ENCLOSURE 1

APPLICANTS ENVIRONMENTAL REPORT
FOR
RAFFINATE SLUDGE DEWATERING PROJECT

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1.0 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. The inventory consists of approximately 1,000,000 cubic feet of sludge containing 15 to 20% solids. These impoundments have a water cover maintained over the sludge to prevent drying and wind dispersion and to reduce the radon flux.

1.1 Proposed Action

SFC proposes to dewater the raffinate sludge using a pressurized filter press system. The action will increase the solids content from the current 15 to 20 % to approximately 45 to 50%. It will also reduce the volume to an estimated 485,000 cubic feet (15,500 tons).

The proposed action supports the overall objective of site remediation and ultimate termination of License SUB-1010. The dewatered raffinate sludge will be packaged in bags and placed in temporary storage cells until a final disposal option is selected.

1.2 Affected Environment

The affected environment is the SFC site, as described in SFC License SUB-1010. Additional description of the affected environment has been provided in the Sequoyah Facility Reclamation Plan, submitted to the NRC in January 2003 (Reference 1). The area that will be involved in the dewatering process is shown in Figure 1.

1.3 Process Description

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 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 raffinate sludge dewatering system that has been selected consists of a floating dredge for removing the sludge from the Clarifiers, two 15,000 gallon feed tanks, feed pumps, two trailer-mounted 100 cubic foot capacity pressurized plate press filters, filter cake handling and packaging conveyors, and associated piping. The sludge dewatering system is shown schematically in Figure 2.

The feed tanks and plate press filter trailers will be located on a newly constructed processing pad on the east bank of Clarifier Basin 1A (See Figure 3).

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 cable and winch system for moving the dredge across the clarifier. The cable is anchored on opposite sides of the clarifier and 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 pressurized 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 dewatered sludge (filter cake) removed and packaged and moved to the temporary storage area.

The liquid (filtrate) removed from the sludge during the de-watering step will normally be returned to the Clarifier Basin that is being processed. Periodically, the excess water in a clarifier will be transferred to Clarifier 3A, treated to reduce the radionuclide and metal levels, transferred to Pond 5 for storage, and then land applied as fertilizer according to specifications in SFC's NRC license (SUB-1010).

1.3.1 Equipment and Facilities

The proposed action will require a minimum of construction or equipment purchase. The trailer mounted pressurized filter presses, feed pumps, and cake conveyors will be provided by a 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.

SFC will construct a processing pad to accommodate the filter press units. Existing materials will be used to construct a bagging and weighing facility for the dewatered sludge as it is collected from the filter press units. A general arrangement of the processing and storage area is shown in Figure 3.

The bagged, dewatered sludge will be placed in temporary storage cells constructed on the Yellowcake Storage Pad. A synthetic liner and cover will be used to protect the cells from moisture intrusion.

1.3.1.1 Filter Press Units

The processing equipment includes two contractor-supplied, trailer-mounted filter press units, with associated equipment and controls required to perform the dewatering process.

The filter press units are R&B automatic filter press frame AEHN 1200 with electro-hydraulic opening and closing and automatic plate shifting (overhead beam design).

Details and specifications for the units, including general operating procedures, are included in Attachment 5.

When the filter cycle has been completed, the pressure on the filter press unit will be bled down to zero psig and the unit will be emptied in preparation for the next cycle. The filter press is opened, an automatic plate shifter moves the plates and allows the filter cake to drop onto a drag conveyor below the unit. The filter cake is conveyed to the back of the unit where it is deposited on a conveyor belt that will transfer it to the bagging station.

The filter press units have an existing cover to protect from precipitation, and have the capability of adding side shielding to protect from wind blown precipitation. This will ensure that the dewatered sludge does not become wet during the time it is conveyed to the bagging station. Additional awnings will be constructed, as needed, to ensure that the dewatering and conveying systems are protected from precipitation.

1.3.1.2 Bagging and Weighing Station

The bagging station will be constructed in the former laundry building on the east side of the Clarifier basin which is adjacent to the area where the processing pad will be constructed. The filter press trailers will be located on the processing pad such that the discharge from the conveyors of the filter press units can be directed into the building, directly to the bagging stations (see Figure 4). When a bag is filled to capacity, the conveyor will be stopped long enough to replace the bag with an empty bag in the fill position. The filled bag will be removed from the fill position with a fork truck and placed on the scale for weighing. Each bag will be numbered with a unique number. The number of the bag and the weight of the bag will be recorded in a log book.

The building that will house the bagging and weighing station is constructed with a floor drain such that spills area can be washed down, with the discharge draining by pipe directly to the Clarifier basin.

The storage bags (SuperSack or equivalent) are made of polypropylene material and are approximately three feet by three feet by four feet high, and have a capacity for approximately 2000 pounds. The bags have lifting straps for handling.

The filled bag will be moved from the scale to the temporary storage cell using a fork truck. To facilitate operations, a flatbed truck may be used at the bagging and weighing station to load several bags prior to movement to the temporary storage cells, in which case they will be removed from the truck and placed in the storage cell using a fork truck or a crane.

1.3.1.3 Temporary Staging Area

A temporary staging area will be constructed near the bagging and weighing station to be used in the event of precipitation. The staging area will consist of a metal building that is open on one side, with a capacity to hold three to four days production. During precipitation events, bags of dewatered sludge will be covered with a tarp or otherwise protected, and will be placed into the temporary staging area until they can be moved to the temporary storage cells.

1.3.1.4 Processing Pad

The processing pad will be constructed on the east side of the Clarifier basin (see Figure 5). The pad is approximately 60 feet by 66 feet, and includes a clay base with a sealed asphalt surface. The open area between the processing pad and the Clarifier basin will be covered with HDPE or hypalon pond liner material, and will be graded such that precipitation runoff and any spills on the process pad can be washed down to the Clarifier basin. Curbs will be constructed to ensure all runoff is directed to the Clarifier basin. The processing pad will be curbed for containment and sloped to drain back to Clarifier Basin 1A. The pad will have a watertight coating or liner to prevent leakage to the underlying soil and to permit routine wash-down for contamination control.

1.3.1.5 Feed Tanks

The feed tanks include two fifteen-thousand gallon tanks and associated pumps and piping. Raffinate sludge is removed from the selected Clarifier basin by means of a barge-mounted pump, and pumped into the feed tanks. The feed tanks are located on the east side of the Clarifier basin, adjacent to the processing pad. The tanks are located on a concrete pad which has concrete curbs around the perimeter. The curbed area is constructed with a discharge that drains directly to the 1A Clarifier basin. Any spills due to leakage or overfill will be washed back to the Clarifier basin.

1.3.2 Temporary Storage Cells

Temporary storage cells will be constructed on the Yellowcake Storage Pad. The cells will be constructed using used railroad ties to form an outside perimeter for each cell. A liner of HDPE or pond liner material will be placed in the bottom of the cell, overlapping the railroad ties. Details of the temporary storage cell construction are shown in Figure 6.

The cells are anticipated to be a nominal 30 feet wide by 150 feet long, and will each hold an estimated 1460 bags of dewatered sludge. A total of 11 temporary storage cells is anticipated. The bags of dewatered sludge will be stacked in the temporary storage cells in a pyramid fashion, to an estimated four bags high.

The cells will be laid out with the railroad tie perimeter around three sides, and the inner liner installed. The HDPE top cover material will be laid out in place in order to keep rain water from accumulating in the empty storage cell. When the storage space is needed, the HDPE top cover will be pulled back and the cells filled from one end. When the cell nears capacity, the railroad ties will be placed along the open end, and the filling of the cell completed.

As the cell is filled, the top cover will be pulled into place and the outer ties installed in order to keep the cover in place.

The temporary storage cells will be constructed to facilitate air flow through the cells to enhance evaporation of the remaining water. Tests of bags filled during the bench scale tests have indicated a significant weigh loss due to evaporation while in storage. By venting the temporary storage cells, it is anticipated that additional weigh loss can be achieved from the bags due to evaporation through the bag material. Details of the vent construction are included in Figure 6.

1.4 Properties of Dewatered Sludge

Physical and chemical properties of the raffinate sludge have been determined at different times to support site characterization activities and treatability studies. The results of those determinations are described in the RCRA Facility Investigation Report (RFI, Reference 2) and the Site Characterization Report (SCR, Reference 3): information from these reports is summarized below. Assessment of the data provided in the RFI or the SCR is included in the respective report. Previously unpublished information regarding physical and chemical properties of the raffinate sludge developed in support of evaluating dewatering the sludge is also summarized here (Reference 4).

Four samples were collected in March 1994 from Pond 4 for the purpose of determining concentrations of metals and radionuclides in the raffinate sludge; the average of analytical results of these samples are presented in Table 1 as *Raw Sludge*. A composite sample was developed from these samples for the purpose of collecting a leachate; the analytical results of the leachate are presented in Table 1 as *Raw Sludge Leachate.*

The raffinate sludge in Pond 4 was transferred to Clarifier A between 1993 and 1995. A single sample of raffinate sludge was collected from Basin 1 of Clarifier A in January 1995 to determine the concentration of volatile and semivolatile organic compounds, and total mercury. The sample results included 41 volatile organic compounds and 115 semivolatile organic compounds; the analytical results of this sample that are greater than respective method detection limit are presented in Table 2. The results presented in Table 2 are for sludge that had not been subjected to dewatering.

Raffinate sludge was collected in May 2003 from Basin 1 of Clarifier A for the purpose of testing feasibility of dewatering the sludge using a pressurized plate filter press. After dewatering by the filter press, three samples were developed and analyzed for metals and radionuclides. The three samples included the dewatered sludge, the water expelled from the sludge as a result of dewatering (filtrate), and a leachate derived from the dewatered sludge. The analytical results of these samples are presented in Table 1 as *Dewatered Sludge*, *Dewatering Filtrate*, and *Dewatered Sludge Leachate*, respectively.

Physical characteristics of the raffinate sludge are provided in Tables 3 and 4. These results represent the raffinate sludge before and after dewatering by pressurized plate filter press, respectively. The dewatered sludge passes the paint filter test for free liquids (EPA Method 9095A). 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).

2.0 Environmental Considerations

The dewatering activities described above will improve the current environmental conditions by reducing the potential for leakage of radioactive materials from the Clarifier A Basin to the underlying groundwater, and supports the overall objective of site remediation and ultimate termination of License SUB-1010.

The filtrate removed from the sludge is an aqueous solution containing ammonium nitrate, and low concentrations of natural uranium, thorium 230, radium 226 and a variety of metals (see Table 1). It is identical to the ammonium nitrate byproduct that SFC treated prior to use as a fertilizer for over 20 years under its license SUB-1010. The pH of this solution is approximately 7.0. Filtrate will be treated to reduce uranium, radium, thorium and metals and land applied under conditions in SUB-1010. No changes to the land application program are needed for this project.

An increase in radon emanation is expected as a result of dewatering and temporarily storing the packaged raffinate sludge on the Yellowcake Storage Pad. The maximum radon concentration at the site boundary has been calculated to be 3e-11 μCi/ml, well below the regulatory limit of 1e-10μCi/ml (see Attachment 1). Radon monitors have been installed at the fenceline and will be maintained during the time the raffinate sludge is being processed and stored. The radon monitors are passive monitors that will be changed out and evaluated quarterly.

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

2.1 Impact of Proposed Action on the Environment

No adverse environmental effects are expected from the proposed action. The raffinate sludge has been stored on site for over 20 years, and has been handled and processed at various times. Processing and handling under the proposed action will be conducted in the same areas in which the raffinate sludge was previously handled. The dewatered sludge will be temporarily stored on the Yellowcake Storage Pad, which was designed and constructed to contain and control contamination from the yellowcake while the facility was in operation.

Measures will be taken to control the spread of contamination during the dewatering process and during storage.

2.2 Alternatives to the Proposed Action

Several alternatives for disposition of the raffinate sludge have been considered and evaluated. The alternatives include the "no action" alternative, shipment of the raffinate sludge as a slurry, in-situ stabilization, solidification of the sludge using cement or fly ash, and dewatering to increase the solids content.

2.2.1 No Action Alternative

The no-action alternative does not support the overall objective of site remediation and ultimate termination of License SUB-1010, therefore has not been evaluated in further detail.

2.2.2 Shipment of Sludge as a Slurry

Shipment of the raffinate sludge as a slurry was done during the 1980s and 1990s. This alternative was abandoned due to the high costs involved with shipping large volumes of water combined with the slurry, and concerns with dispersal of the slurry in the event of a highway accident.

2.2.3 In-situ Stabilization

In-situ stabilization is not considered a viable option because it does not support the overall objective of site remediation and ultimate termination of License SUB-1010.

2.2.4 Solidification Using Cement or Flyash

Bench scale tests were performed to determine whether it was feasible to solidify the raffinate sludge using cement or fly ash. This process resulted in a high rate of release of ammonia from the solidified sludge. The solidification also increased the volume and weight of the sludge, which would result in increased costs for shipping and disposal or in increased volume in the disposal cell.

2.2.5 De-Watering

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 pressurized plate press filtering. Thermal drying was considered (but not tested) and rejected on the basis of excessive cost and probable contamination control issues. Pressurized 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.

2.3 Short-term Uses and Long-term Productivity.

The Final Environmental Statement published in 1975 as NUREG-75/007, Section VII stated, in part:

> "Upon cessation of the present operations, it is unlikely that the entire 75 acre plant site would be restored to the condition existing before the plant was built since the area would be more beneficial as an industrial site than as a pasture. The radioactive and chemical wastes stored in the various ponds can be removed if necessary, and disposed of by other means," (Reference 5).

Dewatering the raffinate sludge is consistent with the short-term uses and long-term productivity projected at the time of issuance of the original plant license, and is consistent with the current goals of site remediation and license termination.

2.4 Irreversible and Irretrievable Commitments of Resources

The irreversible and irretrievable commitment of resources is minimal. The dewatering process will require fuel and electrical power to operate the filter presses and vehicles for moving the bagged sludge into temporary storage cells. Additional resources will include the bags for packaging the dewatered slurry and the materials for the construction of the temporary storage cells. The temporary storage cells will require material to provide for containment around the sides and anchors for the liner and cover. It is anticipated that used railroad ties will be used for the anchors. The temporary storage cells will be lined and covered with HDPE synthetic material. SFC has a large quantity of HDPE currently on hand. Additional material may be purchased, if needed.

3.0 Analysis

This analysis considers the potential effects of the proposed action on the affected environment. The proposed action consists of removing raffinate sludge from the clarifier basins and dewatering the sludge using trailer-mounted high pressure filter presses. The sludge will be bagged and weighed, and then moved to temporary storage on the Yellowcake Storage Pad. The operations are similar in nature to operations previously conducted at the SFC site, and present no new or unique hazards to the environment.

3.1 Accident Assessment

3.1.1 Spills

There is a potential for spills to occur during the sludge dewatering and storage process. These spills may occur with either the feed material or the dewatered sludge.

3.1.1.1 Spills of Feed Material

The feed is a wet, flowable material which minimizes the potential for release of dust to the air. A spill of the feed material may occur during the process of removing the sludge from the Clarifier basin and pumping it to the feed tanks, while pumping the sludge from the feed tanks to the filter press, or from the filter press itself.

Any potential spill or overflow of feed material will be in an area that has a processing pad and curbing as described in Section 1. Spills will be washed down in a timely manner to the Clarifier basin with no release to the surrounding environment.

3.1.1.2 Spills of Dewatered Sludge

The dewatered sludge is a damp solid material which minimizes the potential for release to air. A spill of dewatered sludge can occur during the handling and placement into temporary storage, while the sludge is in storage due to physical damage to the temporary storage cell and package(s), or during handling for final disposition.

The dewatered sludge will be handled and stored in areas that facilitate spill containment and cleanup. Spills that occur in the process pad will be contained in a curbed area and the dewatered sludge will be promptly picked up and placed into containers. The residue can be washed down with the runoff going to the Clarifier basin. Any spills that occur in the bagging and weighing station will be washed down to the sump, with the material draining by pipe back to the Clarifier basin.

Any potential spill of dewatered sludge in the storage area during handling will be on the Yellowcake Storage Pad. The bulk of the material can be picked up and placed into containers. Any residue that cannot be picked up will be washed to the North or South Yellowcake Sump where it will be handled as described in Section 3.2.2.

If spills of the dewatered sludge occur inside temporary storage cells, the material will be contained within a double containment. The stored bags of sludge will be stored in a temporary storage cell constructed with a synthetic liner with a synthetic cover. Spills will be contained within the temporary storage cell. Any material that is not contained in the temporary storage cells will be on the Yellowcake Storage Pad as described above.

3.1.2 Pressurized Line Break

A spray may occur from a break of a pressurized line during the dewatering process of the raffinate sludge. The filter/press units are designed to handle the operating pressure, and include appropriate spray shields for containment and personnel safety.

A spray of pressurized fluid from the dewatering process also has the potential to spread contamination. As stated above, the process equipment will be located in a contained area with berms to control the material and allow wash-down of the process equipment with the wash liquid returning to the Clarifier basin. In the event of a rupture of a pressurized line during processing, the feed pumps will be immediately shut down and the area will be washed down. The cause of the leak will be evaluated and system repairs, replacements or modifications made as deemed appropriate.

An analysis of this worst-case accident is provided in Attachment 2.

3.2 Flood and Rain Protection

Measures will be taken to ensure that moisture is not re-introduced into the sludge after it is dewatered. As previously described, the conveyor system and the bagging system will be covered to keep water out of the process in the event of inclement weather. After bagging, the sacks of dewatered sludge will be transported and stored in covered temporary storage cells as described in Section 3.2.2.

The site is in an area of warm, temperate, continental climate (RSA 1991, Reference 6). Annual precipitation averages 39 to 45 inches, depending on nearby climatological station location. Precipitation is fairly evenly distributed through the year, with more intense precipitation in the spring (ESCI, 1996, Reference 7). For extreme storm events, the probable maximum precipitation events are 29 inches in 6 hours and 19 inches in one hour.

Runoff from the processing pad area for the sludge dewatering project will be directed to the 1A Clarifier basin. When excess water accumulates, the water is pumped to 3A Clarifier Basin for treatment and land application as described in Section 2.0.

Runoff from the Yellowcake Storage Pad drains to the North and South Yellowcake Sumps. Water in the South Yellowcake Sump is sampled prior to being released. If water meets the release criteria, it is discharged through the Combination Stream. If water does not meet the release criteria, it is pumped to the Emergency Basin for treatment and testing prior to release. The North Yellowcake Sump drains by gravity to the Emergency Basin. In the event a precipitation event exceeds the capacity of the South Yellowcake sump, the sump overflows to Outfall 001 (the combination stream), thus the discharge is continuously sampled.

3.2.1 Processing

The dewatered sludge will drop from the filter press onto a conveyor and will be transported to a bagging station to be bagged in polypropylene storage bags. Each bag will be weighed and labeled with a unique number and the gross weight.

3.2.1.1 Rain Protection

The conveyor and bagging systems will be covered to prevent rain water from re-wetting the sludge. The filter press unit is constructed with a cover over the entire unit. The trailer-mounted filter press units will be positioned on the processing pad in close proximity to the building that will house the bagging and weighing station. An awning is present on the building and will be extended if necessary to ensure the entire dewatering process is protected from precipitation rewetting the dewatered sludge.

3.2.2 Storage

The packaged dewatered sludge will be temporarily stored on the Yellowcake Storage Pad until a disposal decision is made. The sludge will be stored in temporary storage cells that will be sized to allow easy access and allow for the liner and cover system to be installed and handled by a minimum number of people.

The Yellowcake Storage Pad is an existing reinforced concrete pad that was used for storage of drummed yellowcake when the facility was in operation. A synthetic liner will be placed over the concrete pad in the proposed storage location to provide a dry storage area. This will keep the bagged sludge from setting in any accumulations of stormwater. Additionally, a synthetic cover will be maintained over the bags until ready for disposal. Figure 6 shows the location and configuration of the temporary storage area for dewatered sludge.

3.2.2.1 Rain Protection

The size of the temporary storage cells will allow the cover to be pulled into place quickly in the event of rain. The cover can be pulled into place using the staff that will be available during the dewatering operation.

Also, a temporary staging area will be constructed near the bagging and weighing station to be used in the event of precipitation. In the event of rain or snow, the bags of dewatered sludge will be covered with tarps prior to leaving the bagging and weighing building, and will be moved to the temporary staging area to be stored until they can be placed in a temporary storage cell.

Stormwater from the Yellowcake Storage Pad presently drains to the North and South Yellowcake Sumps, where it is captured and transferred to the Emergency Basin for treatment prior to release through Outfall 001. This practice will continue during the time that dewatered sludge is stored on the pad.

The South Yellowcake Sump was built in 1980 and is located directly south of the Yellowcake Storage Pad. The unit is constructed of concrete and measures 75 feet by 75 feet by eight feet deep. It receives surface water runoff from the Yellowcake Storage Pad. Drainage patterns for the processing and storage locations are shown in Figure 7.

The North Yellowcake Sump is located on the northeast corner of the Yellowcake Storage Pad. The sump is constructed of concrete and measures approximately 28 feet square by 5 feet deep. It receives surface water runoff from the Yellowcake Storage Pad, and drains by gravity to the Emergency Basin.

3.3 Groundwater Protection

The raffinate sludge will be processed in the area of the Clarifier Basins, and the dewatered sludge will be temporarily stored on the Yellowcake Storage Pad. These areas are subject to the groundwater monitoring plan that is in effect for the facility.

Measures to protect infiltration of contaminants to the groundwater in the event of a spill include the construction of a processing pad that will include the area for the filter press units and the conveyor system. Any spill that occurs in this area will be washed down in a timely manner to the Clarifier basin. The bagging and weighing station will be constructed in an existing building, which has a concrete floor and drain. Any spills occurring in the bagging and weighing area will be washed down in a timely manner with the wash down draining to the Clarifier basin.

Any spill that may occur on the Yellowcake Storage Pad will be picked up in a timely manner. Residue will be washed down to the North or South Yellowcake Sump, which are sampled and analyzed prior to release.

Based on the construction of the pads in the processing and storage areas, and the administrative controls to be employed to ensure spills are cleaned up in a timely manner, there is little potential for infiltration of contaminants to the groundwater in the event of a spill.

3.4 Airborne Protection

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 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 of radon working level taken during pilot testing of the rotary vacuum drum filter indicate that the levels will remain below regulatory limits. 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 concentrations at the Restricted Area Boundary will be within the applicable regulatory limits.

3.5 Worker Protection

Personnel involved in the day-to-day activities of this project will be provided radiation safety training. 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 radiation safety plan for this project is provided in Attachment 3. Radiation safety controls are depicted in Figure 8. An occupational dose assessment is provided in Attachment 4.

4.0 Status of Compliance

The following licenses and permits are in effect at the SFC site. The proposed action requires approval by the NRC in the form of an amendment to License SUB-1010. No additional licenses or permits are required in order to complete the proposed action.

4.1 License SUB-1010, Issued by the U.S. Nuclear Regulatory Commission to Sequoyah Fuels Corporation.

4.2 Environmental Protection Agency (EPA), National Pollution Discharge Elimination System Permit OK0000191 issued to Sequoyah Fuels Corporation, January 1, 1999.

4.3 EPA (U.S. Environmental Protection Agency), Administrative Order on Consent between EPA and SFC, dated August 3, 1993.

5.0 Adverse Information

There is no additional adverse information associated with the proposed action beyond that described in this Applicants Environmental Report.

6.0 References

1. Sequoyah Fuels Corporation Reclamation Plan, January 2003.
2. Sequoyah Fuels Corporation, Final RCRA Facility Investigation Report," October 14, 1996.
3. Sequoyah Fuels Corporation, "Site Characterization Report," December 15, 1998
4. Sequoyah Fuels Corporation, measurements made on site during testing of dewatering capability of pressurized plate filter press, May 2003.
5. NUREG-75/007, Final Environmental Statement related to the Sequoyah Uranium Hexafluoride Plant, February 1975.
6. Roberts/Schornick and Associates, Inc., "Sequoyah Fuels Corporation Facility Environmental Investigation Findings Report," July 1991.

7. Earth Sciences Consultants, Inc., "Conceptual Design Report, Decommissioning, Excavation, and Stabilization/Solidification Program, December 6, 1996.

Table 1 Metals and radiochemical characteristics of raffinate sludge.

Parameter[a]	Raw Sludge[b]	Raw Sludge Leachate[c]	Dewatered Sludge[d]	Dewatering Filtrate[e]	Dewatered Sludge Leachate[f]
Ag	476 µg/g	0.011 mg/l	<90.8 mg/kg	<0.007 mg/l	<0.320 mg/l
Al	3 µg/g	461 mg/l	160000 mg/kg	10.3 mg/l	28.8 mg/l
As	65650 µg/g	0.177 mg/l	3030 mg/kg	0.686 mg/l	0.461 mg/l
Ba	26000 µg/g	0.129 mg/l	4150 mg/kg	0.671 mg/l	<0.100 mg/l
Be	2 µg/g	0.018 mg/l	18.7 mg/kg	<0.002 mg/l	<0.100 mg/l
Ca	30000 µg/g	5.48 mg/l	114000 mg/kg	1260 mg/l	925 mg/l
Cd	11 µg/g	0.042 mg/l	<267 mg/kg	0.141 mg/l	<0.100 mg/l
Co	28 µg/g	0.541 mg/l	133 mg/kg	0.464 mg/l	0.711 mg/l
Cr	217 µg/g	0.129 mg/l	605 mg/kg	<0.010 mg/l	<0.240 mg/l
Cu	561 µg/g	11.2 mg/l	2360 mg/kg	0.326 mg/l	0.745 mg/l
Fe	50700 µg/g	0.149 mg/l	164000 mg/kg	3.57 mg/l	<0.140 mg/l
Hg	No analysis	No analysis	1.41 mg/kg	<0.0004 mg/l	<0.0002 mg/l
K	2785 µg/g	9.98 mg/l	7740 mg/kg	3740 mg/l	203 mg/l
Li	31 µg/g	1.06 mg/l	<2.67 mg/kg	0.820 mg/l	0.464 mg/l
Mg	3015 µg/g	55.9 mg/l	7190 mg/kg	265 mg/l	152 mg/l
Mn	621 µg/g	23.9 mg/l	1930 mg/kg	50.6 mg/l	66.2 mg/l
Mo	5145 µg/g	2.44 mg/l	10700 mg/kg	42.0 mg/l	13.3 mg/l
Na	8565 µg/g	523 mg/l	7480 mg/kg	1260 mg/l	346 mg/l
Ni	473 µg/g	10.3 mg/l	1660 mg/kg	2.69 mg/l	8.86 mg/l
P	553 µg/g	11.5 mg/l	19600 mg/kg	0.20 mg/l	<0.54 mg/l
Pb	411 µg/g	0.449 mg/l	1010 mg/kg	<0.008 mg/l	<1.36 mg/l
Sb	36 µg/g	<0.06 mg/l	78.4 mg/kg	<0.008 mg/l	<0.220 mg/l
Se	<16 µg/g	0.214 mg/l	348 mg/kg	0.182 mg/l	<0.200 mg/l
Sr	644 µg/g	4.83 mg/l	1210 mg/kg	2.63 mg/l	2.81 mg/l
Tl	32 µg/g	0.258 mg/l	5860 mg/kg	0.030 mg/l	0.418 mg/l
V	3305 µg/g	0.374 mg/l	<1.60 mg/kg	1.00 mg/l	0.320 mg/l
Zn	297 µg/g	6.94 mg/l	<751 mg/kg	4.5 mg/l	2.92 mg/l
F	23118 µg/g	No analysis	No analysis	No analysis	No analysis
NO_3(N)	42400 µg/g	No analysis	No analysis	3060 mg/l	No analysis
NH_3(N)	No analysis	No analysis	No analysis	2880 mg/l	No analysis
U-total	7050 µg/g	No analysis	19400 µg/g	774 µg/l	4.67 µg/l
Th-230	No result	No analysis	16200 pCi/g	1520 pCi/l	80.1 pCi/l
Ra-226	189 pCi/g	No analysis	219 pCi/g	50.0 pCi/l	7.06 pCi/l

[a] Metals by EPA Method 6010

[b] Sample ID SD001-SD004, March 1994; results are average of SD001- SD004 [Chain-of-Custody (CoC) E-0278-94]

[c] Sample ID SD005, March 1994; 40 CFR 261 Appendix II "Method 1311 Toxicity Characteristic Leaching Procedure" [CoC E-0278-94]

[d] Sample ID MISC raff-filter press only, May 2003 [CoC SF03-278]

[e] Sample ID MISC (Raffinate Filtrate), May 2003 [CoC SF03-129]

[f] Sample ID MISC raff-filter press only leachate, May 2003; 30 Texas Administrative Code Chapter 335 Subchapter R Appendix 4 "7-day Distilled Water Leachate Test Procedure" [CoC SF03-278]

Table 2 Summary of Organic and Mercury analyses of raffinate sludge[a].

Parameter	Value	Comment
Mercury (total) [b]	0.34 mg/kg	Practical quantitation limit 0.01 mg/kg.
Volatile [c]	2-Butanone, 0.3 mg/kg 2-Hexanone, 0.08 mg/kg	Practical quantitation limit 0.1 mg/kg. Practical quantitation limit 0.05 mg/kg.
Semivolatile [d]	None.	Not applicable.

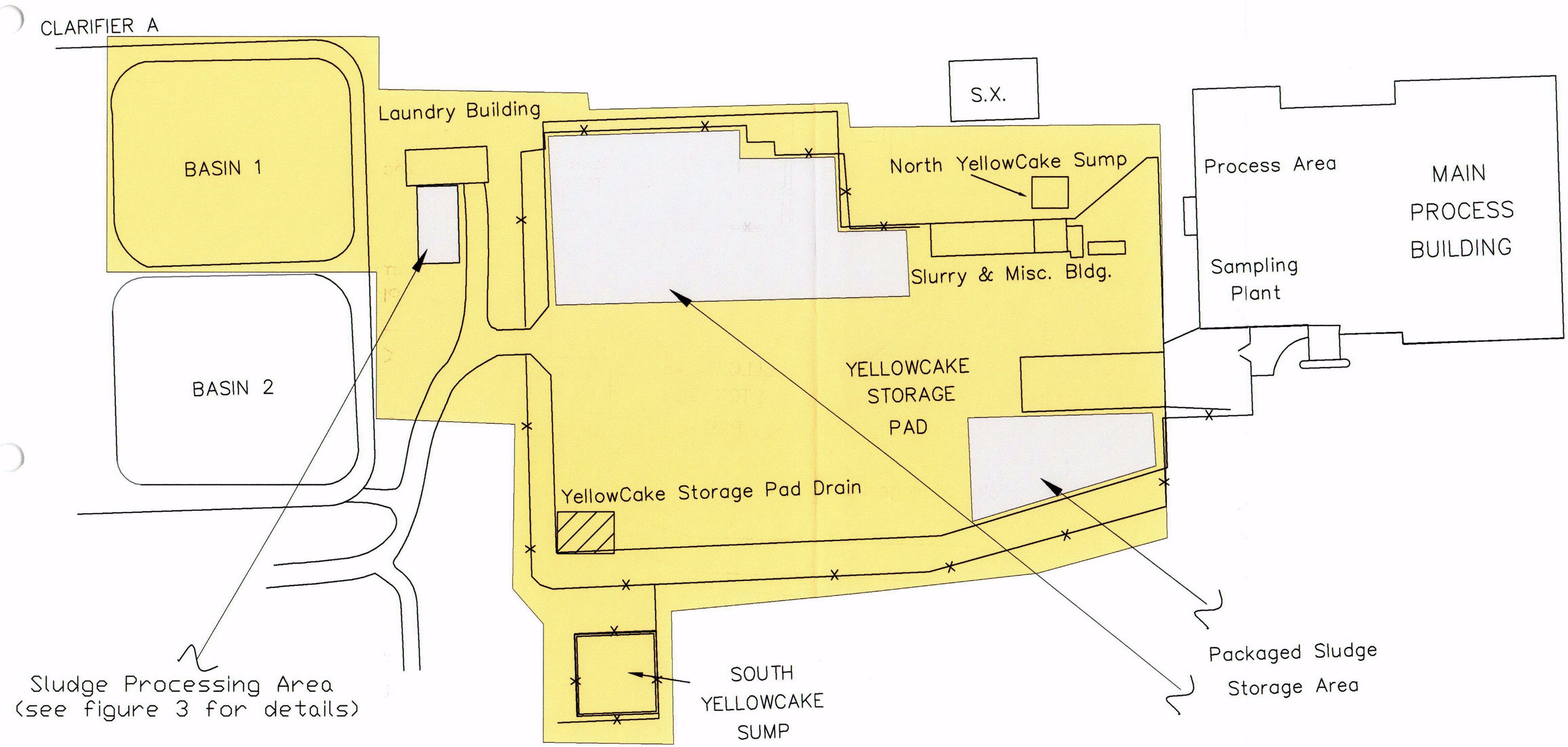
[a] Sample ID SD014, January 1995 [Chain-of-Custody E-0131-95]
[b] EPA Method SW7471
[c] EPA Method SW8240.
[d] EPA Method SW8270.

Table 3 Physical characteristics of raffinate sludge

Parameter	Value	Comment
Density	1.17 g/cm^3	One measurement made on site May 2003.
% solids	18%	A calculated value from data collected May 2003.

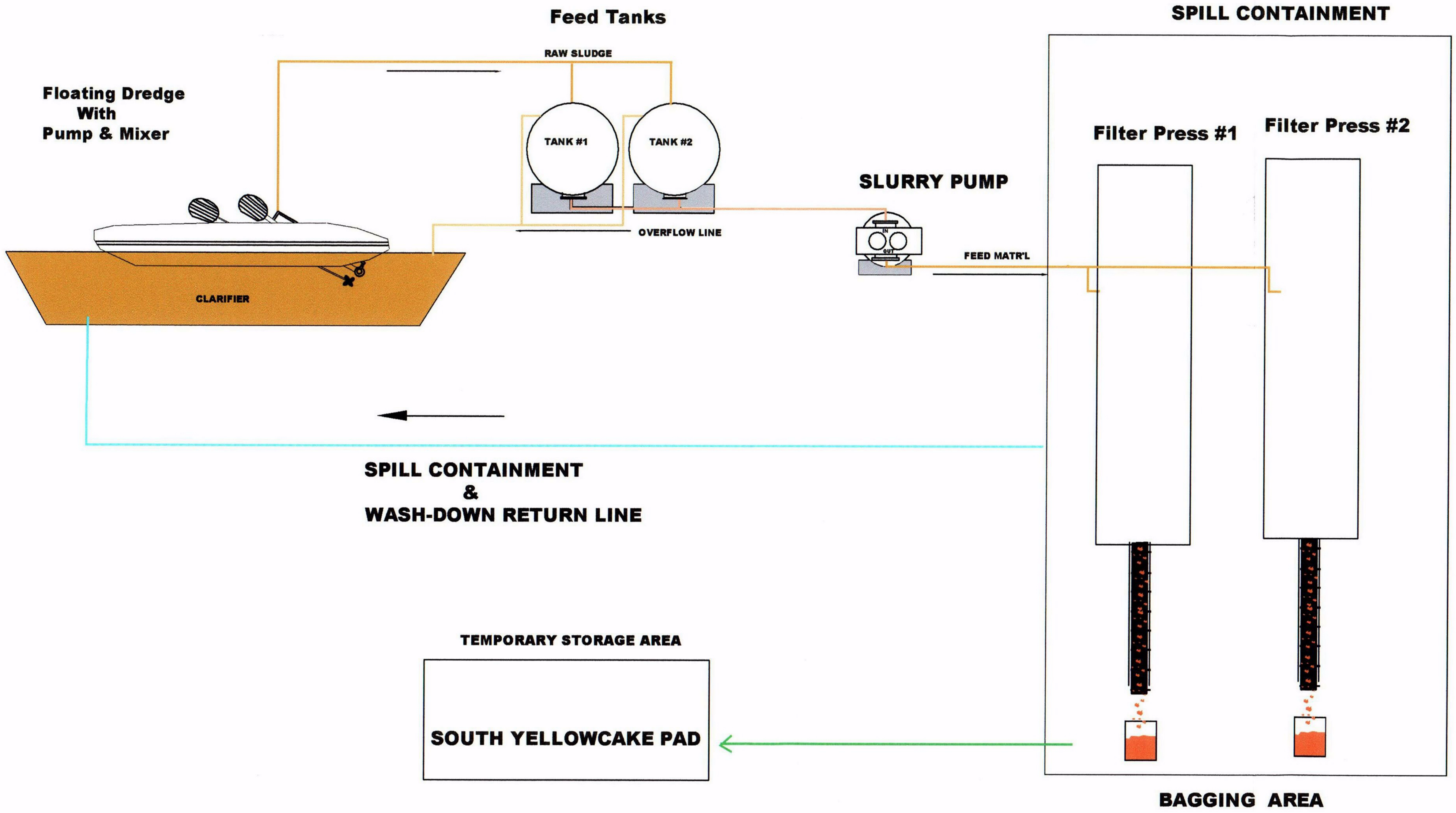
Table 4 Physical characteristics of raffinate sludge after dewatered using the filter press.

Parameter	Value	Comment
Density	1.36 g/cm^3	Average of six measurements made on site May 2003.
% solids	45%	Average of four measurements made on site May 2003.
% weight reduction	46%	Average of four measurements made on site May 2003.
Load bearing	41.7 lb/in^2	Unconfined compressive strength with penetrometer May 2003.
Weight per package	2200 lbs	An assumed value based filling the package to rated weight capacity. The package is presumed to be 3'x3'x4' polypropylene sack.



SEQUOYAH FUELS CORPORATION	
Title: Raffinate Sludge Dewatering Project General Arraignment Drawing	
PREPARED BY: SFC	Filename: SFC0101A
Reviewed by: br	Figure No. 1
Date: 01/05/2004	

c01

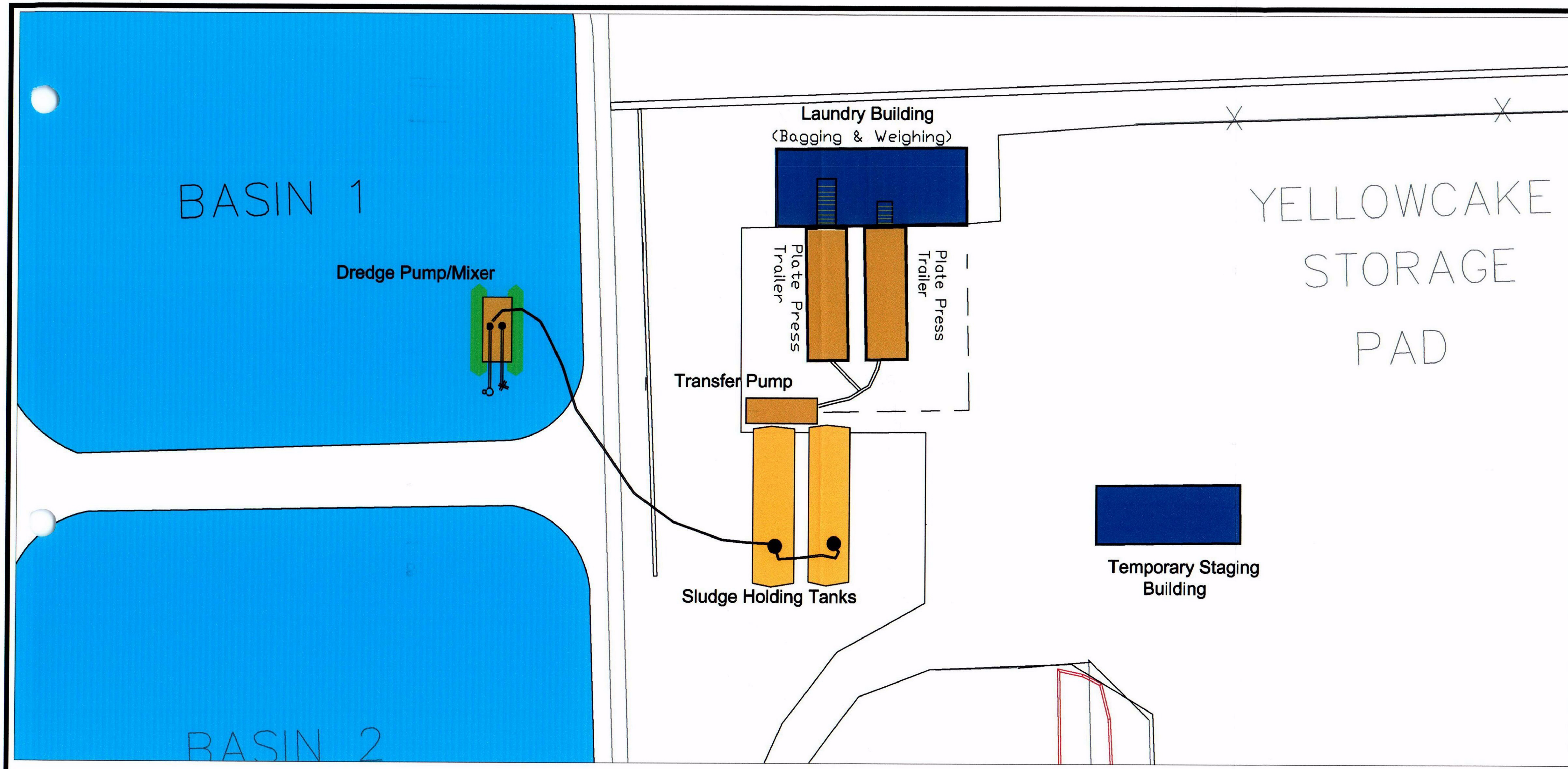


SEQUOYAH FUELS CORPORATION

Title: Raffinate Sludge Dewatering Process Flow Diagram

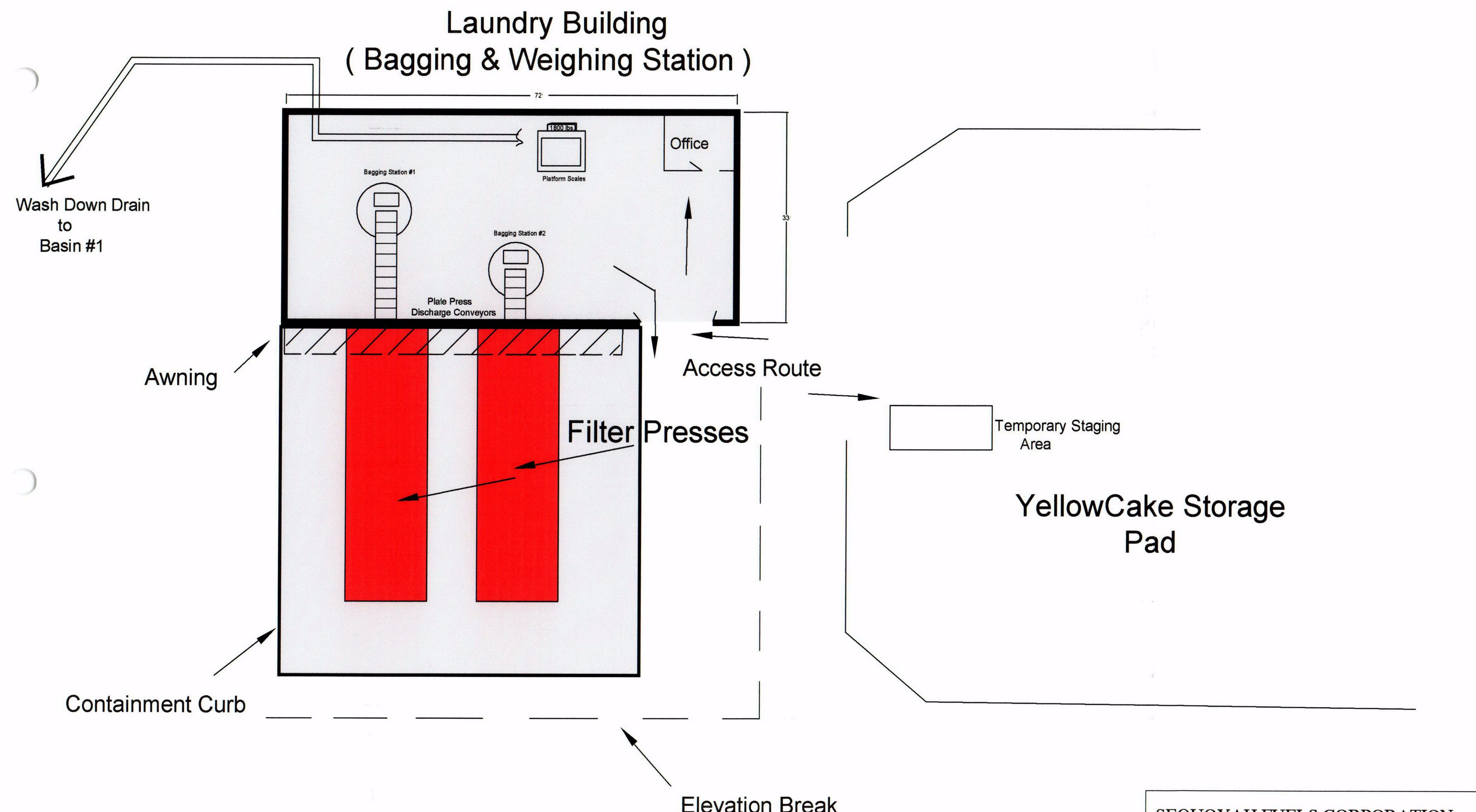
PREPARED BY: SFC	Filename: SFC0102A
Reviewed by: br	Figure No.2
Date: 09/17/2003	

C02



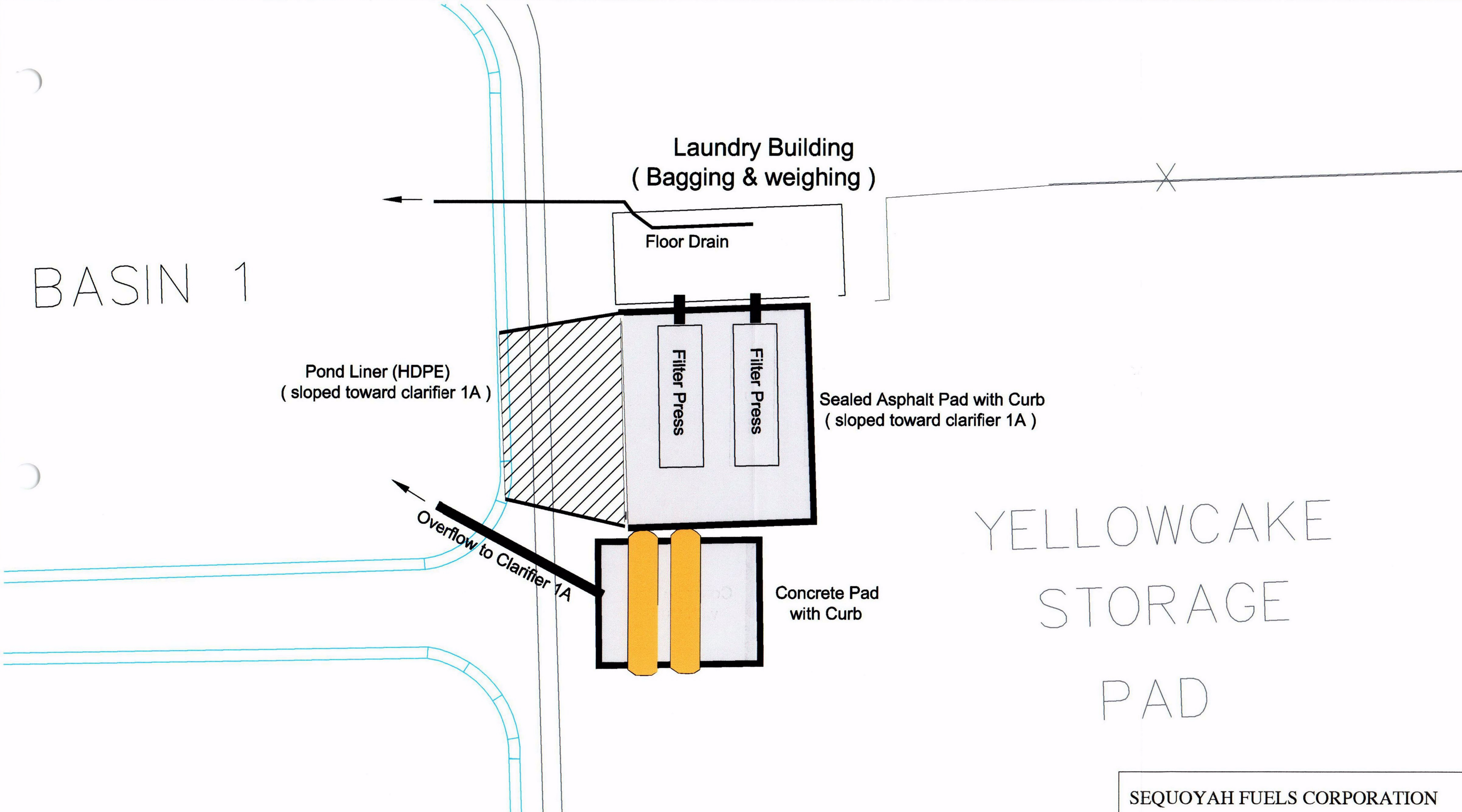
SEQUOYAH FUELS CORPORATION	
Title: Raffinate Sludge Dewatering Process Location Diagram	
PREPARED BY: SFC	Filename: SFC0103A
Reviewed by: br	Figure No.3
Date: 01/05/2004	

C03



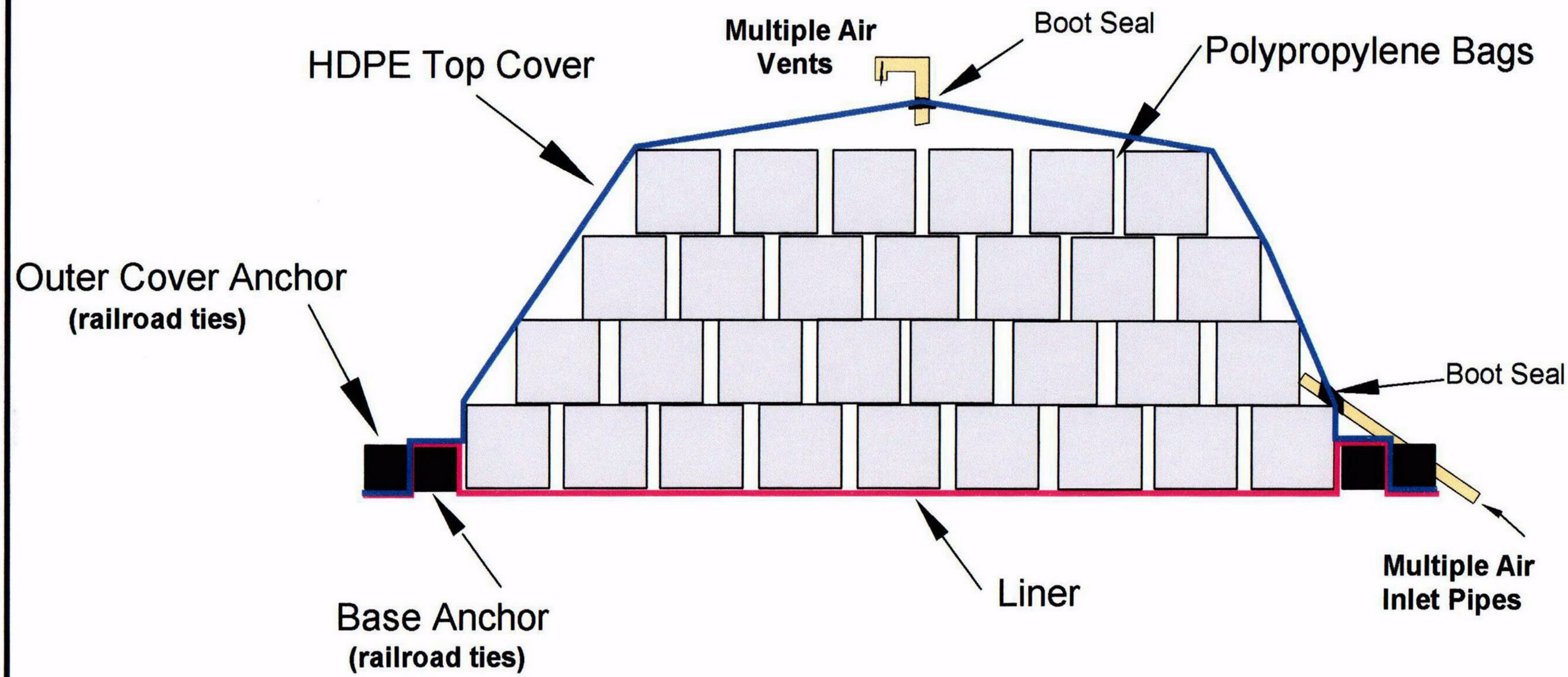
SEQUOYAH FUELS CORPORATION	
Title: Bagging and Weighing Area	
PREPARED BY: SFC	Filename: SFC0104A
Reviewed by: br	Figure No.4
Date: / /2003	

C04



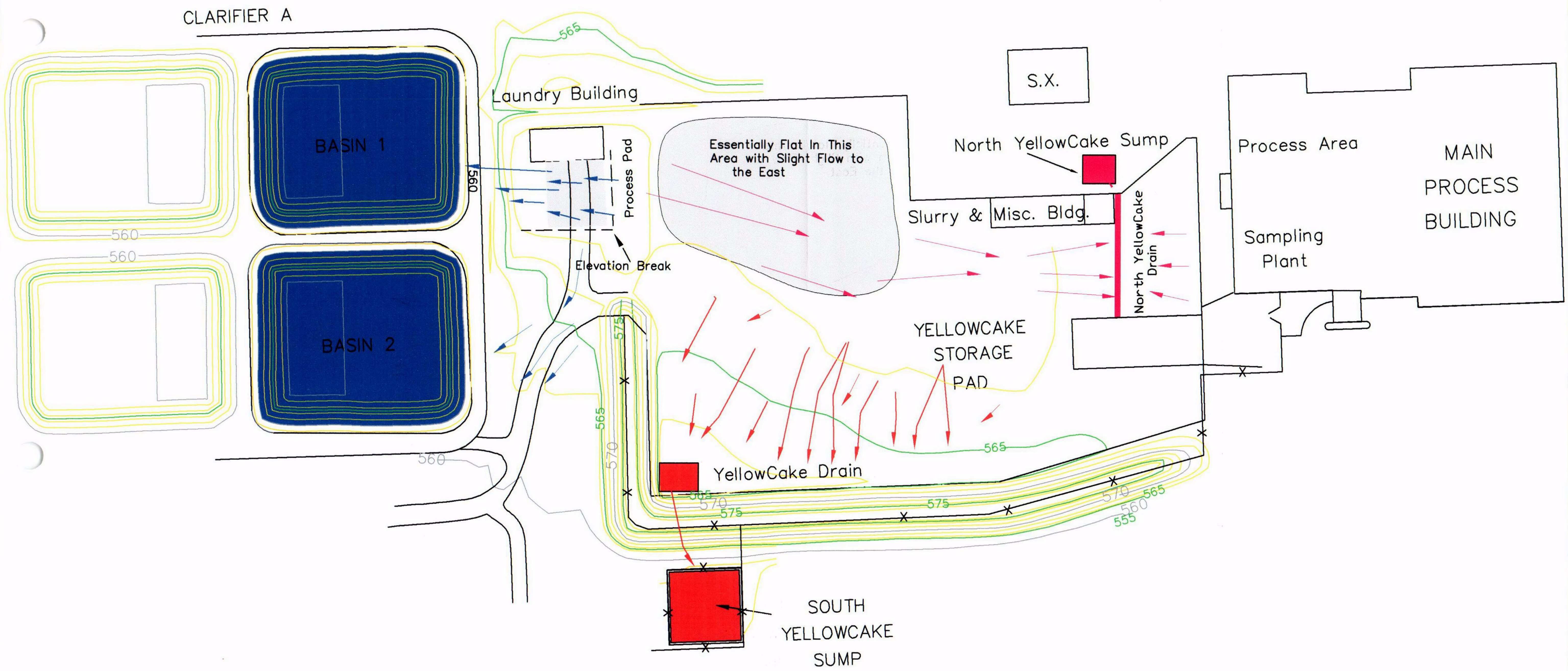
SEQUOYAH FUELS CORPORATION	
Title: Processing Pad and Feed Tank Area	
PREPARED BY: SFC	Filename: SFC0105A
Reviewed by: br	Figure No. 5
Date: 01/05/2004	

C05



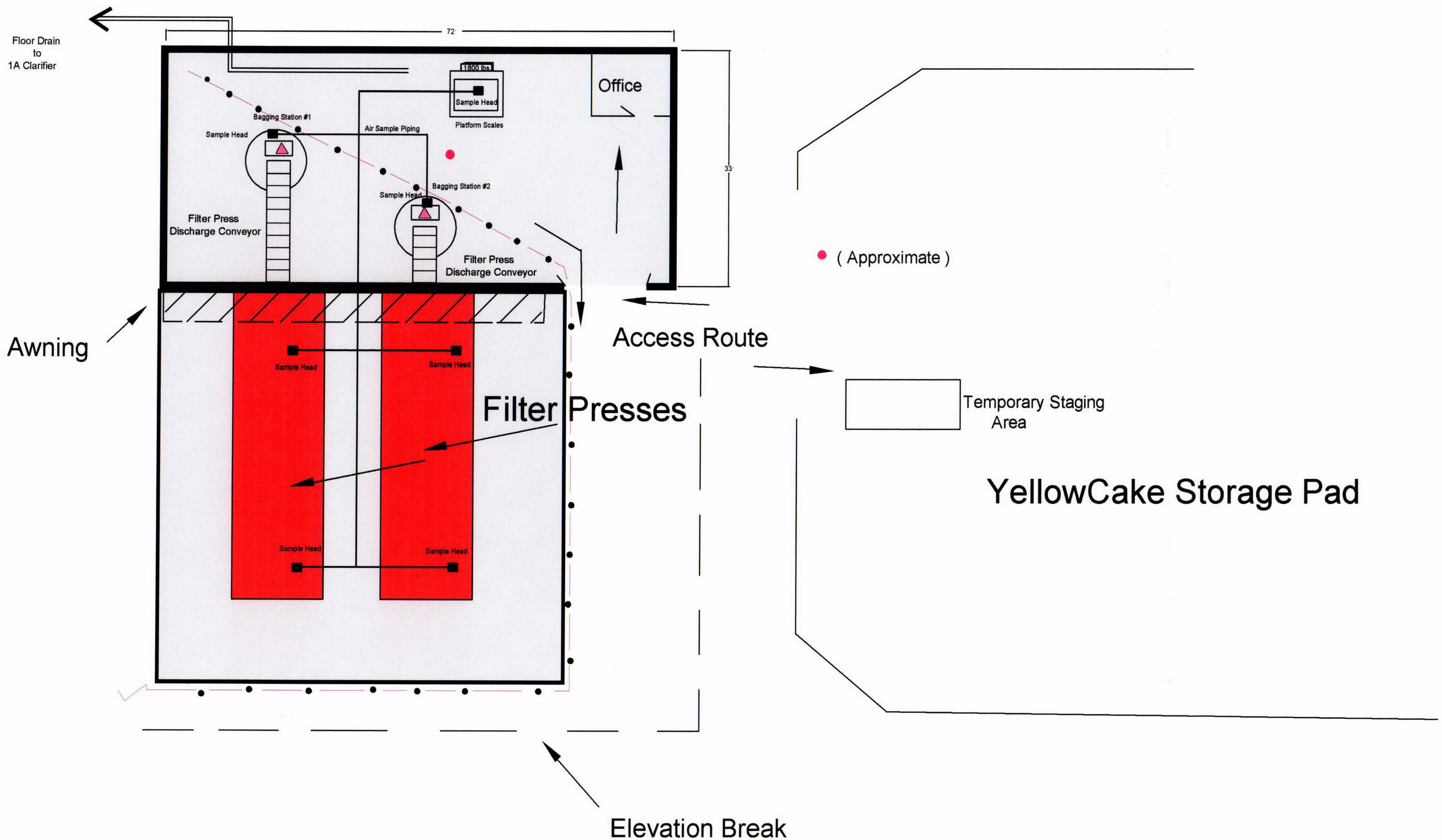
SEQUOYAH FUELS CORPORATION	
Title: Dewatered Raffinate Sludge Temporary Storage Configuration	
PREPARED BY: SFC	Filename: SFC0106A
Reviewed by: br	Figure 6
Date: 01/05/2004	

C06



SEQUOYAH FUELS CORPORATION	
Title: Processing and Storage Area Drainage Patterns	
PREPARED BY: SFC	Filename: SFC0107A
Reviewed by: br	Figure No. 7
Date: 01/05/2004	

C07



Key

- Radon Measurement Location
- Local Mechanical Ventilation
- Fixed Location Air Sample
- Access Control Boundary

SEQUOYAH FUELS CORPORATION	
Title: Radiation Safety Controls	
PREPARED BY: SFC	Filename: SFC0108A
Reviewed by: br	Figure No.8
Date: 01/05/2004	

C08

Attachment 1

RADON DISPERSION

DEWATERING RAFFINATE SLUDGE

Estimate of Radon Dispersion from Storage of Dewatered Raffinate Sludge

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. The sludge will be stored in the temporary storage area until a raffinate sludge disposal alternative is chosen.

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 attachment 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 storage in cells of 1460 sacks in a rectangular pyramid. However, a conservative calculation was performed on a smaller size cell consisting of 124 sacks. This smaller size cell is bounding of the larger cell for radon emanation due to the larger ratio of surface area to volume. For the calculation, each pyramid will have a height of four sacks. Each pyramid will be covered with a synthetic cover. The cover will be sealed at the bottom and have a passive vent on the top. This configuration is a bounding because it is the maximum realistic surface area to which a radon flux from a sack surface may be applied and also a likely minimum release height.

This configuration of the temporary storage area may be 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.
- 0.76 m^3 per sack: 0.9 m long (3 feet) x 0.9 m (3 feet) wide x 0.9 m (3 feet) high.
- 17977 sacks configured as 145 rectangular pyramids of 124 sacks
- 17701 m^2 exposed surface area of sacks in temporary storage; 146 exposed sides of sack per pyramid x 0.8 m^2 per exposed side of sack x 145 pyramids.
    - 146 exposed sides of sack per pyramid
        - 14 exposed sides of sack per end of storage times two ends.
        - 34 exposed sides of sack per side of storage times two sides.
        - 50 [(54 x 0.5)+(12*0.75)] exposed sides of sack per top of storage times one top.
    - 0.8 m^2 per side of sack (0.9 m long x 0.9 m wide).
- 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 $pCi/m^2/s$.
- 0.0885 $\mu Ci/s$; fluence of radon-222 from temporary storage area (Q): 5 $pCi/m^2/s$ from surface of storage sack x 17701 m^2 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 = 150 m; the distance from the center of the temporary storage area (South Yellowcake Storage Pad) to the nearest restricted area fence (about 500 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 = 0.0885 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} = 35 m; the horizontal spread of the plume as a function of atmospheric stability class E, distance from the source of 150 m, and area source: 150m / 4.3 (Reference Chapter 5 "Area Sources").

x_{yv} = 700 m; the distance downwind for s_{yo} and atmospheric stability class E: Reference Figure 3-2.

$x + x_{yv}$ = 850 m; the virtual distance downwind: 150 m + 700 m.

s_{yv} = 43 m; the horizontal spread of the plume as a function of atmospheric stability class E and distance from the source of 850 m: Reference Figure 3-2.

s_{z0} = 5 m; the vertical spread of the plume as a function of atmospheric stability class E and distance from the source of 150 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 = 3.7 m; the effective emission height: the height of two storage sacks (0.9 m per sack x 4 sacks).

χ = 3E-11 μCi/ml; maximum concentration of radon-222 at ground level at the restricted area fenceline nearest the temporary storage area: approximately 150 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.

Reference

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

Attachment 2

ACCIDENT ANALYSIS

DEWATERING RAFFINATE SLUDGE

Accident Analysis for Dewatering Raffinate Sludge

Introduction

This attachment describes a credible accident, estimates the resulting quantity of radioactive material which could potentially be released, and evaluates a dose to a worker due to the accident. Analysis of the accident considers a worst-case hypothetical situation, likely a bounding scenario, which could occur during sludge dewatering process.

Hypothetical Accident Scenario

Intuitively, the exposure pathway of concern for an acute (accident) exposure scenario is identified as inhalation. A large uncontrolled release of sludge into the air, which might then be breathed by a worker, is postulated as the maximum integral exposure to a worker, and thus was chosen as the bounding scenario. The accident scenario assumptions below are conservative and will result in a calculated release and dose to the worker that is a bounding maximum

Scenario Assumptions

Notable assumptions in the accident scenario are:

1. The radionuclides considered here are natural uranium[1], Th-230, and Ra-226.
2. Spilled sludge is assumed to come from Clarifier A basin as the sludge is moved under pressure to the filter press. The spilled sludge is assumed to have the following radionuclide concentrations: U-total = 9000 µg/g, Th-230 = 48200 pCi/g, and Ra-226 = 14 pCi/g.[2]
3. Short-lived transformation products are in secular equilibrium with their parents.
4. A volume of sludge is discharged into the air under pressure due to failure of a pressurized feed line.
5. The spilled sludge generates a cloud that is contained within the three-sided covering of the filter presses: a work area 18 m long, 9.2 m wide, and 4.5 m high.
6. The estimated instantaneous mass loading of sludge in air is 1 g/m^3.
7. There is no atmospheric dispersion.
8. A worker is at the scene of the accident and is exposed to the cloud as he passes through it while exiting the work area.
9. The worker's breathing rate is 1.2 m^3/h.

[1] Assumed specific activity of U-total is 6.77 E-07 µCi/g. Assumed activity ratio of radioisotopes U-238, U-235, and U-234 is 0.489, 0.022, and 0.489, respectively.
[2] Sequoyah Fuels Corporation Chain of Custody SF980226.

Calculations

The concentration of radioactive material in air due to the spilled sludge is:

$$C_{U238} = 2979\,\frac{\text{pCi}}{\text{g}} \times 1\,\frac{\text{g dust}}{\text{m}^3\text{ air}} \times \frac{1\,\mu\text{Ci}}{10^6\text{ pCi}} \times \frac{1\text{ m}^3}{10^6\text{ cm}^3} = 3.0x10^{-09}\,\frac{\mu\text{Ci}}{\text{cm}^3\text{ air}}$$

$$C_{Th230} = 48200\,\frac{\text{pCi}}{\text{g}} \times 1\,\frac{\text{g dust}}{\text{m}^3\text{ air}} \times \frac{1\,\mu\text{Ci}}{10^6\text{ pCi}} \times \frac{1\text{ m}^3}{10^6\text{ cm}^3} = 4.8x10^{-08}\,\frac{\mu\text{Ci}}{\text{cm}^3\text{ air}}$$

$$C_{Ra226} = 14\,\frac{\text{pCi}}{\text{g}} \times 1\,\frac{\text{g dust}}{\text{m}^3\text{ air}} \times \frac{1\,\mu\text{Ci}}{10^6\text{ pCi}} \times \frac{1\text{ m}^3}{10^6\text{ cm}^3} = 1.4x10^{-11}\,\frac{\mu\text{Ci}}{\text{cm}^3\text{ air}}$$

$$C_{U\text{-}235} = 134\,\frac{\text{pCi}}{\text{g}} \times 1\,\frac{\text{g dust}}{\text{m}^3\text{ air}} \times \frac{1\,\mu\text{Ci}}{10^6\text{ pCi}} \times \frac{1\text{ m}^3}{10^6\text{ cm}^3} = 1.3x10^{-10}\,\frac{\mu\text{Ci}}{\text{cm}^3\text{ air}}$$

The longest dimension of the plume at the breathing zone that the worker would travers when exiting the area is the width of the structure covering the filter presses or 6 m. Assuming that the worker walks out of the work area at 1.5 meter per second, the time of exposure is then 9.2 m ÷1.5 m/s, or 6 seconds.

Based on the above assumptions and calculations, the intake is:

$$I_{U238} = 3.0\,x10^{-09}\,\frac{\mu\text{Ci}}{\text{cm}^3\text{ air}} \times 1.2\,\frac{\text{m}^3}{\text{hour}} \times \frac{10^6\text{ cm}^3}{\text{m}^3} \times \frac{1\text{ hour}}{3600\text{s}} \times 6\text{s} = 6.1x10^{-06}\,\mu\text{Ci}$$

$$I_{Th230} = 4.8\,x10^{-08}\,\frac{\mu\text{Ci}}{\text{cm}^3\text{ air}} \times 1.2\,\frac{\text{m}^3}{\text{hour}} \times \frac{10^6\text{ cm}^3}{\text{m}^3} \times \frac{1\text{ hour}}{3600\text{s}} \times 6\text{s} = 9.9x10^{-05}\,\mu\text{Ci}$$

$$I_{Ra226} = 1.4\,x10^{-11}\,\frac{\mu\text{Ci}}{\text{cm}^3\text{ air}} \times 1.2\,\frac{\text{m}^3}{\text{hour}} \times \frac{10^6\text{ cm}^3}{\text{m}^3} \times \frac{1\text{ hour}}{3600\text{s}} \times 6\text{s} = 2.9x10^{-08}\,\mu\text{Ci}$$

$$I_{U\text{-}235} = 1.3\,x10^{-10}\,\frac{\mu\text{Ci}}{\text{cm}^3\text{ air}} \times 1.2\,\frac{\text{m}^3}{\text{hour}} \times \frac{10^6\text{ cm}^3}{\text{m}^3} \times \frac{1\text{ hour}}{3600\text{s}} \times 6\text{s} = 2.7x10^{-07}\,\mu\text{Ci}$$

Comparison with the Allowable Limit on Intake (ALI)

The ALI is the quantity, in microcuries, of a radionuclide that can be taken into the body in one year by the reference man while still meeting the occupational dose limits. The following table lists the most restrictive lung solubility class ALIs from 10 CFR 20 for radionuclides in the U-238 series up to radon, and calculates the fractional ALI intake by the hypothetical worker exposed to the cloud from the spilled sludge.

Nuclide	ALI[3] (μCi)	Intake (μCi)	Fraction of ALI
U-238	4 E-02	6.1 E-06	0.00015
Th-234	2 E+02	6.1 E-06	0.000000030
Pa-234m	7 E+03	6.1 E-06	0.00000000087
U-234	4 E-02	6.1 E-06	0.00015
Th-230	6 E-03	9.9 E-05	0.016
Ra-226	6 E-01	2.9 E-08	0.000000048
U-235	4 E-02	2.7 E-07	0.0000069
Th-231	6 E+03	2.7 E-07	0.000000000046
Pa-231	4 E-03	2.7 E-07	0.000069
Th-227	3 E-01	2.7 E-07	0.00000091
Ra-223	7 E-01	2.7 E-07	0.00000039
		Sum of fractions:	0.017

Thus, the total intake as a fraction of ALI attributable to the hypothetical accident is small enough to be considered insignificant.

As the onsite intake of radioactive material from this accident scenario is insignificant, the offsite intake will also be insignificant. Therefore, no special evaluations were performed for offsite intake or dose.

Conclusions

An accident evaluation was performed to determine the significance of releases and dose to workers. The evaluation was performed for a spill of raffinate sludge that released a cloud of sludge into the air. The assumptions utilized in the calculations were conservative and it is expected that the results are upper bounds of the actual quantities and doses. Even under these conservative assumptions, the total source term was very small, with a projected intake to the maximum exposed individual onsite of an extremely small fraction of the ALI. The intake, and hence dose, to an offsite individual would be even lower than for the onsite individual. Since the onsite intake calculated under this scenario was negligible, no offsite calculations were performed.

[3] 10 CFR 20, Appendix B, Table 1, Column 2.

Attachment 3

RADIATION SAFETY PLAN

DEWATERING RAFFINATE SLUDGE

Radiation Safety Plan for Dewatering Raffinate Sludge

Introduction

This document is the radiation safety project plan (Plan) for dewatering the raffinate sludge in 3A Clarifier. The Plan describes radiation safety measures to protect workers during the dewatering project. The Plan is derived from the Radiation Safety Program (Program) of the Reclamation Plan Sequoyah Facility[1]. In recognition that the amount of radioactivity and therefore associated hazards will be reduced as the project progresses, the Plan may be modified to be commensurate with the activities being performed. SFC will review and approve the Plan, and any revisions that are made during the project. Any such adjustment to the requirements of the Plan shall be made in a manner consistent with existing document control procedures.

Radiation Safety Controls and Monitoring for Workers

The Plan will be implemented directly and/or by written procedures or instructions. The SFC Manager, Health and Safety (Mgr. H&S) is responsible for implementation of the Plan. A contractor may implement the Plan with oversight by the Mgr. H&S.

Air Sampling

Air sampling shall be conducted in accordance with Section 2.1 of the Program.

Collection

Concentrations of radioactive material in air shall be determined in accordance with Sequoyah Facility operating procedures.

Air samples shall be collected of areas local to handling raffinate sludge and dewatered raffinate sludge when and/or where the sludge is being processed. These air samples shall be collected in accordance with Sequoyah Facility Operating Procedure HS-104 "Fixed Location and Non-Routine Air Sampling".

Air samples shall be collected for personnel handling raffinate sludge and dewatered raffinate sludge when and/or where the sludge is being processed. These air samples shall be collected in accordance with Sequoyah Facility Operating Procedure HS-105 "Personal Air Sampling".

Specifically, air samples shall be collected of gross particulate and analyzed for gross alpha radioactivity. Radon measurements will be made by track-etch detector. Working level measurements shall be using a generalized Kusnetz method.

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[1] "Reclamation Plan, Sequoyah Facility, Attachment D, 'Radiation Safety Program During Decommissioning and Reclamation'", Sequoyah Fuels Corporation, Januaty 2003.

Action Level and Limit

A project-specific derived air concentration (DAC) is provided in Appendix A of this Plan. A determination of the minimum detectable concentration for each of area and personal air samplers is provided in Appendix B of this Plan.

The administrative action level and administrative limit shall be those provided in Sequoyah Facility Operating Procedure HS-106 "Personnel Exposure Assessment Using Air Sampling Data".

Respiratory Protection Program

Respiratory Protection shall be conducted in accordance with Section 2.2 of the Program.

Medical Evaluation, *Fit Test*, *Selection*, *Issue*, and *Training* shall be conducted in accordance with Sequoyah Facility Operating Procedure G-150 "Respiratory Protection".

Inspection, *Maintenance*, and *Storage* shall be conducted in accordance with Sequoyah Facility Operating Procedure HS-508 "Inspecting and Maintaining Respiratory Protection Equipment".

Cleaning and *Surveying* shall be conducted in accordance with Sequoyah Facility Operating Procedure HS-501 "Cleaning and Surveying Respiratory Protection Equipment".

Internal Exposure Determination

Internal exposure determination shall be conducted in accordance with Section 2.3 of the Program.

Determination of internal exposure shall be made in accordance with Sequoyah Facility Operating Procedure G-110 "Personnel Radiation Exposure Monitoring".

External Exposure Determination

External exposure determination shall be conducted in accordance with Section 2.4 of the Program.

Determination of external exposure shall be made in accordance with Sequoyah Facility Operating Procedure G-110 "Personnel Radiation Exposure Monitoring".

Summation of Internal and External Exposures

Summation of internal and external doses shall be performed in accordance with Section 2.5 of the Program.

Contamination Control

Control of spread of contamination (i.e. control of the presence of unwanted radioactive material as raffinate sludge) shall be implemented in accordance with Section 2.6 of the Radiation Safety Program of SFCs Reclamation Plan. Additionally, contamination control shall be conducted in accordance with Sequoyah Facility Operating Procedure G-158 "Contamination Control". Contamination control shall be managed by exposure control and radiation surveys. Radiation safety controls are generally depicted in Figure 8 and described in the following subsections.

Exposure Control

Personnel exposure to radioactive material will be controlled by application of engineering, administrative, and personnel protection provisions. The priority of application will be descending with respect to the aforementioned order. Engineering controls will be used to minimize or prevent the presence of uncontained radioactive material. Engineering controls will be predominantly comprised of containment, isolation, ventilation, and decontamination.

Containment: Containment will be a primary engineering control used for contamination control during sludge dewatering activities. As feasible, containment will include use of closed systems for pickup, transfer, and storage of dewatered sludge. The sludge dewatering process is inherently a closed system from point of pickup in the Clarifier A basin up to the point of release of the sludge cake from the filter press. Containment may be provided in the form of a simple cover (e.g. plastic sheet) of the conveyor. Containment is also inherently provided upon closure of the packaging.

Isolation: Isolation will be used in the context of contamination control for those cases where it is not feasible to provide complete containment. Isolation will be implemented by maintaining separation (i.e. space) between any sludge that is not subject to containment during dewatering. Isolation is applied during the sludge dewatering from the point of release of the sludge cake from the filter press through the point of placing the sludge cakes in packaging. Isolation at these stages of the process will be provided by separation of personnel from the sludge due to equipment configuration and/or use of devices to manipulate the sludge from a short distance (e.g. poles to aid even distribution of sludge in the packaging).

Isolation will also be provided by use of barriers between work areas that have potential for contamination due to normal activities and other areas. The filter presses will be operated in an area that naturally drains precipitation and wash water to the Clarifier A basin without crossing or impacting other work or non-work areas. Temporary curbing may be provided to facilitate this condition. A temporary curb will be placed on the floor of the sludge building to segregate wash water from the bagging stations from the remainder of the building. Washwater in the Sludge Building will be directed to the floor drain which is routed directly to the Clarifier A basin.

Ventilation: The sludge, after leaving the filter press, will be damp and highly compacted thereby not susceptible to airborne dispersion. Passive ventilation will be abundant for all work areas. No mechanical ventilation is anticipated for the filter presses. Mechanical ventilation may be used at one or more locations of operation.

Mechanical ventilation may be used for the Sludge Building to provide general air exchange; this ventilation will not be filtered or monitored. Local mechanical ventilation will be used at the bagging stations. This application of ventilation is subject to change based on results of air sampling and contamination measurements.

Local mechanical ventilation may also be used at the conveyors. The ventilation system will exhaust outside the building. This application of ventilation is subject to change based on results of air sampling and contamination measurements.

Decontamination: Decontamination will be a primary engineering control used for contamination control during sludge dewatering activities. Frequent wash-down of equipment and areas will be performed to minimize the presence and preclude buildup of uncontained radioactive material. The filter press plate assembly, conveyor, and underlying containment pad will be washed down during each filter cycle and prior to any maintenance activity. The floor of the Sludge Building will be washed down based on visual inspection but no less frequent than the end of each workshift when sludge dewatering activities have occurred. All wash-water will be returned to the Clarifier A.

Other: Operation of the filter press and packaging of the dewatered sludge will occur under conditions protected from weather. The filter presses include an installed cover (roof). Other barriers (e.g. temporary covers or walls) will be added as necessary to protect the sludge cake from weather. Packaging of the sludge will occur inside a building fully protected from weather.

Administrative controls will be used to control work conditions and work practices. Administrative controls will predominantly be comprised of access control, postings and barriers, and written procedures, instructions, and permits.

Access control: Access will be controlled in accordance with Sequoyah Facility Operating Procedure G-111 "Area Access Control". A controlled access boundary will be established around the filter presses and the bagging stations. Access controls for general ingress will be at least use of process safety shoes, or donning shoe covers over safety shoes. Access controls for egress will include step-of pads requiring at least change of process shoes or donning of shoe covers over process shoes, or doffing of shoe covers from safety shoes. Egress will also require doffing outer protective clothing such as gloves, aprons, smocks, or outer body cover (e.g. Tyvek suit).

Access control requirements will be continually evaluated with respect to results of contamination measurements. Access controls may be increased during the dewatering project but the aforementioned will remain as minimum. Note that egress from the subject controlled access area is into the primary restricted area of the Sequoyah Facility, egress from which requires doffing all protective clothing and equipment, and performing a personal frisk.

Postings and barriers: Postings will be used in accordance with Sequoyah Facility Operating Procedure HS-001 "Establishing and Posting Radiologically Controlled Areas". Postings will warn of radioactive material and potential for loose contamination. Postings will also describe ingress and egress requirements. Barriers such as rope or tape will be used to mark boundaries of controlled areas and to prevent unauthorized access.

Procedures: Written procedures shall be used in accordance with Sequoyah Facility Operating Procedures G-001 "Sequoyah Facility Operating Procedure System" and Health and Safety Department Instruction HSDI-001 "Department Instructions". Operating procedures currently exist to describe requirements for the following:

- Training
- Occupational dose limits
- Air sampling
- Bioassay
- Determination of internal dose
- Determination of external exposure
- Radiation surveys and contamination measurements
- Release limits for restricted and unrestricted use
- Access controls for restricted and controlled-access areas
- Respiratory protection
- Signs and postings
- Recordkeeping
- Contamination control
- Work permits
- Personal protective equipment

Departmental instructions currently exist to describe requirements for the following:

- Calibration of air samplers
- Calibration of radiation detection instruments
- Analysis of air samples
- Analysis of contamination measurements
- Health and Safety inspections
- Respiratory protection equipment

Hazardous Work Permits: Protection of personnel is administratively provided, on a task or project specific basis, through the use of Hazardous Work Permits (HWP). The HWP process is provided to assure worker safety while performing work in the presence of actual or anticipated personnel hazards. HWPs are used in accordance with Sequoyah Facility Operating Procedure G-304 "Hazardous Work Permits". The procedure includes guidelines for performing hazards evaluation, identifying special safety precautions, and selection of worker personal protection equipment and/or clothing. The HWP process includes approval or concurrence signatures by management and staff prior to implementation.

An HWP is a document used to dictate requirements for industrial and radiation safety. An HWP covers:

- Special instructions related to hazards control,
- Requirements for personnel protective equipment and clothing,
- Protective actions to establish a safe work area and environment, and
- Monitoring and survey requirements.

An HWP may be used as a written operating procedure or may augment a written operating procedure.

Personal protective equipment (PPE) shall be used in accordance with Sequoyah Facility Operating Procedure G-160 "Industrial Safety Precautions and Requirements". PPE will be at least Level D. PPE of Level C may be required for certain tasks such as operating the feed barge or performing maintenance on the barge or filter press. Due to the continuous wet condition of the sludge, levels B and A are not expected to be necessary for conduct of the project. However, should air samples or radiation surveys indicate the need, Level B PPE may be used.

Respiratory protection will shall be conducted in accordance with Sequoyah Facility Operating Procedure G-150 "Respiratory Protection Program". Respiratory protection equipment (RPE) is not anticipated necessary to support normal project operations. RPE may be required to support some maintenance activities. RPE will normally be limited to use of half facepiece and full facepiece negative pressure air purifying (particulate only) respirators. A continuous flow ambient air atmosphere supplying system is available onsite to support full facepiece respirators.

<u>Radiation Surveys</u>

Radiation surveys will be performed to describe the radiation types and levels in an area or during a task, to identify or quantify radioactive material, and to evaluate potential and known radiological hazards. The types of radiation surveys include visual survey, contamination measurements, radiation measurements, and personnel surveys.

Visual Survey: Visual survey will be made continuously of work areas. Visual identification of uncontained raffinate sludge will require cleanup as soon as practicable but in no case later than the end of the respective work shift.

Contamination Measurements: Contamination measurements shall be performed at the end of each workshift when sludge dewatering activities have occurred. Measurements shall also be made prior to maintenance activities in order to determine need for decontamination or appropriate level of PPE and/or RPE. Measurements will be made of removable alpha. The measurements will be made in accordance with Sequoyah Facility Operating Procedure G-158 "Contamination Control".

Action levels are established to inform facility personnel when a situation needs to be evaluated so that corrective actions can be taken. Action levels are set so that corrective actions can be made before a regulatory limit is exceeded. The action level for removable alpha radiation on a surface is 200 dpm/100cm2. All accessible surfaces and areas that exceed the respective action level will be decontaminated on a timely basis. In no case will the delay to initiate control exceed one normal workday. In the case of personnel contamination, there will be no delay to initiate decontamination.

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

Radiation Measurements: Knowledge of process and historical operations, and historic radiation surveys at the facility, allow the conclusion that exposure rate measurements are not necessary for the sludge dewatering project. However, as an effort of negative documentation, an exposure rate survey will be made of work areas once per week for the duration of the project.

Limits, as release criteria, are described in SFCs license. These limits are administered in accordance with Sequoyah Facility Operating Procedure HS-301 "Radiation, Contamination, and Release Surveys". The limits are administered such that when exceeded, action must be taken to reduce the levels or additional controls must be applied. Items or areas will not be released for unrestricted use until the relevant limits are satisfied.

Instrumentation

Instrumentation shall be managed and used in accordance with Section 2.7 of the Program.

Instrumentation shall be used in accordance with applicable Sequoyah Facility operating procedures and Health and Safety Department instructions.

Nuclear Criticality Safety

Knowledge of process and historical operations allow the conclusion that this topic is not applicable to the sludge dewatering project.

Health Physics audits, Inspections, and Record-keeping Program

Audits, inspections, and record-keeping shall be conducted in accordance with Section 2.3 of the Program.

The project shall be subject to periodic inspections (a.k.a. surveillances). The surveillances shall be performed to determine if operations are being conducted in accordance with regulations, license conditions, Program requirements, Plan requirements, written procedures, written instructions, and written permits.

The surveillances shall be conducted by the SFC Director, Regulatory Compliance or designee. The surveillances will consider the basic functional areas of the radiation safety program; e.g. Hazardous Work Permits, radiation safety instructions and procedures, radiological surveys and air monitoring, ALARA program, individual and area monitoring results, access controls, respiratory protection program, training, etc. The surveillances shall be conducted in accordance with a written surveillance plan. A written report shall be generated upon completion of the surveillance describing the results. The report shall be distributed to facility management.

As necessary, a written corrective action plan shall be prepared to address non-compliance issues. All corrective actions shall be tracked to completion. Once corrective actions have been completed, a written closure report shall be distributed to management documenting the completion of corrective actions. The Sequoyah Facility Operating Procedure G-192 "Condition Report" may be used to satisfy this requirement.

Periodic inspections shall be conducted by the Health and Safety Department staff in accordance with Health and Safety Department Instruction HSDI-003 "Radiological Safety Reports and Inspections".

Attachment 4

OCCUPATIONAL DOSE ANALYSIS
DEWATERING RAFFINATE SLUDGE

Occupational Dose Analysis for Dewatering Raffinate Sludge

Introduction

This report provides an analysis of occupational dose for workers at Sequoyah Fuels Corporation (SFC) during a pilot test of dewatering raffinate sludge. The report covers the period of middle December 2002 through January 2003. A summary is provided for each of the primary parameters used to monitor radiation dose received by workers at SFC.

SFC monitors both external and internal occupational dose to workers. External dose is monitored by use of thermoluminescent dosimeters. Internal dose is monitored by air sampling and urinalysis. Each of these parameters, as well as measurement of radiation and contamination levels in the work area, is discussed in this report.

External Dose Evaluation

External dose is determined by use of thermoluminescent dosimeters (TLD). The TLDs are assigned individually and exchanged quarterly. The TLDs are transferred to a vendor accredited by the National Voluntary Laboratory Accreditation Program for processing. The type and means of processing of the TLDs allows determination of the whole body shallow and deep dose equivalents.

The results of external dose monitoring for the calendar quarters which included the pilot test of dewatering raffinate sludge are summarized Table 1. The values of deep dose equivalent (DDE) for the fourth quarter 2002, zero mrem, represent 48 hours exposure time or zero mrem per hour. The values of DDE for first quarter 2003, 23 mrem maximum, represent 72 hours exposure time or 0.3 mrem per hour.

Internal Dose Evaluation

The committed effective dose equivalent (CEDE) is determined from air sample data. The air sample results and associated exposure time are used to calculate exposure as derived air concentration hours (DAC-h). A resulting dose is then calculated using the conversion of 5000 mrem per 2000 DAC-h.

The CEDEs based on air sampling during the pilot test of dewatering raffinate sludge are summarized Table 2. The CEDE values for December 2002, 10 mrem, represent 48 hours exposure time or 0.2 mrem CEDE per hour. The CEDE values for January 2003, 18 mrem, represent 72 hours exposure time or 0.3 mrem CEDE per hour.

Unusual Exposure Incidents

No unusual exposure incidents occurred during the pilot test of dewatering raffinate sludge.

Comparison to Limits

No monitoring data exceeded administrative or regulatory limits. No doses occurred in excess of administrative or regulatory limits.

Table 1

External Whole Body Dose[a], mrem

Worker	4th Quarter 2002 DDE	4th Quarter 2002 SDE	1st Quarter 2003 DDE	1st Quarter 2003 SDE
A	0	0	0	0
B	0	0	13	13
C	0	0	23	71
D	0	0	12	27
E	0	0	0	0

DDE - deep dose equivalent
SDE - shallow dose equivalent
[a]External dose was determined using thermoluminescent dosimeters that were exchanged quarterly.

Table 2

Internal Dose[a], mrem

Worker	December 2002 CEDE	January 2003 CEDE
A	0	0
B	10	18
C	10	18
D	10	18
E	n/a	n/a

CEDE - committed effective dose equivalent
[a]Internal dose was determined using air sample results.

Attachment 5

FILTER/PRESS UNITS

SPECIFICATIONS AND GENERAL OPERATING PROCEDURES

II. DESCRIPTION OF SYSTEM

A. Filter Press

1. General

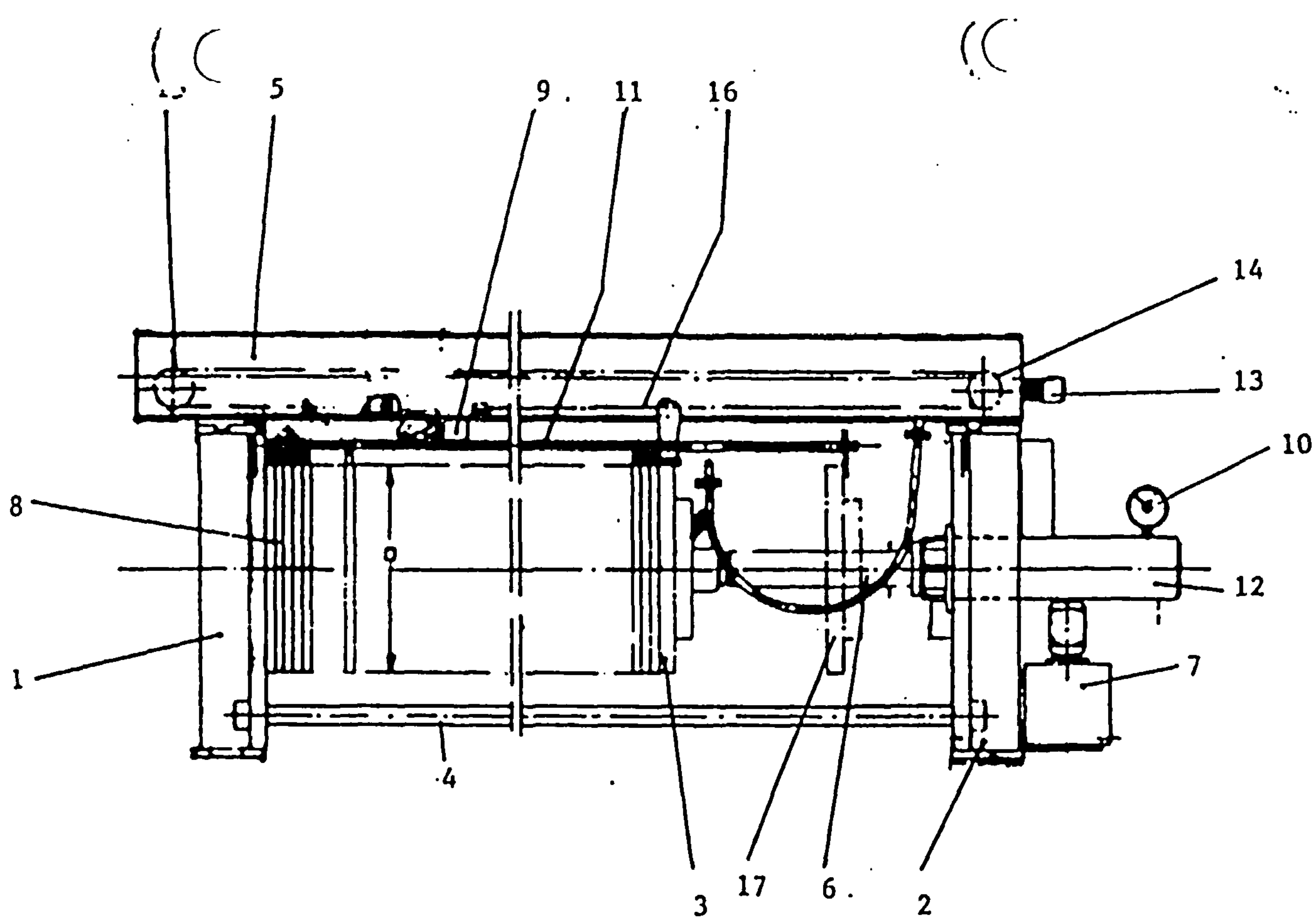
The filter press (Figure 1) consists of a fixed head piece, the filter plates with supporting carriages, the two supporting I-beams, a moveable pressure piece and a stand holding the hydraulic cylinder. The filter plates are suspended from the twin overhead I-beams between the fixed head piece and the moveable pressure piece. The hydraulic cylinder acts horizontally on the moveable pressure piece to press against the filter plates. A two-stage hydraulic pump provides the necessary hydraulic pressure to the hydraulic cylinder.

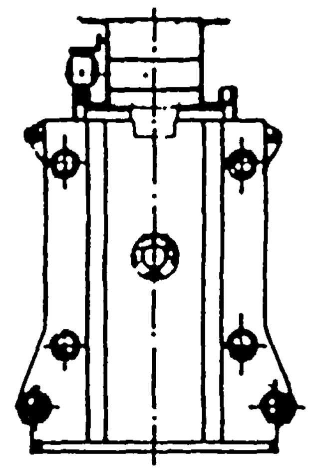
A chain driven plate transport mechanism with automatically engaging and disengaging shifter hooks is designed to move the plates and is situated between the twin overhead I-beams.

2. Filter Plates

106 plates are hung on the twin I-beams. Each plate is constructed of polypropylene, which not only is resistant to chemical attack by most materials but also provides good structural integrity. The outer lip of the plate is raised on both sides, such that when two plates are pressed together, a cavity is formed between them. When all the plates are pressed together, a corresponding number of cavities are formed. These are the cavities into which the slurry is pumped for dewatering.

On the inside face of the plates, grooves have been cut to aid in draining filtrate from the slurry. Filtrate is drained to four outlets (one in each corner) on the edge of the plate. These outlets are drained to flanged connections on the fixed head piece.





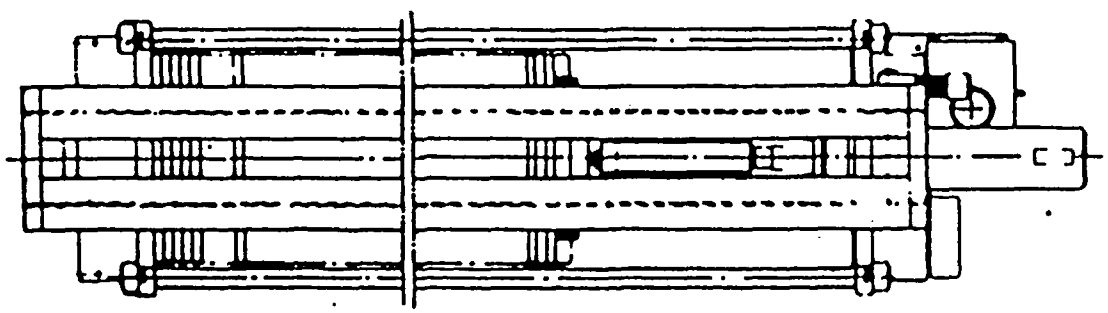


FIGURE 1

<u>Legend</u>

1. Fixed head piece
2. Cylinder stand
3. Follower piece
4. Lower bars
5. Twin I-beams
6. Hydraulic piston
7. Hydraulic power pack
8. Filter plates
9. Transport carriage
10. Pressure-indicating gauge and switch
11. Guide bar
12. Hydraulic cylinder
13. Transport gear motor
14. Drive pulley
15. Tension pulley
16. Inner web-I-beam
17. Retracted follower piece

II. DESCRIPTION OF SYSTEM

An inlet is also provided on each filter plate such that slurry can be fed into each cavity. The inlet flanged connection for the slurry feed is provided on the fixed head piece. Slurry is fed through this inlet located in the center of each plate.

Each filter plate is covered with a filter cloth to aid in filtering the sludge. The filter cloth serves to keep the sludge solids in the plate cavities. Filtrate may drain through the filter cloths to reach the filtrate outlets. The filter cloth also serves as a gasket along the edge of the filter plates, thus preventing leakage from the press during the high pressure filtration step.

Each filter plate is hung from the twin overhead I-beams by two supporting arms. These arms are equipped with grooved rollers that ride atop rails attached to the bottom inside flanges of the twin I-beams. This method of suspension prevents a side-to-side, or pendulum movement, by the use of a guide bar that is positioned along one of the top edges of the filter plates. Each filter plate is secured to the guide bar by a holder piece that prevents this motion, but permits sliding of the plates along the I-beams.

3. Cylinder Stand and Fixed Head Piece

The cylinder stand and fixed head piece provide the support for the filter plates and the hydraulic cylinder. The fixed head piece and the cylinder stand are also of fabricated steel and the cylinder supports the hydraulic cylinder, which is mounted horizontally in the cylinder stand. Two lower bars, one on each side, connect and separate the cylinder stand and fixed head piece at the bottom. The two twin I-beams connect and separate the top of the stand and fixed head piece. Both the stand and fixed head piece are designed to mount directly on the steel truck bed. There are two 1 1/8 inch anchor bolt holes in the fixed head piece. The cylinder stand sits atop two PTFE (Teflon) slider plates that allow flexion in the frame during high pressure.

The fixed head piece is fitted with four 2 1/2 inch ANSI 150 pound flanges for filtrate collection from each of the four corners of the filter plates. A 4 inch ANSI 150 pound flange is also mounted on the fixed head piece as the sludge feed connection to the center of the plates. A 3 inch sludge feed line connects to the 5 inch sludge feed connection by means of a 3 x 5 reducer. Three of the filtrate connections are routed to the 3-inch filtrate drain line that is piped to the filtrate collection tank. The fourth line on an upper corner of the plates is vented to permit free drainage of filtrate from the system.

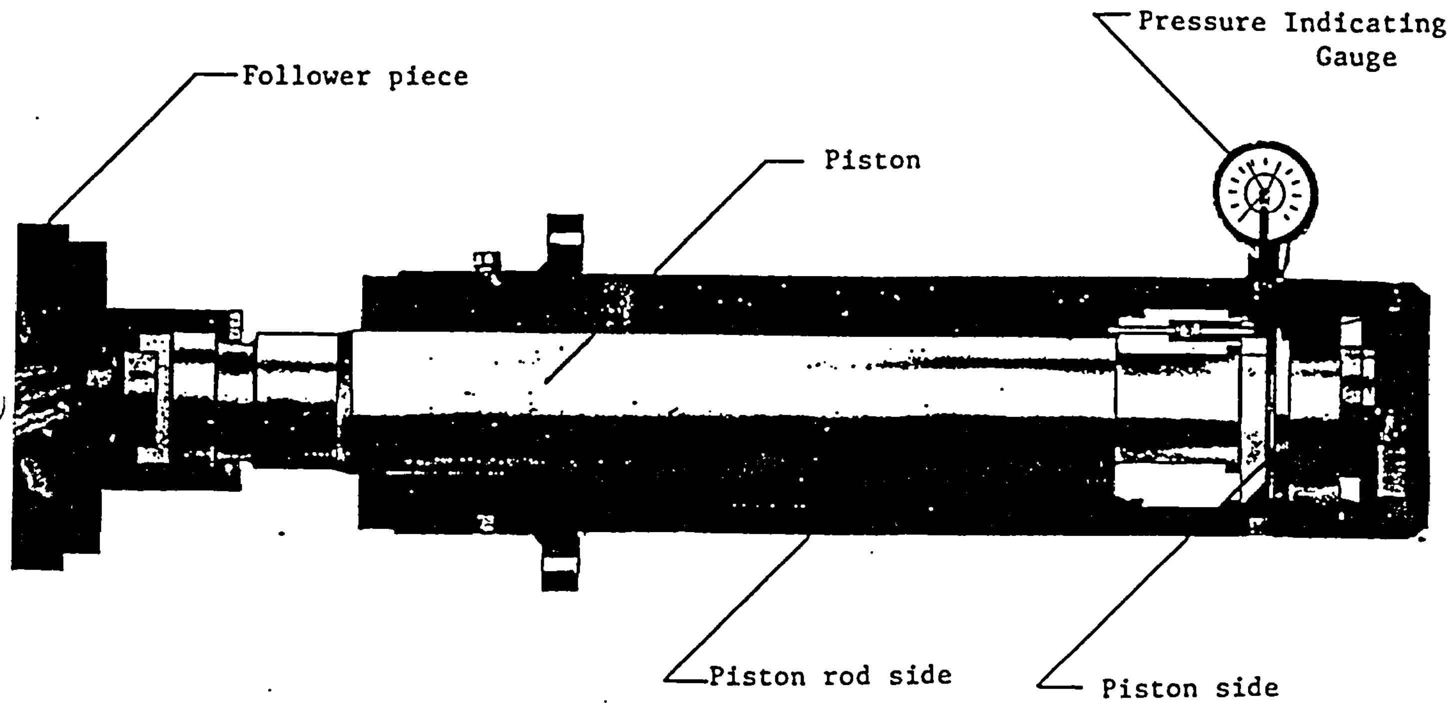
4. Follower and Hydraulic System

The follower or pressure piece is of fabricated steel construction and is suspended by rollers from the twin I-beams. The follower is also connected to the chromium-plated hydraulic piston. The function of the follower is to provide a flat surface to evenly disperse the closing force on the filter plates actuated by the hydraulic cylinder.

The double-acting piston (Figure 2) in the hydraulic cylinder performs two functions: opening and closing the press. The cylinder is fixed horizontally in the cylinder stand. The direction of movement of the piston within the cylinder is regulated by solenoid valves that are piped to the hydraulic pump and reservoir.

When the press is to be closed, the hydraulic pump is switched on and the solenoid valve to the piston side is opened. Hydraulic oil is pumped through the high pressure (HP) line into the cylinder, forcing the piston forward toward the plates. At the same time, hydraulic oil on the piston rod side is allowed to flow back into the hydraulic reservoir through the low pressure (LP) line. The pressure indicating switch is connected to the hydraulic pump and solenoid valve on the piston side. Once the maximum closing pressure has been reached, the pressure indicating switch causes the solenoid valve to close and the hydraulic pump to shut off. The closing pressure is maintained during the filtration period by the pressure indicating switch activating the solenoid valve and hydraulic pump whenever pressure drops occur.

When the press is to be opened, the solenoid valve to the piston rod side is opened and the hydraulic pump is switched on. Hydraulic oil is pumped through the LP line to the piston rod side and the oil on the piston side is allowed to flow back to the hydraulic reservoir. The piston is forced back away from the plates. Only low pressure is required to open the press, since there is no need to reach high pressure just to move the piston. The pressure indicating switch vacuum gauge is not interlocked with the circuit opening the press, since the switch senses pressure only on the piston side.



Hydraulic Cylinder

FIGURE 2

II. DESCRIPTION OF SYSTEM

The hydraulic system is driven by a hydraulic power pack. The hydraulic power pack consists of a two-stage type RZ hydraulic pump (Figure 3) driven by a flanged motor. When the hydraulic system is operating, a pressure is generated which can be read from the pressure gauge mounted on the hydraulic power pack continues to operate until the desired filtration pressure is reached. This pressure is maintained during the filtration period, and the power pack may cycle on to bring any drop in pressure back up to the filtration pressure.

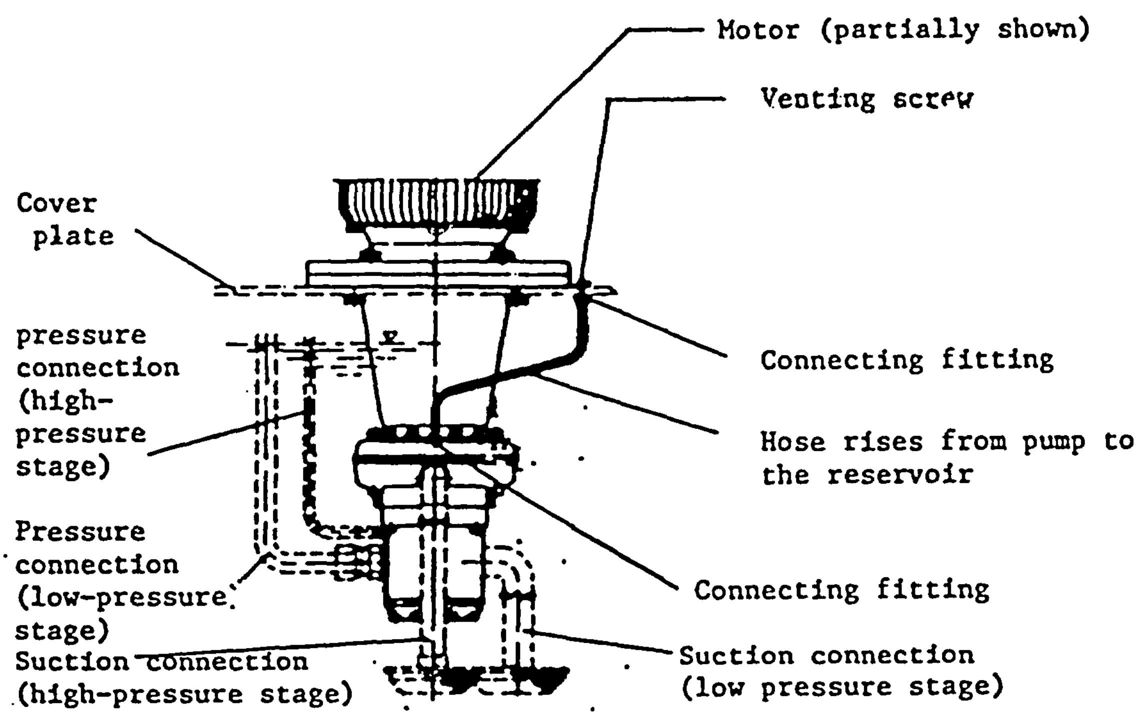
The electrically driven two-stage pump consists of a geared pump for the delivery of low pressure (225 psig) and a piston membrane pump for the delivery of high pressure (6000 psi). The housing of the pressure pump is specially constructed for the connection of the low pressure pump. The driving moment is passed by the high pressure pump and is transmitted by a torque tube to the geared pump. Both pumps are housed in the hydraulic reservoir and are submerged in the hydraulic oil.

Both pumps discharge into a common pipe. The low pressure pump is regulated by a pressure-dependent bypass valve. When the low pressure valve is exceeded, the delivery flow is automatically switched.

The hydraulic system is protected by an adjustable relief valve. The desired pressure is adjusted via the pressure indicating switch that switches off the pump motor when the preadjusted pressure is achieved.

5. Plate Transport System (Figure 4)

The plate transport system is necessary to permit the discharge of cake from the filter press. The plate transport system moves each plate so that the filter cakes can be discharged one at a time from the press. Each plate is moved, one at a time, away from the fixed head piece and toward the retracted follower piece. When the plates are to be returned to the closed position, the follower is used to push the plates back into contact with the fixed head piece.



Hydraulic Pump- Schematic

FIGURE 3

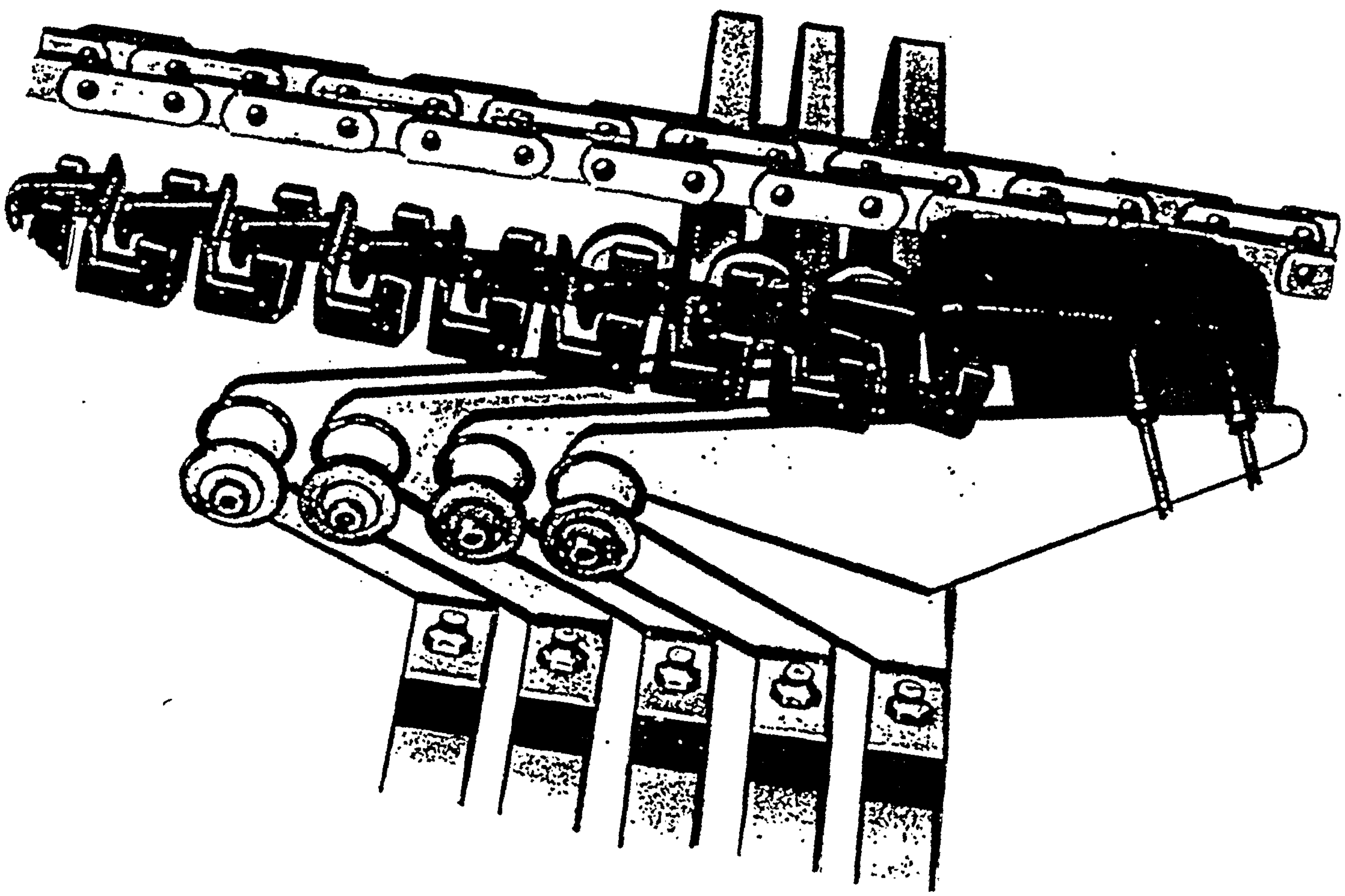


FIGURE 4

II. DESCRIPTION OF SYSTEM

The plate transport system consists of a double chain driven mechanism, several shifter hooks situated between the endless chains and a gearmotor mounted on the cylinder stand near the twin I-beams. Shifter hooks are spaced at regular intervals depending on the rate of discharge desired. Thus, the more shifter hooks, the quicker the discharge.

Each chain is suspended between the twin I-beams by two sprockets. The idle sprockets are mounted between the I-beams on a shaft above the fixed head piece. Two tensioning screws mounted horizontally on a fishplate attached to the end of the I-beam webs allow for the adjustment of the position of the sprockets, such that the tension in the chains may be increased or decreased. A cup spring located on each screw and positioned between the fishplate and heads of the screws maintain the tension on these sprockets.

The drive sprockets are located above the cylinder stand between the two I-beams. The gearmotor is mounted on the outside of the web of an I-beam, so that the drive shaft of the gearmotor interlocks with the drive sprockets shaft. Bearings are attached to the inside web of each I-beam that support the drive sprockets' shaft.

The chains wrap around the top of each sprocket and the shifter hooks engage the plates on the lower run on the chain. To ensure proper operation, the chains' tension must be fairly tight to permit proper engagement with the plates.

II. DESCRIPTION OF SYSTEM

B. Filter Feed Pump

The filter feed pump is an Abel piston membrane pump Model FHG 402-22/30 that is located on the front of the trailer. The pump is rated at 100 gallons per minute at the 225 psig. The pump is quadruple-acting: that is, the pump has two pistons and four membrane chambers for producing the rated flow. The sludge being pumped is isolated from the pistons by the membranes. Two membranes form each membrane chamber. On one side is the piston cylinder that produces a pressure against the primary membrane. Water, or another fluid, is contained in the membrane chamber between the two membranes, and functions to transfer pressure to the secondary membrane. The secondary membrane contacts the sludge and causes displacement of the sludge, producing the pumping action. Ball valves on the suction and discharge sides of the pumping chamber prevent backflow through the pump.

Since the sludge is isolated from the internal working components of the pump, corrosive and gritty slurries can often be pumped with no problem with the Abel pump. However, in severe applications, the Abel pump service representative should be contacted directly at the Abel engineering office.

The pump is driven by a 30 horsepower motor connected by a V-belt drive. The gear box is totally enclosed and lubricated by splash lubrication.

II. DESCRIPTION OF SYSTEM

C. Filtrate Tank and Pump

The primary components of the filtrate drain system provided for the filter press include a filtrate tank, filtrate pump and the piping and valves needed to regulate and carry the filtrate from the trailer. The filtrate tank is used to collect the filtrate generated during dewatering.

Each filter plate is provided with four filtrate discharge openings (one at each corner). When the plates are interlocked under pressure, these discharge openings form four continuous filtrate discharge passages which discharge to piping that transports the filtrate to the filtrate tank.

The filtrate tank furnished for the filter press has a capacity of 120 gallons. The tank is equipped with a Drexelbrook liquid level sensing probe which extends down into the tank and activates the filtrate pump once a high level is reached.

D. Drag Conveyors

Two drag conveyors are used to remove the dewatered sludge from the trailer. One drag conveyor is permanently fixed in the horizontal position under the filter press. When in operation, this conveyor drags sludge back toward the rear of the trailer. The conveyor is driven by a 3 horsepower 1750 rpm motor via a Falk shaft mounted reducer.

The second drag conveyor is stored below the fixed conveyor. This conveyor can be removed and attached to a pivot point just below the fixed conveyor. The unattached end of the coneyor can be elevated to a maximum of 30 degrees to discharge into a dumpster or truck. Lifting lugs are attached to the slide of this conveyor to aid in its elevation. A 5-horsepower 1750 rpm motor drives the conveyor via a Falk shaft mounted reducer.

E. Compressed Air System

The compressed air system includes one Quincy QR-25 air compressor, a Zurn aftercooler, a Zurn refrigerated air dryer, a vertical air receiver and the necessary piping and valves to make the system operational. The system is used to clean the core from the filter press by blowing compressed air through the cores to remove residual slurry. Sludge removed during this process is blown back through the feed port in the fixed head piece to a core separation tank, which dissipates the core blow energy and discharges the sludge into the sludge conditioning tank. The compressed air system also supplies the air needed to operate the various pneumatic valve actuators in the system.

The air-cooled compressor is driven by a 5 horsepower motor which operates at 1,200 RPM on 460 volt, 3 phase, 60 Hertz current. The unit is designed to deliver 80 cubic feet of air per minute at a discharge pressure of 150 psig.

The air-cooled aftercooler on the compressor's discharge line is a unit designed to cool the compressed air and separate any entrained water. A fan cools the cooling tubes. Condensate is captured in a moisture separator.

Two main air receivers are provided to serve the air compressor. One unit has a holding capacity of approximately 120 gallons. The unit is equipped with a pressure gauge, safety valve and an automatic condensate trap. This receiver supplies air to the core blow system and to the valve air system. A smaller 60 gallon air receiver supplies air to the filtrate blow system.

The air dryer removes excess moisture and oils from the air prior to being used by the valve operators. The cooled air is passed through a baffled separator/accumulator where the condensed moisture and oil are separated from the air. Separated moisture is drained from the unit by means of a drain line. A small 20 gallon air receiver stores air for use by the valves.

Refer to Appendix A for additional information from the manufacturer's equipment manuals.

F. Filtration System Control Panel

1. General

The control panel for the sludge dewatering system is housed in a NEMA 4 enclosure 3 feet wide by 6 feet high. The enclosure is mounted next to the filter press on the front of the trailer.

Pushbuttons, switches and indicator lights are all mounted on the front face of the panel for the operator to easily observe and reach. A programmable controller is mounted internally in the panel to control the sequencing of the process. No operator attention is required for the proper operation of the programmable controller.

II. DESCRIPTION OF SYSTEM

2. Description of Controls

Below is a listing of each item and a short description outlining its function.

Top Row - Left Side

FILTRATION START - This pushbutton when depressed starts the filtration cycle. All the other selector switches should be in the AUTO position for this pushbutton to activate all parts of the system.

FILTRATION STOP - OPEN PRESS - By pressing this pushbutton the operation of the filter will be stopped. The press will also be opened once the pressure has been decreased in the press.

FILTRATION COMPLETE - This indicator light is lit when a low filtrate flow and a minimum sludge feed pressure has been maintained for a period of 60 seconds.

Second Row - Left Side

HYDRAULIC PUMP - This selector switch has three positions: MAN, OFF and AUTO. The MAN position defeats any interlocks and switches the hydraulic pump on, pressurizing the piston. The OFF position shuts the pump off. In the AUTO position, the hydraulic pump is interlocked with the FILTRATION START pushbutton. When this pushbutton is pressed, the hydralic pump will start.

PLATE SHIFTER- There are three switch positions: MAN, OFF and AUTO. When the switch is in the MAN position, the plate shifter is started. In the OFF position, the shifter is inoperable. In the AUTO position, the plate shifter will be started when the FILTRATION STOP OPEN press pushbutton is pressed.

FOLLOWER- This switch has three positions: CLOSE, AUTO, and OPEN. The CLOSE position activates the hydraulic system and pushes the follower into contact with the filter plates. The AUTO position interlocks the follower with the FILTRATION START pushbutton. The OPEN position causes the follower to be retracted such that the plates can be moved.

II. DESCRIPTION OF SYSTEM

Third Row - Left Side

DRAG CONVEYOR-This selector switch has three positions: MAN, OFF and AUTO. Placing the switch in the MAN position allows the fixed conveyor to be turned on manually. In the OFF position, the conveyor is fully taken out of the system. In the AUTO position, the cake conveyor will start once the PLATE SHIFT pushbutton has been depressed.

BELT CONVEYOR-This is a three position selector switch identical in operation to the fixed conveyor. This conveyor can be elevated for discharge.

Fourth Row-Left Side

FILTER FEED PUMP-This selector switch has three positions: MAN, OFF, and AUTO. The MAN position causes the pump to be on irregardless of the other conditions in the dewatering system. The OFF position completely shuts the filter feed pump off. In the AUTO position, the operation of the filter feed pump is interlocked with the other components of the filtration system such that the pump's operation is automatic.

FILTRATE PUMP- This selector switch has three positions: MAN, OFF, and AUTO. The MAN position switches the pump on regardless of the settings of the other equipment in the system. The OFF position completely shuts the filtrate pump off. In the AUTO position, the filtrate pump is interlocked with the level switch of the filtrate tank. A high level in the filtrate tank will turn the pump on.

AIR COMPRESSOR- Either the CONT, OFF or AUTO position should be selected. Unless the system will be shutdown for longer than a day, the switch should not be turned OFF. The CONT position turns the compressor on regardless of any interlocks. The AUTO position interlocks. The AUTO position interlocks the compressor with the FILTRATION START pushbutton.

Bottom Row -Left Side

PULL TO START - PUSH TO STOP - This button will totally disconnect power from the dewatering system when pressed. By pulling the button out, the power will be returned to the system.

II. DESCRIPTION OF SYSTEM

First and Second Rows-Right Side

SLUDGE FEED VALVE CLOSED and SLUDGE FEED VALVE OPEN- These indicator lights indicate the position of the valve permitting sludge to be pumped to the filter press. The filter feed valve is open when the filtration process is underway.

CORE BLOW AIR VALVE CLOSED and CORE BLOW AIR VALVE OPEN-These lights indicate whether this valve is open or closed. The valve is opened for blowing the core from the filter press.

CORE BLOW SLUDGE RETURN VALVE CLOSED and CORE BLOW SLUDGE RETURN VALVE OPEN-These indicator lights indicate the position of this valve. This valve is opened to permit the core to be sent back through the part of the part of the sludge feed line.

FILTRATE BLOCK VALVE CLOSED and LOW FILTRATE BLOCK VALVE OPEN-These lights indicate the position of this valve. The valve is closed to shut off the vent line from the upper drainage port.

FILTRATE AIR BLOW VALVE OPEN- This indicator light signals when this valve is open, which would allow compressed air to blow water out of the filtrate lines to the filtrate tank.

Third Row- Right Side

SLUDGE FEED VALVE-There are three positions for this selector switch: OPEN, OFF and AUTO. The valve is in the OPEN position when the operator wants to manually keep the valve open. The OFF position closes the valve. The AUTO position interlocks the operation of the filter feed valve with the FILTRATION START pushbutton. The filter feed valve will be opened whenever this pushbutton is depressed.

CORE BLOW AIR -There are three positions for this selector switch: OPEN, OFF and AUTO. In the OPEN position, the valve regulating air flow to the sludge feed line in the press is manually opened. This would be used if the operator were manually core blowing the press. In the OFF position, the air valve is manually closed. In the AUTO position, the air valve is interlocked with the CORE BLOW pushbutton. When this pushbutton is depressed, the core blow sludge return valve will be opened first, and then the core blow air valve will be automatically opened. The air valve will be automatically closed at the end of 30 seconds.

II. DESCRIPTION OF SYSTEM

CORE BLOW SLUDGE- There are three positions for this selector switch: CLOSE, OFF and AUTO. The CLOSE position manually closes this valve. The OFF position manually opens the core blow sludge return valve when the core blowing is being done manually. In the AUTO position, the valve is interlocked with the CORE BLOW pushbutton. When this pushbutton is depressed, the valve will automatically open, permitting the press core to be blown by air back to the core separation tank.

FILTRATE BLOW AIR- This selector switch has three positions: OPEN, OFF, and AUTO. The OPEN position manually opens the valve such that compressed air can enter the filtrate lines. The OFF position manually closes this valve. In the AUTO position, this valve is interlocked with the OPEN press pushbutton. This valve will be opened in order to blow filtrate out of the press.

FILTRATE BLOCK - This selector switch has three positions: OPEN, OFF and AUTO. In the OPEN position, the block valve is manually opened. This is done after the press has been filled with sludge at the beginning of the filtration cycle. In the OFF position, the drain valve is manually closed. In the AUTO position, the valve is interlocked with the FILTRATION START pushbutton. When the FILTRATION START pushbutton is depressed, the filtrate block valve will be closed until the desired filtration pressure is reached, and filtrate is generated. This valve will then be opened to aid in draining the filtrate.

Fourth and Fifth Rows -Right Side

SLUDGE FEED PUMP INLET VALVE OPEN and SLUDGE FEED PUMP INLET VALVE CLOSED - These indicator lights signal the position of this valve that controls the flow of filtrate from the upper part of the press.

UPPER FILTRATE DRAIN VALVE OPEN and UPPER FILTRATE DRAIN VALVE CLOSED - These indicator lights signal the position of this valve that controls the flow of filtrate from the upper part of the press.

II. DESCRIPTION OF SYSTEM

Sixth Row Right Side

UPPER FILTRATE DRAIN VALVE - There are three positions for this selector switch: CLOSE, OFF and AUTO. The CLOSE and OFF positions manually close and open this valve, respectively. In the AUTO position, this valve is interlocked with the pressure gauge of the hydraulic unit. Once the filtration pressure has been reached, this valve will be opened and filtrate will be allowed to flow to the filtrate tank.

SLUDGE FEED PUMP INLET VALVE- This switch has two positions: CLOSE and OPEN. The valve should normally be in the OPEN position for operation of the pump.

There are also four blank three-position selector switches on the seventh row. These switches are for possible future uses.

III. OPERATION

Startup and shutdown procedures for the filtration system are described in the following sections. An operational checklist and list of panel set points are included to aid in the operation of the system. Should a problem occur, an emergency shutdown procedure and a troubleshooting checklist are included to help remedy the problem.

The control panel, as described in the previous section, has several indicator lights to indicate the current operational status of the system. Whenever possible, the operator should also visually confirm the operating condition of the system.

Prior to normal startup and operation of the filtration system, the following assumptions have been made concerning complimentary systems:

1. Electrical power is available.
2. The sludge feed system is connected and operable.
3. There are suitable amounts of chemicals available to commence and continue operation.
4. The filtrate line is connected to the filtrate return line.
5. The elevated conveyor is properly secured and connected.
6. The sludge feed valve is open. This valve is used to prevent losing the pump's prime when a suction lift is encountered.

A. Normal Startup

In order to begin the operation of the filtration system, the following manual valves should be placed in the open position:

- Ball valves on the filter feed pump.
- Butterfly valve on the inlet line of the filtrate pump.
- Butterfly valve on the discharge of the filtrate pump.

There are no manual valves that should be closed. However, there are several air-operated valves that are operated from the control panel. Their positions for normal operation are described in the next section.

Special reference should be made to the Startup Maintenance Schedule. This checklist includes items that should be inspected during the first few hours of operation.

III. OPERATION

When starting up the filter press, the hydraulic system deserves special attention. The hydraulic system should be vented prior to startup by unscrewing completely the breather cap atop the hydraulic reservoir. The filter screen should be removed and hydraulic oil should be added, if necessary, up to the upper oil gauge mark. Replace and tighten the breather cap. The relief valve jet should be loosened by loosening the check nut and unscrewing the slot bolt. The hydraulic pump should be switched on and off several times, allowing it to run for a few seconds at a time such that no hydraulic pressure is produced. The relief valve should be readjusted when the press is first experiencing closing pressure.

B. Normal Operation

The normal sequence of events, whether the press is operated automatically or manually, should follow the sequence or portions of the sequence as shown below:

Air compressor on
Follower closed
Hydraulic pump on
Sludge feed pump inlet valve open N/C
Upper filtrate drain valve closed N/C
Sludge feed valve open
Filter feed pump on
Upper filtrate drain valve open N/C
Filtrate block valve open
Filtrate pump on
FILTRATION COMPLETE indicator is lit
Filter feed pump off
Hydraulic pump off
Sludge feed valve closed
Core blow sludge return valve open
Core blow air valve open
(Short time interval) 100 sec
Core blow air valve close
Core blow sludge return valve closed
Filtrate air blow valve open
(Short time interval) 100 sec
Filtrate air blow valve closed
Filtrate pump off or shut off by level controller
Follower open
Drag conveyor on
Belt conveyor on
Plate shifter on
(Discharge of cake from all plates)
Plate shifter off
Drag conveyor off
Belt conveyor off

(Repeat cycle)

III. OPERATION

A list of recommended set points is shown below for the normal automatic operation of the system. These set points refer directly to settings on the filtration system control panel.

(1) Press Filling and Filtering

Item	Position of Switch on Control Panel
Filtrate Pump	AUTO
Air Compressor	AUTO
Filtrate Blow Air Valve	AUTO
Filtrate Block Valve	AUTO
Sludge Feed Valve	AUTO
Core Blow Sludge Return Valve	AUTO
Upper Filtrate Drain Valve	AUTO
Core Blow Air Valve	AUTO
Follower	AUTO
Plate Shifter	AUTO
Drag Conveyor	AUTO
Hydraulic Pump	AUTO
Filter Feed Pump	AUTO
Belt Conveyor	AUTO
Sludge Feed Pump Inlet Valve	OPEN

The FILTRATION START pushbutton may be pressed to start the filtration cycle. The hydraulic pump starts initially to pressurize the filter press. Sludge will be pumped to the filter press and filtrate will begin to be generated from the press. The filtrate tank level switch will automatically start the filtrate pump. Sludge will continue to be pumped to the press until a combination of low filtrate flow and the minimum sludge feed pressure occurs continuously for 60 seconds. At this time the FILTRATION COMPLETE indicator light will activate.

(2) Core Blow

The switches and their settings referred to in the previous section should remain in those positions. To remove the core of sludge from the feed openings in each plate, the core blow cycle will be activated automatically. Since all the equipment valves are in the AUTO position, no other actions will be necessary.

III. OPERATION

If the core blow cycle is to be operated in the manual mode, the following sequence should be initiated:

Item	Position of Switch on Control Panel
Hydraulic Pump	OFF
Filter Feed Pump	OFF
Sludge Feed Valve	OFF
Core Blow Sludge Return Valve	OPEN
Core Blow Air Valve	OPEN
Filtrate Air Blow Valve	OPEN

The automatic sequence allows the core blow air valve to stay open approximately 30 seconds; therefore, when operating in the manual mode the same time period should be sufficient.

(3) Opening the Press for Cake Discharge

The press will automatically discharge cake after the FILTRATION STOP-OPEN PRESS pushbutton is pressed. If the press is being operated manually, the selector switches should be left in the position as described in Part (1) except as noted below. The sequence described below should be followed in the order shown.

Item	Position of Switch on Control Panel
Drag Conveyor	ON
Belt Conveyor	ON
Follower	OPEN
Plate Shift	Push to start

The conveyors are initially turned on to handle the discharged cake. If the filter feed pressure is at zero, the follower will begin to open. As soon as the follower has bee completely retracted, the PLATE SHIFT pushbutton can be pushe to initiate the discharge of filter cake.

(4) Closing the Press

In order to close the press after discharge of the cake, the follower may be used to push the filter plates back against the fixed head piece. This is done by setting the FOLLOWER switch to CLOSE. Once the plates are returned, and all the selector switches are in the positions described in Part (1), the filtration cycle can be repeated.

III. OPERATION

C. Normal Shutdown

The following steps are required to shut down the filtration system.

(1) Complete the current filter press cycle. Discharge the cake.
(2) Turn the SLUDGE FEED PUMP SWITCH to OFF. If required, wash all the cloths.
(3) Return the plates and follower to the closed position. Do this by setting the FOLLOWER selector switch to CLOSE and pushing the plates into the closed position.
(4) Turn the conveyors to OFF.
(5) If the system will not be used for a long time (longer than overnight) turn the AIR COMPRESSOR selector switch to OFF. Otherwise, leave it running.

D. Operational Checklist

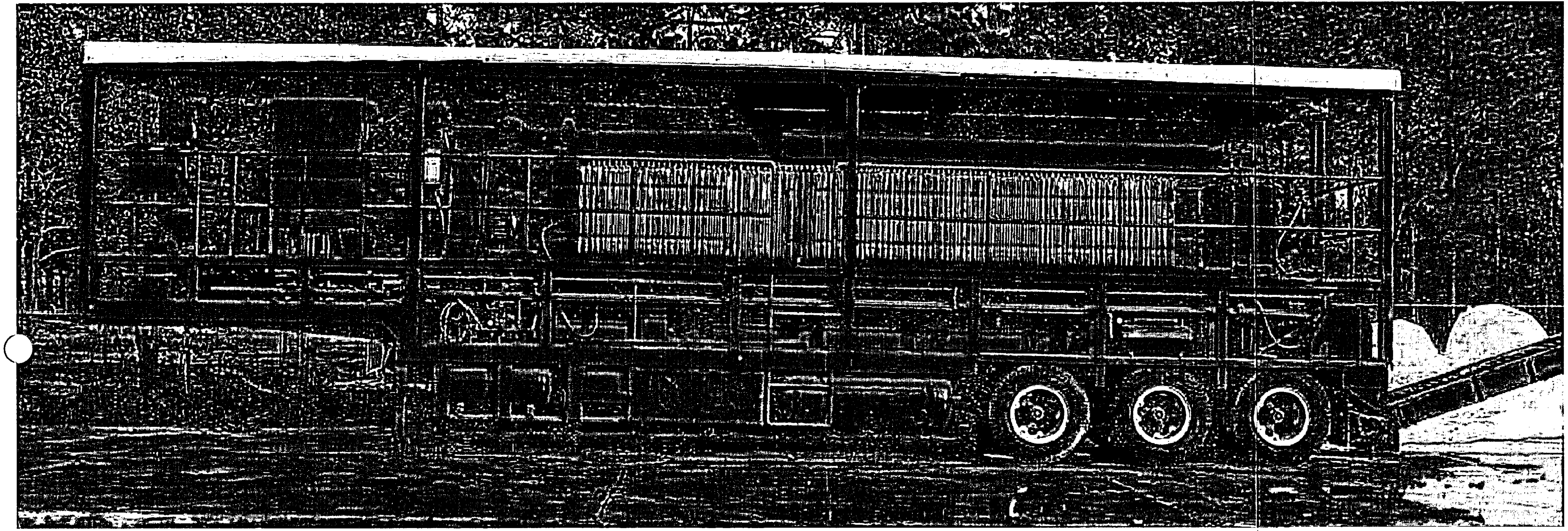
The following items should be inspected on routine walk-throughs of the dewatering system:

Item	Check
Pumps	Proper setting (metering pumps). Leaks around casing. Quiet-running gearbox.
Valves	Proper position. Leaks.
Compressed Air System	Air leaks. Drainage of moisture from system.
Filter Press	Proper operation of hydraulic system. Clean discharge of cakes. Leaks.

Note that this list does not include regularly scheduled maintenance items. Refer to Section IV.A for the specific maintenance schedules.

E. Emergency Shutdown

Should an emergency occur, it may be necessary to manually shut down other parts of the system if the problem cannot be corrected in a short time. For example, should the sludge conditioning system (if used) be shut down for an extended period of time, the filter press should also be shut down since performance will suffer.



SEQUOYAH FUELS CORPORATION	
Title: Trailer-Mounted Filter Press	
PREPARED BY: SFC	Filename: SFC0100A
Reviewed by: br	Attachment 5 Photo 1
Date: 01/05/2004	

Enclosure 2

Response to Request for Additional Information

NRC RAI's on Raffinate Sludge Dewatering Amendment

1. p.2 – In addition to a schematic diagram, provide a figure or figures showing the actual layout of the equipment.

RESPONSE:

Proposed layout of equipment and facilities to be used to dewater raffinate sludge are shown in new Figure 3. This figure has been added to the revised Applicants Environmental Report submitted with the licensee's application for license amendment.

2. p.2 – Provide details, including figures, of all dikes, liners, the processing pad, slopes, etc.

RESPONSE:

The feed tank area is located adjacent to the Clarifier basin, on the east bank. It will be constructed with a concrete pad and concrete dikes to prevent any potential spilled material from draining from the area. Any spilled or overflow material will drain directly back to the Clarifier basin through a 10-inch drain line. Details of the feed tank area are shown in Figure 5.

The processing pad is also located adjacent to the Clarifier basin, on the east bank, between the feed tank area and the bagging and weighing facility. The processing pad will be sloped such that the area can be washed down, with the water draining to the Clarifier basin. Berms or dikes will be constructed to ensure all runoff is directed to the Clarifier basin. The area between the paved processing pad and the Clarifier basin will be filled and graded to provide a slope for runoff, and will be covered with HDPE or pond liner material. Details of the processing pad are shown in Figures 4 and 5.

The bagging and weighing station will be constructed inside an existing building on the east side of the Clarifier basin. The building has a concrete floor and a sump. The floor will be sealed so that any spilled material can be washed down to the sump, with the liquid draining directly to the Clarifier basin. Details of the bagging and weighing station are shown in Figure 4.

The Yellowcake Storage Pad will be used for storage of dewatered sludge. The Yellowcake Storage Pad is an existing concrete pad that was constructed for storage of drums of yellowcake while the plant was operating. This area measures 550 feet by 370 feet, and has existed since plant start-up in 1970. The concrete surface was added to the Pad in 1979. The Pad lies within the Process Area east of the Clarifier basin and the proposed processing pad and bagging and weighing station. Details of the Yellowcake Storage Pad, including water runoff patterns, are included in Figure 7.

3. p.2 – Provide a description of how the dewatered sludge (filtercake) will be removed from the plate press filter units and packaged.

RESPONSE:

When the filter cycle has been completed, the pressure on the filter press unit will be bled down to zero psig and the unit will be emptied in preparation for the next cycle. The filter press is opened, an automatic plate shifter moves the plates and allows the filter cake to drop onto a drag conveyor below the unit. The filter cake is conveyed to the back of the unit where it is deposited on a conveyor belt that will transfer it to the bagging station. This description of how the filtercake is removed from the filter press unit has been added to Section 1.3.1.1 of the Applicant's Environmental Report.

4. p.2 – Provide detailed descriptions of equipment to be used. You can use contractor provided literature.

RESPONSE:

Equipment to be used for dewatering the raffinate sludge includes two contractor-provided, trailer-mounted filter press units, a bagging and weighing station to be constructed in an existing building, and temporary storage cells to be constructed on the Yellowcake Storage Pad. Raffinate sludge will be pumped from the Clarifier basin using a barge-mounted pump. The sludge will be pumped into two slurry feed tanks, and will be pumped from the slurry feed tanks to the filter press units using contractor-supplied slurry feed pumps. The barge and associated pump and the slurry feed tanks are supplied by Sequoyah Fuels Corporation.

<u>Filter Press Units</u>

The filter press units are R&B automatic filter press frame AEHN 1200 with electro-hydraulic opening and closing and automatic plate shifting (overhead beam design). Details and specifications for the units, including general operating procedures, are included in Attachment 5.

When the filter cycle has been completed, the pressure on the filter press unit will be bled down to zero psig and the unit will be emptied in preparation for the next cycle. The filter press is opened, an automatic plate shifter moves the plates and allows the filter cake to drop onto a drag conveyor below the unit. The filter cake is conveyed to the back of the unit where it is deposited on a conveyor belt that will transfer it to the bagging station.

The filter press units have an existing cover to protect from precipitation, and have the capability of adding side shielding to protect from wind blown precipitation. This will ensure that the dewatered sludge does not become wet during the time it is conveyed to the bagging station. Additional awnings will be constructed, as needed, to ensure that the dewatering and conveying systems are protected from precipitation.

<u>Bagging and Weighing Station</u>

The bagging station will be constructed in the former laundry building on the east side of the Clarifier basin which is adjacent to the area where the processing pad will be constructed. The filter press trailers will be located on the processing pad such that the discharge from the conveyors of the filter press units can be directed into the building, directly to the bagging stations (see Figure 4). When a bag is filled to capacity, the conveyor will be stopped long enough to replace the bag with an empty bag in the fill position. The filled bag will be removed from the fill position with a fork truck and placed on the scale for weighing. Each bag will be numbered with a unique number. The number of the bag and the weight of the bag will be recorded in a log book.

The building that will house the bagging and weighing station is constructed with a floor drain such that spills area can be washed down, with the discharge draining by pipe directly to the Clarifier basin.

The storage bags (SuperSack or equivalent) are made of polypropylene material and are approximately three feet by three feet by four feet high, and have a capacity for approximately 2000 pounds. The bags have lifting straps for handling.

The filled bag will be moved from the scale to the temporary storage cell using a fork truck. To facilitate operations, a flatbed truck may be used at the bagging and weighing station to load several bags prior to movement to the temporary storage cells, in which case they will be removed from the truck and placed in the storage cell using a fork truck or a crane.

<u>Temporary Storage Cells</u>

The filled bag will be moved from the scale to the temporary storage cell using a fork truck. To facilitate operations, a flatbed truck may be used at the bagging and weighing station to load several bags prior to movement to the temporary storage cells, in which case they will be removed from the truck and placed in the storage cell using a fork truck or a crane.

<u>Temporary Staging Area</u>

A temporary staging area will be constructed near the bagging and weighing station to be used in the event of precipitation. The staging area will consist of a metal building that is open on one side, with a capacity to hold three to four days production. During precipitation events, bags of dewatered sludge will be covered with a tarp or otherwise protected, and will be placed into the temporary staging area until they can be moved to the temporary storage cells.

5. p.2 – Provide details of the processing pad and its construction and of the bagging and weighing facility.

RESPONSE:

Details of the processing pad and its construction and of the bagging and weighing station are included in Figures 4 and 5.

6. p.2 – Provide details, including figures, of the temporary storage cells.

RESPONSE:

Temporary storage cells will be constructed on the Yellowcake Storage Pad. The cells will be constructed using used railroad ties to form an outside perimeter for each cell. A liner of HDPE or pond liner material will be placed in the bottom of the cell, overlapping the railroad ties. Details of the temporary storage cell construction are shown in Figure 6.

The cells are anticipated to be a nominal 30 feet wide by 150 feet long, and will each hold an estimated 1460 bags of dewatered sludge. A total of 11 temporary storage cells is anticipated. The bags of dewatered sludge will be stacked in the temporary storage cells in a pyramid fashion, to an estimated four bags high.

The cells will be laid out with the railroad tie perimeter around three sides, and the inner liner installed. The HDPE top cover material will be laid out in place in order to keep rain water from accumulating in the empty storage cell. When the storage space is needed, the HDPE top cover will be pulled back and the cells filled from one end. When the cell nears capacity, the railroad ties will be placed along the open end, and the filling of the cell completed.

As the cell is filled, the top cover will be pulled into place and the outer ties installed in order to keep the cover in place.

The temporary storage cells will be constructed to facilitate air flow through the cells to enhance evaporation of the remaining water. Tests of bags filled during the bench scale tests have indicated a significant weigh loss due to evaporation while in storage. By venting the temporary storage cells, it is anticipated that additional weigh loss can be achieved from the bags due to evaporation through the bag material. Details of the vent construction are included in Figure 6.

7. p.3 – Provide a chemical characterization of the dewatered sludge.

RESPONSE:

Physical and chemical properties of the raffinate sludge have been determined at different times to support site characterization activities and treatability studies. The results of those determinations are described in the RCRA Facility Investigation Report[1] (RFI) and the Site Characterization Report[2] (SCR): information from these reports is summarized below. Assessment of the data provided in the RFI or the SCR is included in the respective report. Previously unpublished information regarding physical and chemical properties of the raffinate sludge developed in support of evaluating dewatering the sludge is also summarized here.[3]

Four samples were collected in March 1994 from Pond 4 for the purpose of determining concentrations of metals and radionuclides in the raffinate sludge; the average of

[1] Sequoyah Fuels Corporation, "Final RCRA Facility Investigation Report", October 14, 1996.
[2] Sequoyah Fuels Corporation, "Site Characterization Report", December 15, 1998.
[3] Sequoyah Fuels Corporation, measurements made on site during testing of dewatering capability of pressurized plate filter press, May 2003.

analytical results of these samples are presented in Table 1 as *Raw Sludge*. A composite sample was developed from these samples for the purpose of collecting a leachate; the analytical results of the leachate are presented in Table 1 as *Raw Sludge Leachate*.

The raffinate sludge in Pond 4 was transferred to Clarifier A between 1993 and 1995. A single sample of raffinate sludge was collected from Basin 1 of Clarifier A in January 1995 to determine the concentration of volatile and semivolatile organic compounds, and total mercury. The sample results included 41 volatile organic compounds and 115 semivolatile organic compounds; the analytical results of this sample that are greater than respective method detection limit are presented in Table 2. The results presented in table 2 are for sludge that had not been subjected to dewatering.

Raffinate sludge was collected in May 2003 from Basin 1 of Clarifier A for the purpose of testing feasibility of dewatering the sludge using a pressurized plate filter press. After dewatering by the filter press, three samples were developed and analyzed for metals and radionuclides. The three samples included the dewatered sludge, the water expelled from the sludge as a result of dewatering (filtrate), and a leachate derived from the dewatered sludge. The analytical results of these samples are presented in Table 1 as *Dewatered Sludge*, *Dewatering Filtrate*, and *Dewatered Sludge Leachate*, respectively.

Physical characteristics of the raffinate sludge are provided in tables 3 and 4. These results represent the raffinate sludge before and after dewatering by pressurized plate filter press, respectively. Based on the results of the pilot scale tests that have been performed, the solids content of the dewatered sludge is expected to be 45 to 50%, with a resulting volume of approximately 485,000 cubic feet. The dewatered sludge is estimated to be about 15,500 tons. The dewatered sludge passes the paint filter test for free liquids (EPA Method 9095A). 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).

8. p.4 – Provide details of the measures to be taken to control the spread of contamination during the dewatering process and storage.

RESPONSE:

Details of the measures to be taken to control the spread of contamination during the dewatering process and storage are included in Attachment 3 of the Applicant's Environmental Report.

9. p.6 – Discuss the potential for infiltration of contaminants to the ground water in the event of a spill.

RESPONSE:

Groundwater protection is covered in Section 3.3 of the Applicant's Environmental Report. Additional information has been added to Section 3.3 to clarify provisions to ensure contaminants from a spill will not impact groundwater.

The raffinate sludge will be processed in the area of the Clarifier Basins, and the dewatered sludge will be temporarily stored on the Yellowcake Storage Pad. These areas are subject to the groundwater monitoring plan that is in effect for the facility.

Measures to protect infiltration of contaminants to the groundwater in the event of a spill include the construction of a processing pad that will include the area for the filter press units and the conveyor system. Any spill that occurs in this area will be washed down in a timely manner to the Clarifier basin. The bagging and weighing station will be constructed in an existing building, which has a concrete floor and drain. Any spills occurring in the bagging and weighing area will be washed down in a timely manner with the wash down draining to the Clarifier basin.

Any spill that may occur on the Yellowcake Storage Pad will be picked up in a timely manner. Residue will be washed down to the North or South Yellowcake Sump, which are sampled and analyzed prior to release.

Based on the construction of the pads in the processing and storage areas, and the administrative controls to be employed to ensure spills are cleaned up in a timely manner, there is little potential for infiltration of contaminants to the groundwater in the event of a spill.

10. p.7 – Provide details of the measures to be taken to protect the material during precipitation events. Provide details of the drainage system and its design basis precipitation event.

RESPONSE:

See response to question #6. Additionally, a temporary staging shed will be constructed near the bagging and weighing station to be used in the event of precipitation. In the event of rain or snow, the bags of dewatered sludge will be covered with a tarp prior to leaving the bagging and weighing station, and will be moved to the staging shed to be stored until they can be placed in a temporary storage cell.