SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

RE: 0334-N

August 29, 2003

Federal Express

Susan Frant, Chief
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
And Safeguards, NMSS
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852-2738

Subject: License No. SUB-1010, Docket No. 040-08027
Reclamation Plan Acceptance Review, Request for Additional Information

Dear Ms. Frant:

In a letter dated March 24, 2003, your staff accepted the Sequoyah Fuels Corporation (SFC) Reclamation Plan for technical review. A request for additional information (RAI) was included in that letter. Enclosed, please find SFCs response to the final two questions contained in the request (Enclosure 1). This response covers questions related to protecting water resources, GW1 and GW2.

Also enclosed with this letter are changed pages in the Reclamation Plan (RP) submitted in January of this year, and a complete revision to Attachment A (Enclosure 3) of the RP. These revisions are responsive to your RAI. Please remove the Table of Contents, Section 3 text and Figure 3-2, and Section 6 from your copy of the Reclamation Plan and replace it with Enclosure 2. Remove Attachment A and replace it with Enclosure 3.

NMSS01

If you have any questions, don't hesitate to call me at (918) 489-5511, ext. 13, or Craig Harlin at ext. 14.

Sincerely,

for John H. Ellis
President

xc: Myron Fliegel (3 copies)
Rebecca Tadesse (2 copies)
Al Gutterman
Acting Chief, EPA Reg 6
Pat Gwin, Cherokee Nation
Patricia Ballard, NRMNC
Michael Broderick, OKDEQ
Kelly Burch, OKAG
Timothy Hartsfield, USACE

ENCLOSURE 1
Sequoyah Fuels Corporation
Reclamation Plan Acceptance Review
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SFC Responses to Request for Additional Information
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ENCLOSURE 1
Sequoyah Fuels Corporation
Reclamation Plan Acceptance Review
SFC Responses to Request for Additional Information

<u>Protecting water resources</u>

GW1. Liner configuration: According to figure 3-2, the liner will only partially underlay the tailings and will not have angled sides to the impoundment. This is not adequate from a groundwater protection perspective. In addition, the application has statements such as "if the clay liner is used." In order to review the design, staff must know what the liner material will be.

Per 10 CFR Part 40, Appendix A, Criterion 5A(2) the liner must be "installed to cover all surrounding earth likely to be in contact with the wastes or leachate." Per Criterion 5A(1) the liner must be "designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil, groundwater, or surface water at any time during the active life (including the closure period) of the impoundment."

The original plan consisted of either a compacted clay or synthetic liner beneath Layer A materials, comprising the materials (primarily sludges) with the highest radionuclide concentrations and the most likely to be saturated. A liner system beneath the remaining materials to be disposed was not planned, since these materials are unsaturated and of similar radionuclide concentration as the remaining subsoils.

Since the original plan was proposed, ongoing testing by SFC has clarified the dewatering and treatment strategy for the sludges. In order to provide more flexibility in disposal cell operation and water management, SFC has modified the overall containment concept for the disposal cell. This concept incorporates a multilayered liner system covering the entire disposal cell base and a multilayered cover system over the disposed materials. The liner system and cover system are described below.

The liner system will include (from bottom to top): (1) compacted random fill (of variable thickness) above the excavated soil surface to achieve desired slopes, (2) a 24-inch thick layer of compacted clay (from on-site sources), (3) a 6-inch thick layer of sand (from off-site sources) as a bedding layer, (4) a synthetic liner, (5) an 18-inch thick layer of sand (from off-site sources) as a protective layer and

drainage layer above the synthetic liner. The two sand layers will include a grid of slotted pipe sloped to drain to two external sumps at the southwest corner of the disposal cell. The sumps will serve as monitoring locations for leachate collection (above the synthetic liner) and leak detection (beneath the synthetic liner).

The cover system will include (from bottom to top): (1) a compacted and smoothed disposed material surface to provide a bedding layer, (2) a synthetic liner, (3) a 1.5-foot thick layer of cover soils or sand (from on-site or off-site sources) as a protective layer and drainage layer above the synthetic liner, (4) a 7-foot thick layer of cover soils (from on-site sources), and a 1.5-foot thick layer of topsoil and erosion protection material. The upper 1.5-foot thick layer will consist of entirely topsoil (from on-site sources) on the top surface of the disposal cell, and a 1.0-foot thick layer of topsoil above a 0.5-foot thick layer of rock mulch (from off-site sources) on the side slopes of the disposal cell.

The synthetic liner to be used in the disposal cell liner system and cover system will most likely be a 60-mil thickness high-density polyethylene that is installed, seamed, and tested according to current liner construction practices. The two synthetic liners will be anchored together along the perimeter of the disposal cell to form a complete geomembrane system around the disposed materials. Long-term containment will be provided by the cover soils and clay liner.

GW2. Groundwater detection monitoring program: A groundwater detection monitoring program is absent from this application.

Per 10 CFR Part 40, Appendix A, Criterion 7A requires that a licensee "establish a detection monitoring program." Therefore, a groundwater detection monitoring program must be proposed that complies with Criterion 7. Maps and cross-sections, with respect to the tailings cells, with proposed well locations and screened intervals as well as text giving a basis for the locations is needed. In addition, monitoring constituents and monitoring frequency must be proposed.

A comprehensive groundwater monitoring program has been developed for the site and submitted as the Groundwater Monitoring Plan in June, 2003. This monitoring plan treats the site as a whole and addresses point-of-compliance monitoring as well as monitoring within the contaminated area to better understand the evolving groundwater conditions. A separate groundwater monitoring program for the disposal cell is not feasible.

The disposal cell is part of the overall waste management area at the site and is not a separate isolated disposal feature. Because the disposal cell is in the middle of the waste management area, groundwater monitoring to determine the performance of the cell would not be technically feasible. The traditional methods for determining the effectiveness of the cell in protecting groundwater would be to place wells upgradient and downgradient from the cell. Increasing concentrations of constituents characteristic of the waste material found in downgradient wells would be indicative of seepage from the cell. However, since the groundwater in the cell areas has been significantly impacted with the same constituents that are in the waste, it would not be possible to determine if the cell is leaking by monitoring groundwater downgradient from the facility.

It is more appropriate to monitor seepage from the cell liner system, and to monitor overall groundwater conditions on a site wide basis. As such, the multilayered liner system proposed for the disposal cell allows monitoring of the primary liner performance. Sand layers above and below the synthetic liner will allow monitoring of leachate from the disposed materials and monitoring of the performance of the synthetic (primary) liner. The compacted clay layer beneath the synthetic liner provides a secondary barrier in the system. The proposed liner system has been incorporated into the Reclamation Plan and Technical Specifications as revision 1. As stated earlier, the groundwater monitoring program was submitted under separate cover.

ENCLOSURE 2
Sequoyah Fuels Corporation
Reclamation Plan Acceptance Review
Request for Additional Information

Revisions to the Reclamation Plan
August 29, 2003

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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 placement of these materials in the disposal cell will be in layers by category of radioactivity, listed from the bottom layer upward as layers A, B, C, and D. 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

<u>Raffinate Sludge</u>

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 high pressure filter press to remove free water from the sludge. At 50% reduction in the weight, approximately 15,000 tons of de-watered sludge will be produced. The de-watered sludge will be placed in bags for placement into the disposal cell.

Raffinate sludge will be placed in the disposal cell with a supplemental liner and cover system. After preparation of the cell base and liner system, a supplemental synthetic liner will be installed in the area of raffinate sludge disposal The perimeter of the liner will be anchored into a clay retention dike. The bags of de-watered sludge will be covered with a synthetic liner and anchored into the clay retention dike to prevent rainwater intrusion. The upper synthetic liner will be covered with a layer of clay to reduce long-term radon emanation.

Calcium Fluoride (CaF_2) Sludge

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.

Sediments

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

Soils

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 in the cell in 10 to 12 inch thick 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.

<u>Cell Intrusion</u>

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.

<u>Radon</u>

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.

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 long-term moisture retention zone for infiltrating meteoric water. This zone is optimized with the upper 2.0 feet of the cover zone consisting of silty clay. The base of the cover system will include a continuous synthetic liner to provide infiltration control under short-term conditions.

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 (10,000 years) 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 apron.

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 at the base of the cover would limit moisture migration through the disposed materials under short-term conditions. 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 disposal cell 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 Base Construction

A multilayered liner system will be constructed to form the top zone of the entire disposal cell base. The base of the disposal cell will be sloped to drain to the southwest to facilitate leachate collection and liner leak detection.

The excavated surface within the disposal cell footprint will be backfilled with random fill, to be placed in lifts and compacted to form the desired elevations and slopes for the disposal cell base and liner system. The liner system materials are described below (from bottom to top layers).

The lowest layer of the liner system is a 24-inch thick clay layer consisting of on-site silty clay placed in lifts and compacted. Above the clay layer is a 16-inch thick layer of sand (from off-site commercial sources) to provide a bedding layer for a synthetic liner (most likely 60-mil thickness high-density polyethylene).

The second bedding layer also serves as a potential zone for collection of leakage through the synthetic liner should leakage occur. Above the synthetic liner is the uppermost layer of the liner system, an 18-inch thick layer of sand from off-site commercial sources to provide a protective zone between the synthetic liner and subsequent disposed materials. This sand zone also serves as a leachate collection zone for liquids from the disposed materials and meteoric water within the perimeter of the disposal cell.

3.6 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.

3.6.1 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, most likely 60-mil thickness high density polyethylene, will be used at the base of the cover (approximately 13 acres).

3.6.2 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.

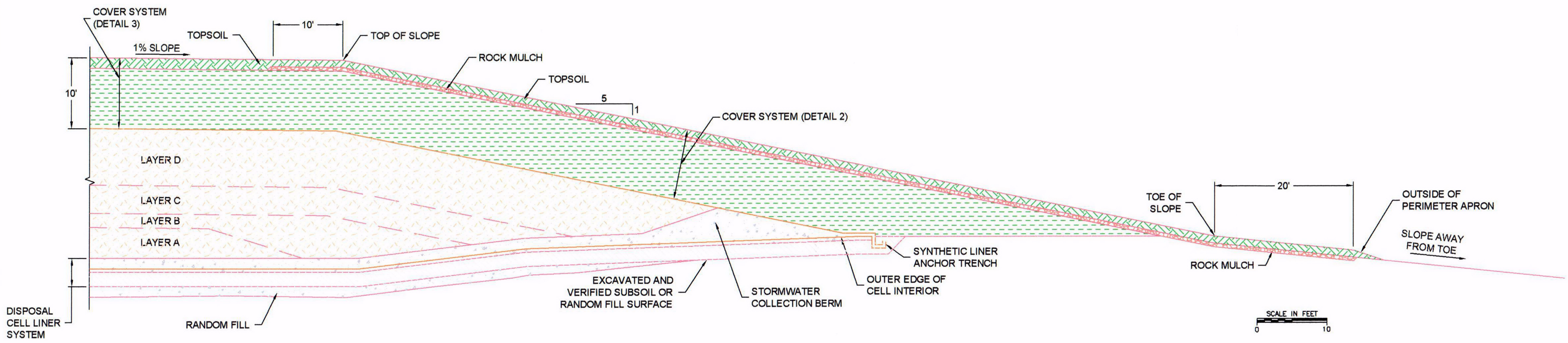
4. Transition of the perimeter apron of the disposal cell with surrounding reclaimed topography to promote runoff away from the disposal cell.

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

3.7 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.



TYPICAL CROSS SECTION ON EAST SIDE OF DISPOSAL CELL

(LOOKING NORTH)

C01

SEQUOYAH FUELS A GENERAL ATOMICS COMPANY RECLAMATION PLAN	Title: TYPICAL CROSS SECTION ON EAST SIDE OF DISPOSAL CELL	
	PREPARED BY: SFC	Filename: SFC0090B
	Reviewed by: CH	Figure No.3-2
	Date: 08/26/2003	

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. However, the disposal cell liner design includes multiple layers, with permeable zones that allow (1) collection of moisture on top of the primary (synthetic) liner as disposed material leachate, and (2) collection of moisture on top of the secondary (clay) liner as a leak detection system. These systems would drain to separate sumps located near the southwest corner of the disposal cell for monitoring.

ENCLOSURE 3
Sequoyah Fuels Corporation
Reclamation Plan Acceptance Review
Request for Additional Information

Revised Technical Specifications for Construction of the Sequoyah Fuels Onsite Disposal Cell
August 29, 2003

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

Prepared For:
Sequoyah Fuels Corporation
I-40 & Highway 10
Gore, Oklahoma 74435

Prepared By:
MFG Inc.
3801 Automation Way, Suite 100
Fort Collins, Colorado 80525

August 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) Staged preparation of the base and liner system 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, with treatment or dewatering, 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 cover system 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 pressure filtration and bagging of raffinate sludge, 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, 2003 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, applicable sections of these specifications, and the SFC 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.

Raffinate sludge will be processed or "dewatered" by pressure filtration, with the resulting filtercake loaded by conveyor into bags (approximately 3 feet by 3 feet by 4 feet) and placed two bags deep at the south end of the disposal cell (shown on Drawings). The placed raffinate sludge bags will be covered with an additional cover system.

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 requireexcavation and placement in the disposal cell.

2.6 CELL CONSTRUCTION MATERIALS

Construction materials for disposal cell liner and cover systems 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 disposal cell base will be lined prior to material placement. The compacted clay component of the liner 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 area and (if soil leaching is selected) a soil leaching area on the yellowcake storage pad (shown on the Drawings).

b) Removal of raffinate sludge for processing or "dewatering" by pressure filtration. The resulting filter cake will be loaded by conveyor into bags and stored in a temporary storage area until the disposal cell is prepared to accept this material.

c) 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.

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

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

f) 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 area beneath the footprint of the disposal cell (shown on the Drawings) will be excavated, backfilled, and prepared for material disposal as outlined below.

3.3.1 General Preparation Sequence

The disposal cell footprint will be prepared for material disposal by removal of sediments and contaminated soils, backfilling of excavated areas to desired grades with compacted random fill, and construction of the disposal cell liner. The base of the disposal cell will be prepared in phases (as shown on the Drawings).

The phased 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.

3.3.2 Specific 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 a temporary on-site storage area. Raffinate sludge will be processed by pressure filtration.

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).

3.3.3 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 and synthetic liner system that is installed over compacted foundation soils (after removal of affected subsoils).

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 DUF_4 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 hydraulic shear, remote jack hammer or similar impact or 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 (if present) 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 will be lined with a compacted clay liner and synthetic liner system.

6.2 MATERIALS DESCRIPTION

6.2.1 Random Fill

The disposal cell footprint is likely to 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 (shown on the Drawings).

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 radionuclide activity concentrations less than the selected subsurface cleanup level.

6.2.2 Clay Liner

Clay liner material 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 radionuclide activity concentrations less than the selected subsurface cleanup level.

6.2.3 Synthetic Liner Bedding Material

Synthetic liner bedding material shall be placed over the prepared surface of the clay liner 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 radionuclide activity concentrations less than the selected subsurface cleanup level.

6.2.4 Synthetic Liner

Synthetic liner material shall be 60-mil nominal thickness HDPE, with material characteristics outlined in Section 7.2.1.

6.2.5 Synthetic Liner Cover

Synthetic liner cover material shall be placed over the synthetic liner to provide a cover material for protection of the synthetic liner during 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.

6.2.6 Synthetic Liner Anchor Backfill

Synthetic liner anchor backfill shall be placed and compacted in the 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 shall be regraded to form a smooth, competent foundation for clay liner construction. Random fill (Section 6.2.1) shall be placed in lifts and compacted in excavated areas of the disposal cell footprint to meet desired grades and elevations for the disposal cell foundation (shown on the Drawings). The final regraded surface shall be compacted with approved construction equipment to provide a foundation surface with uniform density for clay liner 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 placed in lifts and compacted 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 12 inches in loose thickness, and shall be compacted with appropriate construction equipment.

Each lift of random fill 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.

6.3.3 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 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 lifts with maximum compacted thickness of 6 inches to form a continuous layer with a total minimum compacted layer thickness of 24 inches. Clay liner material shall be placed over the prepared foundation of the disposal cell (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 Synthetic Liner Bedding Layer Material Placement

Synthetic liner bedding material shall 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.

6.3.6 Synthetic Liner Material Installation

Synthetic liner material (Section 6.2.4) shall be installed as outlined in Section 7.3.

6.3.7 Synthetic Liner Cover Placement

Synthetic liner cover material shall be placed over the completed synthetic liner to provide a protective cover for placement of disposal material. Synthetic liner cover material (Section 6.2.5) 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.

6.3.8 Synthetic Liner Anchor Backfill Placement

Synthetic liner anchor backfill (Section 6.2.6) 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 surface and compacted random fill 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.

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 top-of-slope perimeter of the disposal cell (shown on the Drawings). Layer A materials may contain an additive such as fly ash or cement, that is added to the material prior to placement within the disposal cell.

The raffinate sludge will be processed or dewatered by pressure filtration, with the resulting filtercake loaded by conveyor into bags (approximately 3 feet by 3 feet by 4 feet). The loaded bags will be placed at the south end of the disposal cell one or two bags deep (shown on the Drawings). The bags of raffinate filtercake will be placed with a supplemental liner and cover (Section 8.3.5).

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 or over other prepared areas of the disposal cell liner system.

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 liner system.

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 liner system. Layer D materials will be used to cover plant equipment and structural debris (Layer C materials) to minimize void spaces, and may be used for additional bedding material for plant equipment and structural debris.

8.3 WORK DESCRIPTION

8.3.1 Layer A Material Placement

Layer A materials shall be placed within the top-of-slope perimeter of the disposal cell (shown on the Drawings). Layer A materials (Section 8.2.1) will be placed within 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.

Raffinate sludge filtercake bags (Section 8.2.1) will be placed at the south end of the disposal cell (shown on the Drawings). A supplemental liner and cover system shall be constructed around these bags, as outlined in Section 8.3.5.

8.3.2 Layer B Material Placement

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 liner system.

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 liner system.

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 liner system. 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.

8.3.5 Raffinate Sludge Liner and Cover

The raffinate sludge filtercake bags shall be placed in the disposal cell on top of a seamed panel of geomembrane (Section 7.2.1). The bags will be placed on the geomembrane one or two bags high. The final bag surface shall be covered with a seamed panel of geomembrane (Section 7.2.1). The supplemental geomembrane liner shall be anchored as shown in the Drawings. The supplemental geomembrane cover shall be covered with a minimum thickness of three feet of clay liner material (Section 6.2.2). The upper surface of the clay cover shall be compacted and tested as outlined in Section 6.3.1.

8.4 PERFORMANCE STANDARDS AND TESTING

8.4.1 Layer A Limits

Layer A materials shall be placed within the perimeter of the top-of-slope line of the disposal cell (shown on the Drawings).

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 Synthetic Liner

Synthetic liner material shall be 60-mil nominal thickness HDPE, with material characteristics outlined in Section 7.2.1.

9.2.2 Cover Material

Cover material will consist of soils from approved on-site borrow areas (Section 3.4). Cover material shall be minus 1-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.

9.2.3 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.

9.2.4 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, and shall be free from sharp objects that would puncture or damage the synthetic liner.

9.3.2 Cover Material Placement

The first lift of cover material (Section 9.2.2) shall be placed in one lift with a minimum thickness of 18 inches, as outlined in Section 6.3.7. The remaining lifts of cover material (Section 9.2.2) shall be placed in lifts of 12-inch maximum loose 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 (including the first lift, 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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