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**FREEZING POINT DIAGRAM AND LIQUID-LIQUID SOLUBILITIES OF THE
SYSTEM URANIUM HEXAFLUORIDE-HYDROGEN FLUORIDE**

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Chief, Declassification Branch

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ABSTRACT

The complete freezing point diagram for the system uranium hexafluoride-hydrogen fluoride has been determined. In addition, liquid-liquid solubilities of these compounds have been measured up to the consolute temperature of 101°C. A miscibility gap starts at 61.2°C. over the composition range 10 to 80 mole per cent uranium hexafluoride. The lowest melting point of this binary system under its own pressure, i.e. the eutectic, is -85°C.

FREEZING POINT DIAGRAM AND LIQUID-LIQUID SOLUBILITIES OF THE SYSTEM URANIUM HEXAFLUORIDE-HYDROGEN FLUORIDE

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Frequent occurrence of hydrogen fluoride as an impurity or a product of reaction along with uranium hexafluoride has necessitated a detailed knowledge of the phase system of these two compounds. Very little work has been reported on this system.

Kirshenbaum (9) made a partial phase rule study of the system in the temperature range 66 to 72°C. and reported that two immiscible solutions were formed. Since this immiscibility indicated the absence of formation of a complex or compound between uranium hexafluoride and hydrogen fluoride the study was not pursued.

The present study is concerned with the phase system uranium hexafluoride-hydrogen fluoride over the entire composition range and involves liquid-solid and liquid-liquid equilibria. Liquid-vapor equilibrium is to be the subject of a subsequent report.

EXPERIMENTAL

Materials

Uranium hexafluoride used in this work CONTAINED
less than 0.015 weight per cent impurity. When vapor pressures at room temperature or 0°C. were higher than reported values (4), this material was pumped until correct pressures were obtained.

Anhydrous hydrogen fluoride was prepared by the method described by Wendolkowski and Barber (15).

Apparatus

Three types of apparatus have been used in this study: 1) filter cell; 2) freezing point cell; 3) transparent Fluorothene tube. The filter cell (figure 1) was used to measure solubilities at temperatures of -5° to 25°C., in which range thermal effects in the freezing point cell could not be determined. The freezing point cell (figure 2) was used when a thermal effect was measurable, i.e., from about 7 to 100 mole per cent uranium hexafluoride under conditions of solid-liquid equilibrium. A more complete discussion of the apparatus has been given by Wendolkowski and Barber (15). A Fluorothene tube (figure 3) was used to measure solubilities in the miscibility gap where visual observation was necessary. This apparatus was used to investigate the whole liquid-liquid system from 62 to 100°C., over the approximate concentration range 10 to 80 mole per cent uranium hexafluoride. It was also used in the region 2 to 10 mole per cent uranium hexafluoride, a region overlapped by the other two units.

FILTER CELL

FIGURE 1

LEGEND:

- A---FREEZING POINT CELL.
- B---SOLENOID.
- C---COPPER SHIELD.
- D---CELL THERMOCOUPLE.
- E---SHIELD THERMOCOUPLE.
- F---AIR THERMOSTAT.
- G---GLASS DEWAR.
- H---NICHROME HEATER COIL.
- I---METAL DEWAR.
- J---GLASS WOOL INSULATION.
- K---STOPCOCK LEADING TO VACUUM PUMP.
- L---CELL ANCHOR.
- M---PLASTIC LIDS.
- N---FIREBRICK SHIELD BASE.
- O--- $UF_6 + HF$ MIXTURE.
- P---PISTON OF STIRRER.
- Q---NICKEL ROD PISTON STOPS.

FREEZING POINT CELL WITH AUXILIARY EQUIPMENT

FIGURE 2

FLUOROTHENE TUBE

FIGURE 3

Procedure

Tube #1 of the filter cell assembly (figure 1) was charged by condensation with a synthetic mixture of hydrogen fluoride and uranium hexafluoride, containing an excess of the latter. The unit, which was mounted on a frame, was then placed in a Prestone-water refrigerator and rotated overnight at a controlled temperature. An average of several Beckman thermometer readings, taken the last hour before filtering, was used as a measure of the solution temperature. Fluctuations in temperature in the refrigerator were less than $\pm 0.05^\circ\text{C}$. After stopping the thermostat rotor so that the cell (figure 1) was in an inverted position, valve V-1 was opened to allow solution to pass through the filter disk and into tube #2. This filtrate was weighed and then analyzed colorimetrically for uranium.

The freezing point cell (figure 2) was loaded under vacuum conditions with uranium hexafluoride and the weight determined, using an analytical balance, with an accuracy of ± 2 milligrams. Enough hydrogen fluoride was then added, by liquid nitrogen condensation, to give the desired synthetic mixture. The melting point of a sample of carefully purified uranium hexafluoride was used as a primary standard after the absolute correction of the copper-constantan thermocouple was found to be only about 0.1°C . This fixed point temperature was measured by Grisard and Oliver (4) as $64.02 \pm 0.05^\circ\text{C}$. Above 7 mole per cent uranium hexafluoride all temperature measurements were within 5 degrees of this melting temperature.

The melting point of pure hydrogen fluoride at -83.6°C^* was used as a calibration point for measurements of the uranium hexafluoride-hydrogen fluoride eutectic temperature, which was less than two degrees from this melting temperature. Double White and K-2 potentiometers were used in conjunction with the freezing point cell.

In order to determine the temperature at which two liquid layers disappear, forming one homogeneous solution, it was necessary to use a transparent Fluorothene tube. This tube (figure 3) was partially filled with weighed quantities of the two chemicals and heated in an air thermostat, with manual shaking of the mixture, until the two layers disappeared. Temperature was measured by use of a calibrated copper-constantan thermocouple and a K-2 potentiometer. The major source of error arose from the difficulty of determining exactly when the two layers disappeared or reappeared. Errors involved in this method amount to as much as $\pm 2^\circ\text{C}$.

*Published literature gives -83°C . as the melting point of hydrogen fluoride. A value of -83.2°C . was obtained in the present work by use of the copper-constantan thermocouple and a speedomax recorder, this combination having been calibrated at -78°C . G. D. Oliver and J. W. Grisard of this laboratory determined a triple point of -83.6°C . in a low temperature calorimetric cryostat (11). This last value was taken to be the best value.

RESULTS

Results obtained in this research are summarized in tables I, II, and III, corresponding to experiments using the freezing point cell, Fluorothene cell, and filter cell, respectively. Calculations involved in converting gross composition to estimated liquid composition values for freezing point cell data are given in appendix B.

These results are shown graphically in figures 4 through 7. All experimental points are the results of two or more determinations.

TABLE I

FREEZING POINT VALUES USING FREEZING POINT CELL

Gross Composition, Mole % UF ₆	Freezing Temp., °C.	Estimated Liquid Composition*		Instrument
		Mole % UF ₆	Wt. % UF ₆	
100.00	64.02	100.00	100.00	Cryostat**
98.37	63.76	99.63	99.98	K-2
95.06	63.09	98.45	99.91	K-2
92.93	62.53	96.47	99.79	K-2
92.93	62.39	96.47	99.79	White
90.46	62.51	95.77	99.75	K-2
90.04	62.45	94.15	99.65	K-2
86.02	61.95	90.46	99.40	K-2
79.55	61.56	87.73	99.21	K-2
74.63	61.32	81.56	98.73	White
65.21	61.18	70.44	97.67	White
64.87	61.25	72.54	97.89	K-2
53.53	61.25	56.77	95.85	White
50.77	61.14	55.02	95.56	K-2
24.08	61.16	24.52	85.11	K-2
12.04	60.96	11.92	70.43	K-2
9.60	60.55	9.45	64.75	K-2
8.48	60.25	8.32	61.51	K-2
6.90	59.12	6.67	55.70	K-2
95.06	-85.10	95.06	99.71	K-2
83.06	-84.99	83.06	98.85	White
82.03	-85.10	82.03	98.77	White
65.21	-85.06	65.21	97.06	White
53.53	-85.13	53.53	95.30	White
6.90	-84.18	6.90	56.59	K-2
0.00	-83.6	0.00	0.00	Cryostat**

*See appendix B

**See references 4 and 11

TABLE II

SOLUBILITIES MEASURED BY USE OF TRANSLUCENT FLUOROTHERE TUBES

Liquid Composition		Temp., °C.	Remarks
Mole % UF_6	Wt. % UF_6		
0.781	12.16	5.0	Temperature Corresponds to the Start of Precipitation of UF_6 from Solution
1.593	22.17	26.5	"
3.04	35.57	44.3	"
3.93	41.87	50.	"
4.20	43.58	52.	"
5.39	50.04	55.	"
6.24	53.96	55.	"
7.95	60.30	58.	"
8.51	62.07	59.	"
10.28	66.84	69.	Temperature Corresponds to the Disappearance of 2 Liquid Layers
10.38	67.08	69.	"
12.20	70.97	78.	"
16.29	77.41	83.	"
19.85	81.34	87.9	"
23.39	84.31	90.3	"
28.58	87.54	97.2	"
29.13	87.86	93.2	"
39.38	91.96	98.8*	Tube Ruptured Before Solution Became Completely Homogeneous
49.97	94.62	100.5	Tube Ruptured After Homogeneous Solution Was Formed
53.14	95.23	99.9	Temperature Corresponds to the Disappearance of 2 Liquid Layers
55.40	95.63	95.7	"
57.09	95.90	95.	"
58.45	96.12	98.	"
61.35	96.54	90.5	"
62.03	96.64	93.5	"
64.49	96.97	87.5	"
66.70	97.23	83.	"
67.13	97.29	84.0	"
69.35	97.55	79.5	"
72.96	97.94	76.	"
91.09	99.45	62.3	Solid UF_6 Precipitated from Solution

PHASE DIAGRAM OF THE CONDENSED SYSTEM: UF_6 -HF
 Temperature Vs. Mole Percent UF_6
 (M.W. HF = 20 ; M.W. UF_6 = 352)

FIGURE 4

PHASE DIAGRAM OF THE CONDENSED SYSTEM: UF_6 - HF
Temperature Vs. Weight Percent UF_6

FIGURE 5

FREEZING POINT OF UF_6 AS A FUNCTION OF HF CONCENTRATION

FIGURE 6

PHASE DIAGRAM OF THE CONDENSED SYSTEM: UF_6 -HF $\log N_{\text{UF}_6}$ Vs $1/T$

FIGURE 7

TABLE III
SOLUBILITY VALUES USING FILTER CELL

Liquid Composition		Bath
Mole % UF_6	Wt. % UF_6	Temp., °C.
0.98	14.76	+25.0
0.48	7.88	- 0.06
0.45	7.37	+ 0.01
0.41	6.78	- 5.05
0.32	5.38	- 5.17
0.27	4.53	- 5.00
0.24	4.00	- 5.09
0.16	2.77	- 5.01

DISCUSSION

Data summarized in tables I through III and figures 4 through 7 are largely self explanatory. Details of the type of system that contains a miscibility gap are given by Glasstone (3), Ricci (13), and others.

Analysis of data in the temperature range where solid uranium hexafluoride can exist is accomplished most readily in terms of activity coefficients. In the present case these may be calculated for uranium hexafluoride but not for hydrogen fluoride, since the solid-vapor pressure equation, or heat of sublimation, of the latter compound has not been determined. The activity coefficient, γ_1 , of component 1 may be expressed according to ideal solution theory by equation 1.

$$\bar{P}_1 = \gamma_1 X_1 P_{1,1}^0 \quad (1)$$

$\bar{P}_1$ = partial pressure of component 1 over the solution at temperature $t^\circ\text{C}$.

γ_1 = activity coefficient of component 1 in solution.

X_1 = mole fraction of component 1 in solution.

$P_{1,1}^0$ = vapor pressure of pure, liquid component 1 at temperature $t^\circ\text{C}$.

Hydrogen fluoride has long been known to be associated (1, 5, 10, 12, 15), or polymerized, in the gas phase. The degree of association and, hence, the average molecular weight of gaseous hydrogen fluoride is a function of the relative pressure. Since the Trouton constant of hydrogen fluoride is "normal" (i.e., 20.8 entropy units (8)) it is probable that hydrogen fluoride in the liquid state is associated to about the same degree as it is in

the saturated vapor. This association has been measured for vapor over only a limited temperature range (1,10,12,15) and because a "normal" Trouton constant may have little meaning in this case, it has been necessary to use a formula weight for hydrogen fluoride rather than a molecular weight. All "mole fraction" or "mole per cent" expressions used in this report are therefore based on a formula weight of 20 for hydrogen fluoride.

Partial pressures of uranium hexafluoride were not measured in the present experiments; hence, the value of P_1 in equation 1 is known only for the saturated solution (solution in equilibrium with solid uranium hexafluoride), where $P_1 = P_{1,s}^0$. This is expressed by equation 2. The subscript 1 has been replaced by UF_6 .

$$\bar{P}_{UF_6} = P_{UF_6,s}^0 = \gamma_{UF_6} X_{UF_6} P_{UF_6,1}^0 \quad (2)$$

$P_{1,s}^0$ = vapor pressure of pure solid component 1 at temperature $t^\circ C$.

Values of "ideal" activity coefficients of uranium hexafluoride listed in table IV were calculated from equation 2 by use of experimental solubility data (X_{UF_6}) and the vapor pressure equation of Grisard and Oliver ($P_{UF_6,s}^0$ and $P_{UF_6,1}^0$).

A partial analysis of the solid-liquid equilibrium data has been made in terms of the theory of real solution developed by Scatchard, Hildebrand, Flory, and Huggins (6). This theory may be expressed by equation 3 in which the subscript 1 refers to uranium hexafluoride and 2 to hydrogen fluoride.

$$\ln \gamma_1 = \frac{V_1 \phi_2^2 (\delta_2 - \delta_1)^2}{RT} + \ln \frac{\phi_1}{X_1} - \phi_2 \left(\frac{V_1}{V_2} - 1 \right) \quad (3)$$

γ_1 = activity coefficient of UF_6 .

V_1 = molar volume of UF_6 .

V_2 = molar volume of HF.

ϕ_1 = volume fraction of UF_6 .

ϕ_2 = volume fraction of HF.

ΔE_1 = energy of vaporization of liquid UF_6 .

ΔE_2 = energy of vaporization of liquid HF.

$\delta_1 = (\Delta E_1/V_1)^{1/2}$.

$\delta_2 = (\Delta E_2/V_2)^{1/2}$.

X_1 = mole fraction of UF_6 in a saturated solution with HF.

R = gas constant.

T = temperature in °K.

TABLE IV
ACTIVITY COEFFICIENTS OF URANIUM HEXAFLUORIDE

Temp., °C.	Solubility, Mole Frac. UF_6		Activity Coefficient of UF_6 , γ_{UF_6}		
	Measured	Ideal	Ideal	Theory*	Adjusted**
- 5	0.0039	0.237	61.	840	65.
0	0.0050	0.265	51.	880	57.
10	0.0079	0.330	42.	740	53.
20	0.0120	0.400	33.3	600	48.
30	0.0158	0.490	31.1	410	37.
40	0.0255	0.600	23.5	250	28.
50	0.040	0.740	18.5	130	19.
60	0.088	0.9185	10.4	25	6.7
61	0.098	0.9383	9.6	19	5.6
62	0.926	0.9583	1.03	1.001	1.00
63	0.980	0.9788	1.00	1.000	1.00
64	0.9996	0.9995	1.00	1.000	1.00

*Equation 3 with data given in appendix A.

**Calculated by reducing values of δ_2 by 1.2 units.

Application of equation 3 to the present system is summarized in appendix A. Values of the activity coefficient calculated according to this equation are listed under the heading "Theory" in table IV. The large deviations between these values and those calculated by use of equation 2 are obvious, and result from the extensive polymerization of hydrogen fluoride, as well as uncertainties in the thermodynamic data on this compound. Equation 3 is not applicable to polymerized systems. However, it is interesting to note that if the δ values for hydrogen fluoride (appendix A) are reduced by about 1.2 units (corresponding to a reduction in the energy of vaporization by 800 cal./mole) the Scatchard, Hildebrand, Flory, Huggins equation yields values of γ_1 in good agreement with those calculated from equation 2.

Data on freezing temperatures of uranium hexafluoride-hydrogen fluoride mixtures in the region of 80 mole per cent or more of the former are of interest from the standpoint of impurity analyses. Results from the present work are summarized in table I. It should be noted that gross compositions obtained from known weights of the two chemicals have been corrected to "Estimated Liquid Compositions". These corrections are appreciable and were made because other work (2) in this laboratory on liquid-vapor equilibrium in the system uranium hexafluoride-hydrogen fluoride has shown large differences between liquid and vapor composition. Thus, at 67°C. a solution containing 99 mole per cent uranium hexafluoride is in equilibrium with vapor containing 52 mole per cent hexafluoride. Calculations involved in estimating liquid composition from gross composition are summarized in appendix B. It is apparent from the data of table IV (corresponding to corrected solution compositions of table I) that uranium hexafluoride and hydrogen fluoride

form ideal solutions when the concentration of the latter is less than 2 mole per cent. Even when this value is increased to about 4 mole per cent the deviations from ideal solution theory are not large, and correspond to an activity coefficient for uranium hexafluoride of 1.03.

Finally, mention should be made of the general nature of phase system indicated by the data. Ricci* has listed four types of vapor pressure relations for two-liquid systems. Results of the present study show that uranium hexafluoride and hydrogen fluoride form a miscibility gap according to Ricci's type II or type IV, shown schematically in figure 8. Transition from IV to II occurs if saturated vapor and liquid composition lines intersect.

VAPOR PRESSURE RELATIONS FOR 2-LIQUID SYSTEMS

Figure 8

*See p. 71 of Ref. 13

Mutual solubilities in the liquid-liquid range, figures 4 through 7, (above the 61.2°C. invariant temperature) were studied by visual observations of the temperature at which two liquid phases of a synthetic mixture disappeared. This temperature was the same as that at which two immiscible phases formed from a homogeneous solution, within the average error of about $\pm 1^\circ\text{C}$. No unusual effects were noted on either cooling or heating these mixtures past the miscibility temperature. Although no experiment was performed with a mixture having the maximum temperature of incomplete miscibility, it is probable that the interpolated value of the consolute temperature 101°C. is accurate within $\pm 2^\circ\text{C}$.

Exact limits on compositions of the two immiscible phases at 61.2°C. cannot be given. Best approximations are 10.0 ± 0.5 mole per cent uranium hexafluoride in the one region and 80 ± 3 in the other.

SUMMARY AND CONCLUSIONS

The condensed phase system uranium hexafluoride-hydrogen fluoride has been studied over the whole range of composition. Below 61.2°C. solubilities are much lower than ideal values, evidently as a result of large differences in the "cohesive energy densities" of the two compounds. Above the four phase invariant temperature of 61.2°C. uranium hexafluoride and hydrogen fluoride exhibit a miscibility gap with a consolute temperature of about 101°C. Compositions of the two immiscible solutions at 61.2°C. are approximately 10 and 80 mole per cent uranium hexafluoride.

Measurements over the composition range 6.9 to 95 mole per cent uranium hexafluoride have shown a single binary eutectic at -85°C . Hence, formation of a complex or compound between uranium hexafluoride and hydrogen fluoride is quite improbable.

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December 28, 1951

NOTEBOOK REFERENCES

No. 1602 Assigned to G. P. Rutledge p. 1-104

No. 1709 Assigned to G. P. Rutledge p. 1-96

Experimental work completed August 28, 1951.

APPENDIX A

Calculation of Activity Coefficient of Uranium Hexafluoride According to Equation 3

$$\ln \gamma_1 = \frac{v_1 \phi_2^2 (\delta_2 - \delta_1)^2}{RT} + \ln \frac{\phi_1}{x_1} + \phi_2 \left(\frac{v_1}{v_2} - 1 \right) \quad (3)$$

Subscript 1 refers to uranium hexafluoride and 2 to hydrogen fluoride. Terms are defined under "Discussion".

The heat of vaporization of liquid uranium hexafluoride was calculated from equations 1-A and 2-A, proposed by Grisard and Oliver (4). Energy of vaporization was calculated from equation 3-A.

$$\Delta H_{v,1} = 4994.5 \left[\frac{T}{t + 217.22} \right]^2 \sqrt{1 - \frac{1.9032 P}{(T \times 10^{-2})^3}} \quad (1-A)$$

t = temperature in °C.

P = pressure in atmospheres.

$$\log P_{\text{sat.}} = 6.93718 - \frac{1091.537}{t + 217.22} : \text{Liquid } \text{UF}_6 \quad (2-A)$$

$$\Delta E_{v,1} = \Delta H_{v,1} - RT \quad (3-A)$$

Vapor pressure data for hydrogen fluoride are meager, and no variation of heat of vaporization with temperature has been reported. K. K. Kelley (8) has summarized available data in terms of equation 4-A. From this equation the heat of vaporization is calculated to be 6090 cal. per 20 g. of hydrogen fluoride.

$$\log P_{\text{atm.}} = -\frac{1331}{T} + 4.549 : \text{liquid HF} \quad (4-A)$$

The energy of vaporization is given by equation 5-A.

$$\Delta E_{v,2} = 6090 - RT \quad (5-A)$$

Molar volumes for uranium hexafluoride (7,10) and hydrogen fluoride were calculated according to equations 6-A and 7-A, respectively.

$$v_1 = \frac{352.07}{3.674} \left[1 + 1.727 (t - 64.05) 10^{-3} + 3.59 (t - 64.05)^2 10^{-6} \right] \quad (6-A)$$

$$v_2 = 20.00 \left[1 + 0.85 (t - 5.00) 10^{-3} \right] \quad (7-A)$$

Volume fractions of the two chemicals were calculated on the basis of ideal mixing since no solution densities have been reported. Thus $\bar{V}_1 = X_1 V_1$ and $\bar{V}_2 = X_2 V_2$, where $\bar{V}_1$ and $\bar{V}_2$ are the partial molar volumes of uranium hexafluoride and hydrogen fluoride, respectively, $\phi_1 = \bar{V}_1 / (\bar{V}_1 + \bar{V}_2)$, and $\phi_2 = (1 - \phi_1)$.

A summary of all quantities used in calculations is given in table A-I.

TABLE A-1
SUMMARY OF DATA USED WITH EQUATION 3

Temp., °C.	$\bar{V}_1$	$\bar{V}_2$	ϕ_1	V_1 , cc.	V_2 , cc.	X_1 , Mole Fraction UF ₆
- 5	9.27	16.7	0.0169	86.11	19.83	0.0039
0	9.18	16.7	0.0212	86.64	19.92	0.0050
10	9.00	16.6	0.0335	87.89	20.09	0.0079
20	8.83	16.5	0.0507	89.21	20.26	0.0120
30	8.66	16.4	0.0664	90.60	20.43	0.0158
40	8.48	16.3	0.105	92.04	20.60	0.0255
50	8.31	16.2	0.158	93.57	20.77	0.040
60	8.13	16.1	0.305	95.17	20.94	0.088
61	8.12	16.1	0.331	95.33	20.95	0.098
62	8.10	16.1	0.983	95.49	20.97	0.9260
63	8.08	16.1	0.995	95.66	20.99	0.9800
64	8.06	16.1	1.000	95.82	21.00	0.9996

APPENDIX B

Conversion of Gross Composition to Liquid Composition for Freezing Point Data

Conversion of gross composition to liquid composition in the case of freezing point experiments was accomplished by calculation of the weight distribution of uranium hexafluoride and hydrogen fluoride between liquid and vapor. This calculation was made possible by experiments now being performed in this laboratory on liquid-vapor equilibrium in the system uranium hexafluoride-hydrogen fluoride. Liquid-vapor composition data (2) were used in the form of a plot of weight per cent uranium hexafluoride in liquid versus weight per cent in vapor, as given in figure 9.

Vapor and liquid volumes were calculated from values of the densities of uranium hexafluoride (14) and hydrogen fluoride (density assumed to be 1 gm./cc.), known weights of the two materials, and a known freezing point cell volume. The weight of uranium hexafluoride in the vapor was calculated from the vapor volume, temperature, and vapor pressure (4); by difference the weight of uranium hexafluoride in the liquid was obtained. Then, the weight distribution of hydrogen fluoride was obtained, by successive approximations, using the liquid versus vapor composition graph of figure 9.

Because the top portion of the freezing point cell was within the solenoid most of the vapor was about 30°C. hotter than the freezing solution. In the temperature region 61.2 to 64.02°C. (about 335°K.) this corresponds to about a ten per cent reduction of the total quantity of vapor. Therefore, calculated values of weights of uranium hexafluoride and hydrogen fluoride in the liquid were increased by ten per cent of the calculated vapor values. Weights so obtained were used to calculate "Estimated Liquid Compositions" listed in table I.

A sample calculation follows.

	Gross composition	= 95.06 mole % UF_6
	Freezing Temp.	= 63.09°C.
	Liquid Volume	= 7.0 cc.
	Vapor Volume	= 55.0 cc.
	Vapor pressure of liquid UF_6 at 63.09°C.	= 1083 mm.
	UF_6 in vapor	= 1.000 gm.
	Total UF_6	= 24.372 gm.
By difference,	UF_6 in liquid	= 23.372 gm.
	Total HF	= 0.072 gm.
From fig. 9,	HF in vapor	= 0.057 gm.
	HF in liquid	= 0.015 gm.
10% Temp. correction	UF_6 in vapor	= 0.900 gm.
	HF in vapor	= 0.051 gm.
	UF_6 in liquid	= 23.472 gm.
	HF in liquid	= 0.021 gm.
	Estimated Liquid Composition	= 98.45 mole % UF_6

END