Final Status Survey Planning Worksheet

GENERAL SECTION	
Survey Area #: NOL-02	Survey Unit #: 01
Survey Unit Name: Spent Fuel Pit Excavation East	
FSSP Number: YNPS-FSSP-NOL02-01-00	

PREPARATION FOR FSS ACTIVITIES

Check marks in the boxes below signify affirmative responses and completion of the action.

1.1 Files have been established for survey unit FSS records. ☒

1.2 ALARA review has been completed for the survey unit. ☒ See YA-REPT-00-003-05

1.3 The survey unit has been turned over for final status survey. ☒

1.4 An initial DP-8854 walkdown has been performed and a copy of the completed Survey Unit Walkdown Evaluation is in the survey area file. ☒

1.5 Activities conducted within area since turnover for FSS have been reviewed. ☒

Based on reviewed information, subsequent walkdown: ☒ not warranted ☐ warranted

Note: Based upon Rad Engineer walkdown at the Final Turnover

If warranted, subsequent walkdown has been performed and documented per DP-8854. ☐

OR

The basis has been provided to and accepted by the FSS Project Manager for not performing a subsequent walkdown. ☐

1.6 A final classification has been performed. ☒

Classification: CLASS 1 ☒ CLASS 2 ☐ CLASS 3 ☐

DATA QUALITY OBJECTIVES (DQO)

1.0 State the problem:

Survey Area NOL-02-01 is the previous site of the New Fuel Vault and surrounding areas east of the former Spent Fuel Pool. The soils located around and under NOL-02-01 include backfill, overburden, and glacio-lacustrine till. Permeability to groundwater flow is varied with the till being the most impermeable and the backfill being the least impermeable. Geoprobe soil samples taken from around the SFP, NFV and IX Pit have shown amounts in excess of the DCGL values for Co-60, Cs-137 and Ag-108m and the subject soil was removed during excavation. Demolition activities have since been completed in NOL-02-01.

Post excavation remediation and a Characterization Survey have been performed in NOL-02-01. Characterization sampling indicates levels of Co-60 less than 0.6 pCi/gm and Cs-137 levels less than 1.5 pCi/gm. Initial scans were performed using SPA-3 and ISOCS with remediation carried out at locations that indicated elevated levels of radioactivity.

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 area NOL-02-01 is identified as a Class 1 Area.

The problem, therefore, is to determine whether the accumulation of licensed radioactive materials generated during plant operation, existing in Survey Unit NOL-02-01, meets the release criterion.

The planning team for this effort consists of the FSS Project Manager, FSS Radiological Engineer, Radiation Protection Manager, FSS Field Supervisor, and FSS Technicians. The FSS Radiological Engineer will make primary decisions with the concurrence of the FSS Project Manager.

2.0 Identify the decision:

The decision to be made can be stated "Does residual plant-related radioactivity, if present in the survey unit, exceed the release criteria?"

Alternative actions that may be employed are investigation, remediation and re-survey.

3.0 Identify the inputs to the decision:

Inputs to the decision include information that will be required to resolve the decision. The information will address such topics as:

- Survey techniques and analytical methodologies selected to generate the required analytical data
- Types and number of samples required to demonstrate compliance with the release criterion
- Identification of the radionuclides-of-concern and their corresponding DCGLs

The various aspects of the data such as quality and data sensitivity ensure accurate information is utilized in the testing of the hypothesis.

Sample media: soil

Types of measurements: soil samples and 100% scans

Radionuclides-of-concern: Co^{60}, Cs^{137}, Ag^{108m} and H^3

Table 1

8.73 mrem/yr DCGL

Radionuclide	Soil (pCi/gm)
H^{3}	130
Co^{60}	1.4
Nb^{94}	2.5
Ag^{108m}	2.5
Sb^{125}	11
Cs^{134}	1.7
Cs^{137}	3.0
Eu^{152}	3.5
Eu^{154}	3.3
Eu^{155}	140
C^{14}	1.9
Fe^{55}	1E+04
Ni^{63}	280
Sr^{90}	0.6
Tc^{99}	4.8
Pu^{238}	11
$Pu^{239, 240}$	10
Pu^{241}	340
Am^{241}	10
$Cm^{243, 244}$	11

***SPA-3Scan MDCR and MDC(fDCGL$_{EMC}$)*:** See Attachment 1

***SPA-3 DCGL$_{EMC}$*:** 6.9 pCi/gm

***Surrogate DCGLs (ISOCS)*:** Co-60 (1.2 pCi/gm) Cs-137 (2.8 pCi/gm) Ag108m (2.1 pCi/gm)

***DCGL$_{EMC}$ (surrogated)*:** Co-60 13 pCi/gm Cs-137 (61 pCi/gm) Ag-108m (19 pCi/gm)

Note: Surrogates were developed based upon the nuclide mix in sample SFP-GP-12-01

***Radionuclides for analysis*:** All LTP nuclides with the focus on Co^{60}, Cs^{137} and Ag^{108m}

***ISOCS Nuclide Library*:** Library will include the gamma emitters listed in Table 2

***Investigation Level for soil samples*:** Investigation Level for soil samples will be >DCGL$_{EMC}$ or >DCGL$_{W}$ and a statistical outlier

***Adjusted investigation Level (DCGL$_{EMC}$) for ISOCS Measurements*:**

- Co-60 (0.87 pCi/gm)
- Cs-137 (4.0 pCi/gm)
- Ag-108m (1.3 pCi/gm)
- Cs-134 (1.80 pCi/gm)

Note: The $DCGL_{EMC}$ for the SPA-3 was developed using area factors for a $43.7m^2$ area (the area in the systematic grid). The adjusted investigation levels for the ISOCS were derived by multiplying the $DCGL_{EMC}$ ($DCGL_W$ * AF for a $1m^2$ elevated area) by the ratio of MDAs obtained from the 12.6 m^2 field of view relative to the MDA obtained for a $1m^2$ area at the edge of the 12.6 m2 field of view as this leads to a conservative model. Cs-134 was not surrogated due to its absence in the characterization samples. The values developed for the $1m^2$ elevated area at the edge of the field of view used for the ISOCS scan investigative levels are sensitive enough to detect the elevated comparison values for the $43.7m^2$ area.

***Investigation Level for SPA-3/E-600*:** Audible increases above background that are reproducible

MDCs for gamma analysis of soil samples:

Table 2

MDCs for gamma emitters

Nuclide	10-50% $DCGL_W$ (pCi/gm
Co-60	0.14-0.70
Nb-94	0.25-1.2
Ag-108m	0.25-1.2
Sb-125	1.10-5.5
Cs-134	0.17-0.86
Cs-137	0.30-1.5
Eu-152	0.35-1.8
Eu-154	0.33-1.7
Eu-155	14-70

The desired MDCs in the laboratory analysis of FSS soil samples should be the 10% values. If it is impractical to achieve those, the 50% $DCGL_W$ values must be achieved in the laboratory analysis of the FSS soil samples. ISOCS measurements will meet the 10-50% $DCGL_{EMC}$ values for the gamma emitting nuclides listed in Table 2.

MDCs for HTD nuclides: In addition to the MDC values listed above, the following MDC values will also be transmitted to the outside laboratory via the chain-of-custody form accompanying the FSS soil samples:

Table 3

MDCs for Hard-to-Detect nuclides

Nuclide	10-50% $DCGL_W$ (pCi/gm)
H-3	13-64
C-14	0.19-0.95
Fe-55	1E03-5E03
Ni-63	28-140
Sr-90	0.06-0.29
Tc-99	0.48-2.4
Pu-238	1.1-5.7
Pu-239,240	1.0-5.2
Pu-241	34-170
Am-241	1.0-5.2
Cm-243, 244	1.1-5.5

Survey coverage: Scan measurements, or ISOCS (the primary method of scans), will provide a 100% coverage of the survey area

QC checks and measurements: QC checks for the Portable ISOCS will be in accordance with DP-8869 and DP-8871. Two samples will be chosen as QC split samples and will be analyzed by an off-site laboratory for all LTP nuclides. Additionally, two samples will be analyzed twice in-house by gamma spectroscopy and the results compared.

4.0 Define the boundaries of the survey:

Survey Unit NOL-02-01 is located within the RCA and is bounded by NOL-01on the north, NOL-02 on the east and south, and NOL-01-02 and NOL-01-03 on the west.

Surveying of NOL-02-01 will be performed during daylight hours when weather conditions will not adversely affect the data acquisition.

5.0 Develop a decision rule:

Null hypothesis: The null hypothesis (H_o), as required by MARSSIM, is stated and tested in the negative form: "Residual licensed radioactive materials in Survey Unit 01 exceeds the release criterion. The null hypothesis, as stated in this manner, is designed to protect the health

of the public as well as to demonstrate compliance with the requirements set forth in the Yankee Rowe License Termination Plan. In general, hypothesis testing will result in the following assessments:

a. If all of the sample data show that the soil concentrations of all plant-related LTP nuclides are below the DCGLs and the sum of fractions for these nuclides are less than unity, reject the null hypothesis (i.e. NOL-02-01 meets the release criteria).

b. If the action levels are exceeded, then perform an investigation survey.

c. If the average concentration is below the DCGL, but individual measurements exceed the DCGL then apply a statistical test to either accept or reject the null hypothesis.

d. If the average concentration of any individual nuclide exceeds the DCGL or if the sum of fractions exceeds unity, then accept the null hypothesis (i.e. NOL-02-01 does not meet the release criteria).

6.0 Specify tolerable limits on decision errors:

***Probability of type I (α) error*:** 0.05
***Probability of type II (β) error*:** 0.05

LBGR: **0.5**

7.0 Optimize Design:

Type of statistical test: WRS Test ☐ Sign Test ☒

Basis including background reference location (if WRS test is specified): N/A

***Number of samples*:** 15 Random Selected

***Split Samples*:** Two samples will be split samples

***Hard-to-Detect analyses*:** Two samples sent for off-site analysis will be analyzed for all LTP hard-to-detect radionuclides referenced in this survey plan

***Sample Recounts*:** Two samples will be recounted on-site

GENERAL INSTRUCTIONS

1. Notify QA of date and time of the pre-survey briefing, commencement of soil sampling and any other scheduled activities subject to QA notification that are currently known.
2. Soil samples will be collected in accordance with DP-8120 in one-liter marinelli beakers. Extraneous materials (e.g. vegetation, debris, rocks, etc.) will be removed prior to placing

the soil into the marinellis.

2. Collect the unbiased soil samples at 15 systematic locations with a random start point.

3. Soil sample designation:

   a. FSS soil samples: NOL-02-01-001-F through NOL-02-01-015-F.

   b. Samples NOL-02-01-005-F-S, NOL-02-01-008-F-S will be designated as split samples sent for full analysis by the off-site laboratory for all LTP nuclides.

   c. The off-site gamma spec. results will be compared with the on-site results in accordance with DP-8864.

Two recount samples: NOL-02-01-004-F and NOL-02-01-011-F will be counted twice on site and the results compared in accordance with DP-8864.

4. All soil samples will be received and prepared in accordance with DP-8813.

5. Chain-of-Custody form will be used in accordance with DP-8123 for all the split samples.

6. The sampling locations will be identified using GPS. In cases where the location cannot be determined directly using GPS, an offset will be used to describe the distance and bearing from a known GPS location, Each location will be marked by a flag, either prior to or at the time of the sampling. The FSS Radiological Engineer or FSS Field Supervisor will guide the FSS Technician to the sample locations.

7. Verify that QA has been notified of the date and time of the commencement of the first ISOCS measurements.

8. Survey instrument: Operation of the Portable ISOCS will be in accordance with DP-8871, with QC checks performed in accordance with DP-8869 and DP-8871. Operation of the E-600 w/SPA-3 will be in accordance with DP-8535, with QC checks preformed in accordance with DP-8540. Instrument response checks shall be performed prior to and after use for the E-600 w/SPA-3 and once per shift for the Portable ISOCS. Any flags encountered during the ISOCS QC Source Count must be corrected/resolved prior to surveying. If anomalies cannot be corrected or resolved, contact the Cognizant FSS Engineer for assistance.

9. The job hazards associated with the FSS in Survey Unit 01 are addressed in the accompanying JHA for NOL-02-01.

10. All personnel participating in this survey shall be trained in accordance with DP-8868.

SPECIFIC INSTRUCTIONS

1. ISOCS measurements will be performed in accordance with DP-8871 "Operation of the Canberra Portable ISOCS".

Grid NOL-02-01 for 100% scan coverage by placing markers 3 meters on center in rows no more than 3 meters apart with every other row shifted 1½ meters off axis from the adjacent row forming a triangular scan grid pattern or place parallel rows of markers forming a square pattern at a maximum distance of 2.6 meters apart. Continue marking the survey unit until there are no markers greater than 1.3 meters from the boundary of NOL-02-01 (add additional scan points closer than 3 meters apart as necessary). Using the 90° collimator, position the ISOCS detector directly at each marker 2 meters from the surface to be scanned. Angle the detector as necessary perpendicular to the scan surface and perform an analysis in accordance with DP-8871

employing a preset count time sufficient to meet the MDAs referenced in this survey plan. ~~At the completion of the analysis~~ 8/11/05 review the report and verify that the MDAs have been met for the nuclides. Identify radionuclides representing licensed radioactive material and compare their concentration to their respective $DCGL_{EMC}$ value. Record the ISOCS measurement location on the survey map using the appropriate FSS numbering protocol (e.g. NOL-02-01-xxx(sequential number)-F-G). 8/11/05

Note: Only radionuclides associated with licensed material (i.e. nuclides listed in the LTP) will be assessed . Nuclides associated with natural background radiation will not be included in the assessment.

2. If an analysis of a survey area is equal to or greater than the investigation level then an investigation of that area shall be performed as follows:

a. Further subdivide the survey area into equal sub-areas.

b. Place a marker in the center of each sub-area.

c. Lower the ISOCS detector to approximately 1 meter above the surface and center directly above the marker.

d. Perform an analysis of that sub-area in accordance with DP-8871.

e. Repeat the analysis sequence for each of the sub-areas within the survey area.

f. In lieu of using ISOCS for first level investigations, SPA-3 scanning may be used for first level investigations.

3. If SPA-3 scanning is utilized for initial scans (i.e. ISOCS scanning is inaccessible, etc.) FSS Technicians will perform scans by moving the SPA-3 detector at a speed 0.25 m/s, keeping the probe within approximately three inches of the ground surface, and following a serpentine pattern that includes at least three passes across each square meter. The FSS Field Supervisor will time and monitor a minimum of 50% of these scans. When scanning and walking, a slow pace (i.e., 1 step per second) shall be used. Scanning will be performed in the rate-meter mode with the audible feature on. Using the headsets, surveyors will listen for upscale readings, to which they will respond by slowing down or stopping the probe to distinguish between random fluctuations in the background and greater than background readings. Location(s) where detectable-above-background scan readings are found will be investigated.

4. If ISOCS is used for investigations, and a sub-area is determined to contain radiologically elevated areas, then scan the sub-area with a SPA-3 to identify and determine the boundaries of the elevated area. SPA-3 investigative scanning is performed similar in manner as described in step 3 with the exception of the scan speed (move detector 2 to 3 inches per second) and the detector need not be moved in a serpentine pattern.

Note: Background levels for the SPA-3 should range between 10000 and 20000 cpm. If the background levels exceed 24000 cpm, contact a Radiological Engineer prior to commencing/continuing the scan with the SPA-3.

Note: Standing water may shield gamma contamination. Standing water should be removed from the excavation prior to scanning.

5. Once the elevated area, requiring an investigation, has been identified and bounded, locate the point of the highest SPA-3 reading within the bounded area and collect a one-liter soil sample for analysis. If a soil sample is collected during the first level investigation, the sample designation will consist of the next sequential measurement location code plus the letter "I" (for

investigation). For example, if a soil sample is collected during a first level investigation it will be designated NOL-01-02-016-F-I. If the investigation calls for more than one sample, sequentially number the investigation samples (e.g. NOL-01-02-017-F-I). A gamma analysis will be performed on all investigative soil samples. If it can be demonstrated that the presence of rocks and boulders is the cause of an increased count rate during a SPA-3 scan, record that finding form DPF-8856.2 and no soil sample is required. The responsible FSS Radiological Engineer will evaluate analysis of any investigation samples for the LTP suite of nuclides.

Detailed descriptions of investigative actions will be recorded on form DPF-8856.2 and the location of the investigation analyses along with the sample designation will be recorded on the survey map. The location description must provide sufficient detail (i.e.) to allow revisiting the spot at a later time.

All sample analysis will achieve the MDC values stated in the DQO section of this plan.

NOTIFICATION POINTS

QA notification point(s) (y/n) ___y*____ QA Signature/Date:

(1) Date/time of initial pre-survey briefing _____/_____

(2) Date/time of commencement of soil sampling _____/_____

(3) Date/time of first scan measurement _____/_____

(4) Date/time of daily pre-survey briefing _____/_____

* Email notification to trudeau@yankee.com with a copy to calsyn@yankee.com satisfies this step

FSI point(s) (y/n) _ n FSS Radiological Engineer Signature/Date:

(1)_____ _____/_____

(2)_____ _____/_____

Prepared by Martin C. Trudeau FSS Radiological Engineer Date 8/8/05

Reviewed by J. Broom FSS Radiological Engineer Date 8/8/05

Approved by JC Smith FSS Project Manager Date 8/9/05

Inputs:

Scan speed: 0.25 m/s

MDCR = 1.38*sqrt(b)/sqrt(p)*t

Where:

b = background counts in time t

p = surveyor efficiency = 0.5

t = time the detector is above localized activity = 2.24 s = 0.0373 min

Assume:

Localized contam diam = 56 cm

$$MDC(fDCGL_{EMC}) = MDCR\sum(f^i / E_i AF^i DCGL^i)$$ (DP-8853)

AF= Area Factor

E_i = Scanning instrument efficiency (YA-REPT-00-015-04)

f = radionuclide fraction

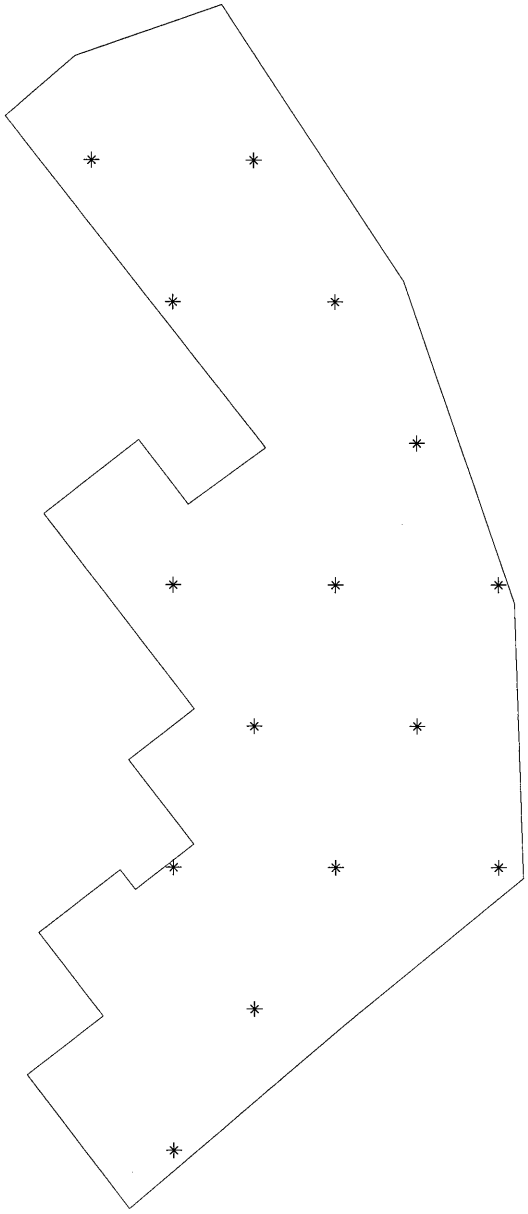
	Cs-137	Co-60
E_i =	188	379
DCGL	3	1.4
f =	0.9	0.1
AF =	3.1	1.5

p = 0.5

BKG	BKG/t	MDCR	MDC(fDCGL$_{emc}$(10))
7000	261.3	845	5.41E-01
8000	298.7	903	5.79E-01
9000	336.0	958	6.14E-01
10000	373.3	1010	6.47E-01
11000	410.7	1059	6.78E-01
12000	448.0	1106	7.09E-01
13000	485.3	1152	7.38E-01
14000	522.7	1195	7.65E-01
15000	560.0	1237	7.92E-01
16000	597.3	1278	8.18E-01
17000	634.7	1317	8.43E-01
18000	672.0	1355	8.68E-01
19000	709.3	1392	8.92E-01

20000	746.7	1428	9.15E-01
21000	784.0	1464	9.37E-01
22000	821.3	1498	9.59E-01
23000	858.7	1532	9.81E-01
24000	896.0	1565	1.00E+00
25000	933.3	1597	1.02E+00

Sample Plan
Phase 1



Area 1

X Coord	Y Coord	Label	Value	Type	Historical
272481.70	3093611.25		0	Systematic	False
272504.01	3093611.25		0	Systematic	False
272492.86	3093591.93		0	Systematic	False
272515.17	3093591.93	NOL-02-01	0	Systematic	False
272526.32	3093572.61		0	Systematic	False
272492.86	3093553.29		0	Systematic	False
272515.17	3093553.29		0	Systematic	False
272537.48	3093553.29		0	Systematic	False
272504.01	3093533.97		0	Systematic	False
272526.32	3093533.97		0	Systematic	False
272492.86	3093514.65		0	Systematic	False
272515.17	3093514.65		0	Systematic	False
272537.48	3093514.65		0	Systematic	False
272504.01	3093495.33		0	Systematic	False
272492.86	3093476.01		0	Systematic	False

Final Status Survey Planning Worksheet

GENERAL SECTION	
Survey Area #: NOL-02	Survey Unit #: 02
Survey Unit Name: Northeastern Upper RCA Yard	
FSSP Number: YNPS-FSSP-NOL02-02-00	

PREPARATION FOR FSS ACTIVITIES

Check marks in the boxes below signify affirmative responses and completion of the action.

1.1 Files have been established for survey unit FSS records. ☒

1.2 ALARA review has been completed for the survey unit. ☒ See YA-REPT-00-003-05

1.3 The survey unit has been turned over for final status survey. ☒

1.4 An initial DP-8854 walkdown has been performed and a copy of the completed Survey Unit Walkdown Evaluation is in the survey area file. ☒

1.5 Activities conducted within area since turnover for FSS have been reviewed. ☒

Based on reviewed information, subsequent walkdown: ☒ not warranted ☐ warranted

Note: Based upon Rad Engineer walkdown at the Final Turnover

If warranted, subsequent walkdown has been performed and documented per DP-8854. ☐

OR

The basis has been provided to and accepted by the FSS Project Manager for not performing a subsequent walkdown. ☐

1.6 A final classification has been performed. ☒

Classification: CLASS 1 ☒ CLASS 2 ☐ CLASS 3 ☐

DATA QUALITY OBJECTIVES (DQO)

1.0 State the problem:

Survey Area NOL-02-02 is adjacent to the previous site of the New Fuel Vault and surrounding areas east of the former Spent Fuel Pool. The soils located around and under these areas include backfill, overburden, and glacio-lacustrine till. Permeability to groundwater flow is varied with the till being the most impermeable and the backfill being the least impermeable. Geoprobe soil samples taken from around the SFP, NFV and IX Pit have shown amounts in excess of the DCGL values for Co-60, Cs-137 and Ag-108m and the subject soil was removed during excavation. Demolition activities have since been completed in NOL-02-02.

Post excavation remediation and Characterization Surveys have been performed in NOL-02-02. Characterization sampling indicates levels of Co-60 less than 0.02 pCi/gm and Cs-137 levels less than 0.06 pCi/gm. Initial scans were performed using SPA-3 and ISOCS with remediation carried out at locations that indicated elevated levels of radioactivity.

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 area NOL-02-02 is identified as a Class 1 Area.

The problem, therefore, is to determine whether the accumulation of licensed radioactive materials generated during plant operation, existing in Survey Unit NOL-02-02, meets the release criterion.

The planning team for this effort consists of the FSS Project Manager, FSS Radiological Engineer, Radiation Protection Manager, FSS Field Supervisor, and FSS Technicians. The FSS Radiological Engineer will make primary decisions with the concurrence of the FSS Project Manager.

2.0 Identify the decision:

The decision to be made can be stated "Does residual plant-related radioactivity, if present in the survey unit, exceed the release criteria?"

Alternative actions that may be employed are no action, investigation, resurvey, remediation and reclassification.

3.0 Identify the inputs to the decision:

Inputs to the decision include information that will be required to resolve the decision. The information will address such topics as:

- Survey techniques and analytical methodologies selected to generate the required analytical data
- Types and number of samples required to demonstrate compliance with the release criterion
- Identification of the radionuclides-of-concern and their corresponding DCGLs

The various aspects of the data such as quality and data sensitivity ensure accurate information is utilized in the testing of the hypothesis.

Sample media: soil

Types of measurements: soil samples and 100% scans

Radionuclides-of-concern: Co^{60} and Cs^{137}

Table 1

8.73 mrem/yr DCGL

Radionuclide	Soil (pCi/gm)
H^{3}	130
Co^{60}	1.4
Nb^{94}	2.5
Ag^{108m}	2.5
Sb^{125}	11
Cs^{134}	1.7
Cs^{137}	3.0
Eu^{152}	3.5
Eu^{154}	3.3
Eu^{155}	140
C^{14}	1.9
Fe^{55}	1E+04
Ni^{63}	280
Sr^{90}	0.6
Tc^{99}	4.8
Pu^{238}	11
$Pu^{239, 240}$	10
Pu^{241}	340
Am^{241}	10
$Cm^{243, 244}$	11

***SPA-3Scan MDCR and MDC(fDCGL$_{EMC}$)*:** See Attachment 1

***DCGL*:** Co-60 =1.4 pCi/gm, Cs-137 = 3.0 pCi/gm

***DCGL$_{EMC\ ISOCS}$*:** Co-60 = 15 pCi/gm, Cs-137 = 66 pCi/gm (Based on 1m^2 area)

***DCGL $_{GA}$*:** 2.27 pCi/g

***DCGL$_{EMC}$*:** Co-60 = 2.1 pCi/gm, Cs-137 = 9.3 pCi/gm (Based on 50m^2 area)

***Radionuclides for analysis*:** All LTP nuclides with the focus on Co^{60} and Cs^{137}

***ISOCS Nuclide Library*:** Library will include the gamma emitters listed in Table 2

***Investigation Level for soil samples*:** Investigation Level for soil samples will be >DCGL$_{EMC}$ -or- >DCGL$_{W}$ and a statistical outlier -or- a sum of DCGL$_{EMC}$ fractions >1.0

***Adjusted investigation Level ($DCGL_{EMC}$) for ISOCS Measurements*:**

- Co-60 = 0.28 pCi/gm
- Cs-137 = 1.22pCi/gm

Note: The adjusted investigation levels for the ISOCS were derived by multiplying the $DCGL_{EMC}$ ($DCGL_W$ * AF for a $1m^2$ elevated area) by the ratio of MDAs obtained from the full field of view (38.5m2) relative to the MDA obtained for a $1m^2$ area at the edge of the field of view as this leads to a conservative model. The values developed for the $1m^2$ elevated area at the edge of the field of view used for the ISOCS scan investigative levels are sensitive enough to detect the elevated comparison.

***Investigation Level for SPA-3/E-600*:** Audible increases above background that are reproducible.

MDCs for gamma analysis of soil samples:

Table 2

MDCs for gamma emitters

Nuclide	10-50% $DCGL_W$ (pCi/gm
Co-60	0.14-0.70
Nb-94	0.25-1.2
Ag-108m	0.25-1.2
Sb-125	1.10-5.5
Cs-134	0.17-0.86
Cs-137	0.30-1.5
Eu-152	0.35-1.8
Eu-154	0.33-1.7
Eu-155	14-70

The desired MDCs in the laboratory analysis of FSS soil samples should be the 10% values. If it is impractical to achieve those, the 50% $DCGL_W$ values must be achieved in the laboratory analysis of the FSS soil samples. ISOCS measurements will meet the 10-50% $DCGL_{EMC}$ values for the gamma emitting nuclides listed in Table 2.

MDCs for HTD nuclides: In addition to the MDC values listed above, the following MDC values will also be transmitted to the outside laboratory via the chain-of-custody form accompanying the FSS soil samples:

Table 3

MDCs for Hard-to-Detect nuclides

Nuclide	10-50% $DCGL_W$ (pCi/gm)
H-3	13-64
C-14	0.19-0.95
Fe-55	1E03-5E03
Ni-63	28-140
Sr-90	0.06-0.29
Tc-99	0.48-2.4
Pu-238	1.1-5.7
Pu-239,240	1.0-5.2
Pu-241	34-170
Am-241	1.0-5.2
Cm-243, 244	1.1-5.5

***Survey coverage*:** Scan measurements, or ISOCS (the primary method of scans), will provide a 100% coverage of the survey area

***QC checks and measurements*:** QC checks for the Portable ISOCS will be in accordance with DP-8869 and DP-8871. Two samples will be chosen as QC split samples and will be analyzed by an off-site laboratory for all LTP nuclides. Additionally, two samples will be analyzed twice in-house by gamma spectroscopy and the results compared.

4.0 Define the boundaries of the survey:

Survey Unit NOL-02-02 is located within the RCA and is bounded by NOL-02-04 on the north, NOL-02-01 on the west and NOL-02-03 on the south, and OOL-11-01 on the east.

5.0 Develop a decision rule:

Null hypothesis: The null hypothesis (H_0), as required by MARSSIM, is stated and tested in the negative form: "Residual licensed radioactive materials in Survey Unit 02 exceeds the release criterion. The null hypothesis, as stated in this manner, is designed to protect the health of the public as well as to demonstrate compliance with the requirements set forth in the Yankee Rowe License Termination Plan. In general, hypothesis testing will result in the following assessments:

a. If all of the sample data show that the soil concentrations of all plant-related LTP nuclides are below the DCGLs and the sum of fractions for these nuclides are less than

unity, reject the null hypothesis (i.e. NOL-02-02 meets the release criteria).

b. If the action levels are exceeded, then perform an investigation survey.

c. If the average concentration is below the DCGL, but individual measurements exceed the DCGL then apply a statistical test to either accept or reject the null hypothesis.

d. If the average concentration of any individual nuclide exceeds the DCGL or if the sum of fractions exceeds unity, then accept the null hypothesis (i.e. NOL-02-02 does not meet the release criteria).

6.0 Specify tolerable limits on decision errors:

***Probability of type I (α) error*:** 0.05
***Probability of type II (β) error*:** 0.05

LBGR: **0.93**

7.0 Optimize Design:

Type of statistical test: WRS Test ☐ Sign Test ☒

Basis including background reference location (if WRS test is specified): N/A

***Number of samples*:** 20 Random start, systematic triangular grid pattern.

***Split Samples*:** Two samples will be split samples

***Hard-to-Detect analyses*:** Two samples sent for off-site analysis will be analyzed for all LTP hard-to-detect radionuclides referenced in this survey plan

***Sample Recounts*:** Two samples will be recounted on-site

GENERAL INSTRUCTIONS

1. Soil samples will be collected in accordance with DP-8120 in one-liter marinelli beakers. Extraneous materials (e.g. vegetation, debris, rocks, etc.) will be removed prior to placing the soil into the marinellis.
2. Collect the unbiased soil samples at 20 systematic locations with a random start point.
3. Soil sample designation:
   a. FSS soil samples: NOL-02-02-001-F through NOL-02-02-020-F.
   b. Samples NOL-02-02-005-F-S and NOL-02-02-008-F-S will be designated as split samples sent for full analysis by the off-site laboratory for all LTP nuclides.
   c. The off-site gamma spec. results will be compared with the on-site results in accordance with DP-8864.
4. Two recount samples: NOL-02-02-004-F and NOL-02-02-011-F will be counted twice on

site and the results compared in accordance with DP-8864.

5. All soil samples will be received and prepared in accordance with DP-8813.

6. Chain-of-Custody form will be used in accordance with DP-8123 for all the split samples.

7. The sampling locations will be identified using GPS. In cases where the location cannot be determined directly using GPS, an offset will be used to describe the distance and bearing from a known GPS location, Each location will be marked by a flag, either prior to or at the time of the sampling. The FSS Radiological Engineer or FSS Field Supervisor will guide the FSS Technician to the sample locations.

8. Survey instrument: Operation of the Portable ISOCS will be in accordance with DP-8871, with QC checks performed in accordance with DP-8869 and DP-8871. Operation of the E-600 w/SPA-3 will be in accordance with DP-8535, with QC checks preformed in accordance with DP-8540. Instrument response checks shall be performed prior to and after use for the E-600 w/SPA-3 and once per shift for the Portable ISOCS. Any flags encountered during the ISOCS QC Source Count must be corrected/resolved prior to surveying. If anomalies cannot be corrected or resolved, contact the Cognizant FSS Engineer for assistance.

9. The job hazards associated with the FSS in Survey Unit 02 are addressed in the accompanying JHA for NOL-02-02.

10. All personnel participating in this survey shall be trained in accordance with DP-8868.

INSTRUCTIONS

1. Locate and mark the measurement points at the locations shown on the attached map(s).
   1.1. Any other measurement designations will be determined by the FSS Engineer.
2. Collect soil samples at the 20 locations specified on the map(s).
   2.1. Soil samples are collected in accordance with DP-8120. Remove extraneous vegetation, debris, rocks, etc prior to placing the soil into the one-liter marinelli beaker.
   2.2. Soil samples are to be received and prepared in accordance with DP-8813.
      2.2.1. Soil samples are to be analyzed onsite for easy-to-detect nuclides and associated MDCs as listed above(*MDCs for gamma analysis of soil samples:).*
   2.3. Samples NOL-02-02-004-F and NOL-02-02-011-F will be counted twice and the results evaluated in accordance with DP-8864.
   2.4. Two soil sample, NOL-02-02-005-F and NOL-02-02-008-F will be split samples and the splits designated NOL-02-02-005-F-S and NOL-02-02-008-F-S respectively:
      2.4.1. The results will be evaluated in accordance with DP-8864.
      2.4.2. The Chain-of-Custody will be maintained in accordance with DP-8123.
   2.5. Send the following soils to the offsite lab for analysis of hard-to-detect nuclides and associated MDCs as listed above (*MDCs for HTD nuclide:).*
      2.5.1. The split soil samples specified above. Do not dry split samples sent off-site for analysis.
   2.6. Soil sample locations may be identified using GPS.
      2.6.1. If the location cannot be determined directly using GPS, tape measurements from known reference points may be utilized.

2.6.2. Each location will be marked either prior to or at the time of the sampling.

2.6.3. The FSS Radiological Engineer or FSS Field Supervisor will guide the FSS Technician to the sample locations as necessary.

3. Scan 100% of the soil area using ISOCS at a 1m height with 180^0 open collimation at the locations specified on the ISOCS map.

3.1. Operation of the Portable ISOCS will be in accordance with DP-8871, with QC checks performed once per shift in accordance with DP-8869 and DP-8871. Resolve flags encountered prior to survey.

3.2. Lay out the grid by placing parallel rows of markers forming a square pattern at a maximum distance of 4.0 m apart and a maximum of 2.0 m from the edge of each surface area.

3.2.1. As a prerequisite for scan grid point count acquisition, ensure all standing water, ice, and/or snow has been removed from the scan field of view. Incidental amounts of moisture occurring during the acquisition such as rain or snow are acceptable, since the short duration of a count (600 seconds) should not accumulate significant absorber interference.

3.2.2. Angle the detector as necessary perpendicular to the scan surface and perform an analysis in accordance with DP-8871 using a preset count time sufficient to meet the MDAs referenced in the survey plan.

3.2.3. Using the 180-degree open collimation configuration, position the ISOCS detector directly above (perpendicular to the reference plane) each marker 1m from the surface to be scanned.

3.2.4. For areas where concrete walls or berms exist in the field of view, estimate the percentage of concrete in the field of view and record on the log sheet.

3.2.5. For areas with saturated soil, such as low points of mud holes, estimate the percentage of saturated soil in the field of view and record on the log sheet. Note: Investigation levels will be reduced on these locations by 20% per guidance in YA-REPT-00-018-05 Rev 0 to account for matrix moisture attenuation effects.

3.3. Review the report ensuring that the MDAs have been met.

3.4. Review the report for identified nuclides and compare values against the $DCGL_{EMC}$.

4. Operation of the E-600 will be in accordance with DP-8535

4.1. QC checks will be performed in accordance with DP-8540.

4.2. Resolve flags encountered prior to survey.

5. All personnel participating in this survey shall be trained in accordance with DP-8868.

6. If an ISOCS measurement needs to be investigated, obtain additional radiological data as follows.

6.1. Scan the ISOCS footprint (3.5m radius) with a SPA-3 at approximately 9" or less per second in rate-meter mode with audible on.

6.2. If the SPA-3 background exceeds 16,800 cpm contact the FSS Engineer.

6.3. Mark the boundaries around any detected elevated areas in the soil.

6.4. Identify the boundaries on the survey map.

6.5. Measure the total area of each outlined area in square centimeters.

6.6. Indicate on the map and the actual location the highest identified activity among all of the elevated areas.

6.7. Indicate the highest reading on the map for each elevated area.

6.8. At the highest reading in each elevated area:

6.8.1. First, perform and record a SPA-3 reading.

6.8.2. Second, obtain a soil sample at that location.

6.8.3. Third, obtain a second SPA-3 reading in the same location and manner as the first.

6.9. Re-perform the ISOCS measurement.

7. If a direct measurement needs to be investigated, obtain additional radiological data as follows.

7.1. Review ISOCS data which may or may not confirm that the soil sample direct measurement was in fact above the investigation level. Because direct measurement locations are usually not coincidentally directly below an ISOCS shot, one or more ISOCS shots may indicate the need to investigate single or multiple direct measurement locations.

7.2. Scan a 2-meter radius footprint around the direct measurement location using a SPA-3 at approximately 9" or less per second in rate-meter mode with audible on.

7.3. If the background exceeds 16,800 cpm contact the FSS Engineer.

7.4. Mark the boundaries around any detected elevated areas in the soil.

7.5. Identify the boundaries on the survey map.

7.6. Measure the total area of each outlined area in square centimeters.

7.7. Indicate on the map and at the actual location the highest identified activity among all of the elevated areas.

7.8. Indicate the highest reading on the map for each elevated area.

7.9. At the highest reading in each elevated area:

7.9.1. First, perform and record a SPA-3 reading.

7.9.2. Second, obtain a soil sample at that location.

7.9.3. Third, obtain a second SPA-3 reading in the same location and manner as the first.

7.10. Obtain a second soil sample around and below the hole from where the first soil sample was obtained.

7.11. Re-perform the ISOCS measurement.

8. Document investigative actions on DPF-8856.2.

9. Upon completion of the survey:

9.1. Verify that MDAs have been met.

9.2. Assess nuclides listed in the LTP through the use of the unity rule.

9.3. Perform an investigation as indicated by the results of the actions listed above.

Prepared by Tozzie Date 5/4/06
FSS Radiological Engineer

Reviewed by N. TOZZIE Date 5/4/06
FSS Radiological Engineer

Approved by Date 5/4/06
FSS Project Manager

Attachment 1

Inputs:

Scan speed: 0.25 m/s

MDCR = 1.38*sqrt(b)/sqrt(p)*t

Where:

b = background counts in time t

p = surveyor efficiency = 0.5

t = time the detector is above localized activity = 2.24 s = 0.0373 min

Assume:

Localized contam diam = 56 cm

$$MDC(fDCGL_{EMC}) = MDCR\sum(f^i / E_i AF^i DCGL^i)$$ (DP-8853)

AF= Area Factor

E_i = Scanning instrument efficiency (YA-REPT-00-015-04)

f = radionuclide fraction

	Cs-137	Co-60
E_i =	188	379
DCGL	3	1.4
f =	0.72	0.28
AF =	3.1	1.5

p = 0.5

BKG	BKG/t	MDCR	MDC(fDCGL$_{emc}$(10))
7000	261.3	845	6.45E-01
8000	298.7	903	6.90E-01
9000	336.0	958	7.32E-01
10000	373.3	1010	7.71E-01
11000	410.7	1059	8.09E-01
12000	448.0	1106	8.45E-01
13000	485.3	1152	8.79E-01
14000	522.7	1195	9.13E-01
15000	560.0	1237	9.45E-01
16000	597.3	1278	9.76E-01
16800	627.2	1309	1.00E+00
17000	634.7	1317	1.01E+00
18000	672.0	1355	1.03E+00
19000	709.3	1392	1.06E+00
20000	746.7	1428	1.09E+00
21000	784.0	1464	1.12E+00
22000	821.3	1498	1.14E+00
23000	858.7	1532	1.17E+00
24000	896.0	1565	1.19E+00
25000	933.3	1597	1.22E+00

Final Status Survey Planning Worksheet

GENERAL SECTION	
Survey Area No.: NOL-02	Survey Unit No.: 03
Survey Unit Name: Northeastern Upper RCA Yard	
FSSP Number: YNPS-FSSP-NOL02-03-00	

PREPARATION FOR FSS ACTIVITIES

Check marks in the boxes below signify affirmative responses and completion of the action.

1.1 Files have been established for survey unit FSS records. ☑

1.2 ALARA review has been completed for the survey unit. ☑ Refer to YA-REPT-00-003-05

1.3 The survey unit has been turned over for final status survey. ☑

1.4 An initial DP-8854 walkdown has been performed and a copy of the completed Survey Unit Walkdown Evaluation is in the survey area file. ☑

1.5 Activities conducted within area since turnover for FSS have been reviewed. ☑

Based on reviewed information, subsequent walkdown: ☑ not warranted ☐ warranted

If warranted, subsequent walkdown has been performed and documented per DP-8854. ☐

OR

The basis has been provided to and accepted by the FSS Project Manager for not performing a subsequent walkdown. ☐

1.6 A final classification has been performed. ☑

Classification: CLASS 1 ☑ CLASS 2 ☐ CLASS 3 ☐

DATA QUALITY OBJECTIVES (DQO)

1.0 State the problem:

Survey Area NOL-02 consists of the surface area of Northeast Upper RCA Yard. The open land area is owned by YNPS and is comprised of soil. Survey Unit NOL-02-03 is a sub unit of survey area NOL-02 and is bordered by NOL-02-01 & 02 to its north, OOL-11-02 to its east, NOL-05-02 to its west and NSY-07 & NOL-03 to its south. It is approximately 469 square meters of surface area.

The problem as defined by this survey plan is to demonstrate that the years of plant operation did not result in an accumulation of plant-related radioactivity that exceeds the release criteria.

The planning team for this effort consists of the FSS Project Manager, FSS Radiological Engineer, FSS Field Supervisor, and FSS Technicians. The FSS Radiological Engineer will make primary decisions with the concurrence of the FSS Project Manager.

2.0 Identify the decision:

Does residual plant-related radioactivity, if present in the survey unit, exceed the release criteria? Alternative actions may include no action, investigation, resurvey, remediation and reclassification.

3.0 Identify the inputs to the decision:

Sample media:	Soil
Types of measurements:	Soil samples, ISOCS Assays and gamma scans
Radionuclides-of-concern:	Co-60, Cs-137

Applicable DCGL:		The DCGLs applied under this survey plan correspond to annual doses of 8.73 mrem/y (the 10-mrem/y DCGL adjusted for the dose contributions from sub-surface concrete structures and tritium in ground water).			
Nuclide	DCGL (pCi/g)	Nuclide	DCGL (pCi/g)	Nuclide	DCGL (pCi/g)
Co-60	1.4E+0	Eu-152	3.6E+0	Sr-90	6.0E-1
Nb-94	2.5E+0	Eu-154	3.3E+0	Tc-99	5.0E+0
Ag108m	2.5E+0	Eu-155	1.4E+2	Pu-238	1.2E+1
Sb125	1.1E+1	H-3	1.3E+2	Pu-239/240	1.1E+1
Cs-134	1.7E+0	C-14	1.9E+0	Pu-241	3.4E+2
Cs-137	3.0E+0	Fe-55	1.0E+4	Am-241	1.0E+1
		Ni-63	2.8E+2	Cm-243/244	1.1E+1

Twenty-five (25) samples from the HSA data were used to provide the characterization data for survey unit NOL-02-03. The data is sufficient to support FSS planning of Survey Unit NOL-02-03.

Based on a review of the characterization data, Co-60 and Cs-137 are the only plant-related radionuclides that were identified consistently in the characterization samples analyzed. The results from the characterization data are summarized below:

- Co-60 (11 detects) — Co-60 is present in 44 % of the characterization samples.
- Cs-137 (10 detects) — Cs-137 is present in 40 % of the characterization samples.
- Other YNPS ETD — There were no other easy to detect nuclides identified >MDA.
- YNPS HTD — There were no hard to detect nuclides identified in the four samples analyzed.

The presence of all LTP-listed radionuclides (gamma-emitters, HTD beta-emitters, and TRUs) in the soil will be evaluated under this survey plan. The YNPS Chemistry Dept. will analyze each FSS soil sample for all LTP-listed gamma-emitting nuclides, except Cm-243/244. In addition, two (2) FSS soil samples will be sent to an independent laboratory for analyses of gamma-emitters, HTD beta-emitting radionuclides, and alpha-emitting radionuclides, which will include Cm-243/244.

Survey Design / Release Criteria

Classification:	Class 1
Average Co-60 concentration:	0.050 pCi/g
Standard deviation Co-60 (σ):	0.087 pCi/g
Average Cs-137 concentration:	0.104 pCi/g
Standard deviation Cs-137 (σ):	0.169 pCi/g
Weighted sum (σ):	0.084
Surrogate DCGL:	N/A (a surrogate DCGL will not be used)

LBGR	Initial = 0.5xDCGL = 0.5 Adjusted = 0.83
Number of Samples	Calculated = 15
Survey Unit Area	469 m^2
Grid Area (A/N)	31.27 m^2
$DCGL_{EMC}$: Co-60	2.1 pCi/g (based on AF = 1.5)
$DCGL_{EMC}$: Cs-137	9.3 pCi/g (based on AF = 3.1)

Investigation Level for soil samples:

- >$DCGL_{EMC}$ for either Co-60, Cs-137 -or-
- A sum of $DCGL_{EMC}$ fractions > 1.0 -or-
- >DCGL for Co-60, Cs-137 and a statistical outlier as defined in the LTP.

Note: The same criteria will be applied to any other LTP-listed nuclide if identified in the soil samples.

ISOCS Assay Coverage:

100% of the surface area, ensured by overlapping field-of-views using ISOCS in the 1m-detector height with 180° open collimation configuration.

Investigation Level for ISOCS measurements:

- 0.18 pCi/g Co-60 (reference document YA-EVAL-00-001-06)
- 0.70 pCi/g Cs-137 (reference document YA-EVAL-00-001-06)
- -or- a sum of their fractions >1.0

Note: The investigation levels for the ISOCS assays were derived by multiplying the $DCGL_{EMC}$ associated with a $1m^2$ area by the ratio of the MDC for the full field of view ($38.5m^2$) to the MDC for a $1m^2$ area at the edge of the full field of view. Additional details regarding the investigation levels for ISOCS assays can be found in YA-REPT-00-018-05. The investigation levels developed in this manner are sensitive enough to detect the $DCGL_{EMC}$ values based on the grid area.

MDC's for ISOCS measurements:

Nuclide	MDC (pCi/g)	Nuclide	MDC (pCi/g)	Nuclide	MDC (pCi/g)
Co-60	1.8^{E}-01	Sb-125	1.0^{E}+00	Eu-152	4.1^{E}-01
Nb-94	2.6^{E}-01	Cs-134	3.0^{E}-01	Eu-154	3.8^{E}-01
Ag-108m	2.5^{E}-01	Cs-137	7.0^{E}-01	Eu-155	1.1^{E}+01

SPA-3 Gamma Scan Coverage:

SPA-3 scans will be performed for surface soil within the field-of-view of an ISOCS assay or surrounding a FSS sample location that exceeds the investigation criteria. The SPA-3 scan will cover 100% of the ISOCS assay total field-of-view area ($38.5m^2$) or a 1-m radius around the FSS sample location ($3.14m^2$).

Investigation Level for SPA-3 Scans:

Reproducible indication above background using SPA-3 and audible discrimination. The expected background range for SPA-3 scans is between 7,000 cpm and 15,000 cpm.

Radionuclides for analysis:

All LTP nuclides with the focus on Co-60 and Cs-137.

MDCs for gamma analysis of soil samples:

Nuclide	10% - 50% of DCGL (pCi/g)
Co-60	1.4E-01 - 7.0E-01
Nb-94	2.5E-01 - 1.3E+00
Ag-108m	2.5E-01 - 1.3E+00
Sb-125	1.1E+00 - 5.6E+00
Cs-134	1.7E-01 - 8.7E-01
Cs-137	3.0E-01 - 1.5E+00
Eu-152	3.6E-01 - 1.8E+00
Eu-154	3.3E-01 - 1.7E+00
Eu-155	1.4E+01 - 6.9E+01

The desired MDCs in the laboratory analyses of FSS soil samples will be the 10% DCGL values. If it is impractical to achieve those, the 50% DCGL values must be achieved in the laboratory analyses of the FSS soil samples.

MDC's for HTD nuclide:

Nuclide	10% - 50% DCGL (pCi/g)
H-3	1.3E+01 - 6.4E+01
C-14	1.9E-01 - 9.7E-01
Fe-55	1.0E+03 - 5.1E+03
Ni-63	2.8E+01 - 1.4E+02
Sr-90	6.0E-02 - 3.0E-01
Tc-99	5.0E-01 - 2.5E+00
Pu-238	1.2E+00 - 5.8E+00
Pu-239	1.1E+00 - 5.3E+00
Pu-241	3.4E+01 - 1.7E+02
Am-241	1.0E+00 - 5.1E+00
Cm-243	1.1E+00 - 5.6E+00

The MDC values for difficult to detect nuclides will be conveyed to the outside laboratory via the sample chain-of-custody form DPF-8823.1 which will accompany the soil samples.

MDCR for SPA-3:

The accompanying table in Attachment 1 provides MDCR values by various background levels.

MDC ($fDCGL_{surveyor-emc}$) for SPA-3 scans:

The accompanying table in Attachment 1 provides MDC values by various background levels.

QC checks and measurements:

- QC checks for ISOCS will be in accordance with DP-8869 and DP-8871.
- QC checks for the Leica GPS will be performed in accordance with DP-8859.
- QC checks for the SPA-3 will be performed in accordance with DP-8504.
- Two QC split samples will be collected (note: this is in accordance with and exceeds DP-8852 requirements.)
- One QC recount for soil samples will be performed by the YNPS Chemistry Lab (note: this is in accordance with DP-8852 requirements.)

4.0 Define the boundaries of the survey:

- Boundaries of Survey Unit NOL-02-03 are as shown on the attached map. This area is bordered by NOL-02-01 & 02 to its north, OOL-11-02 to its east, NOL-05-02 to its west and NSY-07 & NOL-03 to its south.

- The survey will be performed under appropriate weather conditions (as defined by instrumentation limitations and human tolerance). Surveys may be performed on any shift of work.

5.0 Develop a decision rule:

Upon review of the FSS data collected under this survey plan:

(a) If all the sample data show that the soil concentrations of plant related nuclides are below the 8.73 mrem/year DCGLs and the sum of fractions of nuclides are below unity, then reject the null hypothesis (i.e., Survey Unit NOL-02-03 meets the release criteria).

(b) If the investigation levels are exceeded, then perform an investigation survey.

(c) If the average concentration of any LTP-listed nuclide exceeds its respective $DCGL_w$ or the average sum of fractions for any LTP-listed nuclide exceeds one, then accept the null hypothesis (i.e., Survey Unit NOL-02-03 fails to meet the release criteria).

Note: Alternate actions beyond investigations are not expected to be necessary within this survey unit.

6.0 Specify tolerable limits on decision errors:

Null hypothesis:	Residual plant-related radioactivity in Survey Unit NOL-02-03 exceeds the release criteria.
Probability of type I error:	0.05
Probability of type II error:	0.05
LBGR:	The applicable soil (8.73-mrem/y) DCGL ÷ 2 LBGR = 0.5 (Unity Rule)

7.0 Optimize Design:

Type of statistical test: WRS Test ☐ Sign Test ☑ (background will not be subtracted)

Number and Location of Samples: Fifteen (15) soil samples will be collected at locations based on a random start, systematic triangular grid (refer to accompanying DPF-8853.2).

Biased samples: A minimum of two (2) biased sample locations will be selected before, or at the time of sample collection and their locations will be added to the map, with the letter "B" added to the sample number. The addition of these samples and the relocation of any samples may be added to the map without requiring a revision. The coordinates of the biased sample locations will be determined and added to the record.

Biased sample locations: • The two (2) biased sample locations will be determined in the field by the Rad Engineer based on historical data and process knowledge of the area.

GENERAL INSTRUCTIONS

1. Where possible, measurement locations will be identified using GPS in accordance with DP-8859. Each location will be marked to assist in identifying the location. Any locations that are not suitable for soil sampling will be relocated to the nearest suitable location and documented in the field log in accordance with DP-8856.
2. Soil samples will be collected in accordance with DP-8120.
3. Chain of Custody form will be used in accordance with DP-8123 for all soil samples sent to an off-site laboratory.
4. All soil samples will be received and prepared in accordance with DP-8813. Note: Split samples to be sent to an off-site lab will not be dried prior to counting on site or shipping.
5. Collect ISOCS measurements in accordance with DP-8871 to provide 100% scan coverage of the survey unit.
6. Survey instrument: Operation of the E-600 w/SPA-3 will be in accordance with DP-8535 with QC checks performed in accordance with DP-8504. The instrument response checks shall be performed before issue and after use.
7. All SPA-3 scans will be performed with the audible feature activated. FSS Technicians will listen for upscale readings to which they will respond by slowing down or stopping the probe to distinguish between random fluctuations in the background and greater than background readings.
8. The job hazards associated with the Survey described in this package are addressed in the accompanying Job Hazard Assessment (JHA) for NOL-02-03.
9. All personnel participating in this survey shall be trained in accordance with DP-8868.

SPECIFIC INSTRUCTIONS

1. All designated measurement locations will be identified by GPS per DP-8859 or by use of reference points and tape measure as necessary. If a designated sample location is obstructed for any reason, the FSS Radiological Engineer or the FSS Field Supervisor will select an alternate location in accordance with DP-8856. A detailed description of the alternate location will be recorded on form DPF-8856.2, the survey unit map will be annotated appropriately, and the alternate location will be conspicuously marked to facilitate re-visiting to identify and record the coordinates with GPS in accordance with DP-8859 or by measurement from a known reference point when GPS is not available.
2. Sample Requirements:
   - Collect fifteen (15) random 1-liter soil samples in accordance with DP-8120. Two (2) of the fifteen (15) random soil samples will be analyzed as QC split samples to fulfill the QC requirement of DP-8852. The same QC split samples will also be analyzed for Hard-to-Detect nuclides in accordance with section 5.6.3.2.1 of the LTP and DP-8856.
   - Collect two (2) biased 1-liter soil samples in accordance with DP-8120. The radiological engineer assigned to this survey unit will determine the locations of the biased samples.
3. Soil Sample Designation:

FSS soil samples:	NOL-02-03-001-F through NOL-02-03-015-F corresponding to FSS sample locations 001 through 015.
Biased soil samples:	NOL-02-03-016-F-B through NOL-02-03-017-F-B corresponding to the biased sample locations 016 and 017.

QC split samples:	NOL-02-03-009-F-S and NOL-02-03-012-F-S are to be designated as QC split samples. These samples will be sent to the off-site laboratory as collected from the field (i.e., without drying). YNPS Chemistry will count these samples in the "wet" condition prior to shipment to the offsite laboratory.
Recount samples:	NOL-02-03-008-F-RC is to be counted twice on site. The results will be compared in accordance with DP-8864.

4. Sample Analysis:

   - Gamma analysis will be performed on all soil samples. If any of the gamma analyses show that an investigation level has been exceeded an investigation survey will be conducted at that sample location as directed in specific instruction # 6.
   - YNPS Chemistry will analyze NOL-02-03-001-F through NOL-02-03-015-F and NOL-02-03-016-F-B and NOL-02-03-017-F-B for gamma-emitting nuclides.
   - YNPS Chemistry will analyze NOL-02-03-008-F as a sample recount. The recounted sample will possess the naming convention NOL-02-03-008-F-RC.
   - YNPS Chemistry will analyze NOL-02-03-009-F-S and NOL-02-03-012-F-S for gamma-emitting nuclides prior to being sent to the off-site laboratory. These samples will be analyzed for gamma-emitting nuclides and HTD at the off-site laboratory.
   - On-site gamma analysis of the FSS samples shall achieve the MDC values stated in the DQO section of this plan. The MDC's will be communicated to the laboratory using an attachment to the Chain-of- Custody form.

5. ISOCS Assays.

   - Collect the appropriate number of ISOCS measurements in accordance with DP-8871 to provide 100% scan coverage of the survey unit.
   - ISOCS investigation levels are based on specific spacing of ISOCS assays. ISOCS assays, when using the 180° collimator at 1-meter, are restricted to:

     (a) A maximum spacing of 4 meters between assay locations.

     (b) A maximum spacing of 2 meters from any survey unit boundary.

     Note: Use reference document YA-EVAL-00-001-06 for ISOCS investigation levels.

   - ISOCS assays are designated as NOL-02-03-xxx -F-G where "xxx" continues sequentially from the last number assigned to an FSS measurement.
   - QC checks shall be performed at least once per shift in accordance with DP-8869 and DP-8871. Resolve flags encountered prior to survey.
   - ISOCS assays to be performed with 180° collimator at 1m unless otherwise directed by the FSS Engineer. Make note on the daily survey journal (DPF-8856.2) if other geometries are used.
   - For ISOCS assay locations shown on map "ISOCS Scans", position the detector downward facing keeping the detector perpendicular to the ground.
   - Designate additional assay locations in continuing sequence from the last number assigned to an

FSS measurement. Record detailed information about additional assay locations on the daily survey journal.

- If the results on any ISOCS assay exceed an investigation level, investigate the area within the field of view (7m diameter – 38.5m^2 area for 180°-1m) for that assay as directed in Specific Instruction # 7.

- Remove standing water prior to performance of ISOCS assays. Contact the FSS Engineer for directions if conditions are such that standing water cannot be removed.

6. If the results of any FSS sample (statistical and/or biased points) analysis exceed an investigation level, perform a first level investigation as follows:

   Note: Detailed descriptions of investigation actions shall be recorded in the daily survey journal (DPF-8856.2).

   - Review ISOCS data for assays in which the sample requiring investigation may have been in the field of view.

   - Scan a 1m radius footprint around the sample location with a SPA-3 in rate-meter mode moving the detector at a speed of 0.25m or less per second, keeping the probe at a distance of approximately 3" from the surface and following a serpentine path that includes at least 3 passes across each square meter. The area of scan should be increased as necessary to bound any areas of elevated activity identified.

   - Mark the boundaries around any detected elevated areas in the soil and identify the boundaries on a survey map. Measure the total area of each outlined area in square centimeters.

   - Mark the location of the highest identified activity for each of the elevated areas in the soil and on the survey map.

   - At each of the highest identified activity area

     - Perform and record a 1-minute scaler mode SPA-3 measurement. Designate the reading as "NOL-02-03-xxx-F-SC-I" where "xxx" continues sequentially from the last number assigned to an FSS measurement.

     - Obtain a soil sample at the location. Designate the sample as "NOL-02-03-xxx-F-I" where "xxx" continues sequentially from the last number assigned to an FSS measurement.

     - Perform and record a post sample 1-minute SPA-3 measurement. Designate the reading as described above.

7. If the results of an ISOCS assay exceed an investigation level, perform a first level investigation as follows:

   Note: Detailed descriptions of investigation actions shall be recorded in the daily survey journal (DPF-8856.2).

   - Scan the ISOCS footprint with a SPA-3 in rate-meter mode moving the detector at a speed of 0.25m or less per second, keeping the probe at a distance of approximately 3" from the surface

and following a serpentine path that includes at least 3 passes across each square meter.

- Mark the boundaries around any detected elevated areas in the soil and identify the boundaries on a survey map. Measure the total area of each outlined area in square centimeters.
- Mark the location of the highest identified activity for each of the elevated areas in the soil and on the survey map.
- At each of the highest identified activity area
    - Perform and record a 1-minute scaler mode SPA-3 measurement. Designate the reading as "NOL-02-03-xxx-F-SC-I" where "xxx" continues sequentially from the last number assigned to an FSS measurement.
    - Obtain a soil sample at the location. Designate the sample as "NOL-02-03-xxx-F-I" where "xxx" continues sequentially from the last number assigned to an FSS measurement.
    - Perform and record a post sample 1-minute SPA-3 measurement. Designate the reading as described above.
- Re-perform the ISOCS assay. Designate the assay as "NOL-02-03-xxx-F-G-I" where "xxx" continues sequentially from the last number assigned to an FSS measurement.

Prepared by _____ Date 5/18/06
FSS Radiological Engineer

N. TOZZIE

Reviewed by _____ Date 5/18/06
FSS Radiological Engineer

Approved by _____ Date 5/22/06
FSS Project Manager

YNPS-FSSP-NOL-02-03-00
Attachment 1

SPA-3 Scan Table

BKG(cpm)	MDCR	MDC(fDCGL$_{emc}$)
7000	845	6.72E-01
8000	904	7.18E-01
9000	959	7.62E-01
10000	1011	8.03E-01
11000	1060	8.42E-01
12000	1107	8.79E-01
13000	1152	9.15E-01
14000	1196	9.50E-01
15000	1238	9.83E-01
16000	1278	1.02E+00
17000	1318	1.05E+00
18000	1356	1.08E+00
19000	1393	1.11E+00
20000	1429	1.14E+00
21000	1464	1.16E+00
22000	1499	1.19E+00
23000	1533	1.22E+00
24000	1565	1.24E+00

5/18/06

Final Status Survey Planning Worksheet

GENERAL SECTION

Survey Area #: NOL-02	Survey Unit #: 04

Survey Unit Name: Northeast Upper RCA Yard Northern Section

FSSP Number: YNPS-FSSP-NOL02-04-00

PREPARATION FOR FSS ACTIVITIES

Check marks in the boxes below signify affirmative responses and completion of the action.

1.1 Files have been established for survey unit FSS records. ☒

1.2 ALARA review has been completed for the survey unit. ☒ See YA-REPT-00-003-05

1.3 The survey unit has been turned over for final status survey. ☒

1.4 An initial DP-8854 walkdown has been performed and a copy of the completed Survey Unit Walkdown Evaluation is in the survey area file. ☒

1.5 Activities conducted within area since turnover for FSS have been reviewed. ☒

Based on reviewed information, subsequent walkdown: ☒ not warranted ☐ warranted

Note: Based upon Rad Engineer walkdown at the Final Turnover

If warranted, subsequent walkdown has been performed and documented per DP-8854. ☐

OR

The basis has been provided to and accepted by the FSS Project Manager for not performing a subsequent walkdown. ☐

1.6 A final classification has been performed. ☒

Classification: CLASS 1 ☒ CLASS 2 ☐ CLASS 3 ☐

DATA QUALITY OBJECTIVES (DQO)

1.0 State the problem:

Survey Area NOL-02-04 is located northeast of the former Spent Fuel Pool building and east of the Alleyway. The footprint of NOL-02-04 was within the RCA. Systems that traversed the survey unit include a steel reinforced concrete ductbank for storm drain and fuel oil lines, and auxiliary service water. A rail spur to the containment structure ran through the survey unit. Surface activities in the area included outdoor storage of radioactive material and entrance to /egress from the RCA. Demolition activities have been completed in NOL-02-04, which included removal of subsurface systems and ductbanks, and the unit has been subjected to extensive remediation. There are some concrete remnants of the service building wall and the remnant of a support column within the survey unit. These concrete remnants will be surveyed and released under the Radiation Protection Program-Free Release procedure.

Post excavation remediation surveys have been performed in NOL-02-04 using SPA-3 and ISOCS with remediation carried out at locations that indicated elevated levels of radioactivity.

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 area NOL-02-04 is identified as a Class 1 Area.

The problem, therefore, is to determine whether the accumulation of licensed radioactive materials generated during plant operation, existing in Survey Unit NOL-02-04, meets the release criterion.

The planning team for this effort consists of the FSS Project Manager, FSS Radiological Engineer, Radiation Protection Manager, FSS Field Supervisor, and FSS Technicians. The FSS Radiological Engineer will make primary decisions with the concurrence of the FSS Project Manager.

2.0 Identify the decision:

The decision to be made can be stated "Does residual plant-related radioactivity, if present in the survey unit, exceed the release criteria?"

Alternative actions that may be employed are investigation, remediation and re-survey.

3.0 Identify the inputs to the decision:

Inputs to the decision include information that will be required to resolve the decision. The information will address such topics as:

- Survey techniques and analytical methodologies selected to generate the required analytical data
- Types and number of samples required to demonstrate compliance with the release criterion
- Identification of the radionuclides-of-concern and their corresponding DCGLs

The various aspects of the data such as quality and data sensitivity ensure accurate information is utilized in the testing of the hypothesis.

Sample media: soil

Types of measurements: soil samples and 100% scans

Radionuclides-of-concern: Co^{60} and Cs^{137}

Radionuclides-of-Concern were determined from the sample results for the FSS of NOL-01-04 (The survey unit adjacent to NOL-02-04). Additionally, the data utilized for the statistical information was taken from the FSS data.

Table 1

8.73 mrem/yr DCGL

Radionuclide	Soil (pCi/g)
H^{3}	130
Co^{60}	1.4
Nb^{94}	2.5
Ag^{108m}	2.5
Sb^{125}	11
Cs^{134}	1.7
Cs^{137}	3.0
Eu^{152}	3.5
Eu^{154}	3.3
Eu^{155}	1.4E+02
C^{14}	1.9
Fe^{55}	1E+04
Ni^{63}	2.8E+02
Sr^{90}	0.6
Tc^{99}	4.8
Pu^{238}	11
$Pu^{239,240}$	10
Pu^{241}	3.4E+02
Am^{241}	10
$Cm^{243,244}$	11

Surrogate DCGLs (ISOCS): After evaluating previous offsite laboratory soil sample analysis results from previously completed FSS survey units for both ETD as well as HTD nuclides, the data suggests that developing surrogate DCGLs is not necessary, because significant HTD nuclides have not been identified at sufficient magnitudes which would significantly impact investigation levels.

$DCGL_{EMC}$: Based on a contaminated source area of 1 m^2 (see Table 1) for use during ISOCS scans. If necessary, the $DCGL_{EMC}$ will be recalculated if an actual area of elevated concentration is discovered with a source area greater than 1 m^2.

Table 1

MDC, $DCGL_W$, $DCGL_{EMC}$, Investigation Level:

gamma analysis of soil and ISOCS measurements

Nuclide	$DCGL_w$ 8.73 mrem/y	$DCGL_{EMC}$ 8.73 mrem/y with AF based on LTP App.6Q	Range of Soil Sample MDC from desired 10% DCGL to required 50% DCGL	$DCGL_{EMC}$ ISOCS (based on source area = $1m^2$)	Investigation Level ISOCS (based on source area = $1m^2$, 1m, 180° open collimation w/4 meter grid spacing)
	Soil (pCi/g)	Soil (pCi/g)	Soil (pCi/g)	Soil (pCi/g)	Soil (pCi/g)
Co-60	1.4E+00	2.1E+00	1.4E-01 to 7.0E-01	1.5E+01	1.8E-01
Nb-94	2.5E+00	3.3E+00	2.5E-01 to 1.2E+00	2.3E+01	2.6E-01
Ag-108m	2.5E+00	3.3E+00	2.5E-01 to 1.2E+00	2.3E+01	2.5E-01
Sb-125	1.1E+01	1.4E+01	1.1E+00 to 5.5E+00	1.0E+02	1.0E+00
Cs-134	1.7E+00	3.9E+00	1.7E-01 to 8.0E-01	2.8E+01	3.0E-01
Cs-137	3.0E+00	9.3E+00	3.0E-01 to 1.4E+00	6.6E+01	7.0E-01
Eu-152	3.6E+00	4.7E+00	3.6E-01 to 1.7E+00	3.4E+01	4.1E-01
Eu-154	3.3E+00	4.3E+00	3.3E-01 to 1.6E+00	3.2E+01	3.8E-01
Eu-155	1.4E+02	1.8E+02	1.4E+01 to 6.9E+01	1.1E+03	1.1E+01

Radionuclides for analysis: All LTP nuclides with the focus on Co^{60} and Cs^{137}

ISOCS Nuclide Library: Library will include the gamma emitters listed in Table 2

Investigation Level for soil samples: Investigation Level for soil samples will be >$DCGL_{EMC}$ or >$DCGL_W$ and three times the standard deviation of the mean

Investigation Level ($DCGL_{EMC}$) for ISOCS Measurements: See Table 1 above.

Note: The investigation levels developed in this manner (in accordance with YA-EVAL-00-001-06) are sensitive enough to detect the $DCGL_{EMC}$ values based on the grid area. Thus for example the calculated 0.18 pCi/g investigation level for Co-60 is sensitive enough to detect the $DCGL_{EMC}$ of 15 pCi/g.

If other LTP-listed gamma-emitting radionuclides are identified in the ISOCS assays, the investigation level will be evaluated using the same criteria.

Investigation Level for SPA-3/E-600: Audible increases above background that are reproducible

MDCs for ETD nuclides in soil samples and ISOCS: The desired MDCs for laboratory analysis of FSS soil samples should be 10% of the $DCGL_W$. If it is impractical to achieve those, the 50% DCGL

values must be achieved. The required MDCs for ISOCS are shown in Table1 above.

MDCs for HTD nuclides in soil samples: In addition to the MDC values listed in Table 1, the MDC values in Table 2 will also be transmitted to the outside laboratory via the chain-of-custody form accompanying the FSS soil samples.

Soil Sample $DCGL_{EMC}$: As noted in Table 1 above, the soil sample ***$DCGL_{EMC}$*** has been calculated based on the geometry of the sampling grid, utilizing LTP Appendix 6Q to determine the Area Factor. The Co-60 and Cs-137 $DCGL_{EMC}$ have been used to determine the Gross Activity $DCGL_{EMC}$ of 2.7 pCi/g.

Table 2.

MDCs for Hard-To-Detect Nuclides in Soil Samples

Nuclide	DCGLw Soil (pCi/g) at 8.73 mrem/y	Range of MDC (pCi/g) from desired (10% DCGL) to required (50% DCGL)
H-3	1.3E+02	1.3E+01 to 6.4E+01
C-14	1.9E+00	1.9E-01 to 9.7E-01
Fe-55	1.0E+04	1.0E+03 to 5.1E+03
Ni-63	2.8E+02	2.8E+01 to 1.4E+02
Sr-90	6.0E-01	6.0E-02 to 3.0E-01
Tc-99	5.0E+00	5.0E-01 to 2.5E+00
Pu-238	1.2E+01	1.2E+00 to 5.8E+00
Pu-239	1.1E+01	1.1E+00 to 5.3E+00
Pu-241	3.4E+02	3.4E+01 to 1.7E+02
Am-241	1.0E+01	1.0E+00 to 5.1E+00
Cm-243	1.1E+01	1.1E+00 to 5.6E+00

SPA-3 Scan MDCR and MDC($fDCGL_{EMC}$): Refer to Attachment 1 for SPA-3 scan MDC values given a range of background values.

Survey coverage: Scan measurements, or ISOCS (the primary method of scans), will provide a 100% coverage of the survey area

QC checks and measurements: QC checks for the Portable ISOCS will be in accordance with DP-8869 and DP-8871. Two samples will be chosen as QC split samples and will be analyzed by an off-site laboratory for all LTP nuclides. Additionally, two samples will be analyzed twice in-house by gamma spectroscopy and the results compared.

4.0 Define the boundaries of the survey:

Survey Unit NOL-02-04 is located within the RCA and is bounded by OOL-02-02, NOL-01-04 and OOL-12 on the north, NOL-01-04 and NOL-02-01 on the west, and NOL-02-02 on the

south and OOL-08-04 on the east.

A random-start systematic grid will define the soil sample locations. The ISOCS scans are 100% of the survey unit and the grid does not require a random start.

Surveying of NOL-02-04 will be performed during both shifts, with adequate lighting, when weather conditions will not adversely affect the data acquisition.

5.0 Develop a decision rule:

Null hypothesis: The null hypothesis (H_o), as required by MARSSIM, is stated and tested in the negative form: "Residual licensed radioactive materials in Survey Unit NOL-02-04 exceeds the release criterion. The null hypothesis, as stated in this manner, is designed to protect the health of the public as well as to demonstrate compliance with the requirements set forth in the Yankee Rowe License Termination Plan. In general, hypothesis testing will result in the following assessments:

a. If all of the sample data show that the soil concentrations of all plant-related LTP nuclides are below the DCGLs and the sum of fractions for these nuclides are less than unity, reject the null hypothesis (i.e. NOL-02-04 meets the release criteria).

b. If the action levels are exceeded, then perform an investigation survey.

c. If the average concentration is below the DCGL, but individual measurements exceed the DCGL then apply a statistical test to either accept or reject the null hypothesis.

d. If the average concentration of any individual nuclide exceeds the DCGL or if the sum of fractions exceeds unity, then accept the null hypothesis (i.e. NOL-02-04 does not meet the release criteria).

6.0 Specify tolerable limits on decision errors:

***Probability of type I (α) error*:** 0.05
***Probability of type II (β) error*:** 0.05

LBGR: **0.5**

7.0 Optimize Design:

Type of statistical test: WRS Test ☐ Sign Test ☒

Basis including background reference location (if WRS test is specified): N/A

***Number of samples*:** Twenty (20) direct measurement soil samples will be taken, with the triangular grid laid out from a random start point.

***Split Samples*:** Two samples will be split samples

***Hard-to-Detect analyses*:** Two samples sent for off-site analysis will be analyzed for all LTP hard-to-detect radionuclides referenced in this survey plan

***Sample Recounts*:** Two samples will be recounted on-site

GENERAL INSTRUCTIONS

1. Soil samples will be collected in accordance with DP-8120 in one-liter marinelli beakers. Extraneous materials (e.g. vegetation, debris, rocks, etc.) will be removed prior to placing the soil into the marinellis.
2. Collect the unbiased soil samples at 20 systematic locations with a random start point.
3. All soil samples will be received and prepared in accordance with DP-8813.
4. Chain-of-Custody form will be used in accordance with DP-8123 for all the split samples.
5. The sampling locations will be identified using GPS. In cases where the location cannot be determined directly using GPS, an offset will be used to describe the distance and bearing from a known GPS location, Each location will be marked by a flag, either prior to or at the time of the sampling. The FSS Radiological Engineer or FSS Field Supervisor will guide the FSS Technician to the sample locations.
6. Survey instrument: Operation of the Portable ISOCS will be in accordance with DP-8871, with QC checks performed in accordance with DP-8869 and DP-8871. Operation of the E-600 w/SPA-3 will be in accordance with DP-8535, with QC checks preformed in accordance with DP-8540. Instrument response checks shall be performed prior to and after use for the E-600 w/SPA-3 and once per shift for the Portable ISOCS. Any flags encountered during the ISOCS QC Source Count must be corrected/resolved prior to surveying. If anomalies cannot be corrected or resolved, contact the Cognizant FSS Engineer for assistance.
7. The job hazards associated with the FSS in Survey Unit 01 are addressed in the accompanying JHA for NOL-02-04.
8. All personnel participating in this survey shall be trained in accordance with DP-8868.

SPECIFIC INSTRUCTIONS

1. Soil sample designation:
   a. FSS soil samples: NOL-02-04-001-F through NOL-02-04-020-F.
   b. Samples NOL-02-04-009-F-S, NOL-02-04-011-F-S will be designated as split samples sent for full analysis by the off-site laboratory for all LTP nuclides.
   c. The off-site gamma spec. results will be compared with the on-site results in accordance with DP-8864.
2. Two recount samples: NOL-02-04-002-F/RC and NOL-02-04-016-F/RC will be counted twice on site and the results compared in accordance with DP-8864.

3. Scan 100% of the soil area using ISOCS at a 1m height with 180^0 open collimation at the locations specified on the ISOCS map.

   a. Operation of the Portable ISOCS will be in accordance with DP-8871, with QC checks performed once per shift in accordance with DP-8869 and DP-8871. Resolve flags encountered prior to survey.

   b. Lay out the grid by placing parallel rows of markers forming a square pattern at a maximum distance of 4.0 m apart and a maximum of 2.0 m from the edge of each surface area. Numbering of the ISOCS scans will be sequential with the first scan number of NOL-02-04-101 (Sequential number)-F-G.

      - As a prerequisite for scan grid point count acquisition, ensure all standing water has been removed from the scan field of view. An incidental amount of moisture occurring during the acquisition such as rain is acceptable, since the short duration of a count (600 seconds) should not accumulate significant absorber interference. In isolated conditions where saturated soils are known to exist (i.e. a sheen exists on top of the soil), adjustments to account for higher densities may be utilized. One of two approaches can be applied to ISOCS measurements when the soil matrix in the scan area (Field of View) is determined to be saturated. As described in the Technical Basis Document one way is to adjust either the investigation level or the sample mass down by 20%. The second way is to reanalyze the collected spectrum applying an efficiency calibration that accounts for the increased soil density.
      - Angle the detector as necessary perpendicular to the scan surface and perform an analysis in accordance with DP-8871 using a preset count time sufficient to meet the MDAs referenced in the survey plan.
      - Using the 180-degree open collimation configuration, position the ISOCS detector directly above (perpendicular to the reference plane) each marker, 1m from the surface to be scanned.
      - Add additional scan points closer than 4.0 m apart as necessary to achieve 100% unit survey coverage, however, a fully documented GPS survey coordinate survey is required for any additional ISOCS scan points.
      - In deep holes, ISOCS may be used to survey vertical or sloping surfaces. As with horizontal surfaces, the ISOCS should be positioned perpendicularly 1m from the surface.

   c. Review the report ensuring that the MDAs have been met.

   d. Review the report for identified nuclides and compare values against the $DCGL_{EMC}$.

4. If SPA-3 scanning is utilized for initial scans (i.e. ISOCS scanning is inaccessible, etc.) FSS Technicians will perform scans by moving the SPA-3 detector at a speed 0.13 m/sec. (5 in./sec), keeping the probe within approximately three inches of the ground surface, and following a serpentine pattern that includes at least three passes across each square meter. The FSS Field Supervisor will time and monitor a minimum of 50% of these scans. When scanning and walking, a slow pace (i.e., 1 step per second) shall be used. Scanning will be performed in the rate-meter mode with the audible feature on. Using the headsets, surveyors will listen for upscale readings, to which they will respond by slowing down or stopping the probe to distinguish between random fluctuations in the background and greater than background readings. Location(s) where detectable-above-background scan readings are found will be investigated.

5. For investigations, scan the area with a SPA-3 to identify and determine the boundaries of the elevated area. SPA-3 investigative scanning is performed similar in manner as described in step 3 with the exception of the scan speed (move detector 2 to 3 inches per second) and the detector need not be moved in a serpentine pattern.

   Note: Background levels for the SPA-3 should range between 10000 and 20000 cpm. If the background levels exceed 24000 cpm, contact a Radiological Engineer prior to commencing/continuing the scan with the SPA-3.

   Note: Standing water may shield gamma contamination. Standing water should be removed from the excavation prior to scanning.

   a. Once the elevated area, requiring an investigation, has been identified and bounded, locate the point of the highest SPA-3 reading within the bounded area and collect a one-liter soil sample for analysis. If a soil sample is collected during the first level investigation, the sample designation will consist of the next sequential measurement location code plus the letter "I" (for investigation). For example, if a soil sample is collected during a first level investigation it will be designated NOL-02-04-021-F-I. If the investigation calls for more than one sample, sequentially number the investigation samples (e.g. NOL-02-04-022-F-I). A gamma analysis will be performed on all investigative soil samples. If it can be demonstrated that the presence of rocks and boulders is the cause of an increased count rate during a SPA-3 scan, record that finding on form DPF-8856.2 and no soil sample is required. The responsible FSS Radiological Engineer will evaluate analysis of any investigation samples for the LTP suite of nuclides.

   b. Detailed descriptions of investigative actions will be recorded on form DPF-8856.2 and the location of the investigation analyses along with the sample designation will be recorded on the survey map. The location description must provide sufficient detail (i.e.) to allow revisiting the spot at a later time.

6. All sample analysis will achieve the MDC values stated in the DQO section of this plan.

NOTIFICATION POINTS

None

Prepared by _____ Date 7/26/06
FSS Radiological Engineer

Reviewed by _____ Date 7-26-06
FSS Radiological Engineer

Approved by _____ Date 7/26/06
FSS Project Manager

Attachment 2
Random Generator for QA Splits and Recounts
YNPS-FSSP-NOL-02-04-00

Worksheet to randomly select numbers

Date Generated: 7/26/2006

Number of samples to choose among: 20
Area/Unit: NOL-02-04

1st	11	Split
2nd	9	Split
3rd	16	Recount
4th	2	Recount
5th	12	
6th	18	
7th	13	
8th	4	
9th	11	
10th	19	

Directions:
1. Put the number of samples in the highlighted cell.
2. If one random number is needed, choose the 1st one.
3. If two random numbers are needed, choose the 1st two.
4. Etc.
5. If one of the selected numbers is a repeat, go to the next one.
6. After entering the number of samples, accept the first list. If you open it again, you will get a different list.
7. Print this page as a record.

YNPS-FSSP-NOL-02-04-00
Attachment 1
SPA-3 Scan Tables

Max Background

BKG(cpm)	MDCR	MDC(fDCGLemc)
4,000	452	4.81E-01
5,000	505	5.38E-01
6,000	553	5.90E-01
7,000	597	6.37E-01
8,000	639	6.81E-01
9,000	677	7.22E-01
10,000	714	7.61E-01
11,000	749	7.98E-01
12,000	782	8.34E-01
13,000	814	8.68E-01
14,000	845	9.01E-01
15,000	875	9.32E-01
16,000	903	9.63E-01
17,000	931	9.93E-01
18,000	958	1.02E+00
19,000	984	1.05E+00
20,000	1,010	1.08E+00
21,000	1,035	1.10E+00
22,000	1,059	1.13E+00
23,000	1,083	1.16E+00
24,000	1,106	1.18E+00
25,000	1,129	1.20E+00
26,000	1,151	1.23E+00
27,000	1,173	1.25E+00
28,000	1,195	1.27E+00
30,000	1,237	1.32E+00
32,000	1,277	1.36E+00
34,000	1,317	1.40E+00
36,000	1,355	1.44E+00
38,000	1,392	1.48E+00
40,000	1,428	1.52E+00

Scan Speed

In/Sec	m/Sec	BKG (cpm)
39	1.00	2,000
20	0.50	4,000
13	0.33	6,000
10	0.25	8,000
8	0.20	10,000
5	0.13	17,000
4	0.10	21,000

YNPS-FSSP-NOL-02-04-00
Attachment 2

DCGL MDC Table

Nuclide	Soil 6.73 mrem/yr (pCi/g)	10% MDC DCGL	50% MDC DCGL	Easy to Detect?	Area Factor	DCGLemc
Co-60	1.4E+00	1.4E-01	7.0E-01	ETD	1.5E+00	2.1E+00
Nb-94	2.5E+00	2.5E-01	1.3E+00	ETD	1.3E+00	3.3E+00
Ag-108m	2.5E+00	2.5E-01	1.3E+00	ETD	1.3E+00	3.3E+00
Sb-125	1.1E+01	1.1E+00	5.6E+00	ETD	1.3E+00	1.4E+01
Cs-134	1.7E+00	1.7E-01	8.7E-01	ETD	2.3E+00	3.9E+00
Cs-137	3.0E+00	3.0E-01	1.5E+00	ETD	3.1E+00	9.3E+00
Eu-152	3.6E+00	3.6E-01	1.8E+00	ETD	1.3E+00	4.7E+00
Eu-154	3.3E+00	3.3E-01	1.7E+00	ETD	1.3E+00	4.3E+00
Eu-155	1.4E+02	1.4E+01	6.9E+01	ETD	1.3E+00	1.8E+02
Am-241	1.0E+01	1.0E+00	5.1E+00	ETD	1.5E+01	1.5E+02
H-3	1.3E+02	1.3E+01	6.4E+01	HTD	3.9E+01	5.1E+03
C-14	1.9E+00	1.9E-01	9.7E-01	HTD	3.7E+02	7.0E+02
Fe-55	1.0E+04	1.0E+03	5.1E+03	HTD	1.0E+02	1.0E+06
Ni-63	2.8E+02	2.8E+01	1.4E+02	HTD	7.7E+01	2.2E+04
Sr-90	6.0E-01	6.0E-02	3.0E-01	HTD	2.7E+01	1.6E+01
Tc-99	5.0E+00	5.0E-01	2.5E+00	HTD	2.3E+01	1.2E+02
Pu-238	1.2E+01	1.2E+00	5.8E+00	HTD	1.9E+01	2.3E+02
Pu-239	1.1E+01	1.1E+00	5.3E+00	HTD	1.9E+01	2.1E+02
Pu-241	3.4E+02	3.4E+01	1.7E+02	HTD	1.5E+01	5.1E+03
Cm-243	1.1E+01	1.1E+00	5.6E+00	HTD	4.0E+00	4.4E+01