Final Status Survey Planning Worksheet

GENERAL SECTION

Survey Area No.: NOL-03	Survey Unit No.: 02

Survey Unit Name: Southeast Upper RCA Yard

FSSP Number: YNPS-FSSP-NOL-03-02-**01 (supplemental survey plan – modifications of the original FSSP Worksheet to allow for use of ISOCS at 1m-90° geometry for investigation)**

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

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

1.7 A final classification has been performed. ☑

1.8 Classification: CLASS 1 ☑ CLASS 2 ☐ CLASS 3 ☐

DATA QUALITY OBJECTIVES (DQO)

1.0 State the problem:

Survey Unit NOL-03-02 is a Class 1 survey unit consisting of the open land area within the southeast section of the RCA yard. It comprises approximately 1,515 m^2. Portions of Survey Unit NOL-03-02 were posted and controlled as an RCA. The above ground plant structures, such as the Old PCA Storage Building, the New PCA Storage Building, and the tank structures have been removed, leaving only portions of the concrete slab floors and foundations. Subsurface systems that traversed or connected within the survey unit included radioactive drain lines and transfer lines. These subsurface systems have been removed.

The HSA cites contamination events that occurred in the survey unit during the operating years of the plant. In addition, significant localized soil contamination (radioactivity concentrations that exceeded DCGLs listed in the LTP) was identified during the scooping and characterization surveys. These contaminated areas were successfully remediated (as verified through post-remediation sampling). The survey unit is classified as a Class 1 unit due to its history, the identified localized soil contamination, and subsequent remediation activities.

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} and 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+00	Eu^{152}	3.6E+00	Sr^{90}	6.0E-01
Nb^{94}	2.5E+00	Eu^{154}	3.3E+00	Tc^{99}	5.0E+00
Ag^{108m}	2.5E+00	Eu^{155}	1.4E+02	Pu^{238}	1.2E+01
Sb^{125}	1.1E+01	H^{3}	1.3E+02	$Pu^{239/240}$	1.1E+01
Cs^{134}	1.7E+00	C^{14}	1.9E+00	Pu^{241}	3.4E+02
Cs^{137}	3.0E+00	Fe^{55}	1.0E+04	Am^{241}	1.0E+01
		Ni^{63}	2.8E+02	$Cm^{243/244}$	1.1E+01

27 characterization samples were sufficient to develop the DQOs for NOL-03-02. 20 new data measurements will be acquired to support DQAs.

Survey Design / Release Criteria

Classification:	Class 1
Average Co^{60} concentration:	0.25
Standard deviation Co^{60} (σ):	0.1972
Average Cs^{137} concentration:	0.306
Standard deviation Cs^{137} (σ):	0.238
Weighted sum (σ):	0.162
LBGR:	0.6766 (Initial LBGR: 0.5)
$DCGL_w$ (Unity):	1
Surrogate DCGL:	N/A (a surrogate DCGL will not be used)
Number of Samples:	15 (calculated) + 5 (added), for a total of 20 samples (+ 2 QC)
Survey Unit Area:	1515 m^2
Sample Grid Spacing:	Triangular: 9.4m
Grid Area (A/N):	75.75 m^2
$DCGL_{EMC}$: Co^{60}	1.96 pCi/g (based on AF = 1.4)
$DCGL_{EMC}$: Cs^{137}	8.4 pCi/g (based on AF = 2.8)

Investigation Level for soil samples:

- >$DCGL_{EMC}$ for either Co^{60}, and Cs^{137} -or-
- A sum of $DCGL_{EMC}$ fractions > 1.0 -or-
- >DCGL for Cs^{137} or Co^{60} 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.

Scan Coverage:

100% of the surface area will be scanned, either by ISOCS or by SPA-3. ISOCS scans will be on a 4m by 4m grid, to within 2 meters at the edges.

Investigation Level for ISOCS measurements:

- 0.18 pCi/g for Co^{60}
- 0.7 pCi/g for Cs^{137}

-or- a sum of their fractions >1.0

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.

MDCs for ISOCS measurements:

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

Note: The MDCs listed in the above table are equal to the investigation level for ISOCS measurements. Contact the FSSE if the MDC values in the above table cannot be achieved in a reasonable count time.

SPA-3 Gamma Scan Coverage:

SPA-3 scans will be performed in areas where restricted access prevents the use of ISOCS. These scans will cover 100% of the surface area that is not covered by ISOCS scans.

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 (24.6m^2) or a 2.8-m radius around the FSS sample location. SPA-3 MDCRs and MDCs are shown in Attachment 1.

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 15,000 cpm and 25,000 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.

MDCs 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 MDC/MDCR table in Attachment 1 provides MDCR values by various background levels.

MDC ($fDCGL_{surveyor\text{-}emc}$) for SPA-3 scans: The accompanying MDC/MDCR 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 DP-8852 requirements.)
- One soil sample QC Recount 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:

YNPS has been divided into multiple survey areas and units with relatively homogeneous characteristics based on information collected during the years of plant operation, the HSA and post-remediation activities. The area of interest has been named NOL-03 and the survey unit is 02. The medium of interest is described as soil. The radiological characteristics of this unit classify it as a Class 1 area with a $\leq 2{,}000m^2$ limit. The total surface area is $1515m^2$, which is well within the $\leq 2{,}000m^2$ limit. The maximum length is 50m and the maximum width is 38.6m. Soil is surveyed to a depth of 15cm.

See attached GPS coordinates and maps that demonstrate the measurement locations, survey unit boundaries and unit relationship to the YNPS site.

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 LTP-listed nuclides are below the 8.73 mrem/year DCGLs and the sum of fractions of LTP-listed nuclides are below unity, then reject the null hypothesis (i.e., Survey Unit NOL-03-02 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 of LTP-listed nuclides exceeds unity, then accept the null hypothesis (i.e., Survey Unit NOL-03-02 fails to meet the release criteria).

Note: Alternate actions include investigations, reclassification, remediation and resurvey.

6.0 Specify tolerable limits on decision errors:

Null hypothesis:	Residual plant-related radioactivity in Survey Unit NOL-03-02 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 calculated, 0.6766 adjusted

7.0 Optimize Design:

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

Number and Location of Samples: 20 soil samples will be collected at locations based on a random start, systematic triangular grid (refer to accompanying DPF-8853.2).

Biased samples: None.

01 7/10/05

Rev. 2 Supplement to NOL-03-02 FSS Plan

This supplement provides instructions for performance of investigation surveys of ISOCS scan measurements. ISOCS scan measurements that exceed the investigation criteria (stated in Section 3.0 of this plan) or other measurements selected by the FSSE will be investigated. Due to the survey unit proximity to the ISFSI, SPA-3 measurements are greatly influenced by radiation associated with stored fuel. It is desired to use the ISOCS in a collimated geometry to attempt to reduce the area requiring SPA-3 scans.

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 forms 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: 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-03-02.
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 20 1-liter soil samples in accordance with DP-8120. Two of the 20 random soil samples will be analyzed as a QC split sample 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.
3. Soil Sample Designations:

FSS soil samples:	NOL-03-02-001-F through NOL-03-02-020-F corresponding to FSS sample locations 001 through 020.
Biased soil samples:	None.
QC split samples:	NOL-03-02-013-F-S and NOL-03-02-018-F-S to be designated as QC split samples.
Recount samples:	NOL-03-02-004-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 packaged in 1-liter Marinellis. 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-03-02-001-F through NOL-03-02-020-F for gamma-emitting nuclides.
   - YNPS Chemistry will analyze NOL-03-02-013-F-S and NOL-03-02-018-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. Ensure that the lid to the 1-liter Marinelli container is secured and sealed with electrical tape to prevent loss of moisture during shipping.

- YNPS Chemistry will analyze NOL-03-02-004-F as a sample recount. The recounted sample will possess the naming convention NOL-03-02-004-F-RC.
- On-site gamma analysis of the FSS samples shall achieve the MDC values stated in the DQO section of this plan. The MDCs will be communicated to the laboratory using an attachment to the Chain-of-Custody form.
- Note: Ensure that the lid of the container is secured and sealed with electrical tape to prevent loss of moisture during shipping.

5. ISOCS Assays:
   - ISOCS investigation levels are based on specific spacing of ISOCS assays. ISOCS assays, when using the 180° collimator at 1-meter, are restricted to:

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

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

   - ISOCS assays are designated as NOL-03-02-xxx-F-G where xxx corresponds to the 3-digit location indicated on survey map "ISOCS Scans".
   - QC checks shall be performed daily 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.
   - 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 scan grid area 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.

     Note: Notify FSS Supervisor or FSS Engineer for further instructions if Background exceeds 25,000 cpm.

   - 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 areas:
  - Perform and record a 1-minute scaler mode SPA-3 measurement. Designate the reading as "NOL-03-02-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-03-02-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 or if the FSSE determines an area requires additional evaluation, perform a first level investigation as follows:

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

   - **Perform ISOCS scan measurements at each investigation location as follows:**
     - **Perform ISOCS scans at 1m height with 90° collimation**
     - **Perform ISOCS scans at 5 locations within a 4-m grid centered over the original ISOCS scan location – One centered over the original scan location and one in each corner of the grid centered at 1.4 m from the center of the grid. ISOCS Scan Investigation Map #1 shows the proper positioning for ISOCS investigation scans.**
     - **Identify investigation ISOCS scans using the convention: NOL-03-02-xxx-F-G-I, where xxx indicates the next sequential location number starting with 300 (i.e. the first investigation ISOCS scan performed will be NOL-03-02-300-F-G-I).**
     - **Indicate any observations in the daily survey journal. Locations of ISOCS scans should be recorded by use of GPS when available.**
     - **The FSSE will review investigation ISOCS scans and will direct performance of SPA-3 scans as set forth in the following steps. Note: The FSSE may direct performance of additional investigation surveys or terminate steps by use of memo that will be inserted in the survey package file.**
   - 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 areas:
     - Perform and record a 1-minute scaler mode SPA-3 measurement. Designate the reading as "NOL-03-02-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-03-02-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-03-02-xxx-F-G-I" where "xxx" continues sequentially from the last number assigned to an FSS measurement.
NOTIFICATION POINTS:
None.

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