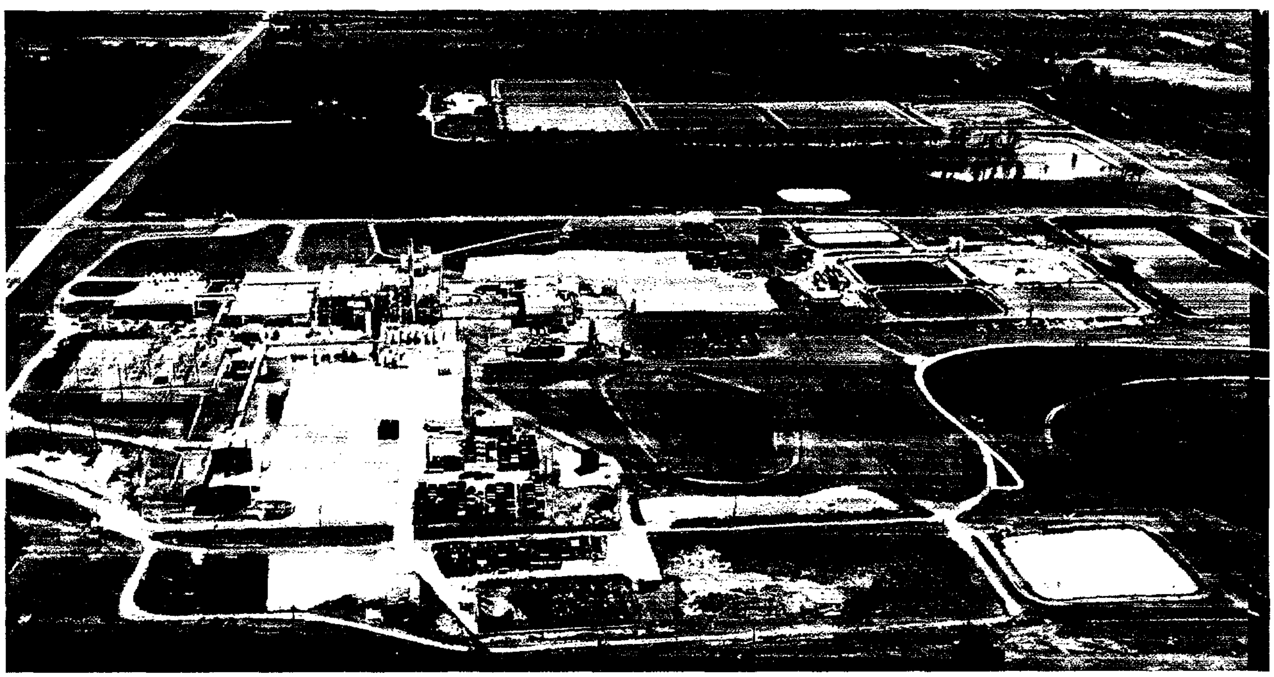
Reclamation Plan Sequoyah Facility



Sequoyah Fuels Corporation
Gore, Oklahoma

January 2003

Reclamation Plan
Sequoyah Facility

SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

PO Box 610
Gore, Oklahoma

January 2003

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1.0 INTRODUCTION

1.1 Background

Sequoyah Fuels Corporation (SFC) operated a nuclear fuel-cycle facility licensed by NRC at U.S. Interstate-40 and Oklahoma State Highway 10, Gore Oklahoma 74435. SFC engaged in different operations in different areas of the Facility, pursuant to NRC Source Material License SUB-1010, including (1) the recovery of uranium by concentration and purification processes, (2) the conversion of concentrated and purified uranium ore into UF_6 between the years of 1970 and 1993, and (3) the reduction of UF_6 into UF_4 from February 1987 until 1993.

SFC ceased production in 1993 and submitted a Preliminary Plan for Completion of Decommissioning (PPCD). The PPCD indicated that decommissioning the facility would include construction of an on-site disposal cell using the performance criteria contained in Appendix A to 10 CFR 40 to isolate the decommissioning waste. SFC conducted site characterization and decommissioning planning activities in order to develop a decommissioning plan for the Sequoyah site. In addition, SFC submitted information in support of an Environmental Impact Statement (EIS) which was initiated by the NRC.

In July 1997, the U.S. Nuclear Regulatory Commission (NRC) adopted new regulations that establish radiological criteria for license termination which included restricted release. Under these criteria, SFC submitted a decommissioning plan proposing an onsite disposal cell meeting the performance criteria in Appendix A of 10 CFR 40 with restricted release of the site once decommissioning activities were completed. During the NRC Staff's review of the plan the NRC Staff expressed concern that SFC had not yet identified a third party that would accept responsibility to enforce the proposed institutional controls. Subsequently, the NRC concluded that the front-end waste at the SFC Facility could be classified as byproduct material as defined in section 11e.(2) of the Atomic Energy Act (11e.(2)), and that such waste may be disposed of in accordance with Appendix A to 10 CFR 40. Appendix A provides for long term custody by assigning the Department of Energy as custodian of reclaimed sites under a general license in 10 CFR 40.

This Reclamation Plan (RP) updates and reformats the previous DP to include changes made to accommodate public input, extensive review by NRC and its contractors and additional studies and evaluations done by SFC since 1999. As such, it describes the decommissioning and reclamation of the Sequoyah Facility as an 11e.(2) byproduct materials site.

1.2 Purpose, Scope and Objectives of Site Reclamation

The Sequoyah Facility is planned for reclamation as an 11e.(2) byproduct material site under performance standards administered by the NRC. All of the waste materials will be disposed on site. Upon successful demonstration to NRC of meeting these performance standards, the site will be transferred to the U.S. Department of Energy for long-term care and maintenance. SFC's proposed approach would result in the dismantlement of facility equipment and structures, removal of sludges, impoundments, buried wastes and impacted soils, and placement of resulting waste materials in an engineered disposal cell.

The drainages that exit the Institutional Control Boundary (ICB) to the west (001, 005, and 007) contain some residual radioactive materials from historic releases. However, doses from exposure to these materials without restrictions is not distinguishable from background. As a result, SFC plans no further cleanup in these drainages

The strategy for a groundwater protection plan will be developed under NRC guidelines. This will result in the preparation of a Groundwater Corrective Action Plan (CAP) for the site. This CAP will be developed independently of this Reclamation Plan and submitted to the NRC by June 15, 2003. As such, the groundwater protection plan is not addressed here.

The reclamation approach consists of the following elements:

- Construction of an above-grade, engineered disposal cell on the SFC site for permanent disposition of the SFC decommissioning and reclamation wastes.
- Removal of sludges and sediments from the ponds and lagoons, excavation of buried low-level wastes, removal of stored soils and debris, and placement of these materials into the disposal cell.
- Dismantlement of process equipment, followed by recovery of gross quantities of contained uranium.
- Size reduction/compaction of process equipment, piping and structural materials (including scrap metal, empty drums, and packaged wastes that will accumulate prior to decommissioning) to satisfy disposal requirements for maximum void volume.
- Dismantlement/demolition of structures excepting the new SFC administrative office building and the storm water impoundment.
- Demolition of concrete floors, foundations and storage pads and asphalt or concrete paved roadways outside the footprint of the cell. Removal of clay liners and/or contaminated soils from under impoundments.
- Excavation of underground utilities, contaminated sand backfill from utility trenches and building foundation areas and more highly contaminated soils under the cell footprint.
- Excavation of contaminated soils lying outside the footprint of the disposal cell that exceed site-specific radiological cleanup criteria.
- Handling and treatment of produced ground water and storm water during cell construction.
- Placement of all SFC decommissioning wastes into the onsite disposal cell, followed by capping and closure of the cell.
- Re-grading the site, backfilling of excavations to the finished grade, and re-vegetation.

- Establishment of a fenced Institutional Control Boundary (ICB) around the cell, installation of additional monitoring wells as necessary, and initiation of a long-term site monitoring plan.
- Transfer title for the restricted property to DOE for long term care and maintenance.
- Termination of SFC's NRC license under the provisions of 10 CFR 40, Appendix A.

1.3 Criteria and Guidelines

The majority of the waste materials to be disposed on site are classified as 11e.(2) by-product materials and, as such, will be reclaimed under the criteria specified in Appendix A to 10 CFR 40. The remaining materials are not classified as 11e.(2) by-product materials, but have similar characteristics which makes them candidates for disposal in the cell. This RP proposes to dispose of the non-11e.(2) byproduct materials in the cell. NRC Regulatory Information Summary 2000-23 (November 30, 2000) provides guidance on disposal in tailings impoundments of wastes that are not 11e.(2) byproduct material. Appendix A of this RP addresses each of the eight considerations of RIS-2000-23 and demonstrates that disposal of the SFC non-11e.(2) byproduct material wastes in the disposal cell is consistent with NRC policy. Therefore, no distinction is made between the 11e.(2) materials and the non-11e.(2) materials in the remainder of this RP.

The key design criteria for the disposal cell are to: (1) meet the performance standards for reclamation outlined in Appendix A of 10 CFR 40, (2) provide sufficient capacity for disposal of on-site materials, (3) result in a facility that blends in with the surrounding area (from a visual, hydrologic and vegetative standpoint), (4) have a negligible effect on underlying groundwater, and (5) facilitate site cleanup and reclamation activity. These criteria are outlined below.

1.3.1 Performance standards

The performance standards in Appendix A of 10 CFR 40 include: (1) isolation of the waste materials in a manner that protects human health and the environment, (2) reduction of the rate of radon emanation from the cover to an average of 20 pCi/square meter-second or less, (3) having the reclamation be effective for a long period of time (200 to 1,000 years), and (4) minimizing reliance on active maintenance.

1.3.2 Disposal cell capacity

The disposal cell layout has been sized for a capacity (beneath the cover system) of approximately 9 million cubic feet which exceeds the estimated total volume of 8.3 million cubic feet. The cell design allows for adjustment of the capacity as needed over a range of 5 to 12 million cubic feet.

1.3.3 Surrounding area impact

The top surface of the cell will be limited to an elevation of approximately 590 feet to minimize the visual impact of the disposal cell from surrounding areas. In addition, the side slopes of the cell will be at 5:1 (horizontal:vertical) or less, with the corners of the cell rounded to create a topographic feature that is visually similar to the surrounding area. The surface of the completed cell will be vegetated with natural species similar to surrounding areas.

1.3.4 Effect on groundwater

The disposal cell cover design strategy includes minimizing infiltration of meteoric water. The cover design incorporates a uniform zone that promotes evapotranspiration from vegetation to achieve a zero water balance. Synthetic liner materials from existing impoundments on the site will used to prevent significant infiltration into the underlying waste materials until the vegetative cover matures and the water balance approaches zero.

1.3.5 Facilitation of site cleanup

The siting and layout of the cell has been designed to accommodate stormwater management and construction activity during site cleanup.

1.3.6 Site Selection and Layout

The disposal cell was sited to be over the major areas of contamination at the facility. The disposal cell was also sited to be close to materials to be placed in the cell to reduce handling costs. Appendix H, "Disposal Cell Design Siting Study For On-Site Disposal Cell" presents the results of SFC's siting evaluations.

1.3.7 Institutional Control

The disposal cell design is based on the site being transferred to the U.S. Department of Energy for long-term care and maintenance following completion of decommissioning. As with other 11e.(2) byproduct material sites, the U.S. Department of Energy will exercise institutional control of the site. This means that SFC will fence the site to limit unauthorized access. Activities within the ICB will be only those authorized by the U.S. Department of Energy or its contractors, such as monitoring or maintenance.

1.3.8 Post-Reclamation Dose

The dose to a member of the public from any activity undertaken on the unrestricted portions of SFC property (outside of the proposed ICB) will not be distinguishable from background.

The dose to a member of the public inside the ICB following completion of reclamation will satisfy not only the requirements of 10 CFR 40, Appendix A (the radium benchmark dose), but also the requirements of 10 CFR 20.1403 (less than 25 mrem/y or less than 100 mrem/y for restricted release with loss of institutional controls).

1.4 Plan Organization

This plan was developed from reports, studies and evaluations developed since 1990. Reliance was placed upon a decommissioning plan which proposed this approach under a different regulatory regime. Although not approved at the time of this writing, the decommissioning plan underwent significant technical and environmental review by the NRC since 1998. The resulting technical exchange between the NRC and SFC has led some refinements of the groundwater model, the dose model and the cell design which have been incorporated here.

This RP relies upon previous studies and reports, many of which have been submitted previously and are on the docket. The decommissioning and reclamation approach is generally summarized in this plan with much of the details contained in the appendices and attachments. Evaluations, studies, reports, etc. that are relied upon for support of the reclamation plan are included here as Appendices. Program documents, specifications, and project plans, some of which are controlled documents used in field implementation of this RP, are included as Attachments.

2.0 GENERAL DESCRIPTION OF THE FACILITY

2.1 Facility History

License SUB-1010, Docket No. 40-8027 was originally issued on October 14, 1969 for storage only of uranium ore concentrates. The license was amended on February 20, 1970, authorizing the operation of the Uranium Hexafluoride (UF_6) Conversion Plant. The license was amended on February 25, 1987 to authorize operation of the UF_6 Reduction Plant. The license was last renewed on September 20, 1985, and would have expired on September 30, 1990. The license has remained in effect based on submittal of a renewal application dated August 29, 1990, and provisions in 10 CFR 40.42(a).

By letter dated February 16, 1993, SFC notified NRC of its decision to suspend all production operations permanently, including uranium recovery by concentration and purification processes and subsequent conversion operations, and to decommission the facility. Since July 1993, the concentration and purification processes, the UF_6 conversion processes, and the DUF_4 reduction processes have been closed. By letter dated 11/26/93, NRC advised SFC that authorized activities were limited to those related to decommissioning, and routine environmental and effluent monitoring.

By letter dated January 5, 2001, Sequoyah Fuels Corporation (SFC) requested U.S. Nuclear Regulatory Commission (NRC) to determine if some of the waste material at the Gore, Oklahoma facility could be classified as byproduct material, as defined in Section 11e.(2) of the Atomic Energy Act. After review of the SFC position and the regulations, the Commission concluded that the front-end waste at the SFC Facility could be classified as 11e.(2) byproduct material, and that such waste may be disposed of in accordance with Appendix A to 10 CFR 40. SFC subsequently submitted a license amendment request to possess 11e.(2) byproduct materials which was approved on December 11, 2002.

2.2 Facility Location and Description

The SFC facility (Facility) is a 600-acre parcel of land containing the Industrial Area which occupies roughly 200 acres of the Facility. The Facility is located in Sequoyah County in mid-eastern Oklahoma about 150 miles east of Oklahoma City, Oklahoma, 40 miles west of Fort Smith, Arkansas, 25 miles southeast of Muskogee, Oklahoma, and 2.5 miles southeast of Gore, Oklahoma in Section 21 of Township 12 North, Range 21 East. Figure 2-1 shows the location of the Facility. The Facility is bounded on the north by private property, on the east by State Highway 10, on the south by Interstate 40 (I-40) and on the west by U.S. Government-owned land (managed by the U.S. Army Corps of Engineers [COE]) adjacent to the Illinois and Arkansas River tributaries of the Robert S. Kerr Reservoir. Figure 2-2 shows the topography of the Facility and surrounding area.

Most of the uranium-processing operations were conducted on an 85-acre portion of the Facility that is commonly referred to as the Process Area. SFC uses an additional 115 acres to manage storm water and store by-product materials. The reclamation activities will focus on the Process Area and the additional management areas that are collectively referred to as the Industrial Area. A location map of Facility designations is included in Figure 2-3. Most of the land outside of the Industrial Area is used either for grazing cattle or forage production.

Prior operations at the Facility can generally be summarized as follows. Following receipt of ore concentrates (yellowcake) at the Facility, the ore was subjected to concentration and purification processes to further purify the yellowcake. The purpose of the concentration and purification processes was to control the grade of materials entering the conversion process so as to avoid the contamination of the conversion processing system which if permitted to occur would lead to the production of off-specification material.

Following the concentration and purification processes, the materials were transferred to the conversion facility which produced high purity UF_6 using the purified yellowcake as feed material.

Also located at the Facility was a separate reduction facility which produced UF_4 using depleted UF_6 as feed material.

In addition to the facilities for concentration and purification, conversion, and reduction, the SFC site also includes: (1) a storage area for the yellowcake received from conventional uranium mills; (2) a yellowcake sampling facility; (3) a bulk storage area for chemicals such as ammonia (NH3), tributylphosphate-hexane solvent, and hydrofluoric (HF), nitric (HNO_3), and sulfuric (H_2SO_4) acids; (4) a facility for electrolytic production of fluorine from HF; (5) treatment systems and storage ponds for both radiological and non-radiological liquid effluent streams; and (6) a facility for the recovery and beneficial use of ammonium nitrate solution (which originated from the solvent extraction system) as fertilizer on SFC-owned land.

Additional facilities include the following: a yellowcake drum storage area, an electrical substation, UF_6 cylinder storage area, tank farm for liquid chemicals and fuel oil, cooling tower for waste heat dissipation, sanitary sewage facilities, retention ponds for calcium fluoride sludge, retention ponds for processing raffinate into fertilizer and raffinate sludge, a raffinate sludge concentration and loading facility, retention ponds for fertilizer, and a reservoir for an emergency water supply. A general Facility layout is presented in Figure 2-4.

2.3 Physical Characteristics of the Facility

The SFC site is located above the east bank of the Illinois River at its confluence with the Arkansas River. The site is on the western end of a broad upland area approximately 100 feet above the normal elevation of the Illinois River (as impounded by the Robert S. Kerr Reservoir). The physical characteristics of the site and surrounding areas have been the subject of several studies since 1990. The following sections summarize the findings of these studies. Additional details are available in Appendix B and Appendix D.

2.3.1 Surface Features

The Facility is situated on gently rolling to level land with several steep slopes to the northwest and wooded lands to the north and south. Elevations on or near the Facility range from 460 feet above mean sea level (amsl) for the normal pool elevation of the Robert S. Kerr Reservoir to nearly 600 feet amsl (Figure 2-2). Slopes over most of the upland areas of the Facility are less than seven percent. Steeper slopes in creek ravines and on hillsides average roughly 28 percent. Near the Robert S. Kerr Reservoir, slopes are very steep. This area is owned by the federal government and is administrated by the COE.

2.3.2 Surface Water Hydrology

The Facility is located on the east bank of the Illinois River tributary of the Robert S. Kerr Reservoir. Southwest of the Facility the Illinois River joins with the Arkansas River tributary of the Robert S. Kerr Reservoir. Flow in the Illinois River arm of the Robert S. Kerr Reservoir is regulated by releases from the Tenkiller Ferry Reservoir, which is located on the Illinois River approximately seven miles upstream from the Facility. The annual average flow of the Illinois River at the gauging station between the Tenkiller Ferry Reservoir and the Facility is 1,610 cubic feet per second (cfs).

Significant differences occur in water quality between the Illinois and Arkansas Rivers. The Illinois River flows through a rugged, rocky watershed throughout much of its course in northeastern Oklahoma and is fed largely by releases from Lake Tenkiller Ferry Reservoir and from steep, spring-fed streams. This results in relatively clear waters, with an average specific conductance of 170 microsiemen per centimeter (microS/cm). In contrast, the Arkansas River, acquires sediment from farming areas along its course in Colorado, Kansas, and Oklahoma, resulting in relatively turbid waters. Specific conductance values from the Robert S. Kerr Reservoir dam are about 600 microS/cm (SFC, 1998a).

The Process Area is located on an upland area approximately 100 feet in elevation higher than the surface elevation of the Robert S. Kerr Reservoir. Relatively steep (28 percent average) surface gradients occur between the

Process Area and the Robert S. Kerr Reservoir and the floodplain area in the southwest portion of the SFC property. Several small ephemeral streams drain the Industrial Area to the Robert S. Kerr Reservoir, including the 001, 004, 005, 007, 008, and 009 streams in Figure 2-5, and the drainage associated with the Storm Water Reservoir. Several other drainages affect the SFC property. One stream, hereafter referred to as Creek A, drains the area south of the Fertilizer Ponds. This stream bends northwestward and follows along the eastern edge of the Agland area, and eventually joins with water from the Storm Water Reservoir drainage. A small, northeast flowing stream occurs east of Highway 10. This stream closely parallels the Carlile School Fault and drains much of the eastern portions of the SFC property (Figure 2-2). This small stream empties into Salt Branch (Figure 2-2), a northwestward flowing drainage that closely parallels the SFC northernmost property boundary.

2.3.3 Climatology and Meteorology

Sequoyah County has a warm, temperate, continental climate. Storms bring ample precipitation when moisture-laden air from the Gulf of Mexico meets cooler, dryer air from the western and northern regions. The most variable weather occurs in the spring, when local storms can be severe and bring large amounts of precipitation. The mean annual temperature is 61.5° F. The monthly average ranges from 40° F in January to 82° F in July. The average daily range in temperature is 24° F. The lowest temperature on record was -19° F in January 1930 and the highest was 115° F in August 1936. The mean annual precipitation ranges from 42.9 inches in the town of Sallisaw, to approximately 44.1 inches in the northeastern part of Sequoyah County. The seasonal distribution of rainfall is fairly even, with 31 percent in spring, 26 percent in summer, 23 percent in fall and 20 percent in winter.

The average amount of snowfall from November through April is about 5.2 inches. Lake evaporation averages about 47.5 inches annually. Of this, 72 percent occurs from May through October. Based on the precipitation and lake evaporation values, there is a net annual evaporation rate of about 4 inches in the SFC area.

The most severe storms occur in the spring, although thunderstorms are also frequent during the summer months. Strong winds, heavy precipitation, and intense lightning may be associated with these storms.

The nearest Sequoyah County weather station is in the town of Sallisaw, Oklahoma. There is no national weather station in the immediate vicinity. Meteorological data may be obtained from the national weather station at Tulsa, Oklahoma, about 70 miles northwest, and at Fort Smith, Arkansas, about 40 miles east. Fort Smith, Arkansas is the closest data station having topographic and climatological characteristics similar to the Facility.

2.4 Geologic Setting

Based on historic information and data from recent site investigations, the following summarizes the geologic, hydrogeologic and geochemical conditions at the SFC Facility. For a detailed description, see Appendix B, section 6.

As described in Appendix B and Appendix D, the site rests on a ridge or upland area above the headwaters of the Robert S. Kerr Reservoir and the lower Illinois River. The SFC site is underlain by a sequence of approximately 400 feet of sedimentary siltstones and sandstones of the Atoka Formation. The Atoka formation is of the Pennsylvanian geologic period (with these sedimentary rocks formed approximately 280 to 325 million years ago. The bedding of these units is nearly horizontal, with varying depths of weathering and erosion. These units are mantled at varying depths with Pleistocene terrace deposits. The underlying soils and sedimentary rocks at the site have been investigated with regional geologic data and over 500 bore holes.

The site is located on the southwest flank of the Ozark Uplift, a regional structural feature. The site is in an area of low seismic activity with no significant faulting in the area within the last 35 million years. NRC has reviewed the seismic setting and concluded that no active or capable faults exist around the facility. Appendix E provides the results of the site seismic evaluations.

The Atoka Formation sedimentary rocks beneath the site consist of alternating shale and sandstone layers, extending to depths of several hundred feet. The Atoka Formation sedimentary rocks are mantled or covered with alluvial terrace deposits of the Quaternary geologic period. These terrace deposits were placed during the Pleistocene epoch (approximately 10,000 to 1,000,000 years before present) during high-water stages of flow on the Arkansas and Illinois Rivers. These high-water stages were most likely from melting periods of Pleistocene glaciation. Subsequent downcutting of the Illinois and Arkansas Rivers has left these deposits above the current river elevations. More recent alluvial deposits are found along the banks of the Illinois and Arkansas Rivers.

Groundwater levels and water quality have been evaluated from over 300 wells that have been completed on site. This information is presented in Appendices B and E of this Reclamation Plan. The shale and sandstone units are both of relatively low hydraulic conductivity, so that although groundwater is present in these units, groundwater yield is low. The uppermost groundwater beneath the site is within the uppermost shale layer. A limited, transient amount of groundwater is perched on the uppermost shale within the terrace deposits.

Soils investigated from drilling on site consist of these terrace deposits and weathered zones of the Atoka Formation. These soils range from sandy, clayey gravels to silty clays. The materials are classified (according to the Unified Soil Classification System) as a low to moderate plasticity silt and clay as well as clayey sand and gravel.

2.5 Seismicity and Ground Motion Estimates

The maximum anticipated acceleration at the Site is less than 0.05 g (Appendix C). Based on a maximum anticipated seismic acceleration of 0.05 g, the corresponding seismic coefficient for use in pseudo-static analyses of the cell and cover system would be 0.03 to 0.04. SFC used a seismic coefficient of 0.05

to conservatively represent the conditions at this site. A seismic coefficient of 0.05 is consistent with the generalized values for the area recommended by the U.S. Army Corps of Engineers (Appendix C). This seismic coefficient value is sufficiently low that a seismic deformation analysis would not be necessary.

2.6 Erosional Stability

The topographic and geologic descriptions above indicate that the site is on an upland area of Pennsylvanian-age sedimentary rocks that have been mantled with Pleistocene epoch terrace deposits and recent alluvial deposits. Erosion during the Quaternary period has been limited to downcutting of the bed of the Arkansas and Illinois Rivers, with no significant erosion of the sedimentary rocks or overlying alluvial deposits at the western end of the upland area.

The SFC site as well as planned reclaimed features of the site are hydraulically separate and erosionally stable from extreme flood events on the Illinois and Arkansas Rivers, as summarized below.

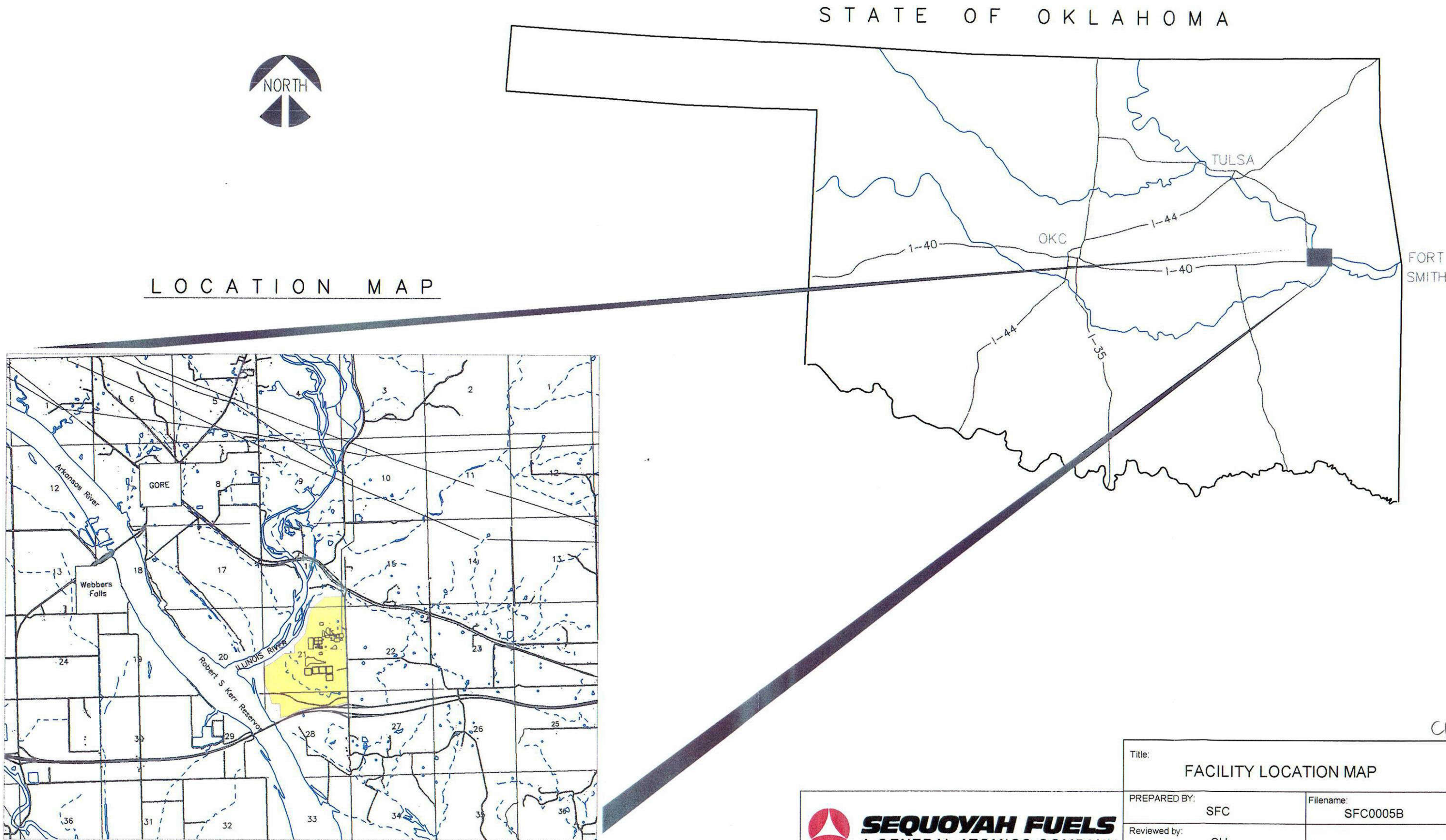
1. The location of planned reclaimed site features are at an elevation approximately 100 feet above the normal and flood-stage elevations of the Illinois and Arkansas Rivers in the site area.

2. The recent geomorphologic history of the site indicates that the most significant periods of erosion and sediment deposition from rivers in the site area coincided with glacial periods over 10,000 years ago. Estimated extreme flow events (under probable maximum precipitation calculation methods) are significantly lower than the Pleistocene epoch flows that were experienced over sustained periods at the site.

3. The Pennsylvanian-age sedimentary rocks that form the foundation for reclaimed features at the SFC site are not susceptible to rapid or significant erosion that would expose the planned reclaimed features at the site.

4. The current topography of the Arkansas and Illinois River basins in the site area shows a large area of lower elevation to the west of the site. There is not a constriction of flow or a bend in the bed of either river that would indicate significant flow velocities or a potential for riverbed migration toward the upland area where the site is located.

5. Low seismic activity with no significant faulting in the area indicates that seismically-induced features that would be susceptible to erosion are not present.



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SEQUOYAH FUELS A GENERAL ATOMICS COMPANY	Title: FACILITY LOCATION MAP	
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	Reviewed by: CH	Figure No.2-1
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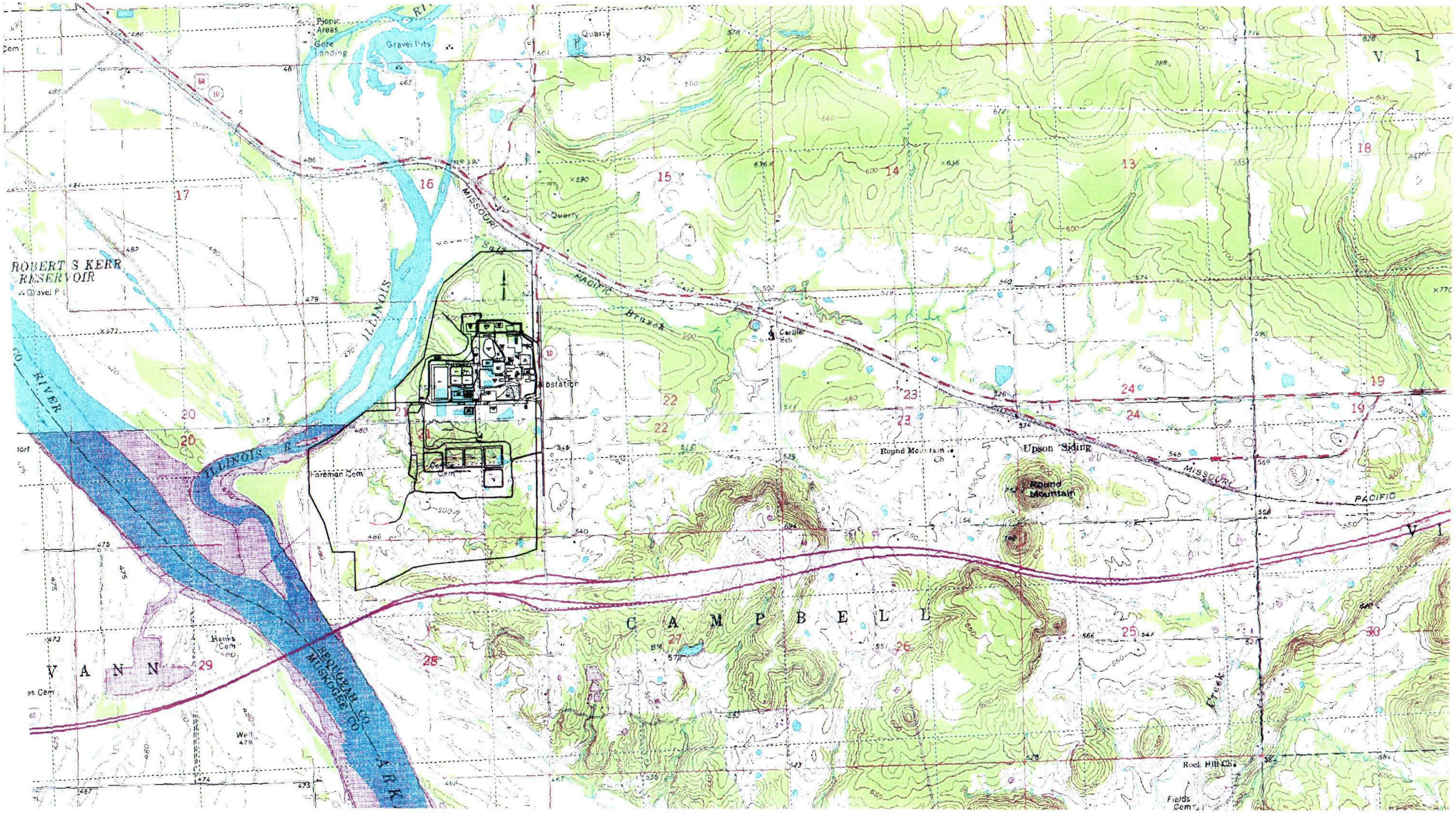

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TOPOGRAPHIC MAP C02

SEQUOYAH FUELS
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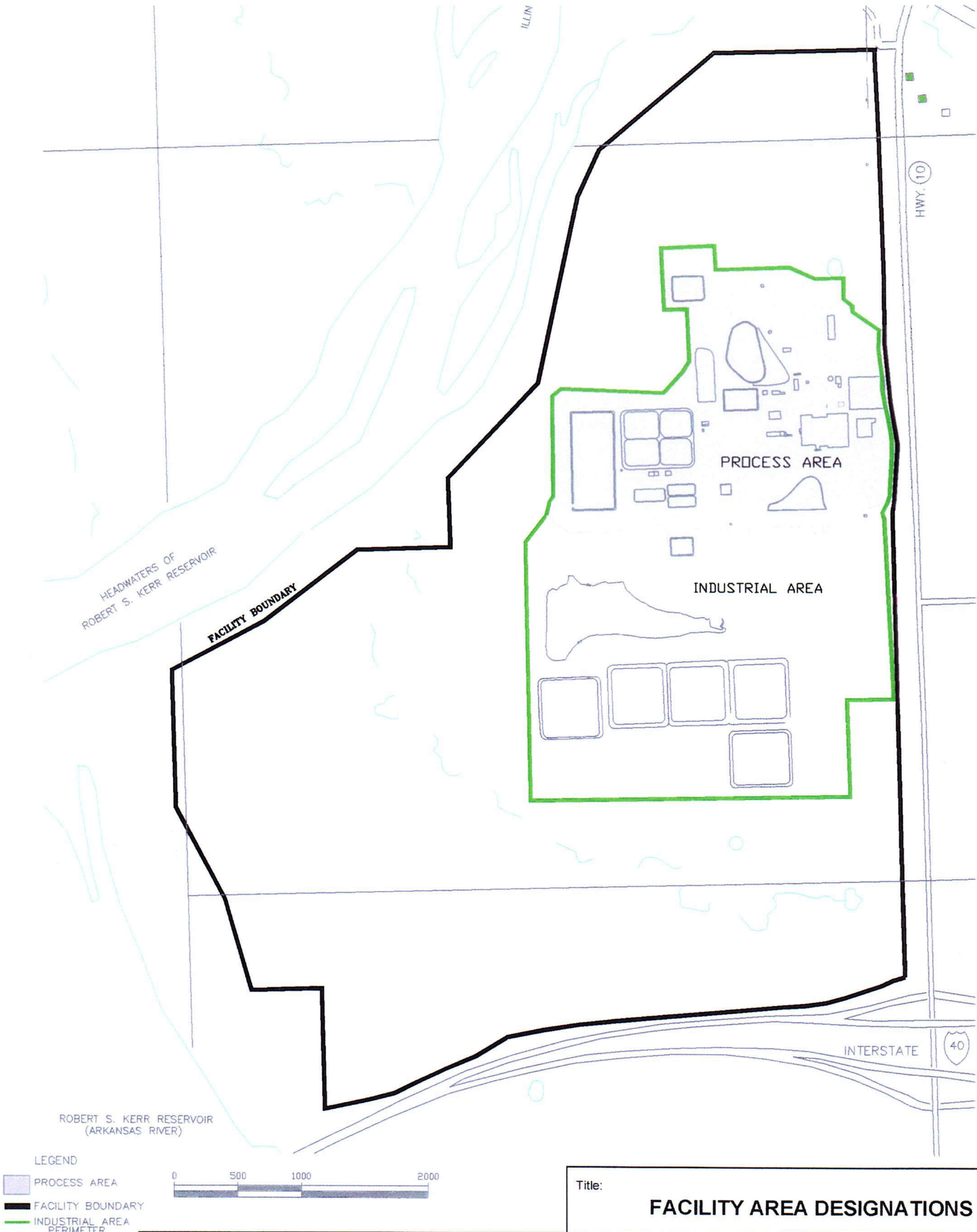
RECLAMATION PLAN

PREPARED BY: SFC	Filename: SFC0087A
Reviewed by: CH	Figure No.2-2
Date: 12/27/2002	



SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY
RECLAMATION PLAN

Title: **FACILITY AREA DESIGNATIONS**	
PREPARED BY: SFC	Filename: SFC006B
Reviewed by: CH	Figure No.2-3
Date: 12/27/2002	

C03

C04

Title:

GENERAL FACILITY LAYOUT

SEQUOYAH FUELS
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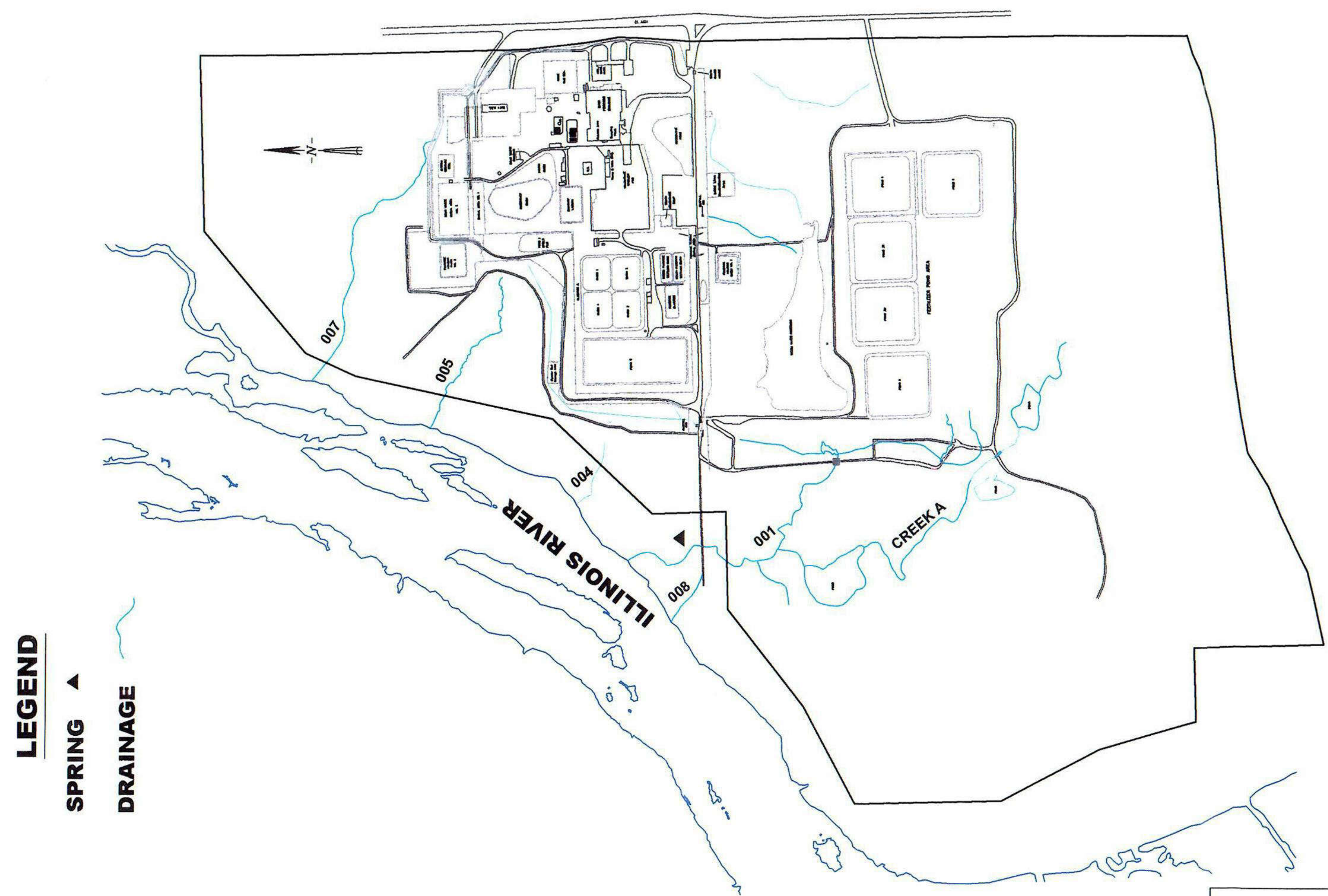
RECLAMATION PLAN

PREPARED BY: SFC	Filename: SFC0088A	
Reviewed by: CH	Figure No.2-4	
Date: 12/27/2002		



SEQUOYAH FUELS A GENERAL ATOMICS COMPANY RECLAMATION PLAN	Title: LOCATIONS OF FACILITY DRAINAGES AND SPRINGS	
	PREPARED BY: SFC	Filename: SFC0089A
	Reviewed by: CH	Figure No.2-5
	Date: 12/27/2002	

C05

3.0 FACILITY DECOMMISSIONING AND SURFACE RECLAMATION

3.1 Summary of Radiological Conditions

The Site Characterization Report (SCR) included as Appendix D, and the Facility Environmental Investigation (FEI) (RSA, 1991) provide thorough descriptions of Facility operations, along with the identification of source characteristics associated with various processes. Detailed historical information about the facility is provided in the documents listed in section 2.2.4 of the SCR. This section summarizes the extent and concentration of the contamination found during those studies.

The contamination at the Facility is a result of uranium processing activities that took place during the operation of the plant. Throughout the operating life of the plant, on-going evaluations of the impact of plant operations, including airborne and liquid discharges, and soil and groundwater sampling, occurred.

In the vicinity of the process buildings, process impoundments and uranium handling areas, concentrations of uranium in the soils exceed background and in many areas exceed the proposed soil cleanup criterion (see section 3.2.2). Uranium in soil at concentrations above 35 pCi/g is found to a maximum depth of about 31 feet beneath the Process Area. In addition, a few areas of limited extent are impacted by thorium-230 and/or radium-226. Soils containing thorium or radium in excess of the proposed limits are confined to areas where raffinate sludge was managed.

Groundwater beneath portions of the SFC site is impacted by uranium from past leaks and spills. The vertical extent of the groundwater impact is limited by an almost impervious sandstone layer, referred to as the Unit 4 Sandstone, that underlies the majority of the site. Monitoring wells in the groundwater zone immediately beneath Unit 4 Sandstone confirm that there is no significant impact below that level.

Groundwater flow on the site is generally to the southwest, conforming to the tilt of the bedrock strata in the area. Some localized areas of groundwater flow to the south and northwest have been measured, however these flows appear to be influenced by erosional features and mounding of water in the vicinity of facility impoundments.

The groundwater is not currently a threat to human health or the environment. The strategy for a groundwater protection plan will be developed under NRC guidelines as the result of a Corrective Action Assessment for the site. The groundwater protection plan is being developed and is scheduled to be completed by June, 2003.

A characterization of structures and equipment in the restricted area was performed to provide information concerning the degree of radioactive contamination and radiation levels in order to provide a basis for identifying contamination control efforts that will be required during decommissioning. The characterization data was compiled from routine and special surveys performed during 1994, 1995, and 1996.

Areas identified as impacted by operation of the SFC Facility are the Process Area, portions of the 1986 Incident Plume pathway, Fertilizer Storage Pond Area, the historic Combination Stream, a drainage pathway south of the plant entrance, the drainage pathway designated as Outfall 005, and most structures within the restricted area. Figure 2-1, Attachment B, summarizes the impacts.

3.2 Decommissioning and Reclamation Activities

Decommissioning and reclamation plans and specifications are presented in Attachment A. This section provides an overview of the activities planned during decommissioning and reclamation for the site.

3.2.1 Description of Activities and Tasks

The scope of decommissioning activities includes the dismantlement and removal of systems and equipment, the deconstruction of structures, the removal and treatment of sludges and sediments, the removal of contaminated soils, and the treatment of wastewater. The following summarizes these activities.

Structures, Systems and Equipment

A detailed volume estimate of the facility equipment and structural materials was made and the disposal volume was estimated to be 824,660 cf (after dismantlement and size reduction; 50% of the concrete left in place). This estimate was based on a review of drawings and other data for the facility structures, equipment, utilities, and concrete in order to determine the location of contamination, to understand the construction of the facility, and to facilitate planning of dismantlement methods. Appendix F describes the review described above.

The majority of the salvageable or recyclable equipment and materials have been removed and dispositioned. Only limited decontamination of materials for unconditional release is planned. All remaining equipment and structures will be dismantled and size reduced, as necessary. The dismantled equipment and structural components will be placed into the cell. Concrete and asphalt will be broken into manageable pieces and placed in the cell.

Soils, Sediments and Sludges

Raffinate Sludge

The raffinate sludge contains a significant fraction of the radionuclides presently on the SFC site (34% of the uranium or 60,800 kg, 76% of the thorium 230 or 156 Ci, and 38% of the radium 226 or 1.1 Ci.). This raffinate sludge is currently contained in Clarifier Basin A. The sludge will be removed from the basin and processed to reduce the water content.

The de-watering method will utilize a rotary vacuum drum filter to remove free water from the sludge. At 50% reduction in the weight, approximately 20,000 tons of de-watered sludge will be produced. The de-watered sludge will be placed in water-tight polypropylene bags for placement into the disposal cell.

Raffinate sludge will be the first Layer A material to be placed in the cell. After preparation of the cell location, (including emptying the Emergency Basin and North Ditch and placement of compacted backfill in these areas) a clay liner and retention dike sufficient to hold all to the raffinate sludge will be constructed. The sludge will be covered with a synthetic material to prevent rainwater intrusion as it is placed.

<u>Calcium Fluoride (CaF_2) Sludge</u>

Calcium fluoride (CaF_2) sludge will be stabilized to improve its structural strength and to reduce leachability of contained uranium by adding flyash prior to placement into the disposal cell.

<u>Sediments</u>

Sediments from the Emergency Basin, North Ditch and Sanitary Lagoon will be stabilized to improve its structural strength and to reduce leachability of contained uranium by adding flyash prior to placement into the disposal cell.

<u>Soils</u>

Soils outside the footprint of the disposal cell which contain uranium, radium, or thorium in excess of the proposed site-specific cleanup criteria will be excavated and placed in the disposal cell. This volume is estimated to range from 0.5 to 3.0 million cf depending on the final soil cleanup criteria that is selected. At a minimum, soils under the footprint of the disposal cell that exceed 560 pCi/g uranium (the concentration that would result in an equivalent dose from Ra-226 at 5 pCi/g) will also be excavated, treated as necessary, and placed in the cell. The volume of these soils is estimated to be about 345,000 cf. A temporary staging area would be established for containing the "footprint" soils until the disposal cell is readied for use. The depth of excavation will be based initially on soil sampling data from characterization studies. Follow-up sampling will be done to determine if additional excavation is required, and to demonstrate that the cleanup criteria have been satisfied.

Additional soil will be excavated, most likely to the soil/bedrock interface, in those areas where the uranium concentration in the perched groundwater is elevated in excess of 150 pCi/l (the SFC license action level, 225 µg/l). This would be done to facilitate the removal and treatment of the impacted perched groundwater. It is likely that some of the soils in the areas of perched groundwater impact contain uranium in the forms of uranyl nitrate and related compounds, which are much more soluble than the oxide forms. Soil washing or stabilization prior to disposal will be considered for these soils to reduce the uranium content and mobility. Technical and economic evaluations will be used to determine the final treatment.

Soils collected from prior cleanup activities that are presently located in the Interim Storage Cell and in the Pond 1 Spoils Pile will also be removed and placed in the disposal cell. These materials have a volume of about 578,000 cf. An additional 952,000 cf of potentially contaminated clay and soil lies beneath the facility ponds, basins and clarifiers. The fraction of this soil exceeding the applicable cleanup criteria is expected to be less than 10% of the total volume, or 95,200 cf.

Soils from excavation areas will be transported to stockpiles or to the disposal cell by haul trucks for long distances, or loaders for shorter distances. Existing roads will be used as much as possible; new haul roads will be constructed only if necessary.

Soils that do not require treatment will be placed into the cell in 10 – 12 inch lifts and mechanically compacted according to design requirements. Placement of this material will be sequenced with other materials to assure stability of the cell, to minimize voids and settlement, to limit leaching and to further restrict the emanation of radon from the cell.

Exact placement sequences and criteria will be developed during the disposal cell detailed design phase.

Wastewater Management

Wastewater includes water from existing ponds and impoundments, storm water runoff from work areas, water used for processing operations, (such as soil washing), and recovered groundwater.

The Wastewater Treatment System, located south of the Clarifier Basins (Figure 2-4) is designed for batch treatment of wastewater to remove uranium. The system utilizes precipitation, filtration, and ion exchange processes to remove uranium prior to release of the water.

Treated water will be sampled and analyzed for uranium prior to discharge through permitted outfall 001. The cleanup goal for the Wastewater Treatment System is to reduce the uranium concentration to less than 30 µg/l, the drinking water MCL.

Site Restoration

After the removal of systems and equipment, structures, and soils and sediments, the site will be restored by backfilling (if necessary), grading and seeding with vegetation.

3.2.2 Cleanup Levels

The cleanup levels for this reclamation plan were either specified by regulations, or derived using guidance provided by the NRC. 10 CFR 40, Appendix A, Criterion 6 (6) limits the concentration of Ra-226 in soil, and concentrations of other radionuclides in soil based on the equivalent dose from Ra-226. Derived concentration guideline levels (DCGL) have been developed as concentrations of residual radioactivity in soils that are equivalent to the Ra-226 concentration. The detailed dose modeling is presented in Appendix G. The approach used is summarized here. Cleanup levels were subsequently chosen based on the DCGLs, application of the ALARA principle, and the limiting conditions of 10 CFR 40, Appendix A, Criterion 6 (6).

Identification of Constituents of Concern (CoC)

The CoCs were determined to be natural uranium and associated transformation products, thorium-230, and radium-226.

Exposure Methodology

The dose from residual radioactivity was determined by constructing a source term and exposure scenario, and using a computer model to simulate the release and transport of radionuclides and radiation in the environment on a site-specific basis. The assessment reflected the site-specific characteristics of the residual radioactivity (e.g. type, extent, concentration) and of the environment (e.g. soil, surface water, groundwater, and air) at the site. Exposure pathways relevant to the exposure scenario were chosen based on this information. The source term and exposure scenario are described in the following sections.

The dose was determined first for a Ra-226 concentration in surface soil of 5 pCi/g. This Ra-226 dose is hereafter referred to as the benchmark dose. The residual concentration in surface soil was subsequently determined for each of natural uranium and thorium-230 that resulted in a dose equal to the benchmark dose.

Source Term

The source term was assumed to be an uncovered contaminated surface soil zone of cylindrical shape. The CoCs for the benchmark dose are Ra-226 and Pb-210 each at 5 pCi/g. The CoCs are assumed homogeneously distributed within the contaminated zone. The contaminated zone is modeled as a 0.3 meter layer of unconsolidated soil. The contaminated soil is known to be underlain by one uncontaminated unsaturated zone; this zone is modeled as a 1.4 meter thick layer of unconsolidated soil. The next layer is an uncontaminated saturated zone; this zone is modeled as shale. The final layer is sandstone; this layer functions as an aquitard and is not included in the model. The relationship between Facility conditions and the source term parameters, and the physical characteristics (density, porosity, ...) of each layer are described in Appendix G.

Exposure Scenario

The exposure scenario modeled here, representing a residential farmer, is comprised of direct exposure to external radiation and inhalation and ingestion of radioactive material to an individual who lives on the site and ingests food grown on the site. The scenario is based on prudently conservative assumptions that tend to overestimate potential doses. The scenario assumes that an individual had access to the restricted area but would not disturb the disposal cell. The model used to assess the dose to the residential farmer was the RESRAD computer code version 5.82. The residential farmer scenario is very conservative since the DOE will restrict access and land use in the reclaimed area, but considered to be a possibility if all controls failed.

Three primary exposure pathways were not considered. The rationale for excluding each is summarized as follows:

<u>Drinking Water</u>

The scenario assumes that readily available, nearby surface water is used for drinking and for irrigation. Use of groundwater is not considered because of the limited quantity and generally poor quality encountered near the SFC site.

A separate groundwater corrective action plan will be developed to address groundwater. By regulation, that plan must include engineering and/or institutional controls that will be protective of human health and the environment. The plan will ensure that concentrations of groundwater at all locations outside the institutional control boundary, where it would be possible for groundwater to be accessed, will be acceptable for all potential future uses including human consumption. The alternatives for the plan will include active, passive and institutional control mechanisms.

The groundwater protection plan is being developed and is scheduled to be completed by June 15, 2003.

Cell Intrusion

Development of the DCGLs did not consider failure or intrusion of the cell's engineered cover. The cover is designed such that failure is not a credible event. DOE will ultimately take control of the site as long term custodian and will prevent any unauthorized intrusion into the cell.

Radon

The radon pathway was not considered because it is specifically excluded from the scope of the technical criteria.

Selection of Cleanup Levels

The benchmark dose resulting from the exposure scenario described above was 54 mrem per year to the resident farmer. The DCGLs in surface soil for U-natural and Th-230 that result in 54 mrem/y for the same exposure scenario are 540 pCi/g and 64 pCi/g, respectively.

The technical criteria provide limits for Ra-226 in soil. Specifically, the concentration of Ra-226 in soil, averaged over areas of 100 square meters, cannot exceed the background level by more than: (i) 5 pCi/g averaged over the first 15 cm below surface, and (ii) 15 pCi/g averaged over 15 cm thick layers more than 15 cm below the surface. Application of the technical criteria includes consideration of the in-growth of Ra-226 from Th-230 over a 1000-year design period. The Th-230 concentration is limited such that it will not cause any $100m^2$ area to exceed the Ra-226 limit at 1000 years (i.e. current concentration of Th-230 is less than 14 pCi/g surface and 43 pCi/g subsurface, if Ra-226 is at approximately background levels).

Cleanup levels have been selected based on the ALARA principle, and regulatory requirement. Cleanup levels for uranium and thorium have been set at concentrations that are much lower than the DCGLs and correspond to doses the are less than the unrestricted release criteria in 10 CFR 20. Cleanup levels for radium have been set at the regulatory limit. Table 3-1 presents the DCGLs and the cleanup levels.

Table 3-1 Derived Concentration Guideline Levels (DCGL) and Cleanup Levels (CL)

Condition	Uranium-Nat pCi/g	Thorium-230 pCi/g*	Radium-226 pCi/g*
DCGL	540	64	5.0 / 15
CL	100	14 / 43	5 / 15

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

The cleanup levels will be applied exclusive of background.

The subsurface cleanup level will be applied to small areas on site where Th-230 and Ra-226 are present as contaminants. These areas are depicted in Figure 2-1 of Attachment B as the Th-Ra areas. In these areas, uranium, thorium, and radium will be considered in combination to ensure that the dose criteria is met; i.e. the sum of ratios for the concentration of each radionuclide present to the respective cleanup level concentration will not exceed one (unity). At least 0.5 foot and likely several feet of clean fill will be placed over these areas following decontamination. The clean fill is expected to remain in place for the foreseeable future after reclamation.

In areas where radium and thorium are not present, the uranium cleanup level will be used.

Dose Assessment

Inside the ICB and using the DCGLs for radium, thorium, and uranium developed in Appendix G, the dose to a person carrying out authorized activities is estimated to be less than 2 mrem/y. For a resident farmer intruder inside the ICB (equivalent to loss of institutional control scenario in 10 CFR 20.1403) the dose will be 54 mrem/y, the SFC site radium benchmark dose. Utilizing the cleanup levels listed in Table 3-1, the dose rate to the industrial worker and the resident farmer would be approximately 20% of the radium benchmark dose or 0.4 mrem/y and 11 mrem/y, respectively.

As demonstrated in Appendix G, the dose to a member of the public from contamination that is presently in the drainages that exit the ICB and cross U.S. Army Corps of Engineers property (drainages 001, 005, and 007) is less than 0.2 mrem/y.

3.2.3 Final Status Survey

The final status surveys will be designed from the guidance contained in NUREG-1575 "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM) and the requirements of 10 CFR 40, Appendix A, Criterion 6 (6). The surveys will demonstrate that the residual radioactivity in each survey unit satisfies the applicable criteria described in Section 3.2.2.

The survey designs will begin with the development of data quality objectives (DQOs). The DQOs will be developed using guidance provided on the DQO Process in Appendix D of MARSSIM. On the basis of these objectives and the known or anticipated radiological conditions at the site, the numbers and locations of measurement and sampling points used to demonstrate compliance with the release criterion will be determined. Finally, survey techniques appropriate for development of adequate data will be selected and implemented. The final status survey plan is presented in Attachment B.

3.3 Disposal Cell Design

The preliminary disposal cell design is presented in Appendix C, Preliminary Design Report for the Disposal Cell at the Sequoyah Fuels Corporation Facility, based on the design criteria and strategy outlined in Section 1.3. The various calculations and analyses are presented in Appendix C. This preliminary design is described in the following subsections.

3.3.1 Site Selection

SFC evaluated four possible locations within its property boundary for siting the disposal cell. All four locations were found to be acceptable, each having strengths and weaknesses. The Process Area location was chosen as the best option due to proximity to materials destined for disposal, pre-existing contamination of the sub-surface, and reduced material handling costs. Appendix H presents the siting evaluation.

3.3.2 Layout and Capacity

The disposal cell layout consists of a four-sided domed structure to contain the disposed materials beneath a soil cover. The top surface of the structure drains to the southeast (the corner with the highest ground surface elevation) at a one-percent slope. The direction of top surface drainage was chosen to be toward the highest ground elevation and away from the west side of the cell. The side slopes of the cell are at 5:1 (20 percent), the maximum slope under NRC reclamation criteria.

The disposal cell layout for the estimated 8.3 million cubic feet of disposed materials (Table 3-2) is shown on Figure 3-1. Due to the variability in disposed material density and the amount of soils that may actually be excavated, the disposal cell location and layout has been planned to accommodate a range of disposed material volumes from 5 million to 12 million cubic feet. For this range of disposal volumes, the north and west sides remain in the same location and with the same height, while the location of the south and east sides are adjusted. A typical cross section through the disposal cell (for any of these volumes) is shown in Figure 3-2.

3.3.3 Cover System

The disposal cell cover design is a homogeneous, (store-and-deplete) cover with a vegetated surface. The cover is designed to promote long-term vegetative growth that optimizes evapotranspiration and subsequently minimizes infiltration. Based on preliminary analyses, this homogeneous cover would be ten feet thick for optimal root zone development and sufficient for radon attenuation. A ten-foot thickness was used for volume estimates, and is shown in Figure 3-2. This ten-foot thickness includes a rock mulch zone overlain by an 18-inch thick topsoil layer at the cover surface.

The upper 18 inches of the cover system consists of an erosion protection and vegetation zone. On the top surface, the upper 18 inches of the cover thickness consists of a topsoil layer. On the side slopes, the upper 18 inches consists of a 12-inch thick topsoil layer above a six-inch thick rock mulch layer. The cover surface will be vegetated, with the long-term vegetation being a native grassland and forest system. The remaining 8.5-foot thickness of the cover system will consist of on-site soils to provide a root zone and moisture retention zone for infiltrating meteoric water.

The reduction in emanation of radon-222 from disposed materials by the cover system was evaluated using calculation procedures outlined in NUREG 3.64. The evaluation results show that the cover system and sequence of disposed material placement in the cell reduces the average rate of radon-222 emanation to below the limit of 20 pCi/square meter-second (from Appendix A of 10 CFR 40).

The radon emanation calculations used the RADON model, with conservative parameters for the cover system and disposed materials. Maximum ingrowth from thorium-230 to radium-226 under long-term conditions was included as input for the disposed materials in the calculations.

3.3.4 Perimeter Area

The disposal cell perimeter will transition into the surrounding reclaimed site topography such that drainage from the toe of the side slopes is conveyed away from the cell. Outside the toe of the side slopes will be a 20-foot wide perimeter apron, consisting of the same topsoil and rock mulch layers as on the side slopes.

3.3.5 Erosional Stability

The erosional stability of the disposal cell design was evaluated according to procedures outlined in NRC guidance. The disposal cell surface was evaluated for peak runoff from the Probable Maximum Precipitation (PMP) event. The calculated velocity from the peak runoff was compared with acceptable, non-erosive velocities on the top surface and side slopes of the disposal cell.

On the top surface of the disposal cell, the one-percent slope with vegetated surface conditions provides sufficient resistance to erosion, even under conservative, poor vegetation conditions. On the side slopes of the disposal cell, flow velocities down the 5:1 slopes require rock for erosion protection from PMP runoff. The selected protection is a layer of rock mulch with a median particle size of 3.2 inches (sized for the peak flow from the PMP). In order to promote vegetative growth on the side slopes, the rock mulch layer will be at the base of the topsoil layer. The same protective layer will be extended 20 feet from the toe of the side slopes for a perimeter.

3.3.6 Slope Stability

The slope stability of the disposal cell was evaluated under static and seismic conditions according to standard criteria outlined in NRC guidance. The stability analysis results are presented as calculated factors of safety, which are compared with accepted minimum factors of safety. The analysis results under static conditions show that calculated factors of safety are higher than the minimum long-term value of 1.5. The analysis results under seismic conditions (represented by pseudostatic analyses) show that calculated factors of safety are higher than the minimum value of 1.1. The stability analyses were conducted using conservative input values for material shear strength and density.

3.3.7 Meteoric Water Infiltration

Infiltration of meteoric water and moisture migration through the cover system was evaluated using the TerreSIM model, an MFG model used for land use and ecosystem evaluation. The TerreSIM model uses a detailed method of tracking evapotranspiration and plant canopy evaporation, based on specific plant communities. Modeling was conducted under average climatic conditions for a simulation period of 200 years. The average rate of migration of meteoric water through the bottom of the cover was calculated to be approximately 7.8 inches/year or 17 percent of annual precipitation, for the first 45 years of simulation. For the next 155 years of simulation (after full development of the plant community), the calculated rate of migration through the cover was essentially zero.

The synthetic liner materials in ponds on site are planned for re-use by placement within the layers of disposed materials in the disposal cell. The synthetic liner will be spread, overlapped, and covered to provide a liner system to intercept downward-migrating moisture from the cover system. Therefore for short-term conditions, the synthetic liner would limit moisture migration through the disposed materials. For long-term conditions (after establishment of mature vegetation on the cover), moisture migration from the bottom of the cover is limited by the cover itself. From the modeling under long-term conditions described above, the rate of moisture migration out of the cover is negligible.

3.4 Disposal Cell Construction

The strategy for disposal cell construction (from the base of the facility to the bottom of the cover system) is outlined in the following subsections.

3.4.1 Construction Materials

In the preliminary disposal cell design, materials have been grouped together by radioactivity content for disposal sequencing to minimize leaching, and optimize shielding and radon attenuation. These groups or layers are summarized in Table 3-2. These groups are referred to as Layers A through D which are generally described below.

Layer A. Layer A materials consist of five components: (1) raffinate sludge, (2) Pond 2 residual materials, (3) Emergency Basin sediment, (4) North Ditch sediment, and (5) Sanitary Lagoon sediment.

Due to the relatively high activity concentration of radionuclides in Layer A materials, these materials would be the lowest layer in the disposal cell profile and would be placed over a prepared native clay liner. In terms of estimated volume, raffinate sludge comprises most of the Layer A materials (60 percent), followed by Pond 2 residual materials (36 percent), and the remaining sediments (totaling 4 percent).

Layer B. Layer B materials consist of soil liner and subsoil materials beneath the clarifier, the calcium fluoride basins, Pond 3E, the Emergency Basin, the North Ditch and the Sanitary Lagoon, as well as Pond 1 spoils pile material. The Layer B materials (primarily contaminated soils) are listed second in the order, since they would be excavated after removal of Layer A materials and placed directly on top of Layer A materials in the disposal cell profile. In terms of estimated volume, the Pond 1 spoils pile (35 percent), clarifier liners (26 percent), and Emergency Basin soils (13 percent) comprise approximately 74 percent of the Layer B materials.

Layer C. Layer C materials consist of structural materials, concrete and asphalt, calcium fluoride basin materials, calcium fluoride sediments, and on-site buried materials. These materials would be placed above the Layer B materials, and covered with contaminated soils (Layer D materials). In terms of estimated volume, the calcium fluoride sediments (35 percent), structural materials (32 percent) and concrete and asphalt (14 percent) comprise approximately 81 percent of the Layer C materials.

Layer D. Layer D materials consist of contaminated soils and sedimentary rock that require cleanup. The cleanup level used for the estimated volume is a natural uranium activity concentration of 27 pCi/g.

The total layer material volumes estimated for each layer are presented in Table 3-2 below, in order of placement from bottom to top within the cell.

Table 3-2 Disposed Material Summary

Layer	Description	Estimated Volume (cu ft)	Fraction of Total Volume (%)	Natural Uranium (pCi/g)	Radium-226 (pCi/g)	Thorium-230 (pCi/g)
A	Sludge and sediment	1,744,735	21.2	357-12100	6-332	211-16300
B	Liner soils and subsoils	1,262,673	15.1	5-95	0.5-2.1	47-70
C	Calcium fluoride sediments, debris	1,764,067	21.0	168-520	0.2-0.8	2.1-4.8
D	Contaminated site soils	3,574,000	42.7	250	--	--
Totals		8,345,475	100.0	--	--	--

As mentioned in Section 3.3.7, the synthetic liner material from the ponds on site will be removed and incorporated into the disposal material layer sequence. The liner material placement will be above the Layer C materials, within the Layer D materials.

3.4.2 Construction Sequence

In conjunction with the overall sequence and water management strategy above, the anticipated construction sequence for the disposal is outlined below.

1. Setup of the soil stockpiling and washing area (if necessary) in the yellowcake storage pad.
2. Removal of sediment and underlying subsoils from the emergency basin, north ditch, and sanitary lagoon (Layer A and Layer B materials). These materials would require temporary stockpiling.
3. Removal of contaminated soils from the footprint of the disposal cell, particularly where the lined area will be. This would include excavation of utility trenches and removal of piping and conduit under the cell footprint. These soils would require temporary stockpiling.
4. Backfilling and compaction of excavations under cell footprint.
5. Preparation of the lined area within the disposal cell.

6. Placement of Layer A materials within the lined area of the disposal cell. This would include the stockpiled materials from the emergency basin, north ditch, and sanitary lagoon, as well as Pond 2 residual material and raffinate sludge.

7. Cleaning and removal of and temporary stockpiling of synthetic liners from raffinate sludge ponds.

8. Excavation of remaining liner soils and subsoils from Layer A ponds and Pond 1 Spoils Pile materials, and placement on top of Layer A materials in the disposal cell. (Layer B Materials)

9. Preparation of remaining areas of the disposal cell for fill placement.

10. Excavation of remaining Layer D materials and placement in the disposal cell.

11. Removal of structural materials, and placement in the disposal cell. Backfilling to fill voids would be done with layer C and D soils and soil-like materials.

12. Excavation of remaining contaminated soils, with disposal cell footprint adjusted to the east and south as necessary (based on contaminated soil volume).

13. Cover construction.

3.5 Disposal Cell Cover Construction

The cover system over the disposal cell consists of a 10-foot thick soil cover on both the top surface and side slopes of the cell. This cover system is summarized in Figure 3-2, Typical Cross-Section on East Side of Disposal Cell.

3.5.1 Construction Materials

The disposal cell cover construction materials are discussed in Appendix C. The material quantities are outlined below.

Cover system materials. The cover material volume (for the 10-foot thick cover) totals approximately 258,700 cubic yards. Significantly more material is available on site than is required for the cover material.

Topsoil. As mentioned above, approximately 35,400 cubic yards of topsoil would be required for the cover, and 4,000 cubic yards for the perimeter apron. Sufficient topsoil is available for this volume (and additional volume) from the agland area.

Rock mulch. The rock mulch volume totals 8,000 cubic yards for the cell cover and 2,000 cubic yards for the perimeter apron. Rock mulch material would be obtained from off-site sources.

Cover subsoil materials. The remaining cover material volume (subtracting the topsoil and rock mulch) is approximately 215,300 cubic yards, for the layout shown on the drawings. The likely sources of this material would be the tornado berm and settling pond berm materials.

Synthethic liner materials. Synthetic liner materials from existing impoundments on the site will be salvaged for use under the Cover. An estimated 13 acres of liner material out of the 23 acres available will be needed.

3.5.2 Construction Sequence

The anticipated construction sequence for the disposal cell cover is outlined below.

1. Construction of the cover on the north and west sides of the disposal cell. The cover material could be placed in horizontal lifts or lifts parallel to the outside 5:1 slopes. The rock mulch and topsoil would be placed as cover areas are completed to final elevations and grades.

2. Cover material placement is planned to minimize voids and future differential settlement. Placement in lifts with a method compaction specification is planned, based on the anticipated type of construction equipment.

3. Construction of the cover over completed areas of the cell, with the south and east sides of the cell established after the volume of contaminated soils has been established.

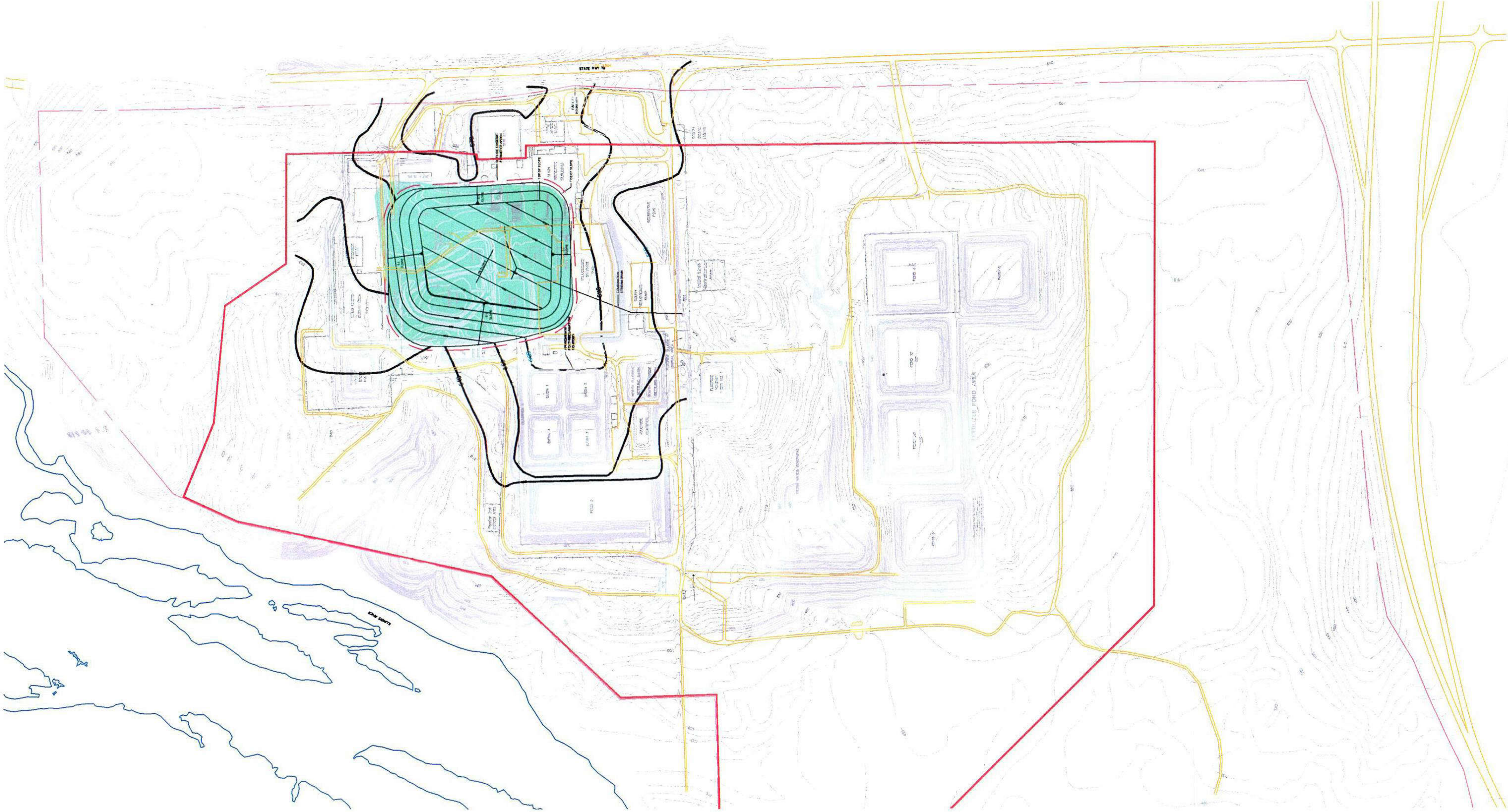
4. Transition of the perimeter apron of the disposal cell with surrounding reclaimed topography to promote runoff away from the disposal cell.

5. Establishment of vegetation on the disposal cell surface, consistent with the overall plan for mature vegetation development.

3.6 Institutional Control

Following successful completion of performance monitoring, the custody of the site will be transferred to the U.S. Department of Energy pursuant to the provisions of 10 CFR 40.28.

SFC will establish and fence the ICB to limit unauthorized access. Activities within the institutional control boundary are only those authorized by the DOE or its contractors, such as monitoring or maintenance. The proposed institutional control boundary for the SFC facility after reclamation is shown on Figure 3-1.



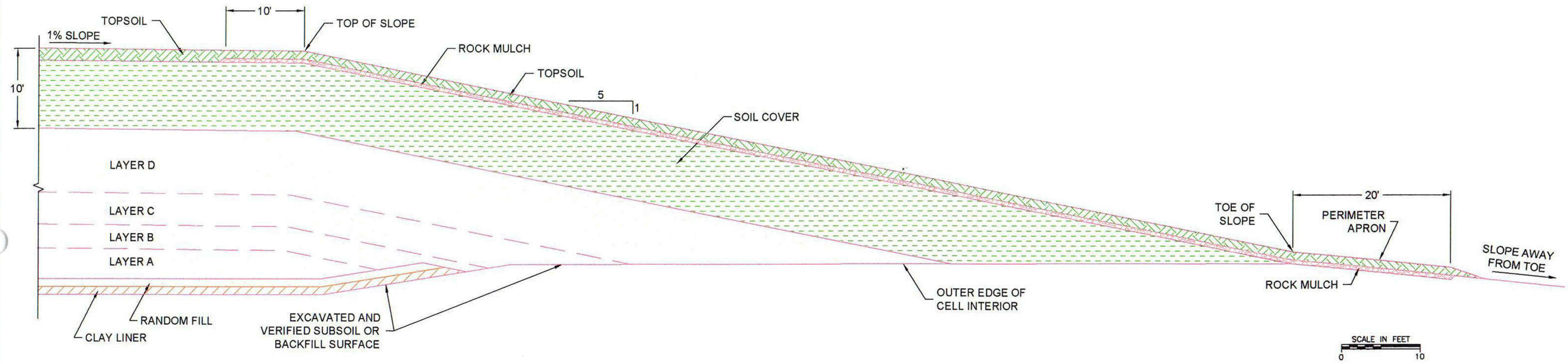
CELL OUTLINE

ICB

SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY
RECLAMATION PLAN

Title: DISPOSAL CELL LOCATION AND LAYOUT		
PREPARED BY: SFC	Filename: SFC0091A	
Reviewed by: CH	Figure No.3-1	
Date: 12/27/2002		

C06



C07

Title: TYPICAL CROSS SECTION ON EAST SIDE OF DISPOSAL CELL

SEQUOYAH FUELS A GENERAL ATOMICS COMPANY RECLAMATION PLAN	PREPARED BY: SFC	Filename: SFC0090A
	Reviewed by: CH	Figure No.3-2
	Date: 12/27/2002	

4.0 QUALITY ASSURANCE

The quality assurance program for the decommissioning and reclamation is presented in Attachment C.

5.0 RADIATION PROTECTION

5.1 Cover Radon, Gamma Attenuation and Radioactivity Content

5.1.1 Radon Emanation

The disposal cell cover has been designed to limit the rate of emanation of radon-222 to the NRC technical criterion limit of 20 pCi/square meter-second, averaged over the entire cover as outlined in 10 CFR 40, Appendix A, Criterion 6. The disposal cell cover and underlying disposed materials were evaluated according to NRC guidelines, using the RADON model. The evaluation results (outlined in Appendix D of the disposal cell preliminary design report) show calculated radon emanation rates below the 20 pCi/square meter-second limit, under conservative input conditions.

As a confirmation of the cover evaluation for radon emanation, the actual rate of radon emanation will be measured after disposal cell cover construction is completed. Measurement of radon emanation will be conducted according to EPA procedures outlined in 40 CFR 61, Subpart T, Method 115. This consists of measuring radon emanation at a minimum of 100 locations on the cover surface, using canisters containing activated charcoal. The canisters are set on the cover surface for 24 hours, with the charcoal subsequently analyzed for adsorbed radon with gamma spectroscopy. The individual measured values are converted to an emanation rate at each canister location, and these rates are used to calculate an average for the entire cover surface.

5.1.2 Gamma Attenuation

The gamma radiation exposure was estimated at the surface of the disposal cell cover. The effect of a soil cover in reducing exposure from a gamma radiation source is calculated as the ratio of the shielded exposure rate to the unshielded exposure rate. Using coefficients for soil, the shielded exposure rate is approximately $1/10^9$ of the unshielded rate at a soil cover of ten feet which is essentially background. The calculations show that gamma radiation exposure is significantly reduced by a small thickness of soil cover.

5.1.3 Cover Radioactivity

The on-site borrow areas planned for disposal cell cover material have been chosen to provide the physical properties desired for the cover, including a moisture retention zone for evapotranspiration and material to attenuate emanating radon. These borrow areas have been selected to provide soils that are of similar radiological characteristics to native soils in the site area. This means that borrow area soils would have a radium-226 activity concentration within 5 pCi/g of background values on site, analogous to site soil cleanup criteria for uranium mill sites in 40 CFR 192.

5.2 Radiation Safety Controls and Monitoring

A Radiation Safety Program describing measures to protect workers, the public, and the environment will be maintained and followed during decommissioning and reclamation. In recognition that the amount of radioactivity and therefore associated hazards will be reduced as the project progresses, the Radiation Safety Program may be modified commensurate with the activities being performed. SFC will review and approve the Radiation Safety Program, and any revisions that are made during the project. Any such adjustment to the requirements of the Radiation Safety Program shall be made in accordance with document control procedures. Attachment D presents the Radiation Protection Program.

6.0 CELL PERFORMANCE MONITORING AND VERIFICATION

The performance monitoring and verification tasks for the disposal cell are consistent with plans for overall site reclamation and review guidelines in NRC (2002). Key tasks are outlined in the following subsections, and address the period of time from site reclamation until property transfer to the U.S. Department of Energy.

6.1 Settlement

Since the disposal materials will be placed in lifts with compaction to minimize void spaces, cover settlement will not be as critical an issue as for uranium tailings impoundments. However, settlement will be monitored with survey monuments installed on a grid system on the cover surface. The monuments will be surveyed on a quarterly basis until four quarters of stable conditions (less than 0.1 foot of settlement per quarter) are measured.

6.2 Vegetative Cover

A vegetation plan will be prepared for the disposal cell surface outlining the initial and mature species desired for the cell and the schedule and methods planned for achieving the mature vegetation (such as transplanting of seedlings and institution of weed control). After establishment of the initial vegetation on the cover surface, the condition of the initial vegetation will be monitored for comparison with the schedule in the vegetation plan. The vegetation performance will be monitored until that responsibility is changed with property transfer to the U.S. Department of Energy.

6.3 Erosional Stability

The erosional stability of the cover surface will be monitored on a semi-annual basis, most likely at the same time as vegetation monitoring. Elements of the erosional stability monitoring are degree of vegetation cover (in terms of surface coverage), identification of settled or ponded areas (such as on the top surface), and identification of rills, gullys, or other areas of runoff concentration. Problem areas that are identified will be monitored to determine if corrective action is necessary. Corrective action would include fill placement with topsoil or placement of erosion-resistant materials on the surface, such as rock mulch.

6.4 Groundwater Protection

The strategy for a groundwater protection plan will be developed under NRC guidelines as the result of a Corrective Action Assessment for the site. This will be developed independently of the disposal cell design.

7.0 DECOMMISSIONING AND RECLAMATION COST

The costs associated with SFC's proposed decommissioning approach, as presented in Table 7-1, only reflect the direct costs for performing the various decommissioning activities. Costs that are included as direct costs include those associated with engineering, design and construction; excavation and handling of material; backfilling excavated areas; deconstruction of buildings, structures, and equipment; sludge and sediment treatment; cell filling; cell closure; wastewater handling and treatment; monitoring during remediation; and post-remediation monitoring, maintenance and security. General and Administrative costs such as SFC overhead, license and permit fees, taxes, routine environmental monitoring costs, etc., are not included.

The funding plan and assurance for the funds for decommissioning has been addressed by the settlement agreement between the NRC and SFC which was approved by the Commission on October 8, 1997 (CLI 97-13). SFC provided a decommissioning cash flow projection to the NRC on February 25, 1997 based on available decommissioning cost and schedule information, and has updated the cash flow projection several times since. The projection indicates that SFC will receive sufficient revenue to implement this reclamation plan provided that significant delays in the overall schedule do not occur. Table 7-2 provides the most recent estimate of decommissioning cash flow.

Table 7-1 Estimated Remaining Direct Costs For Proposed Decommissioning Approach

Activity	Direct Cost[1] ($,000)	Notes
1. Complete Reclamation Plan and Supporting Documents	750	Includes Preparation of Reclamation Plan, Groundwater Monitoring Plan, Groundwater Corrective Action Plan and Alternate Concentration Limit Application and Responses to RAIs
2. NRC Charges for Reclamation Plan Review, EIS Preparation and Inspection Fees	950	$600,000 to complete EIS and review and approve Reclamation Plan plus $50,000 per year average for site inspection for 7 years.
3. Contractor mobilization and demobilization	754	M-K Estimate Based on Mill Tailings Closures
4. Monitoring Well Removal and Replacement	750	Abandon and plug 200 wells @ $3,000 each, install 25 new wells @ $6,000 each
5. Disposal Cell Construction/Closure	1,028	Based on S-M estimate for a 17.8 acre vegetated thick soil cover @ $863,000 plus a plus 55,000 yd of compacted clay base liner and berm @ $3.00 yd
6. Sludge, Removal, Treatment and Disposal	5,780	2,765,553 cf of sludges etc. to be excavated, treated and placed in the disposal cell at a cost of $2.09/cf
7. Soil Remediation	1,418	Appendix I, Table 10-1, Item 200 Total adjusted for remediation of 434.000 cf of soil (>100 pCiU/g) (includes cost of cell placement). Unit costs are from Table 10-1 of M-K Report in Appendix I. DUF4 Trash Drums 2,200 cf @ $12.05 = $ 26,512 Soils > 100 pCiU/gm 434,000 cf @ $ 0.56 = $ 243,040 CaF2 Basin Clay Liners 95,290 cf @ $ 0.66 = $ 62,891 Solid Waste Burials 51,100 cf @ $ 1.46 = $ 74,688 Pond 1 Spoils Pile 437,000 cf @ $ 0.66 = $ 288,420 Interim Soils Storage Cell 154,887 cf @ $ 0.66 = $ 102,411 Pond 3E and 4 Clay Liners 219,100 cf @ $ 0.79 = $ 173,089 Clarifier Clay Liners 332,400 cf @ $ 0.66 = $ 219,384 Drummed LLW 4,050 cf @ 12.05 = $ 48,812 Sanitary Lagoon Soil 56,400 cf @ $ 0.66 = $ 37,290 Emergency Basin Soil 162,500 cf @ $ 0.66 = $ 107,250 North Ditch Soil 87,500 cf @ $ 0.66 = $ 57,750 Crushed Drums 2,000 cf @ $ 0.85 = $ 1,694 Total 2,038,427 cf @ $ 0.72 = $1,418,285
8. Building and Equip. Demolition	5,452	B&W base cost estimate plus 25%, Appendix H, page H-6.
9. Termination Survey	125	1,000 soil samples @ $100 each plus gamma walkover survey – 500 hours @ $50/hr

Activity	Direct Cost[1] ($,000)	Notes
10. Site Restoration	2,255	Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cf of dike material into impoundments at $0.094 per cf, grading 83 acres @ $3000/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cf at $0.11/cf) and seeding 124 acres at $512/acre.
11. Groundwater Remediation	800	$100,000 per year for 7 years plus $100,000 for recovery systems installation. Includes treatment of stormwater and waste water as necessary.
12. Engineering/construction Management	2,634	15% of lines 3 through 10.
13. Post-Closure Monitoring Program	53	Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first three to five years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.
14. SFC Staff	5,802	SFC at current level of 6 plus management augmentation during decommissioning
15. Long-Term Site Control Fund	1,093	Assumes an escrow fund at 2% interest to generate funds for the annual long-term maintenance costs of $21,868. Costs include annual sampling of 25 monitoring wells and analysis for uranium, nitrate and arsenic, preparation of an annual report, NRC inspection fees, mowing 6 times per year, and $500 annually for general maintenance. <u>Sampling Costs</u> Well Purging 16 hours @ $35 = $560.00 Well Sampling 16 hours @ $35 = $560.00 $ 1,120.00 <u>Analytical Costs</u> Uranium $20.00 Arsenic $25.00 Nitrate $15.00 Prep Fee $20.00 Total $80.00 per well x 25 Wells = $ 2,000.00 <u>Annual Report</u> 80 hours @ $90 $7,200.00 Copying Costs $ 200.00 = $ 7,400.00 <u>NRC Inspection Fees</u> Travel Time 8 hours Inspection Time 4 hours Report Preparation 40 hours Total 52 hours @ $144.00 = $ 7,488.00 <u>Mowing</u> 16 hours per mowing x 6 mowings per year = $ 3,360.00 <u>General Maintenance</u> $500.00 per year = 500.00 Total = $21,868 00
Total Cost	29,519	

[1] Entries presented in this column are in 2004 dollars

Table 7-2 Cash Flow Summary For Completion Of Reclamation

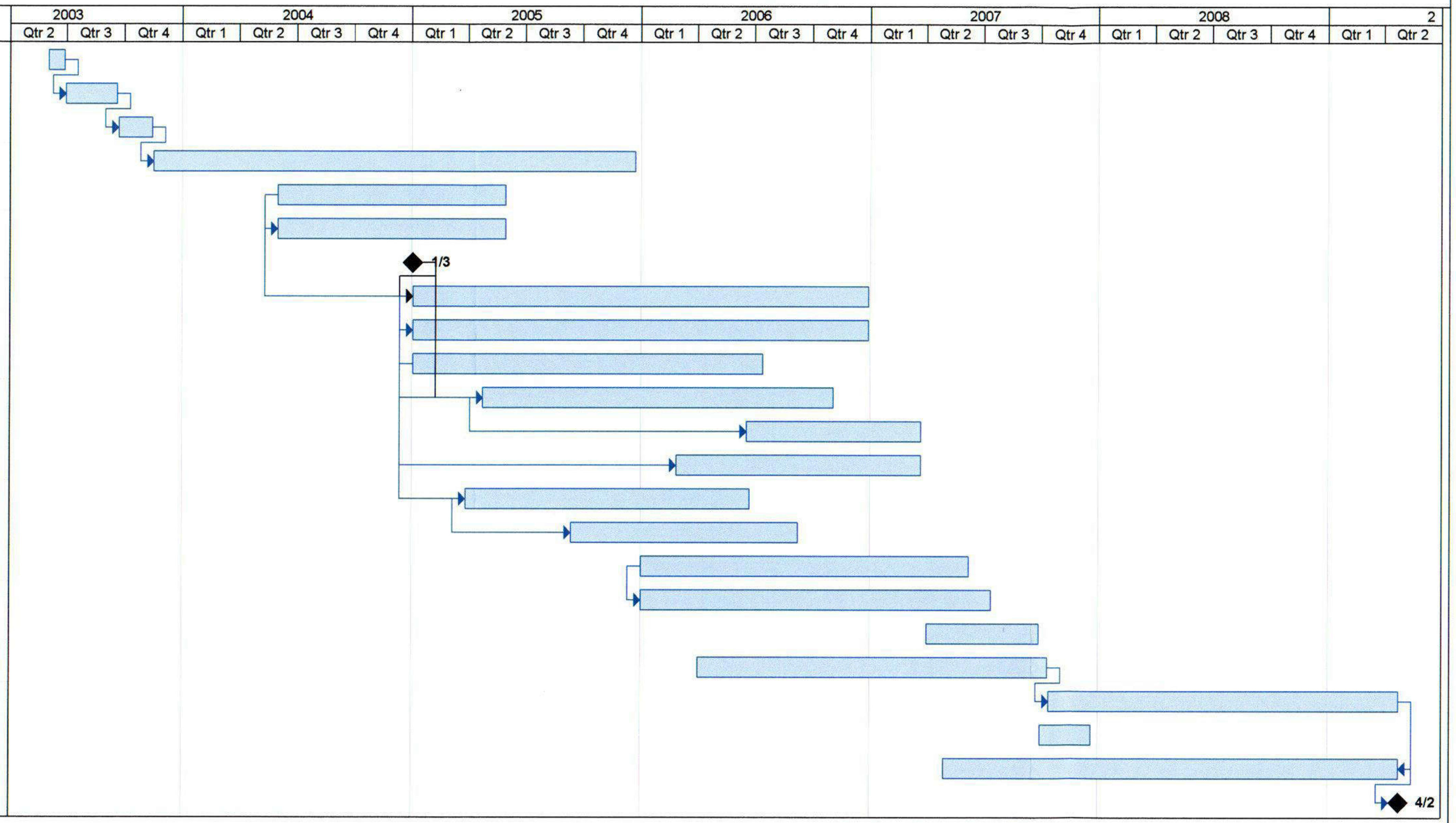
	2003	2004	2005	2006	2007	2008	2009	TOTAL
INCOME								
UF6 CONVERSION REVENUE	2	0	0	0	0	0	0	2
DISPOSITION OF INVENTORY	0	0	0	0	0	0	0	0
RANCH REVENUE	230	220	220	220	220	220	220	1,550
CONVERDYN FEES	5,480	4,803	4,859	0	0	0	0	15,142
INTEREST INCOME	394	401	351	225	82	31	0	1,484
OTHER INCOME	0	0	0	0	0	0	0	0
GA-NRC SETTLEMENT FUND	0	0	0	0	5,400	0	0	5,400
TOTAL REVENUES	6,106	5,424	5,430	445	5,702	251	220	23,578
EXPENSES								
RECLAMATION TASKS								
REC. PLAN & SUPPORT DOCS	*750*	*0*	*0*	*0*	*0*	*0*	*0*	*750*
NRC REVIEW, EIS, INSPECTIONS	*500*	*200*	*51*	*52*	*53*	*54*	*55*	*965*
CONTRACTOR MOB./DEMOB	*50*	*325*	*0*	*0*	*264*	*135*	*0*	*774*
MON. WELL REMOVE/REPLACE	*250*	*200*	*0*	*0*	*159*	*135*	*0*	*744*
CELL CONSTRUCTION & CLOSURE	*50*	*115*	*0*	*623*	*278*	*0*	*0*	*1,066*
SLDG. SED. TRTMNT. & DISPOSAL	*500*	*2,000*	*2,038*	*1,329*	*0*	*0*	*0*	*5,867*
SOIL REMEDIATION	*0*	*500*	*815*	*122*	*0*	*0*	*0*	*1,437*
BUILDING & EQUIP. DEMOLITION	*0*	*500*	*2,548*	*2,076*	*478*	*0*	*0*	*5,602*
TERMINATION SURVEY	*0*	*0*	*0*	*0*	*0*	*135*	*0*	*135*
SITE RESTORATION	*0*	*0*	*0*	*519*	*1,057*	*108*	*0*	*1,684*
GROUNDWATER REMEDIATION	*200*	*100*	*102*	*104*	*106*	*108*	*110*	*830*
ENGR./CONSTR. MANAGEMENT	*235*	*470*	*764*	*799*	*291*	*124*	*31*	*2,714*
POST CLOSURE MONITORING	*0*	*0*	*0*	*0*	*0*	*23*	*24*	*47*
PERSONNEL	*0*	*1,856*	*1,281*	*1,077*	*839*	*462*	*469*	*5,984*
LONG-TERM SITE CONTROL	*0*	*0*	*0*	*0*	*0*	*0*	*1,197*	*1,197*
TOTAL RECLAMATION COST	*2,535*	*6,266*	*7,599*	*6,701*	*3,525*	*1,284*	*1,886*	*29,796*
GEN & ADMIN:								
PERSONNEL	880	0	0	0	0	0	0	880
NRC LIC./FEES	50	0	0	0	0	0	0	50
TAXES, INSUR. & OTHER	642	442	442	442	275	275	275	2,793
RANCH COSTS	63	63	63	63	63	63	63	441
FERTILIZER PONDS	16	16	16	16	0	0	0	64
TOTAL GEN & ADMIN. COST	1,651	571	571	571	388	388	388	4,528
TOTAL COSTS	4,186	6,837	8,170	7,272	3,913	1,672	2,274	34,324
CASH MARGIN	1,920	(1,413)	(2,740)	(6,827)	1,789	(1,421)	(2,054)	
CHANGE IN WC & OTHER	106	79						
PROJECTED NET CASH FLOW								
BEFORE KM DEBT REPAYMENT	2,026	(1,334)	(2,740)	(6,827)	1,789	(1,421)	(2,054)	
CUMULATIVE CASH BALANCE	15,106	13,772	11,032	4,205	5,994	4,573	2,519	
END 2002 CASH BALANCE 13,080								

8.0 SCHEDULE

The preliminary schedule for reclamation of the SFC facility is shown in Figure 8-1. The schedule incorporates the major elements of this proposed reclamation plan, and shows the interrelationships and estimated time required to complete these activities. The NRC approval date for this reclamation plan was chosen as a placeholder since a date certain is not currently available. Several tasks on the critical path are shown as starting prior to the approval date in order to complete the reclamation within the available resources.

Figure 8-1
Preliminary Reclamation Schedule

ID	Task Name
1	Plug Wells Within the Cell Footprint
2	Prepare Cell Base Under Raffinate Sludge Storage Area
3	Construct Raffinate Sludge Storage Area Within Cell Base
4	Dewater Raffinate Sludge, Package and Store
5	Excavate and Treat Material Under Cell Footprint
6	Recover and Treat Impacted Groundwater Encountered
7	NRC Approval of Reclamation Plan
8	Construct Disposal Cell Base and Dike
9	Collect and Treat Stormwater
10	Dismantle Process Equipment
11	Dismantle/Demolish Structures
12	Demolish Concrete Floors, Foundations and Storage Pads
13	Size Reduction/Compaction of Structures, Systems and Components
14	Remove and Treat Sludges and Sediments
15	Remove Clay Liners/Soils Under Impoundments
16	Excavate Contaminated Soils Outside the Cell Footprints
17	Conduct Final Status Survey
18	Complete Capping and Closure of Cell
19	Backfill Excavations to a Finished Grade and Revegetate
20	Monitor Cell Performance
21	Establish Fenced Institutional Control Boundary
22	Transfer Title to DOE
23	Termination of SUB-1010



C08

Project: Sequoyah Facility Reclamatio
Date: Jan 27 '03

Task | Milestone ◆ | Summary

ATTACHMENT A

Technical Specifications For Construction Of The Sequoyah Fuels Corporation On-Site Disposal Cell

TECHNICAL SPECIFICATIONS FOR THE SEQUOYAH FUELS CORPORATION ON-SITE DISPOSAL CELL

Prepared For:
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January 2003

consulting
scientists and
engineers

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LIST OF DRAWINGS

1.0 SPECIAL PROVISIONS

1.1 SCOPE OF DOCUMENT

The following technical specifications have been prepared for the construction, operation, and closure of the on-site disposal cell at the proposed Sequoyah Fuels Corporation (SFC) site near Gore, Oklahoma. These technical specifications have been prepared for review and approval by the U.S. Nuclear Regulatory Commission (NRC), and would form part of contracts for reclamation of the site, for work tasks conducted by contractors selected by and under contract with SFC.

1.2 DEFINITIONS

These technical specifications are referred to in this document as the Specifications. Sections referred to in this document are specific sections of the technical specifications. The Drawings referred to in this document are the design drawings that form a necessary component of these Specifications.

For these Specifications, SFC is referred to as the Owner, with overall responsibility for disposal cell construction, operation, closure; as well as overall site reclamation.

The Contractor is defined as the group (or groups) selected by SFC and responsible for conducting the work tasks outlined in Section 1.3 under the direction of and under contract with SFC.

The QA Manager is defined as the person appointed by SFC responsible for inspection and Quality Assurance (QA) testing of construction work to ensure that the engineering aspects of site reclamation work are conducted as outlined in these Specifications.

The Reclamation Project Manager is defined as the person appointed by SFC responsible for ensuring that reclamation activities, including construction work and inspection and QA testing of construction, is conducted according to these Specifications and the intent of the design.

The Health and Safety Officer is defined as the person appointed by SFC responsible for worker safety and personnel monitoring. The Health and Safety Officer will be responsible for personnel safety training, personnel health monitoring, and documentation. These tasks will be conducted in accordance with the Health and Safety Plan for site reclamation work as well as pertinent sections of these Specifications.

1.3 SCOPE OF WORK

The work outlined in these Specifications consists of execution of the following tasks associated with construction and operation of the disposal cell and associated site reclamation.

a) Preparation of borrow areas for material excavation by removal of vegetation; and stripping, salvaging, and stockpiling of topsoil.

b) Preparation of material staging and stockpile areas by removal of vegetation; stripping, salvaging, and stockpiling of topsoil; and providing for stormwater diversion and internal water collection.

c) Preparation of the base of the disposal cell for placement of on-site materials and construction of stormwater diversion and internal water collection facilities.

d) Removal of residual process and waste materials from ponds and storage areas on site, and placement in the disposal cell.

e) Removal of liner materials and contaminated subsoils from beneath waste material pond and storage areas, and placement in the disposal cell.

f) Demolition of process area structures, with authorized release of salvageable equipment and materials, and placement of remaining materials in the disposal cell.

g) Demolition of process area structure foundations, paved areas, concrete pads and roadways, and placement of these materials in the disposal cell.

h) Excavation of contaminated subsoils from the process area and fertilizer pond area, and placement in the disposal cell.

i) Construction of the soil cover over the disposal cell, with placement of rock mulch and topsoil over the disposal cell cover surface.

j) Regrading and placement of topsoil over excavated areas, stockpile and staging areas, and other disturbed areas of the site.

k) Establishment of vegetation on the disposal cell surface and surrounding reclaimed areas on site.

Work not included in these Specifications consists of groundwater monitoring and remediation, and post-reclamation performance monitoring.

1.4 APPLICABLE REGULATIONS AND STANDARDS

The work shall conform to applicable Federal, State, and County environmental and safety regulations. The work shall conform to applicable conditions in the Radioactive Materials License with NRC. Geotechnical testing procedures shall conform to applicable ASTM standards, as documented in the edition of standards in force at the start of work (ASTM, 2002 or future annual edition). Personnel safety procedures and monitoring shall be conducted in accordance with the Health and Safety Plan for site reclamation.

1.5 INSPECTION AND QUALITY ASSURANCE

Full-time, on-site training, personnel monitoring, and inspection of construction activities shall be conducted by the Health and Safety Officer (and approved assistants as needed) while the site reclamation work is in progress. The Health and Safety Officer (and assistants) will be independent representatives of SFC, appointed by SFC. The responsibilities and duties of the Health and Safety Officer shall be as outlined in the Health and Safety Plan for site reclamation.

Full-time, on-site inspection of all construction activities and quality assurance (QA) testing outlined in these Specifications shall be conducted by the QA Manager (and approved assistants as needed) while the construction work is in progress. The QA Manager (and assistants) will be independent representatives of SFC, appointed by SFC. The inspection and QA testing conducted by the QA Manager shall be under the supervision of the Reclamation Project Manager. Inspection and QA testing shall include the tasks listed below.

a) Observation of construction practices and procedures for conformance with the Specifications.

b) Testing material characteristics to ensure that earthen materials used in the construction conform to the requirements in the Specifications.

c) Testing liner material characteristics and installation to ensure placement, compaction, deployment, seaming, and other work practices conform to the requirements in the Specifications.

d) Documentation of construction activities, test locations, samples, and test results.

e) Notification of results from quality assurance testing to the Contractor.

f) Documentation of field design modifications or approved construction work that deviates from the Specifications.

Documentation outlined above shall be recorded by the QA Manager on a daily basis. Deviations from the Specifications shall be approved by the Reclamation Project Manager and the SFC President, with notification to NRC or other appropriate Oklahoma state regulatory agency personnel.

1.6 CONSTRUCTION DOCUMENTATION

During construction, documentation of construction inspection work will be recorded by the QA Manager on a daily basis. Documentation will include the following items.

a) Work performed by the Contractor.

b) QA testing and surveying work conducted.

c) Discussions with SFC and the Contractor.

d) Key decisions, important communications, or design modifications.

e) General comments, including weather conditions, soil or liner surface conditions, visitors to the site.

All earthwork and synthetic liner QA test results will be documented on a daily basis (on separate reporting forms), with a copy of the results given to the QA Manager by the end of the following working day after the testing.

Photographs of key construction activities and critical items for documentation will be taken by the QA Manager or his representative.

A final construction report documenting the as-built conditions of the disposal cell be submitted to NRC at the end of construction. This report will include the following items.

a) All design modifications or changes to the specifications that were made during construction.

b) An as-built layout of the disposal cell prior to material disposal, and at the completion of cover construction.

c) An as-built layout of other reclaimed areas of the site.

d) Documentation of soil cleanup verification work (soil radiation survey and soil sampling and analyses) in areas of contaminated soil excavation.

1.7 DESIGN MODIFICATIONS

Design modifications (due to unanticipated site conditions or field improvements to the design) will be made following the protocol outlined below.

a) Communication of modification with the Reclamation Project Manager, and approval of modification by the SFC President.

b) Documentation of modification in the as-built construction report.

1.8 ENVIRONMENTAL REQUIREMENTS

The Contractor shall store materials, confine equipment, and maintain construction operations according to applicable laws, ordinances, or permits for the project site. Fuel, lubricating oils, and chemicals shall be stored and dispensed in such a manner as to prevent or contain spills and prevent said liquids from reaching local streams or ground water. If quantities of fuel, lubricating oils or chemicals exceed the threshold quantities specified in Oklahoma regulations, the Contractor shall prepare and follow a Spill Prevention Control and Countermeasures Plan (SPCCP), as prescribed in applicable Oklahoma regulations. SFC shall approve said plan. Used lubricating oils shall be disposed of or recycled at an appropriate facility.

1.9 WATER MANAGEMENT

The Contractor shall construct and maintain all temporary diversion and protective works required to divert stormwater from around work areas. The Contractor shall furnish, install, maintain, and operate all equipment required to keep excavations and other work areas free from water in order to construct the facilities as specified.

Water required by the Contractor for dust suppression or soil moisture conditioning shall be obtained from wells or surface water storage areas identified by the Owner.

1.10 HISTORICAL AND ARCHEOLOGICAL CONSIDERATIONS

The Contractor shall immediately notify the Owner if materials are discovered or uncovered that are of potential historical or archeological significance. The Owner may stop work in a specific area until the materials can be evaluated for historical, cultural, or archeological significance. All materials determined to be of significance shall be protected as determined by appropriate regulatory agencies, including removal or adjustment of work areas.

1.11 HEALTH AND SAFETY REQUIREMENTS

Work outlined in these specifications shall be conducted under the Health and Safety Plan for site reclamation, as directed by the Health and Safety Officer.

The Contractor shall suspend construction or demolition operations or implement necessary precautions whenever (in the opinion of the Reclamation Project Manager or Health and Safety Officer), unsatisfactory conditions exist due to rain, snow, wind, cold temperatures, excessive water, or unacceptable traction or bearing capacity conditions. The QA Manager, Reclamation Project Manager, and Health and Safety Officer each have the authority to stop Contractor work if unsafe conditions or deviations from specifications are observed.

2.0 SITE CONDITIONS

2.1 SITE LOCATION AND LAYOUT

The SFC site is located in north-central Oklahoma, northeast of the confluence of the Illinois River with the Arkansas River (tributaries of the Robert S. Kerr Reservoir). The site encompasses approximately 600 acres on the east bank of the Illinois River, north of Interstate Highway 40 and west of Oklahoma State Highway 10. The SFC facilities are primarily located within the 85-acre process area (shown on the Drawings).

2.2 CLIMATE AND SOIL CONDITIONS

The site is in an area of warm, temperate, continental climate. Annual precipitation averages 39 to 45 inches, and is fairly evenly distributed throughout the year. Annual evaporation averages approximately 70 inches (for Class A pan data) and 50 inches (for shallow lake data).

The site is located on a ridge or upland area above the Illinois River, and is underlain by a horizontally bedded sequence of Pennsylvanian Atoka Formation sandstone, siltstone and shale. The Atoka Formation surface has been weathered and eroded, and mantled to varying depths with Pleistocene terrace deposits. Soils investigated from over 500 drill holes on site consist of the terrace deposits and weathered zones of the Atoka Formation. These soils range from sandy, clayey gravels to silty clays of moderate plasticity.

2.3 PAST SFC OPERATIONS

Uranium processing operations at the SFC site started in 1969 under a license with Kerr McGee Corporation. In 1993, SFC notified the NRC of its intent to terminate licensed activities at the site. The NRC license remains in effect until site decommissioning is completed.

2.4 FACILITIES DEMOLITION

Demolition of equipment, structures, and associated facilities at the SFC site will be conducted according to applicable conditions of the NRC license and the Health and Safety Plan for site reclamation.

2.5 DISPOSED MATERIALS

The materials to be placed in the disposal cell consist of process waste materials, structural debris, and underlying liner materials and subsoils from planned site cleanup activities. The various materials to be placed in the disposal cell will be disposed in a planned sequence. Similar materials will be grouped together as four specific layers, as outlined below. The locations of specific materials are shown on the Drawings.

2.5.1 Layer A

Layer A materials consist of five components: (1) raffinate sludge, (2) Pond 2 residual materials, (3) Emergency Basin sediment, (4) North Ditch sediment, and (5) Sanitary Lagoon sediment. Due to the relatively high activity concentration of radionuclides in Layer A materials, these materials would comprise the lowest layer in the disposal cell profile, and would be placed over a prepared liner within the disposal cell.

2.5.2 Layer B

Layer B materials consist of soil liner and subsoil materials beneath the clarifier, Pond 4, the Emergency Basin, the North Ditch and the Sanitary Lagoon, as well as Pond 1 spoils pile material. The Layer B materials (primarily contaminated soils) are listed second in the order, since they would be excavated after removal of Layer A materials and placed directly on top of Layer A materials in the disposal cell profile.

2.5.3 Layer C

Layer C materials consist of structural materials, concrete and asphalt, calcium fluoride basin materials, calcium fluoride sediments, the calcium fluoride basin liners and subsoils, and on-site buried materials. These materials would be placed above the Layer B materials, and covered with contaminated soils (Layer D materials).

2.5.4 Layer D

Layer D materials consist of contaminated soils and sedimentary rock on site that require cleanup.

2.6 CELL CONSTRUCTION MATERIALS

Potential construction materials for disposal cell liner and cover system include soils and weathered sedimentary rock from on-site sources, and rock from off-site sources. These materials are outlined below, with selected source locations shown on the Drawings.

2.6.1 Cover Material

Cover material would be obtained from on-site terrace deposit soils and weathered Atoka Formation shale and sandstone. Available sources of these materials are existing berms and embankments, underlying subsoils, and previously used borrow areas.

2.6.2 Liner Material

The area of the cell foundation to be covered with Layer A materials will be lined prior to Layer A material placement. If a compacted clay is used for this liner, the material would be obtained from the soil borrow area at the south end of the site.

2.6.3 Topsoil

Topsoil for the surface of the disposal cell and surrounding areas to be vegetated would be obtained from the Agland Area on the west side of the site.

2.6.4 Rock Mulch

A layer of rock mulch will form the erosion protection zone on the side slopes and perimeter apron of the disposal cell. The sources of rock are nearby commercial sources of limestone or alluvial gravel and cobbles.

2.7 STAGING AND STOCKPILE AREAS

Areas on site identified as staging areas or stockpile locations will be approved by SFC. These areas will be constructed and used in a manner consistent with SFC plans for stormwater management.

2.8 ACCESS AND SECURITY

Access to the SFC site will be controlled at gated entrances through the existing Protected Area fence. The gated entrances will be operated by SFC.

2.9 UTILITIES

Utilities on site will be maintained by SFC outside of work areas (areas to be demolished or reclaimed). Utilities inside of work areas will be provided and maintained by the Contractor.

2.10 SANITATION FACILITIES

Sanitation facilities will be maintained by the Contractor, in accordance with the Health and Safety Plan for site reclamation.

3.0 WORK AREA PREPARATION

3.1 GENERAL

This Section describes the preparation of site areas for reclamation. This work will be conducted according to applicable sections of the Health and Safety Plan for site reclamation. The Contractor shall conduct these activities using written procedures that have been approved by SFC.

3.2 PROCESS AREA

The process area includes the disposal cell footprint (as shown on the Drawings). Tasks associated with preparation of the general process area are outlined in this Section. Specific tasks associated with preparation of the area within the disposal cell footprint are outlined in Section 3.3.

3.2.1 Water Management

Work in the process area will initially include the water management tasks outlined below.

a) Removal, treatment and permitted discharge of water in existing ponds (primarily Layer A material ponds).

b) Diversion of clean area stormwater runoff from work areas (where facilities demolition and material excavation will take place) and from the disposal cell footprint.

c) Collection of stormwater runoff from within the work areas and the disposal cell footprint for treatment and permitted discharge, or for disposed material compaction or dust control.

d) Isolation of water used for processing operations associated with reclamation (such as soil leaching or equipment cleaning) from stormwater runoff.

3.2.2 Preparation Sequence

The sequence for preparation of the process area is outlined below.

a) Setup of a soil stockpile and (if soil leaching is selected) a soil leaching area on the yellowcake storage pad (shown on the Drawings).

b) Removal of accumulated water, sediment, and residual solids from sediment and storage ponds in the process area. These materials will be placed in other process area ponds, placed within the disposal cell, or placed in alternative, approved areas.

c) Removal and temporary storage of synthetic liners (as outlined in Section 3.2.3).

d) Removal of soil liners and excavation of underlying subsoils from sediment and storage ponds in the process area.

e) Preparation of remaining regions of the process area for reclamation.

Work in the process area will subsequently include process area facilities demolition, as outlined in Section 4.0.

3.2.3 Synthetic Liner Removal

Salvageable synthetic liner material from the process area ponds will be cut (into panels of manageable size), rolled or folded, removed, and temporarily stored for subsequent placement within Layer C or D materials in the disposal cell.

Synthetic liner material from the process area ponds that is of insufficient quality or size for salvage will be cut and transported to designated areas of the disposal cell for burial.

3.3 DISPOSAL CELL FOOTPRINT

The general preparation sequence for disposal cell construction is outlined below.

a) Preparation of the lined area of the disposal cell for receipt of Layer A materials.

b) Preparation of the remaining footprint of the disposal cell for receipt of Layer B, C, and D materials.

The disposal cell preparation sequence will be based on minimizing double-handling and storage of disposed material where possible. Due to the location of the ponds containing Layer A materials within the lined area of the disposal cell, Layer A materials (from the Emergency Basin, North Ditch, and Sanitary Lagoon) will be excavated and stored in the settling ponds or in alternative, approved locations. The pond synthetic liners, soil liners, and subsoils (from the Emergency Basin, North Ditch and Sanitary Lagoon) will also be removed or excavated and stored in an approved location for disposal cell lined area preparation.

3.3.1 Preparation Sequence

The specific preparation sequence for the disposal cell site is outlined below.

a) Removal of sediment and underlying subsoils from the Emergency Basin, North Ditch and Sanitary Lagoon (Layer A and Layer B materials). These materials will be stockpiled in an approved area.

b) Removal of and temporary stockpiling of synthetic liners (outlined in Section 3.2.3).

c) Removal of contaminated soils from the footprint of the lined area within the disposal cell. These soils will be stockpiled in an approved area.

d) Excavation of utility trenches and removal of piping and conduit.

e) Preparation of the foundation for the lined area within the disposal cell (shown on the Drawings).

3.3.2 Lined Area

The lined area within the disposal cell is shown on the Drawings. The lined area of the disposal cell will consist of a compacted clay or synthetic liner that is installed over compacted foundation soils (after removal of affected subsoils). Layer A materials will be placed within the lined area of the disposal cell.

3.4 FERTILIZER POND AREA

The fertilizer pond area (also referred to as the industrial area) is south of the process area as shown on the Drawings. Tasks associated with preparation of the fertilizer pond area for reclamation are outlined below.

3.4.1 Water Management

Work in the fertilizer pond area will initially include the water management tasks outlined below.

a) Removal, treatment (if necessary), and land application or permitted discharge of water in the ponds.

b) Diversion of clean area stormwater runoff from the work area.

c) Collection of stormwater runoff from within the work area for treatment (if necessary) and permitted discharge.

3.4.2 Preparation Sequence

The preparation sequence for fertilizer pond reclamation is outlined below.

a) If synthetic liner is salvageable, the synthetic liner is removed as outlined in Section 3.4.3.

b) If fertilizer pond berm material is selected for disposal cell cover material, synthetic liner and clay liner material will be removed from the fertilizer ponds and placed in the disposal cell (as Layer C or D material).

c) If fertilizer pond berm material is not selected for disposal cell cover material, synthetic liner and clay liner material will be buried in the bottom of each pond, and the fertilizer pond berms will be regraded.

3.4.3 Synthetic Liner Removal

Salvageable synthetic liner from the fertilizer ponds will be cut (into panels of manageable size), rolled or folded, removed, and stockpiled for subsequent placement within Layer C or D materials in the disposal cell.

Synthetic liner from the fertilizer ponds that is of insufficient size or quality for salvage will be cut and hauled to designated areas of the disposal cell for burial, or pushed to the center of each individual fertilizer pond for burial.

3.5 COVER SOIL BORROW AREAS

Disposal cell cover soils will be excavated from among the identified borrow areas on site. The identified borrow areas are listed below.

a) The tornado berm.

b) The cut area east of the DUF4 building.

c) Uncontaminated portions of the Settling pond (Pond 2) berms.

d) Fertilizer pond berms.

e) The soil borrow area south of the fertilizer ponds.

The use of specific soil borrow areas will be selected based on haul distance to the disposal cell, ease of excavation of cover material, geotechnical characteristics and uniformity of the borrow material, and acceptable radiological and geochemical characteristics.

Borrow area preparation will be done in conjunction with the process area or fertilizer pond area preparation and reclamation work.

3.6 TOPSOIL BORROW AREA

The topsoil borrow area will be located in a designated portion of the Agland Area on the west side of the site (shown on the Drawings). Borrow area preparation will include mowing or shredding of existing vegetation prior to topsoil excavation.

3.7 STAGING AND STORAGE AREAS

Areas on site used for equipment or material staging or temporary storage will be in approved areas of the site. These areas will be prepared in a manner consistent with SFC plans for stormwater management. These areas will be prepared in conjunction with facilities demolition and site reclamation work.

3.8 CLEARING AND STRIPPING

Many of the work areas have been used for processing or construction activities and are free from vegetation. For work areas that are vegetated, preparation work will include the tasks outlined below.

3.8.1 Clearing

Clearing of vegetation and grubbing of roots will be in identified work areas. Clearing and grubbing shall not extend beyond 20 feet from the edge of the work area, unless as shown on the Drawings or as approved by the Reclamation Project Manager.

Vegetation from clearing and grubbing shall be shredded, ground, or chipped to form mulch. Alternative methods of on-site or off-site disposal or burning of stripped vegetation shall be conducted only as approved by the Reclamation Project Manager.

3.8.2 Stripping

Stripping of salvageable topsoil (if present) shall be done within the entire work area. Stripping of topsoil shall not extend beyond 10 feet from the edge of the work area, unless approved by the Reclamation Project Manager. The depth of stripping of reclamation soil shall be based on the presence of suitable topsoil and approved by the Reclamation Project Manager. Water shall be added to the area of excavation if the soils are dry and stripping work is generating dust.

Topsoil shall be stockpiled in approved stockpile areas. The final stockpile surface shall be graded and smoothed to minimize erosion and facilitate interim revegetation of the stockpile surfaces.

4.0 PROCESS AREA DEMOLITION

4.1 PROCESS AREA FACILITIES

This section outlines the demolition of facilities and structures in the process area. The major structures are shown on the Drawings and are outlined below.

4.1.1 Main Process Building

The Main Process Building (MPB) is located near the eastern edge of the process area. The MPB is a four-story metal building with approximately 95,000 square feet on the ground floor. It is the largest building at the process area and contained the major UF_6 conversion processing operation, fluorine generation facilities, utility and maintenance areas, administrative offices and a chemical process laboratory. Construction of the MPB began in 1968 and reached completion in 1969. Plant operations began in 1970 and ceased in 1992.

4.1.2 Solvent Extraction (SX) Building

The Solvent Extraction (SX) Building is a two-story metal building with dimensions of approximately 80 feet by 50 feet. The building is located approximately 150 feet west of the MPB. Construction began in 1968 and was completed in 1969. Operations began in 1970 and ceased in 1992. The solvent extraction process involved the separation of uranium and impurities (such as heavy metals).

4.1.3 DUF_4 Building

The DUF_4 building design and construction began in 1984, reached completion in 1986, and began operations at the end of 1986. The DUF_4 building is a steel frame metal building with approximately 7,000 square feet of ground floor area. There are four upper level working platforms in a 1,600 square foot chemical reactor bay area which is approximately 60 feet high. The DUF_4 building housed the process equipment to chemically react DUF_6 with hydrogen (H_2) to produce DUF_4 and anhydrous hydrofluoric acid (AHF). The dry product was packaged in 55-gallon drums and the recovered AHF was condensed to a liquid and sent to a holding tank south of the DUF_4 building. The steam condensate from the DUF_4 plant discharged to the sanitary lagoon through an underground sanitary sewer pipeline. DUF_4 operations were discontinued in 1993.

4.1.4 ADU/Miscellaneous Digestion Building

The ADU/Miscellaneous digestion building is located west of the MPB and south of the SX building. The ADU/Miscellaneous digestion building is approximately 30 feet by 120 feet.

4.1.5 Laundry Building

The Laundry Building is located south of the clarifier ponds, and is approximately 30 feet by 40 feet.

4.1.6 Centrifuge Building

The Centrifuge Building is located south of the clarifier ponds, and is approximately 30 feet by 70 feet.

4.1.7 Bechtel Building

The Bechtel Building is located southeast of the North Ditch, and is approximately 30 feet by 75 feet.

4.1.8 Solid Waste Building

The Solid Waste Building is located northeast of the North Ditch and is approximately 25 feet by 50 feet.

4.1.9 Cooling Tower

The Cooling Tower is located north of the SX Building and south of the North Ditch and was part of the original construction completed in 1969. The Cooling Tower is approximately 35 feet wide and 100 feet long and was designed to cool the process cooling water that was then re-circulated to various heat exchangers throughout the process area. The equipment is made up of two basins, the hot side basin and the equalization basin, which are used to keep a constant level in the re-circulation process. The Cooling Tower has been partially demolished.

4.1.10 RCC Evaporator

The RCC Evaporator is located north of the SX Building and west of the Cooling Tower and was built in 1980. The RCC Evaporator stands atop a concrete pad that measures approximately 35 feet by 30 feet. The mechanical recompression evaporator is approximately 40 feet tall.

4.1.11 Incinerator

The incinerator is located northeast of the North Ditch, and is approximately 15 feet by 20 feet.

4.1.12 Combination Stream Drain

The Combination Stream Drain is a gravity-flow, reinforced concrete pipe ranging in size from 12 to 30 inches nominal diameter, and ranges in depth from 5 to 30 feet below the ground surface.

The function of the Combination Stream Drain was to transport various discharges to permitted Outfall 001 (shown on the Drawings). These discharges included contact and non-contact overflow water from the re-circulating cooling water system, cooling water emergency system effluent, MPB roof drain storm water, fire water drains, steam boiler blow-down, decanted water softener blowdown, yellowcake pad storm water runoff, treated sanitary wastewater, excess raw water, fluoride treatment effluent, and other miscellaneous stormwater from the process area.

Major flow contributions are made at ten junction manholes at various locations along the Combination Stream Drain. A major flow contribution occurs at the equalization basin overflow weir into the main sump located on the southeast side of the cooling water tower. Smaller flow contributors are plumbed directly into portions of the Combination Stream Drain.

4.1.13 Miscellaneous Buried Utility Lines

The site has numerous buried utility lines, including firewater lines, potable water lines, process water lines, sanitary sewer lines, natural gas lines and electrical conduits. These lines are buried in trenches similar to the Combined Stream Drain. These utilities have been removed from service.

4.2 MATERIALS DESCRIPTION

Similar process area materials have been organized into groups for disposal sequencing. These groups will be placed in the disposal cell in layers. Materials comprising the four layers are outlined below.

4.2.1 Layer A Materials

Layer A materials consist of five components: (a) raffinate sludge, (b) Pond 2 residual materials, (c) Emergency Basin sediment, (d) North Ditch sediment, and (e) Sanitary Lagoon sediment. The locations of these materials are shown on the Drawings. Due to the relatively high activity concentration of radionuclides in Layer A materials, these materials would be the lowest layer in the disposal cell profile, and would be placed over the disposal cell liner.

4.2.2 Layer B Materials

Layer B materials consist of soil liner and subsoil materials beneath the clarifier, Pond 4, the Emergency Basin, the North Ditch and the Sanitary Lagoon, as well as Pond 1 spoils pile material. The Layer B materials (primarily contaminated soils) are listed second in the order, since they would be excavated after removal of Layer A materials and placed directly on top of Layer A materials in the disposal cell profile. The locations of these materials are shown on the Drawings.

4.2.3 Layer C Materials

Layer C materials consist of structural materials, concrete and asphalt, calcium fluoride basin materials, calcium fluoride sediments, calcium fluoride basin liners and subsoils, and on-site buried materials. These materials would be placed above the Layer B materials, and covered with contaminated soils (Layer D materials). The locations of these materials are shown on the Drawings.

4.2.4 Layer D Materials

Layer D materials consist of contaminated soils and sedimentary rock that require cleanup. The cleanup level is a natural uranium activity concentration of 100 pCi/g. The approximate area of material cleanup is shown on the Drawings.

4.2.5 Combination Stream Drain Backfill

Granular backfill and adjacent contaminated soils and sedimentary rock along the Combination Stream Drain will require cleanup (shown on the Drawings). The cleanup level is a natural uranium activity concentration of 100 pCi/g. These materials may be leached to recover uranium prior to placement in the disposal cell (Section 4.3.8).

4.2.6 Salvageable Materials

Equipment and structural materials may be of sufficient value for salvage. Salvageable equipment or structural materials shall be decontaminated and surveyed for release from the site for unrestricted use. Equipment and structural materials that are not of sufficient value for salvage or cannot be feasibly decontaminated will be placed in the disposal cell.

4.3 WORK DESCRIPTION

4.3.1 Material Survey and Inventory

For each structure in the process area, a pre-demolition survey and inventory will be conducted. This work will include the items listed below.

a) Utilities review, to confirm that electrical power lines, high pressure pipelines and other potential hazards to demolition are identified.

b) Radiation surveys to identify areas of above-background areas of exposure to ionizing radiation. SFC's historical survey data may be used for this purpose.

c) Air sampling to identify the need for respiratory protection from dust, gases, and airborne radioactivity. This would include radon daughter surveys to identify potential areas of exposure to radon-222 gas.

d) Hazardous materials surveys to identify potentially hazardous materials such as strong acids or bases, oxidizing agents, corrosive materials, flammable materials or pressurized gases.

e) Asbestos surveys to determine the presence of asbestos-containing materials.

f) Residual liquid surveys to identify residual liquids in tanks, vessels, pipelines, and other storage areas that would require liquid management for treatment and disposal.

g) Structural engineering surveys to assess the physical condition of the structure and its supporting members.

These surveys would be used to determine the need for and identify mitigating measures for the items listed above. These mitigating measures will be incorporated into special operating procedures or work permits for demolition of specific structures or facilities.

4.3.2 Salvage

Salvageable equipment and structural materials may be removed from the specific facility, decontaminated and surveyed for release from the site for unrestricted use. The criteria for release of salvageable materials will be as outlined in NRC Regulatory Guide 8.30 (June, 1983).

Decontamination of potentially salvageable equipment will be conducted based on the nature of contamination, the surfaces to be decontaminated, and worker health and safety. Decontamination methods will include low-pressure washing, followed by surveying of washed surfaces. If contamination remains, decontamination methods will include scraping, steam cleaning, sand blasting, or grinding. Equipment and structural materials that do not meet criteria for release for unrestricted use will be placed in the disposal cell.

Surveying of cleaned surfaces will be conducted on dried surfaces, with release based on the following criteria.

a) An average alpha count of 5,000 dpm or less per 100 square centimeter surface, averaged over an area of 1 square meter or less

b) A maximum alpha particle count of 15,000 dpm per 100 square centimeter of surface.

Equipment and structural materials shall not be released from the site without approval by the Health and Safety Officer.

4.3.3 Equipment Removal

Equipment removal from structures will be scheduled and conducted based on worker safety. Free-standing equipment and residual materials will be removed from the structure prior to dismantling if the removal facilitates dismantling and demolition. Equipment will be removed during dismantling of the structure if the dismantling facilitates equipment removal.

4.3.4 Structure Dismantling

Structure dismantling will be conducted in the general sequence listed below.

a) De-energize equipment and utilities within the structure.

b) Remove equipment (as outlined in Section 4.3.3).

c) Removal or fixation of loose or removable radioactive materials (as necessary) to control contamination.

d) Remove wall sheathing or covering (to facilitate extraction of interior equipment).

e) Remove roof.

f) Remove structural members or framework.

g) Remove foundation materials and underground facilities (as outlined in Section 4.3.5).

4.3.5 Foundation Removal

Removal of structure foundations, interior floor slabs, and exterior slabs and parking areas will follow the general sequence listed below.

a) Cutting (with a concrete saw) or breaking up (with a jack hammer or similar vibratory tool) the slab or foundation material into pieces that can be loaded and hauled by construction equipment.

b) Excavation of contaminated soils from under floor areas and around footings.

c) Transport of the concrete pieces and excavated soils to the disposal cell or approved temporary storage location.

d) Placement of the pieces in the disposal cell by dumping and (where possible) working with a dozer or trackhoe to minimize void spaces.

e) Covering the pieces with contaminated soil or similar material, with vibratory compaction to minimize void spaces.

4.3.6 Material Preparation for Disposal

Because of the wide variety in shape and size of equipment and structural materials, the following guidelines will be used in sizing, handling and disposing of debris.

a) Material will be cut or dismantled into pieces that can be safely lifted or carried with the equipment being used. Material will also be cut or dismantled to minimize void spaces after disposal.

b) A backhoe, front-end loader, crawler or equivalent equipment will be utilized to crush or compact compressible materials. These materials will be laid out in a staging area or other approved area to facilitate crushing or compacting with equipment.

c) Pipe or conduit with an opening or diameter larger than 12 inches that cannot be crushed will be filled with random fill (Section 6.2.1) prior to disposal.

d) Tanks and vats will be handled according to the wall material and wall thickness. Tanks would be crushed or compacted if possible. Wooden vats will be dismantled. Tanks that cannot be crushed will be dismantled, if feasible. Tanks that cannot be crushed or dismantled will be transported to the disposal cell, filled with random fill and buried.

4.3.7 Soil Excavation

Excavation of contaminated soils (Section 4.2.4) will be conducted within the area shown on the Drawings or as dictated by the Reclamation Project Manager. The excavated soils will be placed directly in the disposal cell or in temporary stockpiles for subsequent placement in the disposal cell. The selection of excavation equipment (such as a scraper operation or an excavator and truck operation) will be based on the depth and extent of excavation and the haul distance to the disposal cell or temporary stockpile.

4.3.8 Soil Leaching

Backfill materials and affected soils from the combination stream drain (Section 4.2.5) may be leached to recover uranium prior to placement in the disposal cell. The soil leaching area will be a prepared, synthetically-lined area constructed on the yellowcake storage pad (shown on the Drawings). The soil leaching area will be formed with berms constructed on the yellowcake storage pad with synthetic liner bedding material (Section 6.2.5) and covered with synthetic liner (Section 7.0). Materials that have been leached will be placed in the disposal cell as Layer C materials.

4.4 PERFORMANCE STANDARDS AND TESTING

4.4.1 Health and Safety Requirements

Process area demolition work will be conducted in accordance with the Health and Safety Plan for site reclamation, as directed by the Health and Safety Officer. Due to the different work activities and potential hazards involved with process area demolition, more specific procedures will be utilized for demolition work (documented as special operating procedures or work permits). These procedures will be adjusted based on the results of the material survey and inventory (Section 4.3.1). These procedures will define personal protective equipment and personnel monitoring (as necessary), regular safety meetings, and communication.

4.4.2 Environmental Requirements

The process area demolition work will be conducted according to applicable SFC site environmental requirements (including air quality and water management components). Current restricted area aspects of the site will be maintained or modified for contractor access. Personnel, vehicles, and testing equipment will be screened and surveyed prior to being allowed to leave the restricted area. Equipment and structural debris will be taken directly from the demolition area to the disposal cell or temporarily stored in a staging or storage area within the restricted area.

Air quality requirements for particulate matter and gases will be maintained during demolition by sequencing the work to minimize impacts and by spraying work areas with water for dust control.

Water management associated with process area demolition will include the tasks outlined below.

a) Diversion of clean area stormwater runoff from work areas.

b) Collection of stormwater runoff from within work areas.

c) Collection of decontamination water, dust control spray water, and other liquids associated with demolition work within each work area for re-use or treatment and permitted discharge.

5.0 FERTILIZER POND AREA RECLAMATION

5.1 GENERAL

This section outlines the work associated with reclamation of the fertilizer pond area (also referred to as the industrial area). The preparation of the fertilizer pond area is outlined in Section 3.4. Alternatives for the fertilizer pond area include: (a) reclamation of the area after removal of pond liner materials and excavation of pond berm materials for disposal cell cover, or (b) reclamation of the area without removal of liner or pond berm materials.

5.2 SYNTHETIC LINER

Each fertilizer pond (except Pond 4) includes a synthetic liner above a clay liner. If selected for removal, salvageable synthetic liner material from the fertilizer ponds will be cut (into panels of manageable size), rolled up, removed, and stockpiled for subsequent placement within Layer C or D materials in the disposal cell.

Synthetic liner material from the fertilizer ponds that is of insufficient size or quality for salvage will either be cut and hauled to designated areas of the disposal cell for burial, or pushed to the center of each individual fertilizer pond (or other approved location in the fertilizer pond area) for burial. If the synthetic liner material is not selected for salvage and removal, the material will be pushed to the center of each individual fertilizer pond (or other approved location in the fertilizer pond area) for burial.

5.3 CLAY LINER

Each fertilizer pond includes a clay liner. If the clay liner material is within background conditions from a radiological and chemical standpoint, the clay liner material may be included with pond berm material for use as disposal cell cover material. If the fertilizer pond berm material is not used for disposal cell cover material, the clay liner material may be buried in place.

Clay liner material and subsoils that are not within background conditions from a radiological and chemical standpoint will be excavated and placed with Layer C or D materials in the disposal cell.

5.4 BERM FILL

If the pond berm fill material is within background conditions from a radiological and chemical standpoint, the berm fill material may be used for disposal cell cover material or regraded in place. Berm fill material that is not within background conditions from a radiological and chemical standpoint will be excavated and placed with Layer C or D materials in the disposal cell.

5.5 PERFORMANCE STANDARDS AND TESTING

The regraded elevations of the fertilizer pond area will depend on the use of pond berm material for disposal cell cover. The regraded surface of the fertilizer pond area will be at slopes of 5 percent or less, and not contain areas of significant runoff concentration or abrupt changes in grade. The regraded fertilizer pond area will be covered with a minimum thickness of 6 inches of topsoil (Section 9.2.3) and revegetated (Section 10.0).

If fertilizer pond synthetic liner material is buried in the fertilizer ponds, the synthetic liner material shall be covered with a minimum of 5 feet of covering soil. The covering soil shall be placed in lifts not exceeding two feet in thickness and rolled with construction equipment to minimize void spaces within the buried materials and covering materials.

6.0 DISPOSAL CELL PREPARATION

6.1 GENERAL

This section outlines the work associated with preparation of the disposal cell foundation for receipt of materials (as described in Section 8.0). The footprint of the disposal cell beneath Layer A materials will be lined, with either a compacted clay liner or a synthetic liner. The specifications in this section have been prepared to accommodate either liner system.

6.2 MATERIALS DESCRIPTION

6.2.1 Random Fill

The disposal cell footprint may have an irregular surface from excavation of waste materials and sediments, liner soils, contaminated subsoils, and underground utilities. This excavated surface will be regraded to form a smooth, competent foundation for liner construction. Random fill will be used for fill in excavated areas of the disposal cell footprint to meet desired grades and elevations for the disposal cell foundation.

Random fill will consist of soils and weathered sedimentary rock from approved on-site excavation areas. Random fill shall be minus 6-inch size, and shall be free from roots, branches, rubbish, and process area debris. Random fill shall have a natural uranium activity concentration of less than 27 pCi/g.

6.2.2 Clay Liner

Clay liner material, if used for the disposal cell liner, will consist of soils from approved on-site borrow areas. Clay liner material shall be minus 1-inch size, and shall be free from roots, branches, rubbish, and process area debris. Clay liner material shall have a minimum of 50 percent passing the No. 200 sieve and a minimum plasticity index of 10. Clay liner material shall have a natural uranium activity concentration of less than 27 pCi/g.

6.2.3 Clay Liner Cover

Clay liner cover material will be placed over the completed clay liner to minimize drying of the clay prior to covering with Layer A material. The cover would also prevent physical damage to the clay liner during Layer A material placement.

Clay liner cover material shall consist of soils and weathered sedimentary rock from approved on-site excavation areas. Clay liner cover material shall be minus 6-inch size, and shall be free from roots, branches, rubbish, and process area debris.

6.2.4 Synthetic Liner

Synthetic liner material, if used for the disposal cell liner, shall be 60-mil nominal thickness HDPE, with material characteristics outlined in Section 7.2.1.

6.2.5 Synthetic Liner Bedding Material

If synthetic liner is used for the disposal cell, synthetic liner bedding material will be placed over the prepared foundation of the disposal cell liner area to provide a protective bedding material for placement and installation of the synthetic liner.

Synthetic liner bedding material shall consist of sand from off-site sources and/or soils and weathered sedimentary rock from approved on-site borrow areas. Synthetic liner bedding material shall be minus 1-inch size, and shall be free from roots, branches, rubbish, process area debris, and other angular or pointed materials that could damage the synthetic liner. Synthetic liner bedding material shall be have a natural uranium activity concentration of less than 27 pCi/g.

6.2.6 Synthetic Liner Cover

If synthetic liner is used for the disposal cell, synthetic liner cover material will be placed over the synthetic liner to provide a cover material for protection of the synthetic liner during Layer A material placement.

Synthetic liner cover material shall consist of sand from off-site sources and/or soils and weathered sedimentary rock from approved on-site excavation areas. Synthetic liner cover material shall be minus 1-inch size, and shall be free from roots, branches, rubbish, process area debris, and other angular or pointed materials that could damage the synthetic liner.

6.2.7 Synthetic Liner Anchor Backfill

If synthetic liner is used for the disposal cell, synthetic liner anchor backfill will be placed and compacted in the in anchor trenches excavated along the perimeter of the lined area of the disposal cell.

Synthetic liner anchor backfill shall consist of soils and weathered sedimentary rock from approved on-site excavation areas. Synthetic liner anchor backfill shall be minus 1-inch size, and shall be free from roots, branches, rubbish, process area debris, and other angular or pointed materials that could damage the synthetic liner.

6.3 WORK DESCRIPTION

6.3.1 Foundation Preparation

Th excavated surface of the footprint of disposal cell liner will be regraded to form a smooth, competent foundation for liner construction. Random fill (Section 6.2.1) shall be used to fill in excavated areas of the disposal cell footprint to meet desired grades and elevations for the disposal cell foundation. The final regraded surface shall be compacted with approved construction equipment to provide a foundation surface with uniform density for liner and disposed material placement.

The upper six inches of the regraded disposal cell surface shall be compacted to 90 percent of the maximum dry density for the material, as determined by the Standard Proctor test. During compaction, the material shall be within 1 percent above to 4 percent below optimum moisture content for the material, as determined by the Standard Proctor test. If water addition is required to achieve this range of moisture contents, the added water shall be thoroughly mixed into the material prior to compaction.

6.3.2 Random Fill Placement

Random fill (Section 6.2.1) shall be used to fill in excavated areas of the disposal cell footprint to meet desired grades and elevations for the disposal cell foundation. Random fill shall be placed in lifts not exceeding 18 inches in loose thickness, and shall be compacted with approved construction equipment. The final surface of random fill areas shall be compacted as outlined in Section 6.3.1.

6.3.3 Disposal Cell Foundation Area

The disposal cell has been designed to accommodate a variation in total contaminated soil (Layer D material) volume. The footprint of the disposal cell is established along the north and west sides of the cell (shown on the Drawings). The lined area of the disposal cell is also established (shown on the Drawings). The locations of the south and east sides of the disposal cell (shown on the Drawings) are based on a total disposed volume of approximately 9 million cubic feet. The final location of the south and east sides of the disposal cell, the transition to the north and west sides of the cell, and the corresponding foundation area within the disposal cell will be established as the final volume of Layer D material is determined during contaminated soil excavation.

6.3.4 Clay Liner Material Placement

Clay liner material (Section 6.2.2) shall be placed in two or more lifts to form a continuous layer with a minimum compacted thickness of twelve inches. Clay liner material shall be placed over the prepared foundation of the disposal cell liner area (Section 6.3.1).

Each lift of clay liner material shall be compacted to at least 95 percent of the maximum dry density for the material, as determined by the Standard Proctor test. During compaction, the material shall be within 2 percent above to 2 percent below optimum moisture content for the material, as determined by the Standard Proctor test. If water addition is required to achieve this range of moisture contents, the added water shall be thoroughly mixed into the material prior to compaction.

Compaction of the clay liner material shall be done with a sheepsfoot or tamping-foot roller of sufficient weight to achieve the required compaction specifications. Rubber-tired equipment shall not be used solely to compact the clay liner material.

6.3.5 Clay Liner Cover Material Placement

Clay liner cover material shall be placed over the completed clay liner to provide a protective cover to minimize drying of the clay and prevent physical damage to the clay liner prior to covering with Layer A materials. Clay liner cover material (Section 6.2.3) shall be placed in one lift on top of the clay liner to form a zone a minimum of 12 inches thick. Clay liner cover material placement shall be done in a manner that does not damage the clay liner. The final clay liner cover surface shall be rolled with approved compaction equipment to form a base and running surface for material disposal.

6.3.6 Synthetic Liner Bedding Layer Material Placement

If synthetic liner is used, synthetic liner bedding material will be placed over the footprint of the prepared disposal cell liner area to provide a protective bedding material for placement and installation of the synthetic liner. Synthetic liner bedding material (Section 6.2.5) shall be placed in one or more lifts to form a zone a minimum of 6 inches thick. The final synthetic liner bedding material surface shall be rolled with approved compaction equipment to form a smooth base for synthetic liner installation.

6.3.7 Synthetic Liner Material Installation

Synthetic liner material, if used for the disposal cell liner, shall be installed as outlined in Section 7.3.

6.3.8 Synthetic Liner Cover Placement

If synthetic liner is used, synthetic liner cover material will be placed over the completed synthetic liner to provide a protective cover for placement of Layer A material. Synthetic liner cover material (Section 6.2.6) shall be placed in one lift to form a zone a minimum of 18 inches thick. The lift of synthetic liner cover shall be placed with a small dozer or other approved equipment in a manner that does not tear, puncture, or otherwise damage the synthetic liner.

6.3.9 Synthetic Liner Anchor Backfill Placement

Synthetic liner anchor backfill (Section 6.2.7) shall be placed in lifts of 6-inch maximum loose thickness in the liner anchor trench and compacted by rolling with approved equipment or compaction with a manually-controlled compactor. Synthetic liner anchor backfill shall be compacted to 90 percent Standard Proctor density for the material, as determined by the Standard Proctor test.

Liner anchor backfill placement and compaction shall be done in a manner that does not tear, puncture, or damage the synthetic liner. The final liner anchor material surface shall be rolled with approved compaction equipment to match the adjacent synthetic liner cover surface.

6.4 PERFORMANCE STANDARDS AND TESTING

6.4.1 Foundation Testing

Checking of compaction of the foundation shall consist of a minimum of one field density test per 1,000 cubic yards of material compacted. Field density tests shall be compared with Standard Proctor tests (ASTM D-698 Method A or C) on the same material. Standard Proctor tests shall be conducted at a frequency of at least one test per 2,000 cubic yards of material compacted, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D-1556) or a nuclear density gauge (ASTM D-3107 and D-2922, or as modified by the QA Manager). Calibration of the nuclear density gauge shall be by comparison with results from the sand cone test on the same material.

6.4.2 Clay Liner Testing

Material specifications for the clay liner material shall be confirmed by gradation testing conducted by approved personnel. Testing shall consist of No. 200 sieve wash and maximum particle size testing (ASTM D-422), and Atterberg limit testing (ASTM D-4318) on samples of clay liner materials, at a frequency of at least one test per 2,000 cubic yards of fill placed, or when material characteristics show a significant variation.

Checking of compaction of the clay liner material shall consist of a minimum of one field density test per 1,000 cubic yards of material compacted. Field density tests shall be compared with Standard Proctor tests (ASTM D-698 Method A or C) on the same material. Standard Proctor tests shall be conducted at a frequency of at least one test per 2,000 cubic yards of material compacted, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D-1556) or a nuclear density gauge (ASTM D-3107 and D-2922, or as modified by the QA Manager). Calibration of the nuclear density gauge shall be by comparison with results from the sand cone test on the same material.

The completed clay liner surface shall be constructed to within 1.0 foot of the lines as designed and shown on the Drawings, and within 0.1 foot of the elevations shown on the Drawings. The final surface of the clay liner shall be smoothed to avoid abrupt changes in surface grade.

6.4.3 Synthetic Liner Bedding Layer Testing

The completed synthetic liner bedding layer surface shall be constructed to within 1.0 foot of the lines as designed and shown on the Drawings, and within 0.1 foot of the elevations shown on the

Drawings. The final surface of the synthetic liner bedding material shall be smoothed or rolled to avoid abrupt changes in surface grade. The surface shall provide a smooth and unyielding foundation for the synthetic liner with no sharp or protruding objects. The final surface shall be inspected and approved by the QA Manager prior to initiation of liner installation.

6.4.4 Synthetic Liner Testing

The synthetic liner panels and seams shall be tested as outlined in Section 7.4. The final synthetic liner surface shall be inspected and approved by the QA Manager prior to initiation of synthetic liner cover placement.

6.4.5 Synthetic Liner Cover Testing

Material specifications for synthetic liner cover material (Section 6.2.6) shall be confirmed by gradation testing conducted by approved personnel. Testing shall consist of No. 200 sieve wash and maximum particle size testing (ASTM D-422) at a frequency of at least one test per 2,000 cubic yards of fill placed, or when material characteristics show a significant variation.

6.4.6 Synthetic Liner Anchor Backfill Testing

Material specifications for synthetic liner anchor backfill material (Section 6.2.7) shall be confirmed by gradation testing conducted by approved personnel. Testing shall consist of No. 200 sieve wash and maximum particle size testing (ASTM D-422) at a frequency of at least one test per 2,000 cubic yards of fill placed, or when material characteristics show a significant variation.

Checking of compaction of the liner anchor backfill shall consist of a minimum of one field density test per 1,000 cubic yards of material compacted. Field density tests shall be compared with Standard Proctor tests (ASTM D-698 Method A or C) on the same material. Standard Proctor tests shall be conducted at a frequency of at least one test per 2,000 cubic yards of material compacted, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D-1556) or a nuclear density gauge (ASTM D-3107 and D-2922, or as modified by the QA Manager). Calibration of the nuclear density gauge shall be by comparison with results from the sand cone test on the same material.

7.0 SYNTHETIC MATERIAL INSTALLATION

7.1 GENERAL

This Specification Section describes the placement, seaming, testing, and protection of the synthetic liner (geomembrane) to be installed at the base of the disposal cell (if selected). This section also describes the placement of filter fabric and geogrid in the disposal cell (if selected).

7.2 MATERIALS DESCRIPTION

7.2.1 Disposal Cell Synthetic Liner

The disposal cell synthetic liner shall consist of smooth high density polyethylene (HDPE) geomembrane. The nominal geomembrane thickness shall be 60 mil (0.060 inches). The geomembrane shall be manufactured with products designed and manufactured for the purpose of liquid containment. The geomembrane shall conform to the following minimum physical requirements listed below.

Tensile strength at break	240 lbs/in width
Elongation at break	700 percent

Labels on the geomembrane roll or panel shall identify the thickness, length, width, and manufacturer's mark number. Transport and storage of the geomembrane material shall be according to manufacturer's recommendations. Geomembrane rolls stored on site shall be kept off of the ground surface and covered. Prior to liner deployment, the outer liner surface of each roll shall be inspected for punctures, scratches or other damage. If the outer liner surface of the roll is damaged, the outer two wraps of the roll shall be removed and discarded prior to liner deployment.

The geomembrane shall be manufactured to be free of holes, blisters, undispersed raw materials, gels, or visible evidence of contamination by foreign matter. Any such defect shall render that roll or panel of material unacceptable for use and shall be replaced with material that is free of any such defects. Defects may be repaired in lieu of material replacement only upon approval of the QA Manager.

7.2.2 Filter Fabric

Filter fabric (if used for synthetic liner protection) shall be nonwoven polyester with a minimum unit weight of 10 ounces per square yard.

Transport and storage of the filter fabric shall be according to manufacturer's recommendations. Filter fabric rolls stored on site shall be kept off of the ground surface and covered. Prior to fabric deployment, the outer surface of each roll shall be inspected for tears, scratches or other damage. If the outer surface of the roll is damaged, the outer wrap of the roll shall be removed and discarded prior to liner deployment.

7.2.3 Geogrid

Geogrid (if used to improve bearing capacity of soft disposed materials) shall be HDPE or polypropylene material specifically manufactured for the purpose of bearing capacity support. The geogrid shall have minimum unit weight of 6 ounces per square yard and a maximum aperture size of 1.5 inches.

Transport and storage of the geogrid shall be according to manufacturer's recommendations. Geogrid rolls stored on site shall be kept off of the ground surface and covered. Prior to geogrid deployment, the outer liner surface of each roll shall be inspected for punctures, scratches or other damage. If the outer liner surface of the roll is damaged, the outer wrap of the roll shall be removed and discarded prior to geogrid deployment.

7.3 WORK DESCRIPTION

Installation of geomembrane, filter fabric, or geogrid shall be only on areas approved by the Reclamation Project Manager, as outlined in the Drawings.

7.3.1 Geomembrane Deployment

Individual panels of geomembrane shall be laid out and overlapped a minimum of 4 inches prior to welding, or as recommended otherwise by the manufacturer. Where possible, the overlapping panels shall be shingled, such that the up-slope panel is on top on the down-slope panel. On the side slopes, panels shall be placed with the long dimension perpendicular to the slope contours. The liner panel and roll number shall be marked on the panel and recorded as the material is being deployed.

The geomembrane shall not be placed during precipitation, high winds, or in the presence of excessive liner bedding material moisture. Geomembrane that has been damaged due to wind uplift shall be discarded.

7.3.2 Geomembrane Seaming

All geomembrane panel seams shall be welded to form a continuous, watertight barrier. The seams to be welded shall be cleaned and prepared according to manufacturer's guidelines to be free from dust, debris, oil, moisture, or other material that would interfere with liner seaming.

Panel seams shall be hot wedge welded whenever possible. This shall consist of two parallel welds along the overlap between liner panels that allow pressure testing of the channel between welds. Where wedge welding is not possible, field welds for the remaining seams shall be by a heat extrusion process.

Field welding shall form a continuous bond between the extrudate and liner material, according to the guidelines of the manufacturer. The field welding equipment shall be capable of continuously monitoring and controlling the temperatures and pressures in zone of contact where the machine is actually fusing the lining material to prevent changes in environmental conditions from affecting the integrity of the weld. Field welding shall be conducted when the air temperature (measured 12 inches above the synthetic liner surface) is between 30°F and 110°F. When the measured air temperature is outside of this range, field welding may be conducted, but only if the Contractor can demonstrate that seaming performance is acceptable (in terms of shear and peel testing outlined in Specification Section 7.4.3).

7.3.3 Geomembrane Anchoring

Around the perimeter of the lined area of the disposal cell, the edge of the geomembrane shall be continuously anchored in a trench as shown in the Drawings. The geomembrane shall extend a minimum of five feet into the trench. Liner cover (Specification Section 6.2.3) shall be placed in the trench and compacted (as outlined in Specification Section 6.3.3) to anchor the geomembrane.

At the lined area perimeter, the edge of the geomembrane shall be continuously anchored. Along the liner anchor, welded panel seams shall extend a minimum of six inches beyond the inside edge of the anchor trench.

Backfilling of the liner anchor trench shall be done when the air temperature above the liner is relatively cool, in order to minimize liner shrinkage due to decreasing temperature after the liner is anchored.

7.3.4 Geomembrane Repairs

Geomembrane installation shall be done without puncturing, tearing, or otherwise damaging the geomembrane panels or seams. No vehicles shall be driven or parked on top of the uncovered geomembrane. Punctures, overlaps (fishmouths), or other unacceptable liner conditions shall be repaired with an overlapping patch bonded to the geomembrane by field welding. Geomembrane patching shall be done with the patch material extending a minimum of six inches beyond the puncture, tear, or joint in the liner. Repair of damage to the deployed geomembrane and testing of geomembrane patches will be the responsibility of Contractor.

7.3.5 Geomembrane Protection

Upon completion of geomembrane seaming, the liner shall be protected from uplift due to wind by placing sand bags or similar approved material on the liner surface. These protective materials shall be of a spacing and weight sufficient to prevent uplift or movement of the liner without puncturing, tearing, or otherwise damaging the geomembrane.

7.3.6 Filter Fabric Installation

Rolls of filter fabric shall be handled, deployed and spread according to manufacturer's guidelines. The edges of deployed filter fabric shall have a minimum overlap of six inches. Where possible, the overlapping panels shall be shingled, such that the up-slope panel is on top of the down-slope panel.

Filter fabric shall not be placed during high winds. Upon completion of filter fabric deployment, panels shall be protected from uplift due to wind by placing sand bags or similar approved material on the filter fabric surface. These protective materials shall be of a spacing and weight sufficient to prevent uplift or movement of the filter fabric without tearing the filter fabric.

7.3.7 Geogrid Installation

Rolls of geogrid shall be handled and unrolled according to manufacturer's guidelines. The edges and ends of the geogrid rolls shall have a minimum overlap of six inches. Where necessary, the overlapped edges of the geogrid shall be tied together according to manufacturer's guidelines.

7.4 PERFORMANCE STANDARDS AND TESTING

7.4.1 General Requirements

Testing of the installed geomembrane shall consist of the following items.

a) Visual examination of the panels upon delivery to the site, with documentation of the panel thickness, length, width, and manufacturer's mark number and receipt of mill certification and material property data.

b) Physical examination of the panels upon unfolding and spreading, with checking of nominal widths and examination for material flaws or defects.

c) Pressure testing of the air channel between panel seam welds, as outlined in Specification Section 7.4.2.

d) Destructive (shear and peel) tests on seam samples extracted from all panel seams at a frequency equivalent to one sample collected from up to 1000 linear feet of seam. If the integrity of the seam, weather conditions, or welder operation are of concern to the QA Manager, the maximum spacing shall be reduced to one sample for 500 linear feet of seam. Tests are outlined in Specification Section 7.4.3.

e) Vacuum testing of all extrusion welded seams, as outlined in Specification Section 7.4.4.

f) Physical examination of the completed liner surface, checking for liner damage, punctures and defects in seaming.

7.4.2 Air Channel Testing

Each geomembrane panel seam shall be tested by air pressure testing of the air channel between parallel seams. The minimum air channel test pressure shall be 30 psi, with a maximum pressure drop of 3 psi over a 5-minute test period.

7.4.3 Shear and Peel Tests

Each sample cut from the seamed geomembrane shall be tested for both shear and peel tests. The shear (or bonded seam strength) test shall be conducted according to ASTM D-3083 and ASTM D-638, and have a shear strength of 120 lb/inch width of seam. The peel (or peel adhesion) test shall be conducted according to ASTM D-413 and ASTM D-638, and have a minimum peel strength of 70 lb/inch width of seam. Failure for both tests shall be in a ductile manner and observed at the film bond to be acceptable.

Each type of test shall be performed on five replicate specimens from each material sample (equivalent to five shear tests and five peel tests per material sample). The test results shall be reported individually, with four out of five tests meeting strength requirements being acceptable.

In the event of a failed test (less than four of five tests meeting strength requirements), additional samples shall be collected at 50-foot intervals along the seam on either side of the failed sample location, with additional sampling and testing conducted until tested seam conditions are acceptable. The seam in the failed test area between the acceptable test locations shall be extrusion welded and tested.

7.4.4 Vacuum Testing

All extrusion welded geomembrane seams shall be tested with a vacuum box. The minimum vacuum shall be equivalent to 5 psi (10 inches of mercury). Seam failure shall be assessed by complete loss of vacuum or presence of bubbles.

7.4.5 Testing Documentation

The QA Manager shall review all geomembrane liner test results made by the Contractor and conduct independent tests as necessary. All flaws in the seams or liner panels resulting from the installation shall be repaired and approved by the QA Manager prior to approval of the pond to contain water.

Geomembrane panel and seam locations, seam test results, repair locations, and seam test results shall be marked on the liner surface and documented by the QA Manager. Final approval of the liner testing will be determined by the QA Manager, based on having acceptable QA test results.

8.0 MATERIAL DISPOSAL

8.1 GENERAL

This section outlines the work associated with placement of materials in the disposal cell.

8.2 MATERIALS DESCRIPTION

Similar process area materials have been organized into groups for disposal in specific layers (Section 4.2). The materials comprising the four layers to be disposed in the cell are outlined below.

8.2.1 Layer A Materials

Layer A materials consist of five components: (1) raffinate sludge, (2) Pond 2 residual materials, (3) Emergency Basin sediment, (4) North Ditch sediment, and (5) Sanitary Lagoon sediment. The locations of these materials are shown on the Drawings.

Due to the relatively high activity concentration of radionuclides in Layer A materials, these materials would be the lowest layer in the disposal cell profile. Layer A materials shall be placed within the lined area of the disposal cell. Layer A materials may contain an additive such as fly ash or cement, that is added to the material prior to placement within the lined area of the disposal cell.

8.2.2 Layer B Materials

Layer B materials include soil liner and subsoil materials beneath the clarifier, Pond 4, the Emergency Basin, the North Ditch and the Sanitary Lagoon, as well as Pond 1 spoils pile material. Layer B materials also include interim soil storage cell materials and soils from the equipment storage area. The locations of these materials are shown on the Drawings.

The Layer B materials (primarily contaminated soils) are second in the disposal order, since these materials would be excavated after removal of Layer A materials and would have the second highest activity concentrations of radionuclides. Layer B materials would be placed directly over Layer A materials in the disposal cell profile, within the lined area of the disposal cell, or over other prepared areas of the disposal cell foundation.

8.2.3 Layer C Materials

Layer C materials consist of structural materials, concrete and asphalt, calcium fluoride basin materials, calcium fluoride sediments, calcium fluoride basin liners and subsoils, and on-site buried materials. The locations of these materials are shown on the Drawings. Layer C materials would be placed directly over Layer A or B materials, or over other prepared areas of the disposal cell foundation.

8.2.4 Layer D Materials

Layer D materials consist of contaminated soils and sedimentary rock that require cleanup. The soil cleanup level is a natural uranium activity concentration of 27 pCi/g. The approximate area of material cleanup is shown on the Drawings.

Layer D materials would be placed directly over Layer A, B, or C materials, or over other prepared areas of the disposal cell foundation. Layer D materials will be used to cover plant equipment and structural debris (Layer C materials) to minimize void spaces.

8.3 WORK DESCRIPTION

8.3.1 Layer A Material Placement

Layer A materials shall be placed within the lined area of the disposal cell. Layer A materials (Section 8.2.1) will be placed within the lined area of the disposal cell in lifts that allow consolidation and drying and of wet or saturated materials prior to covering with additional Layer A materials or with Layer B materials.

8.3.2 Layer B Material Placement

Layer B materials will be placed within the disposal cell in lifts. Layer B materials will be placed within the disposal cell in lifts (if necessary) to allow consolidation and drying and of wet or saturated materials. Layer B materials (Section 8.2.2) will be placed directly over Layer A materials, within the lined area of the disposal cell, or over other prepared areas of the disposal cell foundation.

8.3.3 Layer C Material Placement

Layer C materials will be placed within the disposal cell in lifts. Layer C materials (Section 8.2.3) will be placed directly over Layer A or B materials, or over other prepared areas of the disposal cell foundation.

Layer C materials consisting of sediments or soft soils will be placed within the disposal cell in lifts (if necessary) to allow consolidation and drying and of wet or saturated materials. Layer C materials consisting of equipment or structural debris will be placed in the disposal cell by dumping from a causeway within the disposal cell. Where possible, structural debris will be placed or moved within the disposal cell so that it is oriented to minimize void spaces and subsequent settlement of overlying materials. If necessary, water may be added during Layer C material placement for dust control.

8.3.4 Layer D Material Placement

The disposal cell has been designed to accommodate a variation in total contaminated soil (Layer D material) volume. The footprint of the disposal cell is established along the north and west sides of the cell (shown on the Drawings). The final location of the south and east sides of the disposal cell (as well as the transition to the north and west sides of the cell, and the corresponding foundation area) will be established as the final volume of Layer D material is determined during contaminated soil excavation.

Layer D materials (Section 8.2.4) will be placed directly over Layer A, B, or C materials, or over other prepared areas of the disposal cell foundation. Layer D materials will also be used to cover plant equipment and structural debris (Layer C materials) to minimize void spaces. If necessary, water may be added during Layer D material placement for dust control.

8.4 PERFORMANCE STANDARDS AND TESTING

8.4.1 Layer A Limits

Layer A materials shall be placed within the lined area of the disposal cell.

8.4.2 Final Slope and Grades

The final disposed material surface shall have maximum side slopes of 5:1 and a top surface sloping in the direction shown on the drawings at a nominal slope of 1 percent. The side slopes and top surface shall be free from abrupt changes in grade or areas of runoff concentration. The final disposed material surface shall be compacted with approved construction equipment to form a smooth surface with uniform density for subsequent cover placement.

The upper six inches of the final disposed material surface shall be compacted to 90 percent of the maximum dry density for the material, as determined by the Standard Proctor test. During compaction, the material shall be within 1 percent above to 4 percent below optimum moisture content for the material, as determined by the Standard Proctor test. If water addition is required to achieve this range of moisture contents, the added water shall be thoroughly mixed into the material prior to compaction.

Checking of compaction of the final disposed material surface shall consist of a minimum of one field density test per 1,000 cubic yards of material compacted. Field density tests shall be compared with Standard Proctor tests (ASTM D-698 Method A or C) on the same material. Standard Proctor tests shall be conducted at a frequency of at least one test per 2,000 cubic yards of material compacted, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D-1556) or a nuclear density gauge (ASTM D-3107 and D-2922, or as modified by the QA Manager). Calibration of the nuclear density gauge shall be by comparison with results from the sand cone test on the same material.

9.0 DISPOSAL CELL COVER CONSTRUCTION

9.1 GENERAL

This section outlines the work associated with construction of the disposal cell cover.

9.2 MATERIALS DESCRIPTION

9.2.1 Cover Material

Cover material will consist of soils from approved on-site borrow areas (Section 3.4). Cover material shall be minus 3-inch size, and shall be free from roots, branches, rubbish, and process area debris. Cover material shall have a minimum of 30 percent passing the No. 200 sieve.

9.2.2 Rock Mulch

Rock mulch will consist of granular materials from approved off-site areas. Rock mulch material shall meet NRC long-term durability requirements (outlined in Appendix D of the 1990 NRC Staff Technical Position, Design of Erosion Protective Covers).

Rock mulch material shall have the following particle-size distribution: (a) 100 percent passing 6-inch size, (b) 30 to 70 percent passing 3-inch size, (c) 20 to 50 percent passing 1.5-inch size, (d) 10 to 40 percent passing ¾-inch size, and (e) 0 to 30 percent passing No. 4 sieve size. Rock mulch material shall be shall be free from roots, branches, rubbish, and debris.

9.2.3 Topsoil

Topsoil will consist of select material of dark color from the on-site topsoil borrow area (Section 3.5).

9.3 WORK DESCRIPTION

9.3.1 Base Preparation

The foundation for the cover is the final disposed material surface. The final disposed material surface shall be prepared as outlined in Section 8.4.2.

9.3.2 Cover Material Placement

Cover material (Section 9.2.1) shall be placed in lifts of 18-inch maximum thickness, to form a uniform subsoil layer for the cover system with a minimum thickness of 8.5 feet on the top surface and side slopes (as shown on the Drawings). Each lift shall be rolled or compacted with a minimum of four passes with approved construction equipment.

9.3.3 Rock Mulch Placement

Rock mulch material (Section 9.2.2) shall be placed in one or more lifts to form a continuous, uniform layer on the side slopes and perimeter apron of the cover with a minimum thickness of six inches.

9.3.4 Topsoil Placement

Topsoil (Section 9.2.3) shall be placed in one or more lifts to form a uniform layer with a final thickness of 12 inches on the side slopes and perimeter apron and 18 inches on the top surface (shown on the Drawings).

9.4 PERFORMANCE STANDARD AND TESTING

9.4.1 Cover Material Testing

Material specifications for the cover material shall be confirmed by gradation testing conducted by approved personnel. Testing shall consist of No. 200 sieve wash and maximum particle size testing (ASTM D-422) on samples of cover materials, at a frequency of at least one test per 2,000 cubic yards of fill placed, or when material characteristics show a significant variation.

Cover material compaction will be verified by the maximum lift thickness and number of equipment passes outlined in Section 9.3.2.

9.4.2 Rock Mulch Testing

Material specifications for the rock mulch material shall be confirmed by gradation testing conducted by approved personnel. Testing shall consist of particle-size distribution testing (ASTM D-422) at a frequency of at least one test per 2,000 cubic yards of rock mulch placed, or when rock mulch characteristics show a significant variation.

The durability of the rock mulch material shall be verified upon selection of the rock mulch source by durability tests outlined in Appendix D of the 1990 NRC Staff Technical Position, Design of Erosion Protective Covers. The rock mulch material shall have a rock quality designation of 80 (for no over-sizing) or a rock quality designation of 60 to 80 (for over-sizing). Long-term durability tests shall be conducted on two representative samples from the selected rock mulch source.

9.4.3 Topsoil Testing

Material specifications for the topsoil shall be confirmed by observation of organic matter content, as characterized by visual observation of the color of the topsoil.

9.4.4 Surface Slopes and Grades

The final cover surface shall have maximum side slopes of 5:1 and a top surface sloping in the direction shown on the drawings at a nominal slope of 1 percent. The side slopes and top surface shall be free from abrupt changes in grade or areas of runoff concentration. The perimeter apron at the toe of the side slopes shall have a minimum width of 20 feet from the toe of the side slopes and slope away from the toe of the side slopes (as shown on the Drawings).

10.0 REVEGETATION

10.1 GENERAL

Following topsoil placement on the disposal cell, the cover surface will be revegetated. This section describes the requirements for vegetation establishment and where additional vegetation establishment efforts are required. This section may be revised as necessary based on field requirements and soil analysis.

10.2 MATERIALS DESCRIPTION

The following section describes the types of soil amendments, seed mixture, transplant species, and erosion control materials that will be used to achieve vegetation establishment. Submittals for each of the following products shall be provided to SFC for approval prior to use of such products.

10.2.1 Soil Amendments

In order for the cover to function properly as a plant growth media, soil amendments may be needed. Topsoil material will be tested to determine fertilizer requirements, for nutrient availability, pH, texture, and organic matter content. The results from these analyses will be used as a guide for determining site-specific topsoil amendment requirements.

10.2.2 Seed Mix

Species selection for the seed mixture was based on native vegetation found at the site area as well as soil and climatic conditions of the area. Changes to the seed mixture will be approved by SFC. The following seed mixture shall be used on all seeded areas.

Scientific Name	Common Name	Seeding rate (lbs PLS /A)*
Andropogon gerardii	Big bluestem	6.0
Schizachyrium scoparium	Little bluestem	3.0
Panicum virgatum	Switchgrass	2.0
Sorghastrum nutans	Indiangrass	2.0
Elymus villosus	Hairy wildrye	2.0
Solidago altiplanities	High plains goldenrod	1.5
Helianthus petiolaris	Prairie sunflower	1.5
Silphium laciniatum	Compassplant	0.5
Liatris Gaertn. Ex Schreb.	Blazing star	0.5
Rhus microphylla	Littleleaf sumac	2.0
	TOTAL	21.0

* Pounds Pure Live Seed Per Acre

10.2.3 Transplant Species

Post oak, red oak, hickory ash, and American sycamore will be transplanted using containerized seedlings. Seedlings will be three years old. Planting rate for sycamore shall be 150 trees per acre, with no more than 10 percent of seedlings consisting of American Sycamore, and equal proportions of the other species.

10.2.4 Erosion Control Materials

Certified weed-free straw shall be applied to all seeded areas at the rate of 2 tons per acre. Straw mulch shall be applied with a blower designed for such purposes.

10.3 WORK DESCRIPTION

Revegetation efforts shall be directed at all areas included in the disposal cell cover. The goal of the revegetation plan is to ensure that a self-sustaining vegetative community is established.

10.3.1 Soil Amendment Application

Following the final placement and grading of the cover, lime will be applied to those areas identified by soil analysis that require an increase in soil pH. The application of lime will be performed by broadcast spreader. Rates of application will be determined from the soil analysis report.

Organic amendments consisting of manure, sewage sludge, wood chips, or similar organic material will be applied to all seeded areas that are shown to contain less than 2 percent organic matter. Rates of application will be determined from the soil analysis report.

Inorganic sources of nitrogen, phosphorus, and potassium will be applied to the soil by broadcast spreader. Rates of application will be determined from previous soil analyses.

10.3.2 Growth Zone Preparation

A favorable seedbed shall be prepared prior to seeding operations. The soil should be loose and friable so as to maximize contact with the seed. Tillage operations not only prepare the seedbed, but also incorporate soil amendments. The soil will be tilled, following site contours with a disc (or similar approved equipment) to a depth of 6 inches. The depth of valleys and the height of ridges caused by the final tillage operations are not to exceed 2 inches. Thus, the total maximum difference from the top of ridges to the bottom of valleys will be 4 inches. Harrowing may be required to further prepare the soil for seeding.

10.3.3 Seed Application

Seeding will follow the application of soil amendments and seedbed preparation, either by drill seeding or broadcast spreading. Seed shall be drilled to a depth of 0.25 to 0.75 inches by a conventional drill; drilling orientation shall follow the contour of the land. Seed shall be drilled at the specified application rate. Seed shall be applied by broadcast spreader at two times the specified application rate. Broadcast seed shall be harrowed into the soil to a depth of 0.25 to 0.75 inches.

10.3.4 Erosion Control Material Application

Immediately following seeding operations, straw shall be blown over the seeded area. The rate of application shall be 2 tons per acre. Straw should be applied in a uniform manner with no obvious clumping of straw at the soil surface. Following the application of straw, plantago based tackifier (or approved equivalent) shall be applied by a hydromulcher at the rate of 150 pounds per acre. Sufficient water shall be used to apply the tackifier in a uniform manner.

10.3.5 Transplanting

Planting of tree transplants shall occur after the site has been mulched and tackified. Straw will be scraped away from the area where the holes are to be dug. Holes for the transplants shall be dug approximately 1.5 times wider than the root ball. The backfilled soil around the transplant to remove air pockets. A slight depression shall remain around each backfilled transplant to help capture water. Straw that was scraped away shall be placed over the backfill area.

10.4 PERFORMANCE STANDARD AND TESTING

The following section describes performance-based criteria for successful revegetation.

10.4.1 Vegetation Establishment Performance

Total vegetative cover sampling shall be performed at a future date to ascertain vegetation establishment success. The revegetation effort shall be deemed successful if the total vegetation cover on the mill tailings cover is at least 70 percent of the total cover of a nearby background reference area for two consecutive years. Areas that do not meet this performance criterion will be reseeded.

10.4.2 Transplant Performance

Transplant performance will be considered successful if more than 75 percent of the transplants remain living two years after planting. Areas that do not meet this performance criterion will be replanted.

10.4.3 Erosion Control

The tailings cover shall be inspected two times per year for eroded areas. Any area that has experienced erosion shall be backfilled and reseeded. Straw shall also be applied over the reseeded area.

10.4.4 Weed Control

The tailings cover shall be inspected for the presence of weedy species at least two times per year: once in late spring, and once in mid-summer. Weed species should be identified and the approximate coverage should be noted. Spot-spraying of weeds may be necessary to control unwanted species.

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D-05

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D-06

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D-07

ATTACHMENT B

Final Status Survey

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1.0 INTRODUCTION

This section 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 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 E.

2.2 Cleanup Levels (CL)

For the purpose of the final status surveys, the 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 2-1 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 2- 1 Cleanup Levels (CL)

Condition	Uranium-Nat pCi/g	Thorium-230 pCi/g	Radium-226 pCi/g
CL_W	100	=14 / =43	=5 / =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:

- <u>Class 1 areas</u>: 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 $DCGL_W$ for U-nat.
- <u>Class 2 areas</u>: 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 $DCGL_W$ for U-nat.
- <u>Class 3 areas</u>: 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 $DCGL_W$ 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 $DCGL_W$ 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 2-1 in 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 2-2.

Table 2- 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 sampling. These survey techniques are combined in an integrated survey design.

2.6 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 2-3.

Table 2- 3 Identification Of Radiation Detection Instruments For The Final Status Surveys Of The Sequoyah Facility

Measurement	Instrumentation		Background[1] (cpm)	4 p[1] Efficiency (%)	Detection Sensitivity[2, 3]
	Detector	Meter			
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.	2.77	20	56 $dpm/100cm^2$ 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	2200 $dpm/100cm^2$ 50 $dpm/100cm^2$
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[4] 3 pCi/g as Ra-226[4]

[1]Nominal values.
[2]Monitoring audible signal during scanning.
[3]One-half minute integrated count for direct measurements.
[4]MARSSIM Table 6.7
n/a - not applicable

2.6.1 Direct and Removable Measurements

Direct and removable measurements will only be made of structural surfaces. Direct and removable measurements will be limited to alpha and beta/gamma measurements. The types of instruments used for direct and removable measurements and their typical performance characteristics are provided in Table 2-3.

2.6.2 Sampling

Sampling will be limited to land areas. Samples of soil will be collected and analyzed for the radionuclides of concern, as applicable. The analysis technique and typical detection limit for each radionuclide of concern is provided in Table 2-4.

Table 2- 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

2.7 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.

2.8 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.

2.9 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 2-2. 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.

2.10 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 2-4 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 $DCGL_W$ were not changed. The area factors were then computed by taking the ratio of the dose per unit concentration generated by RESRAD for 25000 $m^{½}$ to that generated for the other areas listed.

Table 2- 5 Outdoor Area Factors

	Area Factor										
Radionuclide	**1m²**	**2m²**	**3m²**	**10m²**	**30m²**	**100m²**	**300m²**	**1000m²**	**3000m²**	**10000m²**	**25000m²**
U-Nat	7.6	5.7	4.8	3.1	2.3	1.9	1.6	1.1	1.1	1.0	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 (cleanup levels).

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 2, Clarifier A Basin, and the disposal cell footprint. The final status survey will be applied independently to each 2000 $m^{½}$ 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 (s_s) for uranium in this area.

3.1.3 Calculate Relative Shift

The relative shift (?/s_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 s_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 a = 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. Determining the Number of Data Points for Small Areas of Elevated Activity

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 $m^{1/2}$. The required scan minimum detectable concentration (MDC) will be determined per MARSSIM equation 5-3 using the CL_W in Table 2-1 and the Area Factor in Table 2-5. 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 $m^{½}$ 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 (s_s) for uranium in this area.

3.2.3 Calculate Relative Shift

The relative shift (?/s_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 s_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 a = ß = 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 (s_s) for uranium in these units.

3.3.3 Calculate Relative Shift

The relative shift ($?/s_s$) 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 s_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 a = ß = 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 form each unit. Scanning will be completed for a majority 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

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.

The CL_W is 2000 transformations per minute per 100 cm^2 ($tpm/100cm^2$) total (direct) gross alpha and total (direct) gross beta/gamma, measured independently.

3.4.2 Estimated Number of Data Points

Data from routine contamination surveys for this structure do not indicate the presence of any residual contamination.

3.4.3 Calculate Relative Shift

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. The relative shift ($?/s_s$) 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 s_s = 1000 * 0.30 $tpm/100cm^2$: $?/s_s$ = 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 a = ß = 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 a = ß = 0.05, and $?/s_s$ = 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 five areas are: the footprint of Pond 1 Spoils Pile; the footprint of Clarifier A Basin; the footprint of Pond 2; outside the fence at Pond 2 to the south, west and north; the inside the fence of Pond 4; and outside the fence of Pond 4 to the north and east. The final status survey will be applied independently to each $100m^2$ unit of these areas.

3.5.2 Number of Data Points

One sample will be collected from each unit of each area. Surface soil sample results from site characterization and/or remediation control surveys for the area will be used when available. In situ measurements may be substituted for soil samples.

3.5.3 Determining Survey Locations

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

3.5.4 Integrated Survey Strategy

Sampling will be completed as described previously. At least 30 soil samples will be collected from each area. Each soil sample will be analyzed for uranium, Th-230 and Ra-226.

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. 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. 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 100m2 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 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

A written quality assurance project procedure (QAPP) will be developed for the final status survey effort. The QAPP will be developed using a graded approach. The graded approach will base the levels of controls on the intended use of the results and the degree of confidence needed in their quality. The

QAPP will describe the QA/QC requirements regarding, survey planning, survey implementation, and results evaluation.

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 (DQA).

4.3.1 Data Verification

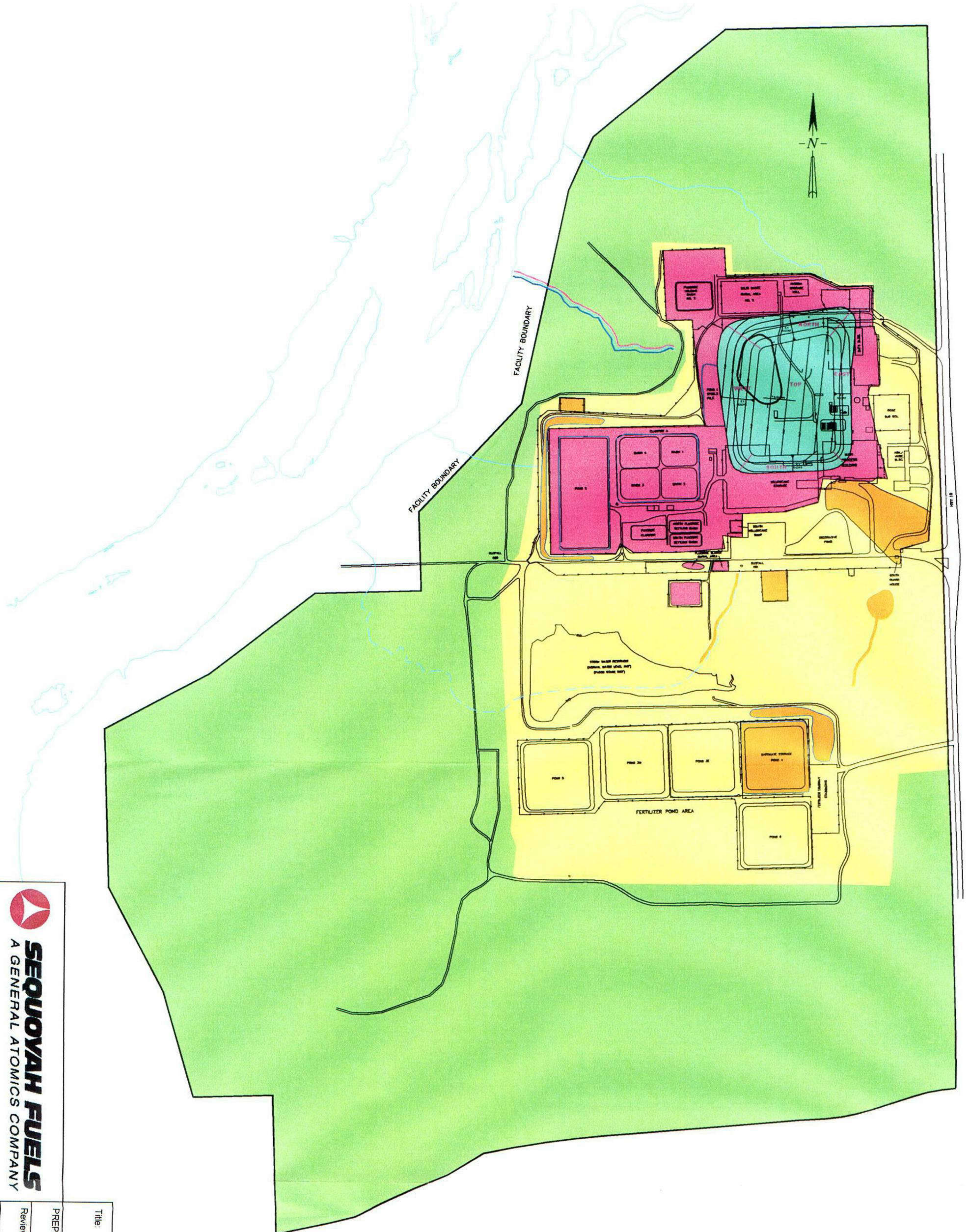
Data verification efforts will be completed to ensure that requirements stated in planning documents are implemented as prescribed. Identified deficiencies or problems that occur during implementation will be documented and reported. Activities performed during the implementation phase will be assessed 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 validation effort will be conducted in consideration of the guidance provided in Chapter 8 and Appendix E of MARSSIM.



LEGEND

PROPOSED CELL

IMPACTED

CLASS 3

CLASS 2

CLASS 1

TH230/RA226

NON-IMPACTED

SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY
RECLAMATION PLAN

Title: CLASSIFICATION OF AREAS FOR FINAL RADIATION SURVEY

PREPARED BY: SFC

Filename: SFC0092A

Reviewed by: CH

Date: 12/27/2002

Figure No.2-1

C09

ATTACHMENT C

Quality Assurance Program

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1.0 ORGANIZATION

1.1 Project Manager

The Project Manager (PM) has overall responsibility for the safe conduct of the SFC Decontamination and Decommissioning Project. This individual provides senior project management oversight for implementation and execution of a project specific Quality Assurance Program, a project specific radiological health and safety program, and for compliance with all local, state, and federal regulations. The Project Manager has further assigned these responsibilities to the Director, Decontamination and Decommissioning Projects, the Manager, Health and Safety and the Quality Assurance Manager.

1.1.1 Experience and Qualifications

The Project Manager will hold a degree in science or engineering, and shall have a minimum 15 years experience, at least five years of which shall be in a project management role.

1.2 Director, Decontamination and Decommissioning Projects

The Director, Decontamination and Decommissioning Projects is responsible for the operation of facility equipment and systems, implementation and oversight of decontamination and decommissioning projects, including development of decommissioning plans, and related activities including waste management and fertilizer distribution programs. In addition, he is responsible for providing engineering support for the facility.

1.2.1 Experience and Qualifications

The Director, Decontamination and Decommissioning Projects shall hold a degree in science or engineering and have at least 5 years experience in a chemical processing or nuclear facility, including at least two years decontamination and decommissioning experience and at least five years supervisory or management experience. The individual shall have demonstrated through progressively more responsible positions the ability to manage complex technical and administrative programs similar to those found in a chemical processing plant or nuclear facility.

1.3 Manager, Health and Safety

The Manager, Health and Safety is responsible for the effluent monitoring program, training program, the respiratory protection program, the bioassay program, the health physics and safety programs, and the program for surveillance of all plant activities related to these areas. He shall be responsible for maintaining all radiation exposure and other health and safety records required by General Atomics, Sequoyah Fuels Corporation and by regulatory agencies. This individual and the cognizant Department Manager, or their designated representatives, shall document that each employee's on-the-job training and qualification has been adequate and that the employee is competent and qualified to perform his or her responsibilities.

1.3.1 Experience and Qualifications

The Manager, Health and Safety shall hold a degree in science or engineering and have at least 5 years experience in areas such as radiation protection, radiation monitoring, health physics, emergency preparedness and personnel exposure evaluation. He shall have demonstrated a proficiency to conduct specified radiation safety programs, recognize potential radiation safety problem areas in operations and advise operation supervision on radiation protection matters. He shall be capable of directing the surveillance activities of the Health and Safety Technicians.

1.4 Quality Assurance Manager

The Quality Assurance Manager is responsible for the implementation and execution of Quality Assurance and Control procedures and practices including supervision of the Project's Document Control procedures. This individual is also responsible for preparation, implementation, and oversight of the Self-Assessment and Audits procedures, including identification of deficiencies and improvements, corrective actions, and feedback.

1.4.1 Experience and Qualifications

The Quality Assurance Manager shall hold a degree in science or engineering and have a minimum of five years experience in management, with a minimum of two years experience in oversight and responsibility for quality assurance and quality control issues.

2.0 QUALITY ASSURANCE PROGRAM

2.1 Activities Affecting Quality

Decommissioning and decontamination activities will be performed under the provisions of the Sequoyah Fuels Corporation Quality Assurance Program (QAP). The requirements and guidance contained in the QAP are based on the principle that work shall be planned, documented, performed under controlled conditions, and periodically assessed to established work item quality and process effectiveness and promote improvement. The requirements described in the QAP reflect the responsibilities assigned to management and personnel of all departments and their responsibility for planning, achieving, verifying, and assessing quality and promoting continuous improvement. The QAP further delineates the quality contributions of all personnel and encourages their active participation in accomplishing the quality objectives.

2.2 Summary of QA Policies

It is the policy of SFC management to perform its decommissioning work professionally and consistently to achieve a level of quality that meets or exceeds facility license termination requirements. As part of accomplishing this management requirement, all personnel are required to comply with the elements of the Quality Assurance Program, implementing directives and project specific addenda in the day-to-day performance of their work. Suggestions on improvements to the Quality Assurance Program and its elements are encouraged, and should be directed to the Decommissioning Project Manager or the Quality Assurance Manager.

The Quality Assurance Program and its sub-tier functional area directives are designed to implement applicable requirements of the NRC's radiation program regulations applicable to fuel cycle facilities and their decommissioning for license termination.

All employees of SFC and its contractors are responsible for assuring the quality of the work that they perform and for compliance with the requirements of this program and applicable regulations.

The Decommissioning Project Manager has the overall responsibility for ensuring that the Quality Assurance Program is implemented and maintained. The Quality

Assurance Manager is designated as the position responsible for implementing and assessing the scope, status, implementation and effectiveness of the Quality Assurance Program.

2.3 Program description

The Quality Assurance Program outlines the requirements and controls applied to Sequoyah Fuels Corporation activities which provide reasonable assurance that activities conform to NRC license requirements, federal and state regulations, and corporate policies and procedures. Authority to stop work is assigned to the Director of Regulatory Affairs. This authority includes further processing of unsatisfactory work or further processing of unsatisfactory items. Inherent in this process is the authority to order resumption of work when the cause of the work suspension has been brought under control. Stop work conditions include:

1. Serious safety threat to employees or surrounding community.
2. Violation of Sequoyah Fuels Corporation License.
3. Violation of government regulation.
4. Gross contractual negligence.

2.4 Management Reviews

SFC officers, directors, managers, and supervisors shall be responsible for assuring that personnel are provided the proper training, tools, skills, and information to properly perform their assigned tasks.

2.5 Procedural Controls

Decommissioning activities that generate results essential to decommissioning (e.g. radiological surveys, waste generation and disposal, and radiation exposure data) shall be controlled using approved, written procedures.

The preparation, issue, and change of the procedures that specify quality requirements or prescribe activities affecting quality, safety, or handling of licensed material shall be controlled to assure that correct procedures are being employed. Such procedures, including changes thereto, shall be reviewed for adequacy and approved for release by authorized personnel (Plant Review Committee).

The procedure control system shall be controlled by written, approved procedures, and shall provide for:

1. Identification of procedures to be controlled and their specified distribution;
2. Identification of assignment of responsibility for preparing, reviewing, approving, and issuing procedures;
3. Review of procedures for adequacy, completeness, and correctness prior to approval and issuance; and
4. Identification of essential criteria (quantitative and qualitative) for work activities with quality assurance requirements.

The procedure changes shall be reviewed and approved by the same organizations that performed the original review, unless other organizations are specifically designated. Some minor procedure changes, such as inconsequential editorial corrections, shall not require that the revised procedures receive the same review and approval as the original procedure. The type of minor changes that do not require such a review and approval are delineated in written procedures.

The Plant Review Committee (PRC) shall be responsible for determining the need for and the amount of training to be conducted prior to implementing new or revised operating procedures.

2.6 Program Changes

Changes to the key elements of the Quality Assurance Program will be submitted to the NRC for review and approval prior to implementation.

The NRC will be notified of any changes to the organizational elements within 30 days after the announcement of the change is made.

Editorial changes or personnel reassignments or a nonsubstantive nature do not require NRC notification.

2.7 Management Assessment of Program Effectiveness

The effectiveness of the Quality Assurance Program will be monitored and assessed through the Audit and Surveillance Program and the Corrective Action Program. Audit findings and deficiencies identified through the Corrective Action Program will be tracked and trended through the commitment tracking system.

Audit findings and their responses and Condition Reports and their resolutions will be reviewed by the Plant Review Committee.

2.8 Instructions to Personnel

Sequoyah Fuels Corporation officers, directors, managers, and supervisors shall be responsible for assuring that personnel are provided the proper training, tools, skills, and information to properly perform their assigned tasks.

2.9 Training and Qualification

SFC is committed to a comprehensive training program to ensure that all employees receive the instruction necessary to be able to perform their jobs safely and efficiently. Components of the training program include:

General Employee Training

General Employee Training consists of classroom lectures and demonstrations for all new hires. Topics covered include radiation protection, emergency requirements, and procedures, as appropriate to the individual's position.

Decontamination and Decommissioning Technician Training and Qualification

Decontamination and Decommissioning Technician Training consists of classroom lectures and on-the-job training modules for specific functions. Before being permitted to perform the requirements without direct supervision, technicians are qualified based upon successful completion of required classroom and on-the-job training. The qualification system is promulgated in an operating procedure, which is reviewed and approved by the Plant Review Committee.

Retraining

Refresher training is conducted each calendar year for all employees whose normal duties expose them to licensed or hazardous materials, and includes such subjects as health physics, safety, hazard communications, and specified procedures.

Development and Approval of Training Materials

Development and approval of training materials is conducted by the department under whose cognizance the subject matter falls. New training materials and revisions to existing training materials are approved by the cognizant Department Manager.

2.10 Formal Training and Qualification Programs

Documentation of formal training and qualification shall include the objectives and content of the program, the attendees, date of attendance, and test scores, as applicable.

2.11 Self-Assessment Program

The Self-Assessment Program is implemented through the Audit and Surveillance Program and the Corrective Action Program. Results of audits and surveillances are forwarded to the cognizant Department Manager, as well as to the Plant Review Committee.

2.12 Independence of Self-Assessment Personnel

Personnel performing self-assessment shall be independent of the activities being observed, and shall be qualified by education, experience and training, as appropriate.

2.13 Organizational Responsibilities

An organizational structure, functional responsibilities and qualifications, levels of authority, and lines of communication for activities affecting quality shall be established and documented. The management organization that is responsible for assuring that decommissioning and subsequent license termination requirements are met is established in Chapter 2 of Source materials License, SUB-1010.

2.14 Acceptance Criteria

Quality-related activities shall be prescribed by and accomplished in accordance with documented and approved instructions, procedures, or drawings. These instructions, procedures and drawings shall contain the necessary detail required by the activity and include or reference appropriate acceptance criteria.

3.0 DOCUMENT CONTROL

Documents that specify quality-related requirements and instructions are identified, reviewed, approved, issued, distributed, and maintained as controlled documents in accordance with written procedures. A listing of the types of documents to be maintained as controlled documents is contained in a Controlled Document List. The Controlled Document List will be updated as needed, to ensure it is comprehensive, current, and complete.

Changes to controlled documents are reviewed and approved by the same organization that reviewed and approved the documents originally, or by other designated qualified organizations. Disposition of superseded or modified documents is controlled in accordance with written procedures. A master list of controlled documents is maintained to identify the current revision number of instructions, procedures, specifications, drawings, and procurement documents. The list is distributed periodically to those individuals or organizations responsible for maintaining the applicable controlled documents, to prevent the use of outdated or obsolete documents.

Appropriate controlled documents are available in work areas before initiation of and during the performance of activities affecting quality. This availability is verified periodically by Quality Assurance. Changes or revisions to controlled documents are verbally communicated to affected individuals and a required reading program assures awareness of the change.

4.0 CONTROL OF MEASURING AND TEST EQUIPMENT

4.1 Equipment Used

Personnel will use appropriate procedures to ensure adequate control of measuring and test equipment that affect site characterization and the quality of design, construction, or operation. Procedures describe calibration technique, frequency, maintenance, and control of measuring and test equipment.

Standards for calibration are determined with appropriate reference to nationally accepted standards, manufacturers' instructions, intended uses, and other factors. If national standards do not exist, the basis for calibration is documented. Calibrations are performed immediately prior to use when such action is necessary to maintain or ensure accurate measurements and tests.

Documented calibration records are maintained as Quality Assurance records, in accordance with applicable procedures. Calibration instructions are maintained as controlled documents.

4.2 Equipment Calibration

Measuring and test equipment is labeled, tagged, or otherwise identified and documented to indicate the next calibration due date, as well as to provide traceability to calibration test data. Before measuring and test equipment is used, it is checked by the user to have a current calibration. Equipment is calibrated at specific intervals based on manufacturer's recommendations or on required accuracy and equipment history of drifting, precision, purpose, or any other characteristics that could affect accuracy. If a piece of equipment is found to be out of calibration, evaluations are made to determine the validity and acceptability of any measurements performed subsequent to the last calibration. If items are measured with equipment found to be out of calibration, the items will be reinspected.

4.3 Daily Calibration Checks

Instruments in use shall be verified (checked) daily when in use to ensure that the instrument is in proper working condition. An instrument shall be removed from service if the source check is not within ±20 percent of the initial post-calibration value. Laboratory instruments used for radioactivity measurements are evaluated daily before use via check sources and efficiency checks. Maintenance or repair shall be performed if the daily source or background checks are not within prescribed ranges.

4.4 Documentation

Documentation will be maintained to demonstrate that only properly calibrated and maintained equipment was used during the decommissioning.

1. Tools, gauges, instruments, and other measuring and test equipment used for specified activities affecting quality shall be controlled and at specified periods calibrated and adjusted to maintain accuracy.
2. Out-of-calibration devices shall be tagged or segregated and not used until they have been re-calibrated.

3. Records shall be maintained to indicate calibration status.

5.0 CORRECTIVE ACTION

5.1 Corrective Action Procedures

Corrective actions are accommodated through written procedures that implement a corrective action program. Conditions adverse to quality are evaluated via the corrective action program, and if found to be significant, are investigated to determine root causes, to decide on immediate corrective actions, to project preventive actions, and to define follow-up needs. The evaluations are documented within the corrective action program.

5.2 Documentation

Follow-up verification by the Quality Assurance Manager or designee ensures that the corrective actions have been implemented in a timely manner and are effective. The Quality Assurance Manager monitors progress and closes corrective actions in a timely manner.

The Quality Assurance Manager reports on corrective actions pending and closed, and on trends related to Condition Reports, at each Plant Review Committee meeting.

Documentation will be maintained of Condition Reports, action taken to resolve the condition, and any follow-up audits or actions.

6.0 QUALITY ASSURANCE RECORDS

6.1 QA Records Management

A records management system for items with quality assurance requirements includes, in part, the following; operating logs, results of reviews, inspections, tests, audits, monitoring of work performance, and material analyses. Records also include closely related data such as qualifications of personnel, training, procedures, equipment records (including calibrations), evaluations and analyses of a quality-related nature.

The types and locations of quality assurance records are identified in a subject-oriented records list. Individual records are classified, designated, validated, and stored in accordance with written procedures. Quality Assurance documents are traceable to relevant items and activities, and are identifiable and retrievable. Record retention is in accordance with applicable regulatory requirements.

6.2 Records Storage

Records will be stored in a manner that prevents damage due to reasonable anticipated events. All permanent records will be protected against larceny and vandalism. Records will be placed in either lockable file cabinets or in rooms that are lockable when the area is unattended.

7.0 AUDITS

7.1 Audit Program

Audits and surveillances are planned and scheduled according to the type and status of work being performed. Unannounced audits and surveillances are performed as necessary.

7.2 Audit Documentation

The results of audits and surveillances shall be documented. Quality Assurance is responsible for ensuring that audit findings and observations are monitored and closed out in a timely manner. Audit results are documented and reviewed by management personnel who are responsible for the audited area.

7.3 Follow-up Activities

Management personnel take appropriate action to identify root causes, correct deficiencies, prevent recurrences, and determine impacts of audit findings in their area of responsibility. Follow-up actions are performed as necessary to ensure that appropriate corrective actions have been implemented in a timely manner and are effective.

ATTACHMENT D

Radiation Safety Program During Decommissioning And Reclamation

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

This program describes measures to protect workers, the public, and the environment during remediation. In recognition that the amount of radioactivity and therefore associated hazards will be reduced as the project progresses, the Radiation Safety Program may be modified to be commensurate with the activities being performed. SFC will review and approve the Radiation Safety Program, and any revisions that are made during the project. Any such adjustment to the requirements of the Radiation Safety Program shall be made in accordance with document control procedures.

2.0 RADIATION SAFETY CONTROLS AND MONITORING FOR WORKERS

The Radiation Safety Program will consist of procedures to protect workers, the public, and the environment from ionizing radiation. The SFC Manager, Health and Safety (Mgr. H&S) is responsible for implementation of the radiation safety program. A contractor may implement the program with oversight by the Mgr. H&S.

2.1 Air Sampling Program

2.1.1 Collection

Concentrations of radioactive material in air will be determined by sampling the air. Air sampling shall be conducted in accordance with or equivalent to the guidance provided in U.S. NRC Regulatory Guide 8.25, "Air Sampling in the Workplace", 1992. Air sampling shall consider applicable guidance provided in NRC Regulatory Guide 8.30 "Health Physics Surveys in Uranium Mills", 1983.Breathing zone air samples will be the primary method of monitoring the worker's intake of radioactive material. The samples will be collected under known physical conditions (e.g. filter type, sample time, flow rate). The flow meters of air samplers shall be calibrated at least annually. Calibration shall also be performed after repair or modification of the flow meter.

Air samples will also be collected of general and localized areas when and/or where there is potential for generation of airborne radioactive material. These samples will be used to verify that the confinement of radioactive material is effective, and provide warning of elevated concentrations for planning or response actions. In each case, the sampling point will be located in the airflow pathway near the known or suspected release point(s). As necessary, more than one air sample location may be used in order to provide a reasonable estimate of the general concentration of radioactive material in air.

2.1.2 Action Level and Limit

An administrative action level shall be established for breathing zone air samples of one DAC; air sample results greater than this administrative action level shall be reported to the Mgr. H&S. An administrative limit shall be established for breathing zone air samples of 10 DAC-hours; individual exposure greater than this action level shall require the individual to be restricted from work involving potential exposure to airborne radioactive material unless approved by the Mgr. H&S.

2.2 Respiratory Protection Program

The respiratory protection program (RPP) provides guidance and instruction regarding protection of workers from occupational injury and illness due to exposure to airborne radioactive material. The RPP is implemented by written procedures. The RPP and implementing procedures are the primary means used to administratively establish safe respiratory protection practices and compliance with requirements of the NRC.

The RPP covers routine use of respiratory protection equipment. The functional areas of the RPP include medical evaluation, fit testing, selection, issue, inspection, cleaning, maintenance, storage, and training.

2.2.1 Medical Evaluation

Prior to the initial fit test, and at least every 12 months thereafter, an evaluation will be made of each worker required to wear respiratory protection equipment as part of the worker's duties as to whether or not the worker can wear the required respirator without physical risk. A worker will not be allowed to wear a particular type of respirator if, in the opinion of a physician, the worker might suffer physical harm due to wearing the respirator. A worker shall not be allowed to use a respirator without a current medical evaluation.

2.2.2 Fit Test

All workers required to wear respiratory protection equipment shall be required to successfully complete a fit test prior to initial use of the equipment. The fit test shall be repeated at least annually. A worker shall not be allowed to wear a respirator without a current successful fit test.

2.2.3 Selection

Respirators shall be selected from those approved by the National Institute for Occupational Safety and Health for the contaminant or situation to which the worker may be exposed. The Health and Safety Department shall select the respirator type. Selection shall be based on the physical, chemical, and physiological properties of the contaminant, the contaminant concentration likely to be encountered, and the likely physical conditions of the workplace environment in which the respirator will be used.

2.2.4 Issue

Workers may be assigned respirators for their exclusive use or they shall otherwise be issued by the Health and Safety Department. Respirators shall only be assigned or issued to workers qualified, with respect to the program, to use respiratory protection equipment. The type of respirator selected shall be documented on the Hazardous Work Permit.

2.2.5 Inspection

All respirators shall be inspected with regard to operability before, and routinely after, each use, and after cleaning.

2.2.6 Cleaning

Respiratory protection equipment that is used routinely shall be cleaned after each use. Respiratory protection equipment that is used by more than one worker shall be cleaned and disinfected after each use. The need for cleaning shall also be based on contamination surveys of the work area and of the respiratory protection equipment.

2.2.7 Maintenance

Respiratory protection equipment shall be maintained to retain its original effectiveness. Replacement or repair shall be done only by experienced persons, with parts designed for the respirator. No attempt shall be made to replace components or to make adjustments or repairs beyond the manufacturer's recommendations. Reducing valves or admission valves on regulators shall be returned to the manufacturer or equivalent for repair.

2.2.8 Storage

Respirators shall be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators shall be stored in dedicated carrying cases or cartons that protect from dirt and damage.

2.2.9 Training

All workers required to use respiratory protection equipment shall be instructed in the content and applicability of the program and implementing procedures, and especially in the proper use of the equipment and its limitations. A worker shall not be allowed to use a respirator without current successful completion of training.

2.3 Internal Exposure Determination

Individual monitoring shall be provided for workers who require monitoring of the intake of radioactive material pursuant to 10CFR 20.1502(b). Monitoring of intake shall normally be conducted by use of air samples, particularly of the breathing zone. Internal dose shall be determined by converting airborne concentrations to intakes in accordance with NRC Regulatory Guide 8.34 "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses", July 1992.

When a potential or actual condition exists where the worker(s) could have received an unmonitored intake of radioactive material, and cannot otherwise be estimated, the intake shall be determined by measurements of quantities of radionuclides excreted from or retained in the body. These measurements shall be made consistent with the guidance provided in NRC Regulatory Guide 8.9 "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program", 1993. These measurements shall consider applicable guidance provided in NRC Regulatory Guide 8.22 "Bioassay at Uranium Mills", 1988.

Determination of radiation dose to the embryo/fetus shall be performed in accordance with NRC Regulatory Guide 8.36 "Radiation Dose to the Embryo/Fetus", 1992.

Work restrictions shall be implemented for any worker with an intake in excess of 50% of the applicable limit in 10 CFR 20. Work restrictions shall be implemented for any worker with an intake in excess of 50% of the chemical toxicity limit for soluble uranium.

2.4 External Exposure Determination

Individual monitoring devices shall be provided to workers who require monitoring for external exposure pursuant to 10 CFR 20.1502(a). External monitoring shall be conducted in accordance with or equivalent to NRC

Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses", July 1992.

External exposure monitoring, when required, shall be accomplished using thermoluminescent dosimeters worn on the front of the upper torso. Radiological surveys may be performed to supplement personnel monitoring when work is being performed where workers are required to be monitored.

Dosimeters shall be processed at lease quarterly by a vendor accredited by NVLAP.

Work restriction shall be implemented for any worker reaching 50% of the annual limits of 10 CFR 20.

2.5 Summation of Internal and External Exposures

Results of internal and external monitoring shall be used to calculate total organ dose equivalent and total effective dose equivalent to workers for which monitoring is required. Summation of internal and external doses shall be performed in accordance with NRC Regulatory Guide 8.34 "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses", July 1992.

2.6 Contamination Control Program

Contamination control shall be managed by exposure control and monitored by radiation surveys. Contamination control measures shall also be made consistent with the applicable guidance provided in NRC Regulatory Guide 8.30 "Health Physics Surveys in Uranium Mills", 1983.

2.6.1 Exposure Control

Personnel exposure to radioactive material will be controlled by application of engineering, administrative, and personnel protection provisions. The priority of application will be descending with respect to their order of description below.

Engineering

Engineering controls will be used, as practicable, to minimize or prevent the presence of uncontained radioactive material. Engineering controls will predominantly be comprised of containment, isolation, ventilation, and decontamination.

Administrative

Administrative controls will be used to control work conditions and work practices. Administrative controls will predominantly be comprised of the following:

Access Control

Routine access to work areas will be limited to personnel necessary to accomplish tasks or activities. Access will also be controlled with respect to training and use of specified personnel protection equipment.

Postings and barriers

Postings will be used to inform personnel of relevant hazards or conditions and associated access requirements. Barriers may be used to prevent unauthorized access.

Procedures

Written procedures may be used to describe specific radiation safety requirements necessary for tasks that involve radioactive material.

Hazardous Work Permits

The requirements for Hazardous Work Permits (HWP) are described in Section 9.2. HWPs will be used to describe specific or special worker protection requirements for activities involving radioactive material and not covered by a procedure. HWPs may also be used in conjunction with a procedure.

Contamination Control

Action levels and limits for radiation surveys, described later in this section, will be used to control the levels of radioactivity on equipment and in areas.

Personal Protective Equipment

Personal protective equipment will be used to control personnel exposure to radioactive material when administrative controls are not sufficient and engineering controls are not practicable. Personal protective equipment may include head covering, eye protection, respiratory protection, impervious outerwear, gloves, and/or protective shoes or shoe covers.

2.6.2 Radiation Surveys

Radiation surveys will be performed to describe the radiation types and levels in an area or during a task, to identify or quantify radioactive material, and to evaluate potential and known radiological hazards.

The types of radiation surveys and their frequency are described in the following subsections.

Contamination Measurements

Measurements will be made of removable alpha and/or beta-gamma. The measurements will be made by wiping an area with cloth, paper, or tape. The radiation levels will be measured on the wipe. Contamination surveys shall be performed at the end of each workday where invasive demolition of contaminated material was performed.

Radiation

Exposure rate measurements will be performed using an ion chamber or equivalent. Measurements will be made at 30 centimeters.
Measurements may also be made at contact

Personnel

Personnel will be frisked prior to leaving access controlled areas.

Action Levels

Action levels are established to inform facility personnel when a situation needs to be evaluated so that corrective actions can be taken. Action levels are set so that corrective actions can be made before a regulatory limit is exceeded.

Exceedance of action levels requires investigation including evaluation of preventative and/or corrective action. The investigation, and documentation of such, is completed commensurate with the significance of the condition.

Radiation levels exceeding the values described in the following subsections will be reduced below the respective levels as soon as practicable.

Removable

The action level for removable alpha or beta-gamma radiation on a surface is 1000 dpm/100cm2.

Exposure Rate

The action level for exposure rate is two millirem per hour at 30 centimeters.

Personnel

The action level for personnel is three times the background count rate of the survey instrument.

Limits

Limits, as release criteria, are described in SFCs license. The limits are administered such that when exceeded, action must be taken to reduce the levels or additional controls must be applied.

Items or areas will not be released for unrestricted use until the relevant limits are satisfied.

All accessible surfaces and areas that exceed the respective limits will be decontaminated on a timely basis. In no case will the delay to initiate control exceed one normal workday. In the case of personnel contamination, there will be no delay to initiate decontamination.

2.7 Instrumentation Program

Instrumentation utilized for personnel monitoring will be calibrated and maintained in accordance with radiation safety procedures. These procedures utilize the manufacturers calibration guidance. Portable instruments are calibrated on a semi-annual basis or as required due to maintenance. Specific requirements for instrumentation include traceability to NIST standards, field checks for operability, background radioactivity checks, operation of instruments within established environmental bounds (i.e., temperature and pressure), training of individuals, scheduled performance checks, calibration with isotopes with energies similar to those to be measured, quality assurance tests, data review, and recordkeeping. Where applicable, activities of sources utilized for calibration are also corrected for decay. All calibration and source check records are completed, reviewed, signed off and retained in accordance with Quality Assurance Program requirements. A list of typical radiation instrumentation and minimum detectable activities (MDA) is given in Table 2-1. Typical personnel monitoring equipment is shown in Table 2-2.

In the event an instrument of the type listed in Table 2-1 is employed during decommissioning, its background count rate or exposure rate and its lower limit of detection will be estimated for its application. Alternative instrumentation must also be able to measure adequately to assess compliance with radiological safety requirements.

Table 2-1 Typical Instruments for Performing Radiation Surveys

MEASUREMENT	METER	DETECTOR
Direct alpha	Multipurpose scaler/ratemeter	ZnS(Ag) scintillation
Direct beta	Multipurpose scaler/ratemeter	Dual phosphor ZnS(Ag) scintillator
Direct alpha/beta/gamma	Multipurpose scaler/ratemeter	Gas filled (Geiger-Mueller) pancake
Removable	Computer software	Gas-flow proportional
Exposure rate	Multipurpose scaler/ratemeter or, integral with detector	NaI(Tl) scintillator Ion chamber or NaI(Tl) scintillator

Table 2-2 Typical Equipment for Performing Personnel Monitoring

EQUIPMENT DESCRIPTION	PURPOSE
Personal Air Samplers (lapel)	Breathing zone air monitoring
Area Air Samplers	High volume air monitoring
Area Air Samplers	Work area low volume air monitoring
Personnel Dosimetry (TLD)	Deep dose, eye dose, skin dose
Handheld direct alpha or direct beta instrument	Contamination monitoring
Micro-R meter	Exposure rate
Ion Chamber	Dose rate

3.0 NUCLEAR CRITICALITY SAFETY

This topic is not applicable to the decommissioning or reclamation at SFC.

4.0 HEALTH PHYSICS AUDITS, INSPECTIONS, AND RECORD-KEEPING PROGRAM

The radiation safety program shall be subject to an annual audit and periodic inspections. Each are performed to determine if radiological operations are being conducted in accordance with regulations, license conditions, and written procedures.

An audit of the radiation safety program shall be conducted annually. The audit shall be conducted by the Mgr. H&S or designee. The audit will consider the basic functional areas of the radiation safety program; e.g. Hazardous Work Permits, radiation safety procedures, radiological surveys and air monitoring, ALARA program, individual and area monitoring results, access controls, respiratory protection program, training, etc.

The audit shall be conducted in accordance with a specific audit plan developed by the auditor. A written report shall be generated upon completion of the audit describing the results. The report shall be distributed to site management. As necessary, a written corrective action plan shall be prepared to address non-compliance issues. All corrective actions shall be tracked to completion. Once corrective actions have been completed, a written closure report shall be distributed to management documenting the completion of corrective actions.

Periodic inspections shall be conducted by the Health and Safety Department staff. These inspections shall be routine reviews performed of operations and activities. The inspections shall normally be completed against a pre-established checklist. Checklists may be developed independently for differing periods; e.g. daily, weekly, monthly, etc. The checklist items shall usually be comprised of routine procedural requirements. Any findings discovered during the routine inspection shall be recorded on a tracking log. The log shall be maintained by the Health and Safety Department. The log shall include a description of planned corrective action and date of completion of corrective action.

APPENDIX A

Assessment of Non-11e.(2) Materials for Disposal in The Cell

Compliance With Interim Guidance on Disposal of Non-Atomic Energy Act of 1954, Section 11e.(2) Byproduct Material in Tailings Impoundments

NRC Regulatory Information Summary 2000-23 (November 30, 2000) provides guidance on disposal of wastes that are not 11e.(2) byproduct material in tailings impoundments. The policy identifies eight considerations. The discussion below addresses each of these considerations and shows that they are consistent with SFC's disposal in the disposal cell of the non-11e.(2) byproduct material wastes described above.

RIS 2000-23 Criterion 1. In reviewing licensee requests for the disposal of wastes that have radiological characteristics comparable to those of Atomic Energy Act of 1954, Section 11e.(2) byproduct material [hereafter designated as "11e.(2) byproduct material"] in tailings impoundments, the Nuclear Regulatory Commission staff will follow the guidance set forth below. Since mill tailings impoundments are already regulated under 10 CFR Part 40, licensing of the receipt and disposal of such material [hereafter designated as "non-11e.(2) byproduct material"] should also be done under 10 CFR Part 40.

SFC Response: The SFC non-11e.(2) byproduct materials have radiological characteristics comparable to those of 11e.(2) byproduct material. These materials are comprised of soil, demolition debris, and calcium fluoride (CaF) sludge, all of which are contaminated with low levels of source material, primarily natural uranium. The first two types of material are typical of a uranium mill operation and are similar to the 11e.(2) material that SFC also plans to place in the disposal cell. The third type of material, CaF sludge, is not found at a typical uranium mill, but it has radiological characteristics comparable to 11e.(2) byproduct material.

The radiological contaminants in all three types of non-11e.(2) byproduct material are U_{nat}, Th_{230} and Ra_{226}. These radiological contaminants are also the radiological contaminants in typical uranium mill tailings, including the SFC 11e.(2) byproduct material. The maximum concentrations of U_{nat}, Th_{230} and Ra_{226} in SFC's non-11e.(2) byproduct material are lower than respective the maximum concentrations in the SFC 11e.(2) byproduct material. In addition, the average concentrations also are lower in the non-11e.(2) byproduct material. The concentrations of these radiological contaminants in the SFC non-11e.(2) byproduct material are comparable to the concentrations in 11e.(2) byproduct material at typical conventional uranium mills. Table 1 provides estimated average and maximum concentrations of U_{nat}, Th_{230} and Ra_{226} in the three classes of non-11e.(2) wastes along with comparable concentrations in the SFC 11e.(2) materials and in 11e.(2) materials at typical conventional uranium mills.

RIS 2000-23 Criterion 2. Special nuclear material and Section 11e.(1) byproduct material waste should not be considered as candidates for disposal in a tailings impoundment, without compelling reasons to the contrary. If staff believes that such material should be disposed of in a tailings impoundment in a specific instance, a request for Commission approval should be prepared.

SFC Response: The SFC non-11e.(2) byproduct materials do not contain any special nuclear material or Section 11e.(1) byproduct material.

RIS 2000-23 Criterion 3. The 11e.(2) licensee must provide documentation showing necessary approvals of other affected regulators (e.g., the U.S. Environmental Protection Agency or State) for material containing listed hazardous wastes or any other material regulated by another Federal agency or State because of environmental or safety considerations.

SFC Response: There are no necessary approvals of other regulators because the non-11e.(2) materials do not contain any wastes that are listed as hazardous under the Resource Conservation and Recovery Act (RCRA), and there is no other Federal agency or State that regulates the land disposal of any of the constituents of the non-11e(2) byproduct material because of environmental considerations. Although the site is subject to an Administrative Order issued by the U.S. Environmental Protection Agency (EPA) under RCRA (the principal contaminant of concern being arsenic in groundwater), the EPA's concerns are not with any of the non-11e.(2) wastes that SFC wants to place in the disposal cell.

As discussed above, the non-11e.(2) byproduct material consists of three types of material: soils, demolition debris and CaF sludge. The soils are very similar to the SFC soils that are 11e(2) byproduct material and do not contain any hazardous wastes.

The demolition debris will consist of the materials resulting from demolition of buildings and equipment. The debris from buildings/equipment that were not used in the front end of the SFC process is non-11e.(2) byproduct material. Demolition debris that is non-11e.(2) byproduct material is very similar to the demolition debris that is 11e.(2) byproduct material. Like typical older uranium mill tailings sites, some of the SFC buildings and equipment contain asbestos bearing materials. About half of the asbestos is 11e.(2) material, the other half is not. Asbestos is not a listed hazardous waste under RCRA. Asbestos is regulated under the Clean Air Act, and therefore is incorporated by reference as a hazardous substance in the Comprehensive Environmental Resource and Liability Act (CERCLA), but it will not migrate in the subsurface and would not present any environmental risk when buried in the cell. No approvals from EPA or the State are required for the land disposal of asbestos.

The CaF sludge was generated by using lime (CaO) to neutralize the acidic wastewater from the conversion process fluorine scrubber systems. Excess lime was used during the neutralization step and the pH was then adjusted to near neutral using sulfuric acid. As a result, the sludge is primarily composed of CaF, CaO and CaS. The sludge also contains about 45% water and an average of about 700 ppm natural uranium.

Attachment 1 provides the results of a detailed chemical analysis of the CaF sludge that was performed as part of the EPA RCRA Facility Investigation completed in 1996. It shows that the sludge samples did not contain RCRA hazardous waste. Attachment 2 provides the results of TCLP leachability analysis on the CaF sludge, demonstrating that it is not a RCRA Hazardous Waste due to Toxic Characteristics.

There is some buried CaF sludge at the site that has not been tested. SFC plans to excavate this sludge during reclamation, test it for chemical constituents and dispose of it accordingly. If it has similar characteristics to the previously tested CaF sludge, it will be included in the disposal cell as non-11e.(2) byproduct material.

Since no listed or characteristically hazardous materials are included in the non-11e.(2) byproduct material, no approval from other Federal or State regulators is required for disposal of these materials in the disposal cell.

RIS 2000-23 Criterion 4. The 11e.(2) licensee must demonstrate that there will be no significant environmental impact from disposing of this material.

SFC Response: No significant environmental impact will result from disposing of the non-11e.(2) byproduct material in the disposal cell. The non-11e.(2) byproduct material that consists of soil and demolition debris is chemically and physically very similar to the soil and demolition debris that is classified as 11e.(2) byproduct material. While the CaF sludge is chemically different from the 11e.(2) byproduct materials, no adverse chemical reaction with other materials in the cell is anticipated. Testing has shown that uranium is less leachable from the CaF sludge than from most of the 11e.(2) materials that will be placed in the cell. Reduction of the water content, which is planned prior to placement in the cell, will result in a structurally acceptable material that will not contribute to cell subsidence. Consequently, including the non-11e.(2) byproduct materials in the disposal cell will not have a significant affect on the ability of the disposal cell to assure that the contaminants in the disposal cell remain isolated from the environment, or to have any other significant environmental impact.

Thus, the only environmental impact of disposal of this non-11e.(2) byproduct material in the disposal cell will be an increase of approximately 20% in the volume of material for disposal in the cell. Any decision not to place the non-11e.(2) byproduct material in the disposal cell would result in a need for separate disposal of this material. If two disposal cells are required, the amount of land dedicated to disposal would be greater due to the need for a buffer area around each cell. Consequently, placing the 11e.(2) and non-11e.(2) byproduct material in the same cell will minimize the total area devoted to disposal of these materials, and minimize the environmental impact of disposal of the non-11e.(2) byproduct material.

RIS 2000-23 Criterion 5. The 11e.(2) licensee must demonstrate that the proposed disposal will not compromise the reclamation of the tailings impoundment by demonstrating compliance with the reclamation and closure criteria of Appendix A of 10 CFR Part 40.

SFC Response: Sections 3 and 4 of this Reclamation Plan demonstrates how disposal of both the 11e.(2) byproduct material and the non-11e.(2) byproduct material will comply with the reclamation and closure criteria of Appendix A of 10 CFR Part 40. It shows that including the non-11e.(2) material in the disposal cell will not compromise compliance with the reclamation and closure criteria.

RIS 2000-23 Criterion 6. The 11e.(2) licensee must provide documentation showing approval by the Regional Low-Level Waste Compact in whose jurisdiction the waste originates as well as approval by the Compact in whose jurisdiction the disposal site is located, for material which otherwise would fall under Compact jurisdiction.

SFC Response: This criterion is not applicable because SFC's non-11e.(2) byproduct material is not "material which otherwise would fall under Compact jurisdiction". The relevant regional low level compact – the Central Interstate Low-Level Radioactive Waste Compact (CILLRWC)– does not require approval for a generator of radioactive waste to dispose of that waste on its own site.

Oklahoma is a member of the CILLRWC, 42 U.S.C 2021d. The CILLRWC provides, in part:

> ARTICLE VI–OTHER LAWS AND REGULATIONS
>
> a. Nothing in this compact shall be construed to:
>
> * * *
>
> 3. prohibit or otherwise restrict the management and waste on the site where it is generated if such is otherwise lawful;

While the quoted sentence uses the phrase "management and waste," it was apparently intended to read "management of waste." ARTICLE II–DEFINITIONS of the CILLRWC states that "As used in this compact, unless the context clearly requires a different construction: * * * h. "management of waste" means the storage, treatment <u>or disposal of waste</u>" (emphasis added). This definition makes clear that SFC's disposal of waste on the SFC site does not fall under CILLRWC jurisdiction. The same conclusion would be reached even if the phrase "management and waste" is not corrected, since the word "management" should be interpreted in light of the definition of "management of waste," and therefore understood to mean that the CILLRWC does not restrict the right of a generator to dispose of its own waste on its own site.

RIS 2000-23 Criterion 7. The U.S. Department of Energy (DOE) and the State in which the tailings impoundment is located, should be informed of the U.S. Nuclear Regulatory Commission findings and proposed action, with a request to concur within 120 days. A concurrence and commitment from either DOE or the State to take title to the tailings impoundment after closure must be received before granting the license amendment to the 11e.(2) licensee.

SFC Response: SFC understands that the NRC will contact the DOE and the State. In anticipation of this, SFC sent a letter to the DOE on 11/18/02 requesting concurrence with the proposed disposal. SFC also sent a copy of its letter to the NRC and the attorney for the State of Oklahoma.

RIS 2000-23 Criterion 8: The mechanism to authorize the disposal of non-11e.(2) byproduct material in a tailings impoundment is an amendment to the mill license under 10 CFR Part 40, authorizing the receipt of the material and its disposal. Additionally, an exemption to the requirements of 10 CFR Part 61, under the authority of 10 CFR 61.6, must be granted, if the material would otherwise be regulated under Part 61. (If the tailings impoundment is located in an Agreement State with low-level waste licensing authority, the State must take appropriate action to exempt the non-11e.(2) byproduct material from regulation as low-level waste.). The license amendment and the 10 CFR 61.6 exemption should be supported with a staff analysis addressing the issues discussed in this guidance.

SFC Response: SFC's request for an amendment to authorize decommissioning of the SFC facility in accordance with this Reclamation Plan includes a request for authorization to dispose of the non-11e.(2) material in the disposal cell.

An exemption from 10 CFR Part 61 is not required in this case because Part 61 is not applicable to SFC's disposal of its own waste materials. The scope of the Part 61 is stated in 10 CFR Section 61.1, which states in pertinent part,

> (a) the regulations in this part establish, for land disposal of radioactive waste, the procedures, criteria, and terms and conditions upon which the Commission issues licenses for the disposal of radioactive wastes containing byproduct, source and special nuclear material received from other persons. Disposal of waste by an individual licensee is set forth in part 20 of this chapter. Applicability of the requirements in this part to Commission licenses for waste disposal facilities in effect on the effective date of this rule will be determined on a case-by-case basis and implemented through terms and conditions of the license or by orders issues by the Commission.

(emphasis added). Since SFC does not propose to receive any waste for any other person, Part 61 is not applicable, and no exemption from it is required. This contrasts with the usual circumstance in which the Commission is asked to authorize disposal of non-11e.(2) byproduct materials in a mill tailings pile. In the typical mill tailings case, all of the wastes at the mill are, by definition, 11e.(2) byproduct material, and the requests for authorization to dispose of non-11e.(2) byproduct material do relate to material the licensee intends to receive from a third party for disposal.

Similarly, no exemption is required from the state of Oklahoma. Although the State does have regulatory authority over land disposal of byproduct, source and special nuclear material, the agreement between the NRC and the State of Oklahoma only provides that Oklahoma shall have authority to regulate land disposal of waste material received from other persons. 65 Fed. Reg. 60695, 60696 (October 12, 2000). In addition, the Oklahoma Radiation Management rules and regulations incorporate by reference 10 CFR § 61.1. (See Oklahoma Administrative Code Section 252:410-10-61(a)(1)(A)). Since SFC will not be receiving any wastes from other persons, the State does not have jurisdiction over SFC's onsite disposal of its non-11e.(2) byproduct material.

Table 1: Characteristics of 11e.(2) adn No-11e.(2) Materials

MATERIAL TYPE	VOLUME cf	DENSITY lbs/cf	WEIGHT lbs	U ppm (dry basis)	U WEIGHT kg	U Ci	RA226 Ci	TH230 Ci	TOTAL Ci
11e.(2) MATERIAL CHARACTERISTICS									
11e.(2) Material Totals	7,092,592		773,085,770		156,889	106.2	2.83	204.3	313.3
Non-11e.(2) MATERIAL CHARACTERISTICS									
CALCIUM FLUORIDE SLUDGE	625,280	77.5	48,459,200	728	6,975	4.7	0.01	1.8	6.5
CAF2 LINERS	95,285	110.0	10,481,350	20	76	0.1	0	0	0.1
SOILS AVG 2500 PPM	53,610	110.0	5,897,100	2,500	5,355	3.6	0	0	3.6
SOILS AVG 100 PPM	303,790	110.0	33,416,900	100	1,214	0.8	0	0	0.8
BLDG./EQUIP DEBRIS (50%)	421,330	200.0	84,266,000	250	9,576	6.5	0	0	6.5
Non-11e.(2) Material Totals	1,499,295		182,520,550		23,196	15.7	0.01	1.8	17.5
All Waste Totals	8,591,887		955,606,320		180,085	121.9	2.84	206.1	330.8
% Non-11e.(2)	17%		19%		13%	13%	1%	1%	5%