SEQUOYAH LICENSE

No. SUB-1010

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PROCESS TECHNOLOGY AND EQUIPMENT

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collected by desublimation in refrigerated heat-exchangers (cold traps). These units are operated on a batch-cycle and are periodically taken off-line and heated to liquify and drain the UF_6 into product cylinders. For economy, fluorine vent gases are passed through a secondary or clean-up reactor to assure complete usage of gas.

Elemental fluorine required for the final processing step is generated by the electrolysis of a molten KF-HF electrolyte. Appropriate gas feed systems, sust collection devices and disposal systems are provided.

The process described in the original license application is altered to include grinding of fluorination ash and recycling it to the fluorination system. The building was designed initially to include provision for the equipment to be added in the future. Additional unit process equipment will be added during the 2½ year construction period as follows:

a. A new tank in a digestion area to serve as a digest tank or an adjustment tank.

b. A new pulse column and raffinate hold tank in the solvent extraction area.

c. Two additional UNH denitrators.

d. A new UNH boildown tank.

e. A new reduction fluid bed.

f. A new two-stage hydrofluorination reactor line.

g. Two additional fluorination towers and an additional cleanup reactor.

h. A new operation for receiving and unloading wet ore concentrate.

In addition to the specific process equipment, certain auxiliaries need to be added, 30 additional fluorine generating cells, additional cold traps and conveyors.

3.2 DETAILED PROCESS AND EQUIPMENT

Descriptions of the production systems involved are presented below.

3.2.1 Sampling the Dry Ore Concentrate

The dry concentrate (yellowcake) is received from uranium mills in 55-gallon steel drums which are tared at the mill and/or sampling plant. The drums of ore concentrate are weighed and sampled by a dry splitter system. Powder discharged from the falling-stream sampler is conveyed to the digestor feed hopper.

The drums are emptied one at a time through a falling-stream sampling unit. This unit consists of 2 samplers in series, each taking a small cut. This produces an initial sample weight of about one percent or less of the total lot. The sample is split down again by a factor of about fifty and is collected in trays. The material collected in the trays is processed to a final sample pulp by the operations of drying, pulverizing, riffling, sieving and blending as needed.

The sampled ore concentrate is usually fed directly into the digestor feed hopper. The sampled concentrate can also be redrummed if desired.

3.2.2 Ore Concentrate to Purified $UO_2(NO_3)_2$

The process of purifying ore concentrate sufficiently for production of pure $UO_2(NO_3)_2$ involves nitric acid digestion and solvent extraction.

3.2.3 Digestion of Dry Yellowcake

Yellowcake and 40% nitric acid are fed to three 4,000 gallon digestors which operate on a batch basis. After digestion, the digestor tank contents are transferred to two 4,000 gallon adjustment tanks where adjustment of acid concentrations and micellaneous adjustment chemicals are added. Overall residence time varies from 12 to 24 hours.

3.2.3.1 Unloading, Sampling and Digestion of Wet Yellowcake

Wet yellowcake slurry delivered from a uranium mill will contain approximately 38% (WT) of water. The slurry is transported in a stainless steel cargo tank meeting specification MC310, MC311, MC312 or MC331. A special yellowcake slurry receiving area is provided at the Sequoyah facility. This area contains facilities and equipment for dissolving the ADU slurry with nitric acid, unloading the cargo tank and sampling the uranyl nitrate solution. (See Fig. 3-2.)

Tanks for receiving, weighing and sampling the uranium product are enclosed in a building which rests on a concrete curbed foundation with sufficient volume to contain spillage in case of accidental release. There are three tanks provided; one 1,000 gallon tank and two 10,000 gallon tanks. The 1,000 gallon tank is used for non-routine, small operations and for calibration of the load cells on the 10,000 gallon receiving and weigh tank. The second 10,000 gallon tank is used for measured storage. The receiving and transfer pumps are contained in a small building with a curbed foundation that drains to the large curb in case of spillage in the pump house. The area where the cargo tank is parked is also curbed adequately to contain

the entire tank volume.

The cargo tank will arive at the facility~60% full, with blind flangs on all openings except the pressure relief valve (tank rated at 30 psi). The cargo tank will be "spotted" and the blinds removed. Three equally spaced pump discharge bayonets are inserted to within 3" of the bottom of the tank, and two pump suction lines are attached to two diptubes, one at the bottom and one 1/3 tank diameter from the top. The vent line and a fail-safe level switch are then attached.

A predetermined amount of either 60% or 40% HNO_3 is then pumped into the receiving tank. The receiving tank, cargo tank and receiving pump are valved to allow pumping acid into the cargo tank. The cargo tank vent valve is opened. The acid is now pumped into the cargo tank until the level switch indicates proper level. (High level shuts down the pump.) Valving is now changed to allow pumping from the upper outlet in the cargo tank. The pump is restarted, providing recirculation of acid in the cargo tank. When acid has been consumed, the contents of the cargo tank is pumped back to the receiving and weighing tank. The dissolving operation is repeated until the slurry is totally dissolved. The contents of the cargo tank is then pumped to the receiving tank using the lower outlet. The cargo tank may be acid rinsed before being disconnected and prepared for return to the shipper.

The Uranyl nitrate in the receiving tank is mixed, weighed, sampled, and then transferred to the 10,000 gallon storage tank. The storage tank contents is then pumped to the process tankage used to prepare the feed for solvent extraction purification.

3.2.4 Purification

Recovery of the U value from the digestor product is accomplished by extraction with 30% tributyl phosphate (TBP) in hexane, using a series of four-foot diameter by six-foot high pumper-decanters. The loaded solvent is then scrubbed in mixer settlers to remove residual impurities and entrained aqueous solution. This scrubber liquid and impurities are returned to the feed stream where they become part of the raffinate after further processing. The uranyl nitrate is re-extracted into water using pulse columns as contactors. The purified solution is subsequently boiled down and denitrated to UO_3.

After Uranium has been removed from the solvent, it is treated with ammonium sulfate-caustic to remove the residual uranium and TBP degradation products. The raffinate from the solvent extraction step (pumper decanters) is stored in on-site ponds.

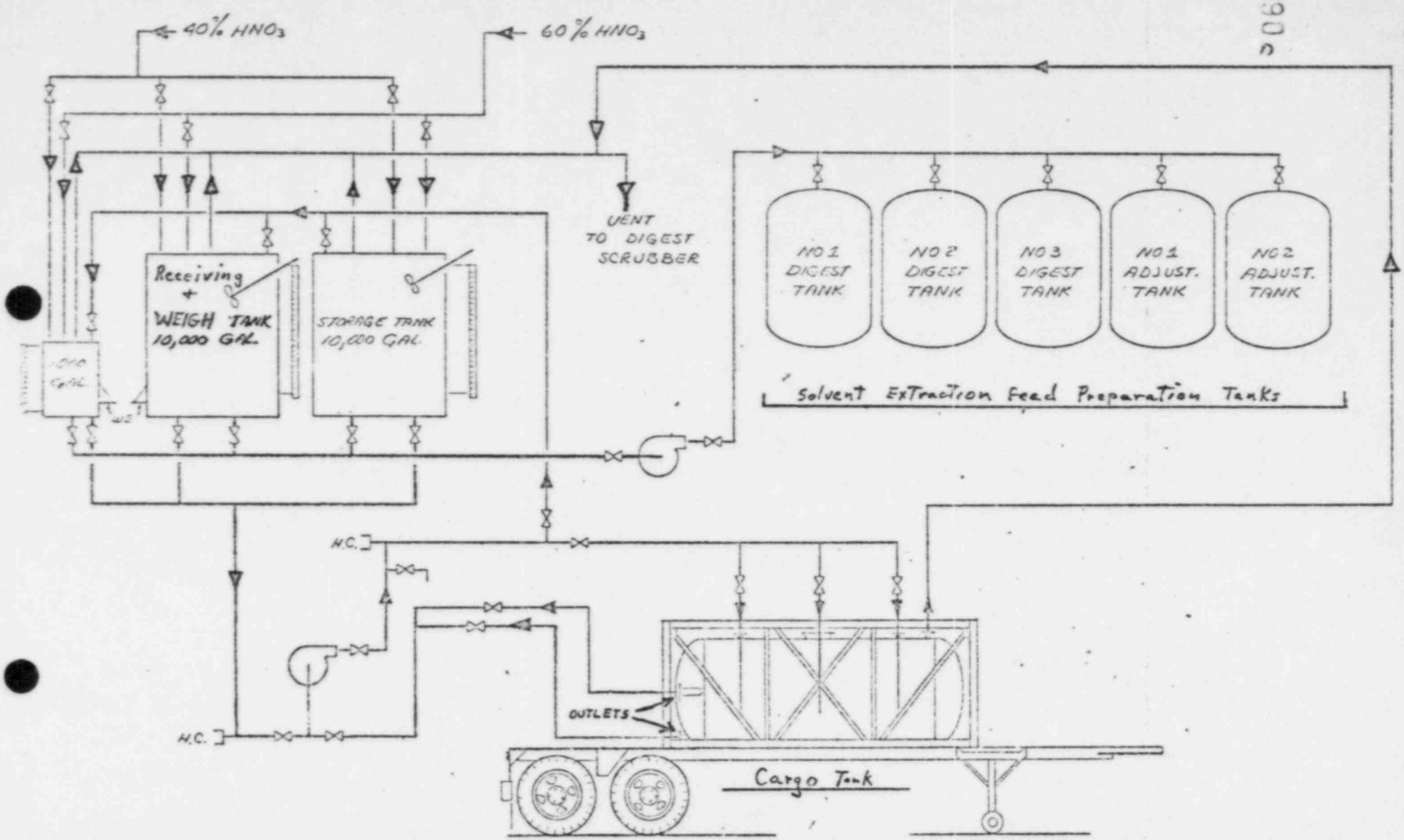

Fig. 3-2

ADU SLURRY RECEIVING AND STORAGE FLOW SHEET

12-22-76 RJS.

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