Atlantic Richfield Hanford Company
Richland, Washington 99352

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ESTIMATED HANFORD LIQUID WASTES CHEMICAL INVENTORY
AS OF MARCH 31, 1976

R. G. Geier

June 1976

PREPARED FOR THE U.S. ENERGY RESEARCH AND DEVELOPMENT
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AS OF MARCH 31, 1976

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Waste Management Process Engineering and Design
Development Engineering Department
Research and Engineering Division

June 1976

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AS OF MARCH 31, 1976

INTRODUCTION

The objective of the current Hanford waste solidification program is the conversion of all liquid wastes of an immobile salt cake and an associated terminal liquor for an interim storage period. The salt cake will be stored in existing single-shell tanks, and the terminal liquor will be stored in new double-shell tanks.

The first step in scheduling the space requirement for the storage of salt and terminal liquor is to have an up-to-date inventory of dilute waste. This document presents such an inventory as of March 31, 1976, and supersedes a similar document published in March 1976 (reference 1).

SUMMARY

The dilute liquid wastes at Hanford comprise a volume of 4.4 million gallons. The liquid contains 51.8×10^6 gram moles (8.8×10^6 pounds) of sodium salts and 3.2 megacuries of ^{137}Cs .

DISCUSSION

The definition of the terms used in subsequent tables is shown in Table I.

The average compositions and volumes (reference 2) of the various types of wastes are summarized in Table II. The analytical data used to compile the average compositions are in the Appendix. The total amount of the individual constituents in each type of dilute waste is tabulated in Table III.

REFERENCES

1. ARH-CD-622 (unclassified), March 1975, R. G. Geier, "Hanford Liquid Waste Inventory as of December 31, 1975"
2. ARH-CD-702A (unclassified), May 26, 1976, J. D. Anderson, "Production and Waste Management Division Waste Status Summary January 1, 1976, Through March 31, 1976"

TABLE IDEFINITION OF TERMS USED IN TABLES II AND III

EB-ITS	- Evaporator Bottoms of In-Tank Solidification
EB-242-T	- Evaporator Bottoms of 242-T System
EB-242-S	- Evaporator Bottoms of 242-S System
RIX	- Ion Exchange Waste from Redox Supernate
IX (PUREX)	- Ion Exchange Waste from Purex Supernate
PSS	- Sludge Wash Waste
CW	- Coating Wastes
OWW	- Organic Wash Waste
Miscellaneous	- Includes B Plant (Low Level) Waste, 300 Area Waste and Semiworks Waste, First Cycle, Decontamination Waste, Second Cycle, TDP Waste
Standard Deviation	- A measure of the variation or scatter of the points around an arithmetic mean.
Standard Error	- A measure of the variation or scatter of the points about the line of regression.

TABLE II

LIQUID WASTE INVENTORY - MARCH 31, 1976

Waste	Type ⁽¹⁾	Volume ⁽²⁾ (Gal. x 10 ⁻⁶)	NaOH	NaAlO ₂	NaNO ₃	NaNO ₂	Na ₂ CO ₃	Na ₃ PO ₄	¹³⁷ Cs Ci/gal
EB - ITS	Free Liquid	3.89 ⁽³⁾	2.7	1.7	2.8	1.5	0.32	0.02	1.1
	Interstitial Liquid	1.47 ⁽⁴⁾							
EB - 242-T	Free Liquid	6.46 ⁽⁵⁾	1.5	0.7	3.9	1.6	0.34	0.05	1.2
	Interstitial Liquid	1.25 ⁽⁶⁾							
EB - 242S	Free Liquid	2.92 ⁽⁷⁾	3.6	1.3	4.1	2.0	0.41	0.08	2.2
	Interstitial Liquid	2.21 ⁽⁸⁾							
Redox IX		0.78	1.38	0.93	5.4	0.58	0.17	0.012	0.8
Purco IX		1.32	0.34	0.02	0.62	0.93	0.47	0.04	0.3
PSS		0.70	(0.2) ⁽⁹⁾	(0.01)	(0.2)	(0.4)	(0.1)	--	2
CS		0.33	(0.5)	(1.0)	(0.5)	(0.5)	-	-	(0.1)
OWW		0.16	-	-	(0.1)	-	(0.3)	-	(0.1)
Miscellaneous		1.14	0.32	0.06	1.2	0.28	0.17	0.09	0.6

(1) See Table I for Notation

(2) Volumes from reference 1 and personal communication - JD Anderson

(3) Includes Tanks 106, 108, 109, and 112-B, 105, 106, 110, 111, and 112-BX, 101, 102, 103, 104, 106, 106, 108, 110, 111, and 112-BY

(4) 33 percent of the solids in Tanks listed under (3)

(5) Includes Tanks 102-112-TX, 114, 115-TX, 102, 103, 105, 106, and 111-U

(6) 33 percent of the solids in Tanks listed under (5)

(7) Includes Tanks 101, 103, 105, 106, 108, 112-S, 102 - 106-SX, 107 - 109-U

(8) 33 percent of the solids in Tanks listed under (7)

(9) Values in parentheses are estimated concentrations

TABLE III.

DISSOLVED SALTS AND CESIUM INVENTORY IN DILUTE LIQUID WASTE
MARCH 31, 1976

Waste Type	Volume Gal x 10 ⁻⁶	NaOH	NaAlO ₂	NaNO ₃	NaNO ₂	Na ₂ CO ₃	Na ₃ PO ₄	¹³⁷ Cs Ci x 10 ⁻⁶
		Gram moles x 10 ⁻⁶						
Redox IX	0.78	4.07	2.74	15.9	1.71	0.50	0.03	0.6
Purax IX	1.32	1.70	0.10	3.1	4.65	2.35	0.20	0.4
PSS	0.70	0.53	0.03	0.53	1.06	0.03	-	1.4
CW	0.33	0.62	1.25	0.52	0.62	-	-	0.03
OWN	0.16	-	-	0.06	-	0.18	-	0.02
Miscellaneous	1.14	1.38	0.26	5.17	1.21	0.73	0.39	0.7
Total	4.43	8.3	4.4	25.4	9.3	3.8	0.6	3.2

APPENDIX

The analytical data on the individual samples used as the basis for Table I are presented in the following tables. Analyses have not been determined on some of the dilute wastes, e.g., PSS, CW, and OWW. Approximate composition of these wastes was estimated from plant flowsheet values.

LIQUID WASTE COMPOSITIONS

(Non Radioactive Constituents Reported as Molarity)

ITS BOTTOMS

	<u>NaOH</u>	<u>NaAlO₂</u>	<u>NaNO₃</u>	<u>NaNO₂</u>	<u>Na₂CO₃</u>	<u>Na₃PO₄</u>	<u>Cs(Ci/Gal)</u>
112-B	2.9	-	2.06	1.61	0.28	-	-
105-BX	2.11	1.17	2.51	1.24	0.25	0.02	1.1
106-BX	2.09	1.15	2.43	1.94	0.26	0.02	1.3
110-BX	3.42	1.99	2.84	1.67	0.09	--(1)	0.4
	3.22	3.29	2.93	1.70	0.23	--	-
111-BX	1.36	1.1	2.76	1.27	0.42	-	-
101-BY	3.62	1.96	2.52	1.02	-	-	-
102-BY	2.48	2.0	2.92	2.17	0.27	0.03	1.4
	2.51	1.11	3.60	1.74	0.28	0.01	1.7
	2.52	1.51	3.82	0.38	-	-	-
104-BY	1.49	0.74	1.97	1.32	0.38	-	0.3
106-BY	3.3	2.89	2.76	1.95	0.24	0.01	1.5
	3.09	1.96	1.9	1.38	-	-	1.1
110-BY	3.10	-	-	-	0.87	-	--
112-BY	3.2	1.52	3.5	1.68	0.30	-	-
Mean	2.73	1.65	2.75	1.51	0.32	0.018	1.10
St. Deviation	0.62	0.60	0.59	0.45	0.19	0.008	0.50
...			0.15	0.12	0.05	0.035	0.30

(1) No value reported

242-T EB

	<u>NaOH</u>	<u>NaAlO₂</u>	<u>NaNO₃</u>	<u>NaNO₂</u>	<u>Na₂CO₃</u>	<u>Na₃PO₄</u>	<u>Cs (Ci/Gal)</u>
102-TX	1.75	0.91	3.7	2.3	0.75	0.04	1.6
103-TX	2.86	(1)	(1)	(1)	(1)	(1)	0.2
	2.85	1.30	3.16	1.7	0.42	0.06	1.8
104-TX	3.02	(1)	(1)	(1)	0.46	(1)	(1)
107-TX	(1)	(1)	4.8	1.2	(1)	(1)	(1)
108-TX	0.65	0.24	6.9	3.9	0.17	0.04	0.6
108-TX	0.84	(1)	(1)	(1)	(1)	(1)	0.7
	0.37	0.25	5.6	0.3	0.31	0.06	0.6
109-TX	2.81	1.56	3.0	2.5	0.25	0.02	1.9
109-TX	0.02	0.33	3.8	0.4	(1)	(1)	(1)
109-TX	1.08	0.67	4.0	1.4	0.54	0.05	1.6
111-TX	2.11	1.3	5.1	2.6	0.25	0.1	2.0
111-TX	1.03	(1)	2.3	1.4	3.23	0.04	(1)
105-U	1.11	0.5]	2.6	0.9	0.21	0.04	0.9
103-U	1.08	0.34	2.8	1.0	0.20	0.04	0.9
102-U	0.98	0.62	3.5	1.2	0.23	0.05	1.0
Average	1.5	0.7	3.8	1.5	0.5	0.05	1.1
Mean	1.50	0.73	3.94	1.63	0.34	0.05	1.15
St. Deviation	0.99	0.47	1.33	1.04	0.17	0.02	0.60
St. Error	0.26	0.14	0.37	0.30	0.05	0.006	0.17

242-S BOTTOMS

	<u>NaOH</u>	<u>NaAlO₂</u>	<u>NaNO₃</u>	<u>NaNO₂</u>	<u>Na₂CO₃</u>	<u>Na₃PO₄</u>	<u>Cs (Ci/Gal)</u>
101-S	3.60	1.82	4.7	2.2	0.32	(1)	2.4
106-S	5.20	1.45	2.9	1.02	0.15	0.05	1.4
109-S	5.57	1.19	4.8	1.8	0.15	0.15	1.9
	5.07	(1)	(1)	(1)	(1)	(1)	2.9
110-S	3.19	1.48	3.7	1.7	0.20	0.06	2.0
111-S	5.16	1.34	4.9	2.8	(1)	0.05	2.9
112-S	4.54	(1)	(1)	(1)	0.29	(1)	1.8
104-SX	2.36	1.48	4.51	2.7	0.77	(1)	(1)
105-SX	2.32	1.41	5.1	2.8	0.79	(1)	2.1
108-U ⁽²⁾	2.02	(1)	4.3	2.5	0.59	(1)	(1)
109-U ⁽²⁾	1.00	0.13	2.2	0.2	(1)	(1)	(1)
Mean	3.64	1.29	4.12	1.97	0.41	0.077	2.2
St. Deviation	1.56	0.50	0.99	0.99	0.27	0.049	0.5
St. Error	0.47	0.18	0.33	0.30	0.10	0.024	0.2

(1) Value not reported

(2) Recently converted to 242-S bottoms tanks.

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PUREX IX

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	<u>NaOH</u>	<u>NaAlO₂</u>	<u>NaNO₃</u>	<u>NaNO₂</u>	<u>Na₂CO₃</u>	<u>Na₃PO₄</u>	<u>Cs (Ci/Gal)</u>
103-BX	0.36	(1)	(1)	(1)	(1)	(1)	0.7
	0.26	0.02	0.50	0.58	0.26	0.02	0.2
	0.01	0.003	0.34	0.43	0.55	0.01	0.1
104-BX	0.72	0.01	0.22	0.76	0.56	0.03	0.2
	0.22	0.01	0.59	1.02	0.60	0.02	0.1
	0.01	0.002	0.50	0.77	0.58	0.01	0.1
	0.38	0.002	0.21	0.75	0.33	0.15	0.1
	0.01	0.001	0.24	0.71	0.55	0.01	0.1
105-BX	0.50	0.007	0.23	0.48	0.39	0.01	0.3
	0.98	0.14	1.47	1.77	0.45	0.06	0.6
	0.00	0.006	1.20	1.29	0.46	0.05	0.2
106-BX	0.63	0.05	1.33	1.62	0.46	0.05	0.6
Batch	0.34	0.02	0.62	0.93	0.47	0.04	0.38
St. Deviation	0.32	0.04	0.48	0.45	0.11	0.04	0.23
St. Error	0.09	0.01	0.14	0.14	0.03	0.04	0.07

REDOX IX

	<u>NaOH</u>	<u>NaAlO₂</u>	<u>NaNO₃</u>	<u>NaNO₂</u>	<u>Na₂CO₃</u>	<u>Na₃PO₄</u>	<u>Cs (Cl/Gal)</u>
104-SX	1.52	0.01(2)	5.8	0.53	0.20	0.014	1.0
	1.33	1.16	6.1	0.70	(1)	(1)	(1)
	1.34	1.02	6.1	0.71	(1)	(1)	(1)
105-SX	1.44	0.60	3.7	0.44	0.2	0.002	0.7
110-SX	1.28	0.94	5.2	0.50	0.10	0.019	0.7
Mean	1.38	0.93	5.4	0.58	0.17	0.012	0.8
St. Deviation	0.097	0.24	1.0	0.12	0.06	0.009	0.49
St. Error	0.04	0.12	0.45	0.06	0.03	0.005	0.29

(1) Value not reported

(2) Not included in determining mean

BNW - DW - N - ETC (MISCELLANEOUS)

	<u>NaOH</u>	<u>NaAlO₂</u>	<u>NaNO₃</u>	<u>NaNO₂</u>	<u>Na₂CO₃</u>	<u>Na₃PO₄</u>	<u>Cs (Ci/Gal)</u>
102-C	0.9	0.2	1.1	0.4	0.1	0.04	0.1
103-C	0.3	0.04	1.3	0.3	0.2	0.09	0.7
	0.7	0.04	1.1	1.1	0.3	0.07	0.6
	0.1	0.05	1.5	0.3	0.2	0.09	0.4
	0.5	0.05	1.8	0.01	(1)	1.0	0.4
104-C	0.5	0.08	0.9	0.2	0.1	0.04	0.2
	0.01	0.02	1.8	0.2	0.5	0.01	0.6
	0.5	0.02	1.8	0.2	0.4	0.004	0.4
	0.4	0.01	1.4	0.06	0.3	0.008	0.3
	(1)	0.05	2.0	0.03	0.1	0.001	0.2
	0.3	0.02	2.0	0.07	0.2	0.001	0.4
105-C	0.9	0.0	0.4	1.1	1.0	0.02	4.8
106-C	0.003	0.02	1.8	0.3	0.6	0.009	0.6
107-C	0.4	0.05	0.6	0.3	0.08	0.3	0.1
111-C	0.8	0.2	1.5	0.6	(1)	(1)	(1)
112-C	0.5	0.02	1.8	1.4	0.5	0.03	0.5
101-T	0.3	0.09	3.8	0.6	0.3	0.08	0.5
107-T	0.08	0.01	0.8	0.7	0.4	0.03	0.2
112-T	0.3	0.04	0.6	0.6	0.1	0.1	0.2
103-B	0.1	0.05	1.1	0.3	0.2	0.1	0.1
	0.1	0.04	1.2	0.4	0.2	0.1	0.2
106-B	0.03	0.0	3.0	0.2	0.1	0.1	(1)
109-B	1.3	0.7	2.5	1.1	0.0	0.02	0.6
102-A	0.01	0.01	1.0	0.1	0.2	0.01	0.2
102-A	(1)	0.01	0.5	0.05	0.2	0.01	0.2
103-AX	0.7	(1)	(1)	(1)	(1)	(1)	5.5

BW - DW - N - ETC (MISCELLANEOUS)

	<u>NaOH</u>	<u>NaAlH₂</u>	<u>NaNO₃</u>	<u>NaNO₂</u>	<u>Na₂CO₃</u>	<u>Na₃PO₄</u>	<u>Cs (Ci/Gal)</u>
106-U	1.2	0.3	3.6	0.1	0.1	0.01	0.5
107-U	0.9	0.1	2.9	0.1	0.05	0.06	0.3
	0.3	0.07	1.3	0.08	0.01	0.1	0.1
	0.3	0.06	1.1	0.06	0.01	0.1	0.1
	0.3	0.03	0.2	(1)	0.02	0.02	0.005
	0.05	0.003	0.05	0.05	0.01	0.3	0.007
	(1)	0.001	0.01	0.02	0.05	0.2	(1)
	0.04	0.001	0.002	0.006	0.04	0.06	0.001
	0.01	0.006	0.2	0.01	0.09	0.03	(1)
	0.0	0.002	2.2	0.01	0.02	0.005	0.002
	0.009	0.001	(1)	0.06	0.01	(1)	0.002
	0.1	0.001	0.03	0.001	0.03	0.02	0.002
	0.04	0.001	0.09	0.01	0.3	0.02	0.002
	0.04	(1)	0.07	(1)	0.01	0.02	0.001
108-U ⁽²⁾	0.0	0.0	0.4	0.003	0.02	0.1	0.006
	0.1	0.02	0.2	0.02	0.04	0.07	0.04
	0.002	0.003	0.10	0.01	0.07	0.09	0.05
	0.1	0.05	1.8	0.1	0.08	0.1	0.02
	0.04	0.002	0.05	0.02	0.05	0.02	0.01
	0.009	0.001	0.01	0.02	0.05	0.2	0.03
	0.7	0.4	2.5	0.8	0.2	0.04	0.8

BW - DW - H - ETC (MISCELLANEOUS)

	<u>NaOH</u>	<u>H₂AlO₂</u>	<u>NaNO₃</u>	<u>Na₂O₂</u>	<u>Na₂CO₃</u>	<u>Na₃PO₄</u>	<u>Cs(Ci/Gal)</u>
104-AX	0.3	(1)	(1)	(1)	(1)	(1)	0.8
101-AY	(1)	(1)	(1)	(1)	(1)	(1)	1.9
	(1)	(1)	(1)	(1)	(1)	(1)	2.3
	(1)	(1)	(1)	(1)	(1)	(1)	1.7
Mean	0.317	0.064	1.20	0.276	0.165	0.087	0.573
St. Deviation	0.346	0.126	1.006	0.356	0.198	0.157	1.094
St. Error	0.052	0.019	0.15	0.054	0.030	0.024	0.160

(1) Value not reported