SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

RE: 0625-N

June 29, 2006

FedEx

U.S. Nuclear Regulatory Commission
ATTN: Mr. Myron Fliegel, Senior Project Manager
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
And Safeguards, NMSS
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

Subject: Sequoyah Fuels Corporation, Docket – 40-8027
Response to Draft Safety Evaluation Report – Reclamation Plan
(TAC L52511)

Dear Mike,

Sequoyah Fuels Corporation (SFC) responded by letter dated 1/31/06 to open issues in the Draft Safety Evaluation Report on SFCs Reclamation Plan. You have identified several open issues (OI) and confirmatory items (CI) that remain open. Please find enclosed with this letter SFC responses to the remaining OIs and CIs. The resulting change pages for the Reclamation Plan and associated documents are not included at this point. It would be my intent to make the necessary changes to the documents when your reviewers have determined that our responses are sufficient to close the issues that remain. Once your staff has had time to review these responses, contact SFC with the results so we can adjust our approach as necessary and submit the change pages.

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

Sincerely,

John H. Ellis

John H. Ellis
President

Enclosure

XC: Alvin Gutterman, MLB
Rita Ware, EPA
Lou Miller, MFG
Jeanine Hale, CN
Trevor Hammons, OAG
Saba Tahmassebi, ODEQ

HIGHWAY 10 & I-40 PO BOX 610, GORE, OKLAHOMA 74435 (918) 489-5511 FAX: (918) 489-2291

Sequoyah Fuels Corporation
Draft Safety Evaluation Report (DSER)
Response to Remaining Open Issues as of May 2006

1. **DSER OI.01** The licensee needs to provide an analysis regarding the potential for Stream 005 to encroach upon the foot or apron of the proposed cell. (SER Section 2.4.2)

   Response:

   This open issue (OI) and OI.20 pertain to erosion of Stream 005 and its effect on the west side of the disposal cell. The geomorphology of Stream 005 is addressed under OI.01 and the details of erosion protection are addressed under OI.20.

   The SFC facility is underlain by sandstones and shales of the Pennsylvanian Period Atoka Formation (described in the Reclamation Plan). The bed of Stream 005 was eroded in the sedimentary rocks to its current level prior to construction of the SFC facility, when the catchment area draining to Stream 005 was larger than it is at the present time. The contributing catchment area to Stream 005 will be reduced further after disposal cell construction.

   The bed of Stream 005 west of the disposal cell has exposed sandstone and shale, in the reach shown in Figure 1. East (upgradient) of this reach of Stream 005, the bed slope is steeper due to fill placement by SFC. Disposal cell construction with erosion protection material placement (described in OI.20) will reduce the bed slope of Stream 005 in this area of fill placement, as shown in Figure 2. This has been designed to protect against gully intrusion from Stream 005 as well as provide erosion protection from runoff from the west slope of the disposal cell.

2. **DSER OI.05** The licensee needs to provide particle size specifications for the synthetic liner bedding and cover materials consistent with information used in the licensee's stability analysis. (SER Section 3.3.2)

   Response:

   Section 4.2.3 and 4.2.5 of the Technical Specifications will be modified to specify the following particle-size distribution for synthetic liner bedding and cover materials:

Sieve Size	Percent Passing
1 inch	100
No. 4	65-100
No. 16	25-85
No. 40	5-45
No. 200	0-10

   The above gradation is consistent with the gradation of the granular material used in the direct shear test of the synthetic liner/granular material (Enclosure 1 of SFC, 2004). This gradation also applies to the liner cover material above the synthetic liner in the disposal cell cover system (Technical Specifications Section 7.2.3). There is no liner bedding material below the synthetic liner in the cover system. Bedding for the synthetic liner is provided by the clay liner (Technical Specifications Section 7.2.1).

3. **DSER OI.07** The licensee needs to provide its proposed approach to addressing placement and compaction specifications for layer-C material and soils placed around such structural materials. (SER Section 3.4.2)

Response:

The Technical Specifications for material placement in the disposal cell will be modified to clarify the methods of structural materials and soils. The materials to be placed in the disposal cell are still outlined in the Technical Specifications as material types A, B, C, and D. Type C materials include structural materials and calcium fluoride sludges. Type D materials include contaminated soils that will be used to cover and fill voids within the structural materials. The updated wording of Section 6.3 of the Technical Specifications is presented below, with the strategy for placement and compaction of materials in the cell outlined below, based on material compressibility and size.

Incompressible materials. Structural materials will be broken or cut to manageable size using typical equipment for demolition work (hydraulic excavators with specialized attachments for shearing and grasping). These materials will be hauled with trucks to the disposal cell for placement. The material placement strategy for incompressible structural materials is to minimize void spaces around these materials in the cell by spreading or laying out these materials in lifts. Materials of large size will be cut for loading and transport to the designated area of the disposal cell, with a maximum dimension of 20 feet (unless loading or handling conditions dictate a smaller dimension). Large or odd-shaped materials will be laid flat in the disposal cell, or (in other words) placed with longest dimension oriented horizontally. The structural materials will be placed in lifts not exceeding two feet, except where material with a vertical dimension exceeds two feet. Each lift of material will be covered with soil and compacted to minimize void spaces within the incompressible materials in the cell.

Large incompressible materials (such as thick-walled tanks or vessels) will be placed in the cell, and the interior void spaces filled with incompressible material such as sand or grout. In some cases, these tanks may be cut into pieces prior to placement in the cell and simply covered with soil and compacted. Soil will be placed outside of the large materials and compacted with standard compaction equipment (where possible) or hand-operated equipment.

Compressible materials. The material placement strategy for compressible materials is to make them incompressible by cutting, crushing, solidifying, or compacting these materials.

Compressible structural material (such as thin-walled piping and tanks) will be flattened or crushed at the disposal cell with hydraulic excavator attachments, or with a dozer or other steel-tracked equipment.

Compressible material (such as calcium fluoride sludge) will be amended with fly ash as necessary to tie up excess water, placed in lifts in the disposal cell, and compacted.

4. **DSER OI.08** The licensee needs to provide its proposed approach to addressing placement specifications for any crushed structural materials, such as piping or tanks. (SER Section 3.4.2)

The licensee needs to address compaction specification for soil placed around disposed structural material (SER Section 3.4.2)

Response:

Crushed structural materials will be laid flat (as described for incompressible materials above), and limited to lifts of two-foot thickness, then covered with soil.

Material type D consists of soils and weathered sedimentary rock from contaminated soil cleanup. These soils will be placed over a lift of structural material and compacted to fill in voids around the structural material. Contaminated soils will be placed in lifts (two feet maximum thickness), planned to be sufficient to cover the structural material but thin enough to allow compaction of the soil and underlying material. Each lift of soil will be compacted with at least six passes with vibratory tamping-foot compaction equipment. The compacted lift of soils will provide a firm base or bedding for a subsequent lift of structural material.

For large structural materials (such as thick-walled tanks and vessels), several lifts of compacted contaminated soils may be necessary to fill in around and cover these items.

Checking soil compaction with standard field density testing methods (such as with a nuclear density gauge) is not recommended because of interference with structural debris. As a result, a method specification for compaction of this material is planned. The method would be a minimum of six passes over a two-foot maximum thickness lift of soil with a vibratory tamping-foot compactor. The number of passes would be confirmed on a field test section of soils to establish a correlation between the compaction method and 95 percent of the maximum dry density for the material, as determined by the Standard Proctor test. These procedures are expanded in Section 6.3.3 of the Technical Specifications (as presented below).

6.3 Work Description

6.3.1 Type A Material Placement

Type A materials (Section 6.2.1) that are not filtered (if disposed on site), will be dewatered or solidified/stabilized to eliminate free water prior to placement in the cell. Type A materials will be placed within the disposal cell in lifts prior to covering with additional Type A materials or with Type B materials.

If disposed on site, raffinate sludge filtercake bags (Section 6.2.1) shall be placed at the south end of the disposal cell (shown on the Drawings). A supplemental liner and cover system shall be constructed around the filtercake bags, as outlined in Section 6.3.5.

6.3.2 Type B Material Placement

Type B materials will be placed within the disposal cell in lifts and spread (if necessary) to allow consolidation and drying of wet materials. Type B materials (Section 6.2.2) will be placed directly over Type A materials, within the lined area of the disposal cell, or over other prepared areas of the disposal cell liner system.

6.3.3 Type C Material Placement

Type C materials will be placed within the disposal cell in lifts. Type C materials (Section 6.2.3) will be placed directly over Type B or C materials, or over other prepared areas of the disposal cell liner system. The preparation and placement of various Type C materials is outlined below.

6.3.3.1 Material Sizing and Preparation

Demolition debris to be placed in the disposal cell will consist of equipment and structural material from facilities demolition. The demolition procedures are outlined in the Facility Demolition Plan (Reclamation Plan attachment F). Because of the wide variety in shape and size of demolition debris, material of odd shapes will be cut or dismantled, to the extent practical, prior to disposal to facilitate handling and placement as well as minimize void spaces in the disposal cell. The maximum size of dismantled or cut materials shall not exceed 20 feet in longest dimension. Smaller dimensions may be necessary for loading, handling, hauling, and placement of material in the disposal cell.

6.3.3.2 Incompressible Debris

Material that is not compressible (steel columns and beams, concrete, and other solid material) shall be reduced in size for loading, hauling, and placement in the disposal cell. Placed compressible material shall be spread in a manner that minimizes void spaces below, between, and above these materials. Material such as steel members shall be placed in the disposal cell with the longest dimension oriented horizontally.

Thick-walled pipe, conduit, tanks, vats, pressure vessels, and other hollow materials that will not be crushed or dismantled shall be transported to the planned location within the disposal cell and oriented for filling and burial. The voids on the inside of the item shall be filled with sand or grout. Contaminated soil (Section 6.2.4) will be placed outside of the item and compacted with standard compaction equipment (where possible) or hand-operated equipment. Several lifts of compacted contaminated soil may be necessary to fill in around and cover these items.

6.3.3.3 Compressible Debris

Materials that are compressible (such as thin-walled piping and thin-walled tanks) shall be flattened or crushed in the disposal cell, prior to final placement in the disposal cell. Flattening or crushing shall be done with hydraulic excavator attachments, or with a dozer or other steel-tracked equipment.

These materials shall be placed in the disposal cell and spread to form a lift with a maximum thickness of two feet. Spreading shall be done in a manner resulting in materials laying flat and minimizing void spaces.

6.3.3.4 Calcium Fluoride Sludge

Calcium fluoride sludge and other loose or soft materials (such as pond sediments and calcium fluoride sludge) will be treated to tie up excess water by mixing with fly ash at a 2:1 ratio by volume (sludge:fly ash), using mixing techniques approved by SFC. The mixture shall be placed in lifts not exceeding one foot in loose thickness and compacted as outlined in Section 6.3.3.6.

6.3.3.5 Soils and Similar Materials

Soils and soil-like materials to be placed in the disposal cell will be from on-site areas identified by SFC for excavation (Section 6.2.3and 6.2.4). Soil or soil-like material (Type C or D material) shall be placed and compacted over each lift of debris (Section 6.3.3.2 or 6.3.3.3) or other Type C materials in lifts not exceeding two feet in loose thickness and compacted prior to placement of additional lifts. Soils will also be used for interim soil cover will also be used to minimize exposure of demolition materials and other Type C materials to air and meteoric water.

6.3.3.6 Material Compaction

Soil or similar Type C material shall be compacted with a minimum of six passes with vibratory compaction equipment. The number of passes shall be confirmed with actual compaction equipment on site with a field test section of soil to establish a correlation between the field compaction method and 95 percent of maximum dry density for the soil, as determined by the Standard Proctor test.

6.3.4 Type D Material Placement

Type D materials (Section 6.2.4) will be placed directly over Type A, B, or C materials, or over other prepared areas of the disposal cell liner system. Type D soil shall be placed in lifts not exceeding two feet in loose thickness, and shall be compacted with a minimum of six passes with vibratory compaction equipment to work the soil downward into underlying void spaces (if present). The number of passes shall be confirmed with actual compaction equipment on site with a field test section of soil to establish a correlation between the field compaction method and 95 percent of maximum dry density for the soil, as determined by the Standard Proctor test.

5. **DSER OI.09** The licensee needs to provide an evaluation of potential disposal-cell settlement. (SER Section 3.4.3)

Response:

Experience with settlement of disposed materials and cover performance is in three general areas: (1) uranium tailings impoundment reclamation, (2) uranium mill demolition and disposal, and (3) municipal landfill performance. From uranium tailings impoundment experience, settlement values on the order of 10 to 20 percent of tailings thickness have been measured. However, these values are for slurry-deposited tailings undergoing loading and decreasing porewater pressures. From uranium mill demolition, settlement has been limited to areas of void spaces between structural materials. Municipal landfill performance data included several publications estimating the typical amount of settlement at municipal landfills. Values ranged from 5 to 25 percent of the waste thickness. Because the disposal cell will not include significant quantities of biodegradable materials, settlement in the disposal cell would be on the lower end of this range. A value of 5 to 10 percent of waste material height was estimated in the preliminary evaluation in Reclamation Plan Attachment E.

Because the disposal cell will not have significant biodegradable materials (like a landfill) or low-density materials (like slurried mill tailings), the settlement would most likely be from compression of void spaces around structural debris or consolidation of soft materials (such as sludges). The placement strategy and techniques described above are planned to minimize these void spaces and compact the soft materials.

A more detailed evaluation of settlement, based on the specific materials to be placed in the disposal cell is outlined below. The general characteristics of materials to be placed in the interior of the three phases of cell construction are summarized in the table below.

Phase	Area (sq. ft)	Primary Material	Volume (cu. ft)	Avg Thickness for 70% of Area (ft)	Total Cell Thickness (ft)*
I	160,000	Subsoils and liner soils Buried solid wastes	306,356 51,250	2.7 0.4	15-30
II	250,000	Building debris Concrete and asphalt	568,660 511,795	3.3 2.9	30-40
II and III	630,000	Calcium fluoride sludge Fly ash	625,280 312,640	2.1 (mixed)	15-40

* including cover thickness

This table indicates that the soft materials and structural debris are a relatively small proportion of the materials to be placed in the cell. The larger proportion of material will be contaminated soils and sedimentary rock.

Lifts of material placed in the disposal cell will be compacted with a conventional vibratory, wedge-foot (tamping-foot) compactor. Based on manufacturer's data, the vertical stress beneath the compactor wheels would be approximately 5,000 psf (Caterpillar, Inc., 1996). This loading of the compaction equipment is generally greater than the loading of subsequent disposed materials and cover.

For example, calcium fluoride sludge is planned for placement as a layer at the base of all three phases of disposal cell construction (Appendix A of the Reclamation Plan Attachment E). The approximate thickness of calcium fluoride sludges mixed with fly ash would be approximately two feet. Using the standard settlement equation from Holz and Kovacs (1981):

$$S = C_c/(1+e_0)\ H_0 \log(\sigma_1/\sigma_0)$$

S = settlement (feet)

C_c = compression index, 0.01 for compacted materials

e_0 = initial void ratio (0.5)

H_0 = initial layer thickness (2 feet)

σ_1 = final vertical stress, in psf

σ_0 = initial vertical stress, in psf

for σ_0 = 50 percent of compaction loading = 2,500 psf

σ_1 = 4700 psf (30 feet of contaminated soils and debris at 120 pcf and 10 feet of cover at 110 pcf)

$$S = \frac{0.01}{1.5} 2 \log\left(\frac{4700}{2500}\right) = 0.0037\ feet$$

If a high compression index value is used (C_c=0.1), the resulting settlement would be 0.04 feet. This calculation represents the most potentially compressible material in the cell. For 40 feet of compacted soils, the total settlement would be on the order of 0.15 feet.

6. **DSER OI.10** The licensee needs to provide an evaluation of potential cracking damage to the cover system owing to differential settlement of the cell. (SER Section 3.4.3)

Response:

Based on a conservatively high total settlement of 5 to 10 percent of waste material height, and differential settlement occurring over a distance of 35 feet (representing the incompressible internal berm in the disposal cell), differential settlement values were calculated (as outlined in Appendix G of the Disposal Cell Construction Plan, Reclamation Plan Attachment E). These values were converted to estimated tensile strain values, and were compared with allowable tensile strain values developed for covers over uranium mill tailings. The estimated tensile strain values were less than allowable values, indicating that the estimated differential settlement would not adversely affect cover performance.

These calculations were based on the allowable strain relationship from Caldwell and Reith (1993):

$$e_f = 0.05 + 0.003\ PI$$

e_f = soil strain at failure (or cracking) in percent

PI = plasticity index of cover soil

For a plasticity index value of 10, the soil strain at failure is 0.08 percent

For differential settlement to reach the allowable strain value above, this would be equivalent to 0.1 feet of differential settlement over a distance of 12.5 feet, or 0.2 feet of settlement over a distance of 50 feet. The effects of changing foundation conditions (from concrete pad left in place to compacted subsoil) would be masked by compaction of subsequent lifts of material and would not be reflected to the top of fill.

7. **DSER OI.14** The licensee needs to provide specifications for the dewatering of calcium fluoride sludge and sediments from the emergency basin, north ditch, and sanitary lagoon; and the placement of such materials in the disposal cell. (SER Section 3.6.1)

Response:

Calcium fluoride sludge will be dewatered by addition of fly ash (at a ratio by volume of approximately 2:1 (sludge:fly ash), as discussed in the response to DSER OI.08 above. Sediments from the emergency basin, north ditch, and sanitary lagoon will be dewatered by pressure filtration (as is currently being done for raffinate sludge) or by addition of fly ash.

8. **DSER OI.16** The issue of representing flow in fissures and desiccation cracks in the infiltration model is yet to be resolved. (SER Section 3.8.2)

Response:

The updated infiltration modeling for the current, multilayered cover design (presented in Appendix E of Reclamation Plan Attachment E) includes a subsoil zone in the cover system designed to retain meteoric water until vegetation can extract the water for evapotranspiration. At the base of the cover system (8 to 10 feet beneath the surface of the cover) is a two-foot thick layer of compacted clay. Desiccation cracking of the clay layer at this depth in the climate of eastern Oklahoma is not expected. Since the infiltration modeling of the cover system is more sensitive to evapotranspiration of meteoric water, desiccation cracking of the clay layer in the cover system (should it occur) would not adversely affect cover system performance.

Desiccation cracks are formed from tensile strain in soil due to a decrease in volume from drying. The change in soil volume with drying is represented by the shrinkage limit, and this change is more pronounced in high-plasticity clays (Holtz and Kovacs, 1981). The soils planned for use in the clay layer of the disposal cell cover system are low-plasticity clays that have a low potential for shrinkage with drying. The sandy soils planned above the clay layer in the cover system have a very low potential for shrinkage with drying.

While the infiltration model cannot simulate the effects of desiccation cracks in the cover, the model used soil properties, rooting depths, and variations in climatic conditions that would incorporate desiccation cracking in the cover system (if it were to occur).

9. **DSER OI.20** The licensee needs to provide a design for rock armor protection of stream 005. (SER Section 4.5.1.3)

Response:

This feature has been provided and enlarged, based on discussions with NRC. The updated rock armor protection layout is shown in Figure 2.

On the north, west, and south sides of the disposal cell, runoff at the toe of the slopes is directed over the perimeter apron to natural ground. As shown on the reclaimed disposal cell layout (Reclamation Plan Attachment A), approximately 5.4 acres of land between the cell and the east facility boundary line will drain towards the east side of the cell. This flow will be intercepted by the diversion channel on the east side of the cell that will direct flow to the north and south of the cell (Reclamation Plan, Attachment A). The perimeter apron on the east side of the cell is extended to a 60-foot width and will be shaped as a trapezoidal channel, with a channel depth of one foot to accommodate this flow. The rock channel will have the same rock size as the perimeter apron rock (a median size of 5.7 to 8.0 inches), and will be placed in a minimum 24-inch thick layer.

A rock apron has been included in the disposal cell design to provide protection in the unlikely event of headward erosion from Stream 005. The rock apron is a downstream extension of the perimeter apron at the toe of the disposal cell slopes and is located where runoff from the west slope of the disposal cell discharges into the east end of Stream 005. The rock apron will be keyed into underlying shale and constructed with the perimeter apron rock.

The rock apron was sized according to guidelines in NUREG 1623, with design calculations presented in Appendix D of the Disposal Cell Construction Plan (Reclamation Plan Attachment E). Scour depth was estimated using the procedures presented in the U.S. Department of Transportation, Hydrologic Engineering Circular 14 (US DOT, 1975). For this calculation, runoff from the west slope of the disposal cell and overland flow from approximately 1.5 acres to the west of the disposal cell discharge at the head of Stream 005. The maximum scour depth is estimated to be approximately 5.4 feet deep. Drill holes near the head of Stream 005 (BH-42 and BH-47) show shale bedrock at a depth of less than 7 feet.

10. **DSER OI.21** The licensee needs to provide specifications for riprap rock gradation. (SER Section 4.5.2)

Response:

The gradation of the rock mulch layer on the side slopes of the disposal cell have been modified to have a median size of 3.4 to 4.7 inches (depending on particle angularity). The rock gradation recommendations, as given in NUREG 4620, Section 4.2.2, pertain to clean riprap. The slope protection planned for the disposal cell is a rock mulch, with the voids filled with smaller particles.

The Technical Specifications for rock mulch material have been modified to be more closely aligned with the median rock size. The rock mulch material will have the following gradation requirements (for material from a nearby limestone quarry):

Sieve Size	Percent Passing
9-in	100
6-in	50-100
4-in	35-65
1.5-in	15-40
No. 4	0-25

This gradation is shown in Figure 3.

The Technical Specifications for perimeter apron material have been modified to be more closely aligned with the median rock size. The perimeter apron material will have the following gradation requirements (for material from a nearby limestone quarry):

Sieve Size	Percent Passing
16-in	100
12-in	50-100
6-in	50-100
4-in	20-50
1.5-in	0-25

This gradation is shown in Figure 3.

11. **DSER OI.22** The licensee needs to provide information necessary to show that rock of acceptable durability will be used for flood protection. (SER Section 4.5.3)

Response:

Two rock sources have been evaluated by SFC: (1) a limestone quarry (Souter Quarry) near the site, and (2) several gravel pits in the site area. Rock from the Souter Quarry has been previously evaluated for durability by SFC, with preliminary results documented in the Disposal Cell Construction Plan (Reclamation Plan Attachment E). The gravel pits in the site area contain rounded particles of chert and other durable materials, but are limited to particles of up to 6 to 8-inch size. No durability testing of the gravel pits has been conducted.

The rock size requirements for the rock mulch and perimeter apron are near the upper limit of what can be produced from the gravel pits in the site area. In addition, the larger-sized rounded rock is in demand in the area for decorative rock. Therefore the limestone quarry is the preferred source for erosion protection materials. From the test results presented in the Disposal Cell Construction Plan, the rock quality designation for the limestone is 69, indicating acceptable durability with an oversizing factor of 11 percent. In the rock size specifications in the Technical Specifications (Reclamation Plan Attachment A), a conservative oversizing factor of 20 percent has been used.

As requested by NRC, a petrographic analysis of the limestone will be conducted to supplement the previous durability testing on the limestone quarry material.

12. **DSER OI.24** The licensee needs to provide information regarding the licensee's rock durability testing program. (SER Section 4.5.4.1)

Response:

The durability testing requirement will be added to the gradation testing requirement in the Technical Specifications. Durability testing will be specified at a frequency equivalent to two tests on rock mulch material and two tests on perimeter apron material.

DSER OI.25 The licensee needs to provide information regarding the licensee's riprap placement procedures. (SER Section 4.5.4.3)

Response:

The Technical Specifications will be modified to specify rock mulch or perimeter apron material placed in lifts, with the coarse material placed first and finer-grained material placed on top and vibrated into the coarse material. The objective of the specified procedure is to minimize particle segregation in placing these materials. Mixing of the coarse and fine-grained layers was discussed with NRC. SFC believes that mixing with a large roto-tiller (such as the equipment used for lime addition in soils) would result in damage to the roto-tiller by the rock mulch or perimeter apron rock, and may not produce a homogeneous mixture. The only other feasible mixing technique would be blending and spreading in windrows with a grader, which may result in particle segregation.

13. **DSER OI.32** The licensee must perform am analysis to verify that some proposed detection parameters will migrate at rates comparable to uranium or propose nonhazardous constituents as detection monitoring parameters. (SER Section 5.4)

Response:

Because the proposed cell will be located in an area where previous contamination has occurred, determining appropriate leak detection parameters has been problematic. Previous discussion has indicated that the soil cleanup will significantly reduce the levels of all constituents in the groundwater near the cell so that any leak from the cell could be detected. Further, the installation of a leak detection system between two liners in the bottom of the cell would provide the best indication of cell leakage. It is believed that these two arguments remain valid and could determine if the cell were to leak.

However, as requested an additional review has been conducted to determine if there would be any unique and conservative parameter that could be used in a conventional way for prompt detection of leakage. It has been determined that sulfate can serve as an appropriate non-hazardous constituent that can be used for prompt detection of seepage from the lined disposal cell. Sulfate is typically used as an indicator parameter since it is a very conservative constituent in groundwater flow. Sulfate will be transported with essentially no retardation. All of the hazardous constituents have some retardation, therefore sulfate will be the first indicator of seepage.

Limited data exists for sulfate concentrations in groundwater. Two samples from the terrace/shale 1 layer (wells MW-025 and MW-075) were taken in 2001 and analyzed for sulfate. These data indicate that the background sulfate concentrations in the terrace/shale 1 layer are relatively low (6.7 and 278 mg/l). Figure 4 shows the location of the wells relative to the disposal cell and Table 1 presents the complete set of analytical results for these wells for the 2001 sampling.

The waste does not contain elevated levels of sulfate; however, significant sulfate will be added to the cell. Fly ash will be added to the calcium fluoride sludge to stabilize that material before it is placed in the cell. It has been determined that a mixture of 1 part fly ash to 2 parts calcium fluoride sludge will stabilize the mixture. There is approximately 50,000,000 pounds of sludge to which approximately 25,000,000 pounds of fly ash will be added.

There will be approximately 1,000,000 cubic feet of the calcium fluoride sludge/fly ash mixture. This material will be preferentially placed as the initial layer within the cell. This will provide approximately 2 feet of the calcium fluoride sludge/fly ash mixture over the entire footprint of the cell. Any water leaching through the cell would flow through this material before it encounters the liner.

One of the major constituents of the stabilized sludge is calcium sulfate (gypsum). Gypsum would be leached from the mixture if water were to contact the solidified sludge. Any leachate from the cell would have sulfate concentrations at approximately 1500 to 2000 mg/l which is the sulfate concentration controlled by gypsum solubility. This concentration is significantly greater than the background sulfate concentrations and sulfate will therefore serve as a good indicator parameter.

Upon approval of the use of sulfate as the indicator parameter for prompt detection of leakage at the cell POC wells, the Reclamation Plan will be modified to require the use of fly ash and to change the sludge placement requirements to ensure a uniform layer of the mixture across the bottom of the cell. Additionally, the POC monitoring program will be changed to include analysis for sulfate.

14. **DSER OI.42** The licensee needs to provide documentation from EPA and the State of Oklahoma that they do not have regulatory authority over the non-11e.(2) byproduct material.

Response:

On May 24, 2006, the Oklahoma Department of Environmental Quality (ODEQ) submitted a letter to NRC confirming that the ODEQ does not intend to assert any regulatory authority over the non-11e.(2) byproduct materials that will be disposed on site.

15. **DSER OI.28** The licensee must revise the reclamation plan to incorporate its commitment to plug all boreholes identified during the cell foundation excavation.

Response:

On 5/24/06, the NRC staff and SFC staff conferred by phone on this item and the action item for SFC was to amend section 5.2.2 of the reclamation plan consistent with May 2006 response. This action will be included in the planned revision to the reclamation plan.

16. **DSER CI.6** The licensee must revise the reclamation plan to incorporate its commitment regarding radioactivity levels in the upper part of the cover.

Response:

On 5/24/06, the NRC staff and SFC staff conferred by phone on this item and the action item for SFC was to cite the location of all barrow areas in the reclamation plan and include a summary table of sample results for these locations. This action will be included in the planned revision to the reclamation plan.

17. **DSER CI.8** The licensee must include soil sampling procedures and analytical methods in the reclamation plan.

Response:

On 5/24/06, the NRC staff and SFC staff conferred by phone on this item and the action item for NRC was to include this item in the proposed license condition concerning approval of the QAPP. SFC will not make any changes to the reclamation plan to deal with this item.

REFERENCES

Bowles, J., 1988. Foundation Analysis and Design, McGraw-Hill, Inc.

Caldwell, J. and C. Reith, 1993. Principles and Practice of Waste Encapsulation, Lewis Publishers.

Caterpillar, Inc., 1996. Caterpillar Performance Handbook, Caterpillar Inc., October.

Grubbs, Garner, and Hoskyn, Inc. (GGH), 1997. Laboratory test data on red silty clay sample from SFC.

Hemphill Corporation (HC), 1980. "Report of Subsurface Investigation, Clay Prospecting, Sequoyah Facility, Gore, Oklahoma," prepared for Kerr McGee Nuclear Corporation, May 6.

Lambe, T.W., and Whitman, R., 1969. Soil Mechanics, John Wiley and Sons.

Professional Service Industries, Inc. (PSI), 1990. Laboratory test data on samples for clay borrow area used for the stormwater reservoir.

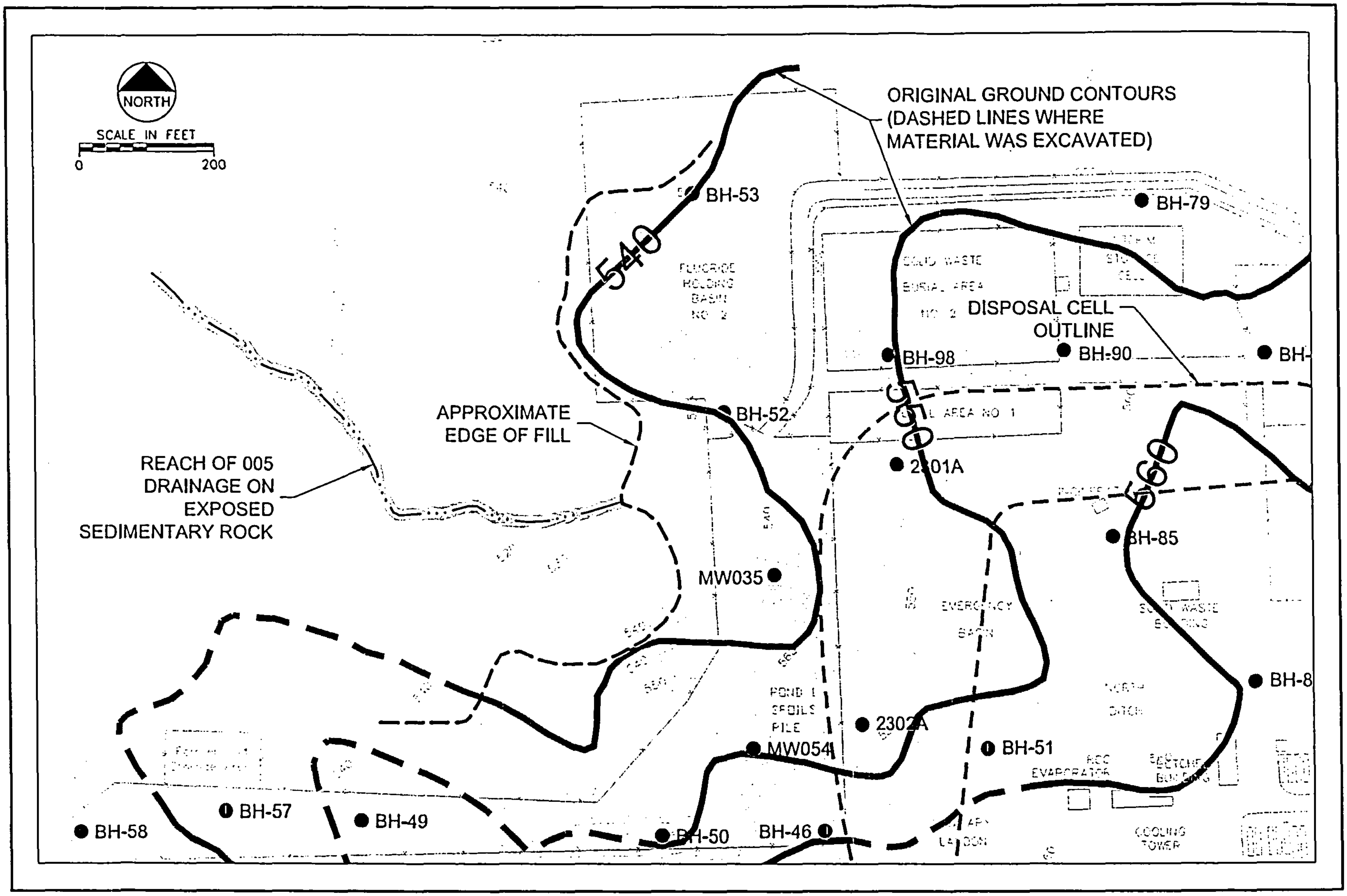
Sequoyah Fuels Corporation, 2004. "Geotechnical Stability of SFC Disposal Cell-Clarification of Responses to Request for Additional Information Dated June 22, 2004." Gore, Oklahoma, November 8. ML043140313.

U.S. Department of Transportation (US DOT), 1975. "Hydraulic Design of Energy Dissipators for Culverts and Channels," Hydraulic Engineering Circular No. 14, December.

Table 1
Analytical Resuls for the Special Groundwater Sampling (June 2001) [1]

Parameter	Units	MW025		MW075	
		Filtered	Unfiltered	Filtered	Unfiltered
Orthophoshate	mg/l	< 0.1		< 0.1	
Radium-226	pCi/l	0.561±0.151		0.081±0.130	
Uranium	mg/l	11.0	111	< 1	< 1
Alkalinity (as $CaCO_3$)	mg/l	2		< 1	
Ammonia as N	mg/l	0.3		< 0.2	
Chloride	mg/l	23.8		268	
Fluorine	mg/l	1.1		2.8	
Nitrate	mg/l	704		< 1	
Nitrite	mg/l	0.041		< 0.01	
Sulfate	mg/l	6.7		278	
Sulfide	mg/l	< 1		< 1	
Total Oragnic Carbon	mg/l	4.8		8.3	
Total Suspended Solids	mg/l		2340		278
Aluminum	mg/l	1.27	90.3	0.394	10.1
Arsenic	mg/l	0.04	0.073	1.96	2.28
Calcium	mg/l	386	240	38.8	26.6
Total Iron	mg/l	0.044	98.5	< 0.02	7.06
Ferrous Iron	mg/l	0.02		< 0.01	
Magnesium	mg/l	170	117	14.9	1.76
Manganese	mg/l	4.35	4.05	< 0.01	0.549
Potassium	mg/l	2.2	24.5	0.57	3.22
Silicon	mg/l	14.8	73.5	0.69	24.6
Sodium	mg/l	90.5	121	230	178
Vanadium	mg/l	< 0.05		< 0.035	
Eh	mV	534		455	
pH	SU	4.23		5.51	
Temperature	°C	16.2		17.2	
Conductivity	µS/cm	5,733		1,501	

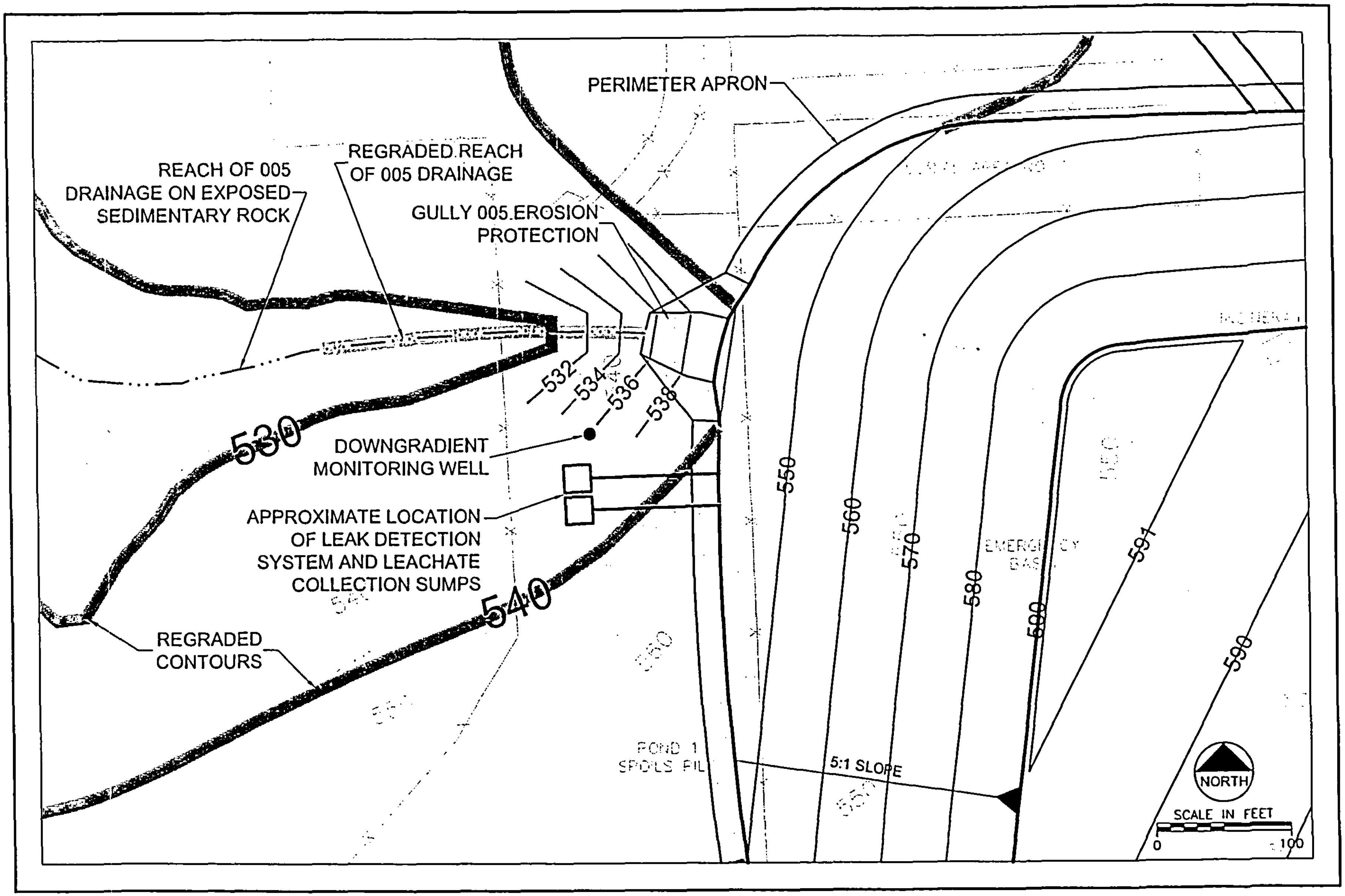
[1] Shaded cells indicate "not measured".



MFG, Inc.
consulting scientists and engineers

FIGURE 1
STREAM 005 DETAIL

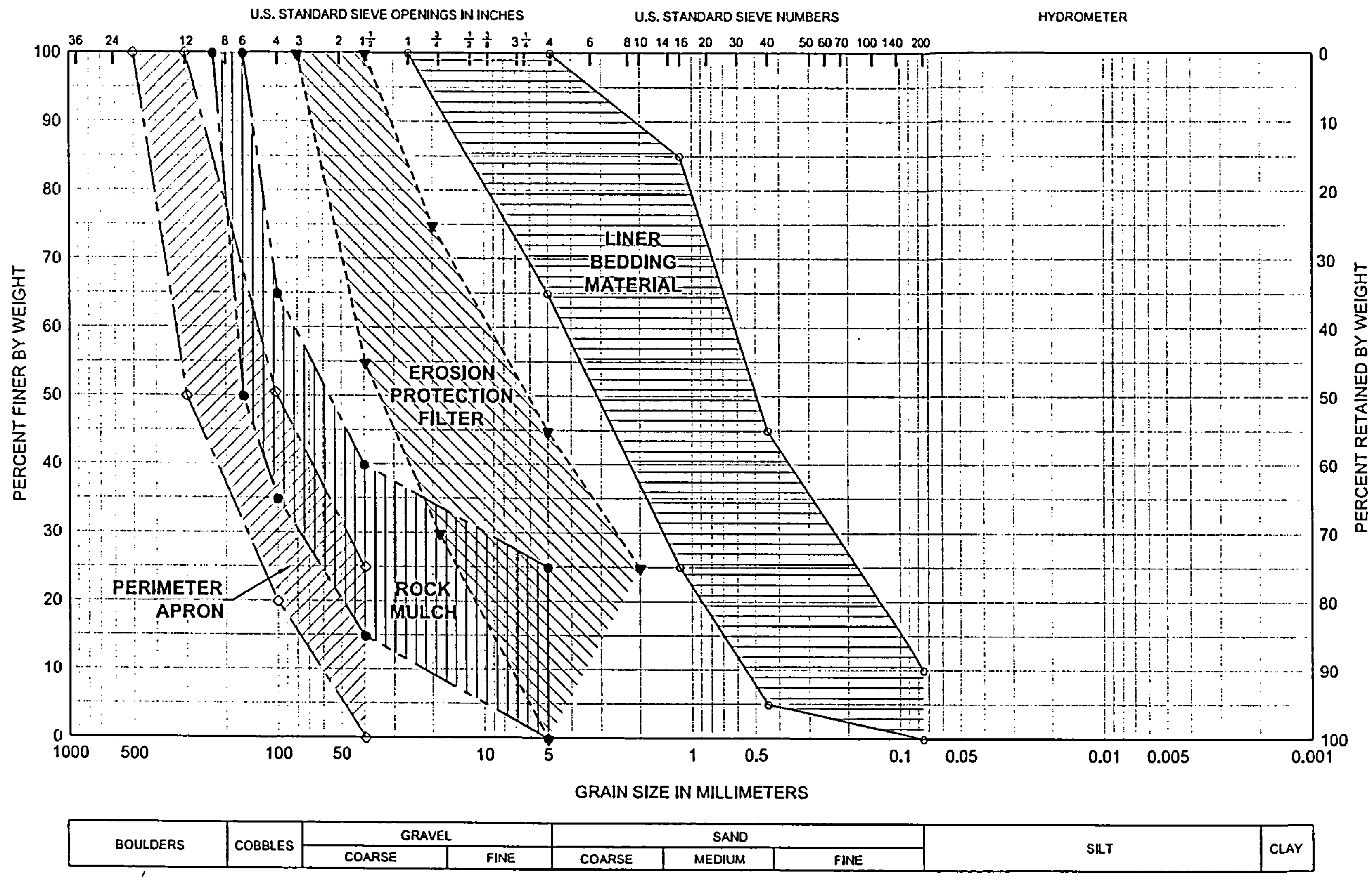
Date:	JUNE 2006
Project:	180735
File:	FIG-005-01.DWG



MFG, Inc.
consulting scientists and engineers

FIGURE 2
EROSION PROTECTION FACILITIES AT TOP OF STREAM 005 DRAINAGE

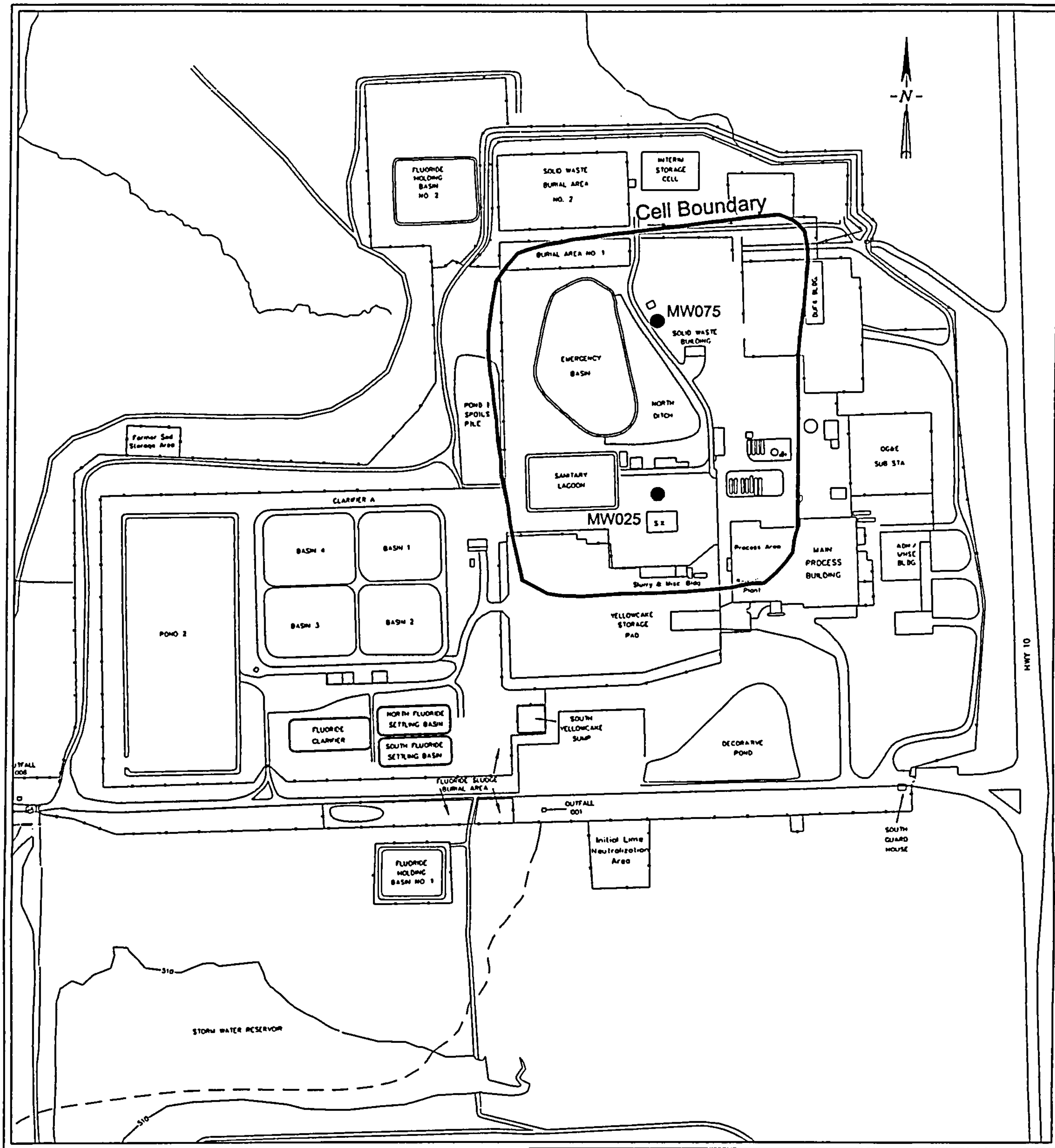
Date:	JUNE 2006
Project:	180735
File:	FIG-005-02.DWG



MFG, Inc.
consulting scientists and engineers

FIGURE 3
PARTICLE-SIZE DISTRIBUTIONS OF EROSION PROTECTION AND BEDDING MATERIALS

Date:	JUNE 2006
Project:	180735
File:	GSD-001.DWG



SEQUOYAH FUELS CORPORATION	
TITLE: *Location of Wells MW025 and MW075*	
PREPARED BY: *SCM*	FILENAME: *WellLocsSulfate.dwg*
REVIEWED BY: *CLH*	FIGURE NO. 4
DATE: *27 Jun 2006*	

OKLAHOMA
DEPARTMENT OF ENVIRONMENTAL QUALITY

STEVEN A. THOMPSON
Executive Director

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

BRAD HENRY
Governor

May 24, 2006

COPY

U.S. Nuclear Regulatory Commission
ATTN: Mr. Myron Fliegel, Senior Project Manager
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety and Safeguards, NMSS
Two White Flint North
11545 Rockville Pike
Rockville, Maryland 20852-2738

Re: Disposal of Non-11e.(2) Byproduct Materials (Non-hazardous Calcium Fluoride Sludge) On-site at Sequoyah Fuels Corporation ("SFC) Site, Gore, Oklahoma

Dear Mr. Fliegel:

It is my understanding that SFC has recently requested a statement from your office to the effect that SFC's non-lle.(2) byproduct material does not meet the definition of hazardous waste and is not subject to regulation under the Oklahoma Hazardous Waste Program.

Provisions of Oklahoma statutes and regulations are incorporated by reference as part of the hazardous waste management program under subtitle C of the federal Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6921 et seq. (See 40 CFR Sec. 272.1851(2005)). Jurisdiction in Oklahoma to regulate hazardous waste disposal lies with the Oklahoma Department of Environmental Quality ("DEQ"). Statutory provisions governing the permitting of hazardous waste disposal cells in Oklahoma provide for permits to be issued only to facilities for the disposal of solid or hazardous waste. Based on its review of information that SFC had submitted to the U.S. Nuclear Regulatory Commission (NRC), the U.S. Environmental Protection Agency and the State, DEQ determined that the only non-11e.(2) byproduct material proposed for disposal in the SFC onsite disposal cell that might be hazardous waste was the Calcium Fluoride sludge. DEQ required SFC to show by testing that the Calcium Fluoride sludge is not hazardous waste. DEQ then reviewed test results provided by SFC and found them to be acceptable. Therefore, DEQ is not asserting jurisdiction to regulate any of the SFC non-11e.(2) byproduct material as hazardous waste under its RCRA authority.

If you have any questions or concerns, please contact Martha Penisten, Deputy General Counsel for the DEQ, at 702-7184.

Sincerely,

Scott A. Thompson
Director
Land Protection Division

C: Trevor Hammons, Assistant Attorney General, State of Oklahoma
Al Gutterman, Attorney for Sequoyah Fuels