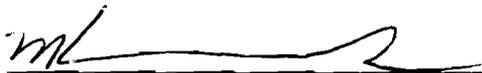
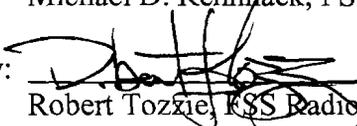


**YANKEE NUCLEAR POWER STATION  
FINAL STATUS SURVEY REPORT**

REPORT NO.: YNPS-FSS-OOL-06-00

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- 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-06

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 <sub>EMC</sub> .....	DCGL for small areas of elevated activity
DCGL <sub>w</sub> .....	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 <sub>o</sub> .....	Null Hypothesis
HSA .....	Historical Site Assessment
HTD .....	Hard-to-Detect
ISOCS .....	<i>In-situ</i> Object Counting System <sup>®</sup>
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-06 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

The OOL-06 Survey Area is comprised of 3 Survey Units. OOL-06 consists of land area west of the site comprised of soil and asphalt. The land is level to steeply sloping and ranges from heavily wooded to open land. Survey Unit OOL-06-01 is a heavily wooded open land area approximately 10,988 m<sup>2</sup> in size. OOL-06-01 was surveyed as a Class 3 Survey Unit. Survey Unit OOL-06-02 is heavily wooded with some asphalt comprising approximately 16,918 m<sup>2</sup> in surface area. OOL-06-02 was surveyed as a Class 3 Survey Unit. Survey Unit OOL-06-03, located north of OOL-06-02 is a asphalt covered open land area consisting of approximately 4,030 m<sup>2</sup> in surface area. OOL-06-03 was surveyed as a Class 2 Survey Unit. A map of the Survey Area and Unit divisions are found in Attachment A.

### 1.2 Dates of Surveys

Table 1 Date of Surveys and DQOs

Survey Unit	Survey Start Date	Survey End Date	DQA Date
OOL-06-01	7/13/2006	7/13/2006	10/24/2006
OOL-06-02	8/25/2006	8/29/2006	10/13/2006
OOL-06-03	9/1/2006	9/1/2006	10/23/2006

### 1.3 Number and Types of Measurements Collected

Final Status Survey Plans 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 46 statistical soil samples were taken in the Survey Area, providing data for the non-parametric testing of the Survey Area. Where sample locations fell on asphalt surfaces, samples were obtained of both the asphalt and the underlying soil. In addition to the statistical soil samples, 10 biased samples were obtained and SPA-3 scans were performed in the area. Approximately 50% of the class 2 survey unit was scanned while judgmental scans were performed in the class 3 survey units.

## **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. Soil sample surveys indicated that none of the systematic measurements exceeded the DCGL<sub>w</sub>, 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<sub>0</sub>) (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-06 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 per year, 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 per year 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 soil 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 soil 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-06 Survey Area is comprised of 3 Survey Units. A map of the Survey Area and Unit divisions are found in Attachment A.

### **3.1.1 OOL-06-01 Description**

Survey Unit OOL-06-01 is the southern most unit of Survey Area OOL-06 and consists of land area west of the industrial area bound by OOL-06-02 on the north and east, OOL-08-01 on the south and non-impacted land on the west. OOL-06-01 is comprised of approximately 10,988 square meters of heavily wooded land area with no structures or systems associated with it. The survey unit, was never part of the RCA and has not been disturbed since plant construction.

### **3.1.2 OOL-06-02 Description**

OOL-06-02 consists mainly of woodland's but includes an asphalt covered roadway which leads to the old administration building and mid-level parking lot. OOL-06-02 is bordered by OOL-06-01, OOL-08-01 to the south, OOL-05-01 to the west, OOL-05-04 & 08, OOL-06-03 to the north and OOL-02-03, OOL-08-06, OMB-02 (Security Gatehouse) to the east. The administration building has been removed as well as all of the trailers. OOL-06-02 is comprised of approximately 16,918 square meters of mostly wooded with some asphalt land area.

### **3.1.3 OOL-06-03 Description**

Survey Unit OOL-06-03 is located on the west side of the site and was never part of the RCA. The survey unit contains the main egress and ingress points for vehicles and personnel as well as a staging area for temporary storage and office trailers. Even though OOL-06-03 was never a site for storing, packaging, or processing radioactive waste, Radwaste shipments traversed the survey unit during the decommissioning. OOL-06-03 is bounded on the north by OOL-05, on the south and west by OOL-06-02, and on the east by OOL-02-03. OOL-06-03 was classified as a Class 3 area in the HSA; however, because of the volume of Radwaste shipments and the potential for activity to exist, OOL-06-03 has been reclassified as a MARSSIM Class 2 area. The survey unit is comprised of approximately 4,030 square meters of asphalt covered, open land area.

## **3.2 History of Survey Area**

OOL-06 contains no radioactive systems and never was a part of the RCA, as delineated in years 2004-2005. Survey area OOL-06 was not used for storing radioactive material or processing or packaging radioactive waste. The area was however, used for storage of demolition and asset recovery materials. Survey Area OOL-06 contained the main access and egress point for vehicles and personnel at the

YNPS site. This included a large volume of radioactive waste transported in containers, for off-site burial. Potential sources for contamination include: low level activity from the transport of the Radwaste containers as well as low level activity from run-off.

### 3.3 Division of Survey Area into Survey Units

The OOL-06 Survey Area is divided into 3 Survey Units. OOL-06-01, and OOL-06-02 are class 3 Survey Units. OOL-06-03 is a class 2 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 HSA

The Table below provides a summary of surveys performed during the Final Status Survey of OOL-06.

**Table 2 Dates of Surveys since HSA**

Survey Unit	Survey Start Date	Survey End Date	Description
OOL-06-01	7/13/2006	7/13/2006	FSS Survey
OOL-06-02	8/25/2006	8/29/2006	FSS Survey
OOL-06-03	9/1/2006	9/1/2006	FSS Survey

#### 4.1.2 Radionuclide Selection and Basis

##### 4.1.2.1 OOL-06-01 Radionuclides of Concern

Based on a review of HSA characterization data for Survey Unit OOL-08-01, the survey unit contiguous to OOL-06-01, Cesium-137 is the only plant-related radionuclide that was identified consistently (83.8%) in the 68 characterization soil samples analyzed (but its presence in soil also has a non-plant related origins such as fallout from weapons testing). The radionuclide-of-concern for OOL-06-01 was determined to be Cs-137 however; all LTP radionuclides were assessed in the survey.

##### 4.1.2.2 OOL-06-02 Radionuclides of Concern

A total of 29 characterization samples were taken from 10/13/94 to 11/10/94 indicating Co-60 and Cs-137 were the

only identified LTP specified radionuclides that warranted consideration in the OOL-06 Survey Area. However, all soil samples were evaluated for all LTP listed nuclides.

#### **4.1.2.3 OOL-06-03 Radionuclides of Concern**

Based upon 30 characterization samples taken from 12/09/97 to 08/03/98 Co-60 and Cs-137 were identified as the only radiological nuclides of concern for OOL-06-03. Characterization survey data from the HSA data indicated no other LTP-specified radionuclides warrant consideration in the OOL-06-03 Survey Unit. However, soil samples were evaluated for all LTP listed nuclides.

#### **4.1.3 Scoping & Characterization**

Because Survey Unit OOL-06-01 is similar in nature and contiguous with Survey Unit OOL-08-01, the radiological characterization data (68 characterization soil, sediment samples) from Survey Unit OOL-08-01 was used to plan the additional characterization data required for Survey Unit OOL-06-01. The design of the plan incorporated the FSS Data Quality Objective (DQO) process in accordance with procedure DP-8856 to facilitate subsequent FSS for Survey Unit OOL-06-01. This approach allowed the characterization data collected under this plan to be used as FSS data provided all of the License Termination Plan (LTP) survey design requirements are met and the results of the collected data satisfy all LTP specific release criteria. The characterization data supported the FSS of OOL-06-01. A total of 29 characterization samples taken from 10/13/94 to 11/10/94 were used to develop the DQOs for OOL-06-02. 30 characterization samples taken from 12/09/97 to 08/03/98 were used to develop the DQOs for OOL-06-03.

#### **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-06-01, and OOL-06-02 were identified as Class 3 areas. Survey Unit OOL-06-03 was identified as a Class 2 area. 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-06-01 Remedial Actions and Further Investigations**

Three areas were investigated in OOL-06-01 and in each case the elevated scan readings were attributed to non-plant related activity (i.e. rocks). One

statistical sample was greater than 50% of the DCGL<sub>w</sub> (i.e. the sum-of-fractions were 0.53). The reason for the higher SOF was attributed to a slightly higher value for the HTD radionuclide Sr-90. Because of the large amount of decayed organic matter found in this survey unit, it is not unusual to find slightly higher concentrations of Sr-90, as demonstrated in other areas of the plant site with similar conditions. No further investigations or remedial actions were required in this survey unit.

#### **4.3.2 OOL-06-02 Remedial Actions and Further Investigations**

One statistical sample was greater than 50% of the DCGL<sub>w</sub> (i.e. the sum-of-fractions were 0.88). The higher SOF was attributed to slightly higher values for the HTD radionuclides Tc-99 and Pu-241. After reviewing the data reports and posting plots, the determination was made that no further investigations or remedial actions were required in this survey unit.

#### **4.3.3 OOL-06-03 Remedial Actions and Further Investigations**

No investigations or remedial actions were required in OOL-06-03.

### **4.4 Unique Features of Survey Area**

Survey Unit OOL-06-01 was a heavily wooded area with steeply inclined topography. Survey Unit OOL-06-02 is a wooded area with clearings for a road, office area and parking areas. Part of the Survey Unit OOL-06-02 unit occupies the hill top overlooking the plant industrial area. OOL-06-03 was an open, level area and was covered with asphalt.

### **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-06 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 3 Survey Area OOL-06 Design Parameters**

Survey Unit	Design Parameter	Value	Basis
OOL-06-01	Survey Unit Area	10988 m <sup>2</sup>	Class 3, Soil, no restrictions
	Number of Direct Measurements	11 (calculated) + 0 (added) Total: 11	$\alpha$ (Type I) = 0.05 $\beta$ (Type II) = 0.05 $\sigma$ : 0.616 Relative Shift: 2.44 DCGLw: 3 (Cs-137) LBGR: 1.5
	Area Factor:	N/A	Class: 3 - N/A
	Gridded Sample Area Size Factor	Class 3: N/A	No grid in Class 3 area
	Sample Grid Spacing:	No Grid	No grid in Class 3 area, random locations
	Direct Measurement Investigation Level	> 50% DCGLw	Class 3 Area.
	Scanning Coverage Requirements	Judgmental	Class 3 Soil Area: Judgmental
	Scan Investigation Level	Audible > Background	Class 3 Area: Detectable over background
OOL-06-02	Survey Unit Area	16918 m <sup>2</sup>	Class 3, Soil, no restrictions
	Number of Direct Measurements	15 (calculated) + 5 (added) Total: 20	$\alpha$ (Type I) = 0.05 $\beta$ (Type II) = 0.05 $\sigma$ : 0.0649 Relative Shift: 2 DCGLw (Unity): 1 LBGR: 0.8702
	Area Factor:	N/A	Class: 3 - N/A
	Gridded Sample Area Size Factor	Class 3: N/A	No grid in Class 3 area
	Sample Grid Spacing:	No Grid	No grid in Class 3 area, random locations
	Direct Measurement Investigation Level	> 50% DCGLw	Class 3 Area.
	Scanning Coverage Requirements	Judgmental	Class 3 Soil Area: Judgmental
	Scan Investigation Level	Audible > Background	Class 3 Area: Detectable over background

Survey Unit	Design Parameter	Value	Basis
OOL-06-03	Survey Unit Area	4030 m <sup>2</sup>	Class 2, Soil, > 2,000 m <sup>2</sup> , ≤ 10,000 m <sup>2</sup>
	Number of Direct Measurements	15 (calculated) + 0 (added) Total: 15	$\alpha$ (Type I) = 0.05 $\beta$ (Type II) = 0.05 $\sigma$ : 0.0104 Relative Shift: 2 DCGL <sub>w</sub> (Unity): 1 LBGR: 0.9792
	Area Factor:	N/A	Class: 2 - N/A
	Gridded Sample Area Size Factor	268.67m <sup>2</sup>	Area / Number of Samples (4030 m <sup>2</sup> /15)
	Sample Grid Spacing:	Triangular: 17.6m	Square Root (4030 m <sup>2</sup> /(0.866*15))
	Direct Measurement Investigation Level	> DCGL <sub>w</sub>	Class 2 Area.
	Scanning Coverage Requirements	403 m <sup>2</sup>	Class 2 Soil Area: 10-100% systematic & judgmental
	Scan Investigation Level	Audible > Background	Class 2 Area: > DCGL <sub>w</sub> or > MDC

### 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-06 Survey Area and throughout this report, the administrative acceptance criterion of 8.73 mRem per year has been set for Soil LTP-listed radionuclides.

Table 4 Soil DCGL Values

Nuclide	Soil 8.73 mRem per year (pCi/g)	Nuclide	Soil 8.73 mRem per year (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. The quantity of statistical measurements collected for each unit is listed above in the table titled “Survey Area OOL-06 Design Parameters”. Split samples and recounts are addressed under the quality control section 6.2. The OOL-06-03 soil sampling grid was developed as a systematic grid with spacing consisting of a triangular pitch pattern with a random starting point. The OOL-06-01 and OOL-06-02 statistical sample locations were randomly determined. Sample measurement locations are provided in Attachment A.

The class 2 area, OOL-06-03, was scanned approximately 50% with a SPA-3. Judgmental SPA-3 scans were performed in the class 3 areas OOL-06-01 and OOL-06-02.

## 5.2 Survey Implementation Activities

The Table below provides a summary of daily activities performed during the Final Status Survey of OOL-06.

**Table 5 FSS Activity Summary for OOL-06**

Survey Unit	Date	Activity
OOL-06-01	7/12/2006	Performed walk-down of Survey Unit
	7/12/2006	Established Isolation and Controls
	7/12/2006	Performed Job Hazard Analysis
	5/2/2006	Performed Unit Classification
	5/2/2006	Performed Sample Quantity Calculations, established DQOs
	5/2/2006	Generated FFS Sample Plans
	7/13/2006	Performed Scans, and Direct measurements.
	10/24/2006	Performed DQA, FSS Complete
OOL-06-02	10/13/2006	Performed walk-down of Survey Unit
	8/25/2006	Established Isolation and Controls
	8/9/2006	Performed Job Hazard Analysis
	8/8/2006	Performed Unit Classification
	8/8/2006	Performed Sample Quantity Calculations, established DQOs
	8/8/2006	Generated FFS Sample Plans
	8/25/2006 to 8/29/2006	Performed Scans, and Direct measurements.
	10/13/2006	Performed DQA, FSS Complete
OOL-06-03	8/31/2006	Performed walk-down of Survey Unit
	9/1/2006	Established Isolation and Controls
	8/31/2006	Performed Job Hazard Analysis
	8/31/2006	Performed Unit Classification
	8/31/2006	Performed Sample Quantity Calculations, established DQOs
	8/31/2006	Generated FFS Sample Plans

Survey Unit	Date	Activity
	9/1/2006	Performed Scans, and Direct measurements.
	10/23/2006	Performed DQA, FSS Complete

### 5.3 Surveillance Surveys

#### 5.3.1 Periodic Surveillance Surveys

Upon completion of the FSS of Survey Area OOL-06, 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

No resurveys were performed in OOL-06.

#### 5.3.3 Investigations

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

### 5.4 Survey Results

Soil sample surveys indicated that OOL-06 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 6 Soil Sample Summary**

Sample Description	SOF	Sample Description	SOF	Sample Description	SOF
OOL-06-01-001-F	0.31	OOL-06-02-001-F	0.21	OOL-06-03-001-F-A	0.04
OOL-06-01-002-F	0.26	OOL-06-02-002-F	0.23	OOL-06-03-002-F-A	0.02
OOL-06-01-003-F	0.06	OOL-06-02-003-F	0.12	OOL-06-03-003-F-A	0.03
OOL-06-01-004-F	0.17	OOL-06-02-004-F	0.06	OOL-06-03-004-F-A	0.03
OOL-06-01-005-F	0.31	OOL-06-02-005-F	0.05	OOL-06-03-005-F-A	0.03
OOL-06-01-006-F	0.37	OOL-06-02-006-F	0.25	OOL-06-03-006-F-A	0.02
OOL-06-01-007-F	0.53	OOL-06-02-007-F	0.88	OOL-06-03-007-F-A	0.04
OOL-06-01-008-F	0.08	OOL-06-02-008-F	0.03	OOL-06-03-008-F-A	0.02
OOL-06-01-009-F	0.27	OOL-06-02-009-F	0.02	OOL-06-03-009-F-A	0.02
OOL-06-01-010-F	0.18	OOL-06-02-010-F	0.05	OOL-06-03-010-F-A	0.03
OOL-06-01-011-F	0.10	OOL-06-02-011-F	0.04	OOL-06-03-011-F-A	0.05
		OOL-06-02-012-F	0.03	OOL-06-03-012-F-A	0.02
		OOL-06-02-013-F	0.13	OOL-06-03-013-F-A	0.02

Sample Description	SOF	Sample Description	SOF	Sample Description	SOF
		OOL-06-02-014-F	0.06	OOL-06-03-014-F-A	0.02
		OOL-06-02-015-F	0.15	OOL-06-03-015-F-A	0.02
		OOL-06-02-016-F	0.08		
		OOL-06-02-017-F	0.27		
		OOL-06-02-018-F-A	0.01		
		OOL-06-02-019-F	0.07		
		OOL-06-02-020-F	0.07		
Max	0.53	Max	0.88	Max	0.05
Average	0.24	Average	0.14	Average	0.03
Standard Deviation	0.14	Standard Deviation	0.19	Standard Deviation	0.01

Subsurface samples were taken at every statistical sample point in OOL-06-03. All subsurface samples were  $<DCGL_w$  and no sum-of-fraction was equal to or greater than 1 therefore the surface asphalt samples were deemed appropriate to be treated as statistical surface soils in accordance with YNPS LTP 5.6.2.3.

SPA-3s were used for scan surveys of OOL-06. No activity greater than background or  $DCGL_w$ , attributable to plant radionuclides was present in OOL-06.

## 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-06-01 Data Quality Assessment

Fixed point sample concentrations were below the  $DCGL_w$  and no sum-of-fractions were equal to or greater than one. HTD sample results were  $<DCGL_w$ . The data set was within approximately two standard deviations with normal dispersion about the arithmetic mean. The data posting plot does not clearly reveal any systematic spatial trends. There are no especially unusual features associated with the quantile plot 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.

### **5.5.2 OOL-06-02 Data Quality Assessment**

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. HTD sample results were <DCGLW. The data set was within one standard deviation with normal dispersion about the arithmetic mean with the exception of one sample that was high, but less than the DCGLW resulting in a slight skew to the right in the frequency plot. The data posting plot, however, does not clearly reveal any systematic spatial trends. The quantile plot exhibits some asymmetry in the upper quartile. The survey maintained sufficient power to pass the unit and the data set verified the assumptions of the statistical test.

### **5.5.3 OOL-06-03 Data Quality Assessment**

Fixed point sample concentrations were below the DCGLW and no sum-of-fractions were equal to or greater than one. HTD sample results were <DCGLW. The data set was within approximately two standard deviations with normal dispersion about the arithmetic mean. There are no especially unusual features associated with the quantile plot and the frequency plot demonstrates a normal distribution. The data posting plot does not clearly reveal any systematic spatial trends. 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-06 satisfied the above criteria for the survey. QC records are found in Attachment C.

## 6.2 Split Samples and Recounts

### 6.2.1 OOL-06-01 Split Samples and Recounts

One split and one recount ‘QC’ sample were gathered and within tolerable limits in accordance with DP-8864, “*Split Sample Assessment for Final Status Survey*”.

### 6.2.2 OOL-06-02 Split Samples and Recounts

One split and one recount “QC” sample were gathered and within tolerable limits in accordance with DP-8864, “*Split Sample Assessment for Final Status Survey*”.

### 6.2.3 OOL-06-03 Split Samples and Recounts

One split and one recount “QC” sample 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-06.

## 7.0 CONCLUSION

The FSS of OOL-06 has been performed in accordance with YNPS LTP and applicable FSS procedures. Evaluation of the soil sample data has shown none of the systematic soil samples 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-06 meets the objectives of the Final Status Survey.

Based upon the evaluation of the data acquired for the FSS, OOL-06 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 per year, 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 per year limit will also be met.

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List of Appendices

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Appendix A – YNPS-FSSP-OOL-06, “*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-06

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List of Attachments

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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.)*