

Final Status Survey Planning Worksheet

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GENERAL SECTION	
Survey Area #: OOL-07	Survey Unit #: 01
Survey Unit Name: Mid-Lot Soil	
FSSP Number: YNPS-FSSP-OOL07-01-03 (Rev. 3 changes are in bold font. Rev. 3 provides instructions for use of a sled-mounted SPA-3 to facilitate scans of the slopes of the pile.)	
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.	<input checked="" type="checkbox"/>
1.2 ALARA review has been completed for the survey unit.	<input checked="" type="checkbox"/> (YA-REPT-00-003-05)
1.3 The survey unit has been turned over for final status survey.	<input checked="" type="checkbox"/>
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.	<input checked="" type="checkbox"/>
1.5 Activities conducted within area since turnover for FSS have been reviewed.	<input checked="" type="checkbox"/>
Based on reviewed information, subsequent walkdown: <input checked="" type="checkbox"/> not warranted <input type="checkbox"/> warranted	
If warranted, subsequent walkdown has been performed and documented per DP-8854. <input type="checkbox"/>	
OR	
The basis has been provided to and accepted by the FSS Project Manager for not performing a subsequent walkdown. <input type="checkbox"/>	
1.6 A final classification has been performed.	<input checked="" type="checkbox"/>
Classification: CLASS 1 <input type="checkbox"/> CLASS 2 <input checked="" type="checkbox"/> CLASS 3 <input type="checkbox"/>	
DATA QUALITY OBJECTIVES (DQO)	
1.0 <u>Statement of problem:</u>	
<p>Survey Unit OOL-07-01 consists of soil that was released under AP-0052 from the YNPS industrial area during the construction of the ISFSI pad and placed in Survey Area OOL-07 (the mid-level parking lot). The soil is referred to as both "mid lot" soil and "ISFSI" soil. The original volume of the soil was approximately 16,800 m³ (22,000 yd³), which, when placed in Survey Area OOL-07, occupied an area of approximately 2108 m². Prior to release from the industrial area, the soil was extensively sampled and analyzed by gamma spectroscopy. The results were evaluated using a protocol developed to provide assurance that plant-related radioactivity was not present. The acceptance criteria were: (1) Cs-137 concentrations in the soil samples did not exceed background and (2) no other gamma emitting plant-related radionuclide was present. These acceptance criteria were consistent with the requirement of no detectable plant-related activity in AP-0052. In addition to the pre-excavation sampling program, aggregate surveys were performed in accordance with radiation protection procedures for each truckload of soil that left the YNPS Industrial Area.</p> <p>During the pre-excavation sampling program, Co-60 was identified at 1 sample point. The area of Co-60 contamination was bounded via sample data and remediated. Post-remediation sampling verified successful remediation by applying the requirement of no detectable plant-related activity. Results from all other soil samples at all other sampling locations met the acceptance criteria. These results were supported by the aggregate surveys performed for the truckloads of soil, none of which exceeded background radiation levels.</p> <p>In April 2005, the mid lot soil was moved from Survey Area OOL-07 to Survey Area OOL-04 to prepare the mid-level parking lot for thermal desorption of PCB-contaminated soil. The mid lot soil is currently located in Survey Unit OOL04-04. At the time of placement in OOL04-04, the mid lot soil occupied an area of approximately 1,687 m² (18,167 ft²). In June 2005, a portion of the mid lot soil pile (approximately 30 truckloads) was removed and used as back fill for the Screen Well House. The area where the soil was removed from the pile has been reshaped to facilitate FSS for the remaining soil pile. The new pile footprint, shown in revision 1 of Map 1, was determined using the FSS Leica GPS. The re-shaped pile occupies approximately 1,597 m² (17,195 ft²) and, because of the new dimensions, it was necessary to recalculate the grid spacing and revise the systematic grid overlay and the MDCR/MDC table.</p> <p>The initial excavation and movement of the soil via truckloads from the industrial area to Survey Area OOL-07 and the subsequent re-excavation and trucking of the soil from Survey Area OOL-07 to the current location, where the soil was</p>	

blended further via bulldozing, is assumed to have resulted in a high degree of mixing (homogeneity) of the soil. Therefore, the results from FSS surface soil samples are applicable to the entire volume of soil.

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

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 LTP release criteria? Alternative actions that may be implemented in this effort are investigations.

3.0 Identify the inputs to the decision:

Sample media: soil

Types of measurements: soil samples and gamma scans.

Applicable DCGL: 3.0 pCi Cs-137 per g soil (8.73 mrem/y DCGL, which is equivalent to the 10-mrem/y DCGL adjusted for the dose contributions from sub-surface concrete structures and tritium in ground water).

Radionuclide-of-concern: Cs-137

The available characterization data for the mid-lot soil consists of surface and sub-surface soil samples collected in 1998, which were analyzed by onsite gamma spectroscopy. With the exception of 1 sample location where Co-60 was identified and then successfully remediated, Cs-137 was the only LTP-listed nuclide identified in the onsite analyses. Cs-137 was identified above the MDA in only 22 of approximately 185 soil samples. The mean Cs-137 concentration in those 22 samples was 0.43 pCi/g ± 0.79 pCi/g.

The gamma analyses performed for the 1998 soil samples were required to achieve a sensitivity of at least 0.18 pCi Cs-137 per gram of sample, which is approximately 6% of the 10-mrem/y DCGL for Cs-137 in soil. The actual MDAs for Cs-137 achieved in the analyses of samples yielding “<MDA” results were significantly lower than the required value.

None of the characterization soil samples were analyzed for hard-to-detect (HTD) nuclides. However, because gamma-emitting nuclides such as Co-60 and Cs-137 were historically more abundant in the nuclide mixtures found in the various waste streams during plant operation (and these nuclides were generally not identified in the mid lot soil), HTD nuclides are not expected to be major dose contributors in the mid-lot soil. Nevertheless, the presence all LTP-listed radionuclides (gamma-emitters, HTD beta-emitters, and TRUs) in the mid-lot soil will be evaluated under this survey plan. The YNPS Chemistry Dept. will analyze each soil sample for LTP-listed gamma-emitting nuclides, and at least 5% of the FSS soil samples will be sent to an independent laboratory for analyses of gamma-emitters and HTD radionuclides.

Average Cs-137 concentration (based on the 22 samples yielding >MDA results): 0.43 pCi/g

Standard deviation (σ) for Cs-137 (based on the 22 samples yielding >MDA results): 0.79 pCi/g

Surrogate DCGL: A surrogate DCGL will not be used.

Investigation Level for soil samples: > 1.5 pCi Cs-137 per g (>50% of 10-mrem/y DCGL for Cs-137). Additionally, if any other LTP-listed nuclide is identified at a concentration greater than 50% of its 10-mrem/y DCGL, or if the sum of the fractions for all detected LTP-listed nuclides exceeds 0.5, an investigation will be conducted at that location.

Investigation Level for scan: reproducible indication above background using an audible signal (i.e., observable with headphones).

Radionuclides for analysis: All LTP-listed nuclides with the focus on Cs-137.

MDCs for gamma analysis of soil samples: 10 - 50% of the 10-mrem/y DCGL = 0.3 - 1.5 pCi Cs137 per g
= 0.25 - 1.3 pCi Ag-108m per g
= 0.14 - 0.7 pCi Co-60 per g
= 0.17 - 0.86 pCi Cs-134 per g
= 1.1 - 5.5 pCi Sb-125 per g
= 0.25 - 1.3 pCi Nb-94 per g
= 0.35 - 1.7 pCi Eu-152 per g
= 0.33 - 1.7 pCi Eu-154 per g
= 14 - 70 pCi Eu-155 per g

MDCs for analyses of HTD nuclides: 10 - 50% of the 10-mrem/y DCGL = 0.059 - 0.29 pCi Sr-90 per g
= 13 - 64 pCi H-3 per g
= 1000 - 5200 pCi Fe-55 per g
= 0.19 - 0.96 pCi C-14 per g
= 28 - 140 pCi Ni-63 per g
= 0.48 - 2.4 pCi Tc-99 per g
= 1.1 - 5.7 pCi Pu238 per g
= 1.0 - 5.2 pCi Pu-239 per g
= 34 - 170 pCi Pu-241 per g
= 1.0 - 5.2 pCi Am-241 per g
= 1.1 - 5.5 pCi Cm-243 per g

Note: The target MDCs in the laboratory analyses of FSS soil samples will be the 10% DCGL values. If those values cannot be achieved, the 50% DCGL values must be achieved in the laboratory analyses of the FSS soil samples. The MDC values listed above will also be transmitted to the outside laboratory as an attachment to the chain-of-custody form accompanying the FSS soil samples.

Scan coverage: SPA-3 scans will be performed for approximately 50% of the total surface area of the mid-lot soil.

MDCR for SPA-3: The accompanying Table 1 provides MDCR values by various background levels.

MDC(fDCGL) for SPA-3 scans: The accompanying Table 1 provides MDC values by various background levels.

QC checks and measurements: QC checks for the SPA-3 will be performed in accordance with DP-8540. Three QC split samples will be collected, and QC recounts for 3 soil samples will be performed by the YNPS Chemistry Lab.

4.0 Define the boundaries of the survey:

Boundaries of OOL-07-01 are as shown on the attached map. The survey will be performed under normal weather conditions and in daylight hours (allowing adequate daylight time for ingress and egress).

5.0 Develop a decision rule:

- (a) If all the sample data show that the soil concentrations of all plant-related nuclides are below the DCGL and the sum of the DCGL fractions for identified nuclides is <1 , reject the null hypothesis (i.e., Survey Unit OOL07-01 meets the release criteria).
- (b) If the action level is exceeded, then perform an investigation survey.
- (c) If the average concentration of the radionuclide-of-concern is below the DCGL, or if the sum of the fractions for identified radionuclides-of-concern <1 , but some measurements exceed the DCGL, then apply a statistical test as the basis for accepting or rejecting the null hypothesis.
- (d) If the average concentration of any LTP-listed nuclide exceeds the DCGL or the sum of the fractions exceeds one, then accept the null hypothesis (i.e., Survey Unit OOL07-01 fails to meet the release criteria).

Note: Based on the characterization data and history of the mid-lot soil, alternate actions beyond investigations are not expected to be necessary for this survey unit.

6.0 Specify tolerable limits on decision errors:

Null hypothesis: Residual plant-related radioactivity in Survey Unit OOL-07-01 exceeds the release criteria.

Probability of type I error: 0.05

Probability of type II error: 0.05

LBGR: $3.0 \text{ pCi/g} \div 2 = 1.5 \text{ pCi/g}$

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 samples (per DP-8853): 16. Refer to the completed DPF-8853.1 in the survey package file.

Biased samples: 10

GENERAL INSTRUCTIONS

1. The FSS Field Supervisor is responsible for contacting the QA Department regarding the FSS activities identified as QA notification points.

2. Mark the sampling points at the locations shown in the attached map. The random start point for the grid is shown as well as the grid dimensions.

- (a) If a measurement location is obstructed such that a sample cannot be collected, select an alternate location in accordance with DP-8856.

3. Collect 16 systematic soil samples in accordance with DP-8120, using sampling equipment as stated in DP-8120. Two of the 16 random soil samples will be QC split samples. Soil sample designations are as follows:

- (a) Systematic soil sample designations: OOL-07-01-001-F through OOL-07-01-016-F corresponding to FSS samples collected at locations 001 through 016.
- (b) 2 QC split sample designations: OOL-07-01-001-F-S and OOL-07-01-004-F-S, collected at sample locations 001 and 004, respectively. The results will be compared in accordance with DP-8864.

Note: Samples OOL-07-01-001-F-S and OOL-07-01-004-F-S will be sent to the off-site laboratory as collected from the field (i.e., without drying). These samples will also be analyzed for gamma-emitters, HTD beta-emitters (including H-3), and TRUs.

Note: Soil samples OOL-07-01-003-F and OOL-07-01-014-F will be QC recounts performed by the YNPS Chemistry Lab and the results will be compared in accordance with DP-8864. The recount designations will be OOL-07-01-003-F-RC and OOL-07-01-014-F-RC, respectively.

3A. Collect 10 biased soil samples in accordance with DP-8120, using sampling equipment as stated in DP-8120. All 10 of the biased samples are to be collected along the south perimeter at the locations shown on the survey map. One of the 10 biased soil samples will be a QC split sample. The biased sample designations are as follows:

1. Biased soil sample designations: OOL-07-01-017-F-B through OOL-07-01-026-F-B corresponding to FSS samples collected at locations 017 through 026.
2. The QC split sample designation: OOL-07-01-019-F-B-S, collected at sample location 019. The results will be compared in accordance with DP-8864.

Note: Sample OOL-07-01-019-F-B-S will be sent to the off-site laboratory as collected from the field (i.e., without drying). This sample will also be analyzed for gamma-emitters, HTD beta-emitters (including H-3), and TRUs.

Note: Soil sample OOL-07-01-026-F-B will be a QC recount performed by the YNPS Chemistry Lab and the results will be compared in accordance with DP-8864. The recount designation will be OOL-07-01-026-F-B-RC.

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 soil samples sent to an off-site laboratory. The required MDCs for the analyses performed by the off-site laboratory will be communicated to the Lab via an attachment to the Chain-of-Custody form.

6. Approximately 50% of the surface area of OOL07-01 will be scanned with a SPA-3. Scanning will cover a path (varying in width – to be determined by the FSS Field Supervisor) beginning at the west end of the pile and proceed east along the length of the pile, ending before the steep side at the east end. The actual area of that scan will be estimated and recorded by the FSS Field Supervisor. In addition, the north perimeter of the pile will be scanned from grade to a safe distance up slope. That scan area will also be estimated and recorded by the FSS Field Supervisor. The sum of the scanned areas should be $>8,600 \text{ ft}^2$ ($>800\text{m}^2$) to provide assurance that 50% of the survey unit was scanned.

- (a) Record the results of the scans on DPF-8856.2. If any part of the areas described above cannot be scanned safely or an unforeseen obstacle prevents scanning, the FSS Field Supervisor is responsible for designating a suitable alternate area. The FSS Field Supervisor will estimate the area of the alternate location and recorded that information on DPF-8856.2.

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-8540. The instrument response checks shall be performed before issue and after use.

7. The job hazards associated with this survey are addressed in the accompanying JHA for OOL-07-01.

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

SPECIFIC INSTRUCTIONS

1. SPA-3 scans are to be performed by moving the detector at a speed no greater than 0.5 m/s, keeping the probe at a distance of less than 3 inches from the ground surface, and following a serpentine pattern that includes at least 3 passes across each square meter. When scanning and walking, a slow pace (i.e., 1 step per second) shall be used. FSS Technicians will wear headphones while scanning and the survey instrument will be in the rate-meter mode. 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.

As a personnel safety measure, a sled-mounted SPA-3 will be used for scanning soil area on the sides of the pile that cannot be safely traversed on foot. The sled-mounted SPA-3 will be kept at a distance of no greater than 3 inches from the surface as it is guided up and down the slopes through the use of ropes. The movement of the sled-mounted SPA-3 will not exceed a speed of 0.5 m/s. The FSS Field Supervisor will ensure that the scan path of the sled-mounted SPA-3 includes at least 3 passes across each square meter of the target soil area. FSS field personnel (using headphones) will listen for upscale readings while the sled-mounted SPA-3 is moving and will indicate to personnel moving the sled when to slow down or stop the probe in order 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.

A first level investigation may be done with the SPA-3/E-600 to determine if the observed increase in the scan measurement is due to the presence of rocks and boulders. SPA-3 scans performed in non-impacted areas have shown that rock formations accounted for increased count rates. 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. If it is demonstrated that the rocks and boulders do not account for an above background SPA-3 measurement, a soil sample will be collected at the point of the highest SPA-3 reading in the scanned area. Detailed descriptions of investigation actions will be recorded on form DPF-8856.2 and the location of the above background scan and sample will be recorded on the survey map. The location description must include sufficient detail to revisit the spot at a later time. If investigation samples are collected, the designations will continue in sequence beginning with OOL-07-01-027-F-I.

If the ambient background count rate at start of the scan is $\geq 12,000$ cpm, reduce the scan speed to 0.25 m/s (approximately 10 inches/s) and perform the scan as described above.

Note: If scan speeds of < 0.5 m/s become required, then the FSS Field Supervisor shall monitor and time scan speeds for at least 50% of such scanned areas.

2. YNPS Chemistry will dry and analyze all soil samples for gamma-emitting radionuclides, except samples OOL-07-01-001-F-S, OOL-07-01-004-F-S, and OOL-07-01-019-F-B-S. If any of the gamma analyses show that the soil concentration of Cs-137 is > 1.5 pCi/g, or the concentration of any other LTP-listed gamma-emitting nuclide is greater than 50% of its DCGL, or the sum of the fractions for detected LTP-listed nuclides > 0.5 , an investigation survey will be conducted at that sample location. The on-site gamma analysis results will also be used to determine if other soil samples (in addition to the designated QC split samples) should be sent to the off-site laboratory for HTD nuclide analyses.

3. Soil samples OOL-07-01-001-F-S, OOL-07-01-004-F-S, and OOL-07-01-019-F-B-S will be sent directly to the off-site laboratory. These samples will be analyzed for H-3, gamma-emitting nuclides, HTD beta-emitting nuclides, and TRUs. Ensure that the lid to the 1-liter marinelli container for each sample is secured to prevent loss of moisture during shipping.

4. On-site and off-site analyses of the FSS samples shall achieve the required MDC values stated in Section 3 of this plan. The MDCs will be communicated to the laboratory using an attachment to the Chain-of-Custody form.

NOTIFICATION POINTS

QA notification* point(s) (y/n) y

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

(2) Date/time of commencement of soil sampling _____ QA signature: _____

(3) Date/time of initial scan measurement _____ QA signature: _____

* E-mail notification to Trudeau@yankee.com with a copy to Calsyn@yankee.com satisfies this step.

FSI point(s) (y/n) n Specify: _____

Prepared by J. Bussan
FSS Radiological Engineer

Date 7-18-05

Reviewed by J. Hammer
FSS Radiological Engineer

Date 7/18/05

Approved by DC Smith
FSS Project Manager

Date 7/19/05

Table 1

MDCR/MDC Table for OOL07-01_rev1						
Background (cpm)	scan speed (m/s)	MDCR (cpm)	MDC(fDCGLemc(10))	scan speed (m/s)	MDCR (cpm)	MDC(fDCGL(10))
8000	0.5	1278	0.81			
9000	0.5	1355	0.86			
10000	0.5	1428	0.90			
11000	0.5	1498	0.95			
12000	0.5	1565	0.99			
13000				0.25	1152	0.73
14000				0.25	1195	0.76
15000				0.25	1237	0.78
16000				0.25	1278	0.81
17000				0.25	1317	0.83
18000				0.25	1355	0.86
19000				0.25	1392	0.88
20000				0.25	1428	0.90
24000				0.25	1565	0.99

JOB HAZARDS ASSESSMENT

Final Status Survey in OOL-007-01

6/24/05

HAZARD ITEM:		Activity	*	Y E S	N O	Date to start	SPECIFIC CONTROLS
VISION HAZARDS:	particles, chemicals, temperatures, vapors			✓			Safety glasses required.
NOISE HAZARDS:	hand or power tools, equipment in area				✓		
HEAD HAZARDS:	falling objects, bump hazards, electrical			✓			Hardhat required by site safety policy.
FOOT HAZARDS:	falling, rolling objects, sharp objects			✓			Wear safety shoes providing ankle support.
FACE HAZARDS:	sparks, splash, particles				✓		
RESPIRATORY:	dusts, fumes, oxygen deficiency, toxic gas, See AP-0627, other		*				
SILICA/DUST HAZARDS:	sandblasting, concrete work, abatement on concrete surfaces, demolition		*				
LEAD HAZARDS:	dust, fumes, AP-0713, AP-0625		*				
ASBESTOS HAZARDS:	insulation, abatement activities, AP-0709		*				
PCB HAZARDS:	dust, paint chips, vapors, AP-0630, AP-0629		*				
VENTILATION REQUIREMENTS:	local exhaust, area exhaust, dilution, intrinsic, OP-8536		*				
AIR MONITORING REQUIRED:	personal bza's, area monitors, hazards sampled		*				
HAND HAZARDS:	sharps, temperatures, hazardous substances			✓			Wear gloves for soil sampling as required by DP-8120.
FALL HAZARDS:	anchor points, prior to use equipment inspection, floor or wall openings, uneven surface, trip hazards, written plan, working over water, AP-0628		*				
MATERIAL HANDLING:	slings, prior to use equipment inspection, lifting, rigging, fork trucks, pinch points, DP- 5950, OP-5972				✓		
WEATHER CONDITION HAZARDS:	heat/cold, AP-0618, overhead/underfoot snow & ice, storms, forecast, monitor if <50 or >80 °F			✓			Dress appropriately for current and projected conditions.
VC SNOW INSPECTION REQUIRED:	November-April, complete inspection per APF-0626.3				✓		
CONFINED SPACE HAZARDS:	AP-0619, confined space work permit		*				
EXCAVATION HAZARDS:	OSHA 1926 Subpart P, soil classification, underground utilities, cave-in protection, competent person, fall hazards				✓		

JOB HAZARDS ASSESSMENT

HAZARD ITEM: Refer to safety manual and safety procedures for guidance	*	Y E S	N O	SPECIFIC CONTROLS
RESCUE HAZARDS/RESCUE PLAN: Access, Layout, Stage equipment for rescue	*			
CHEMICAL AND BODY FLUID EXPOSURE HAZARDS: review MSDS's, HMIS label, AP-0031, AP- 0622, PPE required			✓	
FIRE HAZARDS: AP-5005, AP-0050, AP-0051 Welding, Grinding, Burning, Flammable Materials, Explosion Hazards			✓	
ACCESS HAZARDS: scaffolds, layout of work area, ladders, AP-0617, required department access to proposed work area (security, operations, RP, etc)		✓		When sampling and traversing the pile, remain watchful of trip/slip hazards due to loose ground cover and steep inclines. Relocate any obstructed sample point in accordance with the sampling plan.
ELECTRICAL HAZARDS: assured grounding protection, GFCI, AP-0623, power lines			✓	
SWITCHING AND TAGGING: electrical, hydraulic, pneumatic energy sources, pressurized systems. AP-0017			✓	
COMMUNICATION DIFFICULTIES: radio, speakers		✓		Carry a two-way radio. Brief the control room before going out Use the radio to summon help from the Control Room <u>in case of an injury.</u> <i>L FSS Rad. Engineer</i>
ERGONOMIC CONCERNS: repeated motion, awkward position, proper lifting			✓	
EQUIPMENT/TOOL HAZARDS: guards, intrinsic ventilation required, proper training and use			✓	
WORK PRACTICES: policy and procedure compliance, worker positioning, proper tool use, housekeeping		✓		Wear orange vests as required by site safety policy. Limit the load carried by any one person to 40 pounds. Check yourself for ticks when you come in.
INTERFACE WITH OTHER DEPARTMENTS: Security Impact Radiation Protection Impact Operations Impact QA Health and Safety Other:			✓	
ENVIRONMENTAL HAZARD VERIFICATION: CONTACT SAFETY OVERSIGHT DEPARTMENT hazardous waste generation or disposal concerns, environmental impact from activity, water runoff, sampling needed, APF-0626.4 "Environmental Hazards Assessment"	**			
RADIATION HAZARDS: AP-0801			✓	
POSTING NEEDED: barricades, signs, per safety manual	*			
FME PLAN REQUIRED: written plan per AP-0216			✓	

JOB
7-21-05

* Health and Safety Department review required prior to briefing and start of activity
 ** Contact Safety Oversight Department for verification of hazards and additional requirements

Comments: _____

Completed by: J. Brian Date: 6/23/05 Health and Safety Department Review* _____ Date: _____
 Additional Reviews Required: _____ Date: _____

Final Status Survey Planning Worksheet

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GENERAL SECTION

Survey Area No.: OOL-07

Survey Unit No.: 02

Survey Unit Name: Midlot Parking Area

FSSP Number: YNPS-FSSP-OOL07-02-00

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. 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.
- 1.7 Classification: CLASS 1 CLASS 2 CLASS 3

DATA QUALITY OBJECTIVES (DQO)

1.0 State the problem:

OOL-07-02 is open land area consisting of an approximately ¹³¹⁶~~1332~~ sq m surface area, which at one time served as a personnel parking area and contained an accumulation of Industrial Area/ISFSI soil, generated during decommissioning. Subsurface systems that traverse or connect within OOL-07 include Administration building sanitary sewer system and active leaching field. OOL-07-02 consists of the Midlot land area that lies within survey area OOL-06. Due to the potential impact of plant personnel vehicle and foot traffic, and Industrial Area/ISFSI soil being transported and stored on a portion of OOL-07 – Survey Unit 02 is a Class 1. 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:

The available characterization data for the mid-lot soil consists of surface and sub-surface soil samples

collected in 1998, which were analyzed by onsite gamma spectroscopy. With the exception of 1 sample location where Co⁶⁰ was identified and then successfully remediated, Cs¹³⁷ was the only LTP-listed nuclide identified in the onsite analyses. Cs¹³⁷ was identified above the MDA in only 22 of approximately 185 soil samples. The mean Cs¹³⁷ concentration in those 22 samples corrected for decay is 0.36 pCi/g.

The gamma analyses performed for the 1998 soil samples were required to achieve a sensitivity of at least 0.18 pCi Cs¹³⁷ per gram of sample, which is approximately 6% of the 10-mrem/y DCGL for Cs¹³⁷ in soil. The actual MDAs for Cs¹³⁷ achieved in the analyses of samples yielding "<MDA" results were significantly lower than the required value.

<i>Sample media:</i>	Soil
<i>Types of measurements:</i>	Soil samples, and gamma scans
<i>Radionuclides-of-concern:</i>	Cs ¹³⁷

<i>Applicable DCGL:</i>		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

Based on a review of the characterization data, plant-related radionuclides Cs¹³⁷ was positively identified in more than 11% of the samples. The results from the characterization data are summarized below:

- Cs¹³⁷ (22 detects) Cs¹³⁷ is present in >11% of the characterization samples. One sample exceeded the 8.73-mrem/y Cs¹³⁷ DCGL (3.0 pCi/g) with a value of 3.57 pCi/g.

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. QC split samples will be sent to an off-site laboratory and analyzed for Hard-to-Detects.

Survey Design / Release Criteria

Classification: Class ~~2~~ 1 10/4/00
 Average Cs¹³⁷ concentration: 0.36 pCi/g
 Standard deviation Cs¹³⁷ (σ): 0.67 pCi/g
 DCGL: 3.0 pCi/g

<i>Surrogate DCGL:</i>	N/A (a surrogate DCGL will not be used)																									
<i>LBGR:</i>	Initial = 0.5xDCGL = 1.5																									
<i>Number of Samples:</i>	15 (calculated) + 5 (added), for a total of 20 samples (+2 QC)																									
<i>Survey Unit Area</i>	1332 m ² 1316 m² 1316 m²																									
<i>Sample Grid Spacing:</i>	Triangular: 8.8m 7.6m 8.7m																									
<i>Grid Area (A/N):</i>	66.6 (based on 20 samples) 65.8 m ²																									
<i>DCGL_{emc}:</i>	8.7 pCi/g (based on AF = 2.9)																									
<i>Investigation Level for soil samples:</i>	<ul style="list-style-type: none"> • >DCGL_{EMC} for either Cs¹³⁷ -or • A sum of DCGL_{EMC} fractions >1.0 -or • >DCGL for Cs¹³⁷ and a statistical outlier as defined in the LTP. <p>Note: The same criteria will be applied to any other LTP-listed nuclide if identified in the soil samples.</p>																									
<i>SPA-3 Gamma Scan Coverage:</i>	The SPA-3 scans will cover approximately 100 % of the surface area SPA-3 MDCRs and MDCs are shown in Attachment 1.																									
<i>MDCR for SPA-3:</i>	The accompanying MCDR/MDC table in Attachment 1 provides MDCR values by various background levels.																									
<i>MDC(fDCGL) for SPA-3 scans:</i>	The accompanying MCDR/MDC table in Attachment 1 provides MDC values, as a fraction of DCGL, by various background levels.																									
<i>Investigation Level for SPA-3 Scans:</i>	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.																									
<i>Radionuclides for analysis:</i>	All LTP nuclides with the focus on Cs ¹³⁷ .																									
<i>MDCs for gamma analysis of soil samples:</i>	<table border="1"> <thead> <tr> <th>Nuclide</th> <th>10% - 50% of DCGL (pCi/g)</th> </tr> </thead> <tbody> <tr><td>Co⁶⁰</td><td>1.4E-01 - 7.0E-01</td></tr> <tr><td>Nb⁹⁴</td><td>2.5E-01 - 1.3E+00</td></tr> <tr><td>Ag^{108m}</td><td>2.5E-01 - 1.3E+00</td></tr> <tr><td>Sb¹²⁵</td><td>1.1E+00 - 5.6E+00</td></tr> <tr><td>Cs¹³⁴</td><td>1.7E-01 - 8.7E-01</td></tr> <tr><td>Cs¹³⁷</td><td>3.0E-01 - 1.5E+00</td></tr> <tr><td>Eu¹⁵²</td><td>3.6E-01 - 1.8E+00</td></tr> <tr><td>Eu¹⁵⁴</td><td>3.3E-01 - 1.7E+00</td></tr> <tr><td>Eu¹⁵⁵</td><td>1.4E+01 - 6.9E+01</td></tr> </tbody> </table> <p>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.</p>	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					
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<i>MDCs for HTD nuclide:</i>	<table border="1"> <thead> <tr> <th>Nuclide</th> <th>10% - 50% DCGL (pCi/g)</th> </tr> </thead> <tbody> <tr><td>H³</td><td>1.3E+01 - 6.4E+01</td></tr> <tr><td>C¹⁴</td><td>1.9E-01 - 9.7E-01</td></tr> <tr><td>Fe⁵⁵</td><td>1.0E+03 - 5.1E+03</td></tr> <tr><td>Ni⁶³</td><td>2.8E+01 - 1.4E+02</td></tr> <tr><td>Sr⁹⁰</td><td>6.0E-02 - 3.0E-01</td></tr> <tr><td>Tc⁹⁹</td><td>5.0E-01 - 2.5E+00</td></tr> <tr><td>Pu²³⁸</td><td>1.2E+00 - 5.8E+00</td></tr> <tr><td>Pu²³⁹</td><td>1.1E+00 - 5.3E+00</td></tr> <tr><td>Pu²⁴¹</td><td>3.4E+01 - 1.7E+02</td></tr> <tr><td>Am²⁴¹</td><td>1.0E+00 - 5.1E+00</td></tr> <tr><td>Cm²⁴³</td><td>1.1E+00 - 5.6E+00</td></tr> </tbody> </table>	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	
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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.

QC checks and measurements:

- QC checks for the Leica GPS will be performed in accordance with DP-8859 and documented on DPF-8859.1 "GPS Quality Control Check".
- QC checks for the SPA-3 will be performed in accordance with DP-8504.
- One soil sample will be designated (per this FSSP) for QC recount by the YNPS Chemistry Lab in accordance with DP-8852 requirements.
- Two QC split sample will be collected (note: this is in accordance with DP-8852 requirements).

4.0 Define the boundaries of the survey:

- Boundaries of Survey Unit OOL-07-02 are as shown on the attached map. OOL-07-02 is bounded by OOL-06-01 to the north and OOL-06-02 to the south. OOL-07 Survey Unit 02 lies completely outside of the RCA on the southwest portion of the Yankee Rowe site. There are no radioactive systems present in OOL-07. The Administration building sanitary sewer system, active leaching field lies within the bounds of OOL-07-02 survey area.
- 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 OOL-07-02 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 OOL-07-02 fails to meet the release criteria).

Note: Alternate actions include no action, investigations, reclassification, remediation and resurvey.

6.0 Specify tolerable limits on decision errors:

<i>Null hypothesis:</i>	Residual plant-related radioactivity in Survey Unit OOL-07-02 exceeds the release criteria.
<i>Probability of type I error:</i>	0.05
<i>Probability of type II error:</i>	0.05
<i>LBGR:</i>	The applicable soil (8.73-mrem/y) DCGL ÷ 2 Cs ¹³⁷ : (3.0 pCi/g)/2 = 1.5 pCi/g

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).

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: Split samples to be sent to an off-site lab will not be dried prior to counting on site or shipping.
5. 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.
6. 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.
7. The job hazards associated with the survey described in this package are addressed in the accompanying Job Hazard Assessment (JHA) for OOL-07-02.
8. 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 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.
3. Soil Sample Designations:

FSS soil samples:	OOL-07-02-001-F through OOL-07-02-020-F corresponding to FSS sample locations 001 through 020.
Biased soil samples:	None.
QC split samples:	OOL-07-02-012-F-S and OOL-07-02-015-F-S to be designated as QC split samples.
Recount samples:	OOL-07-02-002-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 OOL-07-02-001-F through OOL-07-02-020-F for gamma-emitting nuclides.
- YNPS Chemistry will analyze OOL-07-02-002-F as a sample recount. The recounted sample will possess the naming convention OOL-07-02-002-F-RC.
- YNPS Chemistry will analyze OOL-07-02-012-F-S and OOL-07-02-015-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 HTDs at the off-site laboratory. The MDCs will be communicated to the off-site laboratory using an attachment to the Chain-of-Custody form.
- 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.

5. SPA-3 Scans:

- FSS Technicians will perform scans by moving the SPA-3 detector at a speed ≤ 0.5 m/s, keeping the probe at a distance of less than 3 inches from the ground surface, and following a serpentine pattern that includes at least 3 passes across each square meter. 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. 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.
- A first level investigation may be done with the SPA-3/E-600 to determine if the observed increase in the scan measurement is due to the presence of rocks. SPA-3 scans performed in non-impacted areas have shown that rock formations accounted for increased count rates. If it can be demonstrated that the presence of rocks is the cause of an increased count rate during a SPA-3 scan, remove the rock record that finding form DPF-8856.2 and continue the scan. If it is demonstrated that the rocks do not account for an above background SPA-3 measurement, a soil sample will be collected at the point of the highest SPA-3 reading in the scanned area. Detailed descriptions of investigation actions will be recorded on form DPF-8856.2 and the location of the above background scan and sample will be recorded on the survey map. The location description must include sufficient detail to revisit the spot at a later time. If a soil sample is collected during the first level investigation, the sample designation will consist of the measurement location code using the next sequential survey location number plus the letter "I" (for investigation). For example, the first soil sample collected during a first level investigation at measurement location will be designated OOL-07-02-021-F-I. If the investigation calls for more than 1 sample, sequentially number the investigation samples.

NOTIFICATION POINTS

None.

Prepared by N. Tozzie *Nancy Tozzie* Date 6/8/06
FSS Radiological Engineer
Reviewed by *[Signature]* Date 6/8/06
FSS Radiological Engineer
Approved by *[Signature]* Date 6/8/06
FSS Project Manager

Attachment 1

SPA-3 Scan

Inputs:

Scan speed: 0.5 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 = 1.12 s = 0.0187 min

Assume:

Localized contam diam = 56 cm

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

AF= Area Factor

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

f = radionuclide fraction

	Cs-137	Co-60
E _i =	188	379 cpm/pCi/g*
DCGL	3	1.4
f =	1	0
AF =	2.9	1

BKG(cpm)	BKG/t	MDCR	MDC(fDCGL _{emc} (8.73))
7000	130.7	1195	7.31E-01
8000	149.3	1278	7.81E-01
9000	168.0	1355	8.29E-01
10000	186.7	1428	8.73E-01
11000	205.3	1498	9.16E-01
12000	224.0	1565	9.57E-01
13000	242.7	1629	9.96E-01
14000	261.3	1690	1.03E+00
15000	280.0	1749	1.07E+00
16000	298.7	1807	1.10E+00
17000	317.3	1862	1.14E+00
18000	336.0	1916	1.17E+00
19000	354.7	1969	1.20E+00
20000	373.3	2020	1.24E+00
21000	392.0	2070	1.27E+00
22000	410.7	2119	1.30E+00
23000	429.3	2166	1.32E+00
24000	448.0	2213	1.35E+00

*E_i values from YA-REPT-00=015-04, "Instrument Efficiency Determination for Use in Minimum Detectable Concentration Calculations in Support of Final Status Survey at Yankee Rowe"

Worksheet to randomly select numbers

Date Generated: 6/7/2006

Number of samples to choose among: 20
Area/Unit: OOL-07-02

1st	12 - QCSPUT
2nd	15 - QC SPLIT
3rd	2 - RECOUNT
4th	4
5th	8
6th	12
7th	20
8th	12
9th	9
10th	11

75

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.

Final Status Survey Planning Worksheet

Page 1 of 7

GENERAL SECTION

Survey Area No.: OOL-07

Survey Unit No.: 03

Survey Unit Name: Midlot Parking Area

FSSP Number: YNPS-FSSP-OOL07-03-00

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.
- 1.7 Classification: CLASS 1 CLASS 2 CLASS 3

DATA QUALITY OBJECTIVES (DQO)

1.0 State the problem:

OOL-07-03 is open land area consisting of an approximately ¹²¹²~~1493~~ sq m surface area, which at one time served as a personnel parking area and contained an accumulation of Industrial Area/ISFSI soil, generated during decommissioning. Subsurface systems that traverse or connect within OOL-07 include Administration building sanitary sewer system and active leaching field. OOL-07-03 consists of the Midlot land area that lies within survey area OOL-06. Due to the potential impact of plant personnel vehicle and foot traffic, and Industrial Area/ISFSI soil being transported and stored on a portion of OOL-07 – Survey Unit 03 is a Class 1. 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:

The available characterization data for the mid-lot soil consists of surface and sub-surface soil samples collected in 1998, which were analyzed by onsite gamma spectroscopy. With the exception of 1 sample location where Co⁶⁰ was identified and then successfully remediated, Cs¹³⁷ was the only LTP-listed nuclide identified in the onsite analyses. Cs¹³⁷ was identified above the MDA in only 22 of approximately 185 soil samples. The mean Cs¹³⁷ concentration in those 22 samples corrected for decay is 0.36 pCi/g.

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<i>Sample media:</i>	Soil
<i>Types of measurements:</i>	Soil samples, and gamma scans
<i>Radionuclides-of-concern:</i>	Cs ¹³⁷

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Based on a review of the characterization data, plant-related radionuclides Cs¹³⁷ was positively identified in more than 11% of the samples. The results from the characterization data are summarized below:

- Cs¹³⁷ (22 detects) Cs¹³⁷ is present in >11% of the characterization samples. One sample exceeded the 8.73-mrem/y Cs¹³⁷ DCGL (3.0 pCi/g) with a value of 3.57 pCi/g.

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. QC split samples will be sent to an off-site laboratory and analyzed for Hard-to-Detects.

Survey Design / Release Criteria

Classification: Class 1
Average Cs¹³⁷ concentration: 0.36 pCi/g
Standard deviation Cs¹³⁷ (σ): 0.67 pCi/g
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LBGR: Initial = 0.5xDCGL = 1.5
Number of Samples: 15 (calculated) + 5 (added), for a total of 20 samples (+2 QC)
Survey Unit Area ~~1493 m²~~ ^{7/4/06} 1212 m²
Sample Grid Spacing: Triangular: ~~9.28m~~ 8.37 m
Grid Area (A/N): ~~74.65~~ (based on 20 samples) 60.6 m²
DCGL_{emc}: 8.7 pCi/g (based on AF = 2.9)
Investigation Level for soil samples:

- >DCGL_{EMC} for either Cs¹³⁷ -or
- A sum of DCGL_{EMC} fractions >1.0 -or
- >DCGL for Cs¹³⁷ 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.

SPA-3 Gamma Scan Coverage: The SPA-3 scans will cover approximately 100 % of the surface area SPA-3 MDCRs and MDCs are shown in Attachment 1.

MDCR for SPA-3: The accompanying MCDR/MDC table in Attachment 1 provides MDCR values by various background levels.

MDC (fDCGL) for SPA-3 scans: The accompanying MCDR/MDC table in Attachment 1 provides MDC values, as a fraction of DCGL, by various background levels.

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 Cs¹³⁷.

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.

QC checks and measurements:

- QC checks for the Leica GPS will be performed in accordance with DP-8859 and documented on DPF-8859.1 "GPS Quality Control Check".
- QC checks for the SPA-3 will be performed in accordance with DP-8504.
- One soil sample will be designated (per this FSSP) for QC recount by the YNPS Chemistry Lab in accordance with DP-8852 requirements.
- Two QC split sample will be collected (note: this is in accordance with DP-8852 requirements).

4.0 Define the boundaries of the survey:

- Boundaries of Survey Unit OOL-07-03 are as shown on the attached map. OOL-07-03 is bounded by OOL-06-01 to the north and OOL-06-02 to the south. OOL-07 Survey Unit 03 lies completely outside of the RCA on the southwest portion of the Yankee Rowe site. There are no radioactive systems present in OOL-07.
- 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:

- 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 OOL-07-03 meets the release criteria).
- If the investigation levels are exceeded, then perform an investigation survey.
- 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 OOL-07-03 fails to meet the release criteria).

Note: Alternate actions include no action, investigations, reclassification, remediation and resurvey.

6.0 Specify tolerable limits on decision errors:

<i>Null hypothesis:</i>	Residual plant-related radioactivity in Survey Unit OOL-07-03 exceeds the release criteria.
<i>Probability of type I error:</i>	0.05
<i>Probability of type II error:</i>	0.05
<i>LBGR:</i>	The applicable soil (8.73-mrem/y) DCGL ÷ 2 Cs ¹³⁷ : (3.0 pCi/g)/2 = 1.5 pCi/g

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).

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: Split samples to be sent to an off-site lab will not be dried prior to counting on site or shipping.
5. 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.
6. 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.
7. The job hazards associated with the survey described in this package are addressed in the accompanying Job Hazard Assessment (JHA) for OOL-07-03.
8. 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 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.
3. Soil Sample Designations:

FSS soil samples:	OOL-07-03-001-F through OOL-07-03-020-F corresponding to FSS sample locations 001 through 020.
Biased soil samples:	None.
QC split samples:	OOL-07-03-014-F-S and OOL-07-03-018-F-S to be designated as QC split samples.

	split samples.
Recount samples:	OOL-07-03-006-F-RC is to be counted twice on site. The results will be compared in accordance with DP-8864.

4. Sample Analysis:

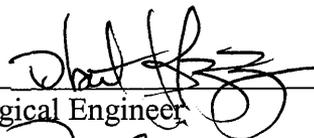
- Gamma analysis will be performed on all soil samples. If any of the gamma analyses show that an investigation level has been exceeded an investigation survey will be conducted at that sample location as directed in specific instruction # 6.
- YNPS Chemistry will analyze OOL-07-03-001-F through OOL-07-03-020-F for gamma-emitting nuclides.
- YNPS Chemistry will analyze OOL-07-03-006-F as a sample recount. The recounted sample will possess the naming convention OOL-07-03-006-F-RC.
- YNPS Chemistry will analyze OOL-07-03-014-F-S and OOL-07-03-018-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 HTDs at the off-site laboratory. The MDCs will be communicated to the off-site laboratory using an attachment to the Chain-of-Custody form.
- 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.

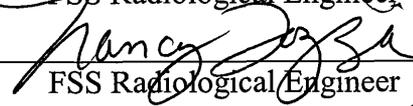
5. SPA-3 Scans:

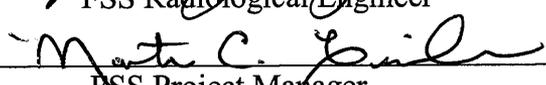
- FSS Technicians will perform scans by moving the SPA-3 detector at a speed ≤ 0.5 m/s, keeping the probe at a distance of less than 3 inches from the ground surface, and following a serpentine pattern that includes at least 3 passes across each square meter. When scanning and walking, a slow pace (i.e., 1 step per second) shall be used. Scanning will be performed in the rate-meter mode with the audible feature on. 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.
- A first level investigation may be done with the SPA-3/E-600 to determine if the observed increase in the scan measurement is due to the presence of rocks and boulders. If it can be demonstrated that the presence of rocks is the cause of an increased count rate remove the rocks, record that finding form DPF-8856.2 and continue scans. If it is demonstrated that the rocks do not account for an above background SPA-3 measurement, a soil sample will be collected at the point of the highest SPA-3 reading in the scanned area. Detailed descriptions of investigation actions will be recorded on form DPF-8856.2 and the location of the above background scan and sample will be recorded on the survey map. The location description must include sufficient detail to revisit the spot at a later time. If a soil sample is collected during the first level investigation, the sample designation will consist of the measurement location code using the next sequential survey location number plus the letter "I" (for investigation). For example, the first soil sample collected during a first level investigation at a measurement location will be designated OOL-07-03-021-F-I. If additional investigations are performed, sequentially number the investigation samples.

NOTIFICATION POINTS

None.

Prepared by Robert Tozzie  Date 6/8/06
FSS Radiological Engineer

Reviewed by Nancy Tozza  Date 6/8/06
FSS Radiological Engineer

Approved by Mark C. Gailer  Date 6/9/06
FSS Project Manager

YNPS-FSSP-OOL-07-03-00
Attachment 1

SPA-3 Scan Table

BKG(cpm)	MDCR	MDC(fDCGLEmc)
7000	1194	7.30E-01
8000	1276	7.80E-01
9000	1354	8.28E-01
10000	1427	8.73E-01
11000	1497	9.15E-01
12000	1563	9.56E-01
13000	1627	9.95E-01
14000	1689	1.03E+00
15000	1748	1.07E+00
16000	1805	1.10E+00
17000	1861	1.14E+00
18000	1915	1.17E+00
19000	1967	1.20E+00
20000	2018	1.23E+00
21000	2068	1.26E+00
22000	2117	1.29E+00
23000	2164	1.32E+00
24000	2211	1.35E+00

Created 6/8/06

By: R. Tozzie

Using: 8853 v3-w-8856 0.2.7 Draft.xls

Attachment 1

SPA-3 Scan

Inputs:

Scan speed: 0.5 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 = 1.12 s = 0.0187 min

Assume:

Localized contam diam = 56 cm

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

AF= Area Factor

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

f = radionuclide fraction

	Cs-137	Co-60	
E _i =	188	379	cpm/pCi/g*
DCGL	3	1.4	
f =	1	0	
AF =	2.9	1	

BKG(cpm)	BKG/t	MDCR	MDC(fDCGL _{emc} (8.73))
7000	130.7	1195	7.31E-01
8000	149.3	1278	7.81E-01
9000	168.0	1355	8.29E-01
10000	186.7	1428	8.73E-01
11000	205.3	1498	9.16E-01
12000	224.0	1565	9.57E-01
13000	242.7	1629	9.96E-01
14000	261.3	1690	1.03E+00
15000	280.0	1749	1.07E+00
16000	298.7	1807	1.10E+00
17000	317.3	1862	1.14E+00
18000	336.0	1916	1.17E+00
19000	354.7	1969	1.20E+00
20000	373.3	2020	1.24E+00
21000	392.0	2070	1.27E+00
22000	410.7	2119	1.30E+00
23000	429.3	2166	1.32E+00
24000	448.0	2213	1.35E+00

*E_i values from YA-REPT-00=015-04, "Instrument Efficiency Determination for Use in Minimum Detectable Concentration Calculations in Support of Final Status Survey at Yankee Rowe"

Created 6/8/06
 By: R. Torrie
 Using: mdc-mocr rev 1.xls

YNPS-FSSP-OOL-07-03-00
Attachment 2

DCGL MDC Table

Nuclide	Soil 8.73 m/yr (pCi/g)	10% MDC DCGL	50% MDC DCGL	Easy to Detect?
Co-60	1.4E+00	1.4E-01	7.0E-01	ETD
Nb-94	2.5E+00	2.5E-01	1.3E+00	ETD
Ag-108m	2.5E+00	2.5E-01	1.3E+00	ETD
Sb-125	1.1E+01	1.1E+00	5.6E+00	ETD
Cs-134	1.7E+00	1.7E-01	8.7E-01	ETD
Cs-137	3.0E+00	3.0E-01	1.5E+00	ETD
Eu-152	3.6E+00	3.6E-01	1.8E+00	ETD
Eu-154	3.3E+00	3.3E-01	1.7E+00	ETD
Eu-155	1.4E+02	1.4E+01	6.9E+01	ETD
Am-241	1.0E+01	1.0E+00	5.1E+00	ETD
H-3	1.3E+02	1.3E+01	6.4E+01	HTD
C-14	1.9E+00	1.9E-01	9.7E-01	HTD
Fe-55	1.0E+04	1.0E+03	5.1E+03	HTD
Ni-63	2.8E+02	2.8E+01	1.4E+02	HTD
Sr-90	6.0E-01	6.0E-02	3.0E-01	HTD
Tc-99	5.0E+00	5.0E-01	2.5E+00	HTD
Pu-238	1.2E+01	1.2E+00	5.8E+00	HTD
Pu-239	1.1E+01	1.1E+00	5.3E+00	HTD
Pu-241	3.4E+02	3.4E+01	1.7E+02	HTD
Cm-243	1.1E+01	1.1E+00	5.6E+00	HTD

Created 6/8/06

By: R. Torrie

Using: 8853 v3-w_8856 0.2.7 Draft.xls

Worksheet to randomly select numbers

Date Generated: 6/8/2006

Number of samples to choose among: 20
Area/Unit: OOL-07-03

1st	14	Split
2nd	18	Split
3rd	6	Recount
4th	8	
5th	18	
6th	12	
7th	2	
8th	18	
9th	5	
10th	2	

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.

Generated 6/8/06

By: R. Tozzie

Using: Randomizer.xls