YANKEE NUCLEAR POWER STATION
FINAL STATUS SURVEY REPORT

REPORT NO.: YNPS-FSS-OOL-02-00

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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-02

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List of Attachments

Attachment A – Maps and Posting Plots

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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_o	Null Hypothesis
HSA	Historical Site Assessment
HTD	Hard-to-Detect
ISOCS	*In-situ* 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-02 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-02 Survey Area is comprised of 5 Survey Units in the original non-RCA portion of the YNPS site inside the security fence, which is owned by YAEC. Three of survey units are in the area of the site known as the Non-Rad Yard Area, one survey unit occupies portions of the Turbine Building footprint and one survey unit occupies the Service Building footprint. Survey Unit OOL-02-01, located in the northern portion of the site industrial area in the footprint of the former Turbine Building, is an open land area approximately 927 m2 in size. OOL-02-01 was surveyed as a Class 1 Survey Unit. Survey Unit OOL-02-02, located in the northern portion of the site industrial area in the footprint of the former Service Building, is an open land area consisting of approximately 1643 m2 in surface area. OOL-02-02 was surveyed as a Class 1 Survey Unit. Survey Unit OOL-02-03, located in the northwestern corner of the site industrial area, is an open land area consisting of approximately 2648 m2 in surface area. The security gatehouse and its diesel generator, which are in the survey unit, were surveyed to free release and therefore are not part of OOL-02-03. OOL-02-03 was surveyed as a Class 3 Survey Unit. Survey Unit OOL-02-04 lies north of and adjacent to the turbine building and service building footprints and is an open land area consisting of approximately 1912 m2 in surface area. OOL-02-04 was surveyed as a Class 1 Survey Unit. Survey Unit OOL-02-05, located to the north of Survey Unit OOL-02-04 is an open land area consisting of approximately 5953 m2 in surface area and is referred to as the "north road". OOL-02-05 was surveyed as a Class 2 Survey Unit.

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 Date of Surveys and DQOs

Survey Unit	Survey Start Date	Survey End Date	DQA Date
OOL-02-01	10/28/05	11/10/05	10/19/06
OOL-02-02	4/24/06	5/01/06	10/30/06
OOL-02-03	9/05/06	9/06/06	10/20/06
OOL-02-04	8/17/06	8/22/06	10/12/06
OOL-02-05	8/24/2006	9/05/2006	10/13/2006

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 105 statistical soil samples were taken in the Survey Area, providing data for the non-parametric testing of the Survey Area along with 3 biased samples. In addition to the soil samples, 100% of the Class 1 areas were scanned, greater than 50% of the Class 2 area was scanned and approximately 30% of the class 3 area was scanned.

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 $DCGL_W$, 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_o) (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-02 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

The OOL-02 Survey Area is comprised of 5 Survey Units in the original non-RCA portion of the YNPS site inside the security fence. Survey Area OOL-02 represents the primary travel path for personnel and material entering and leaving the YNPS site. OOL-02 was not used for radioactive material storage during plant operations, however, during demolition, areas of OOL-02 were utilized as a storage site for contaminated soils. These areas were reclassified accordingly. A map of the Survey Area and Unit divisions are found in Attachment A.

3.1.1 OOL-02-01 Description

Survey Unit OOL-02-01 is the exposed, sub slab land area resulting from the demolition of the Turbine Building concrete pad. Located at the northern portion of the site Industrial Area, it is an open land area of approximately 927 m^2. Survey Unit OOL-02-01 is bounded by Survey Unit OOL-02-04 to the north, OOL-02-02 to the east, Survey Area OOL-10 to the west and NOL-01 and NOL-06 to the south. The above-grade structural part of the Turbine Building has been demolished and removed. The remaining footprint includes the at-grade concrete floor slab, miscellaneous excavations which expose underlying soil and/or concrete, and the exposed soil grade.

Events and conditions during operations and decommissioning have introduced radioactive materials into the survey unit. Examples include the following.

- Contaminated drain piping was removed from under the concrete pad exposing soil underneath.
- Radioactive contaminated soils from various excavations were stored in the area, contaminating the concrete pad as well as exposed soil in cratered areas. This includes the SFP excavation and the sweeper truck residues.
- These areas have been posted Radioactive Materials and Contaminated Areas.

The original HSA and surveys prompted a LTP MARSSIM Classification of 3. Since that time, OOL-02-01 has been reclassified to Class 1 due to the reasons listed above.

3.1.2 OOL-02-02 Description

Survey Unit OOL-02-02, located within the northern portion of the site Industrial Area, is an open land area of approximately 1,643 m^2 surface area. Survey Unit OOL-02-02 is bordered to the north by the north site industrial road, to the west by OOL-02-01, to the south by NOL-01-04 and to the east by OOL-02-05. Sections of the survey unit were formerly within the RCA. OOL-02-02 encompasses the former Service Building and Service Building Annex sub slab soil – post-demolition and removal. The post-demolition condition of OOL-02-02 includes some remnants of concrete associated with foundation walls along the survey unit perimeter. Subsurface systems that traverse or connect within OOL-02-02 have been removed. Survey Unit OOL-02-02 is a Class 1 open land area that is predominantly a level surface, with several excavation trenches.

3.1.3 OOL-02-03 Description

Survey Unit OOL-02-03, located in the northwestern corner of the site industrial area, is an open land area of approximately 2,648 m^2 in surface area. OOL-02-03 is bordered by OOL-04-04 and OOL-05-04 to the north, OOL-08-06 to the south, OOL-06-02 and OOL-06-03 to the west, OOL-10-01 and OOL-02-05 to the east. Structures and subsurface systems remaining in the survey unit (i.e. gatehouse and its diesel generator and the west storm drains) have undergone a free release survey. Based upon the history of the survey unit, there is little reason to believe that concentrations in excess of a very small fraction of the DCGLs exist in the unit; therefore the unit classification remains a Class 3.

3.1.4 OOL-02-04 Description

Survey Unit OOL02-04, located inside the industrial area fence, and outside the RCA, is an open land area of approximately 1,912 m^2 of surface area. The unit shares its north, west and east boundaries with Survey Unit OOL-02-05. Its south boundary is formed with Survey Units OOL-02-01, OOL-02–02, and OOL-10-03. OOL-02-04 consists of a portion of soil area that lies north of and adjacent to the turbine building and service building footprints (Survey Areas TBN-01 and SVC-01).

The unit has been impacted by D&D activities. Materials (soil, debris) have been placed in and removed from the unit as necessary to support decommissioning of the site prompting a reclassification to a Class 1 area.

3.1.5 OOL-02-05 Description

Survey Unit OOL02-05, located inside the industrial area fence, and outside the RCA, is an open land area of approximately 5,593 m^2 of surface area. It consists of a portion of soil area located to the north of Survey Unit OOL-02-04. OOL-02-05 is bordered on the north by Survey Areas OOL-01, OOL-03 and OOL-04. It is bordered on the east by areas OOL-12 and OOL-13. The unit is bordered on the south by areas OOL-12 and OOL-02 and is bordered on the west by OOL-02-03.

A portion of the unit historically represents part of the travel path for personnel and material entering and leaving the Yankee site. During operation of the plant, the unit was not used for storing radioactive material or processing radioactive waste. However, the unit may have been subject to low-level contamination resulting from traffic of personnel and equipment during operations and decommissioning activities. Additionally, inadvertent run-off from the RCA yard areas may have introduced low levels of contamination. Characterization soil samples indicated that the soil concentrations of plant-related radioactivity are not expected to exceed DCGLs. Therefore, the unit has been classified as a Class 2 unit.

3.2 History of Survey Area

Survey Area OOL-02 represents the primary travel path for personnel and material entering and leaving the YNPS site. Systems present in the survey area include the service water discharge, circulating water discharge, the ASWS discharge piping and the east and west storm drains. All of these subsurface systems have been either removed or surveyed to FSS/free release criteria. Contamination of OOL-02 may have resulted from run-off of low levels of radioactive contamination present on the RCA yard area surface or from traffic of contaminated personnel, equipment, and material. Contaminated soils and materials temporarily stored in the area during demolition activities may have additionally contributed to the contamination in the area.

3.3 Division of Survey Area into Survey Units

The OOL-02 Survey Area is divided into 5 Survey Units. OOL-02-01, OOL-02-02 and OOL-02-04 are class 1 Survey Units. OOL-02-05 is a Class 2 and OOL-02-03 is

a Class 3 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-02.

Table 2 Dates of Surveys since HSA

Survey Unit	Survey Start Date	Survey End Date	Description
OOL-02-01	10/28/05	11/10/05	FSS Survey
OOL-02-02	4/24/06	5/01/06	FSS Survey
OOL-02-03	9/05/06	9/06/06	FSS Survey
OOL-02-04	8/17/06	8/22/06	FSS Survey
OOL-02-05	8/24/2006	9/05/2006	FSS Survey

4.1.2 Radionuclide Selection and Basis

4.1.2.1 OOL-02-01 Radionuclides of Concern

During the initial DQO process, Co-60 was identified as the radiological nuclide of concern for OOL-02-01. Characterization survey data from the HSA data indicated no other LTP-specified radionuclides warrant consideration in the OOL-02-01 Survey Unit. However, soil samples were evaluated for all LTP listed nuclides.

4.1.2.2 OOL-02-02 Radionuclides of Concern

Based on a review of characterization data, plant-related radionuclides Co-60, Cs-137 and SB-125 were positively identified in more than 25% of the samples. Characterization survey data indicated no other LTP-specified radionuclides warrant consideration in the OOL-02-02 Survey Unit. However, soil samples were evaluated for all LTP listed nuclides.

4.1.2.3 OOL-02-03 Radionuclides of Concern

During the initial DQO process, Co-60 and Cs-137 were identified as the only radiological nuclides of concern for OOL-02-03. Characterization survey data from the HSA data

indicated no other LTP-specified radionuclides warrant consideration in the OOL-02-03 Survey Unit. However, soil samples were evaluated for all LTP listed nuclides.

4.1.2.4 OOL-02-04 Radionuclides of Concern

During the initial DQO process, Cs-137 was identified as the only radiological nuclide of concern for OOL-02-04. Characterization survey data from the HSA data indicated no other LTP-specified radionuclides warrant consideration in the OOL-02-04 Survey Unit. However, soil samples were evaluated for all LTP listed nuclides.

4.1.2.5 OOL-02-05 Radionuclides of Concern

During the initial DQO process, Cs-137 was identified as the only radiological nuclide of concern for OOL-02-05. Characterization survey data from the HSA and biased survey data indicated no other LTP-specified radionuclides warrant consideration in the OOL-02-05 Survey Unit. However, soil samples were evaluated for all LTP listed nuclides.

4.1.3 Scoping & Characterization

Characterization data used to develop the DQOs for OOL-02 surveys came from a variety of sources including the Historical Site Assessment, review of FSS data from adjacent survey units and from additional characterization surveys.

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 Units OOL-02-01, OOL-02-02, and OOL-02-04 were identified as Class 1 areas. Survey Unit OOL-02-05 was identified as a Class 2 area and OOL-02-03 was identified as a Class 3 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-02-01 Remedial Actions and Further Investigations

Eleven ISOCS scan locations, grouped in three distinct areas of Survey Unit OOL-02-01, were investigated by a combination of repeat ISOCS scans, SPA-3 scans and soil samples. One of these investigations identified a localized area of contamination in excess of the $DCGL_W$ but

less than $DCGL_{EMC}$. The location was remediated by sampling. No further remediation was required and no areas greater than the $DCGL_W$ remained in the survey unit.

4.3.2 OOL-02-02 Remedial Actions and Further Investigations

No investigations or remedial actions were required in OOL-02-02.

4.3.3 OOL-02-03 Remedial Actions and Further Investigations

No investigations or remedial actions were required in OOL-02-03.

4.3.4 OOL-02-04 Remedial Actions and Further Investigations

No investigations or remedial actions were required in OOL-02-04.

4.3.5 OOL-02-05 Remedial Actions and Further Investigations

Four areas were investigated using SPA-3 scanning. No plant related radionuclides were identified in any of the scans and no remediation was required. No elevated areas remained in OOL-02-05.

4.4 Unique Features of Survey Area

All OOL-02 survey units were open land areas and each had areas of excavations and or trenches. Survey Units OOL-02-01 and OOL-02-02 contained concrete remnants in the form of foundation walls or partial slabs that were surveyed separately from OOL-02 in the form of Free Release Surveys or Final Status Surveys.

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-02 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-02 Design Parameters

Survey Unit	Design Parameter	Value	Basis
OOL-02-01	Survey Unit Area	927 m2	Class 1, Soil, ≤ 2,000 m2
	Number of Direct Measurements	15 (calculated) + 5 (added) Total: 20	α (Type I) = 0.05 β (Type II) = 0.05 σ: 0.09 Relative Shift: 2 DCGLw: 1.3 LBGR: 1.12
	Critical Value	14 for Sign test.	(20/2)+(1.645/2)*Square Root (20)
	Gridded Sample Area Size Factor	46.35 m2	Area / Number of Samples (927 m2/20)
	Sample Grid Spacing:	Triangular: 7.31m	Square Root (927 m2/(0.866*20))
	Direct Measurement Investigation Level	> DCGLemc or > DCGLw + 3 Sigma	Class 1 Area: > DCGLemc or > DCGLw + 3 Sigma
	Scanning Coverage Requirements	927 m2	Class 1 Soil Area: 100%
	Scan Investigation Level	Co-60: 0.96 pCi/gm, Cs-137 : 4.1 pCi/gm, or SOF >1	2m 90° ISOCS surrogated
OOL-02-02	Survey Unit Area	1643 m2	Class 1, Soil, ≤ 2,000 m2
	Number of Direct Measurements	15 (calculated) + 5 (added) Total: 20	α (Type I) = 0.05 β (Type II) = 0.05 σ: 0.18 Relative Shift: 2.78 DCGLw (Unity): 1 LBGR: 0.5
	Critical Value	14 for Sign test.	(20/2)+(1.645/2)*Square Root (20)
	Gridded Sample Area Size Factor	82.15 m2	Area / Number of Samples (1643 m2/20)
	Sample Grid Spacing:	Triangular: 9.74 m	Square Root (1643 m2/(0.866*20))
	Direct Measurement Investigation Level	> DCGLemc or > DCGLw + 3 Sigma	Class 1 Area: > DCGLemc or > DCGLw + 3 Sigma

Survey Unit	Design Parameter	Value	Basis
	Scanning Coverage Requirements	1643 m2	Class 1 Soil Area: 100%
	Scan Investigation Level	Co-60: 0.18 pCi/gm, Cs-137 : 0.7 pCi/gm, or SOF >1	1m 180° ISOCS
OOL-02-03	Survey Unit Area	2648 m2	Class 3, Soil, no restrictions
	Number of Direct Measurements	15 (calculated) + 10 (added) Total: 25	α (Type I) = 0.05 β (Type II) = 0.05 σ: 0.0496 Relative Shift: 2 DCGLw (Unity): 1 LBGR: 0.9
	Critical Value	17 for Sign test.	(25/2)+(1.645/2)*Square Root (25)
	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: > 50% DCGLw
	Scanning Coverage Requirements	Judgmental	Class 3 Soil Area: Judgmental
	Scan Investigation Level	> Background Audible.	SPA-3
OOL-02-04	Survey Unit Area	1912 m2	Class 1, Soil, ≤ 2,000 m2
	Number of Direct Measurements	15 (calculated) + 5 (added) Total: 20	α (Type I) = 0.05 β (Type II) = 0.05 σ: 0.0836 Relative Shift: 2 DCGLw: 3 LBGR: 2.8328
	Critical Value	14 for Sign test.	(20/2)+(1.645/2)*Square Root (20)
	Gridded Sample Area Size Factor	95.6 m2	Area / Number of Samples (1912 m2/20)
	Sample Grid Spacing:	Triangular: 10.5 m	Square Root (1912 m2/(0.866*20))
	Direct Measurement Investigation Level	> DCGLemc or > DCGLw + 3 Sigma	Class 1 Area: > DCGLemc or > DCGLw + 3 Sigma
	Scanning Coverage Requirements	1912 m2	Class 1 Soil Area: 100%
	Scan Investigation Level	Co-60: 0.18 pCi/gm, Cs-137 : 0.7 pCi/gm, or SOF >1	1m 180° ISOCS
	Scan Investigation Level	Co-60: 1.0 pCi/gm, Cs-137 : 4.3 pCi/gm, or SOF >1	2m 90° ISOCS
OOL-02-05	Survey Unit Area	5953 m2	Class 2, Soil, > 2,000 m2, ≤ 10,000 m2
	Number of Direct Measurements	15 (calculated) + 5 (added) Total: 20	α (Type I) = 0.05 β (Type II) = 0.05 σ: 0.19 Relative Shift: 2 DCGLw: 3 LBGR: 2.62

Survey Unit	Design Parameter	Value	Basis
	Critical Value	14 for Sign test.	(20/2)+(1.645/2)*Square Root (20)
	Gridded Sample Area Size Factor	297.64 m2	Area / Number of Samples (5953 m2/20)
	Sample Grid Spacing:	Triangular: 18.5 m	Square Root (5953 m2/(0.866*20))
	Direct Measurement Investigation Level	> DCGLw	Class 2 Area: > DCGLw
	Scanning Coverage Requirements	595.3 m2	Class 2 Soil Area: 10-100% systematic & judgmental
	Scan Investigation Level	> Background Audible	Class 2 Area: > DCGLw 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. The method by which ISOCS scan investigation levels are determined was revised subsequent to performance of ISOCS scan surveys in Survey Unit OOL-02-02. As such, the correct investigation levels, indicated in Table 3 above, differ from those stated in the OOL-02-02 FSSP. All scan data was reviewed and compared to the revised investigation levels.

5.1.3 DCGL Selection and Use

For the final evaluation of the OOL-02 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-02 Design Parameters". Split samples and recounts are addressed under the quality control section 6.2. The OOL-02-01, OOL-02-02, OOL-02-04 and OOL-02-05 soil sampling grids were developed as systematic grids with spacing consisting of a triangular pitch pattern with random starting points. The OOL-02-03 sample locations were randomly determined. Sample measurement locations are provided in Attachment A.

The class 1 areas, OOL-02-01, OOL-02-02, and OOL-02-04, were scanned 100% with ISOCS. The results are listed in the table below titled "ISOCS Scan Summary". The class 2 area, OOL-02-05, was scanned using the SPA-3 with scan coverage greater than 50%. The class 3 area, OOL-02-03, was scanned using the SPA-3 with scan coverage of approximately 30%. Investigation scans in OOL-02-01 were performed using ISOCS and SPA-3. Investigation scans in OOL-02-05 were performed using SPA-3.

5.2 Survey Implementation Activities

The Table below provides a summary of daily activities performed during the Final Status Survey of OOL-02.

Table 5 FSS Activity Summary for OOL-02

Survey Unit	Date	Activity
OOL-02-01	10/19/05	Performed walk-down of Survey Unit
	10/20/05	Established Isolation and Controls
	10/19/05	Performed Job Hazard Analysis
	10/13/05	Performed Unit Classification
	10/20/05	Performed Sample Quantity Calculations, established DQOs
	10/20/05	Generated FFS Sample Plans
	10/28/05 to 11/10/05	Initiated Scans, and Direct measurements.
	10/19/06	Performed DQA, FSS Complete
OOL-02-02	4/24/06	Performed walk-down of Survey Unit
	4/24/06	Established Isolation and Controls
	4/24/06	Performed Job Hazard Analysis
	4/4/06	Performed Unit Classification
	4/24/06	Performed Sample Quantity Calculations, established DQOs
	4/24/06	Generated FFS Sample Plans
	4/24/06 to 5/01/06	Initiated Scans, and Direct measurements.
	10/30/06	Performed DQA, FSS Complete
OOL-02-03	8/15/06	Performed walk-down of Survey Unit

Survey Unit	Date	Activity
	9/05/06	Established Isolation and Controls
	8/15/06	Performed Job Hazard Analysis
	8/15/06	Performed Unit Classification
	8/14/06	Performed Sample Quantity Calculations, established DQOs
	8/14/06	Generated FFS Sample Plans
	9/05/06 to 9/06/06	Initiated Scans, and Direct measurements.
	10/20/06	Performed DQA, FSS Complete
OOL-02-04	8/17/06	Performed walk-down of Survey Unit
	8/17/06	Established Isolation and Controls
	8/16/06	Performed Job Hazard Analysis
	6/13/06	Performed Unit Classification
	6/06/06	Performed Sample Quantity Calculations, established DQOs
	8/17/06	Generated FFS Sample Plans
	8/17/06 to 8/22/06	Initiated Scans, and Direct measurements.
	10/12/06	Performed DQA, FSS Complete
OOL-02-05	8/24/2006	Performed walk-down of Survey Unit
	8/24/2006	Established Isolation and Controls
	8/23/2006	Performed Job Hazard Analysis
	8/08/2006	Performed Unit Classification
	8/04/2006	Performed Sample Quantity Calculations, established DQOs
	8/23/2006	Generated FFS Sample Plans
	8/24/2006 to 9/05/2006	Initiated Scans, and Direct measurements.
	10/13/2006	Performed DQA, FSS Complete

5.3 Surveillance Surveys

5.3.1 Periodic Surveillance Surveys

Upon completion of the FSS of Survey Area OOL-02, 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

An area surveillance survey was performed in Survey Unit OOL-02-02 to verify that rain and storm runoff, in addition to remediation activities in adjacent units, had not affected the radiological status of the area. The mean of the original FSS and that of the surveillance survey were in agreement.

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-02 had no systematic or randomly selected 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_o) (that the Survey Unit exceeds the release criteria) is rejected.

Table 6 Soil Sample Summary

Sample Description	SOF	Sample Description	SOF	Sample Description	SOF	Sample Description	SOF	Sample Description	SOF
OOL-02-01-001-F	0.47	OOL-02-02-001-F	0.06	OOL-02-03-001-F	0.04	OOL-02-04-001-F	0.06	OOL-02-05-001-F	0.04
OOL-02-01-002-F	0.13	OOL-02-02-002-F	0.04	OOL-02-03-002-F	0.03	OOL-02-04-002-F	0.06	OOL-02-05-002-F	0.04
OOL-02-01-003-F	0.09	OOL-02-02-003-F	0.06	OOL-02-03-003-F	0.05	OOL-02-04-003-F	0.04	OOL-02-05-003-F	0.06
OOL-02-01-004-F	0.03	OOL-02-02-004-F	0.07	OOL-02-03-004-F	0.06	OOL-02-04-004-F	0.06	OOL-02-05-004-F	0.08
OOL-02-01-005-F	0.08	OOL-02-02-005-F	0.04	OOL-02-03-005-F	0.07	OOL-02-04-005-F	0.06	OOL-02-05-005-F	0.05
OOL-02-01-006-F	0.06	OOL-02-02-006-F	0.08	OOL-02-03-006-F	0.17	OOL-02-04-006-F	0.05	OOL-02-05-006-F	0.06
OOL-02-01-007-F	0.50	OOL-02-02-007-F	0.07	OOL-02-03-007-F	0.15	OOL-02-04-007-F	0.05	OOL-02-05-007-F	0.03
OOL-02-01-008-F	0.08	OOL-02-02-008-F	0.13	OOL-02-03-008-F-A	0.04	OOL-02-04-008-F	0.06	OOL-02-05-008-F	0.07
OOL-02-01-009-F	0.09	OOL-02-02-009-F	0.06	OOL-02-03-009-F	0.07	OOL-02-04-009-F	0.05	OOL-02-05-009-F	0.09
OOL-02-01-010-F	0.13	OOL-02-02-010-F	0.07	OOL-02-03-010-F	0.11	OOL-02-04-010-F	0.05	OOL-02-05-010-F	0.07
OOL-02-01-011-F	0.34	OOL-02-02-011-F	0.05	OOL-02-03-011-F	0.05	OOL-02-04-011-F	0.05	OOL-02-05-011-F	0.08
OOL-02-01-012-F	0.03	OOL-02-02-012-F	0.07	OOL-02-03-012-F	0.11	OOL-02-04-012-F	0.05	OOL-02-05-012-F	0.06
OOL-02-01-013-F	0.13	OOL-02-02-013-F	0.03	OOL-02-03-013-F	0.13	OOL-02-04-013-F	0.07	OOL-02-05-013-F	0.05
OOL-02-01-015-F	0.04	OOL-02-02-014-F	0.05	OOL-02-03-014-F	0.15	OOL-02-04-014-F	0.07	OOL-02-05-014-F	0.06
OOL-02-01-016-F	0.04	OOL-02-02-015-F	0.08	OOL-02-03-015-F	0.07	OOL-02-04-015-F	0.12	OOL-02-05-015-F	0.03
OOL-02-01-017-F	0.06	OOL-02-02-016-F	0.06	OOL-02-03-016-F	0.13	OOL-02-04-016-F	0.08	OOL-02-05-016-F	0.03
OOL-02-01-018-F	0.05	OOL-02-02-017-F	0.05	OOL-02-03-017-F	0.14	OOL-02-04-017-F	0.04	OOL-02-05-017-F	0.07
OOL-02-01-019-F	0.04	OOL-02-02-018-F	0.09	OOL-02-03-018-F	0.04	OOL-02-04-018-F	0.03	OOL-02-05-018-F	0.05
OOL-02-01-020-F	0.05	OOL-02-02-019-F	0.09	OOL-02-03-019-F	0.04	OOL-02-04-019-F	0.05	OOL-02-05-019-F	0.04
OOL-02-01-027-F	0.48	OOL-02-02-020-F	0.02	OOL-02-03-020-F	0.09	OOL-02-04-020-F	0.10	OOL-02-05-020-F	0.07
				OOL-02-03-021-F	0.10				
				OOL-02-03-022-F	0.20				
				OOL-02-03-023-F	0.11				
				OOL-02-03-024-F	0.11				
				OOL-02-03-025-F	0.17				
Max	0.50	Max	0.13	Max	0.20	Max	0.12	Max	0.09
Average	0.15	Average	0.06	Average	0.10	Average	0.06	Average	0.06
Standard Deviation	0.16	Standard Deviation	0.02	Standard Deviation	0.05	Standard Deviation	0.02	Standard Deviation	0.02

SPA-3s were used for scan surveys of OOL-02-03 and OOL-02-05. No activity greater than background or DCGLw, attributable to plant radionuclides, was present in OOL-02-03 or OOL-02-05. ISOCS systems were used to perform scan surveys for the remainder of the units. Measurement results listed below are reported in sum of fraction of the investigation levels. A number less than one indicates that no investigation was warranted.

$$Investigation\ level\ (I_{LV}) = {}^{1}DCGL_W \times {}^{2}AF \times AdjustmentFactor$$

[1] Soil $DCGL_W$ from Appendix 6E of YNPS LTP
[2] Area Factor for 1 m^2 taken from Appendix 6Q of YNPS LTP

$$\frac{C_1}{I_{LV_1}} + \frac{C_2}{I_{LV_2}} + \ldots + \frac{C_n}{I_{LV_n}} \leq 1$$

where:
C_n = Concentration of radionuclide n
I_{LV} = Investigation level for radionuclide n

Table 7 ISOCS Scan Summary

Sample Title	SOF	Sample Title	SOF	Sample Title	SOF
OOL-02-01-101-F-G	0.00	OOL-02-02-101-F-G	0.00	OOL-02-04-101-F-G	0.00
OOL-02-01-102-F-G	0.00	OOL-02-02-102-F-G	0.00	OOL-02-04-102-F-G	0.00
OOL-02-01-103-F-G	0.00	OOL-02-02-103-F-G	0.00	OOL-02-04-103-F-G	0.00
OOL-02-01-104-F-G	0.00	OOL-02-02-104-F-G	0.00	OOL-02-04-104-F-G	0.00
OOL-02-01-105-F-G	0.00	OOL-02-02-105-F-G	0.00	OOL-02-04-105-F-G	0.00
OOL-02-01-106-F-G	0.00	OOL-02-02-106-F-G	0.04	OOL-02-04-106-F-G	0.00
OOL-02-01-107-F-G	0.00	OOL-02-02-107-F-G	0.00	OOL-02-04-107-F-G	0.00
OOL-02-01-108-F-G	0.09	OOL-02-02-108-F-G	0.00	OOL-02-04-108-F-G	0.00
OOL-02-01-109-F-G	0.00	OOL-02-02-109-F-G	0.00	OOL-02-04-109-F-G	0.00
OOL-02-01-110-F-G	0.00	OOL-02-02-110-F-G	0.00	OOL-02-04-110-F-G	0.00
OOL-02-01-111-F-G	0.00	OOL-02-02-111-F-G	0.00	OOL-02-04-111-F-G	0.00
OOL-02-01-112-F-G	0.00	OOL-02-02-112-F-G	0.00	OOL-02-04-112-F-G	0.00
OOL-02-01-113-F-G	0.38	OOL-02-02-113-F-G	0.00	OOL-02-04-113-F-G	0.00
OOL-02-01-114-F-G	0.27	OOL-02-02-114-F-G	0.00	OOL-02-04-114-F-G	0.00
OOL-02-01-115-F-G	0.37	OOL-02-02-115-F-G	0.00	OOL-02-04-115-F-G	0.00
OOL-02-01-116-F-G	0.00	OOL-02-02-116-F-G	0.00	OOL-02-04-116-F-G	0.00
OOL-02-01-117-F-G	0.00	OOL-02-02-117-F-G	0.00	OOL-02-04-117-F-G	0.00
OOL-02-01-118-F-G	0.00	OOL-02-02-118-F-G	0.00	OOL-02-04-118-F-G	0.00
OOL-02-01-119-F-G	0.00	OOL-02-02-119-F-G	0.00	OOL-02-04-119-F-G	0.00
OOL-02-01-120-F-G	0.00	OOL-02-02-120-F-G	0.00	OOL-02-04-120-F-G	0.00
OOL-02-01-121-F-G	0.00	OOL-02-02-121-F-G	0.00	OOL-02-04-121-F-G	0.00
OOL-02-01-122-F-G	0.04	OOL-02-02-122-F-G	0.00	OOL-02-04-122-F-G	0.00
OOL-02-01-123-F-G	0.00	OOL-02-02-123-F-G	0.00	OOL-02-04-123-F-G	0.00
OOL-02-01-124-F-G	0.08	OOL-02-02-124-F-G	0.00	OOL-02-04-124-F-G	0.00
OOL-02-01-125-F-G	0.00	OOL-02-02-125-F-G	0.00	OOL-02-04-125-F-G	0.00
OOL-02-01-126-F-G	0.00	OOL-02-02-126-F-G	0.00	OOL-02-04-126-F-G	0.00
OOL-02-01-127-F-G	0.00	OOL-02-02-127-F-G	0.00	OOL-02-04-127-F-G	0.00
OOL-02-01-128-F-G	0.00	OOL-02-02-128-F-G	0.00	OOL-02-04-128-F-G	0.00
OOL-02-01-129-F-G	0.00	OOL-02-02-129-F-G	0.00	OOL-02-04-129-F-G	0.00
OOL-02-01-130-F-G	0.00	OOL-02-02-130-F-G	0.00	OOL-02-04-130-F-G	0.00

Sample Title	SOF	Sample Title	SOF	Sample Title	SOF
OOL-02-01-131-F-G	0.00	OOL-02-02-131-F-G	0.00	OOL-02-04-131-F-G	0.00
OOL-02-01-132-F-G	0.00	OOL-02-02-132-F-G	0.00	OOL-02-04-132-F-G	0.00
OOL-02-01-133-F-G	0.00	OOL-02-02-133-F-G	0.00	OOL-02-04-133-F-G	0.00
OOL-02-01-134-F-G	0.00	OOL-02-02-134-F-G	0.00	OOL-02-04-134-F-G	0.00
OOL-02-01-135-F-G	0.00	OOL-02-02-135-F-G	0.00	OOL-02-04-135-F-G	0.00
OOL-02-01-136-F-G	0.00	OOL-02-02-136-F-G	0.00	OOL-02-04-136-F-G	0.00
OOL-02-01-137-F-G	0.00	OOL-02-02-137-F-G	0.00	OOL-02-04-137-F-G	0.00
OOL-02-01-138-F-G	0.00	OOL-02-02-138-F-G	0.00	OOL-02-04-138-F-G	0.00
OOL-02-01-139-F-G	0.00	OOL-02-02-139-F-G	0.00	OOL-02-04-139-F-G	0.00
OOL-02-01-140-F-G	0.00	OOL-02-02-140-F-G	0.00	OOL-02-04-140-F-G	0.00
OOL-02-01-141-F-G	0.00	OOL-02-02-141-F-G	0.00	OOL-02-04-141-F-G	0.00
OOL-02-01-142-F-G	0.00	OOL-02-02-142-F-G	0.00	OOL-02-04-142-F-G	0.00
OOL-02-01-143-F-G	0.00	OOL-02-02-143-F-G	0.00	OOL-02-04-143-F-G	0.00
OOL-02-01-144-F-G	0.00	OOL-02-02-144-F-G	0.00	OOL-02-04-144-F-G	0.00
OOL-02-01-145-F-G	0.00	OOL-02-02-145-F-G	0.00	OOL-02-04-145-F-G	0.00
OOL-02-01-146-F-G	0.00	OOL-02-02-146-F-G	0.00	OOL-02-04-146-F-G	0.00
OOL-02-01-147-F-G	0.00	OOL-02-02-147-F-G	0.00	OOL-02-04-147-F-G	0.00
OOL-02-01-148-F-G	0.00	OOL-02-02-148-F-G	0.00	OOL-02-04-148-F-G	0.00
OOL-02-01-149-F-G	0.00	OOL-02-02-149-F-G	0.00	OOL-02-04-149-F-G	0.00
OOL-02-01-150-F-G	0.00	OOL-02-02-150-F-G	0.00	OOL-02-04-150-F-G	0.00
OOL-02-01-151-F-G	0.00	OOL-02-02-151-F-G	0.00	OOL-02-04-151-F-G	0.00
OOL-02-01-152-F-G	0.00	OOL-02-02-152-F-G	0.00	OOL-02-04-152-F-G	0.00
OOL-02-01-153-F-G	0.00	OOL-02-02-153-F-G	0.00	OOL-02-04-153-F-G	0.00
OOL-02-01-154-F-G	0.00	OOL-02-02-154-F-G	0.00	OOL-02-04-154-F-G	0.00
OOL-02-01-155-F-G	0.00	OOL-02-02-155-F-G	0.00	OOL-02-04-155-F-G	0.00
OOL-02-01-156-F-G	0.00	OOL-02-02-156-F-G	0.00	OOL-02-04-156-F-G	0.00
OOL-02-01-157-F-G	0.00	OOL-02-02-157-F-G	0.00	OOL-02-04-157-F-G	0.00
OOL-02-01-158-F-G	0.25	OOL-02-02-158-F-G	0.00	OOL-02-04-158-F-G	0.00
OOL-02-01-159-F-G	0.00	OOL-02-02-159-F-G	0.00	OOL-02-04-159-F-G	0.00
OOL-02-01-160-F-G	0.00	OOL-02-02-160-F-G	0.00	OOL-02-04-160-F-G	0.00
OOL-02-01-161-F-G	0.00	OOL-02-02-161-F-G	0.00	OOL-02-04-161-F-G	0.00
OOL-02-01-162-F-G	0.02	OOL-02-02-162-F-G	0.00	OOL-02-04-162-F-G	0.00
OOL-02-01-163-F-G	0.18	OOL-02-02-163-F-G	0.00	OOL-02-04-163-F-G	0.00
OOL-02-01-164-F-G	0.43	OOL-02-02-164-F-G	0.00	OOL-02-04-164-F-G	0.00
OOL-02-01-165-F-G	0.44	OOL-02-02-165-F-G	0.00	OOL-02-04-165-F-G	0.00
OOL-02-01-166-F-G	0.22	OOL-02-02-166-F-G	0.00	OOL-02-04-166-F-G	0.00
OOL-02-01-167-F-G	0.17	OOL-02-02-167-F-G	0.00	OOL-02-04-167-F-G	0.00
OOL-02-01-168-F-G	0.00	OOL-02-02-168-F-G	0.00	OOL-02-04-168-F-G	0.00
OOL-02-01-169-F-G	0.00	OOL-02-02-169-F-G	0.00	OOL-02-04-169-F-G	0.00
OOL-02-01-170-F-G	0.00	OOL-02-02-170-F-G	0.00	OOL-02-04-171-F-G	0.00
OOL-02-01-171-F-G	0.32	OOL-02-02-171-F-G	0.00	OOL-02-04-172-F-G	0.00
OOL-02-01-172-F-G	0.22	OOL-02-02-172-F-G	0.00	OOL-02-04-173-F-G	0.00
OOL-02-01-173-F-G	0.00	OOL-02-02-173-F-G	0.00	OOL-02-04-174-F-G	0.00
OOL-02-01-174-F-G	0.00	OOL-02-02-174-F-G	0.00	OOL-02-04-175-F-G	0.00
OOL-02-01-175-F-G	0.00	OOL-02-02-175-F-G	0.00	OOL-02-04-176-F-G	0.00
OOL-02-01-176-F-G	0.00	OOL-02-02-176-F-G	0.00	OOL-02-04-177-F-G	0.00
OOL-02-01-177-F-G	0.00	OOL-02-02-177-F-G	0.00	OOL-02-04-178-F-G	0.00

Sample Title	SOF	Sample Title	SOF	Sample Title	SOF
OOL-02-01-178-F-G	0.16	OOL-02-02-178-F-G	0.00	OOL-02-04-179-F-G	0.00
OOL-02-01-179-F-G	0.00	OOL-02-02-179-F-G	0.00	OOL-02-04-180-F-G	0.00
OOL-02-01-190-F-G	0.00	OOL-02-02-180-F-G	0.00	OOL-02-04-181-F-G	0.00
OOL-02-01-191-F-G	0.00	OOL-02-02-181-F-G	0.00	OOL-02-04-182-F-G	0.00
OOL-02-01-192-F-G	0.00	OOL-02-02-182-F-G	0.00	OOL-02-04-183-F-G	0.00
OOL-02-01-193-F-G	0.00	OOL-02-02-183-F-G	0.00	OOL-02-04-184-F-G	0.00
OOL-02-01-194-F-G	0.00	OOL-02-02-184-F-G	0.00	OOL-02-04-185-F-G	0.00
OOL-02-01-195-F-G	0.23	OOL-02-02-185-F-G	0.00	OOL-02-04-186-F-G	0.00
OOL-02-01-196-F-G	0.00	OOL-02-02-186-F-G	0.00	OOL-02-04-187-F-G	0.00
OOL-02-01-197-F-G	0.00	OOL-02-02-187-F-G	0.00	OOL-02-04-188-F-G	0.00
OOL-02-01-198-F-G	0.00	OOL-02-02-188-F-G	0.00	OOL-02-04-189-F-G	0.00
OOL-02-01-199-F-G	0.00	OOL-02-02-189-F-G	0.00	OOL-02-04-190-F-G	0.00
OOL-02-01-200-F-G	0.00	OOL-02-02-190-F-G	0.00	OOL-02-04-191-F-G	0.00
OOL-02-01-201-F-G	0.00	OOL-02-02-191-F-G	0.00	OOL-02-04-192-F-G	0.00
OOL-02-01-202-F-G	0.00	OOL-02-02-192-F-G	0.00	OOL-02-04-193-F-G	0.00
OOL-02-01-203-F-G	0.00	OOL-02-02-193-F-G	0.00	OOL-02-04-194-F-G	0.00
OOL-02-01-204-F-G	0.00	OOL-02-02-194-F-G	0.00	OOL-02-04-195-F-G	0.00
OOL-02-01-205-F-G	0.00	OOL-02-02-195-F-G	0.00	OOL-02-04-196-F-G	0.00
OOL-02-01-206-F-G	0.00	OOL-02-02-196-F-G	0.00	OOL-02-04-197-F-G	0.00
OOL-02-01-207-F-G	0.00	OOL-02-02-197-F-G	0.00	OOL-02-04-198-F-G	0.00
OOL-02-01-208-F-G	0.00	OOL-02-02-198-F-G	0.00	OOL-02-04-199-F-G	0.00
OOL-02-01-209-F-G	0.00	OOL-02-02-199-F-G	0.00	OOL-02-04-200-F-G	0.00
OOL-02-01-210-F-G	0.00	OOL-02-02-200-F-G	0.00	OOL-02-04-201-F-G	0.00
OOL-02-01-211-F-G	0.00	OOL-02-02-201-F-G	0.00	OOL-02-04-202-F-G	0.00
OOL-02-01-212-F-G	0.00	OOL-02-02-202-F-G	0.00	OOL-02-04-203-F-G	0.00
OOL-02-01-213-F-G	0.00	OOL-02-02-203-F-G	0.00	OOL-02-04-204-F-G	0.00
OOL-02-01-214-F-G	0.00	OOL-02-02-204-F-G	0.00	OOL-02-04-205-F-G	0.00
OOL-02-01-215-F-G	0.00	OOL-02-02-205-F-G	0.00	OOL-02-04-206-F-G	0.00
OOL-02-01-216-F-G	0.00	OOL-02-02-206-F-G	0.00	OOL-02-04-207-F-G	0.00
OOL-02-01-217-F-G	0.00	OOL-02-02-207-F-G	0.00	OOL-02-04-208-F-G	0.00
OOL-02-01-218-F-G	0.00	OOL-02-02-208-F-G	0.00	OOL-02-04-209-F-G	0.00
OOL-02-01-219-F-G	0.00	OOL-02-02-209-F-G	0.00	OOL-02-04-210-F-G	0.00
OOL-02-01-220-F-G	0.00	OOL-02-02-210-F-G	0.00	OOL-02-04-211-F-G	0.00
OOL-02-01-221-F-G	0.00	OOL-02-02-211-F-G	0.00	OOL-02-04-212-F-G	0.00
OOL-02-01-222-F-G	0.00	OOL-02-02-212-F-G	0.00	OOL-02-04-213-F-G	0.00
OOL-02-01-223-F-G	0.00	OOL-02-02-213-F-G	0.00	OOL-02-04-214-F-G	0.00
OOL-02-01-224-F-G	0.00	OOL-02-02-214-F-G	0.00	OOL-02-04-215-F-G	0.00
OOL-02-01-225-F-G	0.00	OOL-02-02-215-F-G	0.00	OOL-02-04-216-F-G	0.00
OOL-02-01-226-F-G	0.00	OOL-02-02-216-F-G	0.00	OOL-02-04-217-F-G	0.00
OOL-02-01-227-F-G	0.00	OOL-02-02-217-F-G	0.00	OOL-02-04-218-F-G	0.00
OOL-02-01-228-F-G	0.00	OOL-02-02-218-F-G	0.00	OOL-02-04-219-F-G	0.00
OOL-02-01-229-F-G	0.00	OOL-02-02-219-F-G	0.00	OOL-02-04-220-F-G	0.00
OOL-02-01-230-F-G	0.00	OOL-02-02-220-F-G	0.00	OOL-02-04-221-F-G	0.00
OOL-02-01-231-F-G	0.00	OOL-02-02-221-F-G	0.00	OOL-02-04-222-F-G	0.00
OOL-02-01-232-F-G	0.00	OOL-02-02-222-F-G	0.00	OOL-02-04-223-F-G	0.00
OOL-02-01-233-F-G	0.00	OOL-02-02-223-F-G	0.00	OOL-02-04-224-F-G	0.00
OOL-02-01-234-F-G	0.00	OOL-02-02-224-F-G	0.00	OOL-02-04-225-F-G	0.00

Sample Title	SOF	Sample Title	SOF	Sample Title	SOF
OOL-02-01-235-F-G	0.02	OOL-02-02-225-F-G	0.00	OOL-02-04-226-F-G	0.00
OOL-02-01-236-F-G	0.00	OOL-02-02-226-F-G	0.00	OOL-02-04-227-F-G	0.00
OOL-02-01-237-F-G	0.00	OOL-02-02-227-F-G	0.00	OOL-02-04-228-F-G	0.00
OOL-02-01-238-F-G	0.00	OOL-02-02-228-F-G	0.00	OOL-02-04-229-F-G	0.00
OOL-02-01-239-F-G	0.00	OOL-02-02-229-F-G	0.00	OOL-02-04-230-F-G	0.00
OOL-02-01-240-F-G	0.00	OOL-02-02-230-F-G	0.00	OOL-02-04-231-F-G	0.00
OOL-02-01-241-F-G	0.00	OOL-02-02-231-F-G	0.00	OOL-02-04-232-F-G	0.00
OOL-02-01-242-F-G	0.00	OOL-02-02-232-F-G	0.00	OOL-02-04-233-F-G	0.00
OOL-02-01-243-F-G	0.00	OOL-02-02-233-F-G	0.00	OOL-02-04-234-F-G	0.00
OOL-02-01-244-F-G	0.00	OOL-02-02-234-F-G	0.00	OOL-02-04-235-F-G	0.00
OOL-02-01-245-F-G	0.00	OOL-02-02-235-F-G	0.04	OOL-02-04-236-F-G	0.00
OOL-02-01-246-F-G	0.00	OOL-02-02-236-F-G	0.00	OOL-02-04-237-F-G	0.00
OOL-02-01-247-F-G	0.00	OOL-02-02-237-F-G	0.00	OOL-02-04-238-F-G	0.00
OOL-02-01-248-F-G	0.00	OOL-02-02-238-F-G	0.00	OOL-02-04-239-F-G	0.00
OOL-02-01-249-F-G	0.00	OOL-02-02-239-F-G	0.00	OOL-02-04-240-F-G	0.00
OOL-02-01-250-F-G	0.00	OOL-02-02-240-F-G	0.00	OOL-02-04-241-F-G	0.00
OOL-02-01-251-F-G	0.00	OOL-02-02-241-F-G	0.00	OOL-02-04-242-F-G	0.00
OOL-02-01-252-F-G	0.00	OOL-02-02-242-F-G	0.00	OOL-02-04-243-F-G	0.00
OOL-02-01-253-F-G	0.00	OOL-02-02-243-F-G	0.00	OOL-02-04-244-F-G	0.00
OOL-02-01-254-F-G	0.00	OOL-02-02-244-F-G	0.00	OOL-02-04-245-F-G	0.00
OOL-02-01-255-F-G	0.00	OOL-02-02-245-F-G	0.00	OOL-02-04-246-F-G	0.00
OOL-02-01-256-F-G	0.00	OOL-02-02-246-F-G	0.00	OOL-02-04-247-F-G	0.00
OOL-02-01-257-F-G	0.00	OOL-02-02-247-F-G	0.00	OOL-02-04-248-F-G	0.00
OOL-02-01-258-F-G	0.00	OOL-02-02-248-F-G	0.00	OOL-02-04-249-F-G	0.00
OOL-02-01-259-F-G	0.00	OOL-02-02-249-F-G	0.00	OOL-02-04-250-F-G	0.00
OOL-02-01-260-F-G	0.00			OOL-02-04-251-F-G	0.00
OOL-02-01-261-F-G	0.00			OOL-02-04-252-F-G	0.00
OOL-02-01-262-F-G	0.00			OOL-02-04-253-F-G	0.00
OOL-02-01-263-F-G	0.00			OOL-02-04-254-F-G	0.00
OOL-02-01-264-F-G	0.00				
OOL-02-01-265-F-G	0.00				
OOL-02-01-266-F-G	0.00				
OOL-02-01-267-F-G	0.00				
OOL-02-01-268-F-G	0.00				
OOL-02-01-269-F-G	0.00				
OOL-02-01-270-F-G	0.00				
OOL-02-01-271-F-G	0.00				
OOL-02-01-272-F-G	0.00				
OOL-02-01-273-F-G	0.00				
OOL-02-01-274-F-G	0.00				
OOL-02-01-275-F-G	0.00				
OOL-02-01-276-F-G	0.00				
OOL-02-01-277-F-G	0.00				
OOL-02-01-278-F-G	0.00				
OOL-02-01-279-F-G	0.00				
OOL-02-01-280-F-G	0.00				
OOL-02-01-281-F-G	0.00				

Sample Title	SOF	Sample Title	SOF	Sample Title	SOF
OOL-02-01-282-F-G	0.00				
OOL-02-01-283-F-G	0.00				
OOL-02-01-284-F-G	0.00				
OOL-02-01-285-F-G	0.00				
OOL-02-01-286-F-G	0.00				
OOL-02-01-287-F-G	0.00				
OOL-02-01-288-F-G	0.00				
OOL-02-01-289-F-G	0.00				
OOL-02-01-290-F-G	0.00				
OOL-02-01-291-F-G	0.00				
OOL-02-01-292-F-G	0.00				
Highest Scan Reading	0.44	Max	0.04	Max	0.00
Average Scan Reading	0.02	Average	0.00	Average	0.00
Standard Deviation	0.08	Standard Deviation	0.00	Standard Deviation	0.00

Note: OOL-02-01-180-F-G to OOL-02-01-189-F-G and OOL-02-02-179-F-G sample titles were not used.

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-02-01 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. Scans requiring investigation were investigated and the elevated readings were resolved. HTD sample results were <DCGLw. 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. Review of the quantile plot indicates some asymmetry in the upper quartile with

the frequency plot exhibiting a slight skew to the right. The retrospective standard deviation was higher than the prospective, however the survey maintained sufficient power to pass the unit and the data set verified the assumptions of the statistical test.

5.5.2 OOL-02-02 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 range was within approximately three standard deviations with the scatter plot graphically illustrating that the data vary about the arithmetic mean. The data posting plot does not clearly reveal any systematic spatial trends. The quantile plot exhibits some asymmetry in the upper 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.

5.5.3 OOL-02-03 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. The quantile plot exhibits a slight asymmetry in the lower quartile and the frequency plot demonstrates a slight skew to the left. 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.

5.5.4 OOL-02-04 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 three standard deviations with normal dispersion about the arithmetic mean with the exception of two data points that were slightly higher than the rest of the data 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 slight 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.

5.5.5 OOL-02-05 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 range was within approximately two standard deviations with normal variance 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 shows evidence of a normal data set. 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 portable ISOCS was in accordance with DP-8871,"*Operation of the Canberra Portable ISOCS System*", with QC checks performed in accordance with DP-8869,"*In-situ (ISOCS) Gamma Spectrum Assay System Calibration Procedure*" and DP-8871, "*Operation of the Canberra Portable ISOCS System*". 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 preformed 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 and once per shift for the Portable ISOCS. Any flags (i.e. anomalies in the QC results) encountered during the ISOCS QC Source Count were corrected/ resolved prior to surveying. All instrumentation involved with the FSS of OOL-02 satisfied the above criteria for the survey. QC records are found in Attachment C.

6.2 Split Samples and Recounts

6.2.1 OOL-02-01 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-02-02 Split Samples and Recounts

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

6.2.3 OOL-02-03 Split Samples and Recounts

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

6.2.4 OOL-02-04 Split Samples and Recounts

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

6.2.5 OOL-02-05 Split Samples and Recounts

Two split and two recount "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-02.

7.0 CONCLUSION

The FSS of OOL-02 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_o) is rejected.

OOL-02 meets the objectives of the Final Status Survey.

Based upon the evaluation of the data acquired for the FSS, OOL-02 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.

List of Appendices

Appendix A – YNPS-FSSP-OOL-02, *"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-02

Appendix E – YA-REPT-01-018-05, "*Use of In-situ Gamma Spectrum Analysis to Perform Elevated Measurement Comparison in Support of Final Status Surveys*"

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

Attachment E – ISOCS Scan 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.)