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RECORD CENTER FILE

HW-26640

1 - [illegible] Hurd, K-25
2 - FW Hurd, K-25
3 - OH Greager
4 - AEC - HOO - Att'n. - DG Sturges
5 - FW Albaugh - AH Bushey
6 - FW Woodfield
7 - MK Harmon
8 - JG Bradley
9 - MJ Szulinski
10 - TW Hauff
11 - WN Mobley
12 - VR Cooper
13 - CT Groswith - AR Maguire
14 - RS Bell - VR Chapman
15 - RB Richards - JB Work
16 - 700 File
17 - 300 File
18 - Yellow

Richland, Washington
December 23, 1952

This Document consists of
7 pages [redacted]
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TO: File

FROM: R. B. Richards - J. B. Work, Separations Technology Unit
Engineering Department, Hanford Works

RBR JBW

REPORT ON TRIP TO K-25

The K-25 Plant was visited by R. B. Richards and J. B. Work on December 8 and 9, 1952 to discuss feed plant performance of the recent shipment (HW carload No. 12) of UO_3 prepared from Redox UNH and to continue discussions of UO_3 product specifications. Informal meetings were held with Messrs. Hurd, Lang, Katz, Lafferty, and Barton on Monday morning and with Hurd, Lang, Katz, Humes, and Huber Monday afternoon. Mr. Smiley conducted a brief tour through his new pilot plant the same afternoon. On Tuesday additional discussions were held with Hurd, Katz, Thompson, Parsons, and Smiley. A very brief visit was also made to Oak Ridge National Laboratory for short talks with Messrs. Steahly, Eister, Overholt, and Folger. Since the ORNL conversations were either general program reviews or dealt with specific and detailed questions which have already been reported orally to interested individuals at Hanford, no record of them is made. The following, therefore, is concerned entirely with the UO_3 discussions.

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CARLOAD 12

It did not prove possible to reach as definite conclusions at K-25 as hoped, because the car of UO_3 from HW Redox processing had been delayed in transit and was not delivered until 12/5/52 instead of the expected 11/29. It was unloaded on 12/8 and processing in the feed plant began 12/9. Preliminary determinations of laboratory reactivity (defined as ratio of percent conversion to UF_4 for test vs. standard samples hydrofluorinated simultaneously) were as follows:

Sample	Reactivity Ratio	
	As received	As hydrated
Car 12 composite	0.85	1.07
lot 163	0.75	1.10
lot 192	0.86	1.15

The per cent conversion of the control standard in the above runs was not reported other than that the standard normally is about 85% converted to UF_4. This value is surprisingly low since we were also told that the standard is a Mallinckrodt UO_3. It is of interest to note that the reactivity ratio for Harshaw UO_3 has averaged about 0.75 since April of 1952. The material in carload 12, with the possible exception of lots 161, 162, and 163, is thus seen to be more reactive than normal Harshaw feed.*

UO_3 FROM HW TBP PLANT

Examination of typical spectrographic analysis data for Hanford RCU solution from the TBP plant (analyzed batches from A-11-74 through B-12-2) also indicated a very encouraging picture for this material. It was pointed out that corrosion of the tubes in the evaporator while concentrating the 6% UNH to 60% is currently very serious, adding 1000 or 2000 ppm (U basis) of corrosion products (iron, chromium, and nickel) to the solution. It is evident that, if the corrosion problem can be solved readily, the purity of UO_3 from the TBP plant may be within striking distance of K-25 requirements. It was stated that, if corrosion products could be kept down so that the total metallic impurity concentration was in the vicinity of 200 to 300 ppm, a feed plant test carload would be desired.

*This indication was confirmed by information obtained later by telephone to the effect that carload 12 was processed to UF_4 in the feed plant with good conversion efficiency. Some difficulty was encountered in fluorination of lots 161-163 to UF_6, but lots 192-200 (higher purity) performed well.

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The reactivity of TBP origin UO_3 was also considered good. Samples of two recent Hanford lots, 204 and 209, were found to give reactivity ratios of 0.84 and 0.88 at K-25. Further, the spectrographic analyses of these samples at K-25 showed quite low impurity levels except for the corrosion products. These results are tabulated below. For comparison, samples of lots 204 and 209 were later analyzed at Hanford and the data are also shown below.

Element	K-25 Analysis		HW Analysis	
	Lot 204	Lot 209	Lot 204	Lot 209
Al	4	4	<10	20
Cr	200	300	100	500
Cu	4	6	20	20
Fe	400	800	500	1000
Mg	20	10	10	10
Mn	6	8	10	20
Na	30	20	20	20
Ni	60	100	50	200
Si	30	30	50	50

HYDRATION

All of the recent tests at K-25 (pilot plant and full scale feed plant as well as laboratory) have indicated that changing UO_3 to the monohydrate significantly improves the degree of conversion to UF_4, provides greater uniformity, and in some cases permits a lower temperature to be used for the hydrofluorination. The Harshaw UO_3, which normally gives a reactivity ratio of 0.75 to Mallinckrodt UO_3, is raised to a ratio of 0.85 to 0.90 by hydration. It is of interest to note that HW carload 12 without hydration appears about equivalent in reactivity to the Harshaw monohydrate, although the uniformity is probably not comparable. Hydration is not as beneficial in cases where the initial reactivity is high. For example, Mallinckrodt UO_3 hydrofluorinated at 1050°C after hydration is only 1.05 times as reactive as without hydration. At 850°C, however, the ratio is about 1.25. This observation is of considerable interest because the metallurgical properties of Monel (used for tray construction) are much better known below 900°C and calculations of equipment stresses and life are hence more certain.

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The hydrated oxide has lower density than the original UO_3. This correlates to a degree with the observed improved reactivity of hydrated Harshaw oxide over unhydrated Harshaw and with Hanford UO_3 over Harshaw UO_3. On the other hand, Mallinckrodt UO_3, which has the highest reactivity, is more dense than the others. The lower density of the recent tonnage of hydrated Harshaw UO_3 caused a minor handling problem at K-25, but this was overcome by slight modifications at the head end of one feed plant line. There is also a slight disadvantage in shipping the hydrated oxide due to the weight of water and also to the larger number of drums. The Harshaw material, for instance, weighed about 800 pounds per drum before and about 670 pounds per drum after hydration.

K-25 people estimate a 10 to 25% increase in feed plant capacity could be obtained with hydrated over a non-hydrated Harshaw or Hanford UO_3. Harshaw UO_3 has been run normally at about 260 lbs./hr. with 80% conversion and is currently being processed at about 220 lbs./hr. Mallinckrodt UO_3 has not been run recently but is assumed to provide 90% conversion at about 300 lbs./hr.

If carload 12 performs as expected (reasonably well) it will be desirable to consider equipment changes or additions to permit routine hydration of the Hanford UO_3. There are several alternatives which should be included in an economic study that could best be made jointly by K-25 and HW representatives rather than trying to compare two separate surveys made at the individual sites. Briefly, these would be:

1 - Install hydration equipment at K-25.

2 - Install hydration equipment at Hanford.

3 - Install additional pots at Hanford, permitting hydration in the pots without a double handling of powder.

4 - Install additional fluorine capacity at K-25, eliminating this present bottleneck to the processing of the needed tonnages of UO_3 which have only been 75 or 80% converted to UF_4.

While these various possibilities are quite involved, a few horseback conclusions warrant further examination.

a - Alternatives (1) and (2) might be more expensive than (3), providing hydration in the pots without intermediate grinding is feasible.

b - With this same provision, the possible expansion of the Hanford pot room now under consideration for reasons unrelated to hydration might reduce the cost of either alternative (2) or (3).

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