SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

RE: 0336-N

September 19, 2003

Certified Mail – Return Receipt Requested
Receipt No. 7002 0460 0001 4284 7391

U.S. Nuclear Regulatory Commission
ATTN: Ms. Susan Frant, Chief
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety and Safeguards
11545 Rockville Pike
Two White Flint North
Rockville, Maryland

Subject: License SUB-1010; Docket No. 40-8027
Raffinate Sludge Dewatering Project

Dear Ms. Frant:

Sequoyah Fuels Corporation (SFC) submitted a Reclamation Plan in January, 2003 describing its approach to decommission and reclaim the site. In that plan, SFC proposed to dewater the raffinate sludge prior to placing it into the disposal cell, and indicated in the schedule (figure 8-1) that the project to dewater the sludge would begin during the third quarter of this year. This letter is to inform you that SFC plans to initiate the dewatering project early in the fourth quarter of this year. The project will take 6 to 8 months and will run through mid-2004.

The dewatering project includes the following elements. A more detailed description of the project is contained in Enclosure 1 to this letter.

- Construction of a temporary dewatered sludge storage location on the South Yellowcake Pad
- Installation of feed surge tanks near the Clarifier Basins to facilitate processing of the sludge
- Reactivation of a dredge system previously used in raffinate sludge service to remove sludge from the basins
- Procurement of a contractor to provide high pressure filter presses and filter cake handling equipment

NMSS01

- Preparation of operating procedures for the dewatering system
- Training of personnel involved in the project
- Dewatering and packaging of all the raffinate sludge contained in the Clarifier Basin A
- Cleaning and decontamination of contractor provided equipment to unrestricted release levels at close of project

Filtrate from this activity is identical to the ammonium nitrate byproduct solution that SFC has used for fertilizer over the last 25 to 30 years. The ammonium nitrate byproduct will continue to be handled in accordance with the requirements contained in license SUB-1010.

The raffinate sludge has historically been handled, packaged, and shipped for disposal as a normal part of the facility operations in accordance with SUB-1010, License Renewal Application dated Aug, 1985, as amended. The activities planned in this project are similar to those conducted under this license during the operational life of the facility. SFC has reviewed SUB-1010 and associated commitments and has concluded that the following provisions apply to and are adequate for implementing the sludge dewatering project.

> Chapter 1, Standard Conditions and Special Authorizations, Section 1.7, item 2., states that the following activities are authorized:
>
> > "Handling, removal, treatment, storage and disposal of process materials, equipment, and contaminated waste materials consistent with the provisions of 10 CFR 40.42."
>
> Chapter 1, Standard Conditions and Special Authorizations, Section 1.8 of the License Renewal Application dated Aug, 1985, as amended, prescribes the program for treatment and release of treated raffinate solution. No change to this license program is necessary to complete the sludge dewatering project.
>
> Chapter 3, Radiation Protection, and license conditions 9.4, 24, 42, and 43 prescribe a radiation protection program that adequately protects against any hazards that may result from this operation. No change to this license program is necessary to complete the sludge dewatering project.
>
> Chapter 5, Environmental Protection, Section 5.2.2 prescribes an air sampling program for the facility fenceline. Analysis of potential releases resulting frin the dewatering process and packaged sludge storage indicates that this program is adequate. No change to this license program is necessary to complete the sludge dewatering project.

Fenceline and far field sampling for radon was conducted during past sludge handling and management activities. This radon sampling was terminated in 1994 when the sludge was no longer produced or handled routinely. SFC intends to re-instate this radon sampling prior to and during the course of this project and will evaluate the need to continue from the actual data collected.

The sludge will be packaged and stored in the temporary storage area until a raffinate sludge disposal alternative is chosen. As a result, this project does not foreclose any permanent disposal option for the raffinate sludge. Should you have any questions concerning this project, please contact me at (918) 489-5511, extension 13, or Craig Harlin at extension 14.

Sincerely,

John H. Ellis

John H. Ellis
President, SFC

xc: Mike Fliegel
Bob Evans, RGN-IV/DNMS

Enclosure

Enclosure 1

Assessment of Raffinate Sludge Dewatering Project

Revised 9/17/03

Assessment of Raffinate Sludge Dewatering Project

BACKGROUND

Raffinate sludge was produced during operation of the SFC facility as a result of neutralizing the acidic raffinate stream from solvent extraction purification of yellowcake. Raising the pH caused radionuclides, metals and residual rock particles from the original uranium ore to precipitate and settle to the bottom of the raffinate ponds.

Settled raffinate sludge is currently stored in 3 hypalon-lined impoundments (Clarifier Basins 1A, 2A, & 4A) on the southwest corner of the Process Area. These impoundments have a 10 to 15 inch water cover maintained over the sludge to prevent drying and wind dispersion and to reduce the rate of radon emanation. The inventory consists of approximately 1,064,000 cubic feet of sludge containing 15 to 20% solids.

ALTERNATE APPROACH FOR DEWATERING OF RAFFINATE SLUDGE

Several processes have been tested for removing as much of the liquid as possible from the raffinate sludge, including centrifuging, rotary vacuum drum filtering, porous bag filtering and high pressure plate press filtering. Thermal drying was considered (but not tested) and rejected on the basis of excessive cost and probable contamination control issues. High pressure plate press filtering has been shown to provide the best liquid removal (short of thermal drying), the shortest processing time and the lowest cost and has therefore been selected as the process that SFC will use for raffinate sludge de-watering instead of rotary vacuum drum filtration. This is a change to the SFC Reclamation Plan submitted in January, 2003.

The packaged de-watered sludge will then be temporarily stored on the north half of the South Yellowcake Pad until a disposal decision is made. The South Yellowcake Pad is an existing reinforced concrete pad that was used for storage of drummed yellowcake when the facility was in operation. A clay layer with an HDPE cover will be placed over the concrete pad in the proposed storage location to provide an elevated storage area. This will keep the bagged sludge from setting in any accumulations of stormwater. Additionally, an HDPE cover will be maintained over the bags until ready for disposal. See **Figure 1,**

Dewatered Raffinate Sludge Storage Configuration, shows the location and configuration of the temporary de-watered sludge storage area. Stormwater from the South Yellowcake Pad presently drains to a collection sump where it is captured and transferred to the Emergency Basin for treatment prior to release through Outfall 001. This practice would continue during the time that dewatered sludge is stored on the pad.

RAFFINATE SLUDGE DE-WATERING SYSTEM DESCRIPTION

The raffinate sludge de-watering system that has been selected consists of a floating slurry dredge for removing the sludge from the Clarifiers and two15,000 gallon sludge feed tanks, slurry feed pumps, two trailer mounted 100 cubic foot capacity high pressure plate press filters, filter cake handling and packaging conveyors and associated piping. The sludge de-watering system is shown schematically in **Fig 2, Raffinate Sludge Dewatering Process Schematic Diagram.**

The feed tanks and plate press filter trailers will be located on a newly constructed concrete pad on the east bank of Clarifier Basin 1 (See **Fig 3, Raffinate Sludge Dewatering Process Location Diagram**). The processing pad will be diked for containment and sloped to drain back to Clarifier Basin 1. The pad will have a watertight coating or liner to prevent leakage to the under-lying soil and to permit routine wash-down for contamination control.

The sludge will be slurried and pumped from the clarifiers into the feed tanks using the floating dredge. The electrically powered dredge is remotely operated from the Clarifier bank and has a mixer for slurrying the sludge, a sludge transfer pump and a winch system for moving the dredge across the clarifier. A cable anchored on opposite sides of the Clarifier guides the dredge. Control and power cables and the sludge transfer line from the dredge are supported by floats on the surface of the Clarifier

The sludge will then be pumped batch-wise from the feed tanks to the high pressure plate press filter units. The feed pump system will inject sludge into each plate press filter unit until the filter chambers are filled with sludge and the feed pressure reaches 225 psig. A variable flow pump will then maintain feed pressure at 225 psig until feed and filtrate flow from the filter unit ceases or drops to a specified low flow rate. At that time, the feed pumps will be stopped, the filter press assembly opened and the de-watered sludge (filter cake) removed and packaged.

The solids content of the de-watered sludge is expected to be 45 to 50% based on the results of the pilot scale tests that have been performed. Based on the results of the pilot-scale tests, the raffinate sludge volume will be reduced to approximately 485,000 cubic feet. Total weight of the de-watered sludge is estimated to be about 15,500 tons. The de-watered sludge easily passes the paint filter test for free liquids. The filtering pressure of 225 psig will assure that no further water is extruded from the sludge after placement in the disposal cell (maximum load from overlying soil is estimated to be approximately 32 psi).

The liquid (filtrate) removed from the sludge during the de-watering step consists of water and ammonium nitrate with some uranium, radium 226, thorium 230 and low levels of various metals. Analyses of the filtrate produced during the pilot scale testing are presented in Table 1. The filtrate will normally be returned to the Clarifier Basin that is being processed. Periodically, the ammonium nitrate liquid will be transferred to Clarifier 3A, treated to reduce the radionuclide and metal levels and then land applied as fertilizer as specified in SFC's NRC license (SUB-1010).

The high pressure filter presses, slurry feed pumps, cake conveyors and packaging equipment will be provided by an environmental service contractor. Upon completion of processing of the raffinate sludge, the contractor owned equipment will be disassembled, decontaminated and, if possible, released for unconditional use. SFC's equipment will be washed, dismantled and stored for future disposition or use.

Safety Assessment

The dewatering of raffinate sludge with this system is a wet process throughout which minimizes the potential for release of airborne radioactive materials. The raffinate sludge feed material is a flowable slurry of 15 to 20% solids. It is currently stored in three lined impoundments and has a 10 to 15 inch water cover maintained over the sludge. The filter cake that will be produced by this process is a solid product that remains moist at approximately 45 to 50% solids. The filter cake easily passes the paint filter test for free liquids (EPA Method 9095A).

As previously described, the sludge is pumped into the high pressure filter units and the aqueous filtrate drains by gravity from the filter housings back into a clarifier basin. Sludge is pumped into the filter unit until all the filter chambers are full and the pressure feed increases to 225 psig. When the flow of feed and filtrate slows or stops at 225 psig, the feed pump is stopped and the pressure is allowed to bleed down to 0 psig. The filter chambers are then opened and the

filter cakes from each chamber drop to a conveyor located under the filter unit. The cake is then conveyed into the storage/disposal bags which are then closed and moved to the interim storage area.

The filter press area and equipment will be routinely washed down with fresh water to control contamination. The wash water will drain by gravity to one of the adjacent clarifier basins. Routine visual inspections and smear surveys will be performed to assure that contamination levels are maintained at or below the levels specified in SFC's license and health and safety procedures.

During the operation of the high pressure filter presses, which is expected to last for 6 to 8 months, it is anticipated that there may be an increase in airborne radon concentrations at the site. Measurements taken during pilot testing of the high pressure filter press indicate that the levels will remain below those requiring posting as an airborne radioactivity area. Nonetheless, fixed area air samples of workspaces will be collected on a continuous basis to evaluate operational and engineering controls. In addition, personal air samplers will be used to evaluate worker exposure. All air sampling will be conducted in accordance with existing SFC procedures.

As described in Attachment 1, SFC measured the radon emanation from the proposed polypropylene storage bags filled with raffinate sludge dewatered during pilot testing and found the concentrations to be acceptable for the work area. Dispersion calculations presented in Attachment 1 indicate that the worst case radon concentration at the Restricted Area Boundary will be within the applicable regulatory limits

Personnel involved in the day-to-day operation of the dewatering equipment will be HAZ-WOPER and radiation worker trained and qualified. In addition, project specific operating procedures for the conduct of dewatering activities will be prepared prior to initiation of this project. Personnel involved in the project will then be given formal training on these and applicable SFC health and safety procedures.

The filtrate removed from the sludge is an aqueous solution containing ammonium nitrate, natural uranium, thorium-230, radium-226 and a variety of metals. It is identical to the ammonium nitrate byproduct that SFC has used for fertilizer for over 20 years under its license SUB-1010. The pH of this solution is approximately 7.0. These liquids will continue to be treated to reduce uranium, radium, thorium and metals and land applied under conditions in SUB-1010. Analyses of the filtrate before and after treatment are attached as **Table 1**. No changes to the land application program are needed for this project.

/

This activity does not change the current license conditions for radiation protection, or reduce in any way the level of protection afforded by the radiation protection program in force at the Facility. In addition, no activities are proposed that would introduce new radioactive materials to the site, or concentrate the present materials appreciably. Further, nothing in the proposed activities could increase either the potential for or consequences of postulated accidents. Thus, the proposed operations will not adversely affect the public health and safety.

Environmental Assessment

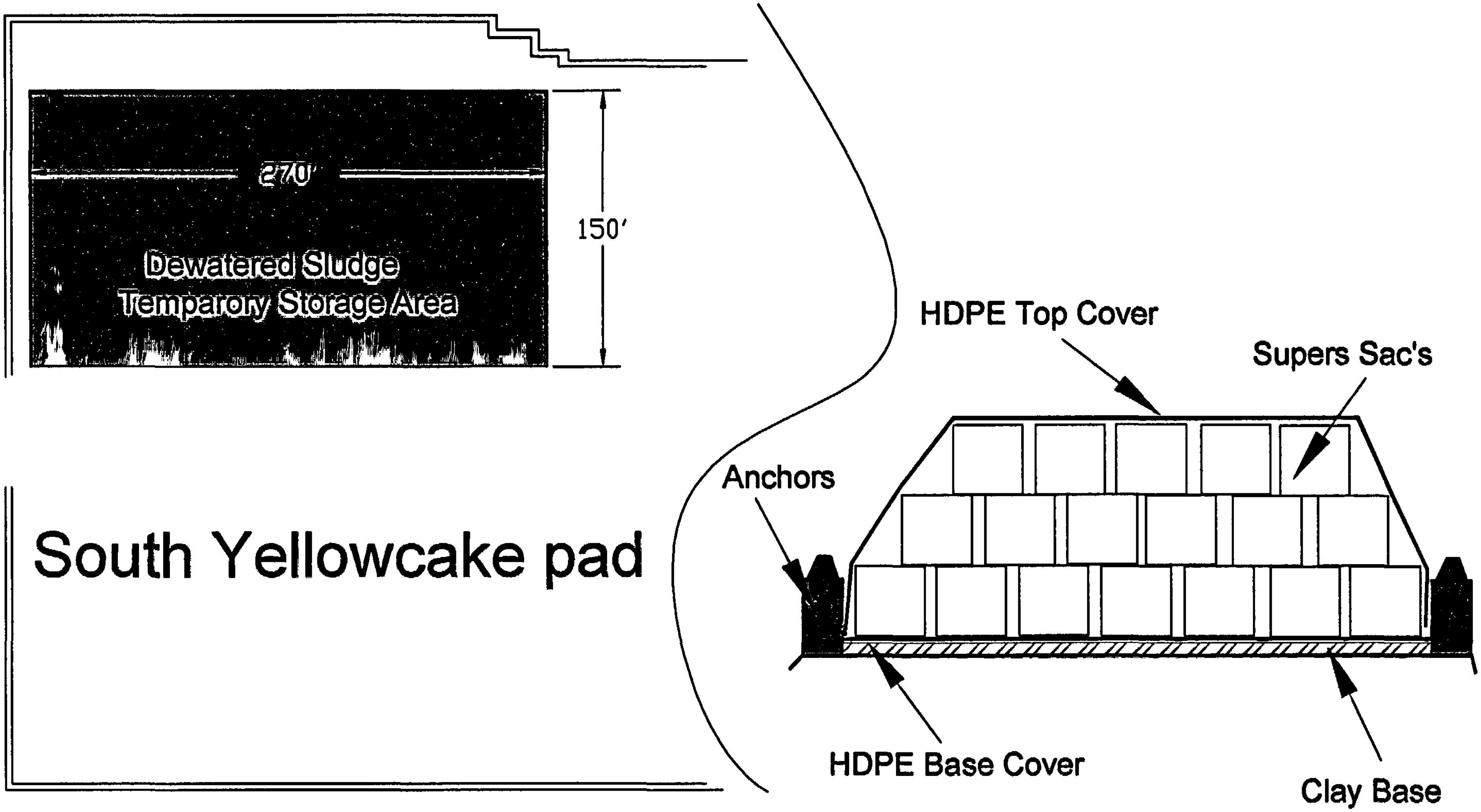
The dewatering activities described above will improve the current environmental conditions by reducing the potential for leakage of radioactive materials from the Clarifier Basin A to the underlying ground water.

An increase in radon emanation is expected as a result of dewatering and temporarily storing the packaged raffinate sludge on the South Yellowcake Pad. The maximum radon concentration at the site boundary has been calculated to be 3e-11 µCi/ml, well below regulatory limit of 1e-10 µCi/ml (see Attachment 1 – Estimate of atmospheric dispersion of radon-222 from storage of dewatered raffinate sludge).

No significant change in the type or amount of effluent released offsite has been proposed. Therefore, this project does not have a negative environmental impact.

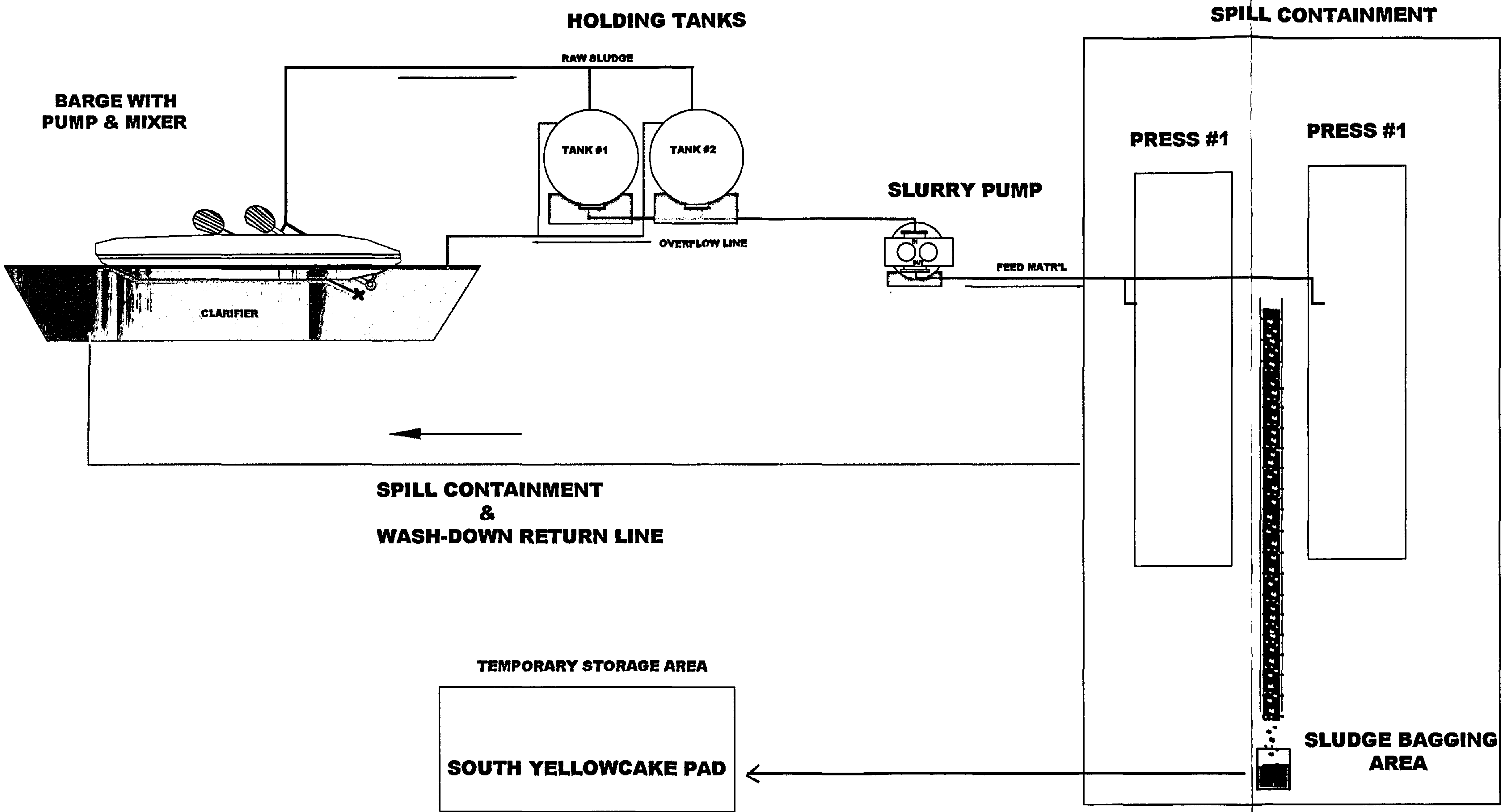
Conclusion

The raffinate sludge dewatering activities proposed here do not require an amendment to license SUB-1010 and are, in fact consistent with the authorized activities *specified in Section* 1.7 of *SFC's license* SUB-1010 *in and in* 10 CFR 40.42. In addition, these activities do not pose an new environmental or public health and safety threats. Finally, the dewatering does not foreclose any decommissioning alternative.



SEQUOYAH FUELS CORPORATION

Title: Dewatered Raffinate Sludge Storage Configuration	
PREPARED BY: SFC	Filename: SFC0098A
Reviewed by: JE	Figure No.1
Date: 09/17/2003	



SEQUOYAH FUELS CORPORATION

Title: Raffinate Sludge Dewatering Process Schmeatic Diagram	
PREPARED BY: SFC	Filename: SFC0099A
Reviewed by: JE	Figure No.2
Date: 09/17/2003	

Attachment 1

omega PROJECT SERVICES LLC

Memorandum

To: Craig Harlin

From: Robert Miller RBM

CC: John Ellis, Scott Munson

Date: September 9, 2003

Re: Estimate of atmospheric dispersion of radon-222 from storage of dewatered raffinate sludge

---

Reference: "Workbook of Atmospheric Dispersion Estimates", D. Bruce Turner, U.S. EPA, revised 1970.

Introduction

Sequoyah Fuels Corporation (SFC) submitted a Reclamation Plan in January, 2003 describing its plan to decommission and reclaim the site. In that plan, SFC proposed to dewater the raffinate sludge currently stored in Clarifier Basin A prior to placing it into the disposal cell. The dewatered sludge will be stored in one-cubic yard sacks of synthetic woven fabric. The dewatering project includes construction of a temporary dewatered sludge storage location on the South Yellowcake Pad approximately 40 meters southwest of the lime storage bin. The location of the temporary storage area is shown on the figure attached to this memorandum. The sludge will be stored in the temporary storage area until a raffinate sludge disposal alternative is chosen and the SFC Reclamation Plan is approved.

An increase in radon emanation is expected as a result of dewatering and temporarily storing the packaged raffinate sludge on the South Yellowcake Pad. A quantitative estimate of this increase is necessary to identify new exposure pathways and plan for management of associated impacts. This memorandum describes a simple, conservative estimate of a maximum radon concentration at the restricted area fenceline and provides a brief evaluation of the significance.

Method

When a gas (e.g. radon) is released from a source to the environment, it is assumed that the gas will be carried downwind, while at the same time it disperses laterally and vertically. The two main consequences of this dispersion in the atmosphere are dilution of the gas, and its eventual return to the breathing zone at ground level. The ground level distribution of the gas depends on a number of factors, including atmospheric stability, wind velocity, terrain, and height of release. Estimates of the dispersion of a gas in the atmosphere can be based on mathematical models that consider the meteorological and physical factors mentioned previously.

One of the more commonly used models for estimating the ground level concentration of a gas released from a point source is the Gaussian plume, straight-line trajectory model. In this model, the

gas is assumed to be normally distributed around the central axis of the plume, and that atmospheric stability, wind speed, and effective release height determine the atmospheric dispersion characteristics of the gas in the downwind direction. A specific application of this model is described by the Pasquill-Gifford equation (Reference Equation 3.1). The equation simplifies for concentrations calculated at ground level (Reference Equation 3.2). The equation further simplifies for concentrations calculated along the centerline of the plume (Reference Equation 3.3).

The final condition of the temporary storage area includes being covered with an HDPE cover. The cover will be sealed at the bottom and have several passive vents on the top. This configuration allows the temporary storage area to be modeled as an elevated area source. Assumptions can be made in application of the aforementioned equation to deal with dispersion from an area source. The assumption is to treat the area source as a cross-wind line source with a normal distribution. Then an upwind point is determined that will give a horizontal dispersion equal to an estimated horizontal dispersion at the area source.

Calculation

The fluence of radon-222 from the temporary storage area was developed as follows:

- 13744 m^3 (485000 cubic feet); estimate of the final volume of dewatered raffinate sludge.
- 0.9 m long (3 feet) x 0.9 m (3 feet) wide x 0.9 m (3 feet) high; dimensions of one sack
- 2 layers of sacks; the estimated maximum final configuration of sacks.
- 8989 sacks per layer; 13744 m^3 / (0.9 m long x 0.9 m wide x 0.9 m high) / 2 layers of sacks.
- 8150 m^2 exposed surface area of sacks in temporary storage;
  - 0.8 m^2 per side of sack (0.9 m long x 0.9 m wide);
  - 95 sacks per side of storage; square root of 8989 sacks per layer.
  - 634 m^2 per side of storage; 95 sacks per side x 2 layers of sacks x 0.8 m^2 exposed per sack x 4 sides of storage.
  - 7516 m^2 per top of storage; 8989 sacks per layer x 1 top layer x 0.8 m^2 exposed per sack.
  - 634 m^2 + 7516 m^2 = 8150 m^2
- 5 pCi/m^2/s; average radon-222 flux from surface of a storage sack.
  - Radon flux measurements were made of the surface of unlined sacks of dewatered raffinate sludge. The measurement method used 10-inch diameter activated charcoal canisters sealed to the surface of the sack. The canisters had an effective surface area of approximately 0.05m^2. The canisters were attached to the sacks for a known length of time, approximately 72 hours. After sampling was completed, the activated charcoal was removed from the sampler, placed in a sealed counting container and counted for radon daughter activity. The calculated flux for two samplers, each from the top of a separate sack, was 6.46 pCi/m^2/s and 4.09 pCi/m^2/s. These two values were averaged to obtain an average flux of 5 pCi/m^2/s.

- 0.041 μCi/s; fluence of radon-222 from temporary storage area (Q): 5 pCi/m²/s from surface of storage sack x 8150 m² exposed surface area of sacks in temporary storage.

The point of exposure is chosen as the distance downwind of the center of the temporary storage area along the plume centerline:

x = 106 m; the distance from the center of the temporary storage area to the nearest restricted area fence (about 350 feet to the NW).

A calculation to estimate the maximum ground level concentration of radon-222 at the restricted area fenceline closest to the proposed area for storage of the dewatered raffinate sludge is provided below.

$$\chi = \frac{Q}{\pi \times s_{yv} \times s_{z0} \times \mu} \exp\left[-0.5 \times \left(\frac{H}{s_{z0}}\right)^2\right]$$

where:

Q = 0.041 μCi/s; fluence of radon-222 from the source (the release rate of radon-222 from the temporary storage area): the average flux from a storage sack multiplied by the exposed surface area of all the sacks at the temporary storage area.

π = 3.14159 ...; the mathematical constant pi.

s_{yo} = 25 m; the horizontal spread of the plume as a function of atmospheric stability class E, distance from the source of 106 m, and area source: 106m / 4.3 (Reference Chapter 5 "Area Sources").

x_{yv} = 400 m; the distance downwind for s_{yo} and atmospheric stability class E: Reference Figure 3-2.

$x + x_{yv}$ = 506 m; the virtual distance downwind: 106 m + 400 m.

s_{yv} = 29 m; the horizontal spread of the plume as a function of atmospheric stability class E and distance from the source of 506 m: Reference Figure 3-2.

s_{z0} = 3.5 m; the vertical spread of the plume as a function of atmospheric stability class E and distance from the source of 106 m: Reference Figure 3-3.

μ = 4 m/s; the annual average wind speed: National Oceanic and Atmospheric Administration, Preliminary Local Climatological Data, (Form F-6), Davis Field, Muskogee, Oklahoma, 1999 through 2001.

H = 1.8 m; the effective emission height: the height of two storage sacks (0.9 m + 0.9 m).

χ = 3E-11 μCi/ml; maximum concentration of radon-222 at ground level at the restricted area fenceline nearest the temporary storage area: approximately 106 meters NW of temporary storage area.

Evaluation

The maximum ground level concentration is estimated to be 3E-11 µCi/ml. This concentration can be compared to the effluent concentration limits (EC) of 10 CFR 20, Appendix B, Table 2, Column 1. The presence of the cover creates a condition of minimal air circulation thus allowing opportunity for ingrowth of radon daughters. Therefore the EC chosen here for comparison is that of Radon-222 with daughters present: 1E-10 µCi/ml.

The radon concentration estimated here is a maximum where the EC represents an annual average concentration limit. The calculation completed here to estimate this maximum does not account for effects of changes in wind direction or increased dispersion due to unstable atmospheric conditions. Comparison of the maximum concentration estimated here to the EC is therefore a conservative application; i.e. the annual average concentration at any given point along the restricted area fenceline will be less than the concentration estimated here and a substantially smaller than the EC.

TABLE 1
COMPARISON OF SFC TREATED RAFFINATE SOLUTION
TO
TREATED FILTRATE FROM DEWATERING RAFFINATE SLUDGE

CONSTITUENT	TREATED RAFFINATE [1]	TREATED FILTRATE
Ra 226 (pCi/l)	0.24	0.06 [2]
Th 230 (pCi/l)	<0.4	1.4
Uranium-Nat (ugm/l)	6.1	14.8 [2]
Ammonia as N (mg/l)	7,109	1,620
Nitrate as N (mg/l)	7,483	3,490
Antimony (mg/l)	not analyzed	<0.008
Arsenic (mg/l)	0.73	0.82
Barium (mg/l)	0.33	104 [3]
Berylium (mg/l)	not analyzed	<0.002
Cadmium (mg/l)	<0.1	0.011
Chromium (mg/l)	0.02	0.01
Cobalt (mg/l)	0.19	0.46
Copper (mg/l)	2.5	0.33
Lead (mg/l)	<0.1	<0.17
Manganese (mg/l)	12	50.6
Mercury (mg/l)	<0.0002	0.0003
Molybdenum (mg/l)	15	42 [4]
Nickel (mg/l)	6	0.23
Selenium (mg/l)	<0.1	0.136
Silver (mg/l)	not analyzed	<0.007
Thallium (mg/l)	not analyzed	<0.003
Vanadium (mg/l)	0.23	1 [4]
Zinc (mg/l)	0.76	4.5 [4]

[1] 1992 average

[2] SUB-1010 limit for Ra 226 is 2 pCi/l and Uranium, 100 ug/l

[3] An excess of BaCl as compared to normal was added to treat the filtrate. The pretreated Ba concentration was <0.147 mg/l

[4] Analysis of filtrate prior to treatment. Constituent not analyzed for treated sample.