INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

May 15, 1968

MSR-68-79

To: P. N. Haubenreich

From: J. R. Engel

Subject: MSRE Book Uranium Inventories at Recovery of ^{235}Fuel Charge

Of the uranium that has been charged into the MSRE fuel salt to date, substantial amounts are known to have been:

A. consumed by fission and transmutation (burnup),

B. removed in salt samples, and

C. mixed into the flush salt.

In addition there will be further inter-mixing of the fuel and flush salts by the handling operations associated with the uranium recovery.

The uranium recovery operations also have loss mechanisms that are significant. First, part of the fuel salt will never get to the FST for fluorination because of runback from the filter. The uranium in that salt will remain in the reactor system. Second, the fluorination of the flush and fuel salts will not be carried to absolute completion; we anticipate leaving 10-ppm U in the flush salt and 100-ppm U in the fuel salt. This uranium will presumably be reduced to the metallic state by the zirconium treatment and deposited on the filter along with the reduced structural metals from corrosion products. However, some of this uranium could remain behind in the FST with the salt that is to be reserved for the distillation experiment. In the tabulation that is to follow, I assumed arbitrarily that the uranium that remains in the FST is proportional to the amount of salt left there.

Our best estimates of uranium losses and transfers have been combined into a "Book" material balance that is summarized in the attached table. It should be noted that there is room for some variation among these numbers depending on how far the fluorination is carried. However, we will probably end up with ~ 1.9 kg of the old uranium left in the fuel salt and ~ 0.1 kg in the flush salt.

J. R. Engel

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JRE:al

Attachment

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SUMMARY OF "BOOK" MATERIAL BALANCE
FOR URANIUM IN ^{235}U FUEL CHARGE IN MSRE

	Change (kg)		Net (kg)	
	U	^{235}U	U	^{235}U
FLUSH SALT				
Charged into Salt	0	0	0	0
Pickup from Fuel Salt	+5.811	+1.917	5.811	1.917
Return to Fuel Salt[A]	-0.044	-0.014		
Total Subject to Recovery			5.767	1.903
Anticipated Loss to Filter[B]	-0.043	-0.014		
Anticipated Recovery on NaF	-5.724	-1.889	0	0
Late Pickup from Fuel Salt[D]	+0.100	+0.033	0.100	0.033
FUEL SALT				
Charged into Salt	231.440	78.341	231.440	78.341
Charging Losses	-0.102	-0.065		
Burnup	-3.729	-3.925		
Loss to Samples	-0.256	-0.083		
Transfer to Flush Salt	-5.811	-1.917		
Pickup from Flush Salt	+0.044	+0.014		
Total Subject to Recovery			221.586	72.365
Transfer into Clean Flush Salt[D]	-0.100	-0.033		
Anticipated Loss to Filter[C]	-0.480	-0.157		
Anticipated Recovery on NaF	-219.116	-71.559		
Left Behind in FST	-0.011	-0.004		
Start New Fuel Loading[A,D]			1.879	0.612

A. Filter runback on transfer to FST.

B. 10 ppm in processed salt reduced to U^{o} by Zr.

C. 100 ppm in processed salt reduced to U^{o} by Zr.

D. This U does not leave the drain tanks.