

December 22, 2004

Mr. John H. Ellis  
President  
Sequoyah Fuels Corporation  
P.O. Box 610  
Gore, OK 74435

SUBJECT: SEQUOYAH FUELS CORPORATION - MATERIALS LICENSE NO. SUB-1010 -  
REQUEST FOR ADDITIONAL INFORMATION - RECLAMATION PLAN -  
RADIATION PROTECTION AND EROSION PROTECTION (TAC L52511)

Dear Mr. Ellis:

The U.S. Nuclear Regulatory Commission (NRC) has completed a detailed technical review of the radiation protection and surface water hydrology/erosion protection aspects of Sequoyah Fuels Corporation's (SFC's) proposed Reclamation Plan for the SFC facility in Gore, Oklahoma. We have reviewed the original submittal of January 28, 2003, and supplements submitted by letters dated August 8, 2003, August 29, 2003, February 17, 2004 and June 22, 2004. Our review has identified deficiencies in the material provided; we will need the additional information identified in the enclosure in order for us to complete our review. Note that the numbering scheme identifies the area of review (e.g., RP for radiation protection) and continues the request for additional information (RAI) numbering from our March 23, 2003, letter.

Additionally, we have initiated our detailed technical review of the ground water aspects of the Reclamation Plan but have not completed that review. We will provide additional RAIs on the ground water aspects of the Reclamation Plan after we complete our detailed technical review.

Within 30 days of the date of this letter, please either provide the requested information or a schedule to provide the information. If you have any questions concerning this letter please contact me at (301) 415-6629 or via e-mail to [mhf1@nrc.gov](mailto:mhf1@nrc.gov).

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

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Sincerely,

/RA/

Myron H. Fliegel, Project Manager  
Fuel Cycle Facilities Branch  
Division of Fuel Cycle Safety  
and Safeguards  
Office of Nuclear Material Safety  
and Safeguards

Docket No.: 40-8027  
License No.: SUB-1010

Enclosure: Request for Additional Information

cc: William Andrews, USGS  
Patricia Ballard, NRMNC  
Michael Broderick, OK DEQ  
Kelly Burch, Esq., OK AG  
Will Focht, OSU  
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Troy Poteete, Cherokee Nation  
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Rita Ware, EPA  
Robert Welsh, OK DEQ  
Kim Winton, USGS  
Merritt Youngdeer, BIA

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ML043580375\*see previous concurrence

<b>OFC</b>	FCFB		FCFB		FCFB	
<b>NAME</b>	M. Fliegel*		B. Garrett		R. Nelson	
<b>DATE</b>	12/20/04		12/22/04		12/22/04	

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**Sequoyah Fuels Corporation  
Reclamation Plan Review  
Request for Additional Information**

Radiation Protection (RP)

**RP1 Radon Barrier Design**

The NRC staff reviewed the Reclamation Plan, revision 2 (February 2004), Section 3 "Facility Decommissioning and Surface Reclamation," and Appendix D, "Radon Emanation" of Appendix C. The latter contained four radon flux model outputs (calculated long-term flux estimates) to justify the cover design for radon attenuation. The most conservative model used the 10,000-year radium (Ra-226) value because thorium (Th-230) in-growth provides a higher value at that time than at the regulatory design period of 1000 years. Because of the minimal characterization data for some material, the conservative model used the 95 percent upper confidence-interval source term value. The resulting flux was 16.04 pCi/m<sup>2</sup>/s. The NRC staff modified this model by using 5-feet for layer D at 10 pCi/g Ra-226, layer B at 120 pCi/g, and a porosity of 0.46 for layers A-D and 0.44 for the cover. The resulting flux was over 40 pCi/m<sup>2</sup>/s.

Sequoyah Fuels Corporation (SFC) used a few very conservative assumptions, but other assumptions were not justified so the uncertainty cannot be assessed. If the responses to any of the comments below indicate that material volume (i.e., layer thickness in the cell) or activity estimates could be significantly impacted, a revised radon flux model should be provided to the NRC.

- A BASIS: Appendix D indicates that layer A, at the bottom of the proposed disposal cell, will contain raffinate sludge that has a median Th-230 value of 5,420 pCi/g. The SFC letter of January 7, 2004, indicates that the dewatered raffinate sludge contains 16,200 pCi/g of Th-230.

REQUEST: The discrepancy between the two Th-230 values should be explained or the radon flux model should use the higher value.

- B BASIS: Figure 39 (Volume II of Appendix D) indicates minimal soil sampling for Ra-226 and Th-230. Appendix D indicates some components of layer B were not analyzed for Ra-226 and Th-230 and does not indicate how many samples were analyzed to represent this layer. Also, four components of layer C have the same Ra-226 and Th-230 values which seems unlikely. These values are important to the radon barrier design which is based on the radon flux modeling.

REQUEST: SFC should provide additional site characterization for Ra-226 and Th-230 soil concentrations, layer B, and layer C with an assessment of the degree of uncertainty in the values.

Enclosure

- C. BASIS: According to the disposal Material Characterization Summary in Attachment D.1 of Appendix D to Appendix C, the large volume of layer D is based on uranium cleanup to 27 pCi/g (40ug/g soil), while Figure 32 of Appendix D, Volume II uses 35 pCi/g to identify contamination. However, the uranium cleanup criterion is 100 pCi/g, so less material than estimated will likely be removed. Also, with the higher uranium cleanup standard, the long-term Ra-226 content may be higher for layer D than the value of 1pCi/g assumed by SFC.

REQUEST: SFC should indicate the calculated thickness of layer D in the completed cell based on cleanup of uranium to 100 pCi/g or revise the uranium cleanup criterion. Also, the Ra-226 value for this layer should be reevaluated.

- D BASIS: The SFC radon flux models use a porosity of 0.40 for the contaminated and cover materials. Based on Regulatory Guide 3.64, this porosity value is associated with a dry bulk density of 1.6 g/cm<sup>3</sup> and compaction to approximately 90 percent of maximum dry density. The submittal did not provide measurement data for either porosity, dry density, or specifications for compaction. Also, the cover thickness includes 1.5 feet of topsoil which will have little or no compaction.

REQUEST: SFC should provide justification for the porosity value used in the models (either data or a compaction specification) or use a conservative porosity value, with the corresponding calculated density value for each layer in a revised radon flux model.

- E BASIS: The SFC flux models assume that cover Ra-226 and Th-230 values are at background. Page 5-2 (Section 5.1.3) of the Reclamation Plan states that the borrow soils would have Ra-226 levels within 5 pCi/g of background values. Criterion 6 (5), Appendix A, to 10 CFR 40, requires background radiation levels in cover materials, so some demonstration of compliance will be needed.

REQUEST: SFC should commit to using only soils with radiation levels at background for cover materials, and indicate what measurements of U-nat, Ra-226, and Th-230 will be done for confirmation.

- F BASIS: Appendix D, Attachment III, discusses depleted uranium. However, it is our understanding that any depleted uranium will be removed from the site.

REQUEST: SFC should indicate if any depleted uranium will be disposed on site.

- G BASIS: In order for NRC to evaluate the accuracy and precision of the SFC soil characterization data and the reliability of the Status Survey Plan, we must review your soil procedures. Note that the procedures can be separate from the Reclamation Plan.

REQUEST: Provide the procedures for soil sampling, preparation, and radionuclide analysis.

## RP2 **Benchmark Dose Modeling and Cleanup Levels**

The NRC staff reviewed the Reclamation Plan, revision 2 (February 2004), Section 3 "Facility Decommissioning and Surface Reclamation," and portions of Appendix D "Site Characterization Plan," and Appendix G, "Radium Benchmark Dose Calculations." SFC used a resident farmer scenario to model (calculate) the radium benchmark dose as the first step to derive cleanup limits for uranium (U-nat) and thorium (Th-230), according to Criterion 6(6) of Appendix A to Part 40.

- A **BASIS:** Section 3.2.2 indicates that the scenario chosen for the radium benchmark dose modeling is based on prudently conservative assumptions that tend to overestimate potential doses. The NRC guidance in NUREG-1620, Appendix H, indicates that a realistic dose estimate is to be provided. Conservative input parameters (assumptions) for the model could result in a high benchmark dose that is not protective, so realistic (not conservative) model parameter values should be used. Also, assuming a resident farmer lives in the process area (Figure G-1) does not appear to be realistic. The potential exposure to 5 pCi/g Ra-226 is for an undefined area with characteristics typical of the licensed site. In addition, the guidance (page H-7) states that for sites with more than 100 acres of contamination, one could assume 25 percent of the diet is from that area. SFC stated that the contaminated area is 65 acres and assumed 50 percent of the diet was from this area.

**REQUEST:** SFC should justify the use of the resident farmer scenario for the site (are there farmers growing vegetables, fruit, grain as well as livestock in the general area), and the existence of edible fish in site surface waters. Also, indicate how likely it is that a farmer in the area produces 50 percent of the food and milk that their family consumes on 65 acres, irrigates all crops with pond water, and produces 50 percent of the family's aquatic food in that same pond.

- B **BASIS:** Page 2 of Appendix G states that the disposal cell **may** (emphasis added) be designed to yield an exposure rate comparable to background. Criterion 6(1) of Appendix A to 10 CFR 40 requires that direct gamma exposure to the wastes be reduced to background levels. Page 5-1 of the Reclamation Plan indicates that calculations show that the gamma radiation exposure will be reduced to essentially background by 10 feet of cover.

**REQUEST:** Revise page 2 of Appendix G to be consistent with the regulations and page 5-1 of the Reclamation Plan.

- C **BASIS:** The Reclamation Plan proposes the use of Subsurface Soil Criteria. The NRC guidance (H 2.2.3 (7)) indicates that the subsurface soil standard is to be used for small areas of deep excavation. Large areas at that contamination level could result in doses higher than the 5 pCi/g radium standard.

**REQUEST:** Indicate the size of the area where subsurface criteria will be used, and why the resulting potential dose would be protective.

- D BASIS: Page 4 of Attachment 1 to Appendix G states that the basic radiation dose limit is 100 mrem/yr as stated in 10 CFR 20.1403(e). That section applies to license termination under restricted conditions; it does not apply to facilities decommissioning under Part 40, Appendix A (see 10 CFR 20.1401(a)).

REQUEST: Correct page 4 of 27 in Attachment 1 to Appendix G.

- E BASIS: Several parameters (e.g., density of contaminated and saturated zones) are stated to be site-specific values but no data is provided to support these values.

REQUEST: Provide the site data for site-specific values used in the dose modeling and indicate why the resulting average is representative.

- F BASIS: Criterion 6(6) states that the Radium Benchmark Dose approach is to be used to derive structure surface cleanup limits, but no calculations or limits were provided in Appendix G or in the final status survey plan.

REQUEST: Provide justified cleanup limits for structure surface cleanup or provide data indicating all levels are approximately background, or below accepted detection limits.

- G BASIS: Page 3-9 of the Reclamation Plan states that cleanup levels for U-nat and Th-230 were selected based on the as low as reasonably achievable (ALARA) principle, however, there is no discussion of how the principle was applied. In fact, the selected Th-230 levels are equivalent (based on 1000 years of decay) to the Ra-226 standards to which ALARA should then be applied. The guidance in NUREG-1620, Appendix H indicates that the cleanup level should be less than 14 pCi/g for surface Th-230.

REQUEST: Indicate how the proposed soil cleanup levels are ALARA. If part of the ALARA approach is that the land will be owned and under perpetual surveillance by the federal government which would limit exposures, indicate if the Department of Energy has agreed to accept the land within the proposed long-term care boundary.

- H BASIS: Part of establishing soil cleanup levels is the appropriate establishment of background levels. Appendix D, Section 4.1.1, indicates that 31 soil samples were collected and analyzed, but that additional sampling will be required for Th-230 and Ra-226 because of problems with two analytical labs. The staff cannot approve of cleanup levels without evaluating the proposed background values, since background is part of the regulations in Criterion 6(6).

REQUEST: Provide the background radiological data for the surface and subsurface soil. Discuss how the sample locations are geochemically representative of the contaminated areas and why two samples are from 12 miles away instead of at the fence line (indicate unit of length on Figure 21), why the variation in sample results is acceptable, and how all these processes/procedures are the same or very similar to those in the final status survey plan.



RP3 **Final Status Survey Plan**

The NRC staff primarily reviewed the Reclamation Plan, revision 2 (February 2004), Attachment B "Final Status Survey" and Attachment C "Quality Assurance Program." Site decommissioning and the final status survey plan should follow the guidance in NUREG-1620, Section 5 and relevant portions of NUREG-1575 (MARRSIM). Also, in finalizing the plan, the licensee should consider that items will be inspected during decommissioning as described in Inspection Procedure 45678.

- A BASIS: Page 3 of Attachment B indicates that only the Ra-226 and Th-230 areas will be surveyed by 100 m<sup>2</sup> units. The uranium is also being remediated under Part 40, Appendix A, Criterion 6(6) and should be assessed by the same unit size.

REQUEST: Revise page 3 to indicate that Class 1 and 2 areas (known and suspected uranium contamination) will be assessed by 100 m<sup>2</sup> units.

- B BASIS: The discussion in Attachment B, page 5, titled "Direct and Removable Measurements," is confusing. Removable activity measurements are performed by doing swipes of the surface and counting the activity on the swipe. However, there is no mention of doing swipes. Page 11 states that the cleanup level is 2000 transformations per minute per 100 cm<sup>2</sup>, for total (direct) gross alpha and gross beta/gamma, but there is no mention of how this value was derived, and what value will be used for removable activity.

REQUEST: Revise page 5 to indicate what measurements are planned (this can be based on NUREG-1575), and what cleanup limits are proposed based on the method described in Appendix H of NUREG-1620.

- C BASIS: Attachment B, page 5, Table 2-4, indicates soil radionuclide analytical methods with detection limits but no references are provided.

REQUEST: Provide the reference for each of the analytical methods to be used.

- D BASIS: Attachment B, Section 3.5, discusses Th-230 and Ra-226 cleanup verification. SFC proposes to take one sample from each unit but does not indicate the size of the sample or how it will represent the entire unit. Section 3.5.2 states that in situ measurements may be substituted for soil samples, but there is no indication of how these will be done or how comparable the results would be to soil analysis. Section 3.5.4 states that gamma measurements may be substituted for some U-nat and Ra-226. Isotope-gamma correlations were not presented to substantiate that the approach is acceptable. In particular, uranium concentrations are unlikely to be correlated with gamma levels and in situ measurements of soil alpha radiation are difficult.

REQUEST: Provide details on the soil cleanup verification as recommended in NUREG-1620, Section 5.2.



- E BASIS: Attachment B, Section 4.2 (page 13) states that a quality assurance procedure will be developed for the final status survey effort. That procedure should be provided as part of the final status survey plan, so that staff can determine that the survey will be conducted in an acceptable manner.

REQUEST: Provide the quality assurance procedure for the final status survey.

## Surface Water Hydrology and Erosion Protection

### SW7 **PMP Event**

Please explain your reasoning for applying durational factors based on Urban Drainage and Flood Control District (Appendix C, p. B-2). NRC guidance in NUREG-1623 (Design of Erosion Protection for Long-Term Stabilization, 2002) suggests using Nelson's method for addressing durations less than one hour. If you choose an alternate method you must explain the applicability of the durational factors to the SFC site. Address whether the factors have universal applicability or have been established based on regional information. If regional information has been used to develop the durational factors, please provide a basis for applying them to the SFC site and show that they lead to conservative estimates of flooding. Note that revisions to the durational factors will affect the results listed for Table B.1 on page B-3, the time of concentration calculated for each sub-basin.

### SW8 **Allowable Stress**

The vegetation established on the top of the cell will play a major role in preventing erosion. Please provide details regarding the type of vegetation expected to volunteer to the top slope. Discuss your reasons for selecting "mixed grasses" on p. B-6 of Appendix C and the corresponding characteristic variables ( $h$ ,  $M$ ). There is no explanation or reference to another section of the reclamation plan where detailed information regarding the vegetation may have been provided. Also, please correct the typo in the value of  $C_e$  (given as 1.14, which is actually the value of  $C_e^2$  used to calculate allowable shear strength).

### SW9 **Abt Method**

Table B.3 on p. B-9 of Appendix C lists median rock sizes for each sub-basin calculated using the Abt method. Please provide your calculation details as our independent verification is not matching the values in the table.

### SW10 **Potential Ponding**

Appendix C, Drawing No. 5, "Current Facilities and Disposal Cell Layout" shows the proposed topography of the site near the cell. The topography of site adjacent to cell on the west side shows the elevation of 540' intersecting the toe of the embankment in a manner that may cause areas of ponding against the toe if the area is not graded away from cell. Please either show that water will not pond against the toe of the cell or address the effects of such ponding.

**SW11 East Side of Cell**

Appendix C, Drawing No. 5, "Current Facilities and Disposal Cell Layout" shows the proposed topography of the site near the cell. The proposed topography of the site adjacent to cell along the east side at elevation 570' is an area of concern. This area directs the flow around the cell toward the north and south but SFC did not analyze this area for the potential for erosion. Please provide an assessment of the potential for erosive flow velocities in this area (to the northwest of the OG&E substation) from the overland areas east of the site and discuss the need for additional erosion protection in this area.

**SW12 Embankment Toe Apron**

Appendix C, Drawing No. 7, "Typical Disposal Cell Cross Section and Details" does not provide details on the embankment toes nor have they been discussed in the text. Please provide dimensions and justification for dimensions of the toes. Lateral flow from drainage areas east of the cell should be considered in addition to the sheet flow from the top and sides of the cell in your discussion.

**SW13 Vegetative Cover**

Please provide information on the vegetation that is expected to volunteer at the site. No information regarding characteristics of the vegetative cover has been supplied or referenced in Appendix C. Information should include species expected and characteristics of each including root penetration, density, growing season, and expected length of life. The type of vegetation that is expected to volunteer at the site is important for consideration because root penetration (among other characteristics) may eventually affect the performance of the cover and gully initiation.

**SW14 Stream 005**

Please provide an assessment of the potential for the tributary on the western side of site (stream 005) to erode towards the cell. Currently, a headcut appears to be migrating upstream. Therefore, the erosion potential at the upstream end due to runoff from the cell should be addressed. An analysis of the discharge in the tributary should include all overland flow from on and around the cell. If you determine that rock armoring of the stream is necessary to prevent erosion reaching the cell, provide details of the proposed armoring and the analysis to support it.

**SW15 Rip Rap Filter Layer**

The use of a filter layer for rip rap proposed for the side slope was not addressed. NRC guidance in NUREG-1623, Appendix D, Section 2.1.1, states that filter or bedding is recommended for cell side slopes and toes where rip rap is used. Please either revise the design to include a filter layer or provide justification for opting not to.

## SW16 **Rock Gradation and Durability Testing**

Please provide information on rock gradation. If the maximum rock size will be greater than 6 inches, either increase the thickness of the rip rap layer or provide justification for a layer thickness less than the maximum rock size. Also, provide information and specifications on testing procedures for rock durability and construction specifications for rock placement.