AEC DISTRIBUTION FOR PART 50 DOCKET MATERIAL
(TEMPORARY FORM)

CONTROL NO: 5345

FROM:	DATE OF DOC:	DATE REC'D	FILE: LTR	MEMO	RPT	OTHER
Carolina Power & Light Company Raleigh, North Carolina 27602 E. E. Utley	9-22-72	9-29-72	X			

TO:	ORIG	CC	OTHER	
Mr. O'Leary	1			SENT AEC PDR X SENT LOCAL PDR X

CLASS:	INPUT	NO CYS REC'D	DOCKET NO:
U PROP INFO		2	50-261

DESCRIPTION:
Ltr re their 6-28-72 ltr, trans the following:

NOTE: * Denotes Ltr Only

DIST PER LIC. COORDINATOR S. KARI

PLANT NAMES: H. B. Robinson

ENCLOSURES:
REPORT: Modification to Waste Evaporator And Boric Acid Evaporators, for period March 9, 1972 thru April 14, 1972.

(2 cys of encl rec'd)

DO NOT REMOVE
ACKNOWLEDGED

FOR ACTION/INFORMATION 9-30-72 AB

BUTLER(L) W/ Copies	KNIEL(L) W/ Copies	VASSALLO(L) W/ Copies	ZIEMANN(L) W/ Copies	KNIGHTON(ENVIRO) W/ Copies
CLARK(L) W/ Copies	SCHWENCER(L) W/ Copies	H. DENTON W/ Copies	CHITWOOD(FM) W/ Copies	YOUNGBLOOD(ENVIRO) W/ Copies
GOLLER W/ Copies	STOLZ(L) W/ Copies	✓ SCHEMEL(L) W/2 Copies	DICKER(ENVIRO) W/ Copies	W/ Copies

INTERNAL DISTRIBUTION

✓ REG FILE	TECH REVIEW	VOLLMER	HARLESS	WADE E
✓ AEC PDR	HENDRIE	✓ DENTON *		SHAFER F & M
✓ OGC, ROOM P-506A	SCHROEDER	✓ GRIMES	F & M	BROWN E
MUNTZING/STAFF	✓ MACCARY *	✓ GAMMILL	SMILEY	G. WILLIAMS E
✓ CASE *	✓ LANGE	KASTNER	NUSSBAUMER	
✓ GIAMBUSSO *	✓ PAWLICKI	BALLARD		A/T IND
BOYD-L(BWR)	✓ SHAO	FINE	LIC ASST.	BRAITMAN
✓ DEYOUNG-L(PWR) *	✓ KNUTH		SERVICE L	SALTZMAN
SKOVHOLT-L	✓ STELLO	ENVIRO	MASON L	
P. COLLINS	✓ MOORE	✓ MULLER	WILSON L	PLANS
	✓ THOMPSON	DICKER	KARI L	✓ MCDONALD *
REG OPR	✓ TEDESCO	✓ KNIGHTON *	SMITH L	✓ DUBE *
✓ FILE & REGION (2)	LONG	YOUNGBLOOD	GEARIN L	
MORRIS	LAINAS	✓ PROJECT LEADER	DIGGS L	INFO
STELLE	✓ BENAROYA	WEST	✓ TEETS L	C. MILES

EXTERNAL DISTRIBUTION

✓ 1-LOCAL PDR Hartville, S. C.
✓ 1-DTIE(ABERNATHY)
✓ 1-NSIC(BUCHANAN)
✓ 1-ASLB-YORE/[illegible] [illegible]H. ST.
✓ 16-CYS ACRS HOLDING

(1)(5)(9)-NATIONAL LAB'S
1-R. CARROLL-OC, GT-B227
1-R. CATLIN, A-170-GT
1-CONSULANT'S NEWMARK/BLUME/AGABIAN

1-PDR-SAN/LA/NY
1-GERALD LELLOUCHE BROOKHAVEN NAT. LAB
1-BOLAND, IDAHO FALLS, IDAHO(50-331 Only)
1-RD...MULLER...F-309GT

DATE: 9-29-72

DOCKET NO. 50-261

TO: Licensing XXXXXXXXX COORDINATOR .....Sybil Kari

[XXX] REQUEST DISTRIBUTION XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

[ ] INSUFFICIENT COPIES FOR NORMAL DISTRIBUTION

The attached material dated 9-22-72 from Carolina Power & Light Company (2 copies received 9-29-72

Please advise as to how you want this material handled by checking one of the following items:

( ) Hold..Pending receipt of additional copies that will be requested.

( ) Make the following distribution:

"C" Dist thru Muller
Action Br Chief & LA
Benaroya
Tedesco
Reg external dist
16 / ACRS

REMARKS:

Donaldson
DOCKET CLERK
REG FILES
PHONE: 7333

DATE: 9-29-72

DOCKET NO. 50-261

TO: Licensing XXXXXXXXXX COORDINATOR .....Sybil Kari

[XXX] REQUEST DISTRIBUTION XXXXXXXXXXXXXXXXXXXXXXXXXXXX

[ ] INSUFFICIENT COPIES FOR NORMAL DISTRIBUTION

The attached material dated 9-22-72 from Carolina Power & Light Company (2 copies received 9-29-72

Please advise as to how you want this material handled by checking one of the following items:

( ) Hold..Pending receipt of additional copies that will be requested.

( ) Make the following distribution:

REMARKS:

Gail Donaldson
DOCKET CLERK
REG FILES
PHONE: 7333

50-261

Regulatory File Cy.

Carolina Power & Light Company

Raleigh, North Carolina 27602

September 22, 1972

Mr. John F. O'Leary, Director
Directorate of Licensing
Atomic Energy Commission
Washington, D. C. 50545

H. B. ROBINSON UNIT NO. 2
LICENSE DPR-23
WASTE EVAPORATOR MODIFICATIONS

Dear Mr. O'Leary:

In a letter dated June 28, 1971, addressed to Dr. Peter A. Morris, then Director, Division of Reactor Licensing, Carolina Power & Light Company reported that the performance of the waste evaporator was unsatisfactory in that the machine failed to meet design specifications. It was reported in the letter of June 28, 1971, that proposed modifications to the waste processing system were being evaluated and that improvements would be made to H. B. Robinson when appropriate.

Accordingly, this report is intended to relate the current status of the waste evaporator and to discuss the performance of the liquid waste processing system.

The following principal modifications, engineered by the equipment supplier, American Machine and Foundry Corporation (AMF), were completed on April 7, 1972.

a. The waste concentrator vacuum pumps were replaced with steam ejectors.

b. The concentrator internals were modified by deletion of the perforated plates between upper and lower shells, relocation of the reflux line, addition of a new moisture separator section, provision of a new sieve type moisture separator, and installation of a heater bundle shroud.

c. A higher capacity steam valve and piping serving the water converter were installed.

An operational test was performed on the system on April 13 and 14 to determine if design specifications were being attained. The test consisted of processing a solution of sodium hydroxide (NaOH) and feedwater. Hourly samples of feed and distillate were taken over a 24-hour period and were analyzed to determine the waste evaporator performance. The results of the test revealed various decontamination factors (DF) in the

5345

range of 10^2 to 10^5 for nonradioactive species and DF values of 10^1 to 10^4 for the radioactive species. The sodium DF values were consistently between 10^4 and 10^5, while those for boron ranged from 10^3 to greater than 10^4. The low DF's observed for the radioactive species were attributed to the relatively low radioactivity contained in the feed solution. Based upon the test data, it is Westinghouse's opinion that consistent DF values of 10^4 to 10^5 can be obtained with the modified unit.

Enclosure (1), an internal report, is forwarded for your information and reports in greater detail the modifications and tests performed on the waste evaporator.

As a result of the modification, the performance and reliability of the waste evaporator has been greatly improved. The design flow rate of 2 GPM has also been consistently achieved and the decontamination factors have been improved significantly. The average DF value has been about 10^3 with a maximum DF of approximately 10^4. However, with the present waste feed low activity levels, the design DF's of 10^6 are not being obtained. However, a polishing demineralizer system has recently been installed downstream of the waste evaporator for further conditioning of liquid wastes. Additionally, an experimental reverse osmosis unit is presently being evaluated at the plant for treatment of liquid wastes.

Carolina Power & Light Company believes that the liquid waste system, as now installed and exclusive of the experimental reverse osmosis unit, provides assurance the liquid radioactive waste can be processed for disposal in a satisfactory manner. No further modifications to the waste evaporator are planned at this time.

Yours very truly,

E. E. Utley
Vice President
Bulk Power Supply

NBB/za

Enclosure

cc: Mr. C. D. Barham
Mr. N. B. Bessac
Mr. B. J. Furr

Enclosure #1

Received w/Ltr Dated 9/22/72

CARLOLINA POWER AND LIGHT COMPANY

H. B. ROBINSON STEAM ELECTRIC PLANT

MODIFICATION TO WASTE EVAPORATOR AND BORIC ACID EVAPORATORS

MARCH 9, 1972 TO APRIL 14, 1972

WRITTEN AND COMPILED BY:

J. G. HAMMOND, PLANT ENGINEER

RETURN TO REGULATORY CENTRAL FILES
ROOM 016

MODIFICATION TO WASTE EVAPORATORS AND BORIC ACID EVAPORATORS

TABLE OF CONTENTS

PART I

PROPOSED MODIFICATION

H. B. Robinson Unit 2 had been unable to achieve the design performance characteristics of its AMF waste concentration system, or its AMF boric acid concentration system. The difficulties encountered were as follows:

1. Insufficient supply of steam to hot water converter (WE)

2. Considerable foaming and carryover into distillate tank (WE)

3. Difficulty in maintaining a vacuum in concentrator (WE & BAE)

4. Inability to achieve decontamination factors (DF) on the design order of 10^6 or design flowrate of 2 GPM (WE)

NOTE: The above abbreviations indicate which concentrator system experienced the problems (i.e. - waste evaporator (WE) and boric acid evaporator (BAE).

These problems have persisted since plant testing and start-up. Efforts have been made to remedy the foaming; and, consequently, improve the DF by use of an anti-foaming agent, DOW H-10. In spite of this, decontamination factors were at best still in the range of 10^2 compared to the design level of 10^6.

Similar problems have been encountered with other AMF installations. AMF and Westinghouse representatives have evaluated these situations and have developed modifications to existing systems in an attempt to meet design criteria. The AMF modification has been performed at other plants. Based on the improved performance of these applications, the system conversion was approved for H. B. Robinson Plant.

This modification includes the following:

NOTE: Items 2 through 6 were performed only on the waste evaporator system.

1. Replacement of the mechanical vacuum pumps on the waste evaporator and both boric acid evaporators with steam ejectors.

2. Modification of the concentrator internals to relocate the reflux line, add a new moisture separator section, provide a new sieve moisture separator, and install a heater bundle shroud.

3. Deletion of the double perforated plates from between the upper and lower concentrator shells.

4. Replacement of the teflon disc in the concentrator level control valve with a 316 SS disc.

5. Installation of a new, higher-capacity steam valve serving the water converter.

6. Provision of additional connections for sampling and chemical addition.

NOTE: See figures 1 through 3 for further details, and refer to bill of materials for list of valves and major components.

Reasons for the above changes are listed below.

The replacement of the vacuum pumps with the steam ejectors upgrades the performance of the vacuum system such that a reliable vacuum can be established. Experience has indicated that a 23 to 25 inch Hg. vacuum can be drawn in about 10 minutes and readily maintained. This added stability will also provide the ability to operate at a wider range of temperature.

The modification of the concentrator internals is intended to reduce moisture carryover and improve the DF of the system. In particular, the rerouting of the reflux line from above the distillate tray prevents condensation from dripping into the tray. The new reflux location also provides better distribution of the flow back into the lower level of the concentrator. The addition of the new moisture separator sections and the sieve assembly are other means used to reduce carryover. Carryover and foaming are further diminished by enclosing the heating tube bundle in a shroud which directs the flow of the heated effluent in a circular motion.

Problems have been encountered at other installations with proper level control in the concentrator. This was attributed to malfunctioning of the level controller valve due to damage to the teflon disc. To preclude the possibility of this happening at H. B. Robinson, the teflon disc was replaced with a 316 stainless steel model.

The low unit output was improved by increasing the steam supply to the steam-water converter. This was accomplished by enlarging the supply piping and providing a new steam regulator. The supply piping was increased from 1½" to 2" O.D.

PART II

SUPPLEMENTARY WORK TO SUPPORT FINAL MODIFICATION

The modification, as outlined in Part I, was supervised by AMF representative, Dave Martin, with work being accomplished by a crew from Metric Constructors, supervised by Earl Erickson. To support the changes being made, modification was required to the component cooling water piping in order to provide cooling water to the heat exchangers in the vacuum systems on both boric acid evaporators and the waste evaporator. These additions to the component cooling system consist of short runs of pipe tapped off of the lines feeding the cooling sections of the evaporators. The tie-ins are made on pipe 6-AC-152N-76A on the 'A' boric acid evaporator, pipe 6-AC-152N-76B on the 'B' boric acid evaporator, and pipe 3-AC-152N-110 on the waste evaporator.

The modification also required the provision of a steam supply to the steam ejectors. A flow rate of 62 lbs. per hour at a minimum pressure of 90 psig is necessary. This steam supply is obtained by tapping off of the auxiliary heating system pipe 6-S-20 upstream of valve V7-15 on the second floor of the auxiliary building. This line is reduced to 1" IPS carbon steel and constitutes a pipe run of about 150 feet through the second floor deck penetration into the boric acid evaporator rooms and across into the waste evaporator room.

When the auxiliary steam system is supplied by number 4 feedwater heater extraction, a pressure of only 60 psig is attained at 735 MWe gross electrical output. In that this does not provide steam at sufficient pressure, the auxiliary boilers must be used as a steam source. However, using the auxiliary boilers for continuous operation of the concentrators is not economically feasible nor have the boilers proved sufficiently reliable. Westinghouse has been contacted and requested to identify an acceptable steam supply for operation of the steam ejectors when the main steam system is in operation. Contingent upon provision for this new extraction point, new piping will be installed and the problem of achieving an adequate, reliable, and economical steam source will be alleviated.

In conjunction with the modification, an inspection was made of the waste evaporator distillate tank float valve. This valve was found to have a damaged plunger. Repair was not feasible and the valve was subsequently replaced.

The additional sampling point called for in Part I was made in the waste evaporator system downstream of the distillate tank. The line is tied in at the 1 X 3/4" reducer at the junction of the distillate discharge piping and pipe 1-WD-151R-17 leading to the waste condensate tanks.

A drain valve has been added to the closed loop heating system of the waste evaporator system. The valve is tapped off the closed loop piping upstream of the expansion tank. The line is reduced from 3" to 3/4" to accomodate the valve.

This work, including the modification called for in Part I was completed on April 7, 1972. No major problems were encountered in accomplishing this job.

PART III

LIST OF FIGURES

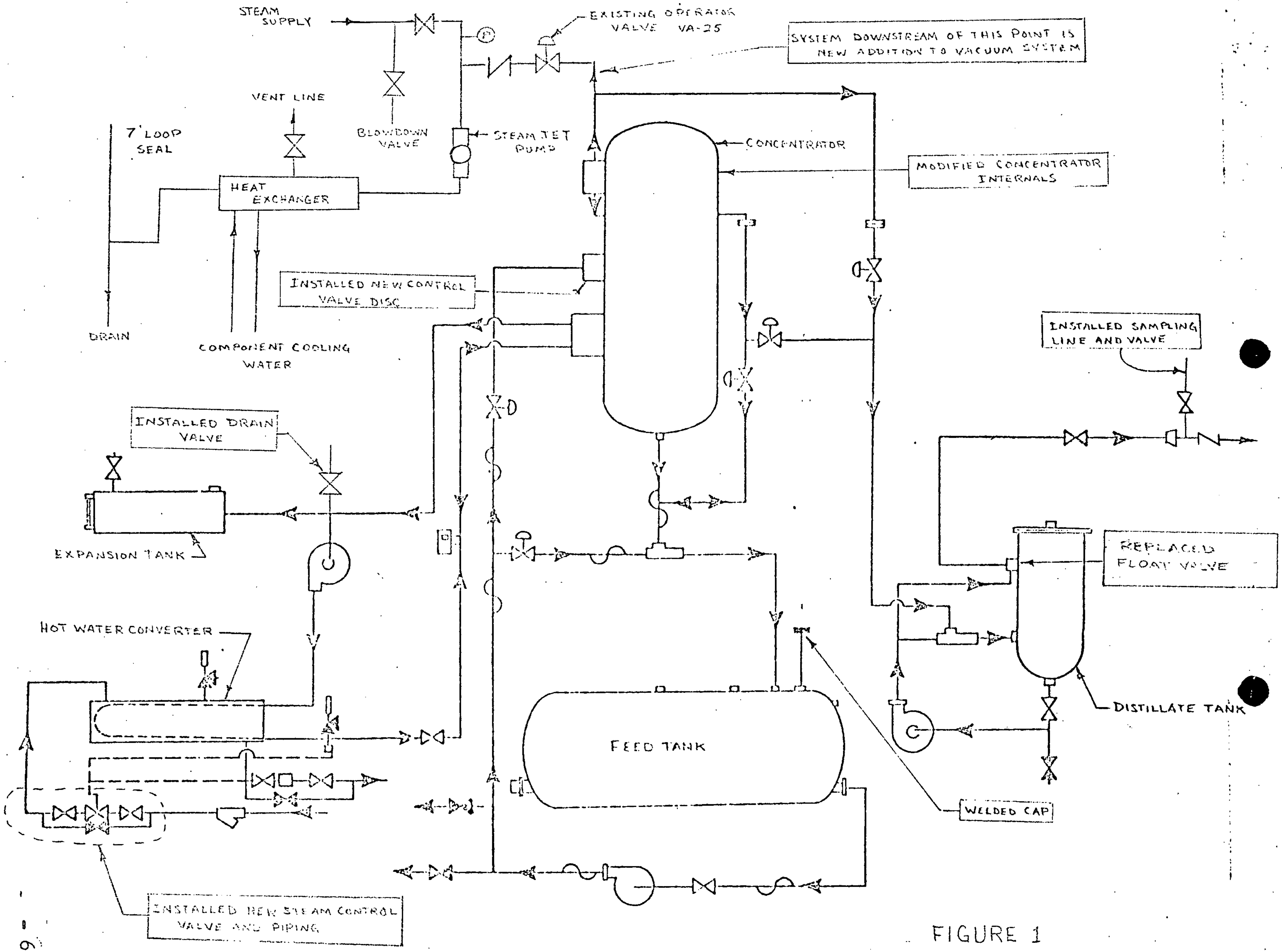

FIGURE 1
WASTE EVAPORATOR MODIFICATION

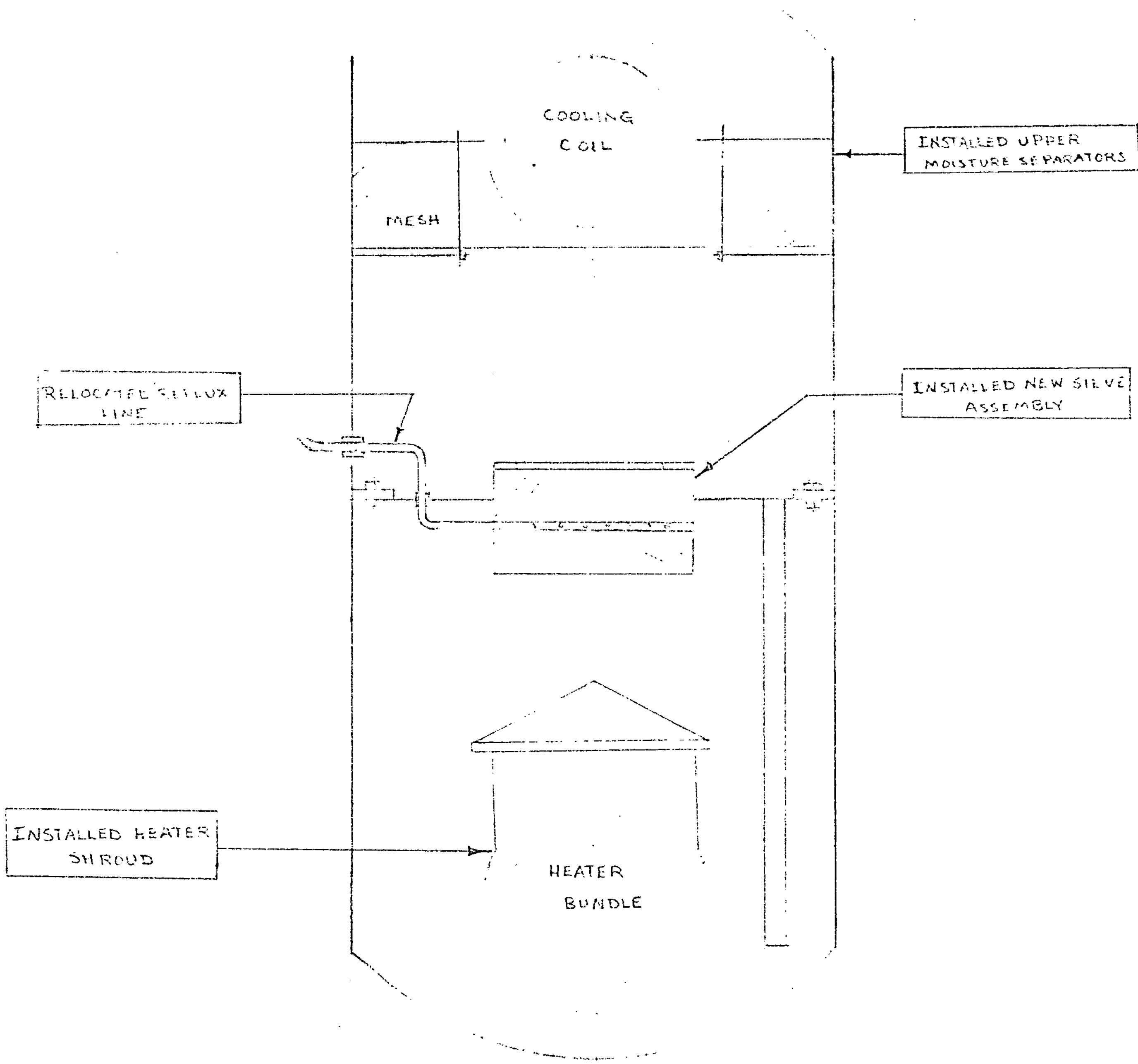

FIGURE 2

MODIFICATION OF CONCENTRATOR INTERNALS

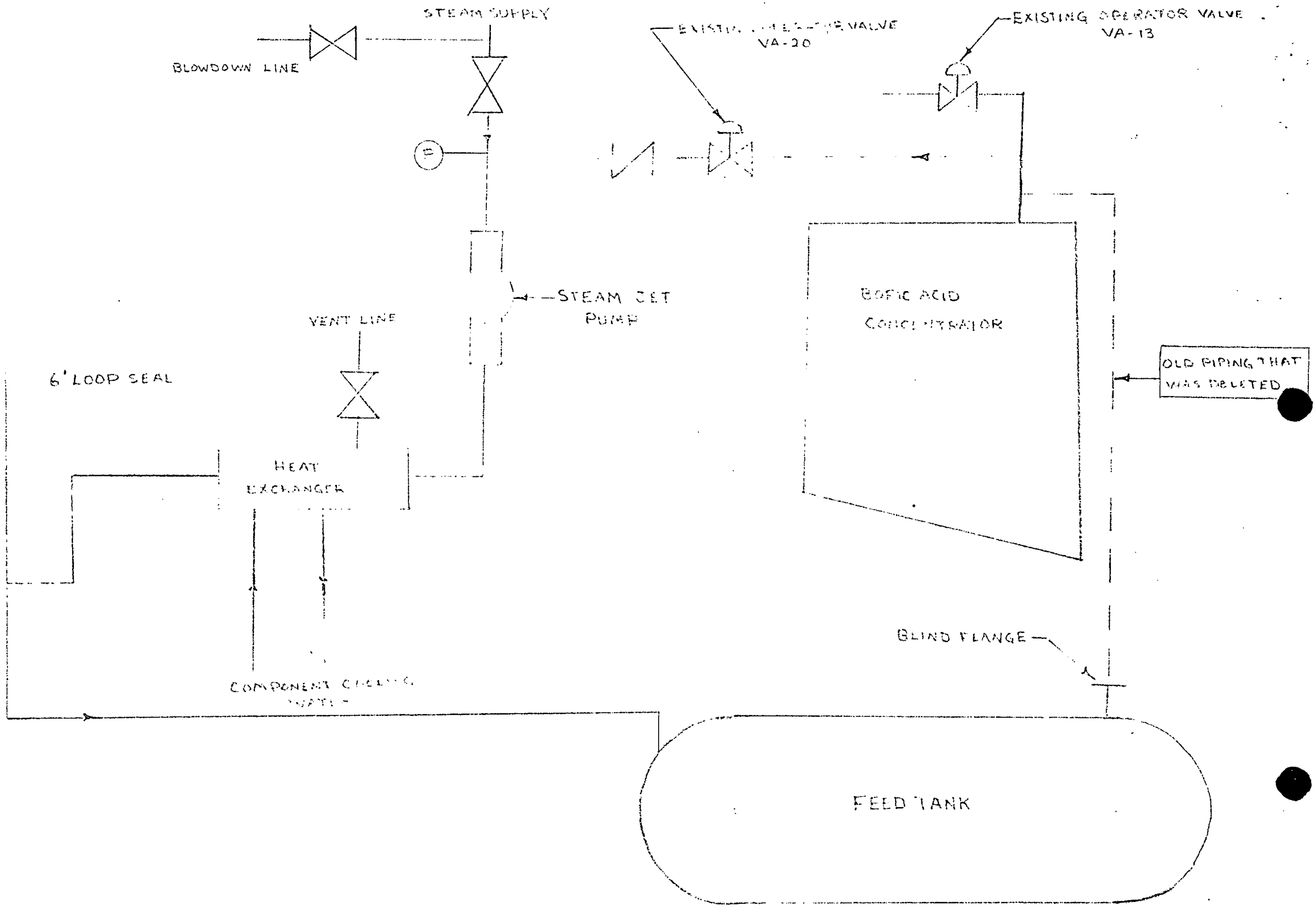

FIGURE 3

MODIFIED PORTION OF BORIC ACID

EVAPORATOR SYSTEM

PART IV

BILL OF MATERIAL

COMPONENT	EACH	MATERIAL DESCRIPTION
Steam Blowdown Valves on Steam Ejector Supply Line	3	½" Edwards, Angle Globe, 1500#, 850° Fig. - 1048Y
Isolation Valves on Steam Ejector Supply Line	3	1" Velan, Globe Stop, 600#, Fig. W5-274B-2TS
Main Isolation Valve on Steam Ejector Supply Line	1	1" Edwards, Angle Globe Stop, Valve Tag No. IT36, Fig. - 848JY
Hot Water Drain Valve on Waste Evaporator	1	½" Velan, screwed, Globe, 600#, Fig. S3-274B-2TS
Sample Line Valve on Waste Evaporator Distillate Line	1	3/4", Grinnel, Diaphram, Saunders Model #2471-3212M with #88 Spring - 316 S.S.
Heat Exchanger Vent Line Valves	3	1" Jenkins, screwed ends, Gate Valve, No. 1300, 316 S.S.
Concentrator Vent Line Isolation Valve (Boric Acid Evaporators)	2	½", Grinnel, Diaphram, Saunders Model - #2471-3212M with #88 Spring - 316 S.S.
Check Valve Downstream of Concentrator Isolation Valve	3	1" Jenkins, screwed end, Swing Check, No. 1328-A, 316 S.S.
Concentrator Isolation Valves	3	1" Grinnel, Diaphram, Saunders Model - #2471-3212M with #88 Spring - 316 S.S.
Steam Jet Vacuum Pump	3	1", Flanged, Schutte & Koerting, Model 53A, #555
Heat Exchanger	3	Whitlock, Type AHT-4-A-C1, Model 3-W-14
Waste Evaporator Distillate Float Valve	1	McDonnell No. 27W, Max. supply pressure 100 lbs.

PART V

TEST RESULTS

Following completion of modifications, the waste evaporator was tested over a 24 hour period on April 13 and April 14, 1972. The test consisted of processing a solution of sodium hydroxide and feedwater. The ability of the evaporator to handle this solution was to be representative of waste processing and provide an indication of the evaporator efficiency.

The test was initiated at 9:00 A.M., April 13 by adding 6 gallons of sodium hydroxide (NaOH) to the evaporator feed tank. This resulted in a PH of 12.5. The evaporator was then started at 9:30 A.M. The reflux line was placed in operation at 2:30 P.M. and adjusted by "feel" to the appropriate flow rate (the flow meter is broken and is on order.). This operation was accomplished without losing vacuum. No problems were encountered with the unit start-up or operation of the equipment during the test.

Feed and distillate samples were taken at hourly intervals for the benefit of Westinghouse analysis. These samples were shipped to Westinghouse in a shielded cask. On site, samples were analyzed every two hours. Data was also recorded at two hour intervals. The sample scheduled to be taken at 8:00 A.M., April 14 was inadvertently omitted. The test was terminated at 10:00 A.M., April 14.

Trouble free operation was experienced throughout the test indicating the improved reliability of the equipment. The vacuum was readily maintained at 21-23 inches of mercury. The design flowrate of 2 GPM was achieved. In fact, a flowrate of 2.5 GPM was maintained without reflux flow and 2.17 GPM resulted with the reflux circulating.

Enclosures (2) and (3) list the analyses of the test samples as performed by C.P.&L. and Westinghouse respectively. Enclosure (1) is a summary of the recorded test data. The analytic procedures that were utilized are listed in enclosure (4). The decontamination factor (DF) referred to is defined as follows:

$$DF = \frac{\text{concentration in feed to concentrator}}{\text{concentration in distillate}}$$

The test revealed decontamination factors in the range of 10^2 to 10^5 for non-radioactive species and DF's of 10^1 to 10^4 for the radioactive species. The isotopes detected were Manganese - 54, Cobalt - 58, and Cobalt - 60. The Cobalt - 58 and Cobalt - 60 distillate levels were at or below the minimum detectable level of 3.0×10^{-8} mc/cc. The low DF valves observed for the radioactive species are

attributed to the relative low radioactivity contained in the feed. Of the non-radioactive species, the highest DF value of 10^5 was observed for sodium. The sodium DF range was consistently between 10^4 and 10^5. The boron DF's ranged from 10^3 to greater than 10^4.

Based on these test results, it was Westinghouse's opinion that the present unit was capable of DF's consistently in the 10^4 to 10^5 range. Since completion of testing, the waste evaporator has been placed in service and proved to be quite reliable. The decontamination factors have also been significantly improved. However, the DF's have only averaged around 10^3 with maximum DF's of approximately 10^4. Therefore, although the present system is markedly improved over the system initially installed, it does not appear that the maximum design DF of 10^6 can be attained.

Twelve hour operational tests were planned to determine if the new steam ejector vacuum systems installed on the boric acid evaporators functioned properly. These tests were aborted due to insufficient steam supply from the auxiliary steam system. There was also a problem with erratic flow control on the 'B' boric acid evaporator which was traced to the concentrator level controller valve. This valve had damaged internals which are on order and will be replaced before putting the unit back on the line. However, both units were operated for short periods of time and the new steam ejectors appeared to function well in achieving and maintaining a vacuum of 23 in. of Hg. Since this time, the boric acid evaporators have been returned to service and provide reliable operation.

ENCLOSURE 1

Date: 4/13/72 WASTE EVAPORATOR DATA

Time	1000	1200	1400	1600	1800	2000	2200	2400
Vacuum, In. Hg.	23.6	22.0	21.7	21.6	21.5	21.5	21.5	21.5
Concentrator Temp. °F	152.	152	150	147	145	147	145	147
Hot Water In., °F	188	187	187	187	186	185	186	183
Hot Water Out, °F	172	170	170	169	168	165	163	166
Cooling Water Flow GPM	70	79	80	80	80	80	80	79.5
Cooling Water Out, °F	113	112	113	113	113	113	113	113
Reflux Flow (Open/Close)	Closed	Closed	Closed	Open	Open	Open	Open	Open
Steam Pressure, PSIG	23	23	23	23	23	23	23	24
Reg. Inlet Pressure, PSIG	10	10	10	11	10.5	11	10.5	12.5
Feed Tank Temp., °F	128	158	155	153	149	140	132	135
Steam to Air Ejector, PSIG	100	99.5	99.9	100	105	100	105	> 100
Feed Tank Level, In.	24.5	15.7	15.2	18.5	23.0	25.6	25.4	19.0
Waste Condensate Level	11%	40.3%	73%	19%	45.2%	73.8%	25.5%	60%

ENCLOSURE 1A

Date: 4/14/72	WASTE EVAPORATOR DATA				
Time	0200	0400	0600	0800	1000
Vacuum, In. Hg.	21.5	21.5	21.5	21.4	21.2
Concentrator Temp °F	145	140	147	147	151
Hot Water In, °F	181	182	185	185	186
Hot Water Out, °F	167	168	167	167	170
Cooling Water Flow GPM	79	79.5	80	80	80
Cooling Water Out, °F	117	118	114	114	115
Reflux Flow (Open/Close)	Open	Open	Open	Open	Open
Steam Pressure, PSIG	24	24	24	24	24
Reg. Inlet Pressure, PSIG	12.5	12.5	12.5	12.5	12.5
Feed Tank Temp., °F	135	155	146	144	160
Steam to Air Ejector, PSIG	>100	>100	>100	>100	>100
Feed Tank Level, In.	22.5	18	24.3	25	9
Waste Condensate Level	83	35	59	89	40

ENCLOSURE 2

CP&L ANALYSIS

Date: 4/13/72 WASTE EVAPORATOR CHEMICAL ANALYSIS

Parameter		1000	1200	1400	1600	1800	2000	2200	2400
Time		1000	1200	1400	1600	1800	2000	2200	2400
γ - Gross Activity	Feed	1.29×10^{-5}	4.39×10^{-5}	2.5×10^{-4}	4.97×10^{-4}	5.69×10^{-4}	5.14×10^{-4}	5.83×10^{-4}	7.13×10^{-4}
	Dist.	2.73×10^{-5}	9.21×10^{-7}	6.25×10^{-6}	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$
Sodium (PPM)	Feed	----	----	----	----	----	----	----	----
	Dist.	1.0	0.17	0.27	0.28	0.09	0.07	0.10	0.04
PH	Feed	12.5	----	12.5	----	----	11.5	----	----
	Dist.	----	----	----	----	----	9.2	----	8.9
Conductivity (MHOS)	Dist.	14	2.45	1.54	2.8	3.1	3.5	5.5	5.6
Gross Activity D.F.		0.47	4.76×10^{1}	4.0×10^{1}	$> 6.5 \times 10^{1}$	$> 7.5 \times 10^{1}$	$> 76.8 \times 10^{1}$	$> 7.7 \times 10^{1}$	$> 9.5 \times 10^{1}$

Date: 4/14/72

Parameter		0200	0400	0600	0800	1000
Time		0200	0400	0600	0800	1000
γ - Gross Activity	Feed	9.71×10^{-4}	9.04×10^{-4}	8.24×10^{-4}	5.31×10^{-4}	1.15×10^{-3}
	Dist.	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$
Sodium (PPM)	Feed	----	----	----	----	----
	Dist	0.0	0.08	0.02	0.0	0.01
PH	Feed	----	----	----	----	10.3
	Dist	8.8	8.2	7.6	7.4	8.3
Conductivity (MHOS)	Dist	6.0	4.5	4.5	5.0	4.5
Gross Activity D.F.		$> 1.28 \times 10^{2}$	$> 1.19 \times 10^{2}$	$> 1.08 \times 10^{2}$	$> 7.0 \times 10^{1}$	$> 1.52 \times 10^{2}$

ENCLOSURE 3

WESTINGHOUSE ANALYSIS OF WASTE EVAPORATOR DATA

		April 13								April 14			
TIME		1000	1200	1400	1600	1800	2000	2200	2400	0200	0400	0600	1000
Sodium (PPM)	Feed	2933	4633	5660	4025	4127	3233	3163	4051	5027	4134	3438	3374
	Dist	3.22	0.10	0.18	0.32	0.02	0.02	0.03	0.02	0.11	0.12	0.06	0.15
	DF	9.10×10^{2}	4.68×10^{4}	3.14×10^{4}	1.26×10^{4}	2.06×10^{5}	1.61×10^{5}	1.05×10^{5}	2.03×10^{5}	4.57×10^{4}	3.45×10^{4}	5.73×10^{4}	5.58×10^{4}
Boron (PPM)	Feed	250	477	892	946	1114	1125	1223	1545	2250	2128	1988	2086
	Dist	0.2	0.4	0.5	< 0.1	0.2	< 0.1	0.3	< 0.1	< 0.1	0.6	0.5	0.5
	DF	1.25×10^{3}	1.19×10^{3}	1.78×10^{3}	$> 9.46 \times 10^{3}$	5.57×10^{3}	$> 1.12 \times 10^{4}$	4.07×10^{3}	$> 1.55 \times 10^{4}$	$> 2.25 \times 10^{4}$	3.55×10^{3}	3.98×10^{3}	1.[illegible]0^{3}
MN 54	Feed	1.11×10^{-5}	----	----	3.24×10^{-5}	----	----	----	6.50×10^{-5}	1.11×10^{-5}	----	8.78×10^{-5}	2.27×10^{-4}
Activity	Dist	$> 3.0 \times 10^{-8}$	----	----	$> 3.0 \times 10^{-8}$	----	----	----	$< 3.0 \times 10^{-8}$	$< 3.0 \times 10^{-8}$	----	$< 4.0 \times 10^{-8}$	$< 3.0 \times 10^{-8}$
(μC/CC)	DF	$> 3.7 \times 10^{2}$	----	----	$> 1.08 \times 10^{3}$	----	----	----	$> 2.13 \times 10^{3}$	$> 3.04 \times 10^{3}$	----	$> 2.19 \times 10^{3}$	$> 7.57 \times 10^{3}$
CO 58	Feed	2.54×10^{-5}	----	----	9.76×10^{-5}	----	----	----	1.64×10^{-4}	2.24×10^{-4}	----	2.09×10^{-4}	5.13×10^{-4}
Activity	Dist	4.53×10^{-7}	----	----	3.1×10^{-8}	----	----	----	$< 3.0 \times 10^{-8}$	$< 3.0 \times 10^{-8}$	----	$< 4.0 \times 10^{-8}$	7.6×10^{-8}
(μC/CC)	DF	5.6×10^{1}	----	----	3.14×10^{3}	----	----	----	$> 5.47 \times 10^{3}$	$> 7.46 \times 10^{3}$	----	$> 5.22 \times 10^{3}$	6.75×10^{3}
CO 60	Feed	4.92×10^{-5}	----	----	1.18×10^{-4}	----	----	----	1.97×10^{-4}	2.85×10^{-4}	----	2.55×10^{-4}	6.43×10^{-4}
Activity	Dist	1.46×10^{-6}	----	----	8.73×10^{-8}	----	----	----	$< 3.0 \times 10^{-8}$	$< 3.0 \times 10^{-8}$	----	$< 6.0 \times 10^{-8}$	2.[illegible] x 1[illegible]
(μC/CC)	DF	3.37×10^{1}	----	----	1.35×10^{3}	----	----	----	$> 6.56 \times 10^{3}$	$> 9.5 \times 10^{3}$	----	$> 4.25 \times 10^{3}$	2.28×10^{3}
PH	Feed	12.9	12.9	13.0	13.0	13.0	12.7	11.7	10.75	10.6	10.2	9.9	10.0
	Dist	5.7	7.1	7.1	7.3	7.8	7.8	7.7	7.3	7.0	6.9	6.6	4.5
Gross B	Feed	1.86×10^{-5}	7.57×10^{-5}	1.20×10^{-4}	1.25×10^{-4}	1.42×10^{-4}	1.19×10^{-4}	1.45×10^{-4}	1.88×10^{-4}	2.53×10^{-4}	2.42×10^{-4}	2.50×10^{-4}	4.04×10^{-4}
Activity	Dist	----	1.10×10^{-7}	5.58×10^{-8}	----	2.56×10^{-8}	1.12×10^{-8}	6.20×10^{-9}	4.22×10^{-8}	$< 1.7 \times 10^{-8}$	5.21×10^{-8}	1.36×10^{-8}	2.50×10^{-7}
(μC/CC)	DF	----	6.88×10^{2}	2.15×10^{3}	----	5.54×10^{3}	1.06×10^{4}	2.33×10^{4}	4.45×10^{3}	$> 1.4 \times 10^{4}$	4.64×10^{3}	1.84×10^{4}	1.62×10^{3}

Enclosure

ANALYTICAL PROCEDURES

The analytical procedures use are summarized below:

Sodium Analysis

Sodium analyses were performed by flame photometry, emission spectroscopy. The feed samples and drain tank sample were diluted to less than 50 ppm sodium prior to analyses while the distillate samples were analyzed undiluted. The accuracy of this method is ± 5%.

Boron Analysis

Boron analyses were performed by using appropriate samples of feed and distillate. The pH of this solution was adjusted to 5.5 with concentrated hydrochloric acid heated to remove dissolved gases, and neutralized to pH of 7 with sodium hydroxide. 10 grams of mannitol were added to this solution and then titrated with 0.1 N sodium hydroxide to pH of 8.4. Accuracy of this method is ± 1%.

Beta Activity

Beta analyses were performed with a GM detector. A 5 ml aliquot of feed solution and a 200 ml aliquot of distillate were evaporated to dryness for analysis. It is noted that no sodium hydroxide was added to any of the solutions prior to evaporation. Gamma spectra of the feed samples showed no radioactive iodine to be present.

The gross beta analysis are reported to have various analytical accuracies which are shown in Table 1.

Manganese-54, Cobalt-58 and Cobalt-60 Activities

Gamma spectroscopy (GeLi) was used to perform the isotopic analyses. A 50 ml aliquot of the feed samples and 500 ml of the distillate samples evaporated to 50 mls were analyzed. The accuracy of this method for each of the three isotopes is ± 20% with the limits of detection being 3.0×10^{-8} uc/cc.