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WASTE MANAGEMENT

PERSONAL NOTES

G. L. Ritter

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WASTE MANAGEMENT

PERSONAL NOTES

December 19, 1967

G. L. Ritter

Classification reviewed for de-
classification but left unchanged
by *[Signature]*
Date *11/26/77*

Classification Cancelled and Changed To

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By Authority of DR-24, C6-PR-2
WDA Sudden 11/27/94
By DE KIMMO 11/14/94
Verified By DE HANSON 1-14-94

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B-Plant Production Schedule

~~SECRET~~

Used this
in preparing
Table &
Diagrams. ①

CAW :

Ref: 150-981, page 2 of Appendix

Si-90, MCi*

Co-137 MCi*

FY	Si-90, MCi*	Co-137 MCi*
68	5.0	0
69	14.0	7.5
70	14.0	15.0
71	14.0	15.0
72	14.0	15.0
73	14.0	15.0
74	11.0	11.8
75	11.0	11.8
76	11.0	11.8
77	11.0	11.8
78	11.0	11.8
79	11.0	11.8
80	11.0	11.8

* Assumes 95% recovery efficiency.

PSN-RSN :

Co-137, MCi

Tanks

FY	Co-137, MCi	Tanks
68	25	105C, 101A, 105A
69	55	101A, 105A, 104A, 106A, 102A, 103C, 106C
70	24	101C, 103AX, SX Farm
71	15	SX Farm
72	31	104AX, B-Plant Waste
	150	

PAS-RAS

Si-90, MCi

Tanks

FY	Si-90, MCi	Tanks
68	0	
69	27	102A, 104A
70	22	106A, 105A
71	17	104A, 103AX
72	25	SX Farm
73	17	104AX
	108	

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STRONTIUM AND CESIUM STORAGE CAPABILITIES IN B-PLANT

<u>Strontium</u>		ISO-525 Capacity		Current Capacity		Proposed Capacity		Estimated
Source	Tank No.	Btu/hr	MCi Sr-90	Btu/hr	MCi Sr-90	Btu/hr	MCi Sr-90	Fill Date
CAW	6-1	1,000,000	15 ⁽¹⁾	800,000	35	800,000	35	9/70
CAW	6-2	1,000,000	40	800,000	12 ⁽¹⁾	800,000	12	7/71
	7-1	500,000	22	300,000	Spare	300,000	Spare	
PAS	7-2	500,000	18	300,000	13	800,000 ⁽²⁾	35	8/69 10/69
PAS	8-1	500,000	18	300,000	13	300,000	13	6/70
PAS	8-2	500,000	22	300,000	13	300,000	13	1/71 3/71
	36-1	500,000	15					
	FPCE	460,000	20					
CAW	34-1	2,000,000	87			760,000	33	2/76
PAS	38-1					760,000	33	6/72 8/72
CAW-PAS	39-3					760,000	33	1/74 6/73
			257		86		174 207	
<u>Cesium</u>								
	14-2	350,000	21	240,000	Spare			
PSN	17-1	500,000	30	420,000	25	420,000 ⁽⁴⁾	25	6/68
	38-2	800,000	49					
	FPCE	460,000	28					
	35-1	2,000,000	122					
CAW-PSN	34-1					760,000	Spare ⁽⁴⁾	1/75
PSN	37-1					760,000	35 ⁽³⁾	1/69 2/69
PSN	37-2					760,000	35 ⁽³⁾	8/69 2/70
PSN-PSN	37-3					760,000	35 ⁽³⁾	1/72 10/71
CAW-PSN	39-1					760,000	35 ⁽³⁾	3/71
CAW-PSN	39-2					760,000	35 ⁽³⁾	6/73 6/72
			250		25		200 235	

Notes

- (1) This tank also contains Sr-89 which reduces the Sr-90 capacity.
- (2) Assumes installation of a larger coil.
- (3) Concentration limited to 10,000 Ci/gal Cs-137 so that heat limit is not reached.
- (4) Assumes PTA recovery of Cs-137 from CAW begins 1/69. TK-34-1 is added to replace 14-2 as a spare.

Sr-90 20.9 Btu/h/Kci
 Sr-89 11.6 Btu/h/Kci
 Cs-137 16.4 Btu/h/Kci

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Accumulation of Sr-90 in B-Plant

Does not allow for decay

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Date _____

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(4)

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add 1 tank to
Case 38 \$195,000

2 10% Eng. 2.9.
(inc APRND)
2.25% Contingency
\$130,000

20,500
95,000

45,500

Case 37 \$29,000

Case 38

over hd.

Case II: a third tank in Case 37
to provide redundancy of an
other case, say Case 38
for future maintenance. Case
tank addition. Case
side complete

\$157,000

31,700

Contingency
25%

\$125,500

11,500

Total Contingency \$114,000

Eng. 2.9 10%
(inc APRND)

Case I
Two tanks (exit & no TCP
changes) in Case 37 and complete
of case & case side

To: Jerry Ritter
From: Alva Zuercher
2 of notes
Additional Rigging
Storage facilities

11/5/67

Cell 13-14 PTA

Cell 34

1 Co storage spare (replaces 14-2)

Cell 36

Vacant

Cell 37

3 Co storage (PSN)

Cell 38

1 Sn storage (PAS)

2 Encaps. waste tanks

Cell 39

2 Co storage current

1 Sn storage current

Note:

3 tanks in Cell 37 plus 1 tank in Cell 38 (Sn) are needed for storage thru FY-71.

Tanks in Cell 34 and 39 are needed if PTA performed in Cells 13 & 14 and for additional Co & Sn storage thru FY73.
Plus use of spare tanks.

Beyond that 1 tank required per 15 years of production (current basis only)

If use 0.4 M $\text{Sr}(\text{NO}_3)_2$ limit:

then	50% Sr-90	0.2 M Sr-90	9680 ci/gal
	40%	0.16 "	7750 "
	30%	0.12 "	5800
	20%	0.08 "	3875

If use 4400 gal tanks (3500 gal working vol), we can store

		heat, Btu/hr
50% Sr-90	34 Mci	780,000
40% Sr-90	27 "	620,000
30% "	20 "	460,000
20% "	13.5 "	310,000

Heat limit on these tanks is 760,000 Btu/hr (382 ft² coil)

If use 5000 gal tanks (4000 gal working vol), we can store

		heat, Btu/hr
50% Sr-90	39 Mci	890,000
40% "	31 "	710,000
30 "	23 "	530,000
20 "	15.5 "	350,000

Heat limit on 6-1, 6-2 & modified 7-2 is 800,000 Btu/hr (410 ft² coil)

" " 8-1, 8-2, is 300,000 Btu/hr (157 ft² coil)

$\therefore$ It is best to put the 20-30% Sr-90 in 8-1 & 8-2 and the 40-50% Sr-90 in 7-2, 6-1 & 6-2.

11-7-67

Don,

Could you prepare for me a B-Plant production forecast for processing $PSN + PSS$ (Mci Cs-137)
 $PAW + ZAW$ (Mci Sr-90)

and PAS (Mci Sr-90)

for the next 3 or 4 ^{following startup} years. Use as a basis the latest reactor production forecast for computing $PAW + ZAW$ (or ISO-981 if appropriate). I need to determine by early tomorrow morning at what point in time the storage tanks will be full.

Also, Bob & I are looking at the possibility of using some Sr tanks for Cs storage. Could you have this by the time I see you on Wednesday morning?

Both letters that you wrote were reviewed by Bob & I and passed along to Paul with our blessing. We did make some changes on the letter for Pm writings which I will tell you on Wednesday.

JLR

P.S. I also need to know the Cs-144 inventory in B Plant, tank by tank. Do you have this from recent samples?

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(5) ~~(S)~~

FY 1968 - 1973

Gal/Yr

MC/Yr

Cs - 137

Sr-90

Purex Acid Waste

71 metal

200,000

7.8

7.4

95 metal

65,000

3.9

3.6

Ziglex Acid Wastes

46,000

3.2

3.0

95, 125, and 210
metal

From: Hanford Waste Management Operational
Analysis Study by T.R. McKenzie
(I think he got it from Smith's basis
for Reevaluation Study.)

Divide by 4 for quarter estimates

Stored Sr @ 7-67

Stored Cs @ 7-67

Total

TK	Quality	MC	@90%	TK	MC
101 A	31	9.83	8.84	101 A	9.1
102-3 A	~25%	17.56	15.8	102-3 A	8.3
104 A	40	12.00	10.8	104 A	13.1
105 A	10	13.6	12.2	105 A	20.8
106 A	49	9.8	8.8	106 A	15.8
103 AX		8.2	7.4	103 C	4.82
104 AX		11.4	10.3	105 C	2.94
102 AX		2.2	2.0	106 C	1.9
		84.6		101 C	1.15
107 SX		3.74	3.4		77.3
108 SX		3.8	3.4	West Area	33.5
109 SX		3.11	2.8	SX mostly	
110 SX		3.44	3.1		
111 SX		7.15	6.5		
112 SX		4.59	4.1	Assume 8.5% Cs in sludge	
114 SX		4.93	4.4		
		115.25	103.8		

Compare with Robert's Document

SECRET

6

Average Nos

TV / TK = 8,000

PSN / TK = 920,000

PSS / TK = 650,000

PAS / TK = 360,000

Processing Rates @ 72% OAE

PSN = 21,000 GPD 30,000 GPD @ 100%

PSS = 25,000 GPD 35,000 GPD @ 100%

PAS = 2,600 GPD 3,600 GPD @ 100%

Time to process tank @ 72% OAE

PSN = 920,000 / 21,000 = 44 dy / TK

PSS = 650,000 / 25,000 = 26 dy / TK

PAS = 360,000 / 2,600 = 138 dy / TK

Use 0.7 of these rates for first 6 m

A- Farm Assume TK's 102-3 equivalent to 1 TK

PSN = 61.4 MCL / 5 = 12.3 MCL / TK

PSS = 5.7 MCL / 5 = 1.14 MCL / TK

S-40

PAS = 62.8 MCL / 5 = 12.6 MCL / TK

C Farm CS-137

103.5.6 PSN = 8.2 MCL / 1 = 8.2

Equivalent 1 TK

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(7)

Accumulation Rates / ~~Day~~ based on one year operation @ 20% OAE

$$PAS: TK's / yr = 365 / 138 = 2.6 \text{ TK's / yr}$$

$$PSS = 2.6 \text{ TK's / yr}$$

$$PSN = [365 - (2.6)(26)] / 44 = 6.7 \text{ TK's / yr}$$

$$PAS \text{ Sr-90 / yr} = (2.6)(12.6) = 32.7 \text{ MCi Sr-90 / yr}$$

2.72 / month

$$PSS \text{ Cs-137 / yr} = (2.6)(1.14) = 3.96 \text{ MCi Cs-137 / yr}$$

0.33 / month

$$PSN \text{ Cs-137 / yr} = (6.7)(12.3) = 82.4 \text{ MCi Cs-137 / yr}$$

6.87 / month

Cs-137 assumes 2200 Gal zeolite bed Smith said the bed would not be initially sized that high. Higher rate than previously used due to using 12 CV Cs element instead of 16 CV

Remember	Storage	Crude	Campaigns
TK- 8-2	Aged	PM	
7-2	Grn	PM	
8-1	Sr		

~~SECRET~~

Strontium & Cesium Storage Capacity

17-8-67 (8)

B. Plant

Case I: Use tanks 6-1, 6-2, ^{spare} 7-1, 7-2, 8-1, 8-2 for Sr Storage
Use tanks 17-1, ^{spare} 14-2 for Cs Storage

Sr

Mei

Cs

Mei

fill TK- 6-2 by 1-69	15 (current)
fill TK- 6-1 by 11-68	35 (sludge)
fill TK- 7-2 by 6-69	13 (sludge)
fill TK- 8-1 by 1-70	13 (current)
fill TK- 8-2 by 1-70	13 (sludge)
	<u>89</u>

fill tank 17-1 by 4-68	26
fill tank 14-2 by 8-68	14
	<u>26</u>

Case II: Use tanks 6-1, 6-2, ^{spare} 7-1, 7-2 for Sr Storage
Use tanks 17-1, ^{spare} 14-2, 8-1, 8-2 for Cs Storage

Sr

Mei

Cs

Mei

fill TK- 6-2 by 1-69	15 (current)
fill TK- 6-1 by 11-68	35 (sludge)
fill TK- 7-2 by 5-69	13 (current)
	<u>63</u>

fill TK- 17-1 by 4-68	26
fill TK- 14-2 by 8-68	14
fill TK- 8-1 by 8-68	18
fill TK- 8-2 by 11-68	18
	<u>62</u>

Maximum Heat Capability

6-1, 6-2	800,000 Btu/hr
7-1, 7-2, 8-1, 8-2	300,000 "
14-2	230,000 "
17-1	430,000 "

Assumes 25°F rise in cooling water (70-95°F), U for unagitated tank = 40 Btu/hr/ft²°F and solution temp 130°F (55°C), Ave. ΔT = 47.5°F,

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Processing Schedule

11-8-67

(9)

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From Roy Roberts document:

Supernate Processing

MCi Cr-122

105C 12-15-67 to 1-5-68
PSN 105A 1-5-68 to 2-27-68
103C 2-27-68 to 3-24-68
PSS 105A 3-24-68 to 4-13-68
PSN 102A 4-13-68 to 6-7-68
106C 6-7-68 to 7-7-68
PSS 102A 7-7-68 to 7-28-68
101C 7-28-68 to 8-26-68
PSN 104A 8-26-68 to 10-20-68

2.9

19.0

4.2

1.8

7.6

1.9

0.7

1.2

13.1

52.4

106A 10-20-68 to 12-15-68

15.8

101A 12-15-68 to 2-15-69

9.1

PSS 104A

Ridox

33

Sludge Processing

MCi Sr-90
(7-67)

103A 2-5-68 to 3-11-68

3-30-68 to 5-5-68

105A 5-25-68 to 6-25-68

102A 7-15-68 to 8-26-68

9-15-68 to 10-15-68

104A 11-5-68 to 12-10-68

12-30-68 to 2-5-69

13.6

17.6

12.0

106A until ~ 6-1-69

9.8

101A until 10-15-69

9.8

62.8

103AX

until

8.2

71.2

PAW Processing

MCi Sr-90

1-15-68 to 2-5-68

3-11-68 to 3-30-68

5-5-68 to 5-25-68

6-25-68 to 7-15-68

8-26-68 to 9-15-68

10-15-68 to 11-5-68

12-10-68 to 12-30-68

14.0

12-30-68 to 12-30-69

14.0

12-30-69 to 12-30-70

14.0

42

~~SECRET~~
Strontium and Cesium Storage Capacity
B-Plant

Void

10

Use for CAW production rate: $150-981 = 14.7 \text{ Mci Sr-90/yr}$

Use for PAS production rate: 30 Mci Sr-90/yr (2 avg tanks/year)

Use for PSN production rate: 60 Mci Cs-137/yr RSN

Need enough storage through FY71 (to 7/1/71)

Begin filling Tanks with Cs, 1/1/68, and with Sr-90 2/1/68.

35 fill TK-6-1 with CAW Sr-90 by 8/1/70

$\frac{15}{50}$ fill TK-6-2 with CAW Sr-90 by 8/1/71 OK.

35 fill TK-7-2 with PAS Sr-90 by 6/1/69 (assumes coil like 6-1-6-2)

61 } 13 fill TK-8-1 with PAS Sr-90 by 11/1/69

13 fill TK-8-2 with PAS Sr-90 by 4/1/70

$\frac{33}{94}$ Install 1 ^{50%₂} 1m tank, fill with PAS Sr-90 by 8/1/71.

26 fill TK-12-1 with Cs by 6/1/68 (schedule ARH-105 now would fill by 4/1/68)

70 Install 2 1m storage tanks, fill with Cs 1/1/70 } (1st by 10/1/68)
or one patch tank with large coil.

35 Install 1 storage tank (no separate process) 1/1/72

Will need storage for 50 Mci Sr-90 from CAW through FY71 (to 7/1/71)
(6-1 + 6-2 are adequate)

65 Mci TK-101, 102-3, 104, 105, 106 A, TK-103 AX

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Cesium and Strontium ~~SECRET~~ Production From B-Plant (11)

Ref. ARH-165 Rev "Waste Management Operating Schedules" R E Roberts (Secret)

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Cesium :

TK-105 C Complete by 1/15/68 MCI Co-137 2.9

TK-105 A 3/10/68 20.8

TK-102 A (101A sup) 5/5/68

9.1 → TK-17-1 filled with 26 MCI Co-137 ~ 4/1/68

TK-104 A 7/1/68

13.1

45.9

TK-106 A

8/25/68

15.8

add 2 new tanks.

TK-103 A (102A sup) 10/20/68

8.3

1st filled by 8/1/68 (34 MCI)

TK-103 C

11/10/68

4.2

2nd filled by

TK-106 C

11/30/68

1.9

6/1/69

TK-101 C

12/20/68

1.2

77.3

TK-103 AX

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12-7-67 (12)

Assumptions:

1. Recover Cs-137 at rate of 37.5 Mci/yr (4 yrs to process Purex and Redox Cs inventory on 1/1/68).
2. Cs-137 recovery efficiencies = 92% from Purex supernates + 92% from Redox supernates (150-981).
3. Cs production rate as in 150-981.
4. Start current cesium recovery beginning FY 74, assume process losses = 5% (Cs). Shut down Purex by FY-80.
5. Hold Cs returned to tank farm prior to FY 74 for 3 yrs before processing. During period FY 74 to FY 80 process Cs from tank farm supernates & current Cs.
6. Redox & Purex sludges are processed with completion by FY 1974.
7. Sr recovery efficiencies are 90% from Purex & Redox sludges and 95% from current acid waste.

$$\begin{aligned} 0.10(35) &= 3.5 \\ 0.05(115) &= 5.75 \end{aligned}$$

Calculations:

1/1/68

Cs

150 Mci Cs-137 reduces to 12 Mci (losses).
 Leave 3 yrs production $(15.7 \times 3) = 47$ Mci in tank.
 Lose 2.4 Mci from processing Cs added to tank farm after 1968 + process 5 before FY 74.

Lose 4.7 Mci of the 47 held at equilibrium, plus 5% of current cesium (0.62 Mci/yr) .

Total loss

$$\begin{array}{r} 2.4 \\ 4.7 \\ \hline \text{Cs } 28.4 \text{ inventory beginning FY 74} \\ + 3 \text{ yrs } (0.62) = 1.86 \\ \hline = 30.2 \text{ Mci terminal inventory} \end{array}$$

$$\begin{array}{l} \text{Sr } 0.1(125) = 12.5 \text{ Mci lost} \\ 0.05(14.7) = 0.735 \text{ Mci/yr lost FY 68-FY 73 } 5.5 \text{ yr } (0.735) = 4.04 \text{ Mci} \\ 0.05(11.5) = 0.575 \text{ Mci/yr lost FY 74-FY 80 } 6 \text{ yr } (0.575) = 3.45 \\ 12.5 + 4.04 + 3.45 = 20 \text{ Mci terminal inventory} \end{array}$$

not including 6 Mci in Non-Breeding tank farm

FROM ARH-344 RD

Net Stored (Includes
Gal $\times 10^{-3}$ Conting Wt)

4-3-68 (13)
Gal/T

YEAR	TU				Gal $\times 10^{-3}$ <small>cooling water</small>				Gal/T
	B & T	Redox	Purex	TOTAL	B & T	Redox	Purex	TOTAL	
1945	636			636	6236			6236	10,980
46	764			764	8908			8908	11,660
47	651			651	6443			6443	9,900
48	786			786	5746			5746	7,300
49	749			749	5973			5973	8,000
50	884			884	8205			8205	9,280
51	1068			1068	7978 ^{unp stored}			7978	7,470
52	413	822		1235	870 $\downarrow$	3599		4469 ⁴⁸⁰⁰	3,620
53	246	1431		1677	-1070	4923		3853 ³²⁰⁰	2,300
54	1019	1579		2598	-3210	4732		1522 ³⁰⁰⁰	1,820
55	1266	2426		3692	4499	3987		8486 ³⁴⁰⁰	2,300
56	45	2335	2520	4900	-212	2885	2158	4831 ¹¹⁰⁰	986
57		1829	4410	6239		641	1773	2414 ⁴⁰⁰	387
58		1404	5256	6660		666	1885(1262)	2551	383
59		944	5113 5170	6057		532	1381(2224)	1913	316
60		822	6247	7069		204	2515	2819	399
61		1253	5448	7201		81	3101	3182	442
62		980	6035	7015		158	1407	1565	223
63		1150	5422	6572		353	2772	3125	476
64		1770	5759	7529		1068	2047	3115	473
65		1679	571	7450		375	2701	3076	413
66		1351	4312	5663		1344	2216	3560	478
67 (1/16/67)		<u>21,775</u>	<u>2651</u>	2651		116	1364	1480	558
			62501						

	Purex				Redox			
	Gal SW	SW year	Gal CW	SW Gal/T	Gal SW	Gal CW	SW Gal/T	CW Gal/T
6	1378	56	780	546	2195	695	940	298
7	466	57	1307	106	363	278	198	152
8	616	58	1269	117	436	230	310	163
9	108	59	1273	13.2	365	167	387	177
0	925	60	1590	148	137	167		310
1	1276	61	1825	215		225		179
2	-261	62	1668			208		212
3	1089	63	1683	201		230		200
4	101	64	1946	17.6	701	361		204
5	853	65	1848	148	50	325		194
6	618	66	1598	143	841	503	622	372
7		1220		480		14		

115 gal/t
avg

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Gal/Ton U

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4-58

14

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Np_P-Pu²³⁸ SEPARATION - WASTE COMPOSITION

TARGET: Al CAAD, MgO-NpO₂ CORE

SS 100% 325,000 gal/yr.

- 1.05 Al
- 1.05 Mg
- 1.05 Np
- 1.05 Pu

AL CAAD AL CAAD AL CAAD AL CAAD AL CAAD

1.05 Al 325,000 gal/yr.

1.05 Mg 1200 gal/yr.

1.05 Np 4800 gal/yr.

1.05 Pu 1000 gal/yr.

1.05 Al 325,000 gal/yr.

Waste management program
for 1000 kg Np²³⁸/yr processed through
the Kelco Plant 1975 - 1985

(*) Separated before burnout.

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~~SECRET ROUGH DRAFT~~

1972 - 73

.10/gal breloff

4-9-68

(16)

Case IHA
HEDTA

EM

Gallons/year

Maximum Rate - GPM

2 tanks/year	Oralley Waste	* 2,500,000	429,000	58 days/yr	5.2
1.6 milking tanks	PAW		136,000	79 "	1.2
6 new tanks	ZAW		162,000	94 "	1.2
	B-Plant Oralley		1,030,000	231	
			1,000,000	0	
			2,000,000	0	

Case II

3 tanks/year	Oralley Waste	3,800,000	652,000	87 days/yr	5.2
	PAW		86,000	50 "	1.2
	ZAW		162,000	94 "	1.2
				231	

Case III

4 tanks/year	Oralley Waste	5,000,000	859,000	115 days/yr	5.2
	PAW		79,000	46 "	1.2
	ZAW		162,000	94 "	1.2
	B-Plant		2,060,000	255	

Case IV

6 tanks/year	Oralley Waste	7,500,000	1,290,000	172 days/yr	5.2
	PAW				
	ZAW		162,000	94 "	1.2
				266	

* Oralley Waste - 1.2 M ANW ; 2.3 M H₂O₃

100,000 to equip B-Plant.
200,000 gal lag storage tanks

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4-11-68 (17)

Case II

	gal/yr
Oralloy	429,000
PAW	136,000
ZAW	162,000

Case II

	gal/yr
Oralloy	528,000
PAW	77,000
ZAW	78,000
U-Zr	112,000

Case III

Oralloy	858,000
PAW	
ZAW	162,000

Case IV

Oralloy	1,060,000
U-Zr	223,000

Notes:

(18)

U-Al Waste

1.2 M ANN
2.4 M HNO_3
0.02 M FeS or 0.01 M Cu^{+6}
1002 to 1005 M Hg

4500-7500 gal/day

U-Zr

.31	0.35 M Zr	.18-.25
2.5	2.8 M F	1.9-3.5
	0.1 M Cu	0.1
	0.005 M Hg	0.002-0.005
0.6	1.0 M HNO_3	1-3
.64	1.8 M ANN	1.0
	2.4 M H^+	
	.02 FeS	

4300 gal/day

Zirconium
starts ppt
at concentration

4-9-68

(19)

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Oralley Waste IAF Comp:

al	0.5	5.2	Feed
Na	1.4	0.5	HA
HEDTA	0.6	4.8	HEDTA
HA	0.5	0.5	NaOH
Fe	0.01		
GPM	12.5 if coupled to Purex	11.0	GPM
pH	4.5		

18,000 gal/day

6 IAF batches/day.
1/4 hourCase I. Processing Time at B Plant:

Oralley	429,000 gal/yr	=	58 days/yr	if at	12.5 GPM IAF
PAW	136,000	"	40	if at	2.5 GPM IAF
ZAW	162,000	"	47	"	" " " "
			145		

Sludge Processing Time

110 " at
255Incremental Chemical Costs:

for Oralley HEDTA:

$$0.6 (2.4) (429,000) (3.785) \left(\frac{344}{454} \right) \left(\$0.55 / lb \right) \left(\frac{11.5}{5.2} \right) = \$2,350,000$$

HA:

$$0.5 (2.4) (429,000) (3.785) \left(\frac{76}{454} \right) \left(\$2.20 / lb \right) \left(\frac{11.5}{5.2} \right) = \frac{150,000}{\$2,500,000}$$

for PAW NTA:

0.26

:947

180 d

~~SECRET~~

Art Bamber 7812

10-10-68

(20)

MWD/T	Sr	Sr-90	RE/am	RE/am/Sr	Sr-90/Sr	MWD/T/Sr
900	31.75	19.1	279	8.79	0.602	28.4
1000	35.28	21.3	310	8.79	0.603	28.3
1200	41.85	25.3	372	8.88	0.605	28.6
2200	71.72	43.6	678	9.45	0.608	30.6

$$Sr - 0.0013 M = 0.116 \text{ g/l} = 0.438 \text{ g/gal} \times 50 \text{ gal/t} = 22 \text{ g/t}$$

$$RE - 0.0077 M = 1.11 \text{ g/l} = 4.20 \text{ g/gal} \times 50 \text{ gal/t} = 210 \text{ g/t}$$

For nat. U- 640 MWD/T, 817 MWD/T

Sr = 22.48

RE = 198

Declassification of Ch. IV in 150-100? Flowsheet?

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ref: HW-75978

(21)

Rh, Pd, Tc, Co-137 Yields (10mw/T, 600MWD/T) not in

	180 days	1 yr.	5 years	10 years	20 yrs
Rh, g/m	8.98	9.23	9.24	9.24	9.24
Pd, g/m	6.98	7.46	8.56	8.63	8.63
Tc, g/m	16.53	16.53	16.53	16.53	16.53
Co-137, g/m	1971	1950	1776	1583	1256

Rh/Pd, g/g 1.29 1.24 1.08 1.07 1.07

Rh/Co, g/g 0.00455 0.00473 0.00521 0.00583 0.00735

Pd/Co, g/g 0.00354 0.00382 0.00482 0.00545 0.00687

Tc/Co, g/g 0.00839 0.00848 0.00932 0.0105 0.0132

Tc/Rh, g/g 1.85 1.80 1.79 1.79 1.79

Tc/Pd, g/g 2.37 2.22 1.93 1.92 1.92

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Rh, Pd, Tc, Co-137 Yields (8.17 MW/T, 640 Mwd/T)
nat U

	180d	1yr	5yr	10yr	20yr
Rh, g/tm	9.435	9.646	9.655	9.655	9.655
Pd, g/t	7.363	7.849	8.929	8.999	9.001
Tc, g/t	17.65	17.65	17.65	17.65	17.65
Co-137, Ci/t	2108	2083	1899	1692	1343
Rh/Pd	1.28				
Rh/Cr			0.00508		
Pd/Cr			0.00470		
Tc/Cr			0.00929		
Tc/Rh					
Tc/Pd					

Rh, Pd, Tc, Co-137 Yields (9.7 WW/T, 900 Mwd/T)
0.947% U-235

Rh	13.16	13.42	13.44	13.44	13.44
Pd	9.958	10.59	12.01	12.10	12.10
Tc	24.81	24.81	24.81	24.81	24.81
Cr	2960	2925	2667	2376	1886
Rh/Pd	1.32	1.27	1.12	1.10	1.10
Rh/Cr	0.0044	0.00458	0.00504	0.00566	0.00713
Pd/Cr	0.00336	0.00361	0.00450	0.00510	0.00642
Tc/Cr					
Tc/Rh	1.89	1.85	1.85	1.85	1.85
Tc/Pd	2.50	2.34	2.06	2.05	2.05

~~SECRET~~ ROUGH DRAFT

(23)

1.1, Pd, Tc + Co-137 yields

(10.6 MW/T, 2100 MW/T)
2.10% U-235

	180d	1yr	5y	10y	20y
Rh	29.97	30.31	30.33	30.33	30.33
Pd	21.60	22.77	25.37	25.54	25.55
Tc	57.66	57.66	57.66	57.66	57.66
Co-137	68.67	67.87	61.88	55.13	43.76
Rh/Pd	1.39	1.33	1.20	1.19	1.19
Rh/Co	0.00435	0.00447	0.00490	0.00550	0.00693
Pd/Co	0.00314	0.00335	0.00409	0.00462	0.00583
Tc/Co	0.00840	0.00850	0.00932	0.0105	0.0132
Tc/Rh	1.93	1.90	1.90	1.90	1.90
Tc/Pd	2.68	2.54	2.28	2.26	2.26

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Rh, Pd, Tc, C₂ Analyses

6-11-68

(24)

Tank No.	Rh, g/gal	Pd, g/gal	Tc, g/gal	^{Rh-106} C-137, Ci/gal	C-134, Ci/gal	^{Co-137} C-134	Age, yr (based on ratio)
101-C				0.02	4.49	0.018	250
102-C							
103-C	0.044		0.064	0.05	9.04	0.055	164
104-C			0.0098	0.015	1.49		8.6
105-C			0.133	0.36	18.8	0.36	52
106-C			0.065	0.07	9.25	0.068	136
104-BX	0.053	0.047	0.082	0.17	0.214	0.0015	142
102-A	0.0085						
103-A	0.071	0.057	0.104	0.19	12	0.18	65.6
104-A	0.0304	0.0308	0.093	0.14	15.4	0.109	141
105-A							8
106-A	0.050	0.032		0.13	18.5	0.219	84
101-AX							6.5
103-AX							
104-AX							

	tot. vol.	sludge	supernate	6-1-68 MC C ₂ -137	Kg Rh	Kg Pd	Kg Tc
101-C	549	51	498	2.2			
103-C	433	35	498	4.5			32
104-C	532	90	442	0.65			4
105-C	538	109	429	8.06			57
106-C	72	62	10	0.09			0.6
104-BX	528	87	441	0.09			36
102-A		99					
103-A	905	20	883	10.6			92
104-A	960	168	792	12.2			74
105-A		110					
106-A	950	176	774	14.3			
101-AX							
102-AX							
103-AX							

SE

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Recovery of Am from PAW

PAW composition

H⁺ 0.95 M
Fe 0.3
Ca 0.03
Na 0.43
Co 0.019
Ni 0.011
Ca 0.0013
Mn Trace
Mg Trace
SiO₂ 0.011
NO₃ 1.21
SO₄ 0.60
PO₄ 0.012
F 0.0045

Rh 0.000434 M
Pd 0.000337
Ru 0.000006
Np Trace
U 0.00022
Te 0.000704
Sr 0.00131
Ce 0.00194
La 0.00224
Pr 0.00284
Am 0.0000175
Sm 0.000108
Zr 0.00434
Nb 0.000157
Ru 0.00181
Sn 0.000314
Tb 0.000673
Tb* 0.00396

Optical Co, Am Sm

5.6. 1.1
125 ml/gal
Vol 50 gal/ten
Flow - 69.4 gph

0.00297 M
0.00031 M
0.00224 M
0.00025 M
0.00679 M
0.00679 M
1.75x10⁻⁶

0.00679 = 3.82x10⁻³

25

1. IBW Composition

D2EHPA 0.3 M

TBP 0.2

NPH

Ce 0.00136

Pm 0.000216

Am 1.0×10^{-6}

Sm 1.9×10^{-4}

TRE 0.0024

Y

U

Sp G. 0.79

Flow 100 (300 GPH) 11.5 gal/hr.

Btu/hr/gal 91 gal/hr

Ce-144 540 ci/gal

Pm-147 90

Am-241 0.0031

Sm-151 0.30

9.24×10^{-4} g/gal

Y-91 768

Other Isotopes < 1%

* 2. ICX Composition

Na₅DTPA 0.09 M

H₂C₂H₃O₃ 0.5

pH 3.9

Sp G. 1.03

Flow 20

3. ICS Composition

H₂D2EHP 0.19 M

Na D2EHP 0.11

TBP 0.2

NPH Diluent

Flow 20

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4. LCW

Na_2DTPA 0.09 M
 HCl 0.5
 H_2SO_4 3.6
pH 3.6
Sp. 6. 20 (60 gph)
Flow

α 0.00007 M
Am 0.0001-
Am 5.1 X 10⁻⁶
Sm 9.5 X 10⁻⁶
TRE 1.2 X 10⁻⁴
Y
U

G-144 ~ 250 g/g (1.2)
Am-147 5 g/g (2.7)
Am-241 0.015 (95%)
Sm-151 0.003 (1.2)

Other isotopes < 1%

5. LCW

DTPA 0.3 M
TGP 0.2
NPH Diluent
Sp. 6. 0.79
Flow 120
864560

Ce
Pm
Am
Sm
TRE
Y
U

G-144 450 g/g
Pm-147 75
Am-241 0.0001 (24%)
Sm-151 0.25

X 6. RE Strip

HNO_3 8.0 M

Sp. 6. 18.5
Vol/Water 1000 gal
Flow

Strip 3 2160 gal Water
of 100 with 1 liter of
resuspension.

HNO_3
Ce
Pm
Am
Sm
TRE
Y
U

Sp. 6. 18.5
Vol/Water 1000 gal
Flow

7. RE Waste

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8. 105

NaOH 2.5 M
citrate 0.1
Sp G. 1.1
Vol/batch 1200 gal
Flow 22.2

WASH 3 2160 gal batches
of solvent with one
batch of 105. 4
contacts/day.

10. 100 Buttl

HNO₃ 12.2 M
Sp G. 1.35
Vol/batch 33.6 gal
Flow 1.87

9. 10W

NaOH 0.7
NaNO₃ 0.3
citrate 0.1
Sp G. 1.05
Vol 1200 gal
Flow 22.2

4-91 ci/gal
Ce-144
Pm-147

11. 1AX and 1CS

4DZEHF 0.19
NaDZEHF 0.11
TBP 0.2
NPH Diluent
Vol/batch 2160
Flow 120

12. Solvent

DZEHFA 0.3 M
TBP 0.2
NPH Diluent
Sp G. 0.79
Volume 1500 gal

* 13. pH ADJUST

HNO₃ 0.4
NaNO₃ 6.0
Sp G.
Vol/BATCH 360
Flow 10

14. Am WASTE

DTPA 0.06 M Am
HC₂H₃O₃ 0.333 Ce
NaNO₃ 2.1 Pm
pH 1.1 TRE
Sp G.
Vol/batch 1080 gal
Flow 30

* 15. Am Strip

HNO₃ 2.0 M
Sg G.
Vol/Batch 600 gal
Flow 16.7

16. Am Product

NaNO₃ 0.01 M
HNO₃ 1.8 Am 0.017 ci/gal (90%)
Sg G. Ce 29
Vol/Batch 600 gal Pm 5.8
Flow 16.7 TRE 1.4 x 10⁻⁴ M

* 17. Sugar

C₁₂H₂₂O₁₁ 1.4 M
Sg G.
Flow 0.53 (0.4 gal/hr)

18. Am Concentrate

NaNO₃ 1.0 M Am 5.7 x 10⁻⁴ M 1.7 ci/gal
HNO₃ 1.0 Ce 0.0073 2900
Sg G. Pm 0.0014 580
Flow 0.167 TRE 0.014

12 gpd

0.136 gal/hr

6.29 Am/day

~ 4-5 wt % Am

90% overall recovery

Operate for 3 weeks yields
130 g Am (24).

250 gal concentrate containing

Store in TK-36-X (2000 gal) Can store nearly one years production
of PAS and PAW.

For PAW: $\frac{410,000 \text{ gal/yr}}{50 \text{ g/hr}} (0.136 \text{ gal/hr}) = 1110 \text{ gal/yr} - 3 \text{ hr}$

For PAS: $\frac{500,000}{50} (0.194) =$

940 gal/yr (1.1 kg)
0.61 kg

1.2 kg total Am/yr

1.95 kg/yr

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[REDACTED]

to EMU with handling 150,000/yr

$$\# \text{ salt } 800,000 (1.05) = \frac{40,000}{75,000}$$

$$350,000 \text{ gal} \times 0.10/\text{gal} = 35,000$$

Waste handling 460,000 gal/yr for handling

$$\frac{75,240/\text{yr}}{320}$$

$$\text{NaOH } 108,000 \text{ } 1,0298$$

$$\text{Sugar } 1.4 (5160) (3.785) \left(\frac{342}{454} \right) = 29,600 \text{ } 1,104$$

$$\text{NaNO}_3 \text{ } 6.0 (97,500) (3.785) \left(\frac{85}{454} \right) = 415,000 \text{ } 17,800$$

$$\text{H}_2\text{H}_3\text{O}_3 \text{ } 0.5 (195,000) (3.785) \left(\frac{75}{454} \right) = 61,700 \text{ } 20,166$$

$$\text{DTP4 } 0.09 (195,000) (3.785) \left(\frac{513}{454} \right) = 75,000 \text{ } 16 \text{ } 45/114 \text{ } 33,800$$

$$\text{HNO}_3 \text{ } 2.0 (162,000) (3.785) \left(\frac{63}{454} \right) = 170,000 \text{ } 16 \text{ } 10284/114 = 4920$$

PAW EM argument:

[REDACTED]

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Rh, Pd analyses

	$1.4 \times 10^{-4} M$	$1.8 \times 10^{-4} M$	$2.7 \times 10^{-4} M$		$C_{137}/C_{134} = 656$	6yr.
<u>TK-103A</u>	Pd	Rh	Tc	Cs-137	Cs-134	
T-1573	15.4 ppm	19.2 ppm	1794 $\mu Ci/gal$	12 Ci/gal	$1.8 \times 10^5 \mu Ci/gal$	
S-27	= 0.057 g/gal	0.071 g/gal	0.104 g/gal	10.8 MCi		
1445		Rh/Cs = 0.0059 g/Ci	(theoretical 0.00519)		Rh/Pd = 1.25	(theoretical 1.08)
329"		Pd/Cs = 0.00475 g/Ci	(theoretical 0.00479)			
905,000		Tc/Cs = 0.0087 g/Ci	(theoretical 0.00932)			
			Tc/Rh = 1.46		(theoretical 1.8)	

TK-104-BX (IX effluent)

T-1540	12.6 ppm	14.4 ppm	1410 $\mu Ci/gal$	$2.4 \times 10^5 \mu Ci/gal$	$1.5 \times 10^3 \mu Ci/gal$
	0.047 g/gal	0.053 g/gal	0.082 g/gal	0.214 Ci/gal	
Cs would be 9.5 Ci/gal if not removed.	Rh/Cs = 0.0056	Pd/Cs = 0.0050	Tc/Cs = 0.0086		
	Rh/Pd = 1.13		Tc/Rh = 1.55		
				Ru-106	$1.74 \times 10^5 \mu Ci/gal$

Other samples taken were:

$$C_{137}/C_{134} = 142$$

age ~

TK-106 A	T-1588
TK-104 A	T-1586
TK-105-C	T-1582
TK-103-C	T-1580

1579 101-C ^{137}Cs 4.49 Ci/gal
 ^{134}Cs 0.018

1580 103-C ^{137}Cs 9.04 Ci/gal
 0.055 ^{134}Cs
 ^{137}Cs 1.10 $\times 10^{-3}$ Ci/gal Tc

1586 104A
 S-29
 349"

15.4 C-137 960,000 14.8 MCi
 0.109 C-134
 1.6×10^{-3} Tc

1581 104-C
 6-3
 0700

1.49 Ci/gal C-137
 1.70×10^{-4} Tc

1588 106 A
 S-29
 346"

18.5 C-137 959,000 17.6 MCi
 0.219 C-134

1582 105-C
 S-29
 191

18.8 C-137
 2.29×10^{-3} Tc
 0.36 C-134

1585 103 A
 S-29
 324"

1583 106-C
 6-3

9.25 C-137
 0.068 C-134
 1.12×10^{-3} Tc

not 1587 105 A
 not 1584 102 A

FISSION PRODUCT
HEAT GENERATION
RATE AS A FUNCTION
OF AGING

640 MW/D/T
7.18 MW/T
NAT. LI.

$Q, \text{ Ctu/hr/gal}$

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HEAT GENERATION RATE
AS A FUNCTION OF
EXPOSURE AND CONCENTRATION
IN WASTE AT 5 YR
AND 10 YR AGING.

Nat LL ONLY

HEAT GENERATION RATE, WATTS/TON

LEGEND. —○— 10 yrs aging
—x— 5 yrs aging

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Production in Power During
1956 through 1969

CT	KWHD	³ H, KGE	RH, KGE	TC, KGE	PL, KGE	CO ₂ , MGE
1956	1216	12.5	18.2	33.2	15.8	4.01
1957	2360	24.3	35.4	64.4	30.7	7.79
1958	2939	29.2	42.6	77.4	36.9	9.37
1959	3578	36.8	52.0	97.6	46.5	11.71
1960	4200	43.3	63.0	114.5	54.6	13.86
1961	4779	43.0	62.7	114.0	54.3	13.79
1962	4023	41.4	60.3	109.7	52.3	12.27
1963	3484	35.9	52.3	95.0	45.3	11.50
1964	3700	38.1	55.5	100.9	48.1	12.21
1965	3704	38.1	55.6	101.0	48.2	12.22
1966	2962	30.5	40.4	80.3	38.5	9.77
1967	3935	40.5	59.0	107.3	51.2	12.77
1968	4197	43.2	63.0	114.5	54.6	13.87
1969	3073	31.7	46.1	73.3	35.9	10.14
	47,451	488.5	711.8	1294.1	573.9	156.52
						(129 MGE)
						4-28-70

1970-75
(a) 10.3 G/KWHD
(b) 15.6 / KWHD
(c) 27.38 / KWHD
(d) 3.38 / KWHD
(e) 3.38 / KWHD

~~See~~

4-28-70

(35) 612

612
4.28.70

(36)

Future Production

Basin: ARH-15462, April 21, 1970, Quarterly Production Forecast, April 1, 1970 Through June 30, 1975.

KE and N Reactors

<u>KE Reactor Discharges</u>				<u>N Reactor Discharges</u>			<u>Fiscal Year</u>
<u>Nat.</u>		<u>Env.</u>		<u>tons</u>	<u>KMwd</u>	<u>MWd/H</u>	
<u>tons</u>	<u>KMwd</u>	<u>tons</u>	<u>KMwd</u>				
409.7	238.1	112.1	80.0	119.5	267.4	2237	70 (last 1/4)
1679.5	857.5	415.7	286.5	462.8	766.5	1656	71
1887.8	777.3	515.2	257.6	551.2	894.3	1622	72
1987.1	516.7	499.8	245.5	577.3	939.1	1607	73
2012.7	877.2	506.2	251.7	676.0	988.1	1555	74
2012.7	877.2	506.2	251.7	676.0	988.1	1555	75
9990		2555		3775			
1196		332		421			

← Inventory at end of FY (in basins)

Purer Production

FY	<u>KE</u>				<u>N</u>		<u>TOTAL KMwd</u>
	<u>Nat.</u>	<u>Env.</u>	<u>94</u>	<u>95</u>	<u>94-1-75</u>		
	<u>tons</u>	<u>KMwd</u>	<u>tons</u>	<u>KMwd</u>	<u>tons</u>	<u>KMwd</u>	
70 (last 1/4)	—	—	100	71	120	218	339
71 (last 1/4)	1270	649	535	330	375	311	1600
72	2560	1112	905	453	1385	868	2413
73	1890	777	500	250	600	476	2003
74	2000	822	500	250	600	476	2003
75	2000	822	500	250	600	476	2003
	9720		2940		2710		
76	1196		332		421		

24 of 100 tons down at end of FY 75

4-28-70

Future Rh, Pd & Tc Production

	<u>total KMWd</u>	<u>Rh, Kgs</u>	<u>Tc, Kgs</u>	<u>Pd, Kgs</u>			<u>C₂, MG</u>
				<u>K</u>	<u>N</u>	<u>Total</u>	
CF-70	590	8.85	16.1	4.2	5.2	9.4	1.9
CF-71	2821	42.32	76.9	20.9	17.3	40.2	9.3
72	2223	33.35	60.6	16.9	15.1	32	7.3
73	2036	30.09	54.7	13.6	15.5	29.1	6.6
74	2008	30.12	54.8	13.9	15.0	28.9	6.6
75	2008	30.12	54.8	13.9	15.0	28.9	6.6

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TABLE 1
PRODUCTION FORECAST(1)

Purex Plant Operation
for
KE Reactor and N Reactor

ARH 1650
has been
issued
REV 1/1/71
M.C. 127C
1/1/71

			Uranium (Tons)		N Reactor		M.C.		
			3.9% Pu-240		8.8% Pu-240		127C	90	
			0.71	0.94	0.94	1.25			
			4 T.U.=1 T.U.						
kg	kg	kg	FY						
58.2	25.5	51.7	1-1-67 70	601(2)	2650(2)	218(2)	54(2)	6.65	6.31
16.6	15.5	30.2	-71	1260(2)	500(2)	304(2)	76(2)	3.94	3.59
23.5	22.0	42.7	72	2185	416	458	115	5.62	5.07
			73	2185	416	458	115		
			74	2185	416	458	115		
			75	2185	416	458	115		
			76	2185	416	458	115		
			77	2185	416	458	115		
			78	2185	416	458	115		
			79	2185	416	458	115		
			80	2185	416	458	115	✓	✓
20000	2000	40000	Total	21,526	6,894	4,644	1,165		

Notes: (1) KW Reactor shut down during FY-70.

(2) Production forecast for FY-70 and
and FY-71 is based on the first six
months of actual operation at the
Purex plant during FY-70 and on
reference 2.

The ^{estimated} Annual CAW volumes for processing through B Plant were
calculated on the following bases: The gallons of CAW
per ton of uranium (gal/T.U.) shown below include 10
percent jet dilution between Purex, F-15 tank, and B
Plant.

Aluminum-Clad Fuel (KE Reactor)

FY 70-71: 88 gal/T.U. gal per ton of uranium (gal/TU)
FY 72-80: 66 gal/T.U. " " " " " "

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LAH-1650 RD
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TABLE 2

FISSION PRODUCT AND WASTE GENERATION DATA

Type	Uranium	% Pu-240	MWD/T	Cs-137 KCi/TU	Sr-90 KCi/TU	Ch g/4m
KE →	0.71	3.90	250	1.00	0.90	3.6
	0.71	4.25	300	1.14	1.02	
	0.71	5.5	500	1.70	1.54	
	0.71	10	1150	3.60	3.30	
KE →	0.94	3.9	520	1.80	1.75	7.6 6.7 14.0
	0.94	4.25	600	2.00	1.92	
	0.94	5.5	800	2.65	2.50	
	0.94	8.25	1300	4.27	3.80	
N →	0.94	8.8	1380	4.55	4.00	21.0 20.0 32.6
	0.94	10	1600	5.27	4.60	
	0.94	12	1920	6.30	5.45	
	1.25	8.25	1500	4.92	4.45	
N →	1.25	8.8	1600	5.25	4.73	24.7 23.7 35.2
	1.25	12	2200	7.25	6.45	

Present recoveries for strontium and cesium are 80 and 95 percent, respectively. ^{it is projected that} Cesium recovery will be maintained at 95 percent or greater. ^{and that} Strontium recoveries from CAW ^{will} are projected to be 80, 90, 95 percent for FY-70 and 71 through 80, respectively.

- c) Six months will be required to sluice and process the equivalent sludge from ^{a typical} an A or AX farm tank. The planned processing order is 106-A, 102-A, 103-A, 103-AX, 104-AX, and 101-AX. The order and tanks to be processed have been altered somewhat from previous plans ^{(1) and waste from}. This is due to sludge movements ^{now during the} in the tank farm from emptying ^{of} 105-A and the preparing ^{ation of} tanks 101-A and 104-A as spare tanks. Tank 101-AX received 5 MCi strontium-90 ^{during} due to B Plant startup ^{transfers were} strontium processing losses before terminating ^{receiving} B Plant high level waste in late January, 1969. ~~This~~

SECRET

TABLE 16
CURRENT NON-BOILING WASTE INVENTORY
(Ref. ARH-90⁸)

<u>Farm</u>	<u>Liquid Available for ITS</u>	<u>RhPd Feed* Liquors</u>	<u>241-SX Supernatants**</u>	<u>IX Rework Material***</u>
B	201	1713	-	489
BX	710	3461	-	456
BY	5404	508	-	-
C	1942	-	-	-
S	7799	-	-	-
SX****	373	-	1839	-
T	1256	-	-	-
TX	5831	-	4066	-
TY	1808	-	606	-
U	<u>4461</u>	<u>-</u>	<u>-</u>	<u>-</u>
Total	29,785	5682	6511	945

* Found in 109, 10, 11 and 12-B;
104, 5, 6, 7, 8, 9, 10, 11 and 12-BX;
and 104-BY.

** Found in 102, 3, and 4-SX;
101, 2, 4, 5, 6, and 7-TX;
and 101-TY.

*** Found in 101-BX and 102-B; will
be available for ITS after rework.

**** ARH-90⁸ considers the 241-SX tank farm
to be "boiling waste"; the non-boiling
tanks in that farm (101, 102, 103, 104
and 106) are included in this table.

East 14,884

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ARH-1650 RD

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^{slightly} ^{in the event of} ~~product content~~ may be altered ^{circumstances} due to future unforeseen ~~circumstances such as a tank leak or waste transfers and~~ water additions for ~~tank~~ sludge temperature control. ^{The estimated} Over-all recovery efficiencies are ^{also} indicated. ^{Recovery} ~~Recovery~~ ^{the} efficiencies are based on actual plant experience for PSN and PSS ~~Other efficiencies are based on~~ extensive laboratory data and similar plant processing experience ^{for} PAS, IXW & RSN.

TABLE 4
PROCESSING EFFICIENCIES

Tank Farm	Type Waste	Processing Volume Gal x 10 ⁻⁶	Recovery Efficiency, %	
			Sr-90	Cs-137
A, AX	PSN	3.96	-	92
	PSS	6.53	-	92
	PAS	2.03	80	-
C	PSN	0.15	-	92
B, BX	IXW	0.945	-	92
SX, TX, TY	RSN	18.07	-	90

PSN - Purex supernatant solution

PSS - Purex sluicing supernatant solution

PAS - Purex acidified sludge

RSN - Redox supernatant solution, diluted for transfer;

IXW - B Plant ion exchange waste ~~2 vol. final vol. grade~~

^{1 gal. of cruise fuel = 2+ gals. of process waste}
The projected stored waste ~~solution~~ ^{which are} volumes to be processed

through B Plant are higher than previously anticipated.

This ^{is} ~~was~~ due to ⁽¹⁾ significant quantities of water, ^{which were} ~~presently~~

~~containing cesium, which were~~ required to sluice ~~empty~~ the

two ~~present~~ A farm spare tanks, 101-A and 104-A; ⁽²⁾ AR Vault

processing experience ~~to date~~ has indicated ~~that~~ additional

PSS will be generated during sludge processing activities; ⁽³⁾

cesium losses were high during initial ion exchange processing

TABLE 3
TANK FARM STRONTIUM AND CESIUM INVENTORIES

January 1, 1970

East Area Sludge and Solution to be processed

Tank or Tank Farm	Supernatant Vol., Gal x 10 ⁻³	Sludge Volume Gal x 10 ⁻³	Cs-137 MCi	Sr-90 MCi	Wt. % of Total Sr
101-A	162 (Water)	11 (NP)	0	Negl	--
102-A	✓ 561 (PSN)	149	2.1*	26.2	27
103-A	58 (PSN)	102	Negl	7.8	>50
104-A	957 (Water)	3 (NP)	0	Negl	--
105-A	33 (PSN)	33	Negl	5.2	>50
106-A	29 (PSN)	230	Negl	21.2	43
101-AX	955 (NHW)	30	12.5*	5	>50
102-AX	848 (NHW)	10 (NP)	3.6	3 (NP)	>50
103-AX	882 (PSN)	23	14.0*	8	>50
104-AX	960 (PSN)	41	22.2*	18.2	>50
105-C	217 (PSN)	233 NP	0.6	NP	-
101-BX	456 (1XW)	43 "	1.5	"	-
102-B	489 (1XW)	24 "	2.2	"	-

West Area Solution to be processed (original volume) (2)

102-SX	679 (RSN)	51 NP	1.5	NP	-
103-SX	550 (RSN)	125 "	1.5	"	-
104-SX	610 (RSN)	165 "	1.5	"	-
110-SX	921 (RSN)	24 "	1.8	"	-
111-SX	864 (RSN)	77 "	1.8	"	-
114-SX	739 (RSN)	204 "	1.8	"	-
101-TX	659 (RSN)	10 "	2.1	"	-
102-TX	736 (RSN)	12 "	1.4	"	-
104-TX	719 (RSN)	11 "	1.4	"	-
105-TX	672 (RSN)	13 "	1.3	"	-
106-TX	622 (RSN)	15 "	1.4	"	-
107-TX	653 (RSN)	6 "	0.8	"	-
101-TY	606 (RSN)	149 "	2.5	"	-
Sub-total	14,523	668	79.5	91.6	-
Other C Tanks (Excl. 105-C)	1,725	1495	Negl	2.0 (Incl. 105-C)	NI
Other SX, S, T	15,295	7723	19	36 (Incl. all West Area Tanks)	"
TX, U Tanks (Excl. above West Area Tanks) (Non-boiling)					
B, BX, BY Tanks (Excl 101-BX, 102-B)	11,997	5630	2	2	-

Notes: 928

NP - Not processed

NI - Not indicated

(NP) - Treatment method not finally decided

(2) - Original solution volume of West Area tank supernatant solution to be processed will be diluted from an original volume of 9.035 million gal to 18.070 million gal for processing.

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Sr-90

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11/6/69 (45)

Capacule volume ≈ 932 cc

$$\begin{aligned} @ 75\% \text{ T.D. wt. SrF}_2 / \text{capacule} &= 932(4.2)(0.75) \\ &= 2930 \text{ grams packaged SrF}_2 \text{ per capacule} \end{aligned}$$

aged ⁹⁰Sr

46.8 MCi decayed to end FY 1985

Have ~ 60.4 MCi (decayed to end FY 74) = 1214 kg
pure total Sr (35 w/o).

$$\frac{127}{89} = 1.43$$

$$\begin{aligned} 1. \text{ assume purity of packaged SrF}_2 &\approx 97\% \\ 1214 \text{ kg pure Sr} \times \frac{127 \text{ kg SrF}_2}{89 \text{ kg Sr}} \times \frac{1.0 \text{ kg packaged SrF}_2}{0.97 \text{ kg SrF}_2} \\ &= 1790 \text{ kg packaged SrF}_2 \end{aligned}$$

$$2. \text{ Total capsules} = \frac{1790}{2.93} = 610 \text{ aged}$$

$$3. \text{ ave kCi/capsule} = \frac{60.4 \times 10^3}{610} = 99$$

current ⁹⁰Sr

Have ~ 125 MCi, assume 54 w/o ⁹⁰Sr
 ≈ 77 Ci/gram

$$1. 124 \text{ MCi} \times \frac{\text{kg Sr}}{0.077 \text{ MCi}} = 1610 \text{ kg pure Sr}$$

$$1610 \text{ kg pure Sr} \times \frac{1.43 \text{ kg SrF}_2}{\text{kg Sr}} \times \frac{1.0}{0.97} = 2370 \text{ kg packaged SrF}_2$$

$$2. \text{ Total capsules} = \frac{2370}{2.93} = 808$$

$$\text{ave. kCi/capsule} = \frac{125}{0.808} = 155$$

$$3. \text{ Low Case} = 68 \text{ MCi current}$$

$$808 \times \frac{68}{125} = 480 \text{ capsules}$$

Q-137

assume Q-137 is all 37 w/o

capsules hold 900cc @ 2.6 g/cc $\approx 57 \text{ K Ci}$

1. Have 260 M Ci to package (Case I decayed to year of purification & packaging)
2. Total capsules = $\frac{260}{0.057} \approx 4560$ capsules
3. Low case = $\frac{186 \text{ M Ci}}{0.057} \approx 3270$ capsules

Hi (2K, C₄H₁₀F₁₃B₁₂, 12)

Low (K + D FF-70-80)

					Sn	C ₄
15	75	22.2	28.5	39.6	22.2	28.5
70	22.2	57	79.2	79.2	22.2	57.0
7	22.2	85.5	118.8	118.8	22.2	85.5
76	22.2	114	158.4	158.4	22.2	114
79	22.2	142.5	199.0	199.0	22.2	142.5
80	22.2	171.0	238.6	238.6	22.2	171.0
81	22.2	184.5	256.4	256.4	22.2	184.5
					1090	3270
					1418	4560

B PLANT ESSENTIAL MATERIALS COST FORECAST

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FISCAL YEAR

(Thousands of Gallons - Thousands of Dollars)

<u>E Plant & AR Vault</u>	<u>70</u>	<u>71</u>	<u>72</u>	<u>73</u>	<u>74</u>	<u>75</u>	<u>76</u>	<u>77</u>
Current Acid Waste								
PAW, Gallons	286	155	141	141	141	141	141	141
PAW x \$1.10/gal @ 20	315	170	200	200	200	200	200	200
\$.40/gal @ 60								
ZAW, Gallons	90	100	172	172	172	172	172	172
ZAW x \$1.00/gal @ 300	90	110	190	190	190	190	190	190
\$1.10/gal @ 240								
Total Cost	405	280	390	390	390	390	390	390
Stored Waste								
PAS, Gallons	200	860	800	800	530	-	-	-
PAS x \$0.30/gal	60	260	240	240	160			
PSS, gallons	400	1,700	1,600	1,600	1,000	-	-	-
PSS x \$0.001/gal	-	2	2	2	2			
PSN, Gallons	3,700	-	-	-	3,600			
PSN x \$0.001/gal	4				4			
RSN, Gallons	-	2,900	4,000	4,000	-	7,100	-	-
RSN x \$0.001/gal		3	4	4		7		
New Zelon bed	50	50	50	50	50			
Purification and Encapsulation								
Sr-90, MCi	-	-	-	Startup	30	30	30	12
Sr-90 x \$3300/MCi	-	-	-	67	100	100	100	40
Cs-137, MCi	-	-	-	Startup	30	30	30	30
Cs-137 x \$1500/MCi	-	-	-	33	45	45	45	45
Total	519	595	686	786	750	542	535	471
Round	550	650	700	800	800	550	550	500

52

Total
70 - 80

78 79 80

141 141 141
200 200 200

172 172 172
190 190 190

390 390 390

- - -

- - -

- - -

(FY-81 Regl.)

5 4.7 4.7
17 16 16

(FY-81 3 MCI)

30 30 30
45 45 45

452 451 451
500 500 500

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-2-

	70	71	72	73	74	75	76
PSN							
Gal	3700	0	0	0	3600	0	0
Cs-137, MCi x 0.92	30	0	0	0	52.3	0	0
Tanks	106A, 106C 101C, 103A, 102A, 101EX, 102B	-	-	-	101, 102, 103	-	-
RSN (3)							
Gal (Dil. 2/1)	0	2900	4000	4000	1000	6100	0
Cs-137, MCi x 0.90	0	3.10	4.60	4.60	-	7.3	0
Tanks	Order of processing not yet established						-

Notes: 1) Take strontium recovery:

FY-70 = 0.85
FY-71 = 0.90
FY-72 - 80 = 0.95

2) For PRTR Purex campaign FY-70 add

CAW 5000 gal.
Sr-90 0.015 MCi @ 100% recovery
Cs-137 0.0346 MCi

3) RSN Data

<u>Tank</u>	<u>Gallons (Thousands)</u>	<u>Est. MCi Cs-137</u>	<u>Tank</u>
102-SX	679	1.5	104-TX
103-SX	550	1.5	105-TX
104-SX	610	1.5	106-TX
110-SX	921	1.8	107-TX
111-SX	864	1.8	101-TX
114-SX	739	1.8	
101-TX	659	2.1	
102-TX	736	1.4	To be pro

(51)

77	78	79	80
0	0	0	0
0	0	0	0
-	-	-	-

$\Sigma = 82.3$

89.5
67.3
7.2

0	0	0	0
0	0	0	0
-	-	-	-

$\Sigma = 19.6$ $T_{HSC} = 112.7$

21.1
2.4
2.2
2.2

Gallons
(Thousands)

Est. MCI Cs-137

719	1.4
672	1.3
622	1.4
658	0.8
606	2.5

cessed

9,035	20.8	in SW
18,070		

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B PLANT PRODUCTION FORECAST

FISCAL YEAR
(Thousands of Gallons)

	<u>70</u>	<u>71</u>	<u>72</u>	<u>73</u>	<u>74</u>	<u>75</u>	<u>76</u>
<u>Current Acid Waste</u>							
K Reactor							
CAW-0.71, Gal.	530	111	116	116	116	116	116
CAW-0.94, Gal.	233	44	25	25	25	25	25
Cs-137, HCl x 0.95	10.35	3.29	2.62	2.62	2.62	2.62	2.62
Sr-90, HCl x 0.95(1)	8.42	2.87	2.30	2.30	2.30	2.30	2.30
H Reactor							
CAW-0.94-1.25 Gal.	90	100	170	170	170	170	170
Cs-137, HCl x 0.95	1.48	1.74	2.72	2.72	2.72	2.72	2.72
Sr-90, HCl x 0.95(1)	1.16	1.46	2.42	2.42	2.42	2.42	2.42
Total							
CAW, Gal. (2)	380	255	313	313	313	313	313
Cs-137, HCl x 0.95 (2)	11.85	5.03	5.34	5.34	5.34	5.34	5.34
Sr-90, HCl x 0.95(2)	9.60	4.33	4.72	4.72	4.72	4.72	4.72
<u>Stored Waste</u>							
PAG					(200)		
Gal	200	860	800	800	530	(130)	0
Sr-90, HCl x 0.80	4.3	19.6	20.7	23.4	8.8	(0.6)	0
Tanks	0.25:	0.75:	0.66:	0.33:	0.33:	(0.33:	-
	106-A	106A	102A	103A	104AX	102AX)	
		0.33:	0.66:	1.0:	1.0:		
		102A	103A	103AX	101AX		
				0.66:	(0.66:		
				104AX	102AX)		
PSS					(1,600)		
Gal	400	1,700	1,600	1,600	1,060	(260)	0
Cs-137, HCl x 0.92	0.7	3.0	2.7	2.7	1.7	(2.7) (0.43)	0
Tanks	106A	106A	102A	103A	104AX	(102AX)	
		102A	103A	103AX	101AX		
				104AX	(102AX)		

50

77 78 79 80 Total
70 - 80

116 116 116
 25 25 25
 2.62 2.62 2.62
 2.30 2.30 2.30

170 170 170
 2.72 2.72 2.72
 2.42 2.42 2.42

313 313 313
 5.34 5.34 5.34
 4.72 4.72 4.72

$\Sigma = 64.9 \text{ MC.}$
 $\Sigma = 56.4 \text{ MC.}$

0 0 0
 0 0 0
 - - -

$\Sigma = 76.8$

0 0 0
 0 0 0
 - - -

$\Sigma = 10.8 (73.4)$

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DEL
2-16-70

(47)

PRODUCTION FORECAST

PUREX PLANT
OPERATING
K REACTOR AND N REACTOR

FY Uranium (Tons) (1)

	K Reactor (1)		N Reactor (1)	
	4.25% Pu-240	0.94	0.25% Pu-240	1.25
	0.71	0.94	0.64	1.25
			4 TU:	1 TU (1)
70	601(3)	2650(3)	218(3)	54(3)
71	1260(4)	500(4)	304(4)	76(4)
72	1760	375	520	130
73	1760	375	520	130
74	1760	375	520	130
75	1760	375	520	130
76	1760	375	520	130
77	1760	375	520	130
78	1760	375	520	130
79	1760	375	520	130
80	1760	375	520	130
Total	17,701	6,525	5,202	1,300

K Reactor shutdown at end of FY-70

NOTES: 1. Two cases were proposed to M. K. Harmon by DUN personnel after a K Reactor

	Tons Uranium		
	K Reactor		K Reactor
	4.25% Pu-240	0.94 - 1.25	4.25% Pu-240
Case 1	8.5	615	4.0 1807 385
Case 2	8.0	690	4.5 1726 369

The average of these two cases was used for production studies.

- The ratio of the amount of 0.94 to 1.25 uranium metal contained in N reactor material was obtained from R. G. Zumhoff.
- The production for FY-70 was obtained by adding the actual production from the first two quarters of FY-70 and the projected production contained in the reference in note 4.
- Production for FY-71 obtained from staffs: DUN, ARHCO, and AFC-EL, "Quarterly Production Forecast - January 1, 1970 thru June 30, 1971," AFM-1546 ED, January 21, 1970.

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072 70 70	08-70	08-70	1/000	072-70	072-70
70/70	70/70	70/70			

1.25	12	2200	7.25	6.75	1620
0.94	10	1100	5.27	4.60	1340
0.94	5.5	800	2.65	2.50	750
0.94	12	1920	6.30	5.75	1520
0.71	5.5	500	1.70	1.54	460
71	10	1150	3.60	3.30	950
1.25	8.25	1500	4.92	4.15	1230
0.94	8.25	130	4.27	3.60	1120
0.94	4.25	600	2.00	1.92	610
0.71	4.25	300	1.14	1.02	300

71 - 30 250 + 25 JD = 265 001/20

67

2-16-75
612

ACCUMULATED SALT CREEP AND LOSS

63

**DATE
FILMED**

4 / 4 / 94

END