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SUBJECT: HRT-CP: Results of H₂O-D₂O Separation Tests

TO: W. D. Burch

FROM: W. L. Albrecht

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SUMMARY

Tests indicate that D_2O and H_2O can be processed alternately in the dissolver without measurable contamination of D_2O by H_2O . The tests indicate also that the loss of D_2O per cycle could amount to about 100 grams, but it is considered unlikely that any loss will actually be incurred.

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In the H_2O - D_2O separation tests, 15 liters of a 5 per cent mixture of D_2O in H_2O was boiled from the dissolver three times. Between each boildown of the D_2O - H_2O mixture, 15 liters of H_2O was refluxed in the dissolver for 1 hr, 3 liters was boiled off, and the remainder was transferred to a decay tank by pressurizing the dissolver. In general, these steps simulated conditions that will be encountered in actual operation of the dissolver.

Specific gravity determinations were made of the D_2O - H_2O mixture after each boildown to determine the amount of contamination with H_2O . The D_2O content was determined also by mass spectrograph. The results of these determinations are presented in Table I. It is seen that while there is a small difference between the average specific gravities of the initial and final mixtures, the difference is less than the deviation in individual determinations. The mass spectrograph readings, accurate to about 2 per cent of the absolute value in this range, indicate that the mixture increased in D_2O content, which, of course, is impossible. It is concluded that substantially no contamination of the D_2O - H_2O mixture occurred in these tests.

Following each boildown of the D_2O - H_2O mixture, the mixture was drained from the D_2O receiver for weight determination and sampling. The mixture was then returned to the receiver. The loss of mixture, based on the amounts drained, was about 100 grams per boildown. It is considered unlikely, however, that there actually was a loss of D_2O - H_2O mixture. In other tests involving the D_2O receiver it was noted that draining from the receiver was quite inconsistent.

W. L. Albrecht
W. L. Albrecht

WLA:ms

Attachment: Table I

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Table 1. Results of Specific Gravity and Mass Spectrograph
Determinations of D₂O-H₂O Mixtures

D ₂ O-H ₂ O Mixture	Specific Gravity, g/cc ^a		Calculated ^b D ₂ O Content, % by Weight	Mass Spectrograph Average Atom % D ^c
	Individual Determinations	Average		
Initial mixture	1.00264 1.00270 1.00271	1.00268	5.564	5.06
Mixture after first boildown	1.00263 1.00271	1.00267	5.555	5.12
Mixture after second boildown	1.00268 1.00268	1.00268	5.564	5.16
Mixture after third boildown	1.00263 1.00264	1.00264	5.525	5.17

^aSpecific gravity determined by the pycnometer method; 25°C.

^bBased on average specific gravity.

^cPer cent of D + H.