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INTER-COMPANY CORRESPONDENCE

# UNION CARBIDE NUCLEAR COMPANY

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K-1420

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Plant: Oak Ridge Gaseous Diffusion

Date: December 15, 1958

Subject: Study of Proposed K-1410 Uranium Recovery System

KP-1601

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PLANT RECORDS K-1034





At your request, a study has been made of a process for the recovery of uranium accumulated during the decontamination of feed plant equipment at K-1410. Included in the study are present uranium recovery costs and a preliminary cost estimate for a proposed recovery system.

The present material flow of uranium originating from the cleaning of feed plant equipment is shown on the attached diagram. The uranium-bearing cleaning solutions are drummed and sampled at K-1410 and transferred to the Coded Chemicals storage area. When a sufficient quantity of material has been accumulated, it is transferred to Y-12 where the uranium is recovered by a solvent extraction system and then converted to the oxide. Two samples of the oxide are taken at Y-12; one is analyzed at Y-12 and the other is transferred to ORGDP Coded Chemicals with the shipment of oxide. The oxide is subsequently screened and pulverized at the K-1231 facility and then transferred to the feed plant for conversion to uranium hexafluoride, or returned to the Coded Chemicals storage area for processing at a later date.

At the present time, there are approximately 6,975 gallons of solution containing 1,002 kilograms of uranium and 9,885 pounds of solids containing 1,959 kilograms of uranium available for processing. The total uranium-235 content is 20 kilograms, valued at $88,150. Based on fiscal year 1958 figures, the annual rate of accumulation of recoverable uranium approximates 3,500 kilograms. The unit cost of recovery of 3,493 kilograms of uranium in fiscal year 1958 was $5.80 per kilogram uranium, and

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Union Carbide Nuclear Company, Oak Ridge Gaseous Diffusion Plant, Operating Contractor for the U.S. Atomic Energy Commission.



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included all costs associated with material handling, sampling, analyses, and actual recovery operations. Costs associated with screening and pulverizing at K-1231 have not been included.

In reviewing the present method of material handling and uranium recovery from the cleaning solutions, it is obvious that there are economic advantages in providing an "on-the-spot" recovery system in the K-1410 area. A schematic flow diagram of a proposed recovery system for this area is attached. In brief, the system includes a pump for transferring solution from the cleaning tank to a continuous centrifuge; a continuous drum dryer for concentrating the effluent from the centrifuge to a semi-dry solid material; and a continuous low temperature calciner to produce a completely dry uranium-bearing solid. The solids are collected in a 30-gallon drum and prepared for shipment to the screening and pulverizing facility at K-1231. The chemical composition of the product will depend on the feed material, but will consist primarily of a mixture of uranium fluorides, oxides and carbonates with other metallic contaminants. In effect, the system is designed to concentrate, de-water, and dry the contained uranium so that it can be blended with normal feed material in the feed plant fluorination system. Since no effort is made to remove the fluoride content of this material in the recovery operation, the fluorine requirements for processing this material in the feed plant fluorination system will be less than current requirements for recovered material.

The uranium-bearing cleaning solutions (15%-20% $(NH_4)_2CO_3$) vary widely in chemical composition. The uranium content will average approximately 10%. Metallic impurities include aluminum, calcium, iron, sodium, and nickel in the range of 1% to 7%. All samples of the solution were found to contain from 15% to 20% fluoride.

A system located at K-1410 will eliminate unnecessary handling of scrap material to and from temporary storage facilities before and after uranium recovery at Y-12. Sampling and accountability costs will also be reduced, in that only one sample per unit of material will be required as compared to the current requirement of three. As mentioned previously, the Y-12 recovery system, which includes a solvent extraction and oxide conversion operation, effectively reduces the metallic contaminants in the product oxide. However, no significant adverse effects on the feed plant fluorination system will result from blending recovered scrap, containing reasonable amounts of metallic impurities, with normal uranium tetrafluoride feed material. If the recovery and blending of feed plant scrap is maintained on a current basis, the ratio of normal feed to scrap will be approximately 550 to 1.

In order to determine capacities and adaptability of drum drying equipment for processing K-1410 cleaning solution, a test was run using an existing drum dryer at the K-1420 recovery facility. It was learned that the drying characteristics of cleaning solution are very similar to those of uranyl nitrate hexahydrate. An easily handled, semi-dry cake was obtained during the test run.

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The estimated cost of labor and equipment for the installation of the proposed recovery system capable of processing 110 kilograms of uranium per 24-hour day is $13,500. This cost includes engineering design and is based on the assumption that existing equipment, such as the cleaning tank, transfer pump, and continuous centrifuge, will be available for the system at no additional cost. By operating the system on a eight-hour per day, five-day per week basis (182 kilograms uranium per week), it would take approximately six months to recover the current generation and present stockpile of feed plant scrap material.

At a recovery rate of 182 kilograms uranium per week, the unit cost of operation is estimated to be $1.75 per kilogram of uranium. This estimate includes costs for utilities and labor for the recovery operation, sampling and analytical costs, and handling costs for transporting material to K-1231. In comparison, the unit cost of recovery during fiscal year 1958 was $5.80 per kilogram of uranium.

Based on a savings of $4.05 per kilogram uranium, and a processing rate of 3,500 kilograms of uranium per year, the cost of installing the proposed recovery system can be economically justified with a payout period of one year. As a result of this study, it is recommended that consideration be given to the design and installation of the proposed recovery system in the near future.

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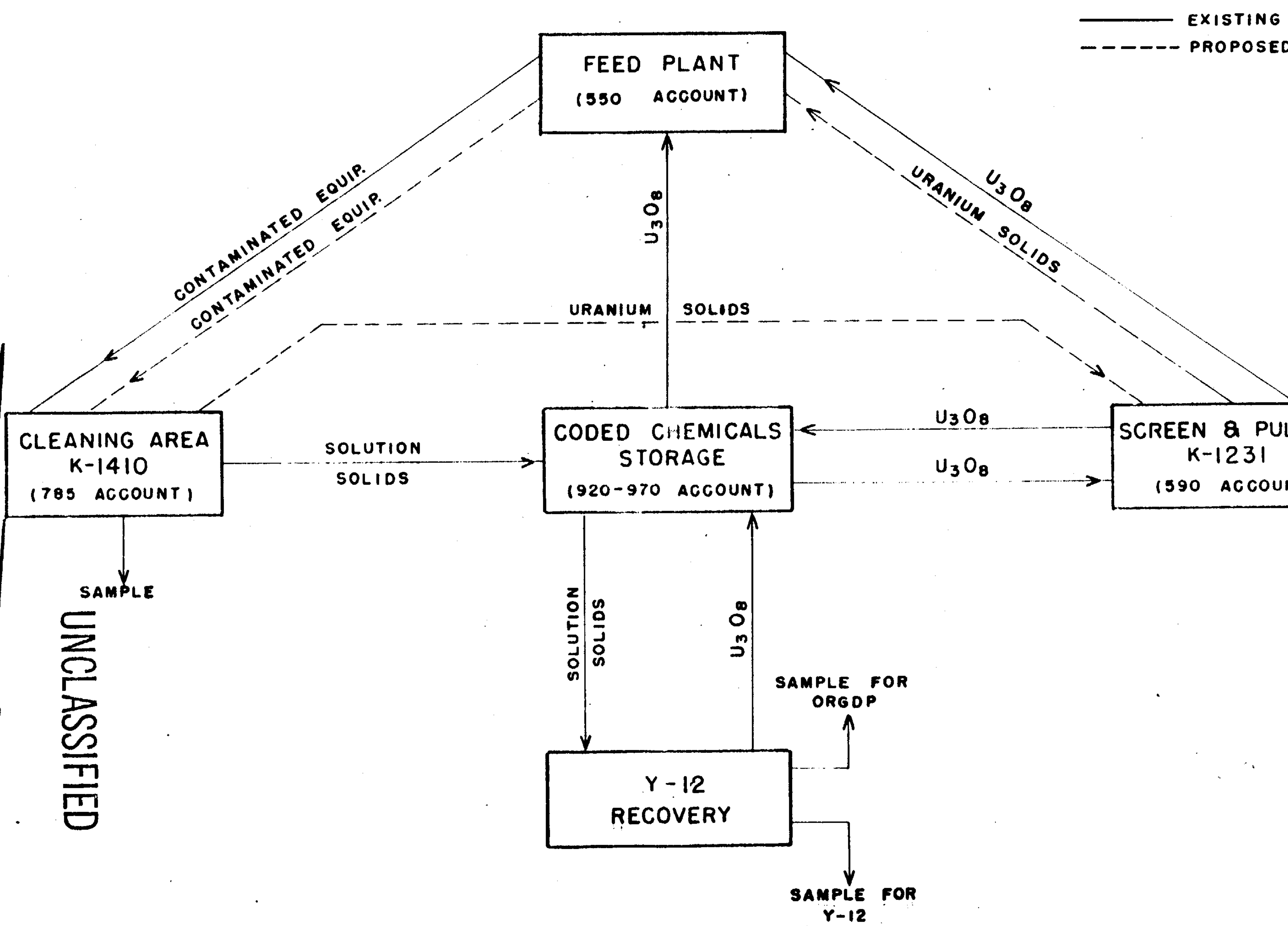
# SCHEMATIC FLOW DIAGRAM OF FEED PLANT SCRAP MATERIAL

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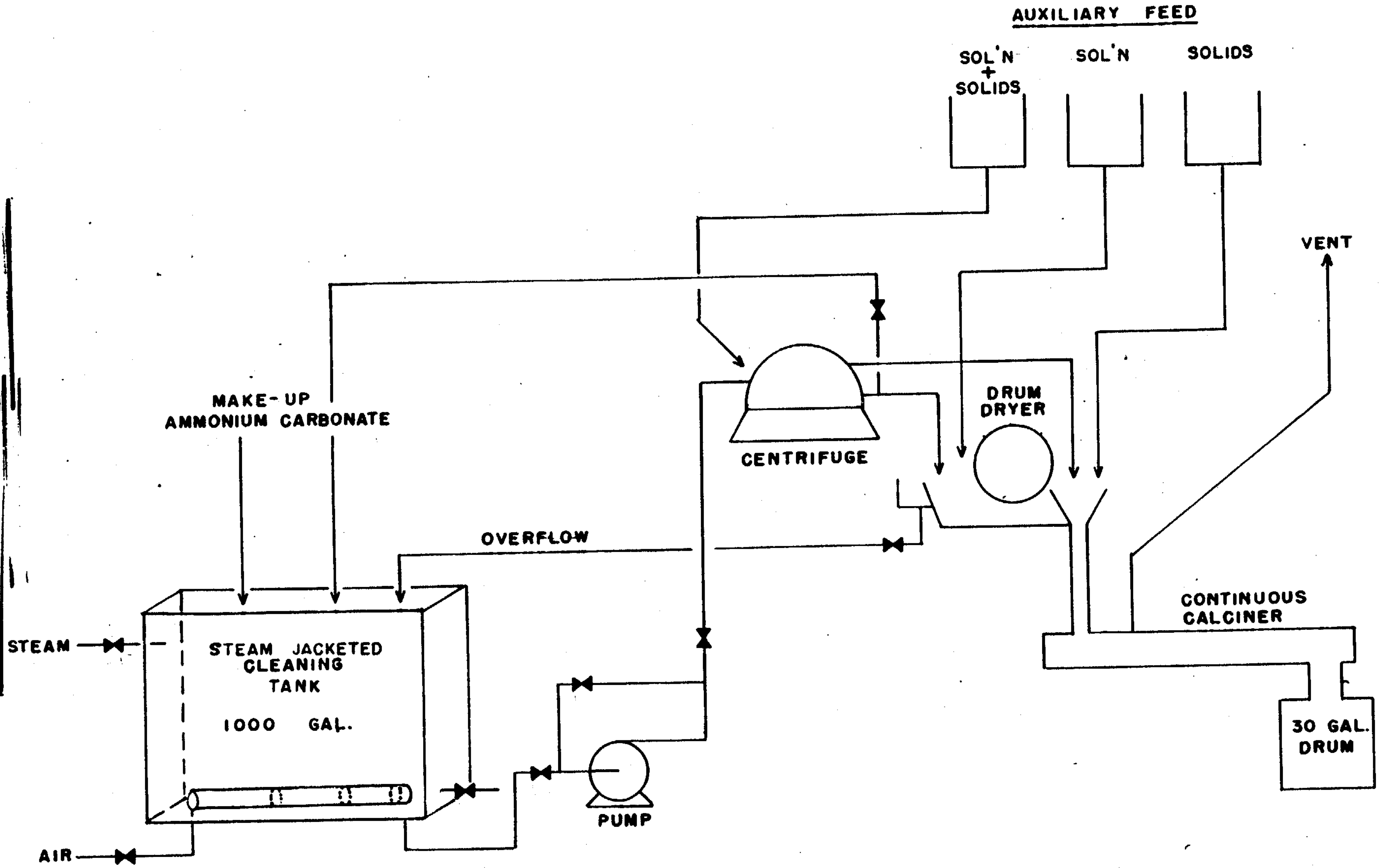


URANIUM RECOVERY SYSTEM K-1410

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