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REVIEW OF OXIDE FACILITIES - 24-U BLDG.

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FROM: C.A. Rohrmann/J.O. Ludlow

February 9, 1953

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February 9, 1953

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FROM: C.A. Rohrmann/J.O. Ludlow

REVIEW OF OXIDE FACILITIES - 224-U BLDG.Introduction

It has been proposed to install two large additional calcining pots in 224-U Building to provide additional calcining capacity up to approximately 18½ T/Mo.

In order to determine the feasibility of pot room expansion, it is necessary to investigate the capacity of the oxide absorption system.

The following is a summary listing the estimated capacities of the various components in the Oxide system.

1. Fume Line

At the time C-361 facilities were designed, little was known regarding the kinetics of the reaction. On the basis of meager data from Mallinckrodt the design basis adopted was that the peak gas rate from a pot was three times the average, that 10 pots would be at peak rate simultaneously, and that the

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gas temperature would be 275°F. This results in 686 CFM at a 13 1/8 T/DV rate, or 523 CFM at a 10 T/D rate. Pressure drop in 6" Header was calculated to be 2.5" H₂O/100' pipe. Measured gas flow at a 10 T/Day rate is 250 CFM.

Fume line is adequate for approximately 20 T/D uranium.

II. Gas Cooler

Gas cooler was designed to receive gas mixture at 400°F, condense water, remove heat of absorption and cool the residual gas to 120°F using water from cooling coils of the absorber. TAL at an estimated temperature of 85°F.

The gas cooler in operation has given an outlet gas temperature of 77-86°F at a rate of 10 T/Day using water from the absorber coils. Piping is installed to allow use of fresh raw water at a temperature of 75°F. Pressure drop across the gas cooler is negligible.

Gas Cooler will be adequate for approximately 20 T/D uranium.

III. Oxide Absorption

During the design of the EA-2 gas cooler it was estimated that the water condensing on the fin tubes and cascading from tube to tube would approximate one theoretical contacting stage, and as such would produce 42% acid at a rate of 0.78 GPM at 13 1/8 T/D. Changes in the residual nitric acid content of the pot feed resulting from changed concentration procedure resulted in increasing this to approximately 0.9 GPM at 13 1/8 T/D, on approximately 0.69 GPM at 10 T/D uranium. Due to the uncertainties of attaining this efficiency of absorption, it was decided to design the absorber on the basis of no oxide absorption in the cooler (only condenses water and cools gas), thus the absorber was required to absorb the oxides from 13 1/8 T/D uranium.

Plant operation has shown that, when producing oxides at a rate equivalent to 10 T/D uranium, the gas cooler produces 0.7 GPM of nitric acid at a strength 42% HNO₃ (equivalent to approximately 4 T/D uranium) which verifies the original assumption of absorption efficiency. Since the processing of additional material in the pot room will result in greater quantities of gas mixture of essentially the same composition, and since absorption efficiency is assumed constant, acid equivalent to 40% of any feasible uranium production will be produced in the gas cooler. At a rate of 20 T/Day uranium the oxides from approximately 8 T/Day uranium will be absorbed in the gas cooler. This leaves the oxides from approximately 12 T/Day uranium to be absorbed in the absorption tower. However, the tower was originally designed to absorb the oxides from 13 1/8 T/Day uranium. Oxide Absorption system will be adequate for approximately 20 T/Day uranium.

IV. Off Gas System

Original absorption tower design was based on nominal air flow into the tower of 100 CFM, made up of 40 CFM through the bleaching system and 60 CFM from the pot room (3.3 CFM/Pot). Control was by a bleed valve at the top of the tower passing up to 67 CFM of air and controlled by pot room header pressure. Pot leakage during operation is approximately twice design rate or 120 - 150 CFM.

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Bleacher requirements at 10 T/Day uranium has averaged approximately 20 CFM. This results in a net flow of air from the top of the absorber of approximately 167 CFM air with no air admitted by the controlled bleed valve. In the light of the proposed addition of two large calcining pots it is recommended that revisions be made to restrict the air leakage from the existing pots, to so revise the new pots to minimize air leakage, and to replace existing T-A-1 Vacuum jet by a unit capable of approximately 220 CFM (a) - 60" H₂O Vac., with a cutoff pressure greater than 75" and less than 150" H₂O to allow margin for control by use of the existing bleeder control system. The existing T-A-1 Vacuum - jet can then be installed on one of the Fractionators, thus providing separate venting systems for these units.

V. Fractionating System

Since the main feed to the Fractionator tower is vapor, the reboiler duty is a direct function of the 40% acid feed, and the reflux. Since reflux was specified, and the reboiler was designed using 6.8 GPM reflux instead of the calculated approximately 3.5 GPM, and since only 0.33 GPM water is boiled off in fractionating 1 GPM of 40% nitric acid to 60%, fractionating an additional 2.3 GPM of 40% nitric acid can be realized by decreasing reflux by 0.76 GPM still leaving ample X'S reflux.

Fractionators can handle the 40% acid from approximately 20 T/D uranium.

VI. Flow Instruments and Control Valves

It is suggested that these items be investigated by the Instrument Group.

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