SURVEY UNIT INFORMATION

4.1 Summary of Radiological Data Since Historical Site Assessment (HSA)

4.1.1 Chronology and Description of Surveys Since HAS

Survey Unit	Date	Activity
OOL-07-01	6/22/2005	Performed walk-down of Survey Unit
	6/29/2005	Established Isolation and Controls
	6/23/2005	Performed Job Hazard Analysis
	6/22/2005	Performed Unit Classification
	6/22/2005	Performed Sample Quantity Calculations, established DQOs
	6/23/2005 to 7/18/2005	Generated FFS Sample Plans
	6/30/2005 to 7/22/2005	Initiated Scans, and Direct measurements.
	8/8/2006	Performed DQA, FSS Complete
OOL-07-02	6/8/2006	Performed walk-down of Survey Unit
	6/10/2006	Established Isolation and Controls
	6/9/2006	Performed Job Hazard Analysis
	6/8/2006	Performed Unit Classification
	6/8/2006	Performed Sample Quantity Calculations, established DQOs
	6/8/2006	Generated FFS Sample Plans
	6/10/2006	Initiated Scans, and Direct measurements.
	7/24/2006	Performed DQA, FSS Complete
OOL-07-03	6/8/2006	Performed walk-down of Survey Unit
	6/9/2006	Established Isolation and Controls
	6/9/2006	Performed Job Hazard Analysis
	6/8/2006	Performed Unit Classification
	6/8/2006	Performed Sample Quantity Calculations, established DQOs
	6/8/2006	Generated FFS Sample Plans
	6/9/2006 to 6/10/2006	Initiated Scans, and Direct measurements.
	7/24/2006	Performed DQA, FSS Complete

4.1.2 Radionuclide Selection and Basis

During the initial DQO process, Cs-137 was identified as the radiological nuclide of concern for each Survey Unit in the Survey Area. Characterization survey data from the HSA data indicated no other LTP-

specified radionuclides warrant consideration in the OOL-07 Survey Area, however, soil samples were evaluated for all LTP listed nuclides.

4.1.3 Scoping & Characterization

The available characterization data for the mid-lot soil consists of surface and sub-surface soil samples collected in 1998, which were analyzed by onsite gamma spectroscopy. With the exception of 1 sample location where Co-60 was identified and then successfully remediated, Cs-137 was the only LTP-listed nuclide identified in the onsite analyses. Cs-137 was identified above the MDA in only 22 of approximately 185 soil samples. None of the characterization soil samples were analyzed for hard-to-detect (HTD) nuclides. However, because gamma-emitting nuclides such as Co-60 and Cs-137 were historically more abundant in the nuclide mixtures found in the various waste streams during plant operation (and these nuclides were generally not identified in the mid lot soil), HTD nuclides were not expected to be major dose contributors in the mid-lot soil.

4.2 Basis for Classification

Based upon the radiological condition of this Survey Area identified in the operating history and as a result of the decommissioning activities performed to date, Survey Unit OOL-07-01 is identified as a Class 2 area. Survey Unit OOL-07-02 and OOL-07-03 are identified as Class 1 areas. The YNPS LTP allows for different classifications of Survey Units within a Survey Area.

4.3 Remedial Actions and Further Investigations

4.3.1 OOL-07-01 Remedial Actions and Further Investigations

20 elevated areas were identified for investigation via SPA-3. None of the 20 elevated areas required remediation. No elevated areas remained in OOL-07-01 in excess of DCGLw.

4.3.2 OOL-07-02 Remedial Actions and Further Investigations

4 elevated areas were identified for investigation via SPA-3. None of the 4 elevated areas required remediation. No elevated areas remained in OOL-07-02 in excess of DCGLw.

4.3.3 OOL-07-03 Remedial Actions and Further Investigations

20 elevated areas were identified for investigation via SPA-3. None of the 20 elevated areas required remediation. No elevated areas remained in OOL-07-03 in excess of DCGLw.

4.4 Unique Features of Survey Area

Survey Units OOL-07-02 and OOL-07-03 are open land areas containing soils and small rocks. OOL-07-01 is unique in the fact that it is a soil pile, and not a typical land survey area.

4.5 ALARA Practices and Evaluations

The generic ALARA evaluation for soils is documented in Appendix C, Technical Report YA-REPT-00-003-05, "Generic ALARA Review for Final Status Survey of Soil at YNPS". The report is augmented by individual evaluations which are found in Appendix D, which concludes that no further remediation of soil below the DCGL is warranted.

5.0 SURVEY UNIT FINAL STATUS SURVEY

5.1 Survey Planning

5.1.1 Final Status Survey Plan and Associated DQOs

The FSS for OOL-07 Survey Area was planned and developed in accordance with the LTP using the DQO process. Form DPF-8856.1, found in YNPS Procedure 8856, "*Preparation of Survey Plans*," was used to provide guidance and consistency during development of the FSS Plans. The FSS Plans can be found in Appendix A. The DQO process allows for systematic planning and is specifically designed to address problems that require a decision to be made in a complex survey design and, in turn, provides alternative actions.

The DQO process was used to develop an integrated survey plan providing the Survey Unit identification, sample size, selected analytical techniques, survey instrumentation, and scan coverage. The Sign Test was specified for non-parametric statistical testing for this Survey Unit, if required. The design parameters developed are presented below.

Table 2 Survey Area OOL-07 Design Parameters

Survey Unit	Design Parameter	Value	Basis
OOL-07-01	Area	1597 m ²	Class 2
	Number of Direct Measurements	16 (calculated)	α (Type I) = 0.05 β (Type II) = 0.05 σ : 0.79 Relative Shift: 1.9 LBGR: 1.5 (Cs-137)
	Sample Area	99.8m ²	Area / Sample #
	Sample Grid Spacing: Triangular	10.74m	<u>Square Root (Area/(0.866*Sample #))</u>

Survey Unit	Design Parameter	Value	Basis
	Scan area	798.5 m2	Class 2 Area ~ 50%
	Scan Investigation Level	> Background Audible	SPA-3 Scan
OOL-07-02	Area	1316 m2	Class 1, $\leq 2,000$ m2
	Number of Direct Measurements	15 (calculated)	α (Type I) = 0.05
		+ 5 (added)	β (Type II) = 0.05
		Total: 20	σ : 0.67
			Relative Shift: 2.2
			LBGR: 1.5 (Cs-137)
	Sample Area	65.8m2	Area / Sample #
	Sample Grid Spacing: Triangular	8.7m	Square Root (Area/(0.866*Sample #))
	Scan area	1316 m2	Class 1 Area – 100%
	Scan Investigation Level	> Background Audible	SPA-3 Scan
OOL-07-03	Area	1212 m2	Class 1, $\leq 2,000$ m2
	Number of Direct Measurements	15 (calculated)	α (Type I) = 0.05
		+ 5 (added)	β (Type II) = 0.05
		Total: 20	σ : 0.67
			Relative Shift: 2.2
			LBGR: 1.5 (Cs-137)
	Sample Area	60.6m2	Area / Sample #
	Sample Grid Spacing: Triangular	8.37m	Square Root (Area/(0.866*Sample #))
	Scan area	1212 m2	Class 1 Area – 100%
	Scan Investigation Level	> Background Audible	SPA-3 Scan

5.1.2 Deviations from the FSS Plan as Written in the LTP

The FSSP design was performed to the criteria of the LTP; therefore, no LTP deviations with potential impact to this Survey Area need to be evaluated.

5.1.3 DCGL Selection and Use

For the final evaluation of the OOL-07 Survey Area and throughout this report, the administrative acceptance criterion of 8.73 mRem/yr has been set for Soil LTP-listed radionuclides.

Table 3 Soil DCGL Values

Nuclide	Soil 8.73 m/yr (pCi/g)	Nuclide	Soil 8.73 m/yr (pCi/g)
Co-60	1.4E+00	H-3	1.3E+02
Nb-94	2.5E+00	C-14	1.9E+00
Ag-108m	2.5E+00	Fe-55	1.0E+04
Sb-125	1.1E+01	Ni-63	2.8E+02
Cs-134	1.7E+00	Sr-90	6.0E-01
Cs-137	3.0E+00	Tc-99	5.0E+00
Eu-152	3.6E+00	Pu-238	1.2E+01
Eu-154	3.3E+00	Pu-239	1.1E+01
Eu-155	1.4E+02	Pu-241	3.4E+02
Am-241	1.0E+01	Cm-243	1.1E+01

5.1.4 Measurements

Error tolerances and characterization sample population statistics drove the selection of the number of statistical measurements. 16 statistical measurements were needed in OOL-07-01, 15 statistical measurements were needed in OOL-07-02, and 15 statistical measurements were needed in OOL-07-03 in the event the Sign test may have been used. In addition to the statistical measurements needed, 5 additional statistical samples were added in OOL-07-02 and 5 additional statistical samples were added in OOL-07-03 to enhance the power of the survey. 4 recount and 7 split samples were also performed in the OOL-07 Survey Area. An additional recount sample designated in the survey design for OOL-07-01 was not collected; however an adequate number of sample recounts were performed to satisfy QC requirements. Scans were performed with a SPA-3 in the three Survey Units.

The direct measurement sampling grid was developed as a systematic grid with spacing consisting of a triangular pitch pattern with a random starting point. The planned survey grid in OOL-07-01 differed from the final survey locations due to some of the locations being inaccessible. The survey locations were moved to alternate locations as per the LTP.

Sample measurement locations are provided in Attachment A.

5.2 Survey Implementation Activities

The Table below provides a summary of daily activities performed during the Final Status Survey of OOL-07.

Table 4 FSS Activity Summary for OOL-07

Survey Unit	Date	Activity
OOL-07-01	6/22/2005	Performed walk-down of Survey Unit
	6/29/2005	Established Isolation and Controls
	6/23/2005	Performed Job Hazard Analysis
	6/22/2005	Performed Unit Classification
	6/22/2005	Performed Sample Quantity Calculations, established DQOs
	6/23/2005 to 7/18/2005	Generated FFS Sample Plans
	6/30/2005 to 7/22/2005	Initiated Scans, and Direct measurements.
	8/8/2006	Performed DQA, FSS Complete
OOL-07-02	6/8/2006	Performed walk-down of Survey Unit
	6/10/2006	Established Isolation and Controls
	6/9/2006	Performed Job Hazard Analysis
	6/8/2006	Performed Unit Classification
	6/8/2006	Performed Sample Quantity Calculations, established DQOs
	6/8/2006	Generated FFS Sample Plans
	6/10/2006	Initiated Scans, and Direct measurements.
	7/24/2006	Performed DQA, FSS Complete
OOL-07-03	6/8/2006	Performed walk-down of Survey Unit
	6/9/2006	Established Isolation and Controls
	6/9/2006	Performed Job Hazard Analysis
	6/8/2006	Performed Unit Classification
	6/8/2006	Performed Sample Quantity Calculations, established DQOs
	6/8/2006	Generated FFS Sample Plans
	6/9/2006 to 6/10/2006	Initiated Scans, and Direct measurements.
	7/24/2006	Performed DQA, FSS Complete

5.3 Surveillance Surveys

5.3.1 Periodic Surveillance Surveys

Upon completion of the FSS of Survey Area OOL-07, the Survey Area was placed into the program for periodic surveillance surveys on a quarterly basis in accordance with YNPS procedure DP-8860, “*Area Surveillance Following Final Status Survey.*” These surveys provide assurance that areas with successful FSS remain unchanged until license termination.

5.3.2 Resurveys

A resurvey was performed on OOL-07-01. The resurvey sample results were evaluated against the original FSS sample data and no statistical differences were found. The resurvey demonstrated that there was no change in the Survey Area's status.

5.3.3 Investigations

No additional investigations were required for this Survey Area due to surveillance surveys.

5.4 Survey Results

Direct measurement surveys indicated that OOL-07 had no systematic measurements that exceeded the $DCGL_W$, depicted in Attachment B. Retrospective power curves were generated and demonstrated that an adequate number of samples were collected to support the Data Quality Objectives. Therefore, the null hypothesis (H_0) (that the Survey Unit exceeds the release criteria) is rejected.

Table 5 OOL-07-01 Direct Measurement Summary

Sample Description	Sum of Fractions	Sample Description	Sum of Fractions
OOL-07-01-001-F	0.04	OOL-07-01-009-F	0.07
OOL-07-01-002-F	0.06	OOL-07-01-010-F	0.05
OOL-07-01-003-F	0.06	OOL-07-01-011-F	0.05
OOL-07-01-004-F	0.07	OOL-07-01-012-F	0.06
OOL-07-01-005-F	0.03	OOL-07-01-013-F	0.06
OOL-07-01-006-F	0.04	OOL-07-01-014-F	0.07
OOL-07-01-007-F	0.08	OOL-07-01-015-F	0.05
OOL-07-01-008-F	0.04	OOL-07-01-016-F	0.05
Maximum Sum of Fractions		0.08	
Standard Deviation		0.01	

Table 6 OOL-07-02 Direct Measurement Summary

Sample Description	Sum of Fractions	Sample Description	Sum of Fractions
OOL-07-02-001-F	0.04	OOL-07-02-011-F	0.04
OOL-07-02-002-F	0.06	OOL-07-02-012-F	0.04
OOL-07-02-003-F	0.07	OOL-07-02-013-F	0.06
OOL-07-02-004-F	0.06	OOL-07-02-014-F	0.04
OOL-07-02-005-F	0.09	OOL-07-02-015-F	0.05
OOL-07-02-006-F	0.04	OOL-07-02-016-F	0.06
OOL-07-02-007-F	0.04	OOL-07-02-017-F	0.07
OOL-07-02-008-F	0.07	OOL-07-02-018-F	0.05
OOL-07-02-009-F	0.05	OOL-07-02-019-F	0.05
OOL-07-02-010-F	0.03	OOL-07-02-020-F	0.04
Maximum Sum of Fractions		0.09	
Standard Deviation		0.01	

Table 7 OOL-07-03 Direct Measurement Summary

Sample Description	Sum of Fractions	Sample Description	Sum of Fractions
OOL-07-03-001-F	0.12	OOL-07-03-011-F	0.08
OOL-07-03-002-F	0.15	OOL-07-03-012-F	0.07
OOL-07-03-003-F	0.06	OOL-07-03-013-F	0.04
OOL-07-03-004-F	0.06	OOL-07-03-014-F	0.07
OOL-07-03-005-F	0.06	OOL-07-03-015-F	0.05
OOL-07-03-006-F	0.04	OOL-07-03-016-F	0.07
OOL-07-03-007-F	0.06	OOL-07-03-017-F	0.04
OOL-07-03-008-F	0.06	OOL-07-03-018-F	0.05
OOL-07-03-009-F	0.10	OOL-07-03-019-F	0.05
OOL-07-03-010-F	0.04	OOL-07-03-020-F	0.05
Maximum Sum of Fractions		0.15	
Standard Deviation		0.03	

5.5 Data Quality Assessment

The Data Quality Assessment phase is the part of the FSS where survey design and data are reviewed for completeness and consistency, ensuring the validity of the results, verifying that the survey plan objectives were met, and validating the classification of the Survey Unit.

The sample design and the data acquired were reviewed and found to be in accordance with applicable YNPS procedures DP-8861, “*Data Quality Assessment*”; DP-8856, “*Preparation of Survey Plans*”; DP-8853, “*Determination of the Number and Locations of FSS Samples and Measurements*”; DP-8857, “*Statistical Tests*”; DP-8865, “*Computer Determination of the Number of FSS Samples and*

Measurements” and DP-8852, “*Final Status Survey Quality Assurance Project Plan*”.

The Data Quality Assessment power curves, scatter, quantile and frequency plots are found in Attachment B. Posting Plots are found in Attachment A.

5.5.1 OOL-07-01 Data Quality Assessment

Many investigation soil samples were collected in response to scan indications. Investigation samples were below the DCGLw. Biased soil samples were collected where scanning could not be performed due to high background. The biased soil sample results were below the DCGLw. Fixed point sample concentrations were below the DCGLw and no sum-of-fractions were equal to or greater than one. The data set was within approximately three standard deviations with normal dispersion about the arithmetic mean. The data posting plot does not clearly reveal any systematic spatial trends. The quantile plot exhibits normal symmetry and the frequency plot demonstrates a normal Poisson distribution. The survey maintained sufficient power to pass the unit and the data set verified the assumptions of the statistical test.

5.5.2 OOL-07-02 Data Quality Assessment

Fixed point sample concentrations were below the DCGLw and no sum-of-fractions were equal to or greater than one. Scans requiring investigation were investigated and the elevated readings were resolved. HTD sample results were <DCGLw. The data set was within approximately three standard deviations with normal dispersion about the arithmetic mean. The data posting plot does not clearly reveal any systematic spatial trends. The quantile plot exhibits normal symmetry and the frequency plot demonstrates a normal Poisson distribution. The survey maintained sufficient power to pass the unit and the data set verified the assumptions of the statistical test.

5.5.3 OOL-07-03 Data Quality Assessment

Fixed point sample concentrations were below the DCGLw and no sum-of-fractions were equal to or greater than one. Scans requiring investigation were investigated and the elevated readings were resolved. HTD sample results were <DCGLw. The data set was within approximately three standard deviations with normal dispersion about the arithmetic mean. The data posting plot does not clearly reveal any systematic spatial trends. The quantile plot exhibits a slight asymmetry in the lower quartile and the frequency plot demonstrates a normal distribution. The survey maintained sufficient power to pass the unit and the data set verified the assumptions of the statistical test.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

6.1 Instrument QC Checks

Operation of the E-600 w/SPA-3 was in accordance with DP-8535, "Setup and Operation of the Eberline E-600 Digital Survey Instrument," with QC checks performed in accordance with DP-8540, "Operation and Source Checks of Portable Friskers." Instrument response checks were performed prior to and after use for the E-600 w/SPA-3. All instrumentation involved with the FSS of OOL-07 satisfied the above criteria for the survey. QC records are found in Attachment C.

6.2 Split Samples and Recounts

6.2.1 OOL-07-01 Split Samples and Recounts

Two recount and three split "QC" samples were gathered and within tolerable limits in accordance with DP-8864, "*Split Sample Assessment for Final Status Survey*".

6.2.2 OOL-07-02 Split Samples and Recounts

One recount and two split "QC" samples were gathered and within tolerable limits in accordance with DP-8864, "*Split Sample Assessment for Final Status Survey*".

6.2.3 OOL-07-03 Split Samples and Recounts

One recount and two split "QC" samples were gathered and within tolerable limits in accordance with DP-8864, "*Split Sample Assessment for Final Status Survey*".

6.3 Self-Assessments

No self-assessments were performed during the FSS of OOL-07.

7.0 CONCLUSION

The FSS of OOL-07 has been performed in accordance with YNPS LTP and applicable FSS procedures. Evaluation of the direct measurement data has shown none of the systematic direct measurements exceeded the $DCGL_w$, depicted in Attachment B. Retrospective power curves were generated and demonstrated that an adequate number of samples were collected to support the Data Quality Objectives. Therefore, the null hypothesis (H_0) is rejected.

OOL-07 meets the objectives of the Final Status Survey.

Based upon the evaluation of the data acquired for the FSS, OOL-07 meets the release requirements set forth in the YNPS LTP. The Total Effective Dose Equivalent (TEDE) to the average member of the critical group does not exceed 25 mRem/yr, including that from groundwater. 10CFR20 Subpart E ALARA requirements have been met as well as the site release criteria for the administrative level DCGLs that ensure that the Massachusetts Department of Public Health's 10 mRem/yr limit will also be met.

List of Appendices

Appendix A – YNPS-FSSP-OOL-07, *“Final Status Survey Planning Worksheets*

Appendix B – YA-REPT-00-015-04, *“Instrument Efficiency Determination for Use in Minimum Detectable Concentration Calculations in Support of the Final Status Survey at Yankee Rowe”*

Appendix C – YA-REPT-00-003-05, *“Generic ALARA Review for Final Status Survey of Soil at YNPS”*

Appendix D – ALARA Evaluations, OOL-07

List of Attachments

Attachment A – Maps and Posting Plots

Attachment B – Data Quality Assessment Plots and Curves

Attachment C – Instrument QC Records

Attachment D – ORTEC Direct Measurement Data

(In the electronic version, every Table of Contents, Figures, Appendices and Attachments, as well as every mention of a Figure, Appendix or Attachment is a hyperlink to the actual location or document.)