ATTACHMENT B

Final Status Survey

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1.0 INTRODUCTION

This attachment presents the final status surveys for the Facility. The surveys were designed from the guidance contained in NUREG-1575 "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM) or were designed with respect to 10 CFR 40, Appendix A, Criterion 6. The surveys will demonstrate that the residual radioactivity in each survey unit satisfies the applicable criteria described in the Reclamation Plan, Section 3.2.2.

2.0 SURVEY DESIGN

The introduction to 10 CFR40, Appendix A, states that, "Licensees or applicants may propose alternatives to the specific requirements in this appendix." SFC is proposing an alternative strategy for the verification survey post-reclamation. The final status survey plan was developed recognizing that contamination of soil may have occurred from different and independent parts of processing at SFC. The NRC has previously concluded that the "activity at the front-end of the … processing was uranium milling, and thus produced 11e.(2) byproduct material as its waste."[1] The back-end of the operation was a uranium conversion process, and thus produced source material (non-11e.(2)) as its waste. Areas of soil contaminated by either end of the process are readily identified by knowledge-of-process and results of site characterization.

SFC will apply the requirements of 10 CFR 40, Appendix A to areas of soil contaminated by the front end of the process. Contamination of soil from the front-end of the process is characterized by the presence of Th-230 in excess of uranium. The following sections classify these areas as “Th-Ra” areas and describe a final status survey consistent with 10 CFR 40, Appendix A, Criterion 6 (6). Particularly, the final status survey of “Th-Ra” areas will be performed on units of 100 m^2.

SFC will use a MARSSIM approach for final status survey of soil contaminated by the back end of the process. NRC recognizes MARSSIM as the

[1] U.S. Nuclear Regulatory Commission, Memorandum, Staff Requirements - SECY-02-0095 - Applicability of Section 11e.(2) of the Atomic Energy Act to Material at the Sequoyah Fuels Corporation Uranium Conversion Facility, July 25, 2002.

survey method of choice for license termination in all cases that do not include 11e.(2) by product material. Contamination of soil from the back-end of the process is characterized by the relative absence of Th-230 in the presence of uranium. The following sections classify these areas as class 1, 2, or 3 areas and describe final status survey requirements consistent with MARSSIM. The final status survey of class 1, 2, or 3 areas will be completed relative the respective MARSSIM guidance for size of units.

The survey designs began with the development of data quality objectives (DQOs). The DQOs were developed using guidance provided on the DQO Process in Appendix D of MARSSIM. On the basis of these objectives, applicable requirements of 10 CFR 40 Appendix A, and the known or anticipated radiological conditions at the site, a survey design was developed to determine the numbers and locations of measurement and sampling points to demonstrate compliance with the release criterion. Finally, survey techniques were selected appropriate for development of supporting data.

2.1 Radionuclides of Concern

The Site Characterization Report (SCR) identified the primary radionuclide of concern as natural uranium (U-nat). The SCR also established areas where thorium-230 (Th-230) and radium-226 (Ra-226) must be considered as contaminants. The SCR is included in the Reclamation Plan as Appendix D.

2.2 Cleanup Levels

For the purpose of the final status surveys, the cleanup levels (CLs) described in the Reclamation Plan represent contamination conditions that are approximately uniform across the survey unit and will be specifically referred to as CL_W. Table B-1 identifies the CL_W used in this survey plan for each radionuclide.

A separate CL will be derived for small areas of elevated activity and will be specifically referred to as CL_{EMC} (elevated measurement comparison).

Table B-1 Cleanup Levels

Condition	Uranium-Nat pCi/g	Thorium-230 pCi/g	Radium-226 pCi/g
CL_W	100	≤14 / ≤43	≤5.0 / ≤15

* first 15cm below surface / 15cm layers more than 15cm below surface

2.3 Classification of Areas based on Contamination

All areas of the Facility do not have the same potential for contamination and, accordingly, do not need the same level of survey coverage to demonstrate that residual radioactivity in the area satisfies the applicable criteria. The surveys were designed so that areas with higher potential for contamination receive a higher degree of survey effort.

The survey designs fall into one of two categories, non-impacted and impacted. Areas that have no reasonable potential for residual contamination are designated as non-impacted areas and are not provided any level of survey coverage. Areas that have some potential for containing contaminated material are designated as impacted areas. Impacted areas are subdivided into four classes according to known or suspected levels of contamination and with regard to the classification guidance of MARSSIM. Specific and thorough consideration was given to site operating history and/or known contamination based on site characterization efforts:

- Class 1 areas: These areas are known to not have thorium-230 or radium-226 as a significant contaminant. These areas are known or suspected to have contamination in excess of the criterion for U-nat.
- Class 2 areas: These areas are known to not have thorium-230 or radium-226 as contaminants. These areas are known or suspected to have contamination less than the criterion for U-nat.
- Class 3 areas: Any impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the criterion for U-nat, based on site operating history and previous radiological surveys. These are areas

with very low potential for residual contamination but insufficient information to justify a non-impacted classification. These areas are known to not have thorium-230 or radium-226 as contaminants.

- Th-Ra areas: These areas are known to have thorium-230 and radium-226 as contaminants. These areas are known or suspected to have contamination in excess of the criterion for U-nat, thorium-230, and radium-226.

Class 1 and Th-Ra areas have the greatest potential for contamination and, therefore, receive the highest degree of survey effort, followed by Class 2, and then Class 3 areas. Class 1 and Class 2 areas may be further subdivided into units in accordance with the guidance in MARSSIM or to better facilitate assessment of the area. Th-Ra areas will be divided into $100m^2$ units in accordance with 10 CFR 40, Appendix A, Criterion 6. Figure Att. B-1 depicts the boundaries of the different areas.

2.4 Investigation Levels

Radionuclide-specific investigation levels will be used to indicate when additional investigations may be necessary. The investigation levels will also serve as a quality control check for the measurement process. The investigation levels to be used at the Facility are provided in Table B-2.

Table B-2 Final Status Survey Investigation Levels

Survey Unit Classification	Investigate When Sample Result:	Investigate When Scanning Measurement:
Class 1 & Th-Ra	> CL_{EMC}	> CL_{EMC}
Class 2	> CL_W	> CL_W
Class 3	> 0.33 CL_W	> Detection Sensitivity

2.5 Survey Techniques

Measurement methods used to generate data during the surveys can be classified into three categories commonly known as scanning surveys, direct measurements, and soil sampling. These survey techniques are combined in an integrated survey design.

The instruments and procedures described here are the same as those used to determine background radioactivity. Instrumentation used for final status survey will be managed as described in this reclamation plan, Attachment D, *Radiation Safety Program*, Section 2.7.

2.5.1 Scanning Surveys

Scanning will be performed to identify areas of elevated activity that may not be detected by other measurement methods. Scanning will be performed of structure surfaces and land areas. Structure surfaces will be scanned for both alpha and beta/gamma radiations. Land areas will be scanned for gross gamma radiations. The types of instruments used for scanning and their typical performance characteristics are provided in Table B-3. Scanning measurements will be conducted in accordance with written operating procedures.

Table B-3 Identification Of Radiation Detection Instruments For The Final Status Surveys Of The Sequoyah Facility

Measurement	**Instrumentation** **Detector**	**Meter**	**Background**[1] (cpm)	**4 π**[a] **Efficiency** (%)	**Detection Sensitivity**[b, c]
Scan alpha Direct alpha	Large area gas prop., Ludlum Meas., Inc., Model 239-1F.	Count rate meter and digital scaler, Ludlum Meas.,Inc., Model 2221.	16	20	300 dpm/100cm^2 37 dpm/100cm^2
Scan beta/gamma Direct beta/gamma	Large area gas prop., Ludlum Meas., Inc., Model 239-1F.	Count rate meter and digital scaler, Ludlum Meas.,Inc., Model 2221.	1220	20	1300 dpm/100cm^2 280 dpm/100cm^2
Scan Soil	NaI scintillation Ludlum Meas., Inc., Model 44-10	Countrate meter, Ludlum Meas., Inc., Model 2221.	10000	n/a	80 pCi/g as natural uranium[d] 3 pCi/g as Ra-226[d]

[a]Nominal values.
[b]Monitoring audible signal during scanning.
[c]One-half minute integrated count for direct measurements.
[d]MARSSIM Table 6.7
n/a - not applicable

Structure Surfaces

Scanning measurements of structure surfaces will be made with a radiation detector coupled to a handheld scaler/ratemeter. Scanning measurements will be performed by placing the detector as near as reasonable to the surface to be measured and moving the detector across the surface at a few centimeters per second. Each measurement will be recorded as the maximum for the area surveyed. The measurement location will be recorded with respect to physical features of the area surveyed.

Land Areas

Gamma scanning measurements will be used to support the final status surveys for Class 1, 2, and 3 areas, and may be used to support final status surveys for Th-Ra areas.

For Class 1, 2, and 3 areas, the use of gamma measurements will be to support a soil sampling scheme. The intent is to provide an integrated survey strategy of gamma scanning and soil sampling to determine compliance with a cleanup level of total uranium in soil. Use of the gamma scan in these cases will not be based on a quantitative correlation but either on a detection sensitivity assumed from MARSSIM Table 6.7, or a qualitative assessment by comparison to background. The scan is intended to find areas of elevated activity not detected by soil sampling on a systematic pattern, or to provide a qualitative level of confidence that no areas of elevated activity were missed by sampling on a random pattern and no error was made in classification of the area. Biased samples may be collected based on elevated scanning results.

Gross gamma measurements of land areas will made with a NaI(Tl) radiation detector coupled to a handheld scaler/ratemeter. Measurements will be collected by keeping the detector within two feet above ground surface while walking or driving over the area at a rate comparable to a casual walk. In open areas, the measurements will be made along a straight path between opposite borders of the area being surveyed and the distance between paths will be approximately five feet. In wooded areas, the measurements will be made along paths allowed by brush and trees.

The scaler/ratemeter, along with global positioning system (GPS) equipment, may be coupled to a data logger. A gamma measurement taken from the ratemeter and a location reading from the GPS unit will be recorded approximately every two seconds by the data logger. Each measurement will be recorded as gross counts per minute. The location will be recorded with respect to the reference coordinate system described below. The expected density of measurements for an area is 60 to 80 measurements per 100 square meters.

For Th-Ra Areas, gamma measurements will be used in lieu of soil sample results if a quantitative relationship can be established between instrument response and soil activity. Such a relation cannot be established at this time because a soil sampling/gamma measurement data set has not been developed in accordance with the guidance in NUREG 1620. The primary areas from which the data would be gathered are currently inaccessible: the footprints of Pond 1 Spoils Pile, Clarifier A Basin, and Pond 2. Noting that Th-230 is the primary contaminant within the scope of Th-Ra Areas, SFC does not expect to be able to rely on gamma measurements in place of soil samples.

2.5.2 Direct and Removable Measurements

Direct measurements will only be made of structural surfaces. Direct measurements will be limited to alpha and beta/gamma measurements. The types of instruments used for direct measurements and their typical performance characteristics are provided in Table B-3. Direct measurements will be conducted in accordance with written operating procedures.

Direct measurements of structure surfaces will be made with a radiation detector coupled to a handheld scaler/ratemeter. The measurements will be performed by placing the detector on or near the surface to be measured and completing a one-minute integrated count. Each measurement will be recorded as gross counts per minute. The measurement results will be converted to transformations per minute per $100cm^2$ using instrument specific calibration data.

The measurement location will be recorded with respect to physical features of the area surveyed.

Removable activity measurements will not be performed for the final status survey.

2.5.3 Soil Sampling

Soil sampling will be performed of land areas. Soil sampling will be conducted in accordance with written operating procedures.

Soil samples will be collected in a known and consistent fashion. The location will be recorded with respect to the reference coordinate system described below. The soil sample will typically be collected from the top six inches of soil.

A single soil plug will be collected from each sample location for the class 1, 2, and 3 areas. The plug from a six inch layer will create one soil sample.

Soil plugs will be collected from five evenly spaced locations across a $100m^2$ grid for Th-Ra areas. The five plugs from a six inch layer will be combined to create one composite soil sample.

Sample collection activities will include documentation of sampling activities on a field log, decontamination of equipment between sample locations, and collection of replicate samples at a rate of one per 10. Sample collection will also include creation of duplicate samples at a rate of one per 10. Chain-of-custody procedures will be applied beginning at the time of sample collection.

Soil samples will be sent to a laboratory for preparation and analysis. The preparation will include removing rocks and vegetation, drying, grinding, mixing/blending, and then acid leaching an aliquot of the prepared soil. These preparation techniques will be carried out in accordance with laboratory-specific procedures.

Samples of soil will be analyzed for the radionuclides of concern, as applicable. The analysis technique and typical detection limit for each radionuclide of concern is provided in Table B-4.

Table B-4 Identification Of Radioanalytical Methods For Final Status Surveys Of The Sequoyah Facility

Radionuclide	Analytical Method	Detection Limit[1] (pCi/g)
Total Uranium	kinetic phosphorescence analysis	0.7
Thorium-230	alpha spectrometry	0.5
Radium-226	co-precipitation, gross alpha and gross beta	0.1

[1] nominal values

The references for the analytical methods used, or equivalent, are:

Total uranium: ASTM D 5174, "Standard Test Method for Trace Uranium in Water by Pulsed-Laser Phosphorimetry", ASTM International.

Th-230: NAS/DOE 3004/RP, "Isotopic Thorium by Alpha Spectroscopy", National Academy of Sciences, DOE Methods for Evaluating Environmental and Waste Management Samples.

Th-01-RC, "Thorium in Urine", U.S. Department of Energy, Environmental Measurements Laboratory Procedures Manual, HASL-300, DE91-010178.

Ra-226: 903.0, "Alpha-Emitting Radium Isotopes", U.S. Environmental Protection Agency, Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA 600/4-80-032.

903.1, "Radium-226 in Drinking Water Radon Emanation Technique", U.S. Environmental Protection Agency, Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA 600/4-80-032.

Upon termination of reclamation activities, stored samples and sample remains will be disposed.

2.6 Reference (Background) Areas

The reference areas used for the conduct of the final status surveys for land areas will be as described in the SCR. The reference for structural surfaces will be determined at the time of the survey as part of instrument calibration.

2.7 Reference Coordinate System

Reference coordinates systems will be used to facilitate selection of measurement and sampling locations, and to provide a mechanism for relocating a survey point. Land area scanning surveys and soil sample locations will be referenced to the Oklahoma State Plane (NAD 1983(93) horizontal, NGVD 29 vertical). Scanning surveys and direct measurements of structural surfaces will be referenced to prominent building features.

2.8 Measurement Evaluation

The Wilcoxen Rank Sum (WRS) statistical test will be used to evaluate the data from the final status surveys of the Class 1, Class 2, and Class 3 areas. Measurements from a survey unit will be compared to equivalent measurements from the reference areas. In general, the comparison will be whether the survey unit exceeds the reference area by more than the CL_W for U-nat.

In addition, a comparison will be performed against each measurement in a Class 1 unit to determine whether the measurement result exceeds the relevant investigation level provided in Table B-2. If any measurement exceeds the investigation level, then additional investigation will be completed regardless of the outcome of the applicable WRS test.

The unity rule will be applied to the measurement results from each unit of the Th-Ra areas. In general, the comparison will be whether the sum of the fractions for each of U-nat, Th-230, and Ra-226 to it's respective CL_W is less than or equal to one.

2.9 Area Factor

The area factor is used to adjust the CL_W to estimate the CL_{EMC}. The area factor is the magnitude by which the concentration within a small area of elevated activity can exceed the CL_W while maintaining compliance with the release criterion. If the CL_W is multiplied by the area factor, the resulting concentration distributed over the specified smaller area delivers the same calculated dose.

Table B-5 provides the area factors to be used at the Facility. The area factors were developed from RESRAD. Other than changing the area (i.e. 1.0, 2.0, 2.5, 3.0, ... or 10000 m^2), the RESRAD values used to develop the release criteria were not changed. The area factors were then computed by taking the ratio of the dose per unit concentration generated by RESRAD for the area of the contaminated zone to that generated for the other areas listed.

Table B-5 Outdoor Area Factors

	Area Factor										
Radionuclide	**1m²**	**2m²**	**3m²**	**10m²**	**30m²**	**100m²**	**300m²**	**1000m²**	**3000m²**	**10000m²**	**25000m²**
U-Nat	2.6	2.4	2.2	1.7	1.5	1.3	1.2	1.1	1.1	1.1	1.0

3.0 SURVEY DESCRIPTIONS

The following sections describe the final status surveys to be completed for each of the area classifications previously described. As necessary, the following sections are further subdivided to provide description of the survey for a particular unit of an area. As an element of conservatism, the surveys were designed relative to the CL_W.

3.1 Class 1

3.1.1 Survey Units

This area is described as the entirety of the current main restricted area at the Facility, excluding the portions contaminated with thorium-230 and radium-226 and the area that will be occupied by the disposal cell. This area may otherwise be described as Restricted Area No. 1 except for Pond 1 Spoils Pile; the footprint of Clarifier A Basin; the footprint of Pond 2. The final status survey will be applied independently to each 2000 m^2 unit of this area.

3.1.2 Estimated Number of Data Points

The estimated number of sample locations will be derived in accordance with Section 5.5.2.2 of MARSSIM. Surface soil sample results from site characterization and/or remediation control surveys for the area will be used to provide an estimate of the standard deviation (σ_s) for uranium in this area.

3.1.3 Calculate Relative Shift

The relative shift (Δ/σ_s) will be calculated using an upper bound of the gray region (UBGR) equal to the CL_W= 100 pCi/g, a lower bound of the gray region (LBGR) of ½CL = 50 pCi/g, and σ_s.

3.1.4 Decision Error Percentiles

The null hypothesis for this Class 1 area is that each survey unit does not meet the release criteria. Acceptable decision error probabilities for testing the hypothesis were chosen as α = 0.05 and ß = 0.25.

3.1.5 Number of Data Points for WRS test

The number of data points will be obtained directly from MARSSIM Table 5.3. The concern for detection of small areas of elevated activity will be addressed in accordance with MARSSIM Section 5.5.2.4. A triangular grid size will be determined for the number of data points and a survey unit size of 2000 m^2. The required scan minimum detectable concentration (MDC) will be determined per MARSSIM Equation 5-3 using the CL_W in Table B-1 and the Area Factor in Table B-5. The grid size will be adjusted as necessary to account for small areas of elevated activity.

3.1.6 Determining Survey Locations

Units will be surveyed on a random-start triangular grid pattern.

3.1.7 Integrated Survey Strategy

Sampling will be completed on the previously described grid. Scanning will be completed for 100% of each unit. Biased samples will be collected based on elevated scanning results.

3.2 Class 2

3.2.1 Survey Units

There are five areas in this classification. The five areas are: the drainage south of the South Guard House, former 001 drainage between the Protected Area fence and the Storm Water Reservoir, Initial Lime Neutralization Area, the former Sod Storage Area, and the front lawn. The final status survey will be applied independently to each 10000 m^2 unit of each area.

3.2.2 Estimated Number of Data Points

The estimated number of sample locations will be derived in accordance with Section 5.5.2.2 of MARSSIM. Surface soil sample results from site characterization and/or remediation control surveys for the area will be used to provide an estimate of the standard deviation (σ_s) for uranium in this area.

3.2.3 Calculate Relative Shift

The relative shift (Δ/σ_s) will be calculated using an upper bound of the gray region (UBGR) equal to the CL_W= 100 pCi/g, a lower bound of the gray region (LBGR) of ½CL = 50 pCi/g, and σ_s.

3.2.4 Decision Error Percentiles

The null hypothesis for these Class 2 areas is that each survey unit does not meet the release criteria. Acceptable decision error probabilities for testing the hypothesis were arbitrarily chosen as $\alpha = \beta = 0.05$.

3.2.5 Number of Data Points for WRS test

The number of data points will be obtained directly from MARSSIM Table 5.3.

3.2.6 Determining Survey Locations

Units will be surveyed on a random-start triangular grid pattern.

3.2.7 Integrated Survey Strategy

Sampling will be completed on the previously described grid. Scanning will be completed for nearly 100% of each unit. Biased samples may be collected based on elevated scanning results.

3.3 Class 3

3.3.1 Survey Units

There are three units in this classification. The three units are: sediment of the Storm Water Reservoir, inside the fertilizer ponds, and the remainder of the Class 3 area. The final status survey will be applied independently to each unit.

3.3.2 Estimated Number of Data Points

The estimated number of sample locations will be derived in accordance with Section 5.5.2.2 of MARSSIM. Surface soil sample results from site characterization and/or remediation control surveys for the area will be used to provide an estimate of the standard deviation (σ_s) for uranium in these units.

3.3.3 Calculate Relative Shift

The relative shift (Δ/σ_s) will be calculated using an upper bound of the gray region (UBGR) equal to the CL_W= 100 pCi/g, a lower bound of the gray region (LBGR) of ½CL = 50 pCi/g, and σ_s.

3.3.4 Decision Error Percentiles

The null hypothesis for these Class 3 units is that each survey unit does not meet the release criteria. Acceptable decision error probabilities for testing the hypothesis were arbitrarily chosen as $\alpha = \beta = 0.05$.

3.3.5 Number of Data Points for WRS test

The number of data points will be obtained directly from MARSSIM Table 5.3.

3.3.6 Determining Survey Locations

Samples will be collected at random locations.

3.3.7 Integrated Survey Strategy

The number of samples determined in Section 3.3.5 will be collected from each unit. Scanning will be completed for a majority of the accessible portions of each unit. Biased samples may be collected based on elevated scanning results.

3.4 Class 3-Office Building

3.4.1 Survey Units

There will be only one structure remaining at the site after decommissioning is completed. That structure is the existing office building which was constructed for office and warehouse space. This building was erected outside the restricted area in 1991 and occupied in mid-1992, only months before the permanent shutdown of the Sequoyah Facility. The building has been surveyed routinely for contamination, and no radioactive material or contamination has ever been found.

The Class 3-Office Building will be considered as several units. The choice of units is based on the limited time the Facility was in operation after the structure was built and the results of routine contamination surveys inside the structure. The units are the roof, the west exterior warehouse wall, the west exterior office building wall, the warehouse floor, and the first floor of the office building.

Surface activity limits were not derived for the Office building. NUREG-1620, Appendix H, Section H2.2.3(8) is applied here. Otherwise, the surface activity limits will default to those provided in Source Materials License SUB-1010, Section 3.3.4.7 for the Sequoyah Facility.

The CL_W is 2000 transformations per minute per 100 cm^2 ($tpm/100cm^2$) total (fixed plus removable) [direct] gross alpha and total (fixed plus removable) [direct] gross beta/gamma, measured independently. The CL_W will be applied as the total activity concentration; background will not be subtracted from the measurement result before comparison to the CL_W.

3.4.2 Estimated Number of Data Points

The estimated number of sample locations will be derived in accordance with Section 5.5.2.2 of MARSSIM. Data from routine contamination surveys for this structure do not indicate the presence of any residual contamination. As a conservative starting point, a coefficient of variation (CV) of 30% is assumed for survey data and the mean is assumed to be ½CL_W.

3.4.3 Calculate Relative Shift

The relative shift (Δ/σ_s) was calculated using an upper bound of the gray region (UBGR) equal to the CL= 2000 tpm/100cm^2, a lower bound of the gray region (LBGR) of ½ CL = 1000 tpm/100cm^2, and σ_s = 1000 * 0.30 tpm/100cm^2: Δ/σ_s = 3.33 rounded down to 3.

3.4.4 Decision Error Percentiles

The null hypothesis for this Class 3-Office building survey is that each survey unit does not meet the release criteria. Acceptable decision error probabilities for testing the hypothesis were arbitrarily chosen as $\alpha = \beta = 0.05$.

3.4.5 Number of Data Points for WRS test

The number of data points were obtained directly from MARSSIM Table 5.3. For $\alpha = \beta = 0.05$, and $\Delta/\sigma_s = 3$, then N/2 = 10.

3.4.6 Integrated Survey Strategy

Ten direct alpha and ten direct beta/gamma measurements will be collected at random locations in each unit. Scanning will be performed in areas of highest potential for residual contamination; e.g. corners, drains, steps, ledges. The measurement results will be evaluated against the CL_W for direct surface radioactivity.

3.5 Class Th-Ra

3.5.1 Survey Units

There are five areas in this classification. The four areas are: the footprint of Pond 1 Spoils Pile; the footprint of Clarifier A Basin; the footprint of Pond 2;

and outside the fence at Pond 2 to the south, west and north. The final status survey will be applied independently to each 100m^2 unit of these areas.

3.5.2 Number of Data Points

At least 30 composite soil samples will be collected from each area. A composite soil sample will be collected with respect to a unit of each area. Surface soil sample results from site characterization and/or remediation control surveys for the area will be used when available. Gamma measurements may be substituted for soil samples.

3.5.3 Determining Survey Locations

The measurement and/or sample location will be recorded as the approximate center of each unit.

3.5.4 Integrated Survey Strategy

Sampling will be completed as described previously.

Gamma measurements, as count rate, may be substituted for some uranium and Ra-226 analyses. The gamma measurement threshold will be established from a correlation between sample result and count rate. The correlation will be derived from at least 30 soil samples from 2 to 25 pCi/g Ra-226. The correlation pairs will each represent a 100m^2 unit. The gamma measurement threshold will be applied in a manner to provide a 95% level of confidence that the subject 100m^2 unit meets the cleanup level. A correlation will be independently derived for each Th-Ra area.

Thorium-230 results may be developed from a correlation with Ra-226 or uranium analyses. The Th-230 correlation will be derived from at least 30 soil sample result pairs from 2 to 25 pCi/g Ra-226. The sample result pairs will each represent a 100m^2 unit. The Th-230 correlation will be applied in a manner to provide a 95% level of confidence that the subject 100m^2 unit meets the Th-230 cleanup level. A Th-230 correlation will be independently derived for each Th-Ra area.

Final status survey units that fail the gamma measurement threshold or unity rule will be tracked. Neighboring units to failed units that were subjected only to gamma measurement will be sampled for direct evaluation of the unity rule. Additional cleanup will be completed on the $100m^2$ unit until the unity rule is satisfied. If the number of failed units is excessive, the gamma measurement threshold will be adjusted downward and units further remediated, as necessary.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

4.1 Introduction

SFC will use the quality assurance program described elsewhere in this Reclamation Plan as a quality system. The quality system will ensure that the final status survey decisions will be supported by sufficient data of adequate quality and usability for their intended purpose, and further ensure that such data are authentic, appropriately documented, and technically defensible.

4.2 Development of a Quality Assurance Project Procedure

SFC will develop a Quality Assurance Project Procedure (QAPP) as a tool to document the type and quality of data needed for Final Status Survey (FSS) decisions and to describe the methods for collecting and assessing those data. The QAPP will be developed consistent with EPA guidance for development of quality assurance project plans. The development, review, approval, and implementation of the QAPP will occur within SFC's existing system for management of operating procedures. The QAPP will be part of SFC's quality system.

The QAPP shall be composed of standardized, recognizable elements covering the entire project from planning, through implementation, to assessment. These elements are arranged for convenience into four general groups: project management, data generation and acquisition, assessment and oversight, and data validation and usability. If an element in whole or part is not applicable, such will be described in the QAPP. The groups and associated elements are described below.

Documentation, such as an approved Work Plan, Standard Operating Procedures, industry standards or methodology, etc., may be referenced in response to a particular required QAPP element. Current versions of all referenced documents will be available for routine use.

Project management The basic area of project management will be addressed, including the project history and objectives, roles and responsibilities of the participants, administrative functions, etc. These elements ensure that the project has a defined goal, that the participants understand the goal and the approach to be used, and that the planning outputs have been documented.

Data generation and acquisition This area will be described to ensure that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and QC activities are employed and documented. These elements describe the requirements related to the actual methods or methodology to be used for the FSS.

Assessment and oversight These activities will be completed to determine whether the QAPP is being implemented as approved (conformance/nonconformance), to increase confidence in the information obtained, and ultimately to determine whether the information may be used for their intended purpose. These activities will be conducted in accordance with SFC's existing quality assurance program.

Data Assessment (Data validation and usability) This section addresses the QA activities that occur after the data collection phase of the project is completed. Implementation of these elements determines whether or not the data conform to the specified criteria, thus satisfying the project objectives. Additional description of these matters is provided below.

4.3 Data Assessment

Assessment of the final status survey data will be made to determine if the data meet the objectives of the surveys, and to whether the data are sufficient to determine compliance with the CL_W. The assessment will consist of three phases: data verification, data validation, and data quality assessment.

4.3.1 Data Verification

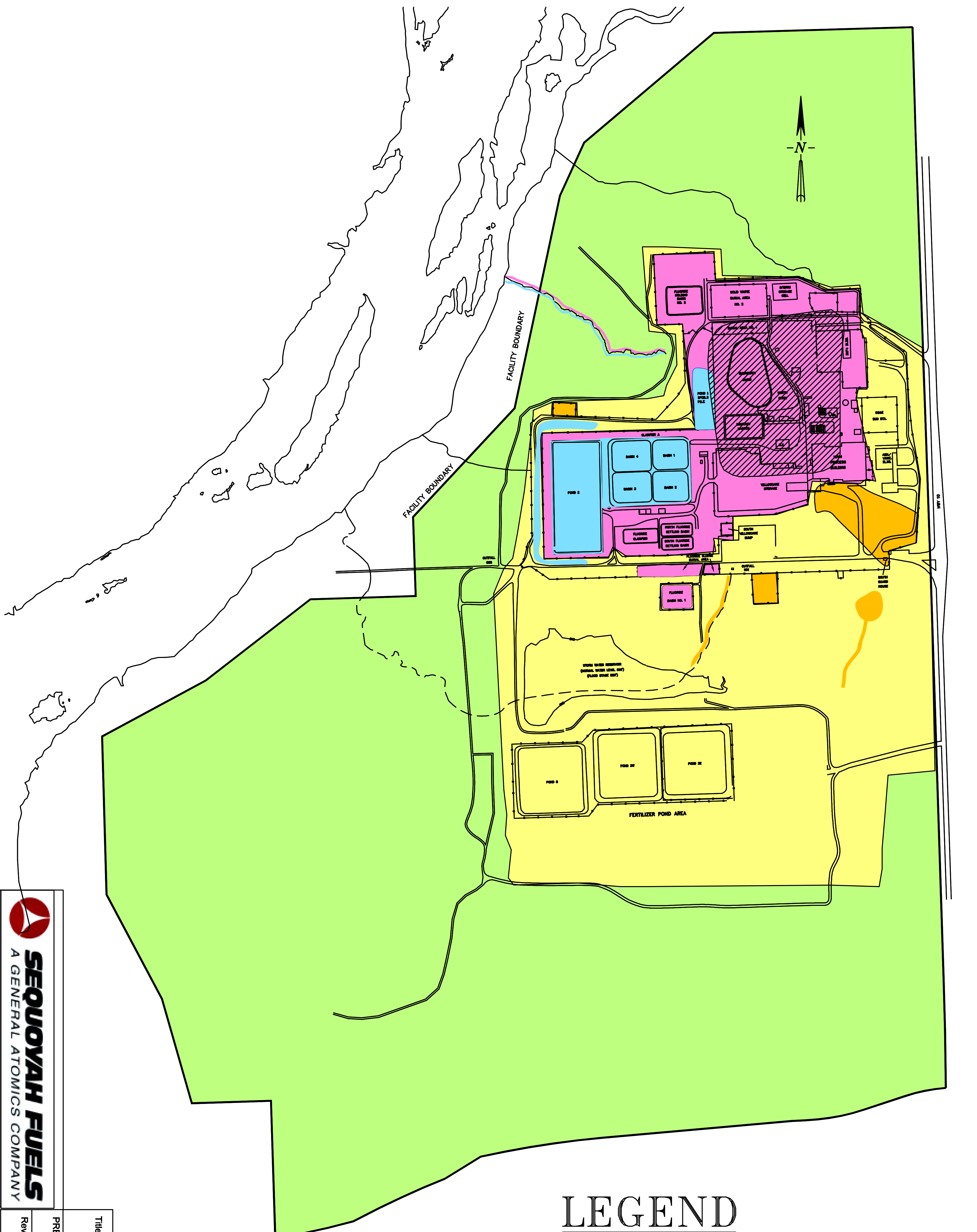
Data verification efforts will be completed to ensure that requirements stated in planning documents are implemented as prescribed. Identified deficiencies or problems that occur during implementation will be documented and reported. Activities performed during the implementation phase will be assessed regularly with findings documented and reported to management. Corrective actions will be reviewed for adequacy and appropriateness and documented in response to the findings. Data verification activities are expected to include inspections, QC checks, surveillance, and audits.

4.3.2 Data Validation

Data validation activities will be performed to ensure that the results of data collection activities support the objectives of the surveys, or support a determination that these objectives should be modified. The data validation effort will be conducted in consideration of the guidance provided in Appendix N of MARSSIM.

4.3.3 Data Quality Assessment

An assessment of data quality will be performed to determine if the data are of the right type, quality, and quantity to support their intended use. The assessment will include assessment of data quality, application of the statistical tests used in the decision-making process, and the evaluation of the test results. The data quality assessment effort will be conducted in consideration of the guidance provided in Chapter 8 and Appendix E of MARSSIM.



LEGEND

CELL FOOTPRINT

IMPACTED

- CLASS 3
- CLASS 2
- CLASS 1
- Th/Ra

NON-IMPACTED

SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

RECLAMATION PLAN

Title: CLASSIFICATION OF AREAS FOR FINAL STATUS SURVEY

PREPARED BY: SCM

Reviewed by: CLH

Date: December 2005

Filename: SFC0092D

Figure No. Att. B-1