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March 1, 1956

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PROCESS SECTION

ATTENTION: R. J. *CHRISTL*

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SCOPE OF WORK - EVALUATION ESTIMATE OF A
U-235 RECOVERY PLANT

This letter defines the scope of the Evaluation Estimate to be made on a U-235 recovery plant proposed for construction at Savannah River. The purpose of the plant will be to purify and recover the uranium (principally U-235 and U-236) from highly irradiated enriched fuel tubes (currently designated Mark VI and VIa.) The uranium will be purified such that it presents no radioactivity hazard to personnel when handled in critically safe, unshielded, tube type shipping containers. The product will be shipped off-site as a nitrate solution containing about 350 g U/liter and about 0.8 molar in nitric acid.

Feed Material

The Mark VI and/or VIa fuel elements will be discharged and stored for 150 days in the 100 Area cooling basins. The tubes are cropped of the end fittings and loaded into special shielding casks for shipment to the recovery plant. Cooling must be provided during shipment for disposal of heat generated by radioactivity.

Plant Capacity

The plant throughput is limited not by the amount of uranium handled, rather by the amount of aluminum associated with the uranium. However, the required plant capacity is defined by the 100 Area power levels and U-235 burnout. Consequently, the plant capacity is best expressed, without use of top secret data, **DOES NOT CONTAIN**

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MASTER

Reviewing
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C. J. Tinker
2/4/57

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as the number of tubes that represent the charging of 25 kg U-235/day to the reactors. This amounts to about 600-900 lbs/Al per day.

Process

For the purpose of the cost estimate, the process described in ORNL 1999 as modified by the attached flowsheet, will be considered. Actually the Savannah River Laboratory is beginning a thorough evaluation of this process and doubtless will recommend some modification of the flowsheet. Such modification, however, will not significantly affect the scope for cost estimation.

Plant Wastes

Regulations in force for the disposal of wastes from the Purex Process will apply in this case.

Equipment Description

The equipment requirements are outlined in the attached flowsheet. Modifications and repair of equipment will be by "contact maintenance" techniques. This will require the installation of decontamination sprays and other devices in and around the equipment to facilitate lowering the radioactivity to tolerable levels. Continuity of operation will be insured by installing spare equipment covering dissolving through the first cycle extraction.

The prevention of nuclear criticality must be a principal design consideration. This will involve maximum use of "geometrically safe" equipment wherever possible. Other techniques involving inventory control and vessel poisoning are under investigation where geometric control seems impossible.

Building Description

The plant is to be located in H Area. Maximum use of existing facilities such as sand filter, power plant, cooling equipment, waste disposal areas, etc., is to be made. If necessary, it may be assumed that operations in 221-H are curtailed or suspended to allow maximum use of these facilities.

The main line equipment is to be Class I construction. Cold feed areas, offices, laboratories, etc. may be other than Class I if savings are effected.

Pertinent References

1. A Proposal for Savannah River Enriched Fuel Processing Plant - ORNL-1999.
2. Optimum U²³⁵ Process - Work Outline - DPW-54-604.

Pertinent References (Cont.)

3. ORNL Interim Reports

ORNL-CF-54-11-67
" -54-11-148
" -54-12-45
" -54-12-182
" -55-1-127
" -55-1-192
" -55-2-92
" -55-2-172
" -55-3-127
" -55-4-2
" -55-4-72
" -55-4-149
" -55-5-34
" -55-5-137

4. The Skeleton of the Design Proposal for Savannah River 25 Recovery Plant 2/1/55 - ORNL-CF-55-2-49.
5. Preliminary Design Proposal - DPW-55-417.
6. Corrosion of Types 347 and 309 Cb Stainless Steels by Simulated "25" Process Waste Solutions ORNL-CF-54-6-7.
7. Continuous Dissolution of Uranium-Aluminum Alloy - DP-127.
8. Equipment Study - "25" Recovery Process - WR-25902.
9. Decontamination of Stainless Steel.
10. Decontamination of ORNL Purex Pilot Plant - ORNL-1242.
11. Study Prints

D-21389 - Combination canyon and direct maintenance plant preliminary layout.
D-21390 - Preliminary layout direct maintenance plant.
D-21391 - Preliminary layout direct maintenance plant.
D-19097 - Direct maintenance feeder.
D-19098 - Remote maintenance feeder.
D-19099 - Combination carrier and charger method.
E-19682 - Fuel tube carrier assembly directly maintained.
E-19681 - Feeder and dissolver assembly directly maintained.
E-19680 - Tipper and hopper assembly study remotely maintained.
E-22425 - Feeder and cutter assembly remotely or directly maintained.
D-22676 - Second cycle feed preparation vessel.
B-22675 - Infinitely safe vessels, Group II.
D-22662 - Solvent recovery turbo-mixers.

Study Prints (Cont.)

- D-22682 - E-I-E Evaporator.
- D-22679 - Vapor condensers.
- D-22671 - Evaporator.
- E-22674 - Nozzle specifications.
- E-22677 - Slab type metal dissolver.
- C-22667 - Manifold drain tank details.
- C-22678 - Dissolver reflex condenser.
- C-22672 - Crud trap.
- C-22660 - Concatenated 1A column.
- C-22669 - Typical pulse plate arrangements and details.
- C-22668 - Pulse columns.
- E-22426 - Hopper and tipper assembly remotely maintained.
- C-21352 - Preliminary chemical and equipment flowsheet acid dissolution and first cycle.
- C-21353 - Preliminary chemical and equipment flowsheet acid dissolution 1B column through second cycle.
- C-21351 - Preliminary chemical and equipment flowsheet caustic dissolution and first cycle extraction.
- C-21355 - Preliminary chemical and equipment flowsheet caustic dissolution 1B column through second cycle.
- E-22659 - Engineering flowsheet Area E.
- E-22658 - Engineering flowsheet Areas D & E.
- E-22657 - Engineering flowsheet Area C, Sheet #2.
- E-22656 - Engineering flowsheet Area C, Sheet #1.
- E-22655 - Engineering flowsheet Areas B & C.
- E-22654 - Engineering flowsheet Area B, Sheet #2.
- E-22653 - Engineering flowsheet Area B, Sheet #1.
- E-22652 - Engineering flowsheet Areas A & B.
- E-22651 - Engineering flowsheet Area A, Sheet #2.
- E-22650 - Engineering flowsheet Area A, Sheet #1.
- E-22673 - Experimental slab type dissolver.
- D-11099 - Combination carrier and charger method.
- D-21390 - Preliminary layout direct maintenance plant, Sheet #1.
- D-21391 - Preliminary layout direct maintenance plant, Sheet #2.
- E-22683 - Material balance flowsheet (acid dissolution).

12. Hot Analytical Facility at ORNL Pilot Plant

- D-11096 - Floor plan and details.
- D-11101 - Cell elevations.
- D-11485 - Elevations and sections electrical.
- D-11490 - Typical work cell phase details electrical.
- D-11608 - Service piping on cell phase.
- D-18691 - Over-all cell equipment plan.
- D-11092 - Drawing index.

 WILLIAM A. JENKINS
 TECHNICAL DIVISION
 ATOMIC ENERGY DIVISION

WAJ:hw
 Enclosure - 2 prints

LINE NO.

1	2	3	4	5	6	7	8	9	10
FUEL	METAL	DISS.	PRO- DUCT	PRO- DUCT	IAF	IAP	IAP	CONCENTR.	ACID
MENTS	MENTS	MENTS	MENTS	MENTS	MENTS	MENTS	MENTS	MENTS	MENTS
623	11100	15500	15500	15500	3680	2475	390		
FLOW, LBS. / HOUR - MAX.	FLOW, LBS. / HOUR - MAX.	FLOW, LBS. / HOUR - MAX.	FLOW, LBS. / HOUR - MAX.	FLOW, LBS. / HOUR - MAX.	FLOW, LBS. / HOUR - MAX.	FLOW, LBS. / HOUR - MAX.	FLOW, LBS. / HOUR - MAX.	FLOW, LBS. / HOUR - MAX.	FLOW, LBS. / HOUR - MAX.
AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
FLOW, MAX. - G.P.M.	FLOW, MAX. - G.P.M.	FLOW, MAX. - G.P.M.	FLOW, MAX. - G.P.M.	FLOW, MAX. - G.P.M.	FLOW, MAX. - G.P.M.	FLOW, MAX. - G.P.M.	FLOW, MAX. - G.P.M.	FLOW, MAX. - G.P.M.	FLOW, MAX. - G.P.M.
OPER'G	OPER'G	OPER'G	OPER'G	OPER'G	OPER'G	OPER'G	OPER'G	OPER'G	OPER'G
VOLUME AVE. - GALS	VOLUME AVE. - GALS	VOLUME AVE. - GALS	VOLUME AVE. - GALS	VOLUME AVE. - GALS	VOLUME AVE. - GALS	VOLUME AVE. - GALS	VOLUME AVE. - GALS	VOLUME AVE. - GALS	VOLUME AVE. - GALS
COND.	COND.	COND.	COND.	COND.	COND.	COND.	COND.	COND.	COND.
1030	1400	1400	1400	1400	282	358			
OPERATING TEMPERATURE °C	OPERATING TEMPERATURE °C	OPERATING TEMPERATURE °C	OPERATING TEMPERATURE °C	OPERATING TEMPERATURE °C	OPERATING TEMPERATURE °C	OPERATING TEMPERATURE °C	OPERATING TEMPERATURE °C	OPERATING TEMPERATURE °C	OPERATING TEMPERATURE °C
H	H	H	H	H	H	H	H	H	H
OPERATING PRESSURE P.S.I.G.	OPERATING PRESSURE P.S.I.G.	OPERATING PRESSURE P.S.I.G.	OPERATING PRESSURE P.S.I.G.	OPERATING PRESSURE P.S.I.G.	OPERATING PRESSURE P.S.I.G.	OPERATING PRESSURE P.S.I.G.	OPERATING PRESSURE P.S.I.G.	OPERATING PRESSURE P.S.I.G.	OPERATING PRESSURE P.S.I.G.
PHYSICAL PROPERTIES	PHYSICAL PROPERTIES	PHYSICAL PROPERTIES	PHYSICAL PROPERTIES	PHYSICAL PROPERTIES	PHYSICAL PROPERTIES	PHYSICAL PROPERTIES	PHYSICAL PROPERTIES	PHYSICAL PROPERTIES	PHYSICAL PROPERTIES
J	J	J	J	J	J	J	J	J	J
SPECIFIC GRAVITY	SPECIFIC GRAVITY	SPECIFIC GRAVITY	SPECIFIC GRAVITY	SPECIFIC GRAVITY	SPECIFIC GRAVITY	SPECIFIC GRAVITY	SPECIFIC GRAVITY	SPECIFIC GRAVITY	SPECIFIC GRAVITY
1.3	1.32	1.32	1.32	1.32	0.787	1.04	1.31		
K	K	K	K	K	K	K	K	K	K
DENSITY, LBS. / CU.FT. OPER. COND.	DENSITY, LBS. / CU.FT. OPER. COND.	DENSITY, LBS. / CU.FT. OPER. COND.	DENSITY, LBS. / CU.FT. OPER. COND.	DENSITY, LBS. / CU.FT. OPER. COND.	DENSITY, LBS. / CU.FT. OPER. COND.	DENSITY, LBS. / CU.FT. OPER. COND.	DENSITY, LBS. / CU.FT. OPER. COND.	DENSITY, LBS. / CU.FT. OPER. COND.	DENSITY, LBS. / CU.FT. OPER. COND.
L	L	L	L	L	L	L	L	L	L
VISCOSITY, C.P. OPER. COND.	VISCOSITY, C.P. OPER. COND.	VISCOSITY, C.P. OPER. COND.	VISCOSITY, C.P. OPER. COND.	VISCOSITY, C.P. OPER. COND.	VISCOSITY, C.P. OPER. COND.	VISCOSITY, C.P. OPER. COND.	VISCOSITY, C.P. OPER. COND.	VISCOSITY, C.P. OPER. COND.	VISCOSITY, C.P. OPER. COND.
M	M	M	M	M	M	M	M	M	M
SPECIFIC HEAT, OPER. COND.	SPECIFIC HEAT, OPER. COND.	SPECIFIC HEAT, OPER. COND.	SPECIFIC HEAT, OPER. COND.	SPECIFIC HEAT, OPER. COND.	SPECIFIC HEAT, OPER. COND.	SPECIFIC HEAT, OPER. COND.	SPECIFIC HEAT, OPER. COND.	SPECIFIC HEAT, OPER. COND.	SPECIFIC HEAT, OPER. COND.
N	N	N	N	N	N	N	N	N	N
BOILING POINT, °C	BOILING POINT, °C	BOILING POINT, °C	BOILING POINT, °C	BOILING POINT, °C	BOILING POINT, °C	BOILING POINT, °C	BOILING POINT, °C	BOILING POINT, °C	BOILING POINT, °C
O	O	O	O	O	O	O	O	O	O
FREEZING POINT, °C	FREEZING POINT, °C	FREEZING POINT, °C	FREEZING POINT, °C	FREEZING POINT, °C	FREEZING POINT, °C	FREEZING POINT, °C	FREEZING POINT, °C	FREEZING POINT, °C	FREEZING POINT, °C
P	P	P	P	P	P	P	P	P	P
FLASH POINT, °C	FLASH POINT, °C	FLASH POINT, °C	FLASH POINT, °C	FLASH POINT, °C	FLASH POINT, °C	FLASH POINT, °C	FLASH POINT, °C	FLASH POINT, °C	FLASH POINT, °C
Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
LATENT HEAT, PCU/LB, OPER. COND.	LATENT HEAT, PCU/LB, OPER. COND.	LATENT HEAT, PCU/LB, OPER. COND.	LATENT HEAT, PCU/LB, OPER. COND.	LATENT HEAT, PCU/LB, OPER. COND.	LATENT HEAT, PCU/LB, OPER. COND.	LATENT HEAT, PCU/LB, OPER. COND.	LATENT HEAT, PCU/LB, OPER. COND.	LATENT HEAT, PCU/LB, OPER. COND.	LATENT HEAT, PCU/LB, OPER. COND.
R	R	R	R	R	R	R	R	R	R
COMPOSITION, LBS. / HOUR - AVE. FLOW	COMPOSITION, LBS. / HOUR - AVE. FLOW	COMPOSITION, LBS. / HOUR - AVE. FLOW	COMPOSITION, LBS. / HOUR - AVE. FLOW	COMPOSITION, LBS. / HOUR - AVE. FLOW	COMPOSITION, LBS. / HOUR - AVE. FLOW	COMPOSITION, LBS. / HOUR - AVE. FLOW	COMPOSITION, LBS. / HOUR - AVE. FLOW	COMPOSITION, LBS. / HOUR - AVE. FLOW	COMPOSITION, LBS. / HOUR - AVE. FLOW
S	S	S	S	S	S	S	S	S	S
URANIUM, LBS	URANIUM, LBS	URANIUM, LBS	URANIUM, LBS	URANIUM, LBS	URANIUM, LBS	URANIUM, LBS	URANIUM, LBS	URANIUM, LBS	URANIUM, LBS
58	58	58	58	58	58	58	58	58	58
T	T	T	T	T	T	T	T	T	T
URANIUM-235 CONC. GMS/LITER	URANIUM-235 CONC. GMS/LITER	URANIUM-235 CONC. GMS/LITER	URANIUM-235 CONC. GMS/LITER	URANIUM-235 CONC. GMS/LITER	URANIUM-235 CONC. GMS/LITER	URANIUM-235 CONC. GMS/LITER	URANIUM-235 CONC. GMS/LITER	URANIUM-235 CONC. GMS/LITER	URANIUM-235 CONC. GMS/LITER
U	U	U	U	U	U	U	U	U	U
UO ₂ (NO ₃) ₂ , LBS	UO ₂ (NO ₃) ₂ , LBS	UO ₂ (NO ₃) ₂ , LBS	UO ₂ (NO ₃) ₂ , LBS	UO ₂ (NO ₃) ₂ , LBS	UO ₂ (NO ₃) ₂ , LBS	UO ₂ (NO ₃) ₂ , LBS	UO ₂ (NO ₃) ₂ , LBS	UO ₂ (NO ₃) ₂ , LBS	UO ₂ (NO ₃) ₂ , LBS
V	V	V	V	V	V	V	V	V	V
AL, LBS	AL, LBS	AL, LBS	AL, LBS	AL, LBS	AL, LBS	AL, LBS	AL, LBS	AL, LBS	AL, LBS
565	565	565	565	565	565	565	565	565	565
W	W	W	W	W	W	W	W	W	W
AL(NO ₃) ₃ , LBS	AL(NO ₃) ₃ , LBS	AL(NO ₃) ₃ , LBS	AL(NO ₃) ₃ , LBS	AL(NO ₃) ₃ , LBS	AL(NO ₃) ₃ , LBS	AL(NO ₃) ₃ , LBS	AL(NO ₃) ₃ , LBS	AL(NO ₃) ₃ , LBS	AL(NO ₃) ₃ , LBS
X	X	X	X	X	X	X	X	X	X
H ₂ (NO ₃) ₂ , LBS	H ₂ (NO ₃) ₂ , LBS	H ₂ (NO ₃) ₂ , LBS	H ₂ (NO ₃) ₂ , LBS	H ₂ (NO ₃) ₂ , LBS	H ₂ (NO ₃) ₂ , LBS	H ₂ (NO ₃) ₂ , LBS	H ₂ (NO ₃) ₂ , LBS	H ₂ (NO ₃) ₂ , LBS	H ₂ (NO ₃) ₂ , LBS
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
HNO ₃ , LBS	HNO ₃ , LBS	HNO ₃ , LBS	HNO ₃ , LBS	HNO ₃ , LBS	HNO ₃ , LBS	HNO ₃ , LBS	HNO ₃ , LBS	HNO ₃ , LBS	HNO ₃ , LBS
Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
H ₂ O, LBS	H ₂ O, LBS	H ₂ O, LBS	H ₂ O, LBS	H ₂ O, LBS	H ₂ O, LBS	H ₂ O, LBS	H ₂ O, LBS	H ₂ O, LBS	H ₂ O, LBS
AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
FE(NH ₄ SO ₄) ₂ , LBS	FE(NH ₄ SO ₄) ₂ , LBS	FE(NH ₄ SO ₄) ₂ , LBS	FE(NH ₄ SO ₄) ₂ , LBS	FE(NH ₄ SO ₄) ₂ , LBS	FE(NH ₄ SO ₄) ₂ , LBS	FE(NH ₄ SO ₄) ₂ , LBS	FE(NH ₄ SO ₄) ₂ , LBS	FE(NH ₄ SO ₄) ₂ , LBS	FE(NH ₄ SO ₄) ₂ , LBS
BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
DILUENT, LBS	DILUENT, LBS	DILUENT, LBS	DILUENT, LBS	DILUENT, LBS	DILUENT, LBS	DILUENT, LBS	DILUENT, LBS	DILUENT, LBS	DILUENT, LBS
CC	CC	CC	CC	CC	CC	CC	CC	CC	CC
TBP, LBS	TBP, LBS	TBP, LBS	TBP, LBS	TBP, LBS	TBP, LBS	TBP, LBS	TBP, LBS	TBP, LBS	TBP, LBS
DD	DD	DD	DD	DD	DD	DD	DD	DD	DD
NaNO ₃ , LBS	NaNO ₃ , LBS	NaNO ₃ , LBS	NaNO ₃ , LBS	NaNO ₃ , LBS	NaNO ₃ , LBS	NaNO ₃ , LBS	NaNO ₃ , LBS	NaNO ₃ , LBS	NaNO ₃ , LBS
EE	EE	EE	EE	EE	EE	EE	EE	EE	EE
Na ₂ CO ₃ , LBS	Na ₂ CO ₃ , LBS	Na ₂ CO ₃ , LBS	Na ₂ CO ₃ , LBS	Na ₂ CO ₃ , LBS	Na ₂ CO ₃ , LBS	Na ₂ CO ₃ , LBS	Na ₂ CO ₃ , LBS	Na ₂ CO ₃ , LBS	Na ₂ CO ₃ , LBS
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
OXALIC ACID, LBS	OXALIC ACID, LBS	OXALIC ACID, LBS	OXALIC ACID, LBS	OXALIC ACID, LBS	OXALIC ACID, LBS	OXALIC ACID, LBS	OXALIC ACID, LBS	OXALIC ACID, LBS	OXALIC ACID, LBS
GG	GG	GG	GG	GG	GG	GG	GG	GG	GG
OXIDES OF H-HNO ₃ EQUIV, LBS	OXIDES OF H-HNO ₃ EQUIV, LBS	OXIDES OF H-HNO ₃ EQUIV, LBS	OXIDES OF H-HNO ₃ EQUIV, LBS	OXIDES OF H-HNO ₃ EQUIV, LBS	OXIDES OF H-HNO ₃ EQUIV, LBS	OXIDES OF H-HNO ₃ EQUIV, LBS	OXIDES OF H-HNO ₃ EQUIV, LBS	OXIDES OF H-HNO ₃ EQUIV, LBS	OXIDES OF H-HNO ₃ EQUIV, LBS
HH	HH	HH	HH	HH	HH	HH	HH	HH	HH
NaOH	NaOH	NaOH	NaOH	NaOH	NaOH	NaOH	NaOH	NaOH	NaOH
II	II	II	II	II	II	II	II	II	II
NaAlO ₂	NaAlO ₂	NaAlO ₂	NaAlO ₂	NaAlO ₂	NaAlO ₂	NaAlO ₂	NaAlO ₂	NaAlO ₂	NaAlO ₂

[illegible]

The diagram illustrates a complex industrial process flow for solvent recovery and waste treatment. Key components and their dimensions are as follows:

- 1ST CYCLE SOLVENT WASHERS:** Three units, each 5'-0" x 15'-0".
- 1ST CYCLE SOLVENT CATCH TK:** 4'-0" x 4'-0".
- 1ST CYCLE SOLVENT SURGE (CO) TK:** 5'-0" x 5'-0".
- 1ST CYCLE SOLVENT RECOVERY WASTE RUN TANKS:** Two units, each 4'-0" x 5'-0" x 5'-0".
- WASTE TANKS:** Two units, each 5'-0" x 5'-0".
- HIGH ACTIVITY WASTE EVAPORATOR:** 6'-0" x 6'-0".
- LOW ACTIVITY WASTE FEED TANK:** 5'-0" x 6'-0".
- LOW ACTIVITY WASTE EVAPORATOR:** 6'-0" x 8'-0".
- LOW ACTIVITY WASTE CONDENSATE RUN TK:** 5'-0" x 6'-0".

The process flow involves multiple stages of solvent recovery, including washing, catching, and recovery, followed by waste treatment through evaporation and condensation. The diagram includes numerous numbered points (1-34) indicating specific locations or stages in the process.

8" ϕ x 9'-0"

ALL EQUIPMENT INSIDE DASH
LINE IS DUPLICATED IN
CONTACT MAINTENANCE CAS

[illegible]

EQ. PO	NO OF
NO.	Y'S

$$\overline{8} = 0^\circ \times 8 = 0^\circ$$

CENTRIFUGE
5'-0" x 5'-0" x 8'-0"

1A
FLEET TANK
5'-5" x 6'-0"

PRECIPITATION

8-A-3-D

LVERS
"

DE DATA 3
3 IN
NCE CAS

EQ. NO.	PCU	AVE.	MAX.	AVE.	MAX.	AVE.	MAX.	AVE.	MAX.
		HT. LOAD		PCU / HR.					
WATER (GPM. / UNIT)									

[illegible]

SAVANNAH RIVER PLANT - 200 AREA
 U-235-AL ALLOY RECOVERY PROCESS - PRELIMINARY
 MATERIAL BALANCE FLOW SHEET, SH. # 1
 DISSOLVING THROUGH 1ST CYCLE
 WASTE DISPOSAL
 DPW-56-167
 PAGE 5

PROJ. NO.	REVISIONS	REVISED BY DATE	CHECKED BY DATE	APPROVED BY DATE

Classification Cancelled/Changed
 TO **UNCLASSIFIED**
 By Authority of

1. *[Signature]* Add 2/16/89
 Name Title Date
 2. *[Signature]* Alter 3/12/89
 Name Title Date

LINE NO.		1	2	3	4	5	6	7	8	9	10
PROCESS MATERIAL		FUEL ELE- MENTS	METAL SOLVENT	DISS. PRO- DUCT	CENT. PRO- DUCT	1AF	1AP	1BP	1BP CONCEN- TRATE	CENT. LEACH	ACID ADJUST
A	FLOW, LBS. / HOUR - AVE.	623	11100	15500	15500	15500	3680	2475	390		
B	FLOW, LBS. / HOUR - MAX.										
C	FLOW, AVE. - G.P.M.										
D	FLOW, MAX. - G.P.M.										
E	VOLUME AVE. - GALS	AT OPER'G COND.	1030	1400	1400	1400		282	358		
F	VOLUME MAX. - C.F.M.										
G	OPERATING TEMPERATURE °C										
H	OPERATING PRESSURE P.S.I.G.										
PHYSICAL PROPERTIES											
J	SPECIFIC GRAVITY		1.3	1.32	1.32	1.32	0.787	1.24	1.11		
K	DENSITY, LBS. / CU.FT. OPER. COND.										
L	VISCOSITY, C.P. OPER. COND.										
M	SPECIFIC HEAT, OPER. COND.										
N	BOILING POINT, °C										
O	FREEZING POINT, °C										
P	FLASH POINT, °C										
Q	LATENT HEAT, PCU/LB, OPER. COND.										
R											
COMPOSITION, LBS./HR. AVE. FLOW											
S	URANIUM, LBS	58									
T	URANIUM-235 CONC, GMS/LITER					5.04	12.6	25	195		
U	UO ₂ (NO ₃) ₂ , LBS			95	95	95		95			
V	AL, LBS	565									
W	Al(NO ₃) ₃ , LBS			4450	4450	4450					
X	H ₂ (NO ₃) ₂ , LBS		32.8	32.8	32.8	32.8					
Y	HNO ₃ , LBS		5533	738	738	738	29.5	29.7	29.7		
Z	H ₂ O, LBS		5533	10184	10184	10184		2349	303		
AA	Fe(NH ₄ SO ₄) ₂ , LBS										
BB	DILUENT, LBS						3370				
CC	TBP, LBS						215				
DD	NaNO ₃ , LBS										
EE	Na ₂ CO ₃ , LBS										
FF	OXALIC ACID, LBS										
GG	OXIDES OF H ₂ HNO ₃ EQUIV, LBS										
HH	NaOH										
II	NaAlO ₂

3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
SS. 0-100	CENT. PRO-DUCT	IAF	IAP	IBP	IBP CONCENTRATE	CENT. LEACH	ACID ADJUST.	IAS	IAX	IBX	Na ₂ CO ₃ WASH	HNO ₃ WASH	WATER WASH	SOLVENT RECOVERY WASTE	IBP EVAP. CONDENSATE	CENT. CARB. WASHES	HAW. NEUTRALIZER	HAW. CONDENSATE
500	15500	15500	3680	2475	390			2940	3585	2350	480	236	233	950	2046	790	9200	908
100	1400	1400		282	358			292	562	282	57.5	28.1	28	113	246		730	109
1.32	1.32	1.32	0.787	1.04	1.11			1.21	0.767	1.00	1.02	1.01	1.00	1.01	1.00		1.51	1.0
95	95	95		95														
950	4450	4450						374										
2.8	32.8	32.8																
738	738	738	29.5	29.7	29.7			422		1.5		2.9		2.9		5		
10184	10184	10184		2349	303			2133		2349	470	233	233	936	2046	785	4600	908
								11										
			3370					3370										
			215					215										
											10			10				
																	4600

20	21	22	23	24	25	27	28	29	30	31	32	33	34	35	36	37
AW	AW	AW	SILICA	2 BD	CONDENSER	CONDENSER	CONDENSER	CONDENSER	CONDENSER	CONDENSER	CONDENSER	CONDENSER	CONDENSER	CONDENSER	CONDENSER	CONDENSER
AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW
730	1090	1690	120	28	11.5	564	45	533	1690							
1.51	1.0	1.3	1.61	1.00	1.01	1.51	1.0	1.3	1.0	1.30						
2200	9080	18300	120	997	240	145	4691	490	620	4400	3.7	18304	231	1184		
AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW
20	21	22	23	24	25	27	28	29	30	31	32	33	34	35	36	37

[illegible]

REFRIGERATION

FLOW SHEET BASIS:

ONE DAY OPERATION: (MARKED)
EQUIVALENT TO 25 KG U-235
PRIOR TO BURN OUT.

stream 21 has been cut

6 6
689 825 70 1801

70 17

SAVANNAH RIVER PLANT - 200 AREA

EQ. PC. NO.	NO. OF UNITS	AVE. HT. LOAD	MAX. P.C.U./HR.	AVE. PSIG.	MAX. PSIG.	AVE. PSIG.	MAX. PSIG.	AVE. PSIG.	MAX. PSIG.
STEAM (LBS. / HR. / UNIT)									

EQ. P
NO.

[illegible][illegible]

Classification Cancelled/Changed
TO UNCLASSIFIED
By Authority of

1.	<i>Steve Rios</i>	ADD	2/4/88
2.	<i>Joe C. Brown</i>	Attn: J	3/3/88

LINE NO.	1	2	3	4	5	6	7	8	9	10	11	12
PROCESS MATERIAL	1BP CONCEN- TRATE	2AF	2AP	2BP	2BP CONCEN- TRATE	PRODUCT	ACID ADJ.	2AS	2AX	2BX	2CO ₂ WASH	HNO ₃ WASH
A FLOW, LBS. / HOUR - AVE.	390	477	1089	1248	250	250	66.4	268	1022	1180	120	6
B FLOW, LBS. / HOUR - MAX.												
C FLOW, AVE. - G.P.M.												
D FLOW, MAX. - G.P.M.												
E VOLUME AVE. - G.P.M. GALS	35.8	47.2	151	140	20	20	7.95	29.5	155	141	14	
F VOLUME MAX. - C.F.M.												
G OPERATING TEMPERATURE °C												
H OPERATING PRESSURE P.S.I.G.												
I PHYSICAL PROPERTIES												
J SPECIFIC GRAVITY	1.31	1.31	1.867	1.07	1.50	1.50	1.31	1.09	0.764	1.00	1.02	1.0
K DENSITY, LBS. / CU.FT. OPER. COND.												
L VISCOSITY, C.P. OPER. COND.												
M SPECIFIC HEAT, OPER. COND.												
N BOILING POINT, °C												
O FREEZING POINT, °C												
P FLASH POINT, °C												
Q LATENT HEAT, PCU/LB., OPER. COND.												
R												
S COMPOSITION, LBS. / HR. AVE. FLOW												
T UO ₂ (NO ₃) ₂ , LBS	(95)	(95)	(95)	(95)	(95)	(95)						
U URANIUM-235, GMS/LITER	195	162	51	60	350	350						
V HNO ₃ , LBS	29.7	72.9	9	10	10	10	43.2	46.5		0.095		0.7
W H ₂ O, LBS	303	346		1179	182	182	43.2	221		1179	117.5	5
X Na ₂ CO ₃ , LBS											2.5	
Y OXALIC ACID, LBS												
Z DILUENT, LBS			838						838			
AA TBP, LBS			184						184			
BB												
CC												
DD

[illegible]

37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
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RATOR

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DPW-56-167

PRODUCT HANDLING

SECOND CYCLE THROUGH

MATERIAL BALANCE FLOW SHEET, SH. #2

SAVANNAH RIVER PLANT - 200 AREA
U-235-AL ALLOY RECOVERY PROCESS - PRELIMINARY

LINE NO.		1	2	3	4	5	6	7	8	9	10	11	12
PROCESS MATERIAL		1BP CONCEN- TRATE	2AF	2AP	2BP	2BP CONCEN- TRATE	PRODUCT	ACID ADJ.	2AS	2AX	2BX	Na ₂ CO ₃ WASH	HNO ₃ WASH
A	FLOW, LBS. / HOUR - AVE.	390	477	1089	1248	250	250	66.4	268	1022	1180	120	60
B	FLOW, LBS. / HOUR - MAX.												
C	FLOW, AVE. - G.P.M.												
D	FLOW, MAX. - G.P.M.												
E	VOLUME AVE - G.P.M. GALS	35.8	47.2	151	140	20	20	7.95	29.5	155	141	14	7
F	VOLUME MAX. - C.F.M.												
G	OPERATING TEMPERATURE °C												
H	OPERATING PRESSURE P.S.I.G.												
PHYSICAL PROPERTIES													
J	SPECIFIC GRAVITY	1.31	1.31	1.867	1.07	1.50	1.50	1.31	1.09	0.764	1.00	1.02	1.0
K	DENSITY, LBS. / CU.FT. OPER. COND.												
L	VISCOSITY, C.P., OPER. COND.												
M	SPECIFIC HEAT, OPER. COND.												
N	BOILING POINT, °C												
O	FREEZING POINT, °C												
P	FLASH POINT, °C												
Q	LATENT HEAT, PCU/LB., OPER. COND.												
R													
COMPOSITION, LB./HR. AVE. FLOW													
S	UO ₂ (NO ₃) ₂ , LBS	(95)	(95)	(95)	(95)	(95)	(95)						
T	URANIUM-235, GMS/LITER	195	162	51	60	350	350				0.075		0.7
U	HNO ₃ , LBS	29.7	72.9	9	10	10	10	43.2	46.5				
V	H ₂ O, LBS	303	346		1179	182	182	43.2	221			1179	117.5
W	Na ₂ CO ₃ , LBS												5
X	OXALIC ACID, LBS											2.5	
Y	DILUENT, LBS			838							838		
Z	TBP, LBS			184							184		
AA													
BB													
CC													
DD

5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
BP VCEN- RATE	PRODUCT	ACID ADJ.	2AS	2AX	2BX	Na ₂ CO ₃ WASH	HNO ₃ WASH	H ₂ O WASH	SOLVENT MAKE UP	2BP EVAP CONDEN- SATE	SOLVENT RECOVERY WASTE	DISPLACE- MENT WASH	DECONT. WASH	COLUMN FLUSH	DISPLACE RE- CYCLE	SILICA GEL WASTE	2AW	
250	250	66.4	268	1022	1180	120	60	60	0.6	997	240	39.4	77.7	48.6	39.4	126	c7	
20	20	795	29.5	155	141	14	7	7		120	28	4.6	9.2	5.8	4.6	15	7c	
1.50	1.50	1.31	1.09	0.764	1.00	1.02	1.01	1.0		1.0	1.01	1.03	1.02	1.0	1.03	1.01	1.07	
(95)	(95)																	
350	350																	
10	10	43.2	46.5		0.075		0.75				0.75	2.4			2.4		110	
182	182	43.2	221		1179	117.5	59	60		997	236	37	75	48.6	37	123	567	
						2.5					2.5							
													2.7			2.7		
				838					0.1									
				184					0.5

[illegible]

838
184

0.1
0.5

2.7

2.7

TDR