40-8027

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SEQUOYAH FUELS CORPORATION

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February 29, 1988

Certified Mail
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Leland C. Rouse, Chief
Uranium Licensing Branch
Division of Fuel Cycle & Material Safety, NMSS
U. S. Nuclear Regulatory Commission
Washington D.C. 20555

Re: License SUB-1010; Docket 40-8027
Revision 02 to Chapter 16.0
DUF_6-DUF_4 Facility

Dear Mr. Rouse:

Since the start up of the depleted UF_6-UF_4 facility in March, 1987, SFC has made several changes in the operating parameters and the process system based on operating experience. Chapter 16.0, Revision 01 of our revised application for Amendment for the DUF_6 to DUF_4 Processing Plant submitted by our letter of November 13, 1986 has been revised to reflect these changes. All changes noted in Revision 02 of Chapter 16.0 dated 2/10/88 enclosed with this letter have been completed with the exception of the pre-heater for the dissociated ammonia as described on page II.16-7. SFC expects to complete the installation of the pre-heater by mid 1988. None of the changes discussed in Revision 02 have decreased the safe operation of the system from that previously described in our revised application for Amendment noted above.

To facilitate your review we have enclosed a complete retype of Chapter 16.0 (pages II.16-1 to II.16-18) dated 2/10/88. All revisions are indicated by a bar mark in the right hand margin.

Should you have any questions concerning the enclosed revision, please contact me at your earliest convenience.

DOCKETED USNRC MAR 3 1988 NMSS MAIL SECTION DOCKET CLERK

Sincerely,

JC Stauter

John C. Stauter, Director
Nuclear Licensing and Regulation

JTC/JCS/jms

Enclosures as stated (8)

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Chapter 16 PROCESS DESCRIPTION AND SAFETY ANALYSIS

16.1 Process Steps and Flowsheet

16.1.1 General

The process chemically reacts depleted uranium hexafluoride with disassociated ammonia and produces depleted uranium tetrafluoride and anhydrous hydrofluoric acid. The depleted uranium tetrafluoride shall be packaged in 55 gallon drums. The anhydrous hydrofluoric acid shall be condensed to a liquid and used in the existing conversion facility.

Drawing 800-M-1401 "Depleted UF_4 Flow Sheet" provides for stream compositions, temperatures, pressures, and flow rates.

The processing equipment shall be housed in a steel frame and metal skin building with approximately 7,000 square feet of ground floor area. There will be four upper level working platforms in a 1,600 square foot chemical reactor bay area which will be approximately 60 feet high.

Utility and reagent supplies that shall be from the existing UF_6 conversion facility are described in License SUB-1010.

16.1.2 Depleted Uranium Hexafluoride Supply

The depleted uranium hexafluoride shall be supplied in 10-ton and 14-ton thin walled and thick walled steel cylinders from the stockpile of the Department of Energy (DOE). After emptying, the cylinders shall be returned to the DOE for refilling. (DUF_6 vaporizing is described in 16.1.5).

16.1.3 Dissociated Ammonia Supply

Ammonia shall be thermally dissociated in one of the three existing ammonia dissociators located at the existing UF_6 conversion building. The dissociated ammonia (a mixture of nitrogen and hydrogen gases) will be piped to the depleted UF_4 plant. The ammonia should be 99.9 percent decomposed to nitrogen and hydrogen.

16.1.4 Molecular Sieve

The dissociated ammonia shall be passed through the molecular sieve to remove any residual ammonia. If allowed to remain with the dissociated ammonia, the residual ammonia would react with uranium hexafluoride and produce an ammonium fluoride-uranium fluoride complex -- an unwanted byproduct. The molecular sieve shall consist of two parallel vertical cylindrical tubes filled with a zeolite adsorbent having a strong affinity for ammonia. The dissociated ammonia shall flow through the adsorbent in one tube and exit that tube essentially free of ammonia. When the adsorbent in the first tube is to be regenerated, the flow of dissociated ammonia shall be diverted through the second tube.

The first tube will be regenerated by heating the adsorbent with electric heaters and purging with nitrogen. This will cause the absorbed ammonia to be vaporized from the adsorbent and carried away by the nitrogen purge gas.

16.1.5 DUF_6 Vaporizing

Depleted UF_6 shall be received as a solid in 10-ton or 14-ton UF_6 cylinders. Thick walled 14-ton cylinders, model 48Y, have a 200 PSIG and 250°F pressure and temperature rating. Thin walled 14-ton cylinders, model 48G, have a 100 PSIG and 235°F pressure and temperature rating. Provisions are made so that 10-ton cylinders, model 48X, can also be handled in the system.

Autoclaves shall be used to heat DUF_6 cylinders and vaporize the DUF_6 for introduction into the processing system. The autoclaves will completely contain the cylinders when they are heated so that any leakage of DUF_6 from a cylinder, a cylinder valve, or the copper "pig tail" attached to the valve, will not escape to the room or to the environment.

The design and operation of the autoclave system at the Sequoyah DUF_6 to DUF_4 Facility is patterned after the system at the Paducah Gaseous Diffusion Plant. Specific details of the Paducah system have been reported in CASCADE OPERATIONS Standard Operating Procedures, Union Carbide Corporation, Nuclear Division, Paducah, Kentucky. Autoclave testing procedures have been reported in the Safety Systems Guidelines, K/D-5205, January 1981, prepared by the Committees on Verification of Safety Systems at Portsmouth, Ohio, Paducah, Kentucky and Oak Ridge, Tennessee.

The two autoclaves shall be horizontal steel cylindrical pressure vessels, 6 feet in diameter by 21 feet long, with design pressure of 200 PSIG and design temperature of 250°F. They are designed, constructed, tested, and code stamped according to requirements of Section VIII, ASME Code. Each autoclave shall be opened by retraction of the cylindrical portion with its attached head using a hydraulic system.

A pressure relief line shall be attached to the fixed head of the autoclave and shall vent out the roof via a rupture disc and a pressure relief valve with a pressure switch between the rupture disc and the relief valve. A separate pressure measuring device monitors autoclave pressure continually and if pressure exceeds a pre-set limit, will initiate automatic shut down of the autoclave, cause an alarm to sound and the reason for the alarm to be displayed. If a pressure in excess of 200 PSIG occurs in the autoclave, a rupture disc and a pressure relief valve will open to reduce autoclave pressure. If a pressure in excess of 200 psig occurs in the autoclave a rupture disc and a pressure relief valve will open to reduce autoclave pressure. When the pressure drops below 200 psig, the relief valve will close.

Using a 20 ton jib crane or fork truck, a cylinder shall be placed on a cylinder transfer cart on rails outdoors at the south end of the building. The cart shall be moved on the tracks and positioned on the cylinder scale inside the building. The gross, tare, and net weight (of DUF_6) will be established for the cylinder, using the gross weight value, and the tare of the cylinder taken from the cylinder name plate. The cylinder serial number from the cylinder name plate shall be entered into the scale electronic system, along with the tare weight, and the electronic system will calculate the net weight. This information shall be printed on a weigh ticket for the weigh station operator. Via the Distributed Control System, the weights shall be printed on a weigh ticket in the central control room for the control room operator. Each operator shall independently compare this weigh ticket with his copy of the DOE shipping document, which includes serial number, gross weight, tare weight, and net weight, and shall verify that the cylinder does not contain more than the maximum allowable weight of DUF_6.

The cylinder shall be transferred to one of the two autoclaves, using a 20-ton bridge crane. The autoclave area shall be designed so cylinders can be transferred at a minimum height above the floor. The maximum lifting heights will be those required for removing and placing the cylinders in the cradles on the scale cart and in the autoclaves.

After the cylinder is in position in the autoclave, the DUF_6 discharge piping ("pig tail") shall be connected to the cylinder discharge valve and leak tested with 80 PSIA nitrogen. The cylinder valve shall be opened and the pressure in the pig tail will fall to less than atmospheric, since the cylinder is under a negative pressure. The extension handle from the motorized valve closer shall then be connected to the cylinder discharge valve. The motorized valve closer shall be designed only to close the valve, not to open it. The valve closer motor shall be outside the autoclave fixed head and its extension handle shall pass through the head via a stuffing box arrangement. All piping and instrument connections to the autoclave shall be on the fixed head. The hydraulic system shall be used to close and lock the retractable cylindrical portion of the autoclave to the fixed head.

The DUF_6 cylinder handling operations described above shall be done under local manual control. Subsequent operations in this area (except for any DUF_6 sampling) shall be monitored and controlled from the control room through the Distributed Control System (DCS).

After the autoclave is closed and locked, the control room operator will use the DCS to open the block valve in the steam line to the autoclave and shall set the temperature controller in the DCS for the steam temperatures in the autoclave to be controlled at 220°F, which corresponds to 3 PSIG saturated steam temperature. Under these conditions, the DUF_6 cylinder and its contained DUF_6 will heat to about 220°F at which point the DUF_6 will be liquid and at a vapor pressure of about 75 to 80 PSIA. The DUF_6 cylinder will then be ready to feed DUF_6 vapor to the chemical reactor system. (For a continuation of this operation see 16.1.6 UF_4 Chemical Reactor).

In the preceding sequence of operations, the pressure in the pig tail shall be monitored and recorded in the DCS. If the DCS has not recorded a 80 PSIA pressure in the pig tail, indicating a pressure test of the pig tail, followed by a fall in pressure to below atmospheric, indicating the cylinder discharge valve has been opened and is not plugged, then the control room operator will not be able to turn on the steam to the autoclave. This feature precludes heating a cylinder with a closed or plugged cylinder valve. After the steam has been turned on, failure of the pig tail pressure to rise to the proper operating pressure in a reasonable period of time will cause the DCS to shut off the steam, sound an alarm in the control room, and display the cause of the alarm. This feature also precludes heating a cylinder with a closed or blocked cylinder valve.

Any leakage of DUF_6 from a cylinder being heated within an autoclave will react with the steam condensate and steam vapor within the autoclave. This reaction would produce hydrofluoric acid (HF) and uranyl fluoride (UO_2F_2), and generate additional heat which, if contained in a fixed volume, would cause an increase in pressure. In order to contain these materials within the autoclave, the autoclave systems shall include remotely operated containment valves on all pipe connections to the autoclave except the pressure relief line, namely:

1. Steam Supply
2. Condensate removal
3. DUF_6 to process
4. Steam sampling line

Also, the remotely operated motorized DUF_6 cylinder valve can be closed to stop leakage from the cylinder valve stem and pig tail. All these valves will be operated via the DCS.

In order to minimize the amount of chemical reaction which can take place in the event of a DUF_6 leak, the amount of water as steam and condensate which can be retained in the autoclave shall be minimized. The amount of water that shall be retained in the autoclave, if completely reacted with DUF_6, would produce a maximum pressure in the autoclave less than the 200 PSIG design pressure of the autoclave and pressure relief valve.

The HF and UO_2F_2 generated by the reaction of DUF_6 with water are both soluble in water and the presence of small amounts would increase the electrical conductivity of the condensate. Condensate conductivity will be continually monitored.

Parameters on the autoclave systems which shall be monitored by the DCS are:

1. Autoclave pressure
2. DUF_6 pressure in the pig tail
3. Condensate level in the autoclave drain nozzles (Redundant)
4. Conductivity of the autoclave condensate (Redundant)
5. Conductivity of the steam sample condensate
6. Temperature of the autoclave
7. Pressure switches between the rupture discs and the pressure relief valves on the autoclaves

Automatic responses by the DCS to abnormal parameter readings are as follows:

1. If the autoclave pressure exceeds 10 PSIG, the steam supply valve and the UF_6 supply valve will close automatically. Also alarms will sound and causes for the alarms will be displayed in the control room. The steam and UF_6 valves provide containment also.

2. A continued pressure rise in the autoclave to 15 PSIG will cause automatic closure of the steam sample containment valve, the condensate discharge containment valve and the UF_6 cylinder valve and also sound an alarm in the control room and display the causes of the alarm.

3. Indication of a high level of water in the autoclave condensate drain nozzle by either of the level probes in the nozzle will close the steam supply valve, sound an alarm in the central control room and display the alarm cause.

4. Indication of high conductivity in the autoclave condensate will close the steam supply valve, sound an alarm in the central control room and display the alarm cause.

5. If the DUF_6 pressure in the pig tail increases from its normal preset parameter, the steam supply valve will be closed, an alarm will be sounded in the central control room and the alarm cause will be displayed.

In addition to the above automatic responses, interruption of power shall result in closing the four containment valves on the autoclave.

After the DUF_6 cylinder is emptied, both the DUF_6 feed valve at the autoclave and the autoclave steam supply valve shall be closed. The pig tail shall be purged with a small measured amount of nitrogen back into the DUF_6 cylinder several times. As the cylinder cools, any residual DUF_6 vapor will condense and the pressure in the cylinder will drop below atmospheric pressure. The cylinder valve shall be closed using the remote operated motorized closer, the autoclave will be opened, and the pig tail and extension handle on the cylinder valve will be disconnected from the empty cylinder.

The empty DUF_6 cylinder shall be removed from the autoclave using the bridge crane and will be placed on the cylinder weight cart on the cylinder scale. The same procedure will be used for weighing the cylinder out as was used for weighing the cylinder in, except the comparison with the D.O.E. shipping information and checking for over filling.

The condensate from each autoclave shall be combined and collected in a condensate receiver and pumped alternately to one of two condensate holding tanks. Each holding tank shall be sized to hold about 24 hours of condensate production. When one tank is full, condensate flow shall be shifted to the empty tank and the full tank shall be agitated and sampled. The sample will be analyzed for uranium and fluoride content. If uranium and fluoride are not present, the condensate shall be drained to the calcium fluoride settling and storage basin #2. If uranium or fluoride is present, the condensate shall be treated with lime as it enters the above mentioned settling basin. Discharge from the settling basin is currently pumped to the existing fluoride clarifier basins and subsequently to outfall 001, which is an approved NPDES discharge. Since uranium or fluoride is not expected in this condensate stream, the amount of calcium fluoride sludge waste from the existing facility will not be increased. Also, the quality of the current outfall discharge will not be impaired and the added percentage flow to the 001 outfall from the addition will be negligible (less than 1 percent).

16.1.6 DUF_4 Chemical Reactor

The chemical reactor shall consist of a small cyclonic type of DUF_6-H_2 mixer mounted on the top of the reaction chamber. The reaction chamber shall consist of a vertical conical-shaped tube 20 inches O.D. by 20 feet long. The reaction chamber shall taper to a 12-inch diameter at the top where a flanged connection will allow bolting of the mixer to the reaction chamber. The bottom shall be welded to a cooling screw conveyor.

The powder shall be cooled to about 300°F and conveyed to a chute between the cooling screw and product transfer screw. A bed of DUF_4 powder (seal leg) shall be maintained in the chute to prevent downward flow of gases with the powder.

The off gases shall also be cooled to about 300°F and shall exit from the top of the discharge end of the conveyer.

16.1.8 DUF_4 Product Pulverizing and Packaging

The DUF_4 product shall discharge from the cooling screw, through a level controlled chute, into the product transfer screw and be conveyed to a bucket elevator which will elevate the product and drop it through a screen to the product bin. The pulverized DUF_4 will drop into the product screw conveyor via another seal leg and be conveyed to a bucket elevator which will elevate the product and drop it through a screen to the product bin. The bin shall discharge DUF_4 product through a screw conveyor and through the packaging system into 55-gallon product drums which will be filled to a net weight of approximately 1,400 pounds. The product will be added to the drum through a ventilated hood resting on the drum. The hood, drum, and scale will be contained in a drumming station enclosure. Room air will be drawn into the enclosure through any openings in the enclosure to prevent escape of dust to the room. The air leaving the hood and enclosure will be filtered through a high efficiency baghouse which discharges to the atmosphere from a stack above the building.

The chemical reaction chamber shall be enclosed in four clam shell vertical cylindrical 45 kw electric heaters approximately 32 inches I.D. by 5 feet straight side. Each heater output shall be independently controlled using temperature sensors attached to the outside shell of the reactor tube. Room air shall be compressed by blower and introduced between each heater section and the reactor tube for cooling as required. Pneumatic vibrators shall be used to shake DUF_4 off the reactor walls.

The UF_6 vapor is superheated from about 220°F as it leaves the autoclave to 350° by use of electric heat tapes on the UF_6 piping headers. The setpoint temperature is controlled by the DCS. The dissociated ammonia (DA) may be pre-heated up to 1300°F by means of an electric heater located between the flow controller and the reactor mix head. The DCS is used to control the temperature of the DA at the desired setpoint. Heat sensors are used to detect possible DA leaks and interlocks will automatically shut off the DA flow upon the detection of a sudden rise in temperature.

The DUF_6 flow rate from the DUF_6 cylinders shall be regulated by a flow controller. The dissociated ammonia flow rate shall be regulated by another controller and shall be at approximately 1.2 times the theoretical quantity required for complete chemical reaction. The two streams will enter the cyclonic mixer and discharge into the top of the chemical reactor tube where the reaction will take place according to the equation:

$$DUF_6(g) + 1.2H_2(g) + 0.4N_2(g) = DUF_4(s) + 0.2H_2(g) + 0.4N_2(g) + 2HF(g)$$

The temperature of the reactor shall be controlled at about 1,200°F at the top and about 850°F at the bottom, using the electric heaters and cooling air as required. The majority of the reaction will occur at the top of the reactor. The DUF_4 formed will be a powdery solid. The DUF_4 and the remaining gaseous reaction products will pass from the bottom of the reactor to the cooling screw conveyor.

16.1.7 Cooling Screw Conveyor

The cooling screw conveyor shall be 10 inches in diameter, and about 8 feet long, and shall be mounted horizontally under the reactor. The conveyor will be provided with cooling water by the cooling jacket attached to the outside of the shell. The single shaft penetration on the drive end of the conveyor shall be sealed with a stuffing box which will be purged with nitrogen gas to prevent release of DUF_4 powder, H_2, or HF. The stuffing box shall be enclosed in a hood under negative pressure so that any release due to an upset will be captured and filtered through a high efficiency baghouse. (This same design feature will be used on all rotating stuffing box shaft seals on equipment under pressure in which radioactive or hazardous chemicals are contained).

16.1.9 Off Gas Treatment

The off gases from the cooling screw conveyor shall pass through a combination cyclone-filter where any entrained dust will be removed. The entrained dust will drop into a chute forming a seal leg just above a rotary valve which will discharge to the discharge end of the cooling screw conveyor, thus combining the dust with the main product stream. The estimated efficiency of the combination cyclone-filter assembly is 99.97 percent.

The off gases shall then pass through a sintered metal filter where any small amount of remaining dust will be removed. The collected dust will drop into a small dust can below the filter. This dust will be removed from the collection can via the vacuum cleaning system.

Two chemical traps in series shall be provided downstream of the filters to absorb any traces of unreacted DUF_6 in the off gas stream. The traps shall contain beds of granular activated carbon.

16.1.10 HF Recovery, H_2 Burning, and HF Scrubbing

After off gas treatment, the gases will pass through the partial HF condenser and shall be cooled to minus 10°F. About two-thirds of the contained HF will be condensed to a liquid and drained to one of the two anhydrous hydrogen fluoride (AHF) storage tanks. The partial HF condenser shall be the shell and tube type, with minus 15°F refrigerant on the shell side.

The remaining minus 10°F off-gas stream will then pass through a final HF condenser and shall be cooled to minus 95°F. Most of the remaining HF will be condensed to a liquid and drained to one of the two AHF storage tanks. The final HF condenser shall be of the shell and tube type, with minus 100°F refrigerant on the shell side.

The minus 95°F off-gases shall then be piped to the existing Sequoyah UF_6 conversion process building, fed into the H_2 burner to burn excess H_2, and then through the existing waste gas HF scrubber to remove any HF remaining. The amount of H_2 and total gases feeding to this existing scrubber shall add only a few percent to the load and can be easily accommodated in the existing system.

The recovered anhydrous HF in the two AHF storage tanks will be sampled and analyzed for purity before being transferred to the existing Sequoyah UF_6 conversion facility AHF storage tanks.

The refrigeration system that will provide coolant to the HF condensers for heat removal shall use cooling tower water from the existing plant.

16.1.11 Vacuum Cleaning System

Two separate piping and dust collecting units shall be provided. One unit, the Process Vacuum System, will be used for cleaning product quality DUF_4 powder from equipment in preparation for maintenance work. The second unit, the Waste Vacuum System, will be for all other uses. Each of the two dust collecting units shall be combination cyclone filters with polyester felt filter fabric.

The clean air streams from both dust collectors shall be combined and flow to a centrifugal vacuum compressor which will discharge through the high efficiency dust collector on the plant dust collection system.

The solids collected in the dust collecting units shall be discharged to drums for either recycle or disposal.

16.1.12 Dust Collection System (Drawing 800-M-6503)

The dust collection system shall consist of a baghouse with bag filters of high efficiency medium, a dust collection fan and a rotary air lock on the baghouse which will discharge the collected DUF_4 dust to the drumming station via a screw conveyor; a ductwork system to the various dust control points; and a duct to route the discharged air to an exhaust stack. Dust control points will be the product drumming station hood, the product drumming station enclosure, refeed system, refeed system enclosure, and the hoods around stuffing boxes and mechanical seals. (For additional details, see Drawing 800-M-6503.)

In Sequoyah Fuels Corporation's letter to the NRC of June 21, 1986, pp. 5-8, calculations were presented that estimated the air discharged to the environment would contain 0.0033 curies per year of DUF_4. Those calculations were based on the proposed installation of a Farr Cartridge Filter Baghouse.

Subsequently, Sequoyah Fuels Corporation has decided to install a Plenum Pulse Fabric Type Baghouse of the same make and type successfully used at the existing Sequoyah UF_6 conversion facility to achieve very low concentrations of particulates in the discharge. This modification will ensure that the previously submitted estimate will be achieved. In fact, the expected discharge will be even lower than previously estimated.

16.1.13 Breathing Air System

Breathing air for use with full face masks shall be Grade D quality and will be piped to each level of the process area.

16.1.14 Air Monitoring System

An air monitoring system shall be provided equivalent to that currently used in the existing Sequoyah UF_6 conversion facility. Filter heads will be provided in all areas of the plant as appropriate, with these heads being piped to a vacuum compressor which discharges to the atmosphere.

16.1.15 Water Supply

Process cooling water (CWS) shall be provided by a pipeline from the existing water cooling tower system to the DUF_6 to DUF_4 building and will be returned by pipeline to the cooling tower. This water will be used for:

1. Cooling water on the cooling screw.
2. Cooling water on refrigeration units.
3. Cooling water on the air compressor.

Potable water will be piped from the main building to the toilet, wash basin, drinking fountain, and the safety showers.

16.1.16 Liquid Effluents

Liquid effluents were previously discussed in paragraph 10.4.1.

16.1.17 Waste Solids

Quantities of solid wastes that will be generated at rated production capacity are shown under 10.4.2. Calc[illegible]ns of these quantities are shown in Appendix II. The quantitie[illegible]peated below and their disposition is indicated.

Fluoride Sludge	1,400 ft.^{3}/year	Offsite Recycling
Ordinary Trash	700 ft.^{3}/year	Sanitary Landfill
Spent Carbon Waste	550 ft.^{3}/year	Licensed Low Level Disposal Site
Off Spec UF_4	5 drums/year	Licensed Low Level Disposal Site
Damaged Drums	5 drums/year	Tailings Pile at Grants, NM
Spent Zeolite	70 ft.^{3}/year	Permitted Hazardous Waste Site

16.1.18 Off Gases

Process off gases have previously been described under 16.1.7, 16.1.9 and 16.1.10. Before release, these gases will be cycloned, double filtered, passed through chemical traps to remove traces of DUF_6, cooled to condense HF, burned to destroy hydrogen, and scrubbed to remove HF.

In Sequoyah Fuels Corporation's letter to the NRC of June 21, 1986, pages 8-11, calculations were presented that estimate the off gases to the burner and scrubber would contain 0.00001 pound DUF_4 per hour or 0.000014 Ci per year.

16.1.19 Power Failure

In the event of a power failure, the DCS shall automatically shut off the flow of DUF_6 and dissociated ammonia to the reactor and close the four containment valves. The burner and scrubber will continue to operate on the main plant emergency power system in the event of a general power failure. The nitrogen supply system requires no power and will continue to operate in the event of a general power failure.

16.1.20 Process Controls

The DUF_6 to DUF_4 process will be operated by a chemical operator from the central control room in the existing Sequoyah Facility main building using a Distributed Control System (DCS). The DCS shall be a micro processor based system with integrated analogue and digital control including electric motor and remotely operated valve control as well as sequential controls on automatic shut down systems.

The central control room shall be equipped with redundant operators' interface consoles with viewing screens which will allow the operator to set control points on operating parameters, operate remotely operable valves, motors, and other devices, monitor operating parameters and variables, receive alarm signals, and read the reason for alarms on the screens.

In the electric room at the DUF_6 to DUF_4 building, besides the regular power supply and motor control centers, there will be redundant multifunctional controllers and several hundred input-output (I/O) devices, which will interface with the instrumentation at the process equipment and with the central control room consoles. The entire DCS shall be powered by an uninterruptible power supply.

In case of power failure, all electric motors will turn off and all electrically actuated valves and other control devices will position themselves to the failed safe position.

16.1.21 Process Streams Descriptions and Activities

Quantities of materials in each process stream are shown on the process flow sheet, Drawing 800-M-1401. Table I is presented as an aid in visualizing each stream's physical nature and activity.

TABLE I

ESTIMATED PROCESS STREAM ACTIVITIES

DEPLETED UF_4 PLANT

SEQUOYAH FUELS CORPORATION SEQUOYAH FACILITY

Stream Name	Physical Nature	Activity	
		uCi/g	uCi/ml
Dissociated Ammonia	Gas (Nitrogen & Hydrogen)	Nil	Nil
UF_6 to Premixer	Gas (UF_6)	3.22×10^{-1}	6.2×10^{-3}
Reactor Feed (1200°F)	Gas (UF_6, N_2, H_2)	3.10×10^{-1}	7.0×10^{-4}
Reactor Discharge	Gas with entrained UF_4 HF	3.10×10^{-1}	9.0×10^{-4}
UF_4 Product Streams	Solid Powder	3.61×10^{-1}	1.11
Off Gas from Sintered Filters	Gas (trace of UF_4, HF)	8.0×10^{-7}	7.8×10^{-10}
Off Gases to HF Recovery	Gases with HF	8.0×10^{-7}	6.4×10^{-10}
Recovered Anhydrous HF	Liquid	1.4×10^{-8}	1.5×10^{-9}
Off Gases to Burner & Scrubber	Gas	5.5×10^{-8}	5.4×10^{-11}
Spent Cooling Water (CWSD)	Water	Nil	Nil
Steam Condensate to Out Fall	Hot Water	Nil	Nil
Autoclave Condensate to Out Fall	Water	Nil	Nil
Dust Collector Discharge	Air	5.4×10^{-8}	5.4×10^{-11}

Reference is made to Drawing 800-M-1401, "Depleted UF_4 Flow Sheet". The above listed activities are calculated for the expected nitrogen purges of 15 pounds per hour.

* Revised November 5, 1986

16.1.22 Sample Points and Primary Control Points

Product DUF_4 shall be sampled and analyzed for conformance to specifications. Steam condensate from the autoclaves shall be sampled and analyzed before discharge. The plant water discharge stream is sampled downstream of the last point of addition to that stream. An isokinetic sampler shall be provided on the dust collector stack to sample for uranium and fluoride. Condensed HF from the AHF storage tanks shall be sampled for purity including uranium analysis.

Primary control points are listed below:

1. Dissociated ammonia supply pressure, flow rate and temperature.
2. DUF_6 supply pressure, flow rate and temperature.
3. Molecular sieve malfunction.
4. Pressure at the top and bottom of the reactor.
5. Chemical reactor temperatures.
6. Level of powder in product seal leg.
7. Pressure drop on cyclone/filter.
8. Pressure drop on sintered metal filter.
9. DUF_6 analysis upstream and downstream of DUF_6 chemical traps.
10. Outlet gas temperature from DUF_6 chemical traps.
11. Pressure drop on baghouse.
12. Powder level in dust collector hopper.
13. Temperature of off-gas stream to cyclone.
14. Temperatures of streams in and out of heat exchangers downstream of the activated carbon chemical traps.
15. Temperatures and pressures on refrigeration systems as recommended by the system vendor.
16. Pressure of nitrogen to insure supply to the various purges.
17. Detection of DUF_6 leakage from cylinders and piping within the autoclaves.
18. Rotating equipment motion sensors.

16.1.23 Safety and Environmental Effects

The basic philosophy in preventing airborne radiation or chemical exposure in the design and operation of the plant shall be to contain the process materials in tightly closed systems wherever possible, and to the degree practicable, to provide for inflow of nitrogen at potential points of leakage from process equipment under pressure, to provide ventilation hoods to capture DUF_4 dust or other chemicals at potential points of leakage, and to filter all gaseous process effluents containing radioactivity through equipment of proven capability. The same philosophy shall provide for containment of hydrogen and capture and dilution of H_2 leakage. The following provisions are made to achieve these objectives:

1. Removal of DUF_4 from the reactor off gases by cycloning, double filtration through sintered metal filters, filtration and adsorption (for DUF_6), burning of the excess hydrogen, and finally water scrubbing before release to the main plant stack.

2. Two vacuum cleaning systems to remove any DUF_4 powder spills and to clean out equipment before inspection and maintenance.

3. A pressurized nitrogen (or air where there is no H_2 in the equipment) seal system on mechanical seals and stuffing boxes on equipment under pressure containing DUF_4, H_2, or HF.

4. A dust collector with a high efficiency filter medium on the dust collector system.

5. Equipment for the processing system (excluding packaging) with proven capability and reliability and of such construction as to be closed and leak tight.

6. Before start up, all piping and equipment through which dissociated ammonia will flow will be purged with nitrogen to displace air. The purg flow will be continued until the dissociated ammonia flow is turn on. This procedure will also be followed before a re-start whenever equipment is replaced or opened for any reason which could allow air to enter the system.

7. Unless one of the two 11,200 CFM roof ventilators in the high bay area of the building is operating, the dissociated ammonia supply valve cannot be opened by virtue of an electrical interlock. This will insure considerable dilution air to dilute any hydrogen leakage to below the explosive limit of 4 volume percent hydrogen in air. Less than 800 CFM air is required to cause this dilution even if the total hydrogen flow is not reacted with DUF_6, but leaks into the room.

8. There will be six strategically placed hydrogen detectors in the building. Detection of one volume percent hydrogen will signal an alarm in the central control room, and detection of 2 volume percent will automatically shut off the flow of dissociated ammonia and DUF_6 and open the nitrogen purge valve to the chemical reactor. Heat sensors at the DA pre-heater and piping to the reactor will also shut off the flow of DA if a sudden rise in temperature is detected.

9. There shall be a powder seal in the chute between the cooling screw and product transfer screw. The seal will prevent hydrogen flow downward along with the DUF_4 powder. The seal will be equipped with 2 level detectors. The higher or top level will control the level of the seal by controlling the rate of removal of powder from the bottom of the seal. The lower detector will alarm in the control room and indicate a safe shutdown of the reactor through an interlock programmed into the DCS if the powder level drops below a pre-set level.

10. Because a failure of the chemical reactor wall could allow HF and H_2 (and possibly DUF_6) to escape and enter the cooling air between the reactor wall and chemical reactor furnaces, a hydrogen detector shall be in the vent to the roof will cause an automatic emergency shut down of the chemical reactor system upon detection of

200 ppm hydrogen. Also, there shall be temperature sensors in each of the four cooling air discharge ducts before the ducts are combined for venting. Any abnormal increase in the temperature will cause an alarm in the central control room. A temperature rise in the cooling air could be caused by a leak of hydrogen above its auto ignition temperature (about 740° F) which would burn in the air. An HF detector is also installed in the cooling air exhaust from the reactor. The instrument will alarm at 4 PPM HF with corrective action to be taken as required.

11. Each pipe carrying DUF_6 gas from an autoclave to the DUF_6 Feed Surge Tank shall be monitored for DUF_6 leaks by ionization type leak detectors. Indication of a leak by any one of the six smoke detector stations will alarm the control room operator through the DCS. With confirmation of the leak, the control room operator shall close the shut-off valves for the affected piping to prevent any additional DUF_6 from flowing into the pipe and to isolate the various sections of the DUF_6 feed system.

12. There shall be four HF detectors inside the building proximal to equipment containing HF. Detection of HF by any of the four detectors will alarm the control room operator.

13. There shall be air monitoring sample filters appropriately located to monitor room air and air flow out the five roof ventilation fans, the reactor cooling air, and the product drum drying system. There shall be an isokinetic filter samplers on the discharge from the dust collection system. The filters shall be collected daily, analyzed, and results reported through appropriate channels as required in License SUB-1010. Remedial action will be taken when samples reach the remedial action level. (See Sequoyah Facility License, Section 3.2.4.1)

14. The system shall consist of standard unit processes and unit operations for which process and safety control systems are well understood and proven.

15. The plant shall be designed and constructed in full accordance with applicable federal and local laws, codes, and regulations.

Under the above conditions, plant operation will not expose personnel to unsafe conditions and will not cause excessive exposure of operating personnel and the environment to airborne chemical or radioactive material.

16.1.24 Refeed System

Provisions shall be made to allow recycle of off-specification product by a refeed system. A 55-gallon drum will be positioned on the lifting platform of a drum dumper via roller conveyors. After removal of the drum locking ring and lid, the dumper will lower and secure to the drum top a conical pouring spout equipped with a butterfly discharge valve.

The dumper will raise and invert the drum and secure it by pressure against a feed spout on a rotary star valve feeder which will feed to the discharge end of the product transfer screw which in turn will discharge to the feed boot of the bucket elevator. After opening the butterfly valve and starting the star valve feeder, the contents of the drum will be fed into the main stream product line.

The above system shall be enclosed in a containment housing. Dust shall be controlled by the use of proximity hoods within the enclosure which shall also be ventilated and under negative pressure relative to the building pressure. All ventilation air shall be discharged through the main dust collection system.

16.1.25 Screen Oversize System

The screen oversize material shall discharge from the product through a chute into a 55 gallon drum. Past experience has proven the oversize material to be a very small amount, therefore the level in the drum shall be monitored by the operator and the drum changed accordingly.

16.2 Safety Analysis of Each Step

16.2.1 General

As pointed out under 16.1.23 "Safety and Environmental Effects," the system shall consist of well known standard unit processes and unit operations--in full conformance with applicable federal and local laws, codes, and regulations. Additional safety analysis of each step beyond that already described is not required.

16.3 Safety Features of Each Step

16.3.1 General

Safety features of the steps have been described in the preceding sections as an integral part of the process discussion. There are no fissile materials involved; thus criticality safety will not be considered.

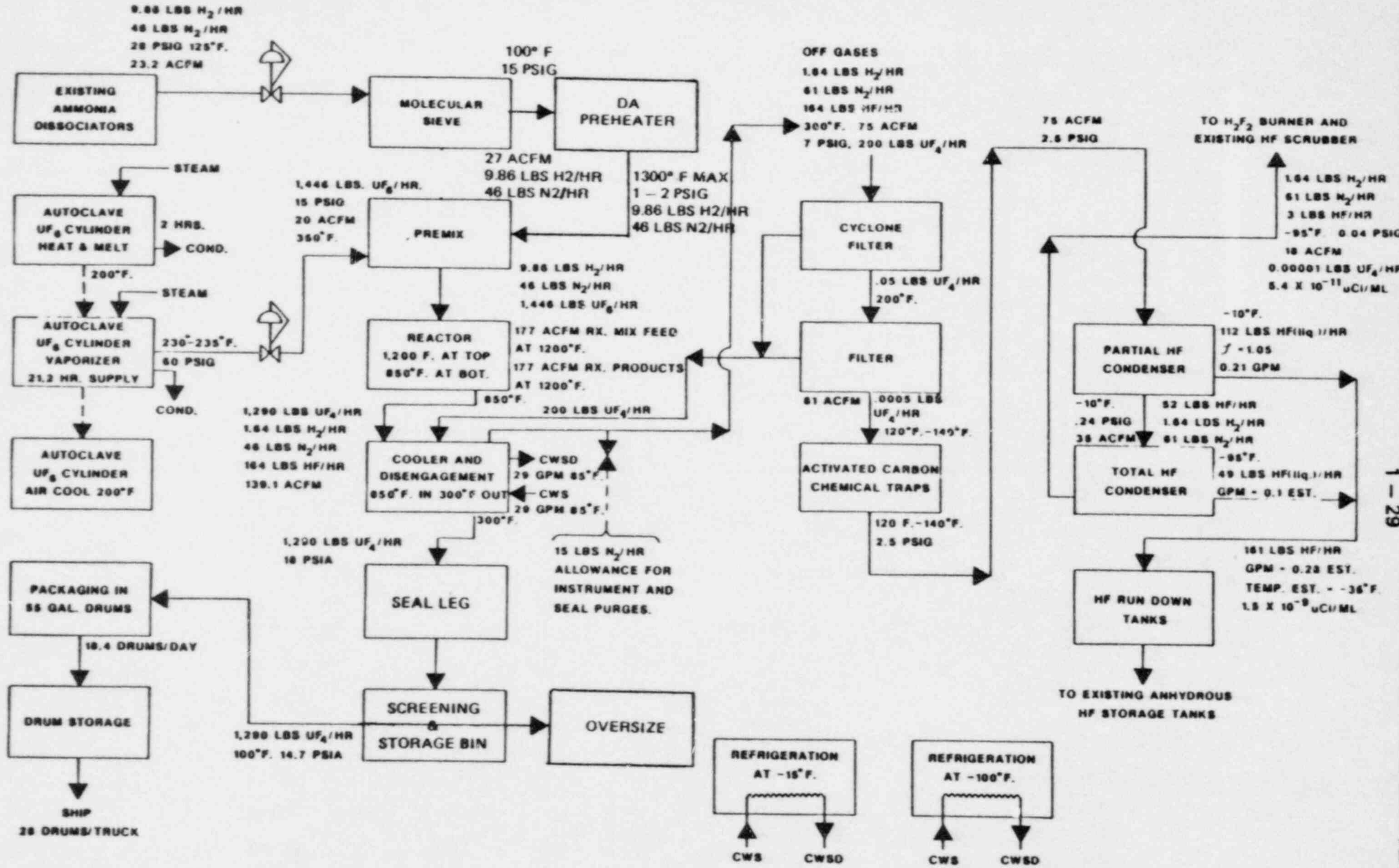
On January 4, 1986, the Sequoyah Facility experienced a release of UF_6 to the environment when an overfilled cylinder was placed in a steam chest and heated to homogenize the contents. The steam chest did not have pressure and heat monitoring devices that would indicate the conditions of either the steam chest or the cylinder. Subsequently, modifications have been made that incorporate extensive capability for monitoring chest and cylinder conditions and provide automatic shut-off of steam if preset pressure points are exceeded. Additional modifications have also been made that preclude the possibility of overfilling a cylinder and the subsequent heating of an overfilled cylinder. The DUF_6 to DUF_4 conversion facility cylinder heating station incorporates similar safety and monitoring features, which have been described in Section 16.1.5.

The safety features installed in the processing equipment and comprehensive monitoring of the area provide for a safe working area.

16.3.2 Fire

In general, the building, structures, and equipment are of noncombustible materials. There will be some fiberglass reinforced plastic equipment and plastic pipe, and wiring will have plastic covering (but routed through conduit). There are no processes using organic reagents in the proposed plant. Accumulation of combustibles will not be allowed.

There will be fire extinguishers strategically located within the building and fire hydrants and hoses immediately outside with water supplied through a buried pipeline from the main plant fire water system.



NOTES:

1. RATES SHOWN ARE INSTANTANEOUS RATES TO PRODUCE 7.5 MM LBS. UF_4/YR. ON STREAM TIME - 5,814 HRS/YR.
2. DISSOCIATED AMMONIA RATES ARE BASED ON A 20% EXCESS OF HYDROGEN.

DEPLETED UF4 PLANT BLOCK DIAGRAM WITH MATERIAL BALANCE
FIGURE 1 – 10

THIS DRAWING REPLACES THE ORIGINAL DRAWING OF THE SAME DRAWING NUMBER DATED 9/24/84

3 | 5/16/86 | REDRAWN AS DESIGNED | M L A | A W R

REVISIONS: NO. | DATE | BY — 5/16/86 M L A

DEPLETED UF_4 FLOW SHEET

SEQUOYAH FUELS

ART ROBERTSON
M. AUCUTT 5/16/86
SEQUOYAH FACILITY
NONE
800-M-1401 (3)

40-8027

February 29, 1988

RE: 8807
License SUB-1010
Docket 40-8027
Revision 02 to
Chapter 16.0
DUF_6-DUF_4 Facility

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