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by Battelle Memorial Institute**

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FILE

1704
100-K

SUBJECT **Project C-187-D Design Requirements**
for Redox Production Plants.

FROM R.H. Beaton

COPY No.

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General Electric Company
Hartford Works
Design Division

1-10. H.E. Willis - Kellax Corp.
11-13. A.A. Nickman - Kellax Corp.

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By Authority of C.A. Bauman
CGNMP-1 7-14-94

By J.E. Savely 7-26-94

Verified By Jerri Maley
7-28-94

Richland, Washington
May 22, 1948

The Kellax Corporation
233 Broadway
New York City, New York

Attention: Dr. E.H. Willis (10)
Project Manager

Gentlemen:

Project C-187-D

DESIGN REQUIREMENTS FOR REDOX PRODUCTION PLANTS

The following outline of the requirements for the Redox Production Plant design is transmitted to the Kellax Corporation by the General Electric Company to be used in carrying out the assignment directed by Work Authority C-187-C (4). This outline briefly describes the critical features of design and emphasizes the General Electric desires for certain types of process and engineering design.

Very truly yours,

R.H. Beaton

R.H. Beaton
Redox Design Section

MASTER

RHB:vax

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DESIGN REQUIREMENTS FOR REDOX PRODUCTION PLANTSINTRODUCTION

The nature and scope of the Kellax Corporation assignment for the design of the Redox Production Plants has been recently changed, according to the directions of Work Authority C-187-C (4) (PM-326, HDC-390). In brief, this new assignment calls for the preparation of an engineering feasibility report evaluating the relative advantages of three types of plants, based on the use of vertical packed columns, horizontal extractors, and

settler contactors respectively. Engineering flow sheets, equipment arrangements, layout sketches, cost estimates, and preliminary schedules are to be prepared. These preliminary designs are to be sufficiently developed to permit final mechanical design to proceed when and if any one is chosen. All area facilities outside of the main process building, such as waste farm, utilities, control laboratory, etc., are to be excluded.

The purpose of this transmittal is to outline the minimum requirements as to process flow sheet and design criteria to initiate the carrying out of this assignment by the Kellax Corporation. It is believed that sufficient information has already passed from the General Electric Company to the Kellax Corporation to permit a brief outline of basic requirements to be used as the additional guidance for this design. In general, this outline information emphasizes the General Electric desires to obtain the following:

1. The range of facilities required to obtain the complete scope of services and functions for satisfactory process performance;
2. A maximum guarantee of safety in both process and maintenance operations;

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3. A large factor of versatility and flexibility in the use of permanently installed facilities to provide for possible future changes in process and engineering flow sheets.

GENERAL DESIGN BASES

A. Capacity

The capacity basis to be used for these preliminary designs is the processing of 1.5 long tons of uranium/day or 45 long tons/month for a single separations production unit. Changes in this basis may be made later, when product concentration in metal and critical mass considerations are better defined, but this capacity sizing is to be used for these designs.

B. Process Performance

Process performance must be such that the following are regularly attained for the production rates quoted above:

1. A plutonium yield approximating 99% and decontamination factor of at least 10^7 .
2. An uranium yield approximating 98% and decontamination factor of at least 3×10^5 .

C. Process Flow Sheet

The process flow sheet to be used should be based on the Argonne National Laboratory flow sheet of September 1, 1947, and should include any proven modifications or revisions recently or currently being developed by the Argonne National Laboratory. The extrapolation of this flow sheet to provide a complete production

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process, as outlined by the revised General Electric Test Plant process flow sheet (Doc. No. HDC-426), should be used as the more definite guide. The pattern of the Test Plant flow sheet should be used as the model for the Production Plant, except as modified by the restrictions outlined in a later section. Finally, the attached Material Balance - Stream Data Flow Sheet (Sketch No. SK-2-5132) ^(General DP-2) should be used as the basis for stream quantity, composition, and routing.

FUNCTIONS VS. FACILITIES REQUIREMENTS

The basic process functions for which equipment facilities are required for carrying out the complete production process are judged to be as follows:

1. Metal handling and metal solution preparation;
2. Solvent extraction cycles comprising one mixed plutonium and uranium cycle and two additional cycles each; (3 cycles)
3. Solvent recovery (with optional inclusion of solvent pretreatment);
4. Chemical solution make-up, aqueous and organic;
5. Waste treatment and disposal;
6. Reworking of off-grade process streams.

DESIGN NECESSITIES

The following design criteria are quoted as necessities, except where qualified, to be observed in preparing process and engineering design:

1. The flowsheet is to provide for separate and individual control of each extraction step, with sufficient intermediate tankage to permit at least 24-hour material balances. An optional but highly desirable additional
- G.E. New critical mass?*
- Comparative Design*

REF ID: A66111

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feature of also providing for the possible gravity cascading of stream flows between pairs of extraction and stripping contactors should be considered. ✓

2. The engineering flowsheet should provide sufficient sparing or multiplication of basic equipment and alternative routings such that the desired production rate of 45 long tons of uranium/month can be maintained with a maximum of 20% shutdown ^{allowed} time required per month. This means that enough dissolvers, storage tanks, neutralizers, contactors, stream routings, etc., must be provided to handle the required production rate, in spite of partial equipment failure. ✓
3. Provisions must be made for reworking any process stream which reaches an inventory or hold-up tank outside of specifications. This should preferably be carried out in a manner not interfering with regular production rates. The methods outlined for the Test Plant are suggested for consideration. *(Appropriate work equipment)* ^{Good}
4. Provisions must be made for washing and flushing all equipment with accurate monitoring and interim disposal of wash liquors. This may be carried out in series fashion by use of regular process solution lines and in a manner requiring production interruptions if necessary.
5. The use of bottom outlets in large-volume "hot" process tanks and pneumatic pressure or non-condensable vapor ejection feed systems is to be avoided. *Eng'g. Considerations.*

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6. Arrangement of the operating gallery must be such that all equipment directly connected to the "hot" process area, such as samplers, recovered solvent ^{feed tanks} and ~~other process solution feed tanks~~, gang valves, and telegage instrumentation, should be located in intermediate "restricted" zones. All central electrical control stations should be located in or closely adjacent to the main operating gallery.
7. Ventilation air flow arrangement should be in series from the intermediate "restricted" control areas to the "hot" process area for eventual controlled discharge. A closed ventilation system for all "hot" process tanks is required. All air discharged must be treated for control of contamination.
8. A cell and trench construction should be provided in the "hot" process area with standardization of cells with respect to permanently installed piping. The order of arrangement of cells should be from high to low radiation levels and all equipment therein shall be capable of being remotely removed and replaced down to individual pieces or small sub-assemblies. All interior concrete surfaces should be protected with an acid and solvent resistant material.
9. All mechanical auxiliaries in the "hot" process area, such as pumps, valves, and instruments, should have the characteristics of corrosion resistance to all process solutions,

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complete drainage in installed positions, leak-proof
or packless construction, and minimum complexity of
primary elements. A service life expectation of at
least one year for all such auxiliaries is desirable.

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One Dissolver Batch 48-hr Extraction Supply

Jacketed S	
U	6600
Pu	600
FP	600
Al	217.0
Si	12.0
Σ	6830.

26% NaN_3	3850
50% NaOH	1070
5% HNO_3	4300
H_2O	835
Σ	~10,050*

Jacket Removal

Waste ~10,280*

60% HNO_3	14,900*
Air	6400*
H_2O	2950*
Σ	24,250*

Metal Dissolver

Stack Gas ~10,050*

H_2O 1350.*

50% $\text{Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$

First

Chemicals Entering Aqueous Make-Up - 24 hr basis			
1. N ₂ H ₄	31. #	6. Al(NO ₃) ₃ ·9H ₂ O	686.6 #
2. NaNO ₃	500. #	7. Na ₂ Cr ₂ O ₇ ·2H ₂ O	207 #
3. NaOH	5360. #	8. KMnO ₄	27.1 #
4. HNO ₃	5880. #	9. Fe(NH ₄) ₂ (SO ₄) ₆ ·H ₂ O	191 #
5. H ₂ O ₂	12.6 #	10. HNO ₃ - HF	46. # (Est average)

IAS	
1 Al(NO ₃) ₃ ·9H ₂ O	405
2 H ₂ O	59.5
Total	~8370
833. gal/day	Sp.Gr = 1.204
#/day	%

IAF	
1 UNH	60.0
2 HNO ₃	131.
3 Na ₂ Cr ₂ O ₇ ·2H ₂ O	207.
4 H ₂ O	37.1
Total	~11,600
833. gal/day	Sp.Gr = 1.67
Pu - 300 gm/day	FP - 300 gm/day
#/day	%

IAP	
1 UNT	6150.
2 HNO ₃	534.
3 Al(NO ₃) ₃ ·9H ₂ O	4.4
4 H ₂ O	478.
5 Hexane	2120.
~28430	74.8
3507 gal/day	Sp.Gr = 0.97
Pu - 299.7 gm/day	FP - 300 gm/day
#/day	%

IA

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%	IBX	#/day	%
21.6	1. $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	988.	29.1
1.9	2. HNO_3	36.9	1.1
0.015	3. N_2H_4	9.4	0.3
1.7	4. $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$	57.4	1.7
1.8	5. Water	2310.	67.9
0.0	Total	~3400.	100.
972	Sp. Gr.	1.162	
	351 gal/day		

%	IBU	#/day	%
15.3	1. UNT	6150.	15.3
1.4	2. HNO_3	584.	1.4
0.01	3. $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	4.4	0.01
0.07	4. N_2H_4	29.6	0.07
1.7	5. Water	697.	1.7
81.4	6. Hexone	32660.	81.4
100.	Total	~40,130.	100.
	Pu	0.30 gm/day	
	δ-curies	90.	
	Sp. Gr.	0.915	
	5254 gal/day		

IB

FIED

ICX	#/day	%
1. HNO ₃	92.1	0.63
2. Water	14560.	99.4
Total	~14650.	100.
Sp. Gr.	1.0023	
1751 gal/day		

ICW	#/day	%
1. UNT	0.6	0.002
2. N ₂ H ₄	29.6	.09
3. HNO ₃	120.	.36
4. Water	691.	2.1
5. Hexone	32400.	97.5
Total	~33240.	100.
4964 gal/day, SpGr-0.803		
Pu - 0.03 gm/day		
8 curies - 80.		

IC

IDS	#/day	%
1. $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	2310.	29.1
2. HNO_3	86.4	1.1
3. N_2H_4	22	0.3
4. $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$	134.	1.7
5. Water	5400.	67.9
Total	~7960.	100.
Sp. Gr.	1.16	
821 gal/day		

TDU	#/day	%
1. UNT	6140.	21.8
2. HNO_3	434.	1.5
3. $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	2.9	0.01
4. N_2H_4	47.3	0.17
5. $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$	—	0.00
6. Hexone	21070.	75.0
7. Water	415.	1.5
Total	~28100	100.
Sp. Gr.	0.972	
3464 gal/day		
8 curies 0.1		

IDF	#/day	%
1. UNH	6890.	60.0
2. HNO_3	537.	4.7
3. $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	4.4	0.04
4. Water	4050.	35.3
Total	~11490.	100.
Sp. Gr.	1.68	
821 gal/day		
Pu -0.27 gm/day		
8 curies 10		

ID

IEX	#/day	%
HNO ₃	113	.63
Water	17850	99.4
Total	~17960	100
Sp. Gr.	1.0023	
2148 gal/day		

IEW	#/day	%
UNT	0.3	0.001
HNO ₃	186	0.87
N ₂ H ₄	47.3	0.22
Water	407	1.9
Hexone	20750	97.1
Total	~21390	100
Sp. Gr.	0.806	
3178 gal/day		
8 curies 0.01

IAW	#/day	%
1. UO ₂ (OH) ₂	41.7	0.2
2. NaNO ₃	2960.	16.5
3. Na ₂ Cr ₂ O ₇ ·10H ₂ O	474	2.6
4. NaAlO ₂	739.	4.1
5. H ₂ O	13630.	76.4
6. NaOH	72.	0.4
Total	~17920.	100.
1766 gal/day SpGr 1.21		
Pu - 0.30 gm/day		
FP - 299.7 gm/day		
8 curies - 9.99 x 10 ⁴		

E
H₂O
H₂O
Hex

<u>IAX</u>	<u>#/day</u>	<u>%</u>
1. HNO_3	876.	3.8
2. H_2O	483.	2.1
3. Hexone	21460.	94.0
Total	~22810.	99.9
3330 gal/day		
Sp. Gr. = 0.821		

<u>IAX</u>	<u>#/.</u>
1. HNO_3	68.
2. HNO_3	473
3. $\text{Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$	207.
4. $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	3380.
5. Hexone	189.
6. H_2O	10,030.
Total	~14,350.
1498 gal/day; Sp. Gr. = 1.1	
Pu - 0.35 gm/day	
FP - 299.7 gm/day	
r-curves = 9.99×10^4	

50% NaOH - ~3760 lbs

Hot Waste
Stripper

Hexone ~28.5 gal 189 lbs

Equip. Flushes

H_2O (To be Tanked) ~450 gal/day
 H_2O (To be Cribbed) ~200 gal/day
 Hexone ~11 gal/day

#/...	%
68.9	0.5
473	3.3
207.	1.4
3380.	23.6
189.	1.3
10,030.	69.9
4,350.	100.0
Sp.Gr = 1.143	
Wt. - 1 gm/day	
99 x 10 ⁴	

IBP	#/...	%
1. N ₂ H ₄	25.4	0.2
2. H ₂ O ₂	52.5	0.3
3. Water	228.	1.9
4. Hexone	140.	27.6
Total ~ 20.		100.
Sp. Gr. 0.301		
1783 gal/day		

IBP	#/...
1. HNO ₃	1
2. Al(NO ₃) ₃ · 9H ₂ O	98
3. N ₂ H ₄	
4. Fe(NH ₄)(SO ₄) ₂ · 6H ₂ O	5
5. Hexone	4.
6. Water	2320
Total ~ 3430	
U = 0.15 gm./day	
8 curies 10.	
Sp. Gr. 1.152	
357 gal./day	
Pu - 299.4 gm/day	

#/day	%
18.8	0.5
988.	28.8
3.2	0.1
H ₂ O 57.4	1.7
43.7	1.3
2320.	67.6
3430.	100.
/day	
2.	
gm/day	

ICU	#/day
1. JH	6890.
2. HNO ₃	557.
3. N ₂ H ₄	0.
4. H ₂ O	4.4
5. Hexone	261.
6. Water	13820.
	~2.530.
Sp. Gr.	1.269
2034	gal/day
Pu	0.27 gm/day
3 cures	10.

ICU
1. H ₂
2. H ₂
3. W ₂
7
Sp.
121.
Pu.
8 c

Stack

ICU concentrator

#/day	%
30.	32.0
57.	2.6
0.	.0
4.4	.02
61.	1.2
20.	64.2
30.	100.

IDX	#/day	%
1. HNO ₃	690	3.1
2. N ₂ H ₄	44.9	.02
3. H ₂ O	479	1.8
4. Hexone	21260	94.9
Total	~22470	100.
Sp. Gr.	0.82	
	3284 gal/day	

IDW	#/day
1. UNH	14.
2. HNO ₃	879.
3. Al(NO ₃) ₃ · 9H ₂ O	2310.
4. N ₂ H ₄	19.6
5. Fe(NH ₄) ₂ (SO ₄) ₂ · 6H ₂ O	34.
6. Hexone	193.
7. Water	10260.
Total	~13810.
Sp. Gr.	1.12
	1479 gal/day
Pu	-0.27 gm/day
8 curies	9.9

ICU Concentrator Condensate		
	#/day	%
1. HNO ₃	20.3	.02
2. Hexone	261.	2.6
3. Water	9770.	97.2
Total	~10,050.	100.
Sp. Gr.	-0.994	
	1211 gal/day	
Pu	-0	
8 curies	- ?	

IIAS	#/day	%
1. Al(NO ₃) ₃ · 9H ₂ O	178.	29.6
2. H ₂ O	428.	70.4
Total	~606.	100

IIAP	#/day
1. HNO ₃	2.0
2. Al(NO ₃) ₃ · 9H ₂ O	.00
3. H ₂ O	11

g	%
14.	0.1
9.	6.4
10.	16.8
19.6	0.15
34.	1.0
33.	1.4
60.	74.3
10.	100.

IEU	*/day	
UNH	6880.	2
HNO ₃	361.	
Al(NO ₃) ₃ 9H ₂ O	2.9	
Hexone	323	
Water	17120.	6
Total	~24690	10
Sp.Gr	1.22	
	2427 gal/day	
	8 curies	0.1

day	%
0	0.4
0002	
2.2	

IBX	*/day	%
1. HNO ₃	0.40	0.63
2. H ₂ O	62.2	99.4
Total	~62.6	100

IBW	*/day	
1. HNO ₃	0.09	
2. H ₂ O	11.	
3. Hexone	427	

cu	%
0.	28.0
1.	1.5
2.9	0.01
3	1.3
2.	69.3
0	100.

IEU
Concentrator

IEU Concentrator Product		
	#/day	%
1. UNH	6880.	55.0
2. HNO ₃	343.	3.0
3. Al(NO ₃) ₃ · 9H ₂ O	2.9	.02
4. Water	5280.	42.
Total	~12,500.	100.
Sp. Gr.	1.570	
956 gal/day		
8 curies	0.1	

UNH

IEU Concentrator Condensate		
	#/day	%
1. HNO ₃	18.3	0.2
2. Hexane	323.	2.6
3. Water	11840.	97.2
Total	~12,200	100.
Sp. Gr.	0.994	
1468 gal/day		
Pu - 0		
8 curies - ?		

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day	%
09	0.02
	2.2
	97.8

IEU Concentrator Product		
	#/day	%
1. UNH	6880.	55.0.
2. HNO ₃	343.	3.0
5. Al(NO ₃) ₃ · 9H ₂ O	2.9	.02
4. Water	5280.	42.
Total	~12500.	100.
Sp. Gr. 1.570		
956 gal/day		
8 curies 0.1		

→ UNH Storage

Analyze	
	%
	0.2
	2.6
	97.2
	100.

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50% NaOH ~4600#

Strippers

Equip. Flushing	
HNO ₃	631#
HNO ₃ -HF	33
H ₂ O	3476
Total	4140
~460 gals	

50% NaOH
~800#

Equip. Flushing	
HNO ₃	
HNO ₃ -F	
NaOH	
H ₂ O	
Total	~47

Cell Flush
~950 gal

Waste Tanks

Source	Gals	Gal(Conc)
Jacket Removal	~567	~189
Equip. Flush	~525	~193
From Strippers		
IAW	~1766	~760
IDW	~1705	~604
IIAW	~320	~320
Hex Scrub	~600	~60
Equip. Flush	450	~5
Total	~5945	~2150

Crib

Source
Equip. Flush
Cell Flushes & Misc.
ICU Conc.
FEU Conc.
COC. Cond
Hex Scrub
Tank Flush
Total

NaOH Scrub
 NaOH 295 #
 H₂O 6860 #

Hexone ~1063 #/day
 H₂O 21

Hexone Recovery

Reco
 Hexone
 N₂H₄
 782

H₂O ~8100 #/day
 NaOH ~100
 NaNO₃ ~914
 Hexone ~154
 UNH ~1
 PU ~0.33 gm/day

Chemical
Organic

QUIPT Flushing
 251 #
 -HF 13 #
 232 #
 3637 #
 401 ~4133 #
 472 gals

Flushes
 al H₂O/day

10
 Gals
 ~472
 Misc. ~950
 ~1174
 ~1421
 ~212
 ~400
 ~200
 ~4830 gal

Organic Waste Disposal
 N₂H₄ ~8.6 #
 Hexone ~1000 #

Estimated Hexone
 Disappearance 1750 #

Chemicals Entering Organic Make-up

Recovered
Xone ~ 5200#/day
~ 75"/day
7828 gals

Hexone ~ 2750#/day
HNO₃ ~ 1619.0

Organic Make-up

Chemical
1.60% HNO₃
253.3% KMnO₄
3.30% H₂O₂

<u>al. Additions</u>	
IO ₃	148. Lbs
4nO ₄	50.8 Lbs
O ₂	41.9 Lbs

Off Gas
~22.7#

<u>Condensate</u>		
	<u>g/day</u>	<u>%</u>
1. H ₂ O	1760.	97.
2. Hexone	43.7	2.4
3. HNO ₃	10.7	0.6
Total	~1816.	100.
Sp Gr	0.997	Pu - 0
218 gal/day		
8 curies < 10 ⁻⁴		

Cross Over Charger

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IIAX	
1 HNO ₃	20.7
2 H ₂ O	11.4
3 Hexone	508
Total	~541
Sp. Gr.	0.821
79 gal/day	

IIAF	
1 Al(NO ₃) ₃ ·9H ₂ O	988
2 HNO ₃	41.5
3 Fe ₂ (NH ₄) ₂ (SO ₄) ₂ ·24H ₂ O	70.6
4 NH ₄ NO ₃	11.7
5 Mn(NO ₃) ₂ ·6H ₂ O	49.3
6 KNO ₃	17.4
7 H ₂ O	651
Total	~1830
Sp. Gr. - 1.387	
158 gal/day	
U - 0.15 gm/day	
Pu - 299.4 gm/day	
8 curies / 10	

Sp. Gr.	1.142
63 gal/day	

IIA

IIAW	
1 Al(NO ₃) ₃ ·9H ₂ O	1166
2 HNO ₃	60.2
3 Fe ₂ (NH ₄) ₂ (SO ₄) ₂ ·24H ₂ O	70.6
4 NH ₄ NO ₃	11.7
5 KNO ₃	17.4
6 Mn(NO ₃) ₂ ·6H ₂ O	49.3
7 H ₂ O	1075
8 Hexone	20.3
Total	~2470
Sp. Gr.	1.31
225 gal/day	
Pu - 0.3 gm/day	
8 curies	9.9

Sp. Gr.	0.803
75 gal/day	
Pu - 299.1 gm/day	
U - 0.15 gm/day	
8 curies	0.1

100.	%
47.2	
2.4	
2.9	
0.5	
0.6	
2.0	
43.6	
0.8	
100.	

97.4	100.
7.5	gal/day
SP. Gr	1.002

SP. Gr	1.002
7.5	gal/day

II B

II BP	%/day	%
I/HNO ₃	2.28	3.5
2 H ₂ O	62.2	94.7
3 Hexane	1.2	1.8
Total	~65.5	100.
Sp. Gr.	1.01	
7.8	gal/day	
8 curies	0.01	
Metals	gm/day	%
Pu	298.8	99.6
U	0.15	0.05
Al	0.07	0.02

Total	~498.	100.
SP. Gr	0.801	
74.6	gal/day	
Pu	0.3 gm/day	
8 curies	0.1	

00.

99.6

Isolation

104

NO.

DESCRIPTION

BY

REVISIONS

SCALE.

DRAWN BY: J.D. DIXON 3/10/48

CHECKED BY J.M.F. DATE 3/27/48

ENG. REP. NO

PROJECT NO

GENERAL ELECTRIC

HANFORD V

"DO" ADV

4DC-427
5-22-58

[illegible]

Strippers

Eqipt Flushing

HNO ₃	631 ^g
HNO ₃ -HF	33
H ₂ O	3476
Total	4140
~460 gals	

50% NaOH
~800^g

Eq

HNO ₃	
HNO ₃ -H	
NaOH	
H ₂ O	
Total	~47

Cell Flu
~950 gal

Waste Tanks

Source	Gals	Gal(Conc)
Jacket Removal	~567	~189
Eqipt. Flush	~525	~193
From Strippers		
IAW	~1766	~760
IDW	~1705	~604
IIAW	~320	~320
Hex Scrub	~600	~60
Eqipt Flush	450	~5
Total	~5945	~2150

Crib

Source
Eqipt. Flush
Cell Flushes & Misc.
ICU Conc.
IEU Conc.
COC Cond
Hex Scrub
Tank Flush
Total

DECLASSIFIED

Possible Transfer By Concentration
~3830 gals

Strippers

H₂O ~8100#/day
NaOH ~100.
NaNO₃ ~914.
Hexone ~154.
UNH ~ 1.
PU ~ 0.33 gm/day

Hexone

Equip. Flushing

HNO₃ ~ 251#
HNO₃-HF ~ 13#
NaOH ~ 232#
H₂O ~ 3637#
Total ~ 4133#
~ 472 gals

Cell Flushes

~950 gal H₂O/day

Crib

Source	Gals
Equip. Flush	~ 472.
Cell Flushes & Misc.	~ 950.
ICU Conc.	~ 1174.
IEU Conc.	~ 1421.
COC. Cond	~ 212.
Hex Scrub.	~ 400.
Tank Flush	~ 200.
Total	~ 4830 gal

Organic Waste Disposal

N₂H₄ ~ 8.6#
Hexone ~ 1000#

Estimated Hexone
Disappearance 1750#

0% NaOH
300#

Gal(Conc)
~189.
~193.
~760.
~604.
~320.
~60.
~5.
~2150.

Possible Transfer By Concentration
~ 3830 gals

One Recovery

Recovered

Hexone ~ 52,000 #/day
N₂H₄ ~ 75 #/day
7828 gals

Organic Make-Up

Chemicals Entering
Organic Make-Up

Hexone ~ 275
HNO₃ ~ 1619

sol/

*

0*

DECLA

~1619.0

~2750 #/day

c Makeup

CROSS OVER CHARTER

TAX		T HNO ₃		2 H ₂ O		3 Hexone		Total		Sp. Gr.		79 gwt/day	
/day		/day		/day		/day		/day		/day		/day	
100	%	20.7	3.8	11.4	2.1	508	94.1	54.5	100	0.821	79 gwt/day		

54.1	98.8	54.1
2.3	41.5	2.3
3.9	70.6	3.9
0.6	11.7	0.6
2.7	49.3	2.7
0.8	17.4	0.8
35.6	65.1	35.6
	~ 1830	
100		100

IIA

2.3
3.9
0.6
2.7
0.8
35.6
100.

%
3.8
2.1
94.1
100.

IIAW	#/day	%
1. $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	1166.	47.2
2. HNO_3	60.2	2.4
3. $\text{Fe}_2(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 24\text{H}_2\text{O}$	70.6	2.9
4. NH_4NO_3	19.7	0.5
5. KNO_3	17.4	0.6
6. $\text{Mn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	49.3	2.0
7. H_2O	1075.	43.6
8. Hexone	20.3	0.8
Total	~2470.	100.
Sp Gr	1.31	
225 gal/day		
Pu - 0.3 gm/day		
Curies	9.9	

II B

<u>II B P</u>	<u>#/day</u>	<u>%</u>
1. HNO ₃	2.28	3.5
2. H ₂ O	62.2	94.7
3. Hexane	1.2	1.8
Total	~65.8	100.
Sp. Gr.	1.01	
7.8 gal/day		
8 curies	0.01	
<u>Metals</u>	<u>gm/day</u>	<u>%</u>
Pu.	298.8	99.6
U	0.15	.05
Al	0.07	.02

Isolation

"PRELIMINARY -

DECLASSIFIED

3+2 Ser. 5-

104

NO.

DESCRIPTION

BY

DATE

Approved

DATE

APPLY

REVISIONS

SCALE

APPROVALS

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DEFY

FATE

DRAWN BY: J.D. DIXON 3/10/48

CHECKED BY J.M.F. DATE 3/29/48

ENG. REP. NO

PROJECT NO

GENERAL ELECTRIC CO.
HANFORD WORKS

Redox Production Plant
Stream Data
Material Balance Flow Sheet

BLOG
VO'S.

202

SWD
NO

SK-2-5132

5-22-48