JAN 04 1996 (21)

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

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E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

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(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1	1	Cog.Eng. JE Ham	JE Ham	12/22/95	L5-70						
1	1	Cog. Mgr. EJ Bitten	EJB	1/3/96	L5-70						
1	1	Other BC Cornwell			L5-70						
		Safety									
		Env.									
		QA									

18.	19.	20.	21. DOE APPROVAL (if required)
JE Ham	BC Cornwell	EJ Bitten	Ctrl. No. (N/A)
JE Ham 12/22/95	12/22/95	1/3/96	[ ] Approved
Signature of EDT Originator Date	Authorized Representative for Receiving Organization Date	Cognizant Manager Date	[ ] Approved w/comments
			[ ] Disapproved w/comments

BD-7400-172-2 (04/94) GEF097

BD-7400-172-1 (07/91)

RLA ION EXCHANGE VAULT ENTRY AND CHARACTERIZATION

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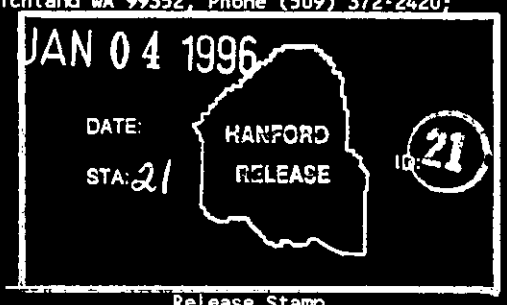
Key Words: 309 Building, PRTR, RLA, Vault, Ion, Exchange, Columns, Entry, Characterization

Abstract: This engineering report documents the entry and characterization of the Rupture Loop Annex Ion Exchange (RLAIX) Vault located near the 309 Building's Plutionium Recycle Test Reactor (PRTR). Twelve ion exchange columns were found in the vault. Some of which contained transuranics, Cs^{137}, and Co^{60}. The characterization information is necessary for future vault cleanout and column disposal.



Karen L. Noland 1/4/96
Release Approval Date

Release Stamp

Approved for Public Release

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

The Rupture Loop Annex Ion Exchange (RLAIX) Vault, located northwest of the 309 Building dome in the 300 Area, is part of the Plutonium Recycle Test Reactor (PRTR) which has been declared surplus by the U.S. Department of Energy. The PRTR is scheduled for decontamination and decommissioning after characterization and stabilization are completed in 1998. The PRTR Transition Group is responsible for the characterization and stabilization of these legacy items.

In August 1995, the vault was opened for characterization. Twelve ion exchange columns were found in the vault along with miscellaneous piping equipment and debris. No water was found in the vault, however, seven of the columns contain liquid (presumably water but possibly heavy water) which must be removed before disposal of the solid waste. Source terms of 3.62 g transuranics (TRU) as Pu^{239}, 4.6 Ci Cs^{137}, 0.74 Ci Sr^{90}, and 0.0022 Ci Co^{60} were established based on Non Destructive Assay (NDA) of the columns. The Sr^{90} content was determined using process knowledge.

The history of the 309 Building shows the similarities in process and resin content between the RLAIX Vault and the previously sampled PRTR IX Vault (reference WHC-SD-SP-ER-003). The PRTR IX Vault was part of the main cleanup system for the reactor's primary coolant. The RLAIX Vault was part of a test loop that tested intentionally defected fuel in the reactor. An accident occurred in 1965 which left both cleanup systems contaminated with fuel residue and fission products. Laboratory analysis of the PRTR IX Vault column resin shows that the contents are not hazardous or regulated.

This report concludes that the RLAIX column contents are also nonhazardous and nonregulated, based on historical data, the PRTR IX Vault data, and the RLAIX vault NDA information.

RLA ION EXCHANGE VAULT ENTRY & CHARACTERIZATION

1 INTRODUCTION

1.1 OBJECTIVE

This report provides documentation for the initial entry and characterization activity in the Rupture Loop Annex Ion Exchange (RLAIX) Vault. The purpose of this effort was to make an entry into the vault and establish vault conditions. Information obtained during characterization will be used for future vault cleanout planning.

1.2 WORK SCOPE

The work scope involved initial entry into the RLAIX vault, and vault characterization. The rain cover and required shielding blocks were removed for entry and characterization. A video camera was used to document and examine vault condition and content. Characterization data was obtained through radiation surveys, Non-Destructive Examination (NDE), and Non-Destructive Assay (NDA).

1.3 BACKGROUND

The 309 Building and Plutonium Recycle Test Reactor (PRTR) have been declared surplus and are scheduled for decontamination and decommissioning after characterization and stabilization are completed in 1998. Facility transition activities are described in the PRTR Transition Plan (reference WHC-SD-SP-SPP-001).

In June 1995, spent ion exchange columns were removed from the main PRTR IX Vault and the vault was decontaminated and stabilized. This cleanout effort was completed ahead of schedule and under budget. So, approval was obtained to use the cost savings for entering the RLAIX Vault.

The RLAIX Vault contained cleanup ion exchanger columns for cleanup of Fuel Element Rupture Test Facility (FERTF) coolants. The FERTF itself was a pressurized, light-water-cooled loop, using one of the 85 process tubes within the main, heavy-water-cooled PRTR calandria. The FERTF could be operated in a recirculating or once through cooling mode. It was used as a pilot irradiation facility to test new fuel element designs and new operating regimes. Many of its tests involved testing of pre-defecting fuel elements, containing natural uranium and 1% to 4% PuO_2, with pinhole breaks to study the stability of various defected materials under irradiation. The RLAXIV design had positions for three active ion exchangers and storage space for 12 spent ion exchange columns. The operating columns were connected in series for removal of fuel and fission products in the FERTF coolant. Based on process knowledge, the vault was expected to contain from three to five columns.

An accident occurred in 1965 when some test fuel failed excessively, causing failure of the process tube which contaminated the reactor's moderator coolant system. The RLAIX cleanup test loop and the PRTR main cleanup system were both contaminated with fuel residual and fission products. Sample results from the PRTR IX column resin indicate that the contents are

not hazardous (see Appendix A). Since the cleanup system ion exchange columns in both vaults have similar resin media, similar isotopic and material contents are expected. See Appendix C for a description of the RLAIX process.

2 DESCRIPTION

2.1 ION EXCHANGE VAULT

The RLAIX Vault is located northwest of the 309 Building containment dome (see Figure 1). The vault is a one level concrete structure below grade (see Figure 2). It measures 3.96 m (13 ft) in width, 7.10 m (23.3 ft) in length, and 4.57 m (15 ft) in depth. The vault is covered by 1.22 m (4 ft) of concrete shielding blocks and a painted metal rain cover.

There are two sections within the vault. The southern section was used for operation and can contain up to three in-line columns. It can be accessed by the removal of three upper blocks and two lower blocks. The northern section contains twelve shielding bays, where a column could be isolated by installing shielding plates along groves in the inner walls. Each bay has a 1.22 m (4 ft) thick concrete storage block overhead. The blocks are keyed and have to be removed in sequence.

2.2 ION EXCHANGE COLUMNS

There were three types of ion exchange columns used in the vault. A cation exchange column, a mixed bed column, and a de-oxygenator column. The cation exchange column (RLIX-1) contains an Amberlite IRN-163 resin. The mixed bed column (RLIX-2) contains an Amberlite IRN-154 resin, which is a combination of Amberlite IRN-163 and Amberlite IRN-78 resins. The de-oxygenator column (RLIX-3) contains a Duolite S-10 and IRN-154 mixture. These resins are non-hazardous and non-regulated (see Appendix B).

The column shell for the cation and mixed bed design are 0.71 m (2 ft - 4 in) in diameter and 3.30 m (10 ft - 10 in) high. Variations of this type include a carbon steel body, and internal baffle/plate or sparger system. The shell for the deoxygenator column is 0.53 m (1 ft - 9 in) in diameter and 3.35 m (11 ft) high (see Appendix C).

2.3 ENTRY AND CHARACTERIZATION

Work plan, 309-WP-95-003, was prepared to provide instruction for making the initial entry and characterization. The work plan was performed under work package 3U-95-00462/W, which contained data tables, checklists, figures, job hazard analysis, radiation survey reports, radiation work permits, etc.

Work activities began on August 29, 1995 using 1100 Area ICF-KH iron workers/ riggers, 300 Area WHC radiological control technicians and non-destructive examination personnel, 300 Area PNL non-destructive assay personnel, and WHC remote surveillance (video) personnel.

Initial entry required the removal of the rain cover, the set up of guard rails, and the removal of four shielding blocks (see Figure 2). Several

tarps were attached to the guardrail to serve as a wind break prior to the removal of the fourth block. Due to the possibility of alpha contamination, verification of wind speeds less than 15 miles per hour was required. During block removal, Radiological Control Technicians (RCTs) monitored for radioactive contamination. Remote radiation surveys were performed from outside of the vault prior to entry.

A Portable Temporary Remote Air Exhaust Unit (PTRAEU) was used to exchange the air in the vault and provide High Efficiency Particulate Air (HEPA) filtration. A video camera was used to examine the vault and contents prior to entry.

Additional radiation surveys were taken upon initial entry. This information was used to make a map of the vault with pertinent dose rate information. The ion exchange columns were then examined for water content using an ultrasonic fluid detection system (non-destructive examination) on the discharge pipe extending from the bottom to the top of the column.

Additional cover blocks were removed to accommodate the non-destructive assay (NDA) of the columns. The assay equipment was lowered into the vault using a crane. Two types of assays were performed on each column. One was a passive neutron count which measured neutron emissions due to transuranic (TRU) activity. The other was a gamma energy scan. The data was collected in accordance with a PNL approved NDA procedure.

Once the NDA was complete, the guardrail was removed and the cover blocks and rain cover replaced. Three of the top layer cover blocks were left out of the vault for future entry. The work site was cleaned up and the package was closed out.

3 RESULTS AND DISCUSSION

3.1 VAULT ENTRY

Twelve ion exchange columns, a filter assembly, and miscellaneous equipment and jumpers were found in the vault during the video survey. The vault was relatively clean with some dirt and debris, but no water on the floor. Most of the columns were covered with surface rust, and some appeared to have been painted at one time.

One column was found in the southern section of the vault in the RLIX-1 position, however, it was not connected to the wall piping. The other eleven were found in the northern section of the vault. These columns were named after their position in the vault at the time of entry (ie. L1 means left side in bay #1 from the north). No isolation plates were in place to shield the columns (see Figure 3).

Nine of the columns appeared to be either cation or mixed bed columns by design, and one (C2) fit the description of a de-oxygenator column. The remaining two columns (C3 & C4) were of the PRTR Vault style (bottom pipe did not return to upper pipe level), and did not show signs that resin had been added. In the PRTR IX Vault, the fill plugs had been welded after resin addition, whereas these had not.

3.2 VAULT CHARACTERIZATION

3.2.1 Radiation Surveys

Radiation surveys were taken during cover block removal, remotely from above the vault prior to entry, and again after entry. There was no smearable contamination found on the blocks, and the dose rate at the guard rail was less than 5 mRem/hr.

The general area radiation field inside of the vault was 35 mrem/hr. Two of the columns had the highest readings at 2.4 Rem/hr and 1.3 Rem/hr. Three more columns read between 100 and 400 mRem/hr, however, they were in close proximity to the hotter columns. The remaining eight read less than 50 mRem/hr. When two columns (C3 & C4) were moved for NDA, their dose rates dropped to near background levels. A dose rate summary is shown in Table 1.

Spot checks were taken on the floor, walls, and ion exchange columns. No smearable contamination was found. However, in the southern section near the floor drain, a small amount of alpha (350 dpm smearable/7,000 dpm direct) and a small amount of beta (1,000 dpm smearable) was found. The radiation survey reports are located in Appendix D.

3.2.2 Non Destructive Examination

The ultrasonic liquid level measurements were performed on each RLAIX column's bottom pipe which returns to the level of the upper pipe. Seven of the columns were found to have liquid in them. Six of these columns (L1, L2, L3, R1, R2, R3) were full and one (RLIX-1/R5) had (0.74 m) 29 inches of liquid.

3.2.3 Non Destructive Assay

Four days were required to complete the NDA. Three columns (C2, C3, C4) were lifted with the crane and moved to allow the assaying of other columns (see Figure 4). These columns were weighed during crane lifting. The weights were 450 kg, 240 kg, and 82 kg for C2, C3, and C4 respectively. The weights are lower than expected for columns filled with resin. This indicates empty columns even though the NDA results show radiological activity.

A recount of the C4 column after being moved resulted in a drop in the NDA data results. This validates the drop in dose rate also observed. The two PRTR style columns are therefore presumed empty, and the activity is credited to shine from the L3 and R3 columns. The same presumption cannot be made for the C2 column, because of uncertainty associated with its weight measurement.

A summary of the NDA results are shown in Table 1. A source term has been established based on 120% of the isotopic totals in Table 1. See Appendix E for the full report from PNL, and Appendix F for the PRTR fuel isotope distribution calculations.

Table 1. RLAIX Vault NDA Results and Dose Rate Summary

IX Column	Wt. kg (1) total/resin	Cs^{137} Ci	Sr^{90} Ci (2)	Co^{60} Ci	Tru grams (3) Pu^{239} 11%Pu^{242}	Notes
R1	1519/763	0.010	0.0016	8.19e-05	0.0	15 mR/hr peak dose
R2	1519/763	0.467	0.0747	7.52e-04	0.0	100 mR/hr peak dose
R3	1519/763	1.1	0.176	0.00157	0.143 +/-.08	1,300 mR/hr peak dose
R4	1519/763	0.0377	.006	5.32e-04	0.0	35 mR/hr peak dose
R5/RLIX-1	1519/763	0.0	0.0	7.7e-05	0.0	2 mR/hr peak dose
L1	1519/763	0.00430	.0007	4.2e-05	0.0	5 mR/hr peak dose
L2	1519/763	0.136	.0218	1.73e-04	0.0	25 mR/hr peak dose
L3	1519/763	2.1	.3360	1.33e-04	1.44 +/- .22	2,500 mR/hr peak dose
L4	1519/763	0.0108	.0017	1.24e-04	0.405 +/- .11	30 mR/hr peak dose
C2	816/326	0.00335	5.36e-04	8.94e-05	1.03 +/-.16	35 mR/hr peak dose
C3	227/0	1.36e-09	2.2e-7	1.55e-08	0.0	2 mR/hr (Empty)
C4	82/0	1.36e-09	4.0e-5	1.55e-08	0.0	2 mR/hr (Empty)
Total		3.87	0.62	0.00357	3.018 +/- .304	
Source Term = Measured Value + 20%		4.6 Ci	0.74 Ci	0.0022 Ci	3.62 g as Pu^{239}	

(1) Wt. 2'4" IX Column: H-3-14005 rev 6; 1723/562/462 kg Total/Resin/Rock; Base of Column Wt. 146 kg.
Wt. 2'4" IX Column: H-3-14005 rev 5; 1519/763 kg Total/Resin; Base of Column Wt. 146 kg.
(2) Sr90 to Cs137 ratio is 0.16. Basis PRTR IX column Laboratory analysis 222-S Lab RSA #5804.
(3) Uncertainty total based on square root of the sum of the squares of individual uncertainties.

4 CONCLUSIONS

Due to the similarity of the RLAIX Vault and the PRTR IX Vault's resin type, cleanup process, and common accidental test failure, it has been concluded that the data presented in Appendix A for the PRTR IX columns sample analysis is a valid source in the determination of the RLAIX column contents as nonhazardous and nonregulated.

The RLAIX Vault contains twelve ion exchange columns and miscellaneous equipment and debris. Of the twelve columns, seven contain liquid that must be removed prior to disposal. Two columns are of the PRTR design and are empty shells without resin.

The NDA results indicate transuranics (Pu^{239}, Pu^{240}), Co^{60}, and Cs^{137} in the columns. However, those columns, like C2, that were in close proximity to the L3 and R3 columns during NDA, may exhibit higher-than-actual readings due to shine.

Based on NDA, the selected source term for the RLAIX Vault is 4.6 Ci of Cs^{137}, 0.74 Ci of Sr^{90}, 0.0022 Ci of Co^{60}, and 3.62 g of Pu^{239}. The value for Sr^{90} was derived from a ratio of Sr^{90} to Cs^{137} based on laboratory analysis of PRTR IX Vault columns, which used similar (and in some cases the same) resin in the columns.

5 REFERENCES

Cornwell, B.C., March 1995, *PRTR Ion Exchange Vault Column Sampling*, WHC-SD-SP-ER-003, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Graves, C.E., August 1994, *309 Building Transition Plan*, WHC-SD-SP-SPP-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Graves, C.E., April 1994, *Stability of the Plutonium Recycle Test Reactor Main Ion Exchange and Resin Disposal Vaults*," WHC-SD-SP-ER-002, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

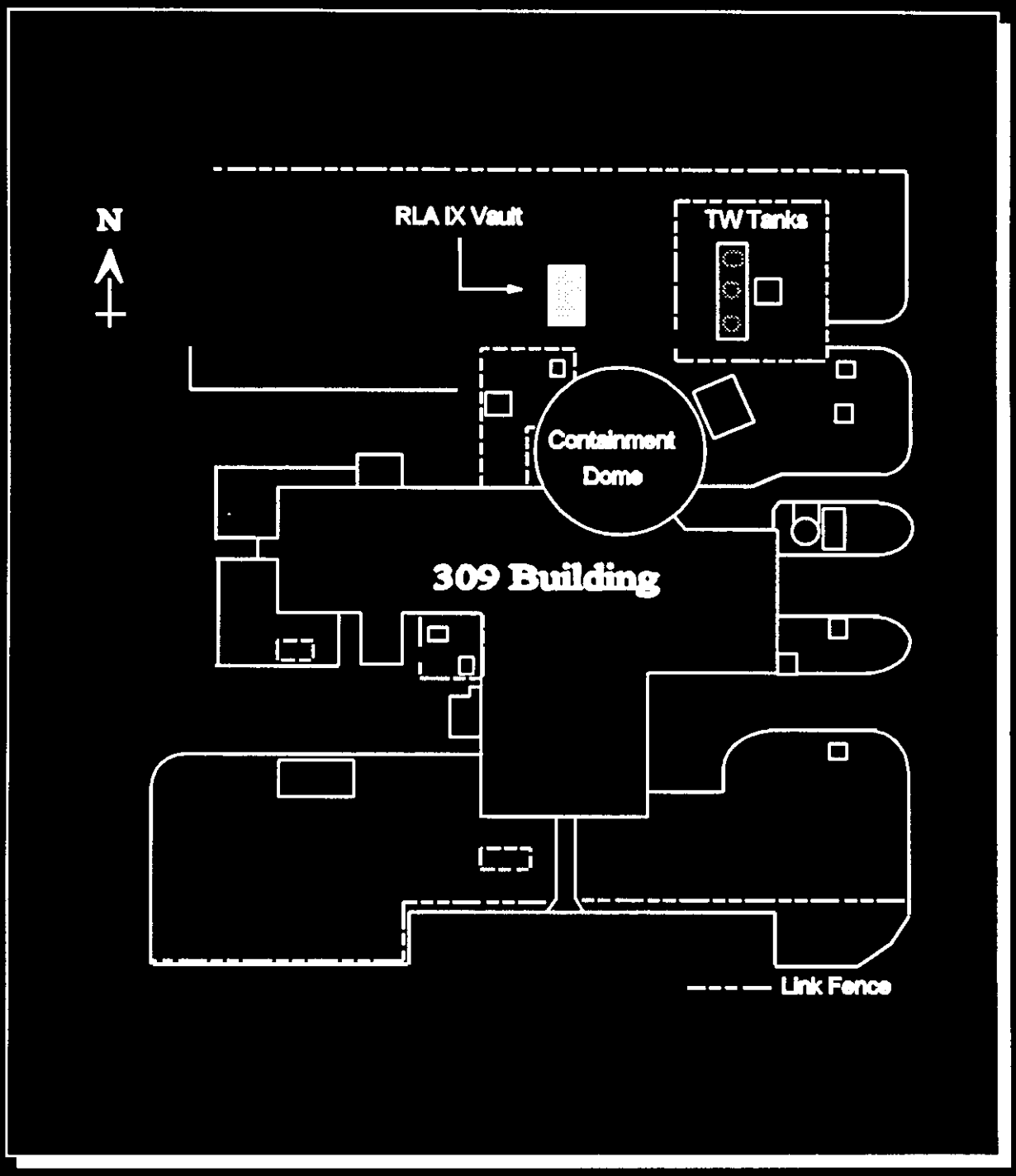
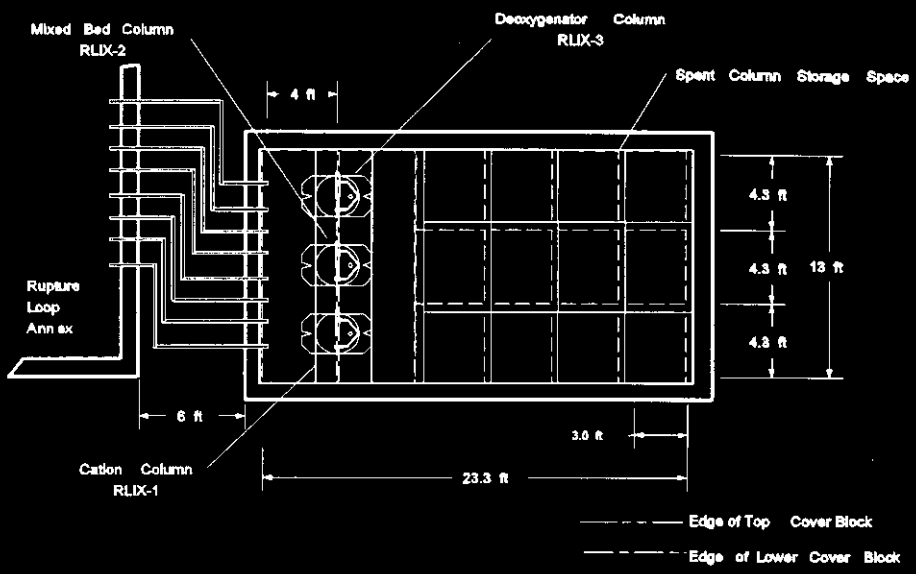
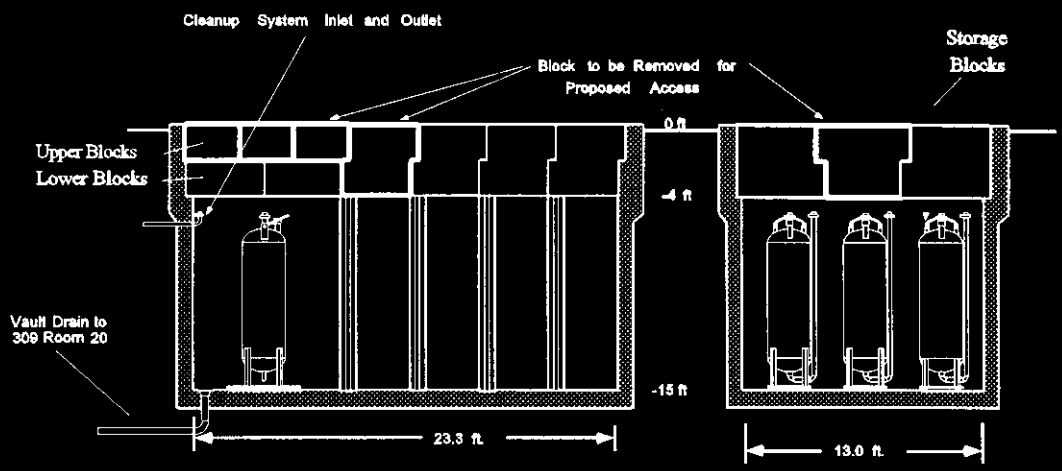


Figure 1. RLAIX Vault Location





Upper Block	2'-11" x 13'-10" x 2'	12,200 lbs
Lower Block	4'-5" x 13'-10" x 2'	18,300 lbs
Center Storage	5'-2" x 3'-10" x 4'	11,900 lbs
Side Storage	3'-10" x 4'-4" x 4'	10,000 lbs

Figure 2. RLAIX Vault Plan

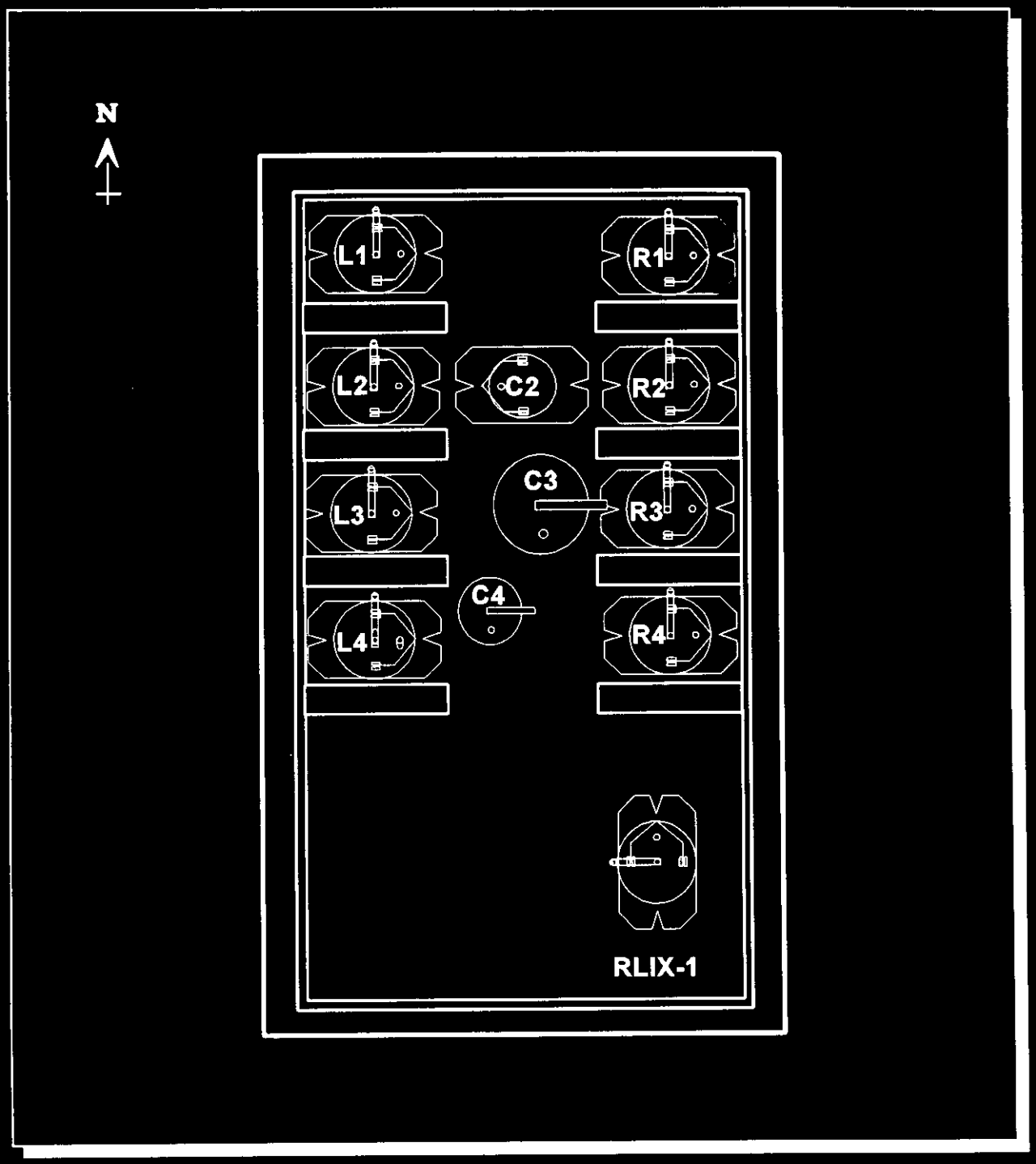


Figure 3. RLAIX Vault Column Arrangement As Found

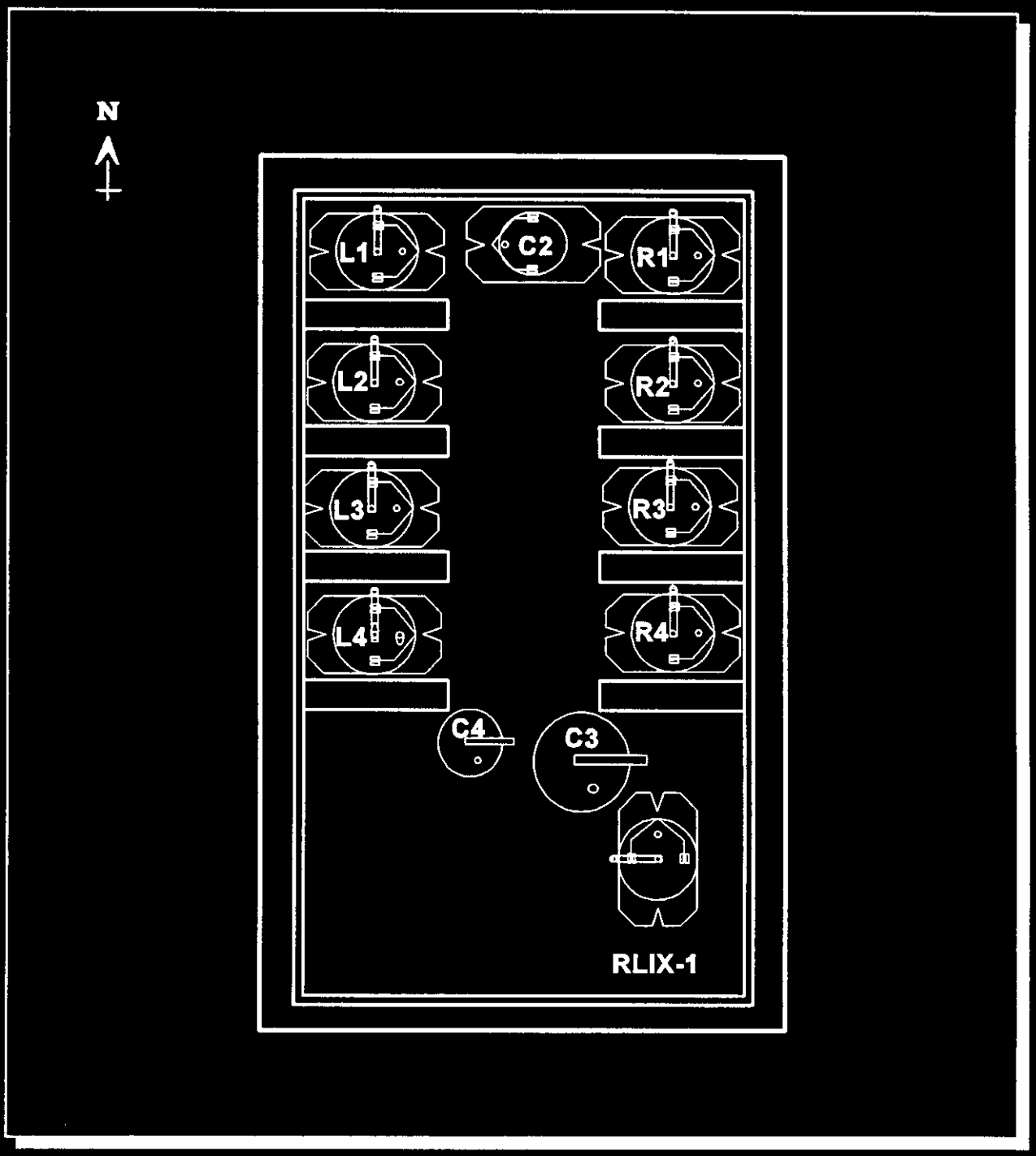


Figure 4. RLAIX Vault Column Arrangement As Left

APPENDIX A

PRTR IX Resin Analysis Report

Analysis Results of PRTR Vault IX-1 Resin

ION EXCHANGE RESIN ANALYSIS				CERCLA Metals of Concern (TCLP)		
Determination	Sample 1	Sample 2	Units	Listed Materials	Max Conc. /with Dilution mnG/L (uG/G)	% TCLP Totals Conc.
pH	5.27					
pH	5.12					
ICP on Dissolved Resin (TOTALS ANALYSIS)*						
Ag		1.100E-01	uG/G	D011	5.0 / 100*	0.1%
Al	1.730E-00	1.790E 00	uG/G			
B	7.800E-01	8.190E-01	uG/G			
Ba	6.000E-01	6.300E-01	uG/G	D005	1.0 / 20*	0.03%
Ca	2.940E 01	3.020E 01	uG/G			
Cd	2.420E 00	2.500E 00	uG/G	D006	1.0 / 20*	10.0%
Co	1.590E 00	1.670E 00	uG/G			
Cr	1.710E 01	1.890E 01	uG/G	D007	5.0 / 100*	17.1%
Cu	4.410E 00	4.590E 00	uG/G			
Fe	7.190E 01	7.850E 01	uG/G			
K	6.070E 00	8.710E 00	uG/G			
Li	1.480E 00	1.520E 00	uG/G			
Mg	2.300E 01	2.360E 01	uG/G			
Mn	4.690E 01	4.860E 01	uG/G			
Mo	4.870E 00	5.010E 00	uG/G			
Na	2.120E 02	2.180E 02	uG/G			
Ni	3.990E 01	4.190E 01	uG/G			
Pb	8.120E 00	8.170E 00	uG/G	D008	5.0 / 100*	8.1%
S	2.230E 02	2.290E 02	uG/G			
Si	9.770E 00	1.010E 01	uG/G			
Sr	1.500E-01	1.600E-01	uG/G			
V	4.890E 00	5.060E 00	uG/G			
Zn	5.800E-01	5.800E-01	uG/G			
Zr	2.400E-01	2.300E-01	uG/G			
Uranium Analysis						
U	4.380E-06	3.900E-06	G/G			
Radioactive Analysis						
TOTAL BETA	1.710E-02	1.720E-02	uCi/G			
TOTAL ALPHA	7.390E-05	6.700E-05	uCi/G			
Cs-137	6.280E-03	6.380E-03	uCi/G			
Co-60	6.070E-03	6.120E-03	uCi/G			
Pu-239/240	< 5.920E-05	< 5.490E-05	uCi/G			
Am-241	< 6.540E-04	< 2.060E-03	uCi/G			

* For TCLP limit comparisons to ICP concentrations. The TCLP max. conc. is multiplied by 20 (accounting for dilution that occurs during a TCLP test.) Comparison is conservative because all material may not be leached during a TCLP test.

1- Concentration test data is based upon a dissolved resin (i.e. total concentration.)

2- Sample represents a 33 in. vertical core, total depth of resin is approx 55 in.

17] From: David B Encke at ~WHC80 5/18/95 11:41AM (1483 bytes: 34 ln)
o: Michael E Burnside at ~WHC1
c: Paul W Griffin at ~WHC77, Bruce C Cornwell at ~WHC158, Ryan J Johnson,
Rikki A Harris at ~WHC77
cc: David B Encke
ubject: BOX#1 IX's 309 Bldg.
---------- Message Contents ----------

Mike,
We just received the NDA results for the IX's from the upper vault at the 309 Bldg. (Burial Box #1). Results are:

Cs-137	0.0103 Ci/box
Co-60	0.0937 Ci/box

Using the results from the resin sample obtained previously (222-S lab # 5804), to obtain a Sr/Cs ratio we get the following:

Sr-90	1.02E-3 uCi/gm
Cs-137	6.38E-3uCi/gm

Therefore: (1.02E-3uCi/gm)/(6.38E-3uCi/gm) = 0.16 ratio of Sr-90 to Cs-137

Total Sr-90 in Box: (0.0103 Ci) x 0.16 = 1.648E-3 Ci

CAT I limit for Sr-90 = 4.3E-3 Ci/m3

Therefore: (225 ft3/box) x (1 m3/35.3 ft3) = 6.37 m3/box

(1.648E-3 Ci Sr-90)/6.37 m3 = 2.59E-4 Ci/m3 Sr-90 which is less than the CAT I limit.

The Cs-137 is also less than the CAT I limit.

If you have any questions call me at 373-3461.

Dave

SAMPLE STATUS REPORT FOR R 5802, 300 AREA STD TIME: 4/ 7/95 14:36
DISPATCHED: 7/19/94 12: 4 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 7/19/94 14:25

EXT.	DETER.	RESULTS OR STATUS	OUT OF RANGE?	GOOD ANS?	CHARGE CODE
5515	pH	1.00200E 02 % RECOVERY	N	Y	XPRTR
5520	TB	OUT FOR RERUN			XPRTR
5520	TB	8.99000E 01 % RECOVERY	N	Y	XPRTR
5525	AT	OUT FOR RERUN			XPRTR
5525	AT	9.94000E 01 % RECOVERY	N	Y	XPRTR
5530	GEA	OUT FOR RERUN			XPRTR
5530	GEA	1.07100E 02 % RECOVERY Cs-137	N	Y	XPRTR
5530	GEA	1.05100E 02 % RECOVERY Co-60	N	Y	XPRTR
5540	U	OUT FOR RERUN			XPRTR
5540	U	OUT FOR RERUN			XPRTR
5540	U	1.04400E 02 % RECOVERY	N	Y	XPRTR
5550	ICP	1.02620E 02 % RECOVERY Ag	N	Y	XPRTR
5550	ICP	1.02460E 02 % RECOVERY Al	N	Y	XPRTR
5550	ICP	1.01460E 02 % RECOVERY B	N	Y	XPRTR
5550	ICP	1.03960E 02 % RECOVERY Ba	N	Y	XPRTR
5550	ICP	1.06300E 02 % RECOVERY Ca	N	Y	XPRTR
5550	ICP	1.06240E 02 % RECOVERY Cd	N	Y	XPRTR
5550	ICP	1.06460E 02 % RECOVERY Co	N	Y	XPRTR
5550	ICP	1.06200E 02 % RECOVERY Cr	N	Y	XPRTR
5550	ICP	1.05660E 02 % RECOVERY Cu	N	Y	XPRTR
5550	ICP	1.06180E 02 % RECOVERY Fe	N	Y	XPRTR
5550	ICP	1.07000E 02 % RECOVERY K	N	Y	XPRTR
5550	ICP	1.01800E 02 % RECOVERY Li	N	Y	XPRTR
5550	ICP	1.01900E 02 % RECOVERY Mg	N	Y	XPRTR
5550	ICP	1.03480E 02 % RECOVERY Mn	N	Y	XPRTR
5550	ICP	1.05020E 02 % RECOVERY Mo	N	Y	XPRTR
5550	ICP	1.01680E 02 % RECOVERY Na	N	Y	XPRTR
5550	ICP	1.06180E 02 % RECOVERY Ni	N	Y	XPRTR
5550	ICP	1.05120E 02 % RECOVERY Pb	N	Y	XPRTR
5550	ICP	1.03060E 02 % RECOVERY S	N	Y	XPRTR
5550	ICP	1.00460E 02 % RECOVERY Si	N	Y	XPRTR
5550	ICP	1.03440E 02 % RECOVERY Sr	N	Y	XPRTR
5550	ICP	1.05960E 02 % RECOVERY V	N	Y	XPRTR
5550	ICP	1.04200E 02 % RECOVERY Zn	N	Y	XPRTR
5550	ICP	1.04380E 02 % RECOVERY Zr	N	Y	XPRTR
5581	Pu239/40	1.01400E 02 % RECOVERY	N	Y	XPRTR
5582	Am241	1.05500E 02 % RECOVERY	N	Y	XPRTR
5586	Sr90	8.77000E 01 % RECOVERY			XPRTR
8500	ACD DGST	D.F.=20	N	Y	XPRTR
8550	ICP	9.27400E 01 % RECOVERY Al	N	Y	XPRTR
8550	ICP	9.20200E 01 % RECOVERY B	N	Y	XPRTR
8550	ICP	9.35000E 01 % RECOVERY Ba	N	Y	XPRTR
8550	ICP	9.08200E 01 % RECOVERY Ca	N	Y	XPRTR
8550	ICP	9.14200E 01 % RECOVERY Cd	N	Y	XPRTR
8550	ICP	9.36600E 01 % RECOVERY Co	N	Y	XPRTR
8550	ICP	9.21200E 01 % RECOVERY Cr	N	Y	XPRTR
8550	ICP	9.44200E 01 % RECOVERY Cu	N	Y	XPRTR
8550	ICP	9.37600E 01 % RECOVERY Fe	N	Y	XPRTR
8550	ICP	8.62400E 01 % RECOVERY K	N	Y	XPRTR
8550	ICP	9.70800E 01 % RECOVERY Li	N	Y	XPRTR
8550	ICP	9.04600E 01 % RECOVERY Mg	N	Y	XPRTR

04/07/98 13:53 ☎373 2178 2229 3B 003

SAMPLE STATUS REPORT FOR R 5802. 300 AREA STD TIME: 4/ 7/95 14:36
DISPATCHED: /19/94 12: 4 SAMPLE HAS NOT BEEN SLURPED

EXT.	DETER.	RESULTS OR STATUS	OUT OF RANGE? ***	GOOD ANS? ***	CHARGE CODE ******
8550	ICP	9.39800E 01 % RECOVERY Mo	N	Y	XPRTR
8550	ICP	9.42800E 01 % RECOVERY Na	N	Y	XPRTR
8550	ICP	9.22400E 01 % RECOVERY Ni	N	Y	XPRTR
8550	ICP	9.00000E 01 % RECOVERY Pb	N	Y	XPRTR
8550	ICP	8.97800E 01 % RECOVERY S	N	Y	XPRTR
8550	ICP	8.97800E 01 % RECOVERY Si	N	Y	XPRTR
8550	ICP	9.45200E 01 % RECOVERY Sr	N	Y	XPRTR
8550	ICP	9.28800E 01 % RECOVERY V	N	Y	XPRTR
8550	ICP	8.93000E 01 % RECOVERY Zn	N	Y	XPRTR
8550	ICP	9.40200E 01 % RECOVERY Zr	N	Y	XPRTR
8550	ICP	8.51400E 01 % RECOVERY Ag	N	Y	XPRTR

END OF REPORT

04/07/95 15:54 ☎373 3178 2229 3B

SAMPLE STATUS REPORT FOR R 5903. 300 AREA BLANK TIME: 4/ 7/95 14:37
DISPATCHED: 7/19/94 12: 5 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 7/19/94 14:26

EXT.	DETER.	RESULTS OR STATUS			OUT OF RANGE?	GOOD ANS?	CHARGE CODE
8600	ACD DGST	COMPLETED					XPRTR
8600	ACD DGST	COMPLETE					XPRTR
8620	TB	OUT FOR RERUN					XPRTR
8620	TB	5.490000E-05	uCi/G		N	Y	XPRTR
8625	AT	OUT FOR RERUN					XPRTR
8625	AT	< 1.600000E-05	uCi/G Rec		N	Y	XPRTR
8630	GEA	OUT FOR RERUN					XPRTR
8630	GEA	< 2.550000E-04	uCi/G Rec	Cs-137	N	Y	XPRTR
8630	GEA	< 1.880000E-04	uCi/G Rec	Co-60	N	Y	XPRTR
8640	U	OUT FOR RERUN					XPRTR
8640	U	OUT FOR RERUN					XPRTR
8640	U	< 3.670000E-01	uG/ML		N	Y	XPRTR
8650	ICP	< 5.000000E 02	uG/ML	Al	N	Y	XPRTR
8650	ICP	< 1.000000E-02	uG/ML	Ag	N	Y	XPRTR
8650	ICP	< 5.000000E-02	uG/ML	B	N	Y	XPRTR
8650	ICP	< 5.000000E-02	uG/ML	Ba	N	Y	XPRTR
8650	ICP	< 5.000000E-02	uG/ML	Be	N	Y	XPRTR
8650	ICP	< 1.000000E-01	uG/ML	Ca	N	Y	XPRTR
8650	ICP	< 1.000000E-02	uG/ML	Cd	N	Y	XPRTR
8650	ICP	< 2.000000E-02	uG/ML	Co	N	Y	XPRTR
8650	ICP	< 1.000000E-02	uG/ML	Cr	N	Y	XPRTR
8650	ICP	< 1.000000E-02	uG/ML	Cu	N	Y	XPRTR
8650	ICP	< 5.000000E-02	uG/ML	Fe	N	Y	XPRTR
8650	ICP	< 3.000000E-01	uG/ML	K	N	Y	XPRTR
8650	ICP	< 1.000000E-02	uG/ML	Li	N	Y	XPRTR
8650	ICP	< 1.000000E-01	uG/ML	Mg	N	Y	XPRTR
8650	ICP	< 1.000000E-02	uG/ML	Mn	N	Y	XPRTR
8650	ICP	< 5.000000E-02	uG/ML	Mo	N	Y	XPRTR
8650	ICP	< 1.000000E-01	uG/ML	Na	N	Y	XPRTR
8650	ICP	< 2.000000E-02	uG/ML	Ni	N	Y	XPRTR
8650	ICP	< 1.000000E-01	uG/ML	Pb	N	Y	XPRTR
8650	ICP	< 5.000000E-02	uG/ML	S	N	Y	XPRTR
8650	ICP	< 5.000000E-02	uG/ML	Si	N	Y	XPRTR
8650	ICP	< 1.000000E-02	uG/ML	Sr	N	Y	XPRTR
8650	ICP	< 5.000000E-02	uG/ML	V	N	Y	XPRTR
8650	ICP	< 1.000000E-02	uG/ML	Zn	N	Y	XPRTR
8650	ICP	< 1.000000E-02	uG/ML	Zr	N	Y	XPRTR
8681	Pu239/40	< 6.520000E-05	uCi/G Rec	PU239/240	N	Y	XPRTR
8682	AM241	< 2.050000E-03	uCi/G Rec		N	Y	XPRTR
8686	Sr90	< 2.390000E-04	uCi/G Rec		N	Y	XPRTR

END OF REPORT

SAMPLE STATUS REPORT FOR R 5804. 300 AREA S4047-01 TIME: 4/ 7/95 14:37
DISPATCHED: 7/19/94 12: 6 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 7/19/94 14:26

EXT.	DETER.	RESULTS OR STATUS			OUT OF RANGE?	GOOD ANS?	CHARGE CODE
5715	pH	8.27000E 00	NONE		N	Y	XPRTR
5815	pH	5.12000E 00	NONE		N	Y	XPRTR
8700	ACD DGST	1.00054E 02	G/L		N	Y	XPRTR
8700	ACD DGST	1.00170E 01	G/L		N	Y	XPRTR
8720	TB	OUT FOR RERUN					XPRTR
8720	TB	1.71000E-02	uCi/G		N	Y	XPRTR
8725	AT	OUT FOR RERUN					XPRTR
8725	AT	7.39000E-05	uCi/G Rec		N	Y	XPRTR
8730	GEA	OUT FOR RERUN					XPRTR
8730	GEA	6.28000E-03	uCi/G Rec	Cs-137	N	Y	XPRTR
8730	GEA	6.07000E-03	uCi/G Rec	Co-60	N	Y	XPRTR
8740	U	OUT FOR RERUN					XPRTR
8740	U	OUT FOR RERUN					XPRTR
8740	U	4.38000E-06	G/G Rec		N	Y	XPRTR
8755	ICP-SOL	1.73000E 00	uG/G Rec	Al	N	Y	XPRTR
8755	ICP-SOL	7.80000E-01	uG/G Rec	B	N	Y	XPRTR
8755	ICP-SOL	6.00000E-01	uG/G Rec	Ba	N	Y	XPRTR
8755	ICP-SOL	2.94000E 01	uG/G Rec	Ca	N	Y	XPRTR
8755	ICP-SOL	2.42000E 00	uG/G Rec	Cd	N	Y	XPRTR
8755	ICP-SOL	1.59000E 00	uG/G Rec	Co	N	Y	XPRTR
8755	ICP-SOL	1.71000E 01	uG/G Rec	Cr	N	Y	XPRTR
8755	ICP-SOL	4.41000E 00	uG/G Rec	Cu	N	Y	XPRTR
8755	ICP-SOL	7.19000E 01	uG/G Rec	Fe	N	Y	XPRTR
8755	ICP-SOL	6.07000E 00	uG/G Rec	K	N	Y	XPRTR
8755	ICP-SOL	1.48000E 00	uG/G Rec	Li	N	Y	XPRTR
8755	ICP-SOL	2.30000E 01	uG/G Rec	Mg	N	Y	XPRTR
8755	ICP-SOL	4.69000E 01	uG/G Rec	Mn	N	Y	XPRTR
8755	ICP-SOL	4.87000E 00	uG/G Rec	Mo	N	Y	XPRTR
8755	ICP-SOL	2.12000E 02	uG/G Rec	Na	N	Y	XPRTR
8755	ICP-SOL	3.99000E 01	uG/G Rec	Ni	N	Y	XPRTR
8755	ICP-SOL	8.12000E 00	uG/G Rec	Pb	N	Y	XPRTR
8755	ICP-SOL	2.23000E 02	uG/G Rec	S	N	Y	XPRTR
8755	ICP-SOL	9.77000E 00	uG/G Rec	Si	N	Y	XPRTR
8755	ICP-SOL	1.50000E-01	uG/G Rec	Sr	N	Y	XPRTR
8755	ICP-SOL	4.89000E 00	uG/G Rec	V	N	Y	XPRTR
8755	ICP-SOL	5.80000E-01	uG/G Rec	Zn	N	Y	XPRTR
8755	ICP-SOL	2.40000E-01	uG/G Rec	Zr	N	Y	XPRTR
8781	Pu239/40	< 5.92000E-05	uCi/G Rec	PU239/240	N	Y	XPRTR
8782	Am241	< 6.54000E-04	uCi/G Rec		N	Y	XPRTR
8786	Sr90	1.09000E-03	uCi/G Rec		N	Y	XPRTR
8800	ACD DGST	1.00068E 02	G/L		N	Y	XPRTR
8800	ACD DGST	1.00760E 01	G/L		N	Y	XPRTR
8820	TB	OUT FOR RERUN					XPRTR
8820	TB	1.72000E-02	uCi/G		N	Y	XPRTR
8825	AT	OUT FOR RERUN					XPRTR
8825	AT	6.70000E-05	uCi/G Rec		N	Y	XPRTR
8830	GEA	OUT FOR RERUN					XPRTR
8830	GEA	6.38000E-03	uCi/G Rec	Cs-137	N	Y	XPRTR
8830	GEA	6.12000E-03	uCi/G Rec	Co-60	N	Y	XPRTR
8840	U	OUT FOR RERUN					XPRTR
8840	U	OUT FOR RERUN					XPRTR

04/07/95 13:56 3373 1176 2226 3R 000

0040 U 3.90000E 06 G/G Rec N Y XPRTR

REPORT CONTINUED ON NEXT PAGE

SAMPLE STATUS REPORT FOR R 5804. 300 AREA S4047-01 TIME: 4/ 7/95 14:37
DISPATCHED: 7/19/94 12: 6 SAMPLE HAS NOT BEEN SLURPED

EXT.	DETER.	RESULTS OR STATUS			OUT OF RANGE?	GOOD ANS?	CHARGE CODE
8855	ICP-SOL	1.10000E-01	uG/G Rec	Ag	N	Y	XPRTR
8855	ICP-SOL	1.79000E 00	uG/G Rec	Al	N	Y	XPRTR
8855	ICP-SOL	8.19000E-01	uG/G Rec	B	N	Y	XPRTR
8855	ICP-SOL	6.30000E-01	uG/G Rec	Ba	N	Y	XPRTR
8855	ICP-SOL	3.02000E 01	uG/G Rec	Ca	N	Y	XPRTR
8855	ICP-SOL	2.50000E 00	uG/G Rec	Cd	N	Y	XPRTR
8855	ICP-SOL	1.67000E 00	uG/G Rec	Co	N	Y	XPRTR
8855	ICP-SOL	1.89000E 01	uG/G Rec	Cr	N	Y	XPRTR
8855	ICP-SOL	4.59000E 00	uG/G Rec	Cu	N	Y	XPRTR
8855	ICP-SOL	7.85000E 01	uG/G Rec	Fe	N	Y	XPRTR
8855	ICP-SOL	8.71000E 00	uG/G Rec	K	N	Y	XPRTR
8855	ICP-SOL	1.52000E 00	uG/G Rec	Li	N	Y	XPRTR
8855	ICP-SOL	2.36000E 01	uG/G Rec	Mg	N	Y	XPRTR
8855	ICP-SOL	4.86000E 01	uG/G Rec	Mn	N	Y	XPRTR
8855	ICP-SOL	5.01000E 00	uG/G Rec	Mo	N	Y	XPRTR
8855	ICP-SOL	2.18000E 02	uG/G Rec	Na	N	Y	XPRTR
8855	ICP-SOL	4.19000E 01	uG/G Rec	Ni	N	Y	XPRTR
8855	ICP-SOL	8.17000E 00	uG/G Rec	Pb	N	Y	XPRTR
8855	ICP-SOL	2.29000E 02	uG/G Rec	S	N	Y	XPRTR
8855	ICP-SOL	1.01000E 01	uG/G Rec	Si	N	Y	XPRTR
8855	ICP-SOL	1.60000E-01	uG/G Rec	Sr	N	Y	XPRTR
8855	ICP-SOL	5.06000E 00	uG/G Rec	V	N	Y	XPRTR
8855	ICP-SOL	5.80000E-01	uG/G Rec	Zn	N	Y	XPRTR
8855	ICP-SOL	2.30000E-01	uG/G Rec	Zr	N	Y	XPRTR
8881	Pu239/40	< 5.49000E-05	uCi/G Rec	PU239/240	N	Y	XPRTR
8882	Am241	< 2.06000E-03	uCi/G Rec		N	Y	XPRTR
8886	Sr90	9.55000E-04	uCi/G Rec		N	Y	XPRTR
8900	ACD DGST	100.0210G/L,WHC-1A&2 DF=20					XPRTR
8920	TB	OUT FOR RERUN					XPRTR
8920	TB	1.01700E 02	% RECOVERY		N	Y	XPRTR
8925	AT	OUT FOR RERUN					XPRTR
8925	AT	1.28000E 02	% RECOVERY		N	Y	XPRTR
8940	U	OUT FOR RERUN					XPRTR
8940	U	OUT FOR RERUN					XPRTR
8940	U	8.28000E 01	% RECOVERY		N	Y	XPRTR
8950	ICP	9.79400E 01	% RECOVERY	Al	N	Y	XPRTR
8950	ICP	1.01400E 02	% RECOVERY	Ba	N	Y	XPRTR
8950	ICP	9.64400E 01	% RECOVERY	B	N	Y	XPRTR
8950	ICP	9.82000E 01	% RECOVERY	Ca	N	Y	XPRTR
8950	ICP	9.93600E 01	% RECOVERY	Cd	N	Y	XPRTR
8950	ICP	1.01220E 02	% RECOVERY	Co	N	Y	XPRTR
8950	ICP	1.09400E 02	% RECOVERY	Cr	N	Y	XPRTR
8950	ICP	9.77800E 01	% RECOVERY	Cu	N	Y	XPRTR
8950	ICP	1.44200E 02	% RECOVERY	Fe	N	Y	XPRTR
8950	ICP	1.06060E 02	% RECOVERY	K	N	Y	XPRTR
8950	ICP	9.98400E 01	% RECOVERY	Li	N	Y	XPRTR
8950	ICP	9.50000E 01	% RECOVERY	Mg	N	Y	XPRTR
8950	ICP	8.84000E 01	% RECOVERY	Mn	N	Y	XPRTR
8950	ICP	1.04460E 02	% RECOVERY	Mo	N	Y	XPRTR
8950	ICP	9.20000E 01	% RECOVERY	Na	N	Y	XPRTR
8950	ICP	8.22000E 01	% RECOVERY	Ni	N	Y	XPRTR
8950	ICP	9.69600E 01	% RECOVERY	Pb	N	Y	XPRTR

04/07/95 13:56 ☎373 3178 2226 3B ☎008

SAMPLE STATUS REPORT FOR R 5804. 300 AREA S4047-01 TIME: 4/ 7/95 14:37
DISPATCHED: 7/19/94 12: 6 SAMPLE HAS NOT BEEN SLURPED

EXT.	DETER	RESULTS OR STATUS	OUT OF RANGE?	GOOD ANS?	CHARGE CODE
8950	ICP	7.20000E 01 % RECOVERY S	N	Y	XPRTR
8950	ICP	9.64600E 01 % RECOVERY Si	N	Y	XPRTR
8950	ICP	1.01700E 02 % RECOVERY Sr	N	Y	XPRTR
8950	ICP	1.00620E 02 % RECOVERY V	N	Y	XPRTR
8950	ICP	9.50400E 01 % RECOVERY Zn	N	Y	XPRTR
8950	ICP	1.02520E 02 % RECOVERY Zr	N	Y	XPRTR
8950	ICP	9.25000E 01 % RECOVERY Ag	N	Y	XPRTR
8981	Pu239/40	1.04100E 02 % RECOVERY	N	Y	XPRTR
8982	Am241	1.11100E 02 % RECOVERY	N	Y	XPRTR
8985	Sr90	9.16000E 01 % RECOVERY	N	Y	XPRTR

END OF REPORT

04/07/95 13:56 ☎373 3178 2229 AR 003

SAMPLE STATUS REPORT FOR R 5806. 300 AREA STD TIME: 4/ //95 14:38
DISPATCHED: 7/19/94 12: 7 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 7/19/94 14:26

EXT.	DETER.	RESULTS OR STATUS	OUT OF RANGE?	GOOD ANS?	CHARGE CODE
5515	pH	1.00200E 02 % RECOVERY	N	Y	XPRTR
5520	TB	OUT FOR RERUN			XPRTR
5520	TB	9.10000E 01 % RECOVERY	N	Y	XPRTR
5525	AT	OUT FOR RERUN			XPRTR
5525	AT	9.15000E 01 % RECOVERY	N	Y	XPRTR
5530	GEA	OUT FOR RERUN			XPRTR
5530	GEA	1.04500E 02 % RECOVERY Cs-137	N	Y	XPRTR
5530	GEA	1.03600E 02 % RECOVERY Co-60	N	Y	XPRTR
5540	U	OUT FOR RERUN			XPRTR
5540	U	OUT FOR RERUN			XPRTR
5540	U	9.59000E 01 % RECOVERY	N	Y	XPRTR
5550	ICP	1.02100E 02 % RECOVERY Ag	N	Y	XPRTR
5550	ICP	1.01420E 02 % RECOVERY Al	N	Y	XPRTR
5550	ICP	9.94400E 01 % RECOVERY B	N	Y	XPRTR
5550	ICP	1.00880E 02 % RECOVERY Ba	N	Y	XPRTR
5550	ICP	1.05960E 02 % RECOVERY Ca	N	Y	XPRTR
5550	ICP	1.04760E 02 % RECOVERY Cd	N	Y	XPRTR
5550	ICP	1.05420E 02 % RECOVERY Co	N	Y	XPRTR
5550	ICP	1.05120E 02 % RECOVERY Cr	N	Y	XPRTR
5550	ICP	1.03120E 02 % RECOVERY Cu	N	Y	XPRTR
5550	ICP	1.04500E 02 % RECOVERY Fe	N	Y	XPRTR
5550	ICP	1.00240E 02 % RECOVERY K	N	Y	XPRTR
5550	ICP	9.93200E 01 % RECOVERY Li	N	Y	XPRTR
5550	ICP	1.01060E 02 % RECOVERY Mg	N	Y	XPRTR
5550	ICP	1.02120E 02 % RECOVERY Mn	N	Y	XPRTR
5550	ICP	1.04640E 02 % RECOVERY Mo	N	Y	XPRTR
5550	ICP	9.89600E 01 % RECOVERY Na	N	Y	XPRTR
5550	ICP	1.04800E 02 % RECOVERY Ni	N	Y	XPRTR
5550	ICP	1.05540E 02 % RECOVERY Pb	N	Y	XPRTR
5550	ICP	1.02480E 02 % RECOVERY S	N	Y	XPRTR
5550	ICP	9.95200E 01 % RECOVERY Si	N	Y	XPRTR
5550	ICP	1.00620E 02 % RECOVERY Sr	N	Y	XPRTR
5550	ICP	1.04400E 02 % RECOVERY V	N	Y	XPRTR
5550	ICP	1.03780E 02 % RECOVERY Zn	N	Y	XPRTR
5550	ICP	1.02340E 02 % RECOVERY Zr	N	Y	XPRTR
5581	Pu239/40	1.03500E 02 % RECOVERY	N	Y	XPRTR
5582	Am241	1.12100E 02 % RECOVERY	N	Y	XPRTR
5586	Sr90	8.14100E 01 % RECOVERY	N	Y	XPRTR

END OF REPORT

APPENDIX B

RLAIX Resin MSDS

100 INDEPENDENCE MALL WEST PHILADELPHIA PA 19106-2399 U S A
TELEPHONE (215) 592-3000 CABLE ADDRESS: ROHMHAAS CENTRAL FAX (215) 592-3377

ROHM AND HAAS COMPANY

May 26, 1995

Westinghouse Hanford Company
Mr. Bruce Cornwell, MSIN L473
P.O. Box 1970
Richland, WA 99352

Dear Bruce:

This is a followup to our telephone conversation concerning information which you need to dispose of three ion exchange resin products.

Duolite S-10 Resin was manufactured either by Diamond Shamrock Corporation or their predecessor, Chemical Process Company. I was not able to find a material safety data sheet (MSDS) on this resin, but one database indicated that it was a resin functionalized with copper/amine groups and used to scavenge oxygen from water. The insoluble polymer matrix was either phenol/formaldehyde or epoxy condensate; I haven't been able to clarify which one.

Amberlite XE-163 Resin was the developmental name for the commercial product Amberlite IRN-163 Resin, which is no longer sold by itself. This is a sulfonated polystyrene/divinylbenzene copolymer supplied in the lithium ion form. Amberlite XE-154 Resin was commercialized as Amberlite IRN-154 Resin. This product is a mixture of two resins: Amberlite IRN-163 Resin and Amberlite IRN-78 Resin (a quaternary ammonium hydroxide copolymer of styrene/divinylbenzene). MSDS for both of these products are enclosed. Contrary to what I said on the telephone, neither product contains the lithium seven isotope.

Thank-you for your interest in our ion exchange products, and thanks especially for referring me to 10CFR 61.55 for information on disposal of radioactive wastes.

Very truly yours,

A. Barry Simpson

A. Barry Simpson
Regulatory and Product Safety Manager
Separation Technologies
(215) 592-2540

Rohm and Haas Company
100 Independence Mall West
Philadelphia, PA 19106-2399

HEALTH EMERGENCY : 215-592-3000
SPILL EMERGENCY : 215-592-3000
CHEMTREC : 800-424-9300

MATERIAL SAFETY
DATA SHEET

PRODUCT IDENTIFICATION

AMBERLITE-R IRN-154 Resin

Product Code : 69856
Key : 890664-1
MSDS Date : 11/21/91
Supersedes : 10/04/85

Rohm and Haas Hazard Rating		Scale
Toxicity	1	4=EXTREME
Fire	1	3=HIGH
Reactivity	0	2=MODERATE
Special	-	1=SLIGHT
		0=INSIGNIFICANT

Product as supplied is a mixed bed exchange resin, strongly acidic cation, lithium ion form and strongly basic, hydroxide ion form.

COMPONENT INFORMATION

No.		CAS REG NO.	AMT.(%)
1	Sulfonated divinylbenzene/styrene copolymer, Li ion form	63182-07-0	35 - 45
2	Quat amine divinylbenzene/styrene copolymer, OH ion form	9017-79-2	
3	Water	7732-18-5	55 - 65

EMERGENCY RESPONSE INFORMATION

FIRST AID PROCEDURES

Eye Contact

Flush eyes with a large amount of water for at least 15 minutes. Consult a physician if irritation persists.

Skin Contact

Wash affected skin areas thoroughly with soap and water.

Rohm and Haas Company
100 Independence Mall West
Philadelphia, PA 19106-2399

PRODUCT: AMBERLITE-R IRN-154 Resin
KEY: 890664-1
DATE: 11/21/91

FIRE FIGHTING INFORMATION

Unusual Hazards

Combustion generates toxic fumes of the following:
- sulfur oxides - nitrogen oxides

Extinguishing Agents

Use the following extinguishing media when fighting fires involving this material:
- carbon dioxide - dry chemical - water spray

Personal Protective Equipment

Wear self-contained breathing apparatus (pressure-demand MSHA/NIOSH approved or equivalent) and full protective gear.

SPILL OR LEAK HANDLING INFORMATION

Personal Protection

Wear gloves made of the following material:
- butyl rubber

Additional personal protective equipment should include the following:
- safety glasses (ANSI Z87.1 or approved equivalent)

Procedures

Floor may be slippery; use care to avoid falling. Transfer spilled material to suitable containers for recovery or disposal.

HAZARD INFORMATION

HEALTH EFFECTS FROM OVEREXPOSURE

Primary Routes of Exposure

Skin Contact
Eye Contact

Eye Contact

Material can cause the following:
- irritation

CONTINUED

Rohm and Haas Company
100 Independence Mall West
Philadelphia, PA 19106-2399

PRODUCT: AMBERLITE-R IRN-154 Resin
KEY: 890664-1
DATE: 11/21/91

CONTINUATION
Skin Contact

Prolonged or repeated skin contact can cause the following:
- slight skin irritation

FIRE AND EXPLOSIVE PROPERTIES

Flash Point	Not Applicable
Auto-ignition Temperature	427 C/800 F Estimate
Lower Explosive Limit	Not Applicable
Upper Explosive Limit	Not Applicable

REACTIVITY INFORMATION

Instability

This material is considered stable under specified conditions of storage, shipment and/or use. See STORAGE AND HANDLING INFORMATION Section for specified conditions. However, avoid temperatures above 200C/392F.

Hazardous Decomposition Products

Thermal decomposition may yield the following:
- monomer vapors - sulfur oxides - alkylamines - oxides of nitrogen

Hazardous Polymerization

Product will not undergo polymerization.

Incompatibility

Avoid contact with strong oxidizing agents, particularly concentrated nitric acid.

Rohm and Haas Company
100 Independence Mall West
Philadelphia, PA 19106-2399

PRODUCT: AMBERLITE-R IRN-154 Resin
KEY: 890664-1
DATE: 11/21/91

ACCIDENT PREVENTION INFORMATION

COMPONENT EXPOSURE INFORMATION

Component Information

No.		CAS REG NO.	AMT.(%)
1	Sulfonated divinylbenzene/styrene copolymer, Li ion form	63182-07-0	35 - 45
2	Quat amine divinylbenzene/styrene copolymer, OH ion form	9017-79-2	
3	Water	7732-18-5	55 - 65

Exposure Limit Information

Comp		ROHM AND HAAS		OSHA		ACGIH	
No.	Units	TWA	STEL	TWA	STEL	TLV	STEL
1		None	None	None	None	None	None
2		None	None	None	None	None	None
3		None	None	None	None	None	None

PERSONAL PROTECTION MEASURES

Respiratory Protection

A respiratory protection program meeting OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use. None required under normal operating conditions.

Eye Protection

Use safety glasses (ANSI Z87.1 or approved equivalent).

Hand Protection

Chemically resistant gloves should be worn whenever this material is handled.
Gloves should be removed and replaced immediately if there is any indication of degradation or chemical breakthrough.

Rohm and Haas Company
100 Independence Mall West
Philadelphia, PA 19106-2399

PRODUCT: AMBERLITE-R IRN-154 Resin
KEY: 890664-1
DATE: 11/21/91

FACILITY CONTROL MEASURES

Ventilation

The ventilation system employed is dependent on the user's specific application of this material. Refer to the current edition of Industrial Ventilation: A Manual of Recommended Practice published by the American Conference of Governmental Industrial Hygienists for information on the design, installation, use, and maintenance of exhaust systems. None required under normal operating conditions.

Other Protective Equipment

Facilities storing or utilizing this material should be equipped with an eyewash facility.

STORAGE AND HANDLING INFORMATION

Storage Conditions

The minimum recommended storage temperature for this material is 0C/32F. The maximum recommended storage temperature for this material is 49C/120F. Keep from freezing; material stability may be affected.

Handling Procedures

The maximum recommended operating temperature for this material is 60C/140F. Properly designed equipment is vital if these ion exchange resins are to be used in conjunction with strong oxidizing agents such as nitric acid to prevent a rapid build-up of pressure and possible explosion. Consult a source knowledgeable in the handling of these materials before preceding. Do not pack column with dry ion exchange resins. Dry beads expand when wetted; this expansion can cause glass columns to shatter.

SUPPLEMENTAL INFORMATION

TYPICAL PHYSICAL PROPERTIES

Color	Tan
State	Beads
Odor Characteristic	Odorless
pH	7 to 9.5 Aqueous slurry
Viscosity	Not Applicable
Specific Gravity (Water = 1)	1.1
Vapor Density (Air = 1)	< 1 Water

CONTINUED

Rohm and Haas Company
100 Independence Mall West
Philadelphia, PA 19106-2399

PRODUCT: AMBERLITE-R IRN-154 Resin
KEY: 890664-1
DATE: 11/21/91

CONTINUATION

Vapor Pressure	17 mm Hg @20 C/68 F Water
Melting Point	0 C/32 F Water
Boiling Point	100 C/212 F Water
Solubility in Water	Practically insoluble
Percent Volatility	55 to 65 % Water
Evaporation Rate (BAc = 1)	< 1 Water

TOXICITY INFORMATION

Acute Data

No toxicity data are available for this material.

WASTE DISPOSAL

Procedure

Unused resin may be incinerated or landfilled in facilities meeting local, state, and federal regulations. For contaminated resin, the user must determine the hazard and use an appropriate disposal method.

REGULATORY INFORMATION

WORKPLACE CLASSIFICATIONS

This product is considered non-hazardous under the OSHA Hazard Communication Standard (29CFR 1910.1200).

This product is not a 'controlled product' under the Canadian Workplace Hazardous Materials Information System (WHMIS).

TRANSPORTATION CLASSIFICATIONS

US DOT Hazard Class . . . NONREGULATED

EMERGENCY PLANNING & COMMUNITY RIGHT-TO-KNOW (SARA TITLE 3)

Section 311/312 Categorizations (40CFR 370)

This product is not a hazardous chemical under 29CFR 1910.1200, and therefore is not covered by Title III of SARA.

CONTINUED

Rohm and Haas Company
100 Independence Mall West
Philadelphia, PA 19106-2399

PRODUCT: AMBERLITE-R IRN-154 Resin
KEY: 890664-1
DATE: 11/21/91

CONTINUATION
Section 313 Information (40CFR 372)

This product does not contain a chemical which is listed in Section 313 above de minimis concentrations.

CERCLA INFORMATION (40CFR 302.4)

Releases of this material to air, land, or water are not reportable to the National Response Center under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to state and local emergency planning committees under the Superfund Amendments and Reauthorization Act (SARA) Title III Section 304.

RCRA INFORMATION

When a decision is made to discard this material as supplied, it does not meet RCRA's characteristic definition of ignitability, corrosivity, or reactivity, and is not listed in 40 CFR 261.33. The toxicity characteristic (TC), however, has not been evaluated by the Toxicity Characteristic Leaching Procedure (TCLP).

CHEMICAL CONTROL LAW STATUS

All components of this product are listed or are excluded from listing on the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

AMBERLITE-R is a trademark of Rohm and Haas Company or one of its subsidiaries or affiliates.

ABBREVIATIONS:
ACGIH = American Conference of Governmental Industrial Hygienists
OSHA = Occupational Safety and Health Administration
TLV = Threshold Limit Value
PEL = Permissible Exposure Limit
TWA = Time Weighted Average
STEL = Short-Term Exposure Limit
BAc = Butyl acetate
▒ Bar denotes a revision from previous MSDS in this area.

Rohm and Haas Company
100 Independence Mall West
Philadelphia, PA 19106-2399

PRODUCT: AMBERLITE-R IRN-154 Resin
KEY: 890664-1
DATE: 11/21/91

The information contained herein relates only to the specific material identified. Rohm and Haas Company believes that such information is accurate and reliable as of the date of this material safety data sheet, but no representation, guarantee or warranty, express or implied, is made as to the accuracy, reliability, or completeness of the information. Rohm and Haas Company urges persons receiving this information to make their own determination as to the information's suitability and completeness for their particular application.

97

J.J. COGGINS
HO, INDUST CHEM

ROHM AND HAAS COMPANY

CORPORATE PRODUCT INTEGRITY DEPARTMENT
INDEPENDENCE MALL WEST
PHILADELPHIA, PA 19105

EMERGENCY TELEPHONE
215-592-3000 (ROHM AND HAAS)
800-424-9300 (CHEMTREC)

HAZARD RATING
4=EXTREME
3=HIGH
2=MODERATE
1=SLIGHT
0=INSIGNIFICANT
**=SEE SECTION IV

FIRE 1 REACTIVITY 0 TOXICITY 0 SPECIAL

LIST 7

MATERIAL SAFETY DATA SHEET

NOT OSHA HAZARDOUS

MATERIAL	CODE	KEY	DOT HAZARD CLASS
AMBERLITE® IRN-154 Resin	69856	890664-1	NONREGULATED
	DATE ISSUED 10/04/85		

FORMULA	CHEMICAL NAME OR SYNONYMS
Not applicable	Styrene/divinylbenzene ion exchange resin (lithium and hydroxide forms)

I – COMPOSITIONAL INFORMATION

	CAS Reg. No.	APPROX WT %	TWA/TLV R&H	OSHA	ACGIH
Styrene/DVB anion/cation exchange resins	NONHAZ	40-45	NE	NE	NE
Water	NONHAZ	55-60	NE	NE	NE

II – PHYSICAL PROPERTY INFORMATION

APPEARANCE · ODOR · pH			VISCOSITY
Tan beads; odorless; pH(aqueous slurry) 7-9.5			NA
MELTING OR FREEZING POINT	**BOILING POINT**	**VAPOR PRESSURE (mm Hg)**	**VAPOR DENSITY (AIR=1)**
0C/32F (water)	NA	17 (water)	0.62 (water)
SOLUBILITY IN WATER	**PERCENT VOLATILE (BY WEIGHT)**	**SPECIFIC GRAVITY (WATER=1)**	**EVAPORATION RATE (BUTYL ACETATE=1)**
Negligible	55-60 (water)	1.1	<1 (water)

III – FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT	AUTO IGNITION TEMPERATURE	LOWER EXPLOSION LIMIT (%)	UPPER EXPLOSION LIMIT (%)
NA	427C/800F (est.)	NA	NA

EXTINGUISHING MEDIA

☐ FOAM ☐ "ALCOHOL" FOAM ☒ CO_2 ☒ DRY CHEMICAL ☒ WATER SPRAY ☐ OTHER

SPECIAL FIRE FIGHTING PROCEDURES

Wear MSHA/NIOSH-approved, pressure-demand, self-contained breathing apparatus or equivalent, and full protective gear.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Toxic combustion products include sulfur dioxide and sulfur trioxide, and oxides of nitrogen.

IV – HEALTH HAZARD INFORMATION

ROHM AND HAAS RECOMMENDED WORK PLACE EXPOSURE LIMITS

None established

EFFECTS OF OVEREXPOSURE

Eye Contact: Possibly irritating to eyes.

EMERGENCY AND FIRST AID PROCEDURES

Eye Contact: Flush eyes with large amounts of water for at least 15 minutes. Consult a physician if irritation persists.

V – REACTIVITY INFORMATION

STABILITY	CONDITIONS TO AVOID
[X] STABLE [ ] UNSTABLE	Temperatures over 220C/428F

HAZARDOUS DECOMPOSITION PRODUCTS
Styrene monomer, divinylbenzene, and oxides of nitrogen.

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
[ ] MAY OCCUR [X] WILL NOT OCCUR	None known

INCOMPATIBILITY (MATERIALS TO AVOID) [ ] WATER [X] OTHER
Avoid contact with concentrated nitric acid or any other strong oxidizing agents at all times.

VI – SPILL OR LEAK PROCEDURE INFORMATION

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Floor may be slippery; use care to avoid falling. Sweep up and transfer to containers for recovery or disposal.

WASTE DISPOSAL METHODS
Dispose of according to local, state, and federal regulations.

VII – SPECIAL PROTECTION INFORMATION

VENTILATION TYPE
Normal room ventilation.

RESPIRATORY PROTECTION
None required for normal operations

PROTECTIVE GLOVES	EYE PROTECTION
Impervious	Safety glasses (ANSI Z87.1 or equivalent)

OTHER PROTECTIVE EQUIPMENT
NA

VIII – STORAGE AND HANDLING INFORMATION

STORAGE TEMPERATURE	INDOOR	HEATED	REFRIGERATED	OUTDOOR
MAX 49C/120F MIN 0C/32F	YES	NO	NO	YES

Avoid repeated freeze-thaw cycles

FOOTNOTE TO SECTION I: NE= None established

IX – TOXICITY INFORMATION

No data

X – MISCELLANEOUS INFORMATION

CAUTION: DO NOT pack column with dry ion exchange resins. Dry beads expand when wetted; this expansion can cause a glass column to shatter.
CAUTION: Nitric acid and other strong oxidizing agents can cause explosive reactions when mixed with ion exchange resins. Proper design of equipment to prevent rapid buildup of pressure is necessary if use of an oxidizing agent such as nitric acid is contemplated. Before using strong oxidizing agents in contact with ion exchange beads, consult sources knowledgeable in handling these materials.
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NA = NOT APPLICABLE C = CEILING VALUE	KEY	DATE OF ISSUE	SUPERSEDES
	890664-1	10/04/85	NEW

HO, INDUST CHEM

ROHM AND HAAS COMPANY

CORPORATE PRODUCT INTEGRITY DEPARTMENT
INDEPENDENCE MALL WEST
PHILADELPHIA, PA 19105

EMERGENCY TELEPHONE
215-592-3000 (ROHM AND HAAS)
800-424-9300 (CHEMTREC)

HAZARD RATING
4-EXTREME
3-HIGH
2-MODERATE
1-SLIGHT
0-INSIGNIFICANT
**-SEE SECTION IV

FIRE 1 | REACT 0 | TOXICITY 0 | SPECIAL

MATERIAL SAFETY DATA SHEET

NOT OSHA HAZARDOUS

LIST 7

MATERIAL	CODE	KEY	DOT HAZARD CLASS
AMBERLITE® IRN-163 Resin	69243	906215-9	NON-REGULATED
	DATE ISSUED 08/14/85		

FORMULA	CHEMICAL NAME OR SYNONYMS
Not applicable	Styrene/DVB ion exchange resin (lithium form)

I - COMPOSITIONAL INFORMATION

	CAS REG. NO.	APPROX WT %	TWA/TLV R&H	OSHA	ACGIH
Styrene/divinylbenzene cation exchange resin	NONHAZ	45-50	NE	NE	NE
Water	NONHAZ	50-55	NE	NE	NE

II - PHYSICAL PROPERTY INFORMATION

APPEARANCE - ODOR - pH.			VISCOSITY
Tan beads; odorless; pH (aqueous slurry) 5-7			NA
MELTING OR FREEZING POINT	**BOILING POINT**	**VAPOR PRESSURE (mm Hg)**	**VAPOR DENSITY (AIR=1)**
0C/32F (water)	NA	17 (water) 20C/68F	0.62 (water)
SOLUBILITY IN WATER	**PERCENT VOLATILE (BY WEIGHT)**	**SPECIFIC GRAVITY (WATER=1)**	**EVAPORATION RATE (BUTYL ACETATE=1)**
Negligible	50-55 (water)	1.26	<1 (water)

III - FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT	AUTO IGNITION TEMPERATURE	LOWER EXPLOSION LIMIT (%)	UPPER EXPLOSION LIMIT (%)
NA	427C /800F	NA	NA

EXTINGUISHING MEDIA

☐ FOAM ☐ "ALCOHOL" FOAM ☒ CO_2 ☒ DRY CHEMICAL ☒ WATER SPRAY ☐ OTHER

SPECIAL FIRE FIGHTING PROCEDURES

Wear MSHA/NIOSH-approved, pressure-demand, self-contained breathing apparatus or equivalent.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Toxic combustion products include sulfur dioxide and sulfur trioxide.

IV - HEALTH HAZARD INFORMATION

ROHM AND HAAS RECOMMENDED WORK PLACE EXPOSURE LIMITS

None established

EFFECTS OF OVEREXPOSURE

Eye Contact: Possibly irritating to eyes.

EMERGENCY AND FIRST AID PROCEDURES

Eye Contact: Flush eyes with large amounts of water for at least 15 minutes. Consult a physician if irritation persists.

V – REACTIVITY INFORMATION

STABILITY	CONDITIONS TO AVOID
[X] STABLE [ ] UNSTABLE	Temperatures over 220C/428F

HAZARDOUS DECOMPOSITION PRODUCTS
Styrene monomer, divinylbenzene.

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
[ ] MAY OCCUR [X] WILL NOT OCCUR	

INCOMPATIBILITY (MATERIALS TO AVOID) [ ] WATER [X] OTHER
Avoid contact with concentrated nitric acid or other strong oxidizing agents at all times.

VI – SPILL OR LEAK PROCEDURE INFORMATION

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Floor may be slippery. Use care to avoid falls. Sweep up and transfer to containers for recovery or disposal.

WASTE DISPOSAL METHODS
This material can be disposed of as ordinary trash.

VII – SPECIAL PROTECTION INFORMATION

VENTILATION TYPE
Normal room ventilation.

RESPIRATORY PROTECTION
None required for normal operations.

PROTECTIVE GLOVES	EYE PROTECTION
Impervious	Safety glasses (ANSI Z87.1 or equivalent)

OTHER PROTECTIVE EQUIPMENT

VIII – STORAGE AND HANDLING INFORMATION

STORAGE TEMPERATURE	INDOOR	HEATED	REFRIGERATED	OUTDOOR
MAX. 49C/120F MIN. 0C/32F	YES			YES

Avoid repeated freeze-thaw cycles.

NOTE: The maximum operating temperature recommended for this product is 121C/250F.

Footnote to Section I: NE = None established

IX – TOXICITY INFORMATION

No data

X – MISCELLANEOUS INFORMATION

Caution: Do not pack column with dry ion exchange resins. Dry beads expand when wetted; this expansion can cause a glass column to shatter.
Caution: Nitric acid and other strong oxidizing agents can cause explosive-type reactions when mixed with ion exchange resins. Proper design of equipment to prevent rapid build-up of pressure is necessary if use of an oxidizing agent such as nitric acid is contemplated. Before using strong oxidizing agents in contact with ion exchange beads, consult sources knowledgeable in handling these materials.
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NA = NOT APPLICABLE C = CEILING VALUE	KEY	DATE OF ISSUE	SUPERSEDES
	906215-9	08/14/85	06/08/82

APPENDIX C

RLAIX Column Information

Rupture Loop Annex Ion exchange Vault Resin/Materials Summary

Process

Ion exchangers were designed to: (1) continuously purify coolant at 10 to 200 gpm and remove oxygen from coolant at 10 gpm operating in a recirculating mode. (2) During failed fuel experiments remove radioactive materials from the entire coolant stream (at 200 gpm) during intermittent six hour single pass operating periods. Fuel used was natural uranium with 2% or 4% PuO_2.

Ion exchangers included three units a mixed bed exchanger, a cation exchange and a deoxygenating exchanger. The ion exchanger will purify and deoxygenate water at a pH of 9-11. Ion exchange resins are in the LiOH form.

(Ref. HW-63863, "Design Criteria for PRTR Fuel Element Rupture Test Facility". HW-61236 Sup5, "PRTR Final Safeguards Analysis, Fuel Element Rupture Testing Analysis". BNWL-40, "PRTR Fuel Element Rupture Test Facility Capabilities and Project History". HWS-7928, "Proc. Spec. for Cleanup System Ion Exchangers, PRTR FERTF"

Materials

IX Column	Volume	Resin	
RLIX-1 Cation	27 ft^3	Amberlite XE-163 (Amberlite IRN-163) Sulfonated polystyrene/divinylbenzene copolymer	Non-Hazardous Non-Regulated Transportation
RLIX-2 Mixed Bed	27 ft^3	Amberlite XE-154 (Amberlite-R IRN-154) (Mixture of IRN-163 and Amberlite IRN-78) (IRN-78 is a quaternary ammonium hydroxide styrene/divinylbenzene copolymer)	Non-Hazardous Non-Regulated Transportation
RLIX-3 Deoxygenator	16 ft^3	Amberlite XE-154 Duolite S-10 3 to 5 Ratio Duolite S-10 is either a phenol/formaldehyde or epoxy condensate resin.)	May have not been used extensively in system.

Columns are depicted on H-3-14005 and H-3-14006

Filter assembly used during rupture loop decon conducted in 1966, (Ref H-3-15245 Shts 1&2, "Rupture Loop Decontamination Details."

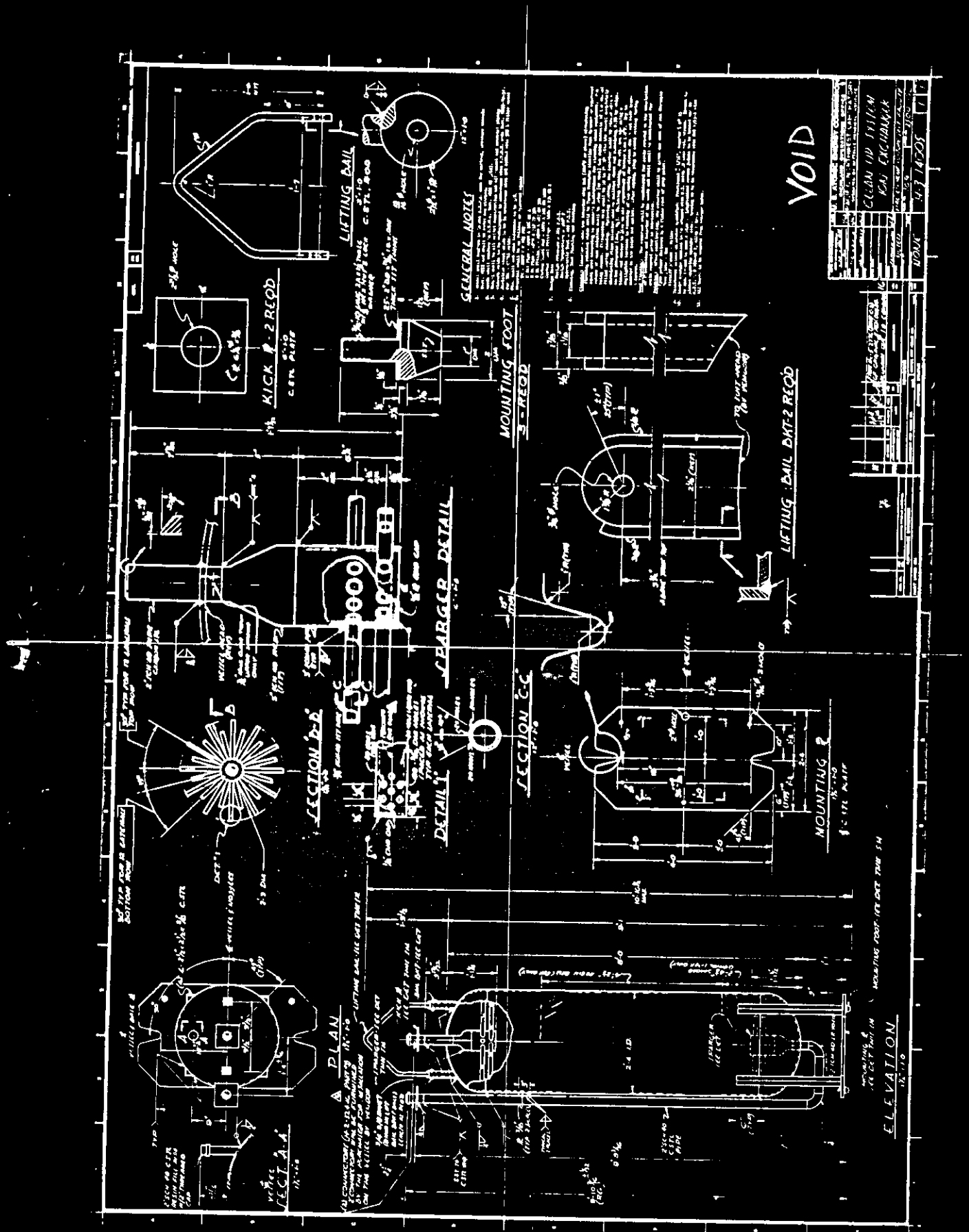
Analysis

Resins similar and function and operational use to those analyzed from other vault which were determined nonhazardous.

Columns have water which will need to be removed and remaining water absorbed in some manner.

MECHANICAL DATA REFERENCE INFORMATION

Item	Size	Est. Weight
Cation/Mixed Bed Ion Exchange Column	2'-4" I.D. 8'-0" Long 10'-10 1/2" Maximum Height ~33 ft^3 Total Volume	3,800 lbs
Resin Volume	4'-2 1/2" Long 28" Dia. (18. ft^3)	
Gravel	~28 1/2" Long 28" Dia (9.7 ft^3) (Last column incorporated upper and lower sparger for flow distribution.) 20 % resin void (est) 50 % gravel void (est)	
Pre 1964 Ion Exchange Column (Cation/Mixed Bed)	2'-4" I.D. 8'-0" Long 11' Maximum Height ~33 ft^3 Total Volume	3,500 lbs
Resin Chamber Volume	6'-6" Long 28" Dia. Resin volume 27 ft^3 (Ref HW-61236 sup 5 pg 19) (Early column design used upper and lower flow distribution grids. Design is distinguished from later design by shorter resin fill pipe.) 20 % resin void	
De-Oxygenator Ion Exchange Column	1'-9" I.D. 8'-0" Long 11' Max Height ~18 ft^3 Total Volume	1800 lbs
Resin Volume	6'-6" Long 21" Dia. ~16 ft^3 20 % resin void	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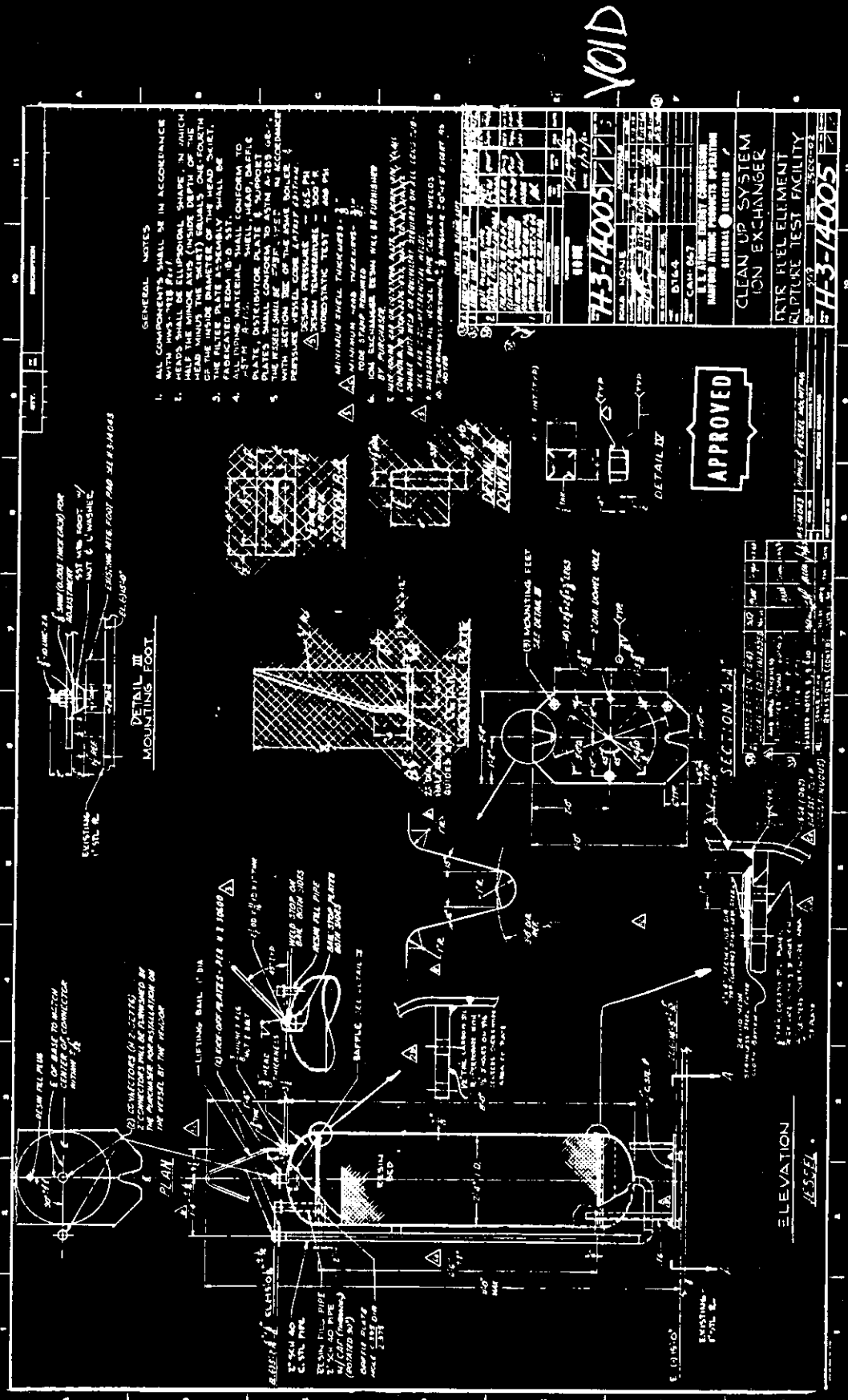
LIFTING RAIL
KICK PAD-2 REQD
GENERAL NOTES
MOUNTING FOOT 3-REQD
LIFTING RAIL DET-2 REQD
CLEAN UP SYSTEM
SECTION BB
SECTION CC
DETAIL A
MOUNTING
PLAN
ELEVATION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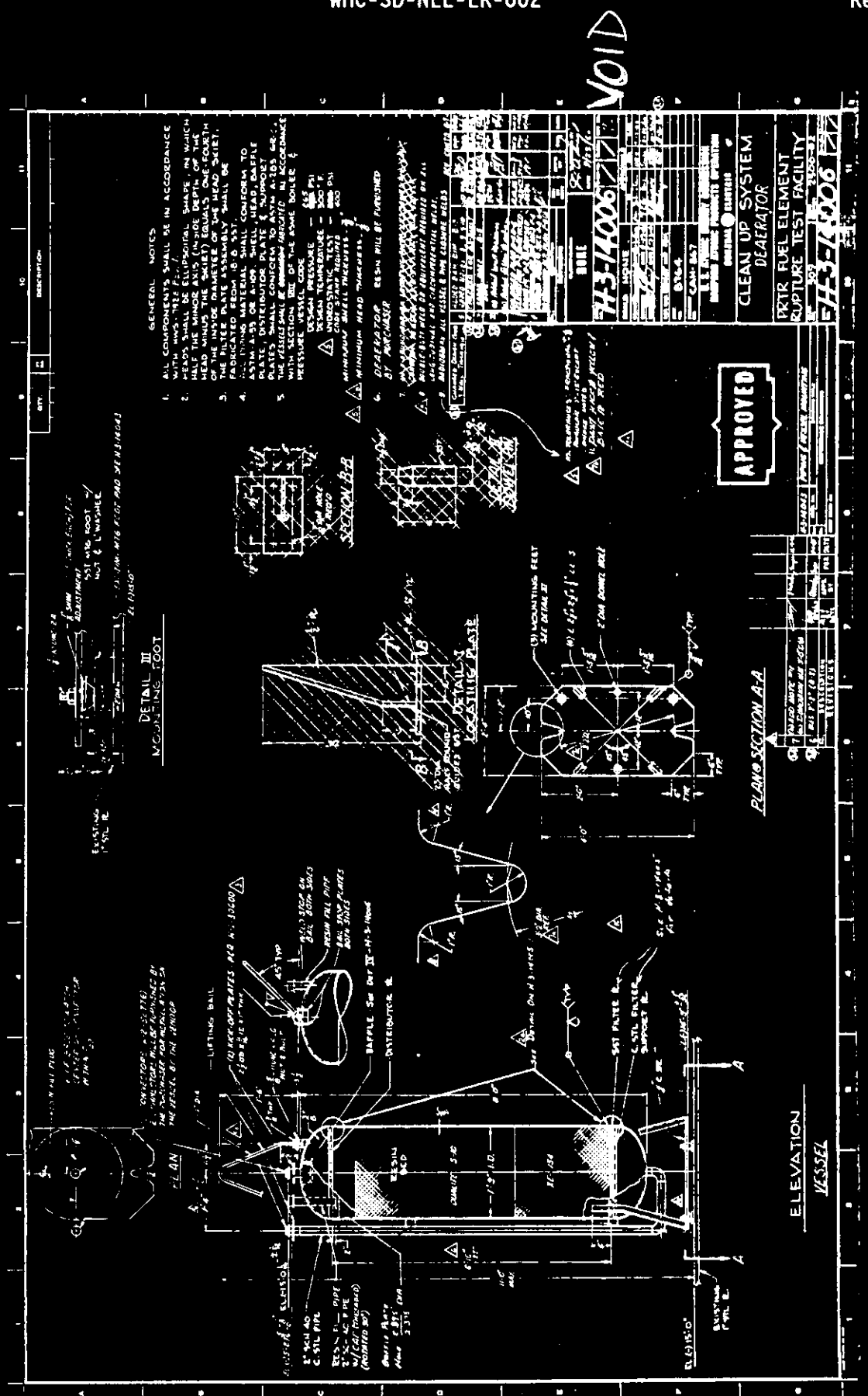
H3-74005
CLEAN UP SYSTEM ION EXCHANGER
FFTR FUEL ELEMENT RUPTURE TEST FACILITY
APPROVED
GENERAL NOTES
DETAIL III
MOUNTING FOOT
SECTION A-A
PLAN
ELEVATION


GENERAL NOTES
APPROVED
CLEAN UP SYSTEM
DEAERATOR
PRTR FUEL ELEMENT
RUPTURE TEST FACILITY
H3-74006
H3-74006
VOID
DETAIL II
MOUNTING FOOT
DETAIL I
LOCATING PLATE
SECTION B-B
PLAN SECTION A-A
ELEVATION
VESSEL

APPENDIX D

RLAIX Rad Survey Reports

Information Only

Westinghouse Hanford Company - Health Physics
RADIOLOGICAL SURVEY REPORT

Survey No. 194833

Date	Time	RWP No.	Page
8/30/95	0630	R-117	1 of 8

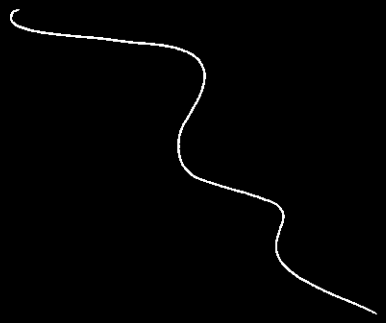
Area/Bldg./Room/Location (Code): 300/309/ Rupture Loop Vault — F.C.: R

Job Description: Covering Job Rupture Loop Annex Ion Exchange Vault Dose Assements on Ion Exchanger See attached Maps for More Detail Dose Measurements

Purpose of Survey (check appropriate box[es]):
Contamination Incident: ☐ Skin, ☐ Clothing, ☐ Spill
Alarm Response: ☐ CAM, ☐ ARM(RAM), ☐ PSD
☐ HRA/VHRA Work ☒ Job Coverage
☐ Exposure Incident ☐ Material Release
☐ RM Transfer/Shipment ☐ Required, Task No. _____

Map/Sketch

See attached Maps.



No.	Description	Dist.	DOSE RATE β (non-pen) mrad/h	DOSE RATE γ (pen) mR/h	DOSE RATE n mrem/h	CONTAMINATION LEVELS Direct (dpm/probe) β	Direct (dpm/probe) α	Smear (/100cm²) β (dpm)	Smear (/100cm²) α (dpm)	Smear (/100cm²) mrad/h
	L1 Colum	1cm	—	5 mr	—	—	—	<1,000	<20	—
	L2 Colum	1cm	—	35 mr	—	—	—	<1,000	<20	—
	L3 Colum	1cm	—	2.5 R	—	—	—	<1,000	<20	—
	L4 Colum	1cm	—	30 mR	—	—	—	<1,000	<20	—
	R1 Colum	1cm	—	15 mr	—	—	—	<1,000	<20	—
	R2 Colum	1cm	—	100 mr	—	—	—	<1,000	<20	—
	R3 Colum	1cm	—	1.9 R	—	—	—	<1,000	<20	—
	R4 Colum	1cm	—	35 mR	—	—	—	<1,000	<20	—
	R5 Colum	1cm	—	2 mr	—	—	—	<1,000	<20	—
	C3 Colum	1cm	—	450 mR	—	—	—	<1,000	<20	—

Continued on page 2

Air Sample Results (μCi/ml)

	BZ	GA	Initial	Decay
α 1		X	1.08E-11	3.72-14
β 1		X	2.27E-11	4.69-14
α 2				
β 2				

Legend
(1) - Smear Location ⚠ - Air Sample Location
[1] - Large Area Smear * - Contact Reading
Other _____

Information Only

Westinghouse Hanford Company - Health Physics RADIOLOGICAL SURVEY REPORT	F.C. R	Page 2 of 2	Survey No. 194833

No.	Description	Dist.	DOSE RATE β (non-pen) mrad/h	DOSE RATE γ (pen) mR/h	DOSE RATE n mrem/h	CONTAMINATION LEVELS Direct (dpm/probe) β	Direct (dpm/probe) α	Smear (/100cm²) β (dpm)	Smear (/100cm²) α (dpm)	Smear (/100cm²) mrad/h
	C3 Colum	1cm	—	35mr	—	—	—	<1,000	<20	—
	C4 Colum	1cm	—	350mr	—	—	—	<1,000	<20	—
	Floor Drain & Around	—	—	—	—	7,000	7,000	1,000	350	—
	All Cover Blocks	—	—	—	—	—	—	<1,000	<20	—
	CP Smears to R083095	—	—	—	—	—	—	<1,000	<20	—
	PAM "	—	—	—	—	—	—	<1,000	<20	—
	ULTRA Scope VP#131 "	—	—	—	—	—	—	<1,000	<20	—
	Buckett Smears to R083095	—	—	—	—	—	—	<1,000	<20	—
	Laundry " "	—	—	—	—	—	—	<1,000	<20	—

Comments

On The Floor, Walls, Ion Exchange Columns Found No Smearable Contamination. There are 12 Columns, also Pump Heads and what looks Like a Pressure Volumes cos, and a Plastic Bag With Something Wrapped Inside. No Water.

Samples Counted with portable instruments for ____ minutes.

Instr./Probe Model	RO-3B (CP)	E-140/ (GM/Probe)	Pam Sunrox	Mini Scaler α	Mini Scaler BX		
Serial No.	6462	E 1206/441	2275	5-226/RD-13	5216/83		
Efficiency	100%	10%	14%	.34	.27		
Correction Factor	1	10	7	2.94	3.7		

ADDITIONAL REPORTS

RPR No. ____ Sample Counter Log(s) Smears/083095

RSR No. ____ . . . Contamination - Skin ____ Procedure: WHC-IP-0718

. . . Contamination - Clothing ____ Other(s) ____

HPT:	First-Line HP Manager:
Payroll No.: G9695	Date: 9/6/95 Payroll No.: 69685
Name (Print): H T Miller	Name (Print): H T Miller
Signature:	Signature:

WHC RC DAILY AIR SAMPLE COUNTER LOG

Log No. (FC-MMDDYYYY-P): R-08301995 | Page 4 of 96

Counter:

	Instrument ID No./Model	Detector ID No.	E_C/CF	N_B (counts)/T_B (min.)	R_B (cpm)	Counter Location (i.e., Area/Facility/Room)
Alpha:	5946 / 1115-3	32098	.34/2.94	4 / 5	.3	300 / 309 / 210
Beta:	5216 / 1115-3	HP210-#83	.27/3.7	149 / 5	29.8	300 / 309 / 210

No.	Sampling Location and EDP Code or Sampler Model/ID No. GA or BZ (Circle One)	Filter Media (Circle one)	ON: Date/Time/Flow Rate* / OFF: Date/Time/Flow Rate*		T_S (Start Time)	T_G (min.)	MDC (μCi/ml)	N_G (counts)	R_N (cpm)	C (μCi/ml)	HPT: Signature and Payroll No.	Survey No.
1	(GA) Rupture Loop	HV-70	8-30-95 0735 2.0 cfm	α	1440	1	3.69-13	196	175.2	1.08-11	[illegible] 95904	198833
	BZ Vault	LB-5211 (AN-3000)	8-30-95 1130 2.0 cfm	β	1442	1	1.75-12	351	321.2	2.29-11	[illegible]	
2	GA	HV-70		α								
	BZ	LB-5211 AN-3000		β								
3	GA	HV-70		α								
	BZ	LB-5211 AN-3000		β								
4	GA	HV-70		α								
	BZ	LB-5211 AN-3000		β								
5	GA	HV-70		α								
	BZ	LB-5211 AN-3000		β								
6	GA	HV-70		α								
	BZ	LB-5211 AN-3000		β								
7	GA	HV-70		α								
	BZ	LB-5211 AN-3000		β								
8	GA	HV-70		α								
	BZ	LB-5211 AN-3000		β								

NOTE: For all filter media (i.e., Hollingsworth & Vose HV-70, LB-5211, or Gelman Versapor AN-3000), the fractional filter (collection) efficiency E_F = 91.0%/100 = 0.91.
*NOTE: Record the flow rate units (i.e., cfm, scfh, or lpm).

$$MDC = \frac{2.71 + \left(3.29\sqrt{R_B T_G\left(1+\frac{T_G}{T_B}\right)}\right)}{E_F E_C V_A k T_G}, \quad C = \frac{R_N}{E_F E_C V_A k}$$

Definitions: E_C = Counting efficiency (cpm/dpm); CF = Correction Factor ($1/E_C$); N_B = Number of background counts observed; T_B = Background counting time (min.); R_B = Background count rate (cpm, N_B/T_B); GA = General Area; BZ = Breathing Zone; T_S = Time sample counting started (24-hr clock); T_G = Gross (sample) counting time (min.); MDC = Minimum detectable concentration (μCi/ml); N_G = Number of gross (sample) counts observed; R_N = Net sample count rate (cpm, $N_G/T_G - R_B$); C = Concentration (μCi/ml); E_F = 0.91, Filter media collection efficiency; V_A = Volume of air sampled; k = 6.288E+10 if V_A is in ft³, or k = 2.22E+9 if V_A is in liters or k = 2.22E+12 if V_A is in m³.

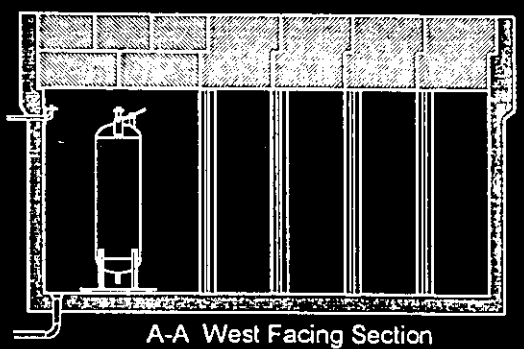
Log Validated By (Print Name and Sign): ____________ Date: ________

A-6000-274 (02/95)

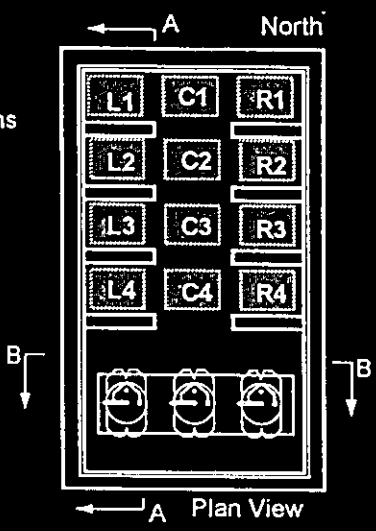
Information Only

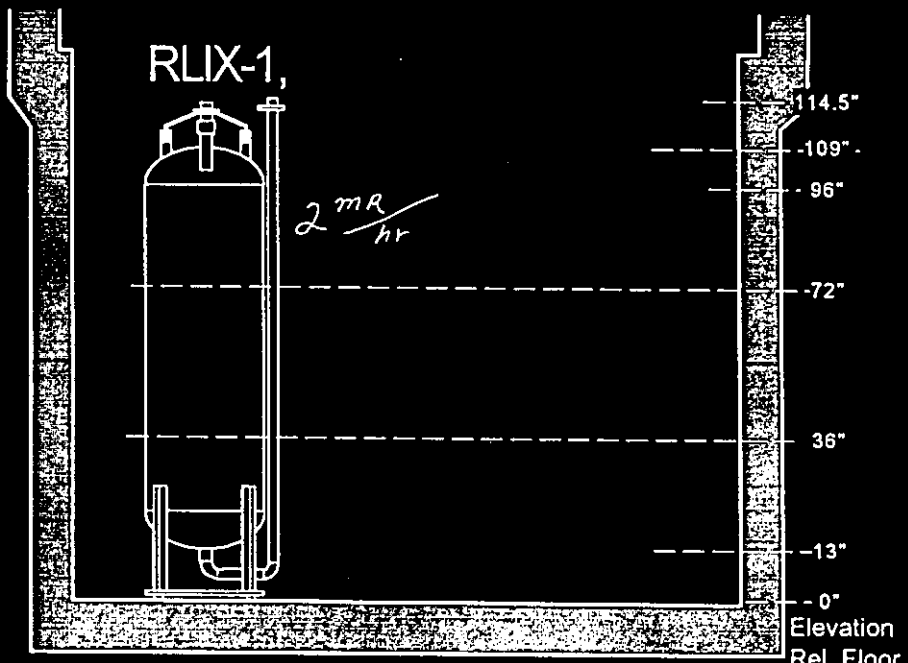
RLA-IXV Measurment Record

Place X in storage spaces with columns.
Record Water Level Measured on Column
Indicate relative radiation levels on Columns



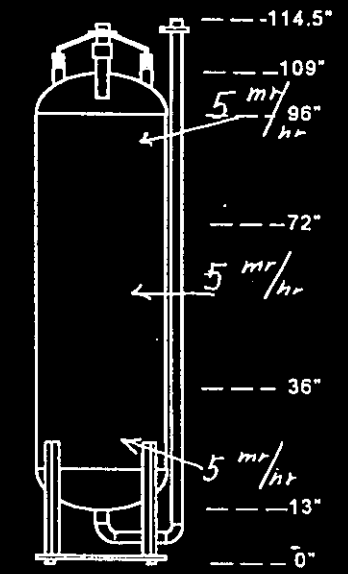
A-A West Facing Section



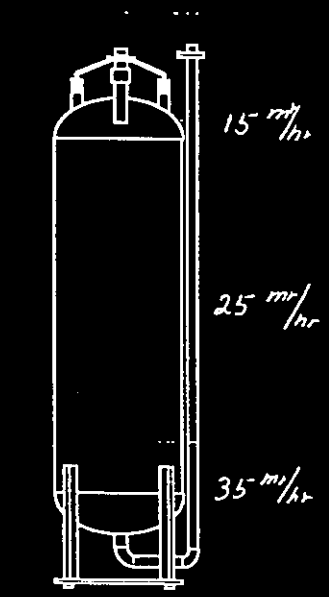


B-B South Facing Section

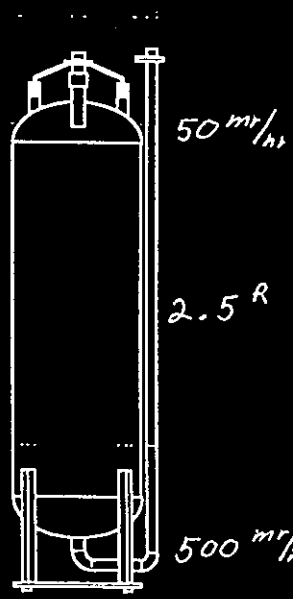
Information Only



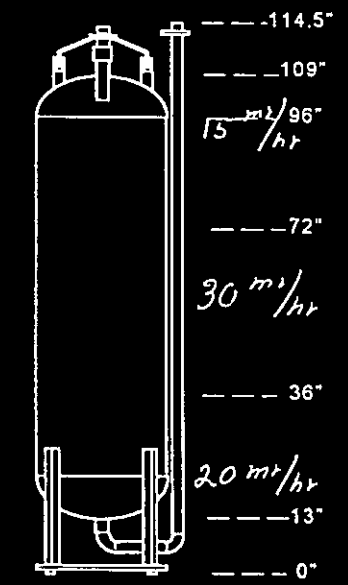
Location L 1



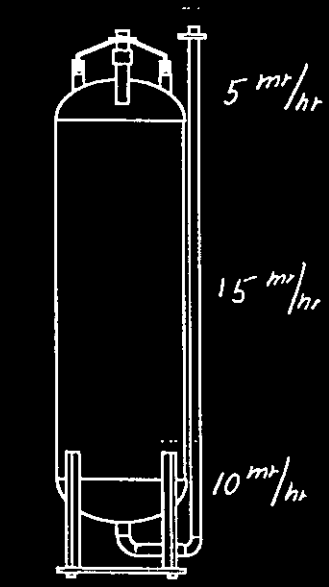
Location L-2



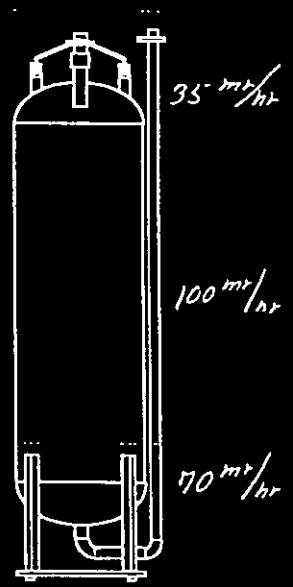
Location L-3



Location L-4

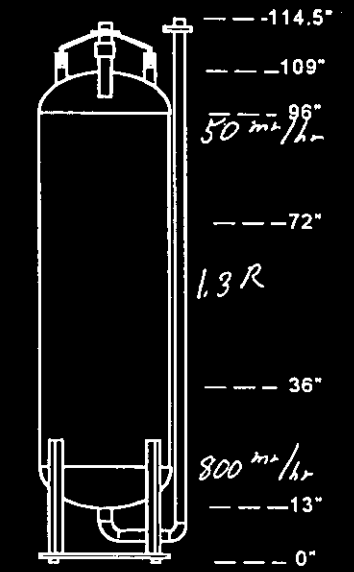


Location R-1

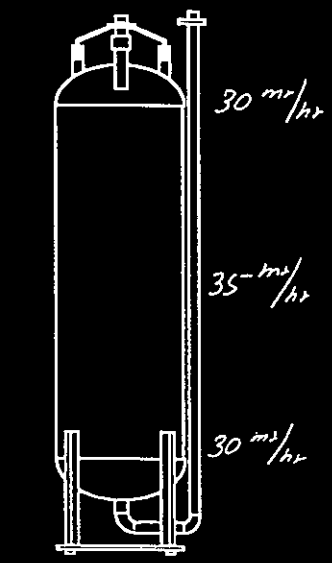


Location R-2

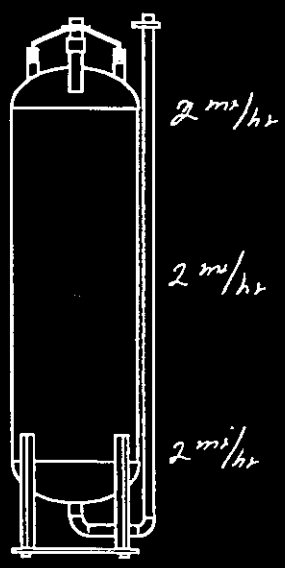
Information Only



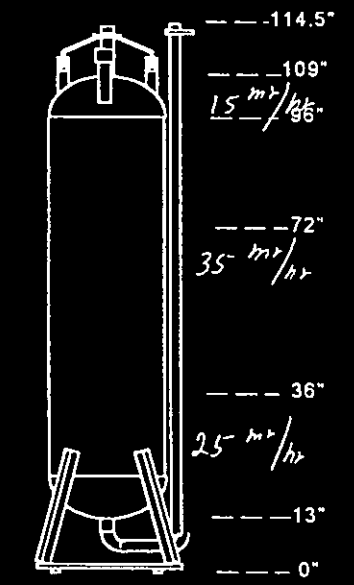
Location R-3



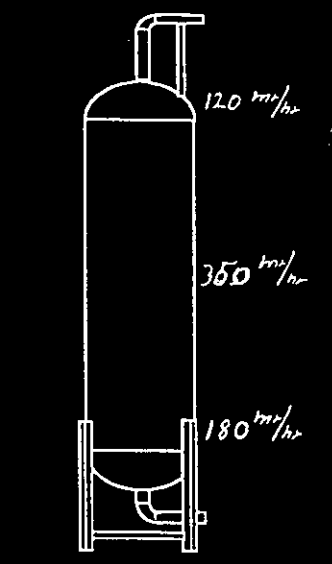
Location R-4



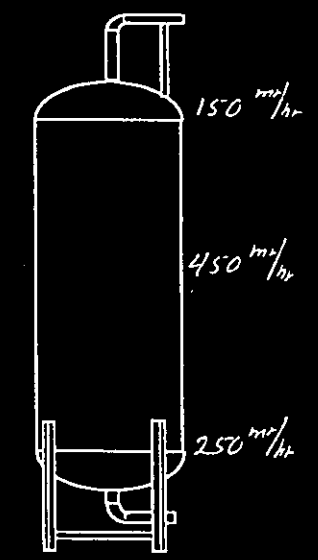
Location RLIX-1



Location C-2



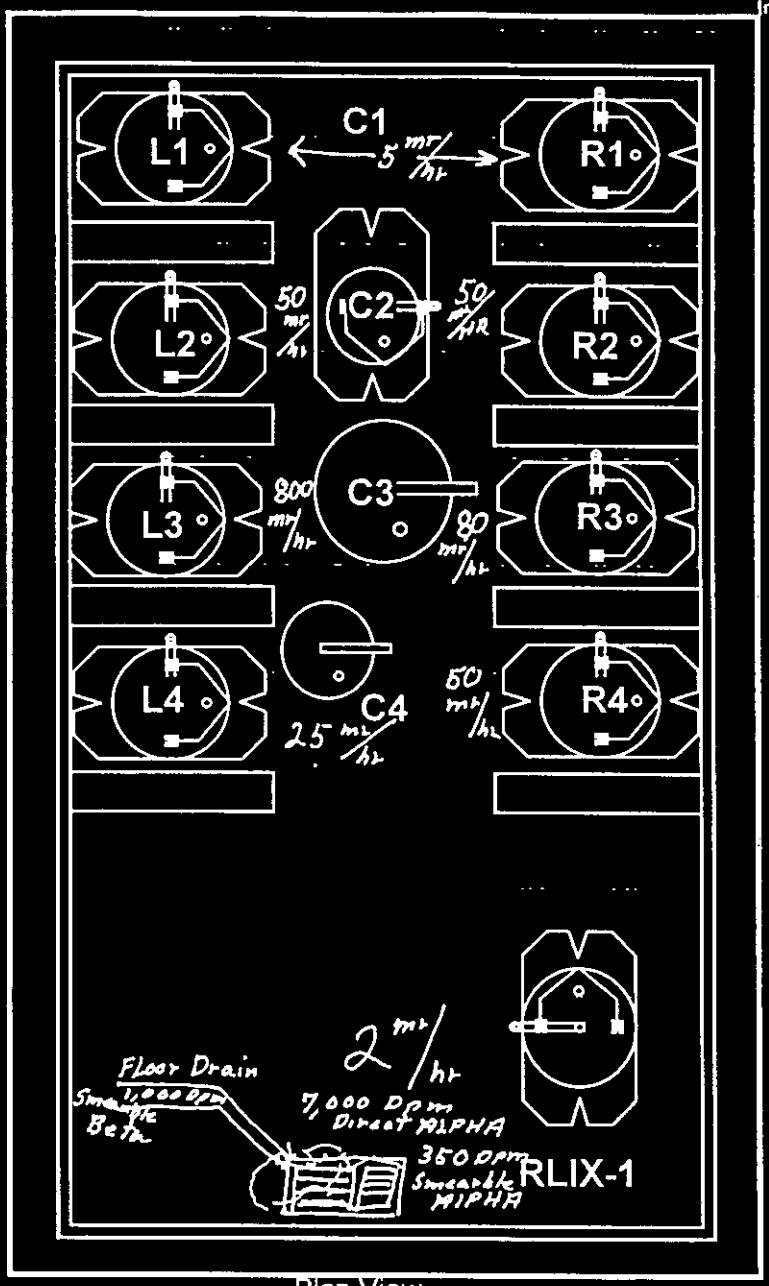
Location C-4



Location C-3

Survey # 194833 Page 8 of 8

Information Onl,



Plan View

Rupture Loop Annex Ion Exchange Vault

Information Only

Westinghouse Hanford Company - Health Physics
RADIOLOGICAL SURVEY REPORT

Survey No. 194843

Date	Time	RWP No.	Page
Sept. 7, 1995	0630 - 1500	R-116	1 of 2

Area/Bldg./Room/Location (Code): 300 / 309 / Rupture Loop Vault — F.C. R

Job Description: Coverage to perform Gamma & Neutron Counting on Column & filter.

Purpose of Survey (check appropriate box[es]):
Contamination Incident: ☐ Skin, ☐ Clothing, ☐ Spill
Alarm Response: ☐ CAM, ☐ ARM(RAM), ☐ PSD
☐ HRA/VHRA Work ☒ Job Coverage
☐ Exposure Incident ☐ Material Release
☐ RM Transfer/Shipment ☐ Required, Task No. ____

Map/Sketch

N/A

No.	Description	Dist.	DOSE RATE β (non-pen) mrad/h	DOSE RATE γ (pen) mR/h	DOSE RATE n mrem/h	CONTAMINATION LEVELS Direct (dpm/probe) β	Direct (dpm/probe) α	Smear (/100cm²) β (dpm)	Smear (/100cm²) α (dpm)	Smear (/100cm²) mrad/h
1	Dose Rate at Rails	field	—	<0.5	—	—	—	—	—	—
2	Tools & Equipment	C	—	—	—	<20	<1000	<20	<1000	—
3	Column C3	3"	—	2	—					
4	Column C4	3"	—	3	—					
5	Column C5	3"	—	2	—					
	N/A									

Continued on page 2

Air Sample Results (μCi/ml)

	BZ	GA	Initial	Decay
α 1			N/A	
β 1				
α 2				
β 2				

Legend
⓪ - Smear Location ⚠ - Air Sample Location
β - Large Area Smear * - Contact Reading
Other N/A

43

Information Only

Westinghouse Hanford Company - Health Physics
RADIOLOGICAL SURVEY REPORT

F.C. R | Page 2 of 2 | Survey No. 194843

No.	Description	Dist.	DOSE RATE β (non-pen) mrad/h	DOSE RATE γ (pen) mR/h	DOSE RATE γ mrem/h	CONTAMINATION LEVELS Direct (dpm/probe) β	Direct (dpm/probe) α	Smear (/100cm²) β (dpm)	Smear (/100cm²) α (dpm)	Smear (/100cm²) mrad/h
	N/A									

Comments

Columns C-3, C-4, and R-5 were recounted at South Rupture Loop Vault location using a telestar. Readings from survey # 194833 were background coming from R-3 and L-3. No contamination was found on coveralls, tool & equipment through-out job.

_____ Samples Counted with portable instruments for _____ minutes.

Instr./Probe Model	RO-38 (CP)	E-140/ (GM/Probe)	Ratson Surveyor X	N/A			Telestar
Serial No.	6845	0924/1553	2127				6395
Efficiency	100%	10%	14%				100%
Correction Factor	1	10	7				1

ADDITIONAL REPORTS

RPR No. N/A | Sample Counter Log(s) N/A

RSR No. N/A | . . . Contamination - Skin N/A | Procedure: WHC-IP-0718 Appendix I 2.1

. . . Contamination - Clothing N/A | Other(s) N/A

HPT:
Payroll No.: 95906
Name (Print): C R Meineke
Signature: C R Meineke

First-Line HP Manager:
Date: 9/11/92 | Payroll No.: 68685
Name (Print): H H Mellen
Signature: H H Mellen

WHC RC DAILY SWIPE COUNTER LOG

Log No. (F.C-MMDDYYYY-T): R-0330 1995 | Page 3 of 8

Counter:

	Instrument ID No./Model	Detector ID No.	F_C/CF	N_B (counts)/T_B (min.)	R_B (cpm)	T_G (min)	MDA (dpm)	Counter Location (i.e., Area/Facility/Room)
Alpha	5226	220913	.39/2.54	4/5	.8	1	5	300/1209/210
Beta	—	—	—	—	—	—	—	—

No	*Identify Swipe (Location, Serial No., etc.)	Ts (Start Time)		N_G (counts) α	N_G (counts) β	R_N (cpm) α	R_N (cpm) β	A (**dpm/100 cm²) α	A (**dpm/100 cm²) β	HPT: Signature and Payroll No.	Comments	Survey No.
1	ULTRAscope Sides Norlec HP 131	1st	12:20	0	—	0	—	0	—	H.T.Miller 69655	Released	194933
		2nd		—	—	—	—	—	—	R Smith		
2	" " Tip & Bottom	1st	1220	0	—	0	—	0	—	H.T.Miller 69655	Released	194833
		2nd		—	—	—	—	—	—	R Smith		
3	CP HP Instrument	1st	12:30	0	—	0	—	0	—	H.T.Miller 69655	Released	194833
		2nd		—	—	—	—	—	—	R Smith		
4	Bucket	1st	12:35	0	—	0	—	0	—	H.T.Miller 69655	Released	194833
		2nd		—	—	—	—	—	—	R Smith		
5	#9275 Screws	1st	12:35	0	—	0	—	0	—	H.T.Miller 69655	Released	194533
		2nd		—	—	—	—	—	—	R Smith		
6	Laundry	1st	12:40	0	—	0	—	0	—	H.T.Miller 69655	Released to RMA	194833
		2nd								R Smith		
7		1st										
		2nd										
8		1st										
		2nd										

*NOTE: For Swipes: Indicate approximate size of swipe, area, and location. For Nasal Swipes: Record the employee's name and payroll number, and which nostril was swiped.
**NOTE: Record the approximate smear area, when it is less than 100 cm².

$$MDA = \frac{2.71 + \left(3.29\sqrt{R_B T_G\left(1 + \frac{T_G}{T_B}\right)}\right)}{F_C T_G}, \quad A = R_N \times CF = \frac{R_N}{F_C}$$

Definitions: F_C = Counting efficiency (cpm/dpm); CF = Correction Factor ($1/F_C$); N_B = Number of background counts observed; T_B = Background counting time (min.); R_B = Background count rate (cpm, N_B/T_B); T_G = Gross (sample) counting time (min.); MDA = Minimum detectable activity (dpm); T_S = Time sample counting started (24-hr clock); N_G = Number of gross (sample) counts observed; R_N = Net sample count rate (cpm, $N_G/T_G - R_B$); A = Activity (dpm/100 cm², unless stated otherwise); dpm = disintegrations per minute; cpm = counts per minute.

Log Validated By (Print Name and Sign): ______________________ Date: __________

A-6000-723 (03/95)

Information Only

APPENDIX E

Non Destructive Analysis Results

Battelle
Pacific Northwest Laboratories
Battelle Boulevard
P.O. Box 999
Richland, Washington 99352
Telephone (509) 376-0405

November 10, 1995

E. J. Bitten
Westinghouse Hanford Company
P. O. Box 1970
Mail Stop L4-73
Richland, WA 99352

Dear Mr. Bitten:

RESULTS OF PNL ASSAY OF 309 BUILDING RUPTURE LOOP ION EXCHANGE COLUMNS

Enclosed are sets of data for work performed **August 30 - September 7, 1995**, using the PNL Box Assayer System on **12 ion exchange columns** at the **309 Building Rupture Loop Annex Ion Exchange Vault**.

The PNL Box Assayer System employs high-resolution (HPGe) gamma-ray spectrometry and passive neutron counting to characterize the contents of wood and metal waste containers. The enclosed sets of data were acquired in accordance with the specifications of PNL Technical Procedure SGS-001, "Burial Box Assay by High Resolution Gamma-Ray Spectrometry and/or Neutron Counting," Rev. 2 under administative control of the PNL Quality Assurance Project Plan MCS-032, Rev. 2.

Activity Measured via Gamma-Ray Spectrometry

Exhibits 1 and 2 summarize results of the box assay for gamma-ray analysis and passive neutron counting. The PNL verified-and-validated RAYGUN gamma-ray reduction code was used to identify and compute levels of activity from the spectral data. The data reduction code analyzes for typical long-lived fission and activation products and for selected transuranics (TRU) that typically appear in several Hanford radioactive waste streams. The predominant radionuclide observed in the ion exchange columns was the fission product ^{137}Cs. The only other radionuclide observed was trace levels of the activation product ^{60}Co. No gamma rays were observed that can be attributed to TRU isotopes, due to the high backgrounds that result from Compton scatter of the ^{137}Cs gamma ray.

The activity levels presented in Exhibit 1 are reported in units of *μCi/g* and *Ci*. The net weight used in computing activity levels is expressed in units of *kg* and is computed by subtracting the weight of an empty ion exchange column from the gross weight that is provided. A unique PNL run number is used to store and track each data set. The uncertainty associated with highlighted values is merely the counting error as determined by the RAYGUN code.

Gamma-Ray Spectrometer Efficiency Calibration

As part of daily operation for the PNL Box Assayer System, the gain of the spectrometer is set and an operability check is performed.

The efficiency calibration curves used by the gamma-ray analysis program RAYGUN were previously determined by counting several drum standards containing NIST-traceable quantities of ^{60}Co, ^{134}Cs, and ^{137}Cs homogenously fixed in a Dow resin of the same density as ion exchange media. The drum standards were counted using the same shielding configuration that was used for counting the ion exchange columns. The counting configuration is illustrated in Exhibit 3. A tungsten collimator was used whose slit width was controlled by a stepping motor. Lead bricks and plates were used for all other shielding.

Exhibit 4 provides the response curve from counting the standard drums at various collimator slit widths.

Alpha-Particle Activity Measured via Passive Neutron Counting

The results of the passive neutron analysis are summarized in Exhibit 2. The activity is reported in units of *nCi-α/g*. Because the entire ion exchange column is considered to be waste and will be disposed of in appropriate waste containers, the gross weight is used in computing TRU activity levels, expressed in units of *kg*.

Passive neutron counting was performed on the containers separately from counting with gamma-ray spectrometry. The neutron counter is a slab geometry in which 10 $^{10}BF_3$ tubes (5-cm diameter, 90 torr fill pressure) are embedded in slabs of high-density polyethylene moderator. The tubes each operate with a custom signal preamplifier module that allows operation in fields exceeding 4 R/hr without spurious counts due to gamma-ray pulse pileup, as verified using the ^{60}Co sources at the Hanford Calibration Facility (318 Building.)

Any alpha-particle activity in the ion exchange columns results in neutron emissions via (α,n) reactions, predominantly with oxygen and other light elements of the matrix, especially lithium and boron. Neutron emissions are also associated with spontaneous fission of various transuranic isotopes, especially ^{240}Pu. Process knowledge that was provided confirmed that the assumption of specific alpha-particle activity of weapons-grade PuO_2 is appropriate for TRU present in the ion exchange columns.

The specific α-particle activity used for weapons-grade PuO_2 is $8.5 \cdot 10^7$ nCi-α/g, determined from ORIGEN2 calculations[a] assuming 6.00% ^{240}Pu.

Neutron Counter Efficiency Calibration

Direct efficiency calibrations were performed previously on a 5'x5'x9' burial box containing several different ion exchange columns relative to the NIST-traceable

[a] DC Hedengren and HJ Goldberg, "ORIGEN2 Predictions of N Reactor Fuel Actinide Composition," SD-CP-TI-105, Rev. 1, 330 pages, (1987).

100-g weapons-grade $^{239}PuO_2$ standard, 19B14B. Calibration consists of a series of counts with the standard centered on the far side of the box, as specified in the PNL Technical Procedure SGS-001. A count is taken with the standard moved back in 1-ft increments. Five such counts are typically performed on each box that is calibrated. Exhibit 5 illustrates the results of this neutron calibration count.

A count taken in the vault away from columns containing measureable activity was performed to establish the ambient background. Because the shielding effects of the concrete walls of the vault, as well as the surrounding soil, the ambient background was a factor of 4 lower than above ground. The shielding helps remove some of the excess of ambient neutrons that are generated from cosmic rays that spall at higher elevations in the atmosphere. The net result of reducing the effects of this cosmogenic neutron background is an enhanced sensitivity for TRU with the neutron detector.

A set of counts on a given ion exchange column consisted of several 200-s counts taken with the bank of moderated neutron tubes suspended adjacent to the column being counted. The observed passive neutron data and the corresponding efficiency are used in the NANAL Neutron Analysis Code, version 2.00, to determine TRU levels. The resulting hardcopy output are enclosed with the computer printouts taken in the field, together with the output of the RAYGUN gamma-ray analyses of the corresponding ion exchange columns.

Please note that the uncertainty for TRU levels as presented in Exhibit 2 is a 1-σ value and that a greater degree of uncertainty attends lighter-weight columns. Please note also that the level of neutrons counted in some columns (i.e., C2, R3, L4, and C3 and C4, both of which turned out to be empty) was elevated due to the inability to entirely shield the detector from neutrons emanating from the column (L3) that definitely contained neutron emitters from entrained TRU. One empty container, C4, was subsequently moved to a more open position within the vault and recounted; the recount showed a neutron count consistent with the ambient neutron background, confirming that neutrons counted previously had emanated from a source other than C4. The fact that columns directly adjacent to L3, namely L2 and L4, did not yield a significantly elevated neutron count is probably due to the shielding effects of the concrete wall separating the columns; this observation also gives credence to the claim that L3 is the sole source of excess neutrons observed within the vault.

Quality Assurance: Accuracy and Precision via Field Calibration Source Check

The gamma-ray spectrometer was checked in the field before and after use of the instrumentation using a 25-g thoria standard: #54124-73-1. Three peaks (238.63-, 911.07-, and 2614.47-keV) were examined for position and area as part of an operability check and as a control check of the energy and efficiency calibrations. The positions and areas are determined using commercial ADCAM software and compared to previous control values.

For data summarized in this report for this batch of containers, no accuracy or precision noncompliance issues exist.

Recommendations and Conclusions

The data show that each IX column in this analysis is below the TRU limit of 100 nCi-α/g. Gamma-rays that are associated with TRU activity were also not detected at levels that can be measured directly using the high-resolution gamma-ray spectrometer because of the high background caused by Compton scatter of the ^{137}Cs gamma ray. The only fission product measured in the columns was ^{137}Cs. Traces of the activation product ^{60}Co were also measured. A filter and some pipes in the North corner showed no evidence of TRU when examined with the neutron counter.

The gamma-ray spectrometer was placed inside a steel basket that was lowered by crane into the vault. Because of the confining nature of the vault, size limitations determined the placement of lead shielding around the detector. No space was available behind the liquid-nitrogen dewar for shielding, which was unfortunate when counting L3 and R3 since the majority of radiation entering the detector when counting these two columns was probably entering the detector from the backside, through the dewar and cryostat, making direct quantitation of radionuclides difficult. Dose-to-curie conversion based on other columns and knowing that ^{137}Cs was the only dose contribution allowed a bracket to be placed on radiation levels.

Columns that probably do not contain TRU (i.e., C2, L4, and R3) may be recounted using the neutron detector. Such a count should be performed either by moving L3 to some distance from the others or by moving each of the columns in question to the neutron detector, which would be positioned at some distance from L3.

Hard copies of the data are enclosed for you to maintain as record copies while floppy diskettes containing the archived spectral data are kept on file for backup purposes at PNL. Any questions may be directed to me at Mail Stop P8-08, by cc:Mail, by FAX at 376-2329, or by phone at 376-0405.

Sincerely,

Richard J. Arthur
Sr. Research Scientist

Enclosures & Attachments

cc w/attachments:
BC Cornwell, L4-73
DE Robertson, P8-01
MD Winterrose, P8-01
File /LB

Excel 4.0 File: 950831L1.XLS Date: 10/30/95 1:46 PM

E. J. Bitten
Page 5 / November 10, 1995

Exhibit 1

Column: L-1 (Type: "Design 2")

Gross Wt:	3352 lb	1520.5 kg
Net Wt:	1684 lb	763.9 kg
Length:	96 inch	(external)
	78 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95083102	5.26E-05	8.6	3.65E-06	31.2
95083103	1.53E-04	5.1		
95083105	6.32E-04	2.6	1.59E-05	11.1
95083106	1.33E-03	1.9	1.17E-05	18.9
95083107	1.68E-03	1.8	1.47E-05	26.6
95083108	1.06E-03	2.1	9.04E-06	14.7
95083109	5.26E-04	2.8		
95083110	1.95E-04	4.5		

	5.63E-03 uCi/g	5.50E-05 uCi/g
	0.004302 Ci	4.2E-05 Ci
Ratio =	99.0% Cs-137	
	1.0% Co-60	

Excel 4.0 File: 950831R1.XLS Date: 10/30/95 1:46 PM

E. J. Bitten
Page 6 / November 10, 1995

Exhibit 1

Column: R-1 (Type: "Design 2")

Gross Wt:	3352 lb	1520.5 kg
Net Wt:	1684 lb	763.9 kg
Length:	96 inch	(external)
	78 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95083117	9.79E-05	6.7	8.55E-06	21.9
95083118	1.57E-04	5.3	9.59E-06	20.9
95083119	2.88E-03	1.6	1.56E-05	11.5
95083120	4.20E-03	1.6	2.19E-05	18.2
95083121	4.10E-03	1.6	2.46E-05	12.3
95083122	1.33E-03	2.4	1.79E-05	18.6
95083123	4.44E-04	3.2	9.11E-06	21.1

	1.32E-02 uCi/g	1.07E-04 uCi/g
	0.010094 Ci	8.19E-05 Ci

Ratio = 99.2% Cs-137
0.8% Co-60

Excel 4.0 File: 950901L2.XLS Date: 10/30/95 1:46 PM

E. J. Bitten
Page 7 / November 10, 1995

Exhibit 1

Column: L-2 (Type: "Design 2")

Gross Wt:	3352 lb	1520.5 kg
Net Wt:	1684 lb	763.9 kg
Length:	96 inch	(external)
	78 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95090109	7.49E-05	10.3	2.14E-05	17.6
95090110	3.33E-04	4.7	1.76E-05	14.6
95090111	4.96E-03	1.8		
95090113	9.17E-02	1.3		
95090114	8.12E-02	1.3	1.87E-04	12.9

1.78E-01 uCi/g 2.26E-04 uCi/g

0.13613 Ci 0.000173 Ci

Ratio = 99.9% Cs-137
0.1% Co-60

Excel 4.0 File: 950831C2.XLS Date: 11/10/95 3:45 PM

E. J. Bitten
Page 8 / November 10, 1995

Exhibit 1

Column: C-2 (IX-2 Type)

Gross Wt:	1800 lb	816.5 kg
Net Wt:	720 lb	326.6 kg
Length:	77 inch	(external)
	66 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95083111	1.30E-04	5.8	7.46E-06	22.0
95083112	2.01E-03	4.0	3.70E-05	29.9
95083113	2.76E-03	3.3	7.21E-05	18.6
95083114	2.70E-03	3.4	6.04E-05	21.6
95083115	1.75E-03	4.3	4.07E-05	20.3
95083116	9.21E-04	5.9	5.62E-05	16.3

	1.03E-02 uCi/g	2.74E-04 uCi/g
	0.003354 Ci	8.94E-05 Ci
Ratio =	97.4% Cs-137	
	2.6% Co-60	

Excel 4.0 File: 950901R2.XLS Date: 10/30/95 1:43 PM

E. J. Bitten
Page 9 / November 10, 1995

Exhibit 1

Column: R-2 (Type: "Design 2")

Gross Wt:	3352 lb	1520.5 kg
Net Wt:	1684 lb	763.9 kg
Length:	96 inch	(external)
	78 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95090103	4.56E-05	12.6	1.10E-05	16.0
95090104	3.85E-05	16.8	1.27E-05	24.2
95090105	3.62E-03	4.0		
95090106	1.23E-02	2.5		
95090107	2.53E-01	1.7		
95090108	3.42E-01	1.5	9.60E-04	11.8

	6.11E-01 uCi/g	9.84E-04 uCi/g
	0.466546 Ci	0.000752 Ci

Ratio = 99.8% Cs-137
0.2% Co-60

Excel 4.0 File: 9509_6L3.XLS Date: 11/10/95 4:14 PM

E. J. Bitten
Page 10 / November 10, 1995

Exhibit 1

Column: L-3 (Type: "Design 2")

Gross Wt:	3352 lb	1520.5 kg
Net Wt:	1684 lb	763.9 kg
Length:	96 inch	(external)
	78 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95090602	4.74E-04	3.6	1.79E-05	17
95090603	9.23E-04	3.6	3.74E-05	15.8
95090604	1.03E-02	2.2	1.19E-04	11.3
95090605	2.05E-02	1.8		
95090606	3.27E-01	1.4		
95090607	8.03E-01	1.2		
95090608	8.14E-01	1.2		
95090609	8.39E-01	1.2		
95090610	3.47E+00	1.1		
95090611	5.91E+00	1.1		
95090612	5.52E+01	1.1		

	6.74E+01 uCi/g	1.74E-04 uCi/g
	< 2.1 Ci	0.000133 Ci

Ratio = 100.0% Cs-137
0.0% Co-60

Excel 4.0 File: 950907C3.XLS Date: 10/30/95 1:40 PM

E. J. Bitten
Page 11 / November 10, 1995

Exhibit 1

Column: C-3 (IX-1 Type: Empty; 304 Stainless Steel)

Gross Wt:	520 lb	235.9 kg
Net Wt:	1 lb	0.5 kg
Length:	77 inch	(external)
	59 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)		Co-60 (μCi/g)	
95090714				
95090715	2.99E-06	100	5.60E-06	100
95090716			3.31E-06	37
95090711			2.52E-05	12.6
95090717				

	2.99E-06 uCi/g	3.41E-05 uCi/g
	1.36E-09 Ci	1.55E-08 Ci

Ratio = 8.1% Cs-137
91.9% Co-60

Excel 4.0 File: 9509_6R3.XLS Date: 11/10/95 4:14 PM

E. J. Bitten
Page 12 / November 10, 1995

Exhibit 1

Column: R-3 (Type: "Design 2")

Gross Wt:	3352 lb	1520.5 kg
Net Wt:	1684 lb	763.9 kg
Length:	96 inch	(external)
	78 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95090613	7.73E-04	4.4	1.85E-05	22.6
95090614	4.57E-03	4		
95090615	2.20E-02	1.9		
95090616	8.97E-01	1.3	3.83E-04	26.7
95090617	2.68E+00	1.2		
95090618	9.06E+00	1.1		
95090619	1.08E+02	1.2		
95090620	1.42E+01	1.1		
95090621	6.73E+00	1.1		
95090622	8.76E+00	1	1.65E-03	25.4

	1.51E+02 uCi/g	2.05E-03 uCi/g
	< 1.1 Ci	0.001567 Ci

Ratio = 100.0% Cs-137
0.0% Co-60

Excel 4.0 File: 950906R4.XLS Date: 10/30/95 1:41 PM

E. J. Bitten
Page 13 / November 10, 1995

Exhibit 1

Column: R-4 (Type: "Design 2")

Gross Wt:	3352 lb	1520.5 kg
Net Wt:	1684 lb	763.9 kg
Length:	96 inch	(external)
	78 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95090624	1.49E-05	22.5	7.65E-06	14.3
95090625	1.61E-05	21.3	7.23E-06	15.7
95090626	1.50E-05	23.8	1.22E-05	11.6
95090627	4.78E-05	20.1	2.29E-05	22.6
95090628	5.32E-04	10.7	5.27E-05	23.7
95090629	1.97E-03	5.6	8.01E-05	19.3
95090630	1.75E-03	5.9		
95090631	1.29E-02	7.2		
95090632	2.07E-02	4.7		
95090633	1.13E-02	6.6	5.14E-04	11.8

	4.93E-02 uCi/g	6.96E-04 uCi/g
	0.037635 Ci	0.000532 Ci

Ratio = 98.6% Cs-137
1.4% Co-60

Excel 4.0 File: 950906C4.XLS Date: 10/30/95 1:43 PM

E. J. Bitten
Page 14 / November 10, 1995

Exhibit 1

Column: C-4 (IX-2 Type: Empty; Aluminum Exterior)

Gross Wt:	180 lb	81.6 kg	
Net Wt:	1 lb	0.5 kg	
Length:	77 inch	(external)	
	59 inch	(internal, resin)	

PNL Run No. (top to bottom)	Cs-137 (μCi/g)		Co-60 (μCi/g)	
95090634	4.29E-05	57.6	1.59E-05	100
95090635	5.15E-04	15		
95090636	6.10E-04	13.1		
95090637				
95090638	1.42E-04	43.5		
95090639	5.91E-05	42.5	1.15E-04	11

1.37E-03 uCi/g 1.31E-04 uCi/g

6.21E-07 Ci 5.95E-08 Ci

Ratio = 91.3% Cs-137
8.7% Co-60

Excel 4.0 File: 950907C4.XLS Date: 10/30/95 1:45 PM

E. J. Bitten
Page 15 / November 10, 1995

Exhibit 1

Column: C-4 (IX-2 Type: Empty; Aluminum Exterior)

Gross Wt:	180 lb	81.6 kg	
Net Wt:	1 lb	0.5 kg	
Length:	77 inch	(external)	
	59 inch	(internal, resin)	

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95090714				
95090715	2.99E-06	100	5.60E-06	100
95090716			3.31E-06	37
95090711			2.52E-05	12.6
95090717				

	2.99E-06 uCi/g	3.41E-05 uCi/g
	1.36E-09 Ci	1.55E-08 Ci
Ratio =	8.1% Cs-137	
	91.9% Co-60	

Excel 4.0 File: 950830L4.XLS Date: 10/30/95 1:46 PM

E. J. Bitten
Page 16 / November 10, 1995

Exhibit 1

Column: L-4 (Type: "Design 2")

Gross Wt:	3352 lb	1520.5 kg
Net Wt:	1684 lb	763.9 kg
Length:	96 inch	(external)
	78 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95083001	6.21E-04	2.7	1.66E-05	11.1
95083002	6.29E-04	2.7	1.73E-05	20.6
95083003	5.04E-04	3	4.97E-06	23
95083004	4.20E-03	1.4	1.25E-05	12.8
95083005	7.09E-03	1.5	3.83E-05	11.3
95083006	9.81E-04	2.2	3.07E-05	7.9
95083007	4.91E-05	11.4	4.14E-05	6.9
95083008	5.31E-05	8.9		

	1.41E-02 uCi/g	1.62E-04 uCi/g
	0.010786 Ci	0.000124 Ci
Ratio =	98.9% Cs-137	
	1.1% Co-60	

Excel 4.0 File: 950907RL.XLS Date: 10/30/95 1:38 PM

E. J. Bitten
Page 17 / November 10, 1995

Exhibit 1

Column: RLIX-1

Gross Wt:	3352 lb	1520.5 kg
Net Wt:	1684 lb	763.9 kg
Length:	96 inch	(external)
	78 inch	(internal, resin)

PNL Run No. (top to bottom)	Cs-137 (μCi/g)	Unc.	Co-60 (μCi/g)	Unc.
95090706			1.20E-05	23.6
95090707			1.66E-05	13.8
95090708			1.46E-05	13.4
95090709			1.56E-05	17.6
95090710				
95090712			1.62E-05	25
95090713			2.59E-05	13.7

0.00E+00 uCi/g 1.01E-04 uCi/g

0 Ci 7.7E-05 Ci

Ratio = 0.0% Cs-137
100.0% Co-60

E. J. Bitten
Page 18
November 10, 1995

Exhibit 2

ıte: 11/10/95 Excel 4.0 File: 9508IXTU.XLS

esults of Passive Neutron Count: PNL Box Assayer Data

ID:	L1	R1	L2	C2	R2
PNL Run No.:	95083102	95083103	95090108	95083104	95090107
ross Wt. (kg):	1520.7	1520.7	1520.7	816.5	1520.7
	Activity Level*	Activity Level	Activity Level	Activity Level	Activity Level
TRU (nCi/g)	0.0	0.0	0.0	107.3	0.0
± 1 σ	± 5.6	± 6.0	± 5.4	± 8.8	± 4.5
pper Limit *1.645σ or 95% C.I.)*	< 9.2	< 9.8	< 8.8	< 120	< 7.5
TRU (g)	0.0	0.0	0.0	1.03	0.0
± 1 σ	± 0.1	± 0.1	± 0.1	± 0.16	± 0.1

* Transuranic (TRU) "Activity Level" is based upon the assumption of weapons-grade plutonium oxide that is intimately in contact with ion exchange resin composed of 53% oxygen, 22.5% lithium or boron, 20% sodium, and 6% silicon; weapons-grade Pu oxide is a conservative estimate since it yields the lowest neutron emission rate of any TRU material that can reasonably be expected in Hanford waste.

E. J. Bitten
Page 19
November 10, 1995

Exhibit 2

ˌte: 11/10/95 Excel 4.0 File: 9508IXTU.XLS

ˈesults of Passive Neutron Count; PNL Box Assayer Data

ID:	L3	C3	R3	L4
PNL Run No.:	95090104	95090106	95090105	95083105
ross Wt.(kg):	1520.7	235.9	1520.7	1520.7
	Activity Level*	Activity Leve t	Activity Level	Activity Level
TRU (nCi/g)	80.7	256.0	8.1	22.8
± 1 σ	± 11.8	± 7.3	± 4.5	± 5.9
pper Limit (1.645σ or 95% C.I.)	< 100	< 270	< 15	< 33
TRU (g)	1.44	0.71	0.14	0.41
± 1 σ	± 0.22	± 0.13	± 0.08	± 0.11

* Transuranic (TRU) "Activity Level" is based upon the assumption of weapons-grade plutonium oxide that is intimately in contact with ion exchange resin composed of 53% oxygen, 22.5% lithium or boron, 20% sodium, and 6% silicon; weapons-grade Pu oxide is a conservative estimate since it yields the lowest neutron emission rate of any TRU material that can reasonably be expected in Hanford waste.

E. J. Bitten
Page 20
November 10, 1995

Exhibit 2

te: 11/10/95 - Excel 4.0 File: 9508IXTU.XLS

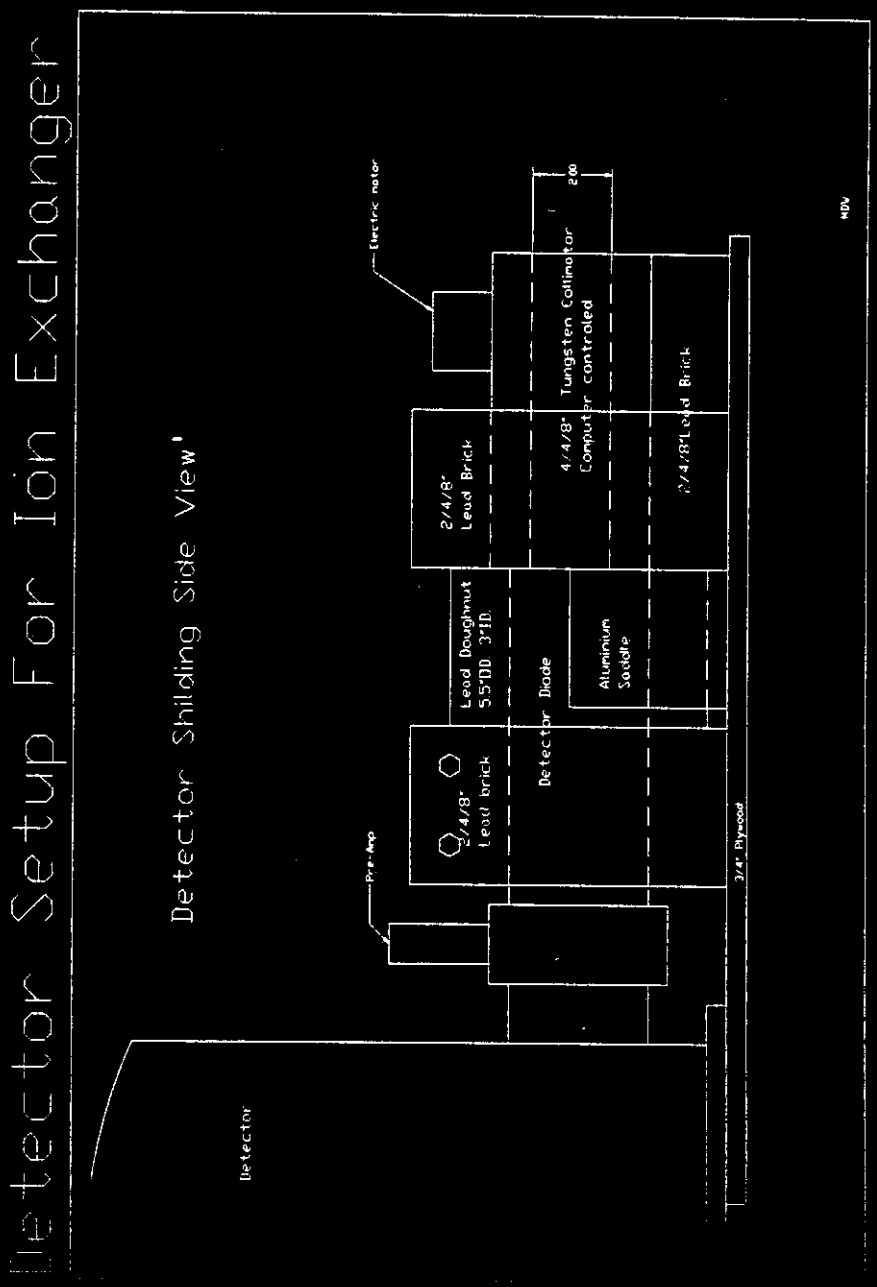
'esults of Passive Neutron Count: PNL Box Assayer Data

		Recount			
ID:	C4	C4	R4	RLIX-1	Filter & Pipes
PNL Run No.:	95090103	95090704	95090102	95090702	95090703
ross Wt.(kg):	81.6	81.6	1520.7	1520.7	0.0
	Activity Level*	Activity Level	Activity Level	Activity Level	Activity Level
TRU (nCi/g)	789.9	0.0	0.0	0.0	
± 1 σ	± 7.0	± 5.0	± 5.3	± 5.2	
pper Limit 1.645σ or 95% C.I.)	< 800	< 8.3	< 8.6	< 8.5	
TRU (g)	0.75	0.0	0.0	0.0	0.0
± 1 σ	± 0.13	± 0.1	± 0.1	± 0.1	± 0.1

* Transuranic (TRU) "Activity Level" is based upon the assumption of weapons-grade plutonium oxide that is intimately in contact with ion exchange resin composed of 53% oxygen, 22.5% lithium or boron, 20% sodium, and 6% silicon; weapons-grade Pu oxide is a conservative estimate since it yields the lowest neutron emission rate of any TRU material that can reasonably be expected in Hanford waste.

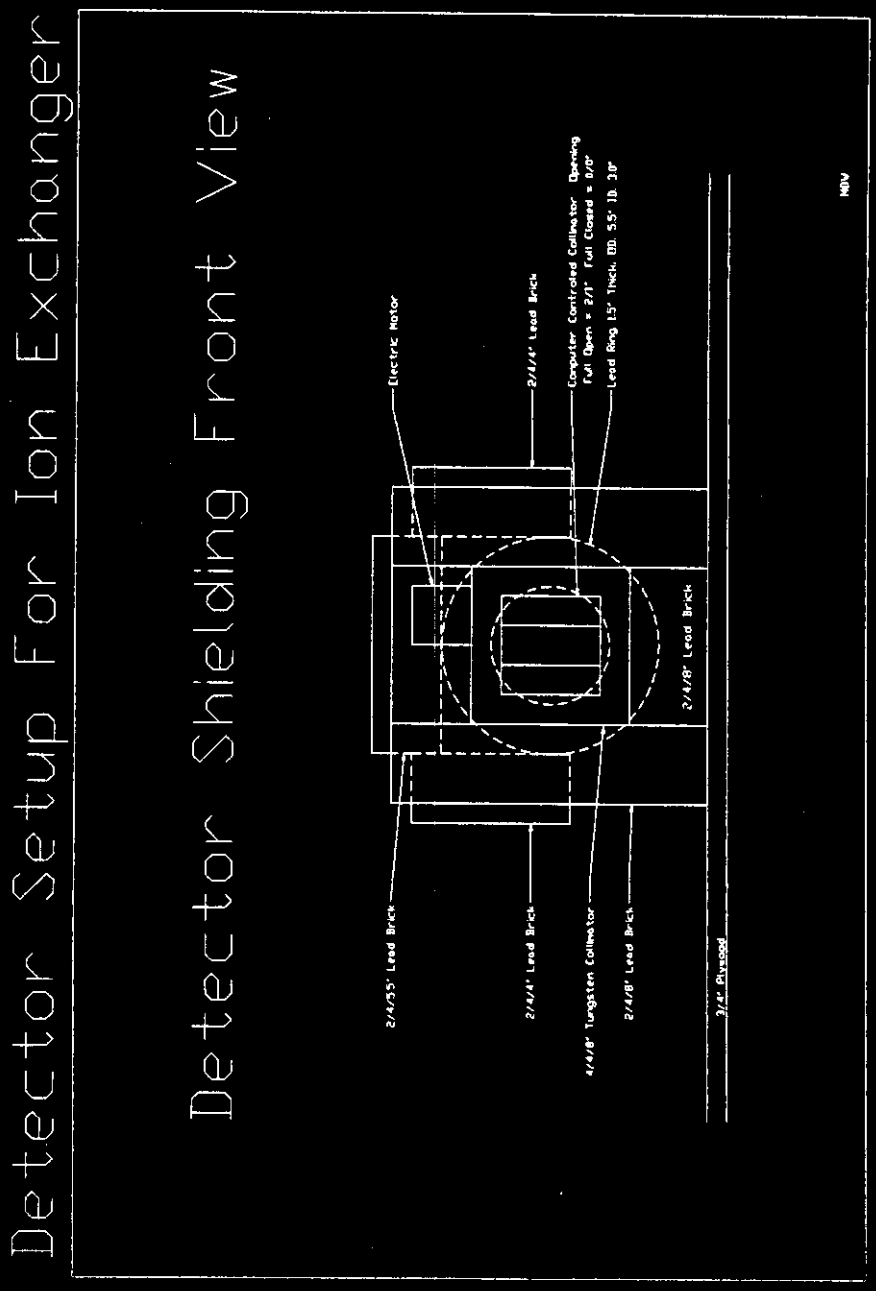
E. J. Bitten
Page 21
November 10, 1995

Exhibit 3



E. J. Bitten
Page 22
November 10, 1995

Exhibit 3



Excel 4.0 File: WSLITS3.XLC

E. J. Bitten
Page 23
November 10, 1995

Exhibit 4

Gamma-Ray Efficiency Curves for 309 Bldg. IX Columns at Various Collimator Slit Widths

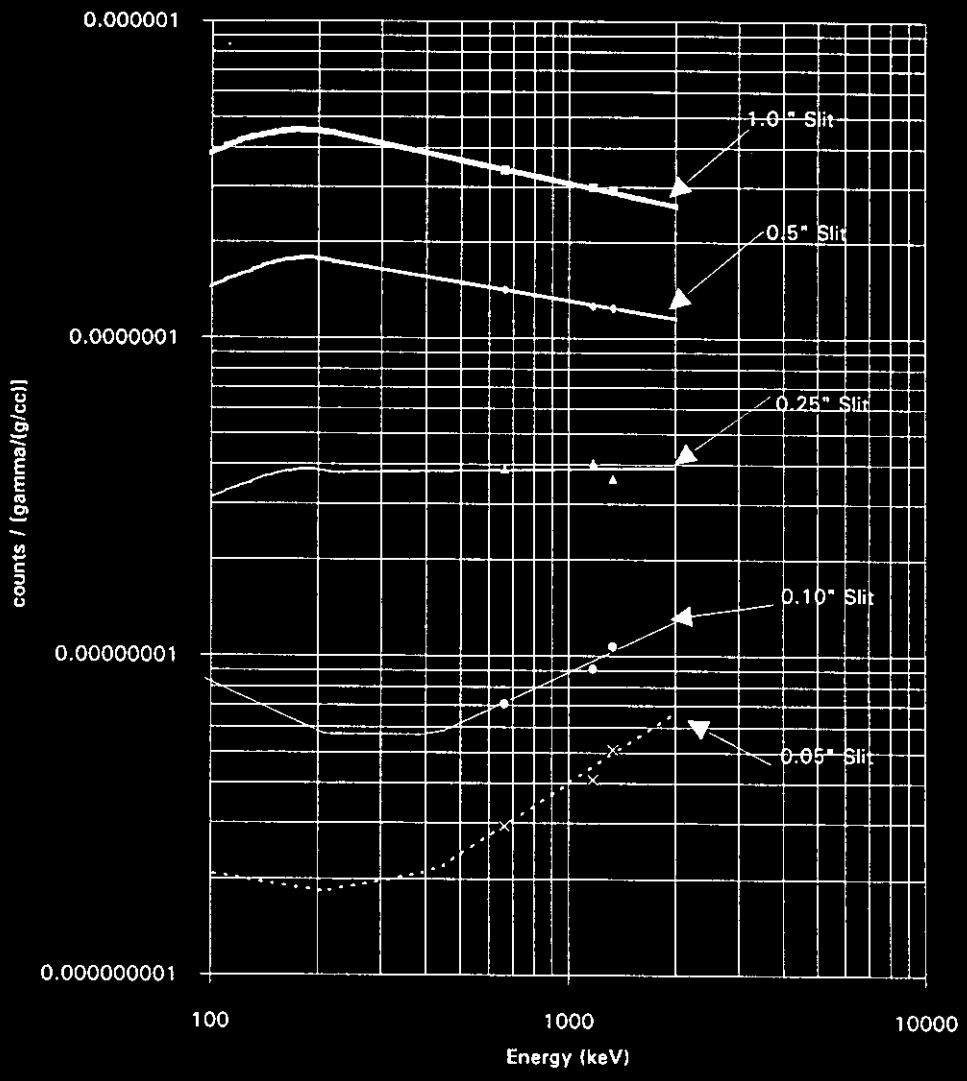


Exhibit 5

Date: 6/16/95 1:28 PM File: 95051903.XLS

5.08'H x 5.08'D x 9.08'W Waste Container
95051903 counted: 05/19/95

H 61 "
W 109 "
D 61 "

Container ID: ETFF-95-083-01

Gross:	6600 lb
Tare:	1747 lb
Net:	4853 lb

Type of Count: 3-sided

Detector Placement: 0 ft away

Count of Container at Specified Detector Placement

Side A	Side B	Side C	Side D
968		1035	1073
1037		1115	1107
1041		1056	
		1079	

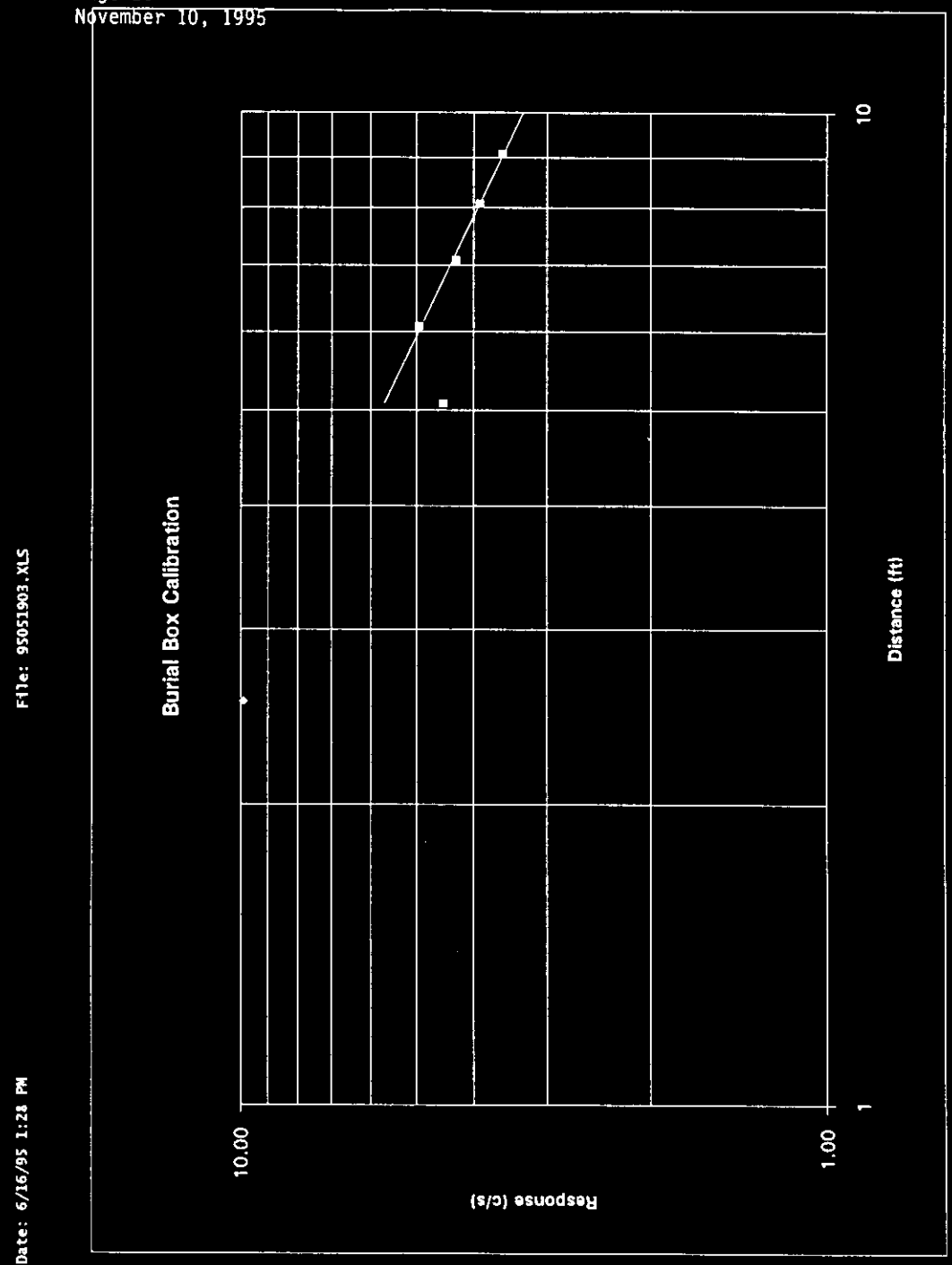
200 s 1056.8
± 46.5

Calibration information 19B14B 10820.0 n/s on: 05/19/95

Distance (ft)	Count Time (s)	Gross Count (c)	Distance (ft)	Net Rate (c/s)	Net Rate <Fit> (c/s)	ln(ft.)	ln(rate)
0 ft away							
5.083333333 ft	600 s	5872 c	5.083333	4.50 c/s	5.67	1.626	1.505
6.083333333 ft	500 s	5117 c	6.083333	4.95 c/s	4.91	1.806	1.599
7.083333333 ft	500 s	4786 c	7.083333	4.29 c/s	4.34	1.958	1.456
8.083333333 ft	700 s	6432 c	8.083333	3.90 c/s	3.91	2.090	1.362
9.083333333 ft	425 s	3765 c	9.083333	3.57 c/s	3.56	2.206	1.274
			10		3.29		

	Calibration Factor	±	Uncertainty	Expected count rate using neutron standard		Type
Calibration Factor (c/n):	9.1572E-04	±	4.5786E-05	2.54	9.91	Homogenous
Calibration Factor (c/n):	2.4445E-03	±	1.2222E-04	0.75	26.43	IX-2, IX-3
Calibration Factor (c/n):	1.6207E-03	±	8.1036E-05	1.25	17.54	IX-1
Calibration Factor (c/n):	5.2431E-04	±	2.6215E-05	5.08	5.67	3-Sided
Calibration Factor (c/n):	1.5387E-03	±	7.6936E-05	1.33	16.65	BIX-5

Exhibit 5


Burial Box Calibration
Response (c/s)
10.00
1.00
Distance (ft)
10
1
File: 95051903.XLS
Date: 6/16/95 1:28 PM

Appendix A
[to PNL Assay report]

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95083102.nan * * *
  MANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:04 on 10/17/95)

 Neutron ANALYSIS file:  \DATA\95083102.NAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00          326.        .00
       2         200.00          348.       1.22
       3         200.00          333.        .39
       4         200.00          299.      -1.50
       5         200.00          374.       2.66
       6         200.00          322.       -.22
       &        1200.00         2002.    6-Sample Median        326.00
   BARREL:  Rupture Loop Annex: Ion Exchange Column L-1              TID
     SITE:  300 Area: 309 Building Ion Exchange Vault
 OPERATOR:  mdw
 Statistics on   6 counts                          (Differences in Sigma units)
 CenMoment    Calc Value       Poisson Value       Diff/CalcSD  Diff/PoissonSD
  2        5.382222E+02        3.336667E+02              .79          1.06
  3        4.142942E+03        3.336667E+02              .74           .62
  4        6.924776E+05        3.343340E+05              .94           .80
 Mean            333.67              333.67
 SDofMEAN         10.38                7.46
 Std Dev          25.41               18.27             1.28          1.35
 SD of SD          5.58                5.28
 Skewness       .331792             .054745              .60           .28
 Kurtosis      -.609535             .002997             -.55          -.30
 Median           326.00              333.67             -.59          -.82
 SDof MED         13.00                9.35
 ************************
 ** NO NET NEUTRON COUNT **
 ************************

 ********************************************************************
 ** Measurement error dominates detection efficiency error         **
 ** Can profitably increase measurement time by factor of  3.87D-01 **
 ********************************************************************
 EFFNEU=    3.86D-03    1.93D-04        5.00%
 Y1=      13.422320  Y2=      21.583690

 Only the  6 GOOD neutron counts used in TRU calculations
 Measured Neutron Count Rate = 1.66833E+00 c/s  +/- 5.18759E-02     [    3.11%]
 Estimated Bkgd N Count Rate = 1.80000E+00 c/s  +/- 4.06945E-02     [    2.26%]
 Net Est  Neutron Count Rate = 1.00000E-20 c/s  +/- 6.59329E-02     [********%]
 Measured N Source Strength  = 2.58739E-18 n/s  +/- 1.70594E+01     [********%]

 PRELIMINARY TRU activity 1.2906E-12 nCi  +/- 8.5092E+06 nCi        [*******%]
              LESS THAN 1.3998E+07 nCi   (  1.64-sigma threshold)
 TRU activity Density 8.4867E-19 nCi/gram  +/- 5.5956E+00 nCi/gram  [********%]
           LESS THAN 9.2047E+00 nCi/gram   based on GROSS WT=  1520712. grams
 TRU activity Density 1.6893E-18 nCi/gram  +/- 1.1138E+01 nCi/gram  [********%]
           LESS THAN 1.8322E+01 nCi/gram   based on   NET WT=   763986. grams
 Total grams of TRU in barrel 1.5107E-20 gram  +/- 9.9605E-02 gram  [********%]
                    LESS THAN 1.6385E-01 gram

 CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
 Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [  5.00%]
 Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
 Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
 Meas Bkg Count Rate= 1.8000E+00 ( 4.0695E-02)  cps                 [  2.26%]
 Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
 TRU material assumed to be:  PRTR PuOxide(11%Pu242)
```

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95083103.nan * * *
  MANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:06 on 10/17/95)

 Neutron ANALYSIS file:  \DATA\95083103.NAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00          314.            -1.62
       2         200.00          370.             1.40
       3         200.00          363.             1.02
       4         200.00          301.            -2.32
       5         200.00          344.              .00
       6         200.00          359.              .81
       &        1200.00         2051.    6-Sample Median        344.00
   BARREL:  Rupture Loop Annex: Ion Exchange Column R-1                TID
     SITE:  300 Area: 309 Building Ion Exchange Vault
 OPERATOR:  mdw
 Statistics on   6 counts                          (Differences in Sigma units)
 CenMoment    Calc Value       Poisson Value       Diff/CalcSD  Diff/PoissonSD
  2        6.638056E+02        3.418333E+02             1.50          1.63
  3       -8.791280E+03        3.418333E+02             -.87         -1.44
  4        7.162107E+05        3.508919E+05             1.29           .78
 Mean            341.83              341.83
 SDofMEAN         11.52                7.55
 Std Dev          28.22               18.49             2.34          1.82
 SD of SD          4.16                5.34
 Skewness      -.514033            .054087             -.76          -.57
 Kurtosis     -1.374605            .002925            -1.46          -.68
 Median           344.00              341.83              .15           .23
 SDof MED         14.44                9.46
 ************************
 ** NO NET NEUTRON COUNT **
 ************************

 ********************************************************************
 ** Measurement error dominates detection efficiency error         **
 ** Can profitably increase measurement time by factor of  4.54D-01 **
 ********************************************************************
 EFFNEU=    3.86D-03    1.93D-04        5.00%
 Y1=      14.906210  Y2=      22.111970

 Only the  6 GOOD neutron counts used in TRU calculations
 Measured Neutron Count Rate = 1.70917E+00 c/s  +/- 5.76110E-02     [    3.37%]
 Estimated Bkgd N Count Rate = 1.80000E+00 c/s  +/- 4.06945E-02     [    2.26%]
 Net Est  Neutron Count Rate = 1.00000E-20 c/s  +/- 7.05342E-02     [********%]
 Measured N Source Strength  = 2.58739E-18 n/s  +/- 1.82499E+01     [********%]

 PRELIMINARY TRU activity 1.2906E-12 nCi  +/- 9.1031E+06 nCi        [*******%]
              LESS THAN 1.4975E+07 nCi   (  1.64-sigma threshold)
 TRU activity Density 8.4867E-19 nCi/gram  +/- 5.9861E+00 nCi/gram  [*******%]
           LESS THAN 9.8471E+00 nCi/gram   based on GROSS WT=  1520712. grams
 TRU activity Density 1.6893E-18 nCi/gram  +/- 1.1915E+01 nCi/gram  [*******%]
           LESS THAN 1.9601E+01 nCi/gram   based on   NET WT=   763986. grams
 Total grams of TRU in barrel 1.5107E-20 gram  +/- 1.0656E-01 gram  [*******%]
                    LESS THAN 1.7528E-01 gram

 CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
 Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [ 5.00%]
 Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [10.94%]
 Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [ 4.52%]
 Meas Bkg Count Rate= 1.8000E+00 ( 4.0695E-02)  cps                 [ 2.26%]
 Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
 TRU material assumed to be:  PRTR PuOxide(11%Pu242)
                                                0
```

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95090108.nan * * *
  MANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:35 on 10/17/95)

 Neutron ANALYSIS file:  \DATA\95090108.MAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00          351.             1.44
       2         200.00          302.            -1.28
       3         200.00          388.   HI        3.49
       4         200.00          311.             -.78
       5         200.00          325.              .00
       &         800.00         1289.    5-Sample Median        325.00
   BARREL:  Rupture Loop Annex: Ion Exchange Column L-2              TID
     SITE:  300 Area: 309 Building Ion Exchange Vault
 OPERATOR:  mdw
 Statistics on   5 counts                          (Differences in Sigma units)
 CenMoment   Calc Value       Poisson Value       Diff/CalcSD  Diff/PoissonSD
  2        9.658400E+02       3.354000E+02             1.46          2.97
  3        1.928335E+04       3.354000E+02             1.10          2.80
  4        1.864963E+06       3.378149E+05             1.85          3.08 <==
 Mean            335.40             335.40
 SDofMEAN         15.54               8.19
 Std Dev          34.75              18.31             2.37          2.84
 SD of SD          6.95               5.80
 Skewness       .642428            .054603              .78           .54
 Kurtosis     -1.000784            .002982             -.76          -.45
 Median           325.00             335.40             -.53         -1.01
 SDof MED         19.48              10.26

 Statistics on only   4 GOOD counts --  1 counts discarded at  3.00-sigma
 Statistics on   4 counts                          (Differences in Sigma units)
 CenMoment   Calc Value       Poisson Value       Diff/CalcSD  Diff/PoissonSD
  2        3.426875E+02       3.222500E+02              .13           .09
  3        3.514219E+03       3.222500E+02              .81           .45
  4        2.168580E+05       3.118574E+05            -1.07          -.19
 Mean            322.25             322.25
 SDofMEAN         10.69               8.98
 Std Dev          21.38              17.95              .80           .54
 SD of SD          4.26               6.35
 Skewness       .553964            .055706              .60           .41
 Kurtosis     -1.153374            .003103             -.85          -.47
 Median           311.00             322.25             -.84         -1.00
 SDof MED         13.40              11.25
 ************************   -----    WARNING!    -----
 ** NO NET NEUTRON COUNT **   NEGATIVE NET NEUTRON COUNT
 ************************    INCONSISTENT WITH ZERO!

 ********************************************************************
 ** Measurement error dominates detection efficiency error          **
 ** Can profitably increase measurement time by factor of  4.40D-01 **
 ********************************************************************
 EFFNEU=    3.86D-03    1.93D-04        5.00%
 Y1=      13.826750  Y2=      20.845190

 Only the  4 GOOD neutron counts used in TRU calculations
 Measured Neutron Count Rate = 1.61125E+00 c/s  +/- 5.34390E-02      [    3.32%]
 Estimated Bkgd N Count Rate = 1.93636E+00 c/s  +/- 3.37728E-02      [    1.74%]
 Net Est  Neutron Count Rate = 1.00000E-20 c/s  +/- 6.32165E-02      [********%]
 Measured N Source Strength  = 2.58739E-18 n/s  +/- 1.63566E+01      [********%]

 PRELIMINARY TRU activity 1.2906E-12 nCi  +/- 8.1587E+06 nCi         [********%]
              LESS THAN 1.3421E+07 nCi   (  1.64-sigma threshold)
 TRU activity Density 8.4867E-19 nCi/gram  +/- 5.3650E+00 nCi/gram  [********%]
          LESS THAN 8.8255E+00 nCi/gram   based on GROSS WT=  1520712. grams
 TRU activity Density 1.6893E-18 nCi/gram  +/- 1.0679E+01 nCi/gram  [********%]
          LESS THAN 1.7567E+01 nCi/gram   based on   NET WT=   763986. grams
 Total grams of TRU in barrel 1.5107E-20 gram  +/- 9.5501E-02 gram  [********%]
                   LESS THAN 1.5710E-01 gram

 CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight            10 N-tubes
 Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]        [  5.00%]
 Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
 Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
 Meas Bkg Count Rate= 1.9364E+00 ( 3.3773E-02)  cps                 [  1.74%]
 Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CfERR= 0.0000E+00
 TRU material assumed to be:  PRTR PuOxide(11%Pu242)
                                                                 0
```

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95083104.nan * * *
  NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:08 on 10/30/95)

 Neutron ANALYSIS file:  \DATA\95083104.NAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00          513.              .72
       2         200.00          466.            -1.39
       3         200.00          519.              .99
       4         200.00          484.             -.58
       5         200.00          497.              .00
       &        1000.00         2479.    5-Sample Median        497.00
   BARREL:  Rupture Loop Annex: Ion Exchange Column C-2              TID
     SITE:  300 Area: 309 Building Ion Exchange Vault
 OPERATOR:  mdw
 Statistics on   5 counts                          (Differences in Sigma units)
 CenMoment   Calc Value       Poisson Value       Diff/CalcSD  Diff/PoissonSD
  2        3.725600E+02        4.958000E+02             -.88            -.39
  3       -2.105842E+03        4.958000E+02             -.56            -.21
  4        2.370456E+05        7.379487E+05            -4.54            -.46
 Mean            495.80              495.80
 SDofMEAN          9.65                9.96
 Std Dev          21.58               22.27             -.19            -.10
 SD of SD          3.63                7.04
 Skewness      -.292841             .044910             -.50            -.31
 Kurtosis     -1.292190             .002017            -2.02            -.59
 Median           497.00              495.80              .10             .10
 SDof MED          12.10               12.48

 ********************************************************************
 ** Measurement error dominates detection efficiency error          **
 ** Can profitably increase measurement time by factor of  3.59D+00 **
 ********************************************************************
 EFFNEU=     3.86D-03     1.93D-04        5.00%
 Y1=       16.638020  Y2=       8.784414

 Only the  5 GOOD neutron counts used in TRU calculations
 Measured Neutron Count Rate = 2.47900E+00 c/s  +/- 4.97896E-02      [    2.01%]
 Estimated Bkgd N Count Rate = 1.80000E+00 c/s  +/- 4.06945E-02      [    2.26%]
 Net Est  Neutron Count Rate = 6.79000E-01 c/s  +/- 6.43043E-02      [    9.47%]
 Measured N Source Strength  = 1.75684E+02 n/s  +/- 1.88146E+01      [   10.71%]

 PRELIMINARY TRU activity 8.7631E+07 nCi  +/- 1.3417E+07 nCi         [   15.3%]
              LESS THAN 1.0970E+08 nCi   (  1.64-sigma threshold)
 TRU activity Density 1.0731E+02 nCi/gram  +/- 1.6430E+01 nCi/gram  [   15.3%]
           LESS THAN 1.3434E+02 nCi/gram   based on GROSS WT=   816612. grams
 TRU activity Density 1.7885E+02 nCi/gram  +/- 2.7384E+01 nCi/gram  [   15.3%]
           LESS THAN 2.2390E+02 nCi/gram   based on   NET WT=   489967. grams
 Total grams of TRU in barrel 1.0258E+00 gram  +/- 1.6375E-01 gram  [   16.0%]
                   LESS THAN 1.2841E+00 gram

 CALCULATIONS BASED ON:   816.612 kg   Net barrel weight          10 N-tubes
 Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [  5.00%]
 Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
 Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
 Meas Bkg Count Rate= 1.8000E+00 ( 4.0695E-02)  cps                 [  2.26%]
 Bkg Gross Barrel Wt=   721.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
 TRU material assumed to be:  PRTR PuOxide(11%Pu242)

 ######################################
 ###  TRU waste -- place accordingly  ###
 ######################################
```

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95090107.nan * * *
 NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:32 on 10/12/95)

Neutron ANALYSIS file:  \DATA\95090107.NAN
Segment      CountTime   NeutronCount   Discard  Sigma from Median
      1         200.00          335.              -.49
      2         200.00          348.               .22
      3         200.00          355.               .59
      4         200.00          344.               .00
      5         200.00          407.   HI         3.40
      6         200.00          329.              -.81
      &        1000.00         1711.    6-Sample Median        344.00
  BARREL:  Rupture Loop Annex: Ion Exchange Column R-2              TID
    SITE:  300 Area: 309 Building Ion Exchange Vault
OPERATOR:  mdw
Statistics on   6 counts                          (Differences in Sigma units)
CenMoment    Calc Value       Poisson Value       Diff/CalcSD  Diff/PoissonSD
 2        6.543333E+02        3.530000E+02              .72          1.48
 3        2.282700E+04        3.530000E+02             3.10          3.37 <**
 4        1.491168E+06        3.741800E+05             2.14          2.23
Mean            353.00              353.00
SDofMEAN         11.44                7.67
Std Dev          28.02               18.79             1.12          1.70
SD of SD          8.23                5.43
Skewness      1.363799             .053225             1.33          1.31
Kurtosis       .482800             .002833              .14           .24
Median          344.00              353.00             -.63          -.94
SDof MED         14.34                9.61

Statistics on only   5 GOOD counts --  1 counts discarded at  3.00-sigma
Statistics on   5 counts                          (Differences in Sigma units)
CenMoment    Calc Value       Poisson Value       Diff/CalcSD  Diff/PoissonSD
 2        8.536000E+01        3.422000E+02            -8.19         -1.19
 3       -7.502713E+01        3.422000E+02             -.81          -.06
 4        1.220653E+04        3.516447E+05           -56.50          -.66
Mean            342.20              342.20
SDofMEAN          4.62                8.27
Std Dev          10.33               18.50            -4.81         -1.40
SD of SD          1.70                5.85
Skewness       -.095134             .054058             -.23          -.14
Kurtosis      -1.324735             .002922            -2.72          -.60
Median          344.00              342.20              .31           .17
SDof MED          5.79               10.37
*************************   -----    WARNING!    -----
** NO NET NEUTRON COUNT **   NEGATIVE NET NEUTRON COUNT
*************************    INCONSISTENT WITH ZERO!

**********************************************************************
** Measurement error dominates detection efficiency error           **
** Can profitably increase measurement time by factor of  2.34D-01 **
**********************************************************************
EFFNEU=    3.86D-03    1.93D-04        5.00%
Y1=      10.702540  Y2=      22.135680

Only the  5 GOOD neutron counts used in TRU calculations
Measured Neutron Count Rate = 1.71100E+00 c/s  +/- 4.13642E-02      [    2.42%]
Estimated Bkgd N Count Rate = 1.93636E+00 c/s  +/- 3.37728E-02      [    1.74%]
Net Est  Neutron Count Rate = 1.00000E-20 c/s  +/- 5.34004E-02      [********%]
Measured N Source Strength  = 2.58739E-18 n/s  +/- 1.38168E+01      [********%]

PRELIMINARY TRU activity 1.2906E-12 nCi  +/- 6.8918E+06 nCi         [********%]
                LESS THAN 1.1337E+07 nCi   (  1.64-sigma threshold)
TRU activity Density 8.4867E-19 nCi/gram  +/- 4.5320E+00 nCi/gram  [********%]
          LESS THAN 7.4551E+00 nCi/gram   based on GROSS WT=  1520712. grams
TRU activity Density 1.6893E-18 nCi/gram  +/- 9.0209E+00 nCi/gram  [********%]
          LESS THAN 1.4839E+01 nCi/gram   based on   NET WT=   763986. grams
Total grams of TRU in barrel 1.5107E-20 gram  +/- 8.0672E-02 gram  [********%]
                LESS THAN 1.3271E-01 gram

CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [  5.00%]
Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
Meas Bkg Count Rate= 1.9364E+00 ( 3.3773E-02)  cps                 [  1.74%]
Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
TRU material assumed to be:  PRTR PuOxide(11%Pu242)
```

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95090104.nan * * *
  NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:25 on 10/17/95)

 Neutron ANALYSIS file:  \DATA\95090104.NAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00          647.              2.69
       2         200.00          691.   HI         4.52
       3         200.00          588.               .25
       4         200.00          595.               .54
       5         200.00          630.              1.99
       6         200.00          556.             -1.08
       7         200.00          523.             -2.45
       8         200.00          582.               .00
       9         200.00          540.             -1.74
      10         200.00          536.             -1.91
       &        1800.00         5197.   10-Sample Median          582.00
   BARREL:  Rupture Loop Annex: Ion Exchange Column L-3              TID
     SITE:  300 Area: 309 Building Ion Exchange Vault
 OPERATOR:  mdw
 Statistics on  10 counts                          (Differences in Sigma units)
 CenMoment    Calc Value        Poisson Value      Diff/CalcSD  Diff/PoissonSD
  2        2.618960E+03        5.888000E+02            2.16          7.71 <==
  3        7.508688E+04        5.888000E+02            1.18          6.71 <==
  4        1.567996E+07        1.040645E+06            1.83         13.58 <==
 Mean            588.80              588.80
 SDofMEAN         17.06                7.67
 Std Dev          53.94               24.27            3.23          5.47 <==
 SD of SD          9.18                5.43
 Skewness       .560236             .041211            1.13           .67
 Kurtosis      -.713943             .001698            -.88          -.46
 Median           582.00              588.80            -.32          -.71
 SDof MED         21.38                9.62

 Statistics on only   9 GOOD counts --  1 counts discarded at  3.00-sigma
 Statistics on   9 counts                          (Differences in Sigma units)
 CenMoment    Calc Value        Poisson Value      Diff/CalcSD  Diff/PoissonSD
  2        1.620469E+03        5.774445E+02            2.03          3.83 <==
  3        2.149100E+04        5.774445E+02             .71          1.84
  4        5.006337E+06        1.000904E+06            1.94          3.66 <==
 Mean            577.44              577.44
 SDofMEAN         14.23                8.01
 Std Dev          42.70               24.03            2.92          3.29 <==
 SD of SD          6.39                5.67
 Skewness       .329455             .041615             .62           .35
 Kurtosis     -1.093493             .001732           -1.87          -.67
 Median           582.00              577.44             .26           .45
 SDof MED         17.84               10.04

 ********************************************************************
 ** Measurement error dominates detection efficiency error          **
 ** Can profitably increase measurement time by factor of  2.74D+00 **
 ********************************************************************
 EFFNEU=    3.86D-03    1.93D-04        5.00%
 Y1=      20.380630  Y2=      12.301570

 Only the  9 GOOD neutron counts used in TRU calculations
 Measured Neutron Count Rate = 2.88722E+00 c/s  +/- 7.11616E-02     [    2.46%]
 Estimated Bkgd N Count Rate = 1.93636E+00 c/s  +/- 3.37728E-02     [    1.74%]
 Net Est  Neutron Count Rate = 9.50862E-01 c/s  +/- 7.87691E-02     [    8.28%]
 Measured N Source Strength  = 2.46025E+02 n/s  +/- 2.38054E+01     [    9.68%]

 PRELIMINARY TRU activity 1.2272E+08 nCi  +/- 1.7925E+07 nCi        [   14.6%]
              LESS THAN 1.5220E+08 nCi   (  1.64-sigma threshold)
 TRU activity Density 8.0697E+01 nCi/gram  +/- 1.1787E+01 nCi/gram  [   14.6%]
          LESS THAN 1.0009E+02 nCi/gram   based on GROSS WT=  1520712. grams
 TRU activity Density 1.6063E+02 nCi/gram  +/- 2.3463E+01 nCi/gram  [   14.6%]
          LESS THAN 1.9922E+02 nCi/gram   based on   NET WT=   763986. grams
 Total grams of TRU in barrel 1.4365E+00 gram  +/- 2.1963E-01 gram  [   15.3%]
                  LESS THAN 1.7816E+00 gram

 CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
 Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [  5.00%]
 Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
 Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
 Meas Bkg Count Rate= 1.9364E+00 ( 3.3773E-02)  cps                 [  1.74%]
 Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
 TRU material assumed to be:  PRTR PuOxide(11%Pu242)

 ######################################
 ###  TRU waste -- place accordingly  ###
```

E-33

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95090106.nan * * *
  NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:30 on 10/17/95)

 Neutron ANALYSIS file:  \DATA\95090106.NAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00          483.        .00
       2         200.00          483.        .00
       3         200.00          493.        .46
       4         200.00          534.       2.32
       5         200.00          439.      -2.00
       6         200.00          464.       -.86
       7         200.00          470.       -.59
       &        1400.00         3366.    7-Sample Median        483.00
   BARREL:  Rupture Loop Annex: Ion Exchange Column C-3              TID
     SITE:  300 Area: 309 Building Ion Exchange Vault
 OPERATOR:  mdw
 Statistics on   7 counts                          (Differences in Sigma units)
 CenMoment    Calc Value        Poisson Value       Diff/CalcSD  Diff/PoissonSD
  2        7.335510E+02         4.808571E+02              .65             .98
  3        1.035566E+04         4.808571E+02             1.28            1.01
  4        1.594557E+06         6.941516E+05             1.00            1.05
 Mean             480.86               480.86
 SDofMEAN          11.06                 8.29
 Std Dev           29.25                21.93             1.02            1.25
 SD of SD           7.17                 5.86
 Skewness       .521233              .045603             1.25             .51
 Kurtosis      -.036674              .002080             -.03            -.02
 Median            483.00               480.86             .15             .21
 SDof MED          13.86                10.39

 ********************************************************************
 ** Measurement error dominates detection efficiency error         **
 ** Can profitably increase measurement time by factor of  7.67D+00 **
 ********************************************************************
 EFFNEU=    3.86D-03    1.93D-04        5.00%
 Y1=      16.762340  Y2=       6.053685

 Only the  7 GOOD neutron counts used in TRU calculations
 Measured Neutron Count Rate = 2.40429E+00 c/s  +/- 5.52853E-02      [    2.30%]
 Estimated Bkgd N Count Rate = 1.93636E+00 c/s  +/- 3.37728E-02      [    1.74%]
 Net Est  Neutron Count Rate = 4.67926E-01 c/s  +/- 6.47848E-02      [   13.85%]
 Measured N Source Strength  = 1.21071E+02 n/s  +/- 1.78220E+01      [   14.72%]

 PRELIMINARY TRU activity 6.0390E+07 nCi  +/- 1.1077E+07 nCi         [   18.3%]
              LESS THAN 7.8611E+07 nCi   (  1.64-sigma threshold)
 TRU activity Density 3.9712E+01 nCi/gram  +/- 7.2838E+00 nCi/gram  [   18.3%]
           LESS THAN 5.1694E+01 nCi/gram   based on GROSS WT=  1520712. grams
 TRU activity Density 7.9046E+01 nCi/gram  +/- 1.4498E+01 nCi/gram  [   18.3%]
           LESS THAN 1.0290E+02 nCi/gram   based on   NET WT=   763986. grams
 Total grams of TRU in barrel 7.0689E-01 gram  +/- 1.3353E-01 gram  [   18.9%]
                 LESS THAN 9.2018E-01 gram

 CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
 Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [  5.00%]
 Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
 Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
 Meas Bkg Count Rate= 1.9364E+00 ( 3.3773E-02)  cps                 [  1.74%]
 Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
 TRU material assumed to be:  PRTR PuOxide(11%Pu242)
                                                  0

 ########################################
 ###  TRU waste -- place accordingly  ###
 ########################################
```

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95090105.nan * * *
  NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:28 on 10/17/95)

 Neutron ANALYSIS file:  \DATA\95090105.NAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00          403.             -.10
       2         200.00          409.              .20
       3         200.00          369.            -1.79
       4         200.00          416.              .55
       5         200.00          419.              .70
       6         200.00          405.              .00
       7         200.00          442.             1.84
       8         200.00          387.             -.89
       &        1600.00         3250.    8-Sample Median        405.00
   BARREL:  Rupture Loop Annex: Ion Exchange Column R-3              TID
     SITE:  300 Area: 309 Building Ion Exchange Vault
 OPERATOR:  mdw
 Statistics on   8 counts                          (Differences in Sigma units)
 CenMoment    Calc Value       Poisson Value       Diff/CalcSD  Diff/PoissonSD
  2        4.141875E+02       4.062500E+02              .04           .04
  3       -1.268156E+03       4.062500E+02             -.53          -.24
  4        4.664656E+05       4.955234E+05             -.11          -.05
 Mean            406.25             406.25
 SDofMEAN          7.69               7.13
 Std Dev          21.76              20.16              .34           .32
 SD of SD          4.72               5.04
 Skewness       -.150445           .049614             -.51          -.23
 Kurtosis       -.280897           .002462             -.27          -.16
 Median           405.00             406.25             -.13          -.14
 SDof MED          9.64               8.93

 ********************************************************************
 ** Measurement error dominates detection efficiency error          **
 ** Can profitably increase measurement time by factor of  1.16D+02 **
 ********************************************************************
 EFFNEU=     3.86D-03     1.93D-04        5.00%
 Y1=       13.243400   Y2=        1.227618

 Only the  8 GOOD neutron counts used in TRU calculations
 Measured Neutron Count Rate = 2.03125E+00 c/s  +/- 3.84609E-02     [    1.89%]
 Estimated Bkgd N Count Rate = 1.93636E+00 c/s  +/- 3.37728E-02     [    1.74%]
 Net Est  Neutron Count Rate = 9.48900E-02 c/s  +/- 5.11844E-02     [   53.94%]
 Measured N Source Strength  = 2.45517E+01 n/s  +/- 1.33002E+01     [   54.17%]

 PRELIMINARY TRU activity 1.2246E+07 nCi  +/- 6.7681E+06 nCi        [   55.3%]
              LESS THAN 2.3380E+07 nCi   (  1.64-sigma threshold)
 TRU activity Density 8.0531E+00 nCi/gram  +/- 4.4506E+00 nCi/gram  [   55.3%]
          LESS THAN 1.5374E+01 nCi/gram   based on GROSS WT=  1520712. grams
 TRU activity Density 1.6030E+01 nCi/gram  +/- 8.8589E+00 nCi/gram  [   55.3%]
          LESS THAN 3.0603E+01 nCi/gram   based on   NET WT=   763986. grams
 Total grams of TRU in barrel 1.4335E-01 gram  +/- 7.9488E-02 gram  [   55.5%]
                  LESS THAN 2.7367E-01 gram

 CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
 Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [  5.00%]
 Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
 Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
 Meas Bkg Count Rate= 1.9364E+00 ( 3.3773E-02)  cps                 [  1.74%]
 Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
 TRU material assumed to be:  PRTR PuOxide(11%Pu242)
                                                  o
 ########################################
 ###  TRU waste -- place accordingly  ###
 ########################################
```

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95083105.nan * * *
  NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:11 on 10/17/95)

 Neutron ANALYSIS file:  \DATA\95083105.NAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00           398.            -.59
       2         200.00           452.            2.07
       3         200.00           434.            1.19
       4         200.00           400.            -.49
       5         200.00           379.           -1.53
       6         200.00           423.             .64
       7         200.00           410.             .00
       &        1400.00          2896.    7-Sample Median        410.00
   BARREL:  Rupture Loop Annex: Ion Exchange Column L-4              TID
     SITE:  300 Area: 309 Building Ion Exchange Vault
 OPERATOR:  mdw
 Statistics on   7 counts                          (Differences in Sigma units)
 CenMoment    Calc Value        Poisson Value       Diff/CalcSD  Diff/PoissonSD
  2        5.167755E+02        4.137143E+02              .51           .47
  3        2.417532E+03        4.137143E+02              .35           .26
  4        5.534426E+05        5.138923E+05              .13           .06
 Mean            413.71              413.71
 SDofMEAN          9.28                7.69
 Std Dev          24.55               20.34              .95           .77
 SD of SD          4.45                5.44
 Skewness       .205788             .049164              .31           .17
 Kurtosis      -.927623             .002417            -1.47          -.50
 Median          410.00              413.71             -.32          -.39
 SDof MED         11.63                9.64

*****************************************************************
** Measurement error dominates detection efficiency error      **
** Can profitably increase measurement time by factor of  2.110+01 **
*****************************************************************
 EFFNEU=     3.860-03    1.930-04        5.00%
 Y1=       15.969190  Y2=       3.474583

 Only the  7 GOOD neutron counts used in TRU calculations
 Measured Neutron Count Rate = 2.06857E+00 c/s  +/- 4.64029E-02      [    2.24%]
 Estimated Bkgd N Count Rate = 1.80000E+00 c/s  +/- 4.06945E-02      [    2.26%]
 Net Est  Neutron Count Rate = 2.68571E-01 c/s  +/- 6.17193E-02      [   22.98%]
 Measured N Source Strength  = 6.94899E+01 n/s  +/- 1.63428E+01      [   23.52%]

 PRELIMINARY TRU activity 3.4662E+07 nCi  +/- 8.9909E+06 nCi         [   25.9%]
              LESS THAN 4.9452E+07 nCi   (  1.64-sigma threshold)
 TRU activity Density 2.2793E+01 nCi/gram  +/- 5.9123E+00 nCi/gram  [   25.9%]
           LESS THAN 3.2519E+01 nCi/gram   based on GROSS WT=  1520712. grams
 TRU activity Density 4.5369E+01 nCi/gram  +/- 1.1768E+01 nCi/gram  [   25.9%]
           LESS THAN 6.4728E+01 nCi/gram   based on   NET WT=   763986. grams
 Total grams of TRU in barrel 4.0573E-01 gram  +/- 1.0683E-01 gram  [   26.3%]
                    LESS THAN 5.7886E-01 gram

 CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight           10 N-tubes
 Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [  5.00%]
 Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
 Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
 Meas Bkg Count Rate= 1.8000E+00 ( 4.0695E-02)  cps                 [  2.26%]
 Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
 TRU material assumed to be:  PRTR PuOxide(11%Pu24Z)
                                                    D

 ########################################
 ###  TRU waste -- place accordingly  ###
 ########################################
```

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95090103.nan * * *
  NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:23 on 10/17/95)

 Neutron ANALYSIS file:  \DATA\95090103.NAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00          478.          .00
       2         200.00          496.          .82
       3         200.00          499.          .96
       4         200.00          477.         -.05
       5         200.00          496.          .82
       6         200.00          477.         -.05
       &        1200.00         2923.    6-Sample Median        478.00
   BARREL:  Rupture Loop Annex: Ion Exchange Column C-4              TID
     SITE:  300 Area: 309 Building Ion Exchange Vault
 OPERATOR:  mdw
 Statistics on   6 counts                          (Differences in Sigma units)
 CenMoment   Calc Value       Poisson Value       Diff/CalcSD  Diff/PoissonSD
  2        9.780556E+01        4.871667E+02          -44.02          -1.38
  3        2.726224E+01        4.871667E+02            -.59           -.04
  4        1.003536E+04        7.124812E+05         -374.16           -.74
 Mean            487.17              487.17
 SDofMEAN          4.42                9.01
 Std Dev          10.83               22.07          -25.13          -1.76
 SD of SD           .45                6.37
 Skewness       .028185             .045307            -.02           -.02
 Kurtosis     -1.950927             .002053          -63.83           -.97
 Median           478.00              487.17           -1.65           -.81
 SDof MED          5.54               11.29

 ****************************************************************
 ** Measurement error dominates detection efficiency error      **
 ** Can profitably increase measurement time by factor of  5.08D+00 **
 ****************************************************************
 EFFNEU=    3.86D-03    1.93D-04        5.00%
 Y1=      14.568780  Y2=       6.461824

 Only the  6 GOOD neutron counts used in TRU calculations
 Measured Neutron Count Rate = 2.43583E+00 c/s  +/- 4.50540E-02     [    1.85%]
 Estimated Bkgd N Count Rate = 1.93636E+00 c/s  +/- 3.37728E-02     [    1.74%]
 Net Est  Neutron Count Rate = 4.99473E-01 c/s  +/- 5.63069E-02     [   11.27%]
 Measured N Source Strength  = 1.29233E+02 n/s  +/- 1.59375E+01     [   12.33%]

 PRELIMINARY TRU activity 6.4461E+07 nCi  +/- 1.0628E+07 nCi        [   16.5%]
              LESS THAN 8.1944E+07 nCi   (  1.64-sigma threshold)
 TRU activity Density 4.2389E+01 nCi/gram  +/- 6.9887E+00 nCi/gram  [   16.5%]
          LESS THAN 5.3885E+01 nCi/gram   based on GROSS WT=  1520712. grams
 TRU activity Density 8.4375E+01 nCi/gram  +/- 1.3911E+01 nCi/gram  [   16.5%]
          LESS THAN 1.0726E+02 nCi/gram   based on   NET WT=   763986. grams
 Total grams of TRU in barrel 7.5455E-01 gram  +/- 1.2899E-01 gram  [   17.1%]
                LESS THAN 9.5920E-01 gram

 CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
 Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [  5.00%]
 Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
 Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
 Meas Bkg Count Rate= 1.9364E+00 ( 3.3773E-02)  cps                 [  1.74%]
 Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
 TRU material assumed to be:  PRTR PuOxide(11%Pu24Z)

 ########################################
 ###  TRU waste -- place accordingly  ###
 ########################################
```

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95090704.nan * * *
 NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:50 on 10/17/95)

Neutron ANALYSIS file:  \DATA\95090704.NAN
Segment      CountTime   NeutronCount   Discard  Sigma from Median
      1         200.00          382.              .00
      2         200.00          383.              .05
      3         200.00          394.              .61
      4         200.00          373.             -.46
      &         800.00         1532.    4-Sample Median        382.00
  BARREL:  Rupture Loop Annex: Ion Exchange Column C-4 Recount      TID
    SITE:  300 Area: 309 Building Ion Exchange Vault
OPERATOR:  mdw
Statistics on   4 counts                        (Differences in Sigma units)
CenMoment   Calc Value       Poisson Value      Diff/CalcSD  Diff/PoissonSD
 2        5.550000E+01       3.830000E+02          -11.80          -1.21
 3        8.250000E+01       3.830000E+02           -1.44           -.03
 4        6.160500E+03       4.404500E+05         -143.55           -.60
Mean           383.00             383.00
SDofMEAN         4.30               9.79
Std Dev          8.60              19.57            -5.89          -1.58
SD of SD         1.86               6.92
Skewness      .199533            .051098              .27            .12
Kurtosis    -1.000000            .002611             -.92           -.40
Median         382.00             383.00             -.19           -.08
SDof MED         5.39              12.26
*************************
** NO NET NEUTRON COUNT **
*************************

*********************************************************************
** Measurement error dominates detection efficiency error          **
** Can profitably increase measurement time by factor of  2.61D-01 **
*********************************************************************
EFFNEU=    3.86D-03    1.93D-04        5.00%
Y1=       12.659050  Y2=       24.774890

Only the  4 GOOD neutron counts used in TRU calculations
Measured Neutron Count Rate = 1.91500E+00 c/s  +/- 4.89260E-02      [    2.55%]
Estimated Bkgd N Count Rate = 1.96500E+00 c/s  +/- 3.34395E-02      [    1.70%]
Net Est  Neutron Count Rate = 1.00000E-20 c/s  +/- 5.92617E-02      [********%]
Measured N Source Strength  = 2.58739E-18 n/s  +/- 1.53333E+01      [********%]

PRELIMINARY TRU activity 1.2906E-12 nCi  +/- 7.6483E+06 nCi         [*******%]
             LESS THAN 1.2581E+07 nCi   (  1.64-sigma threshold)
TRU activity Density 8.4867E-19 nCi/gram  +/- 5.0294E+00 nCi/gram   [*******%]
          LESS THAN 8.2733E+00 nCi/gram   based on GROSS WT=  1520712. grams
TRU activity Density 1.6893E-18 nCi/gram  +/- 1.0011E+01 nCi/gram   [*******%]
          LESS THAN 1.6468E+01 nCi/gram   based on   NET WT=   763986. grams
Total grams of TRU in barrel 1.5107E-20 gram  +/- 8.9527E-02 gram   [*******%]
                  LESS THAN 1.4727E-01 gram

CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [  5.00%]
Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
Meas Bkg Count Rate= 1.9650E+00 ( 3.3439E-02)  cps                 [  1.70%]
Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
TRU material assumed to be:  PRTR PuOxide(11%Pu24Z)
```

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95090102.nan * * *
  NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:21 on 10/17/95)

 Neutron ANALYSIS file:  \DATA\95090102.NAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00          326.              .00
       2         200.00          348.             1.22
       3         200.00          333.              .39
       4         200.00          299.            -1.50
       5         200.00          374.             2.66
       6         200.00          322.             -.22
       &        1200.00         2002.    6-Sample Median        326.00
   BARREL:  Rupture Loop Annex: Ion Exchange Column R-4              TID
     SITE:  300 Area: 309 Building Ion Exchange Vault
 OPERATOR:  mdw
 Statistics on   6 counts                          (Differences in Sigma units)
 CenMoment    Calc Value       Poisson Value      Diff/CalcSD  Diff/PoissonSD
  2        5.382222E+02        3.336667E+02              .79            1.06
  3        4.142942E+03        3.336667E+02              .74             .62
  4        6.924776E+05        3.343340E+05              .94             .80
 Mean            333.67              333.67
 SDofMEAN         10.38                7.46
 Std Dev          25.41               18.27             1.28            1.35
 SD of SD          5.58                5.28
 Skewness       .331792             .054745              .60             .28
 Kurtosis      -.609535             .002997             -.55            -.30
 Median           326.00              333.67             -.59            -.82
 SDof MED         13.00                9.35
 *************************   -----    WARNING!    -----
 ** NO NET NEUTRON COUNT **   NEGATIVE NET NEUTRON COUNT
 *************************    INCONSISTENT WITH ZERO!

 ********************************************************************
 ** Measurement error dominates detection efficiency error          **
 ** Can profitably increase measurement time by factor of  3.87D-01 **
 ********************************************************************
 EFFNEU=    3.86D-03    1.93D-04        5.00%
 Y1=      13.422320  Y2=      21.583690

 Only the  6 GOOD neutron counts used in TRU calculations
 Measured Neutron Count Rate = 1.66833E+00 c/s  +/- 5.18759E-02     [    3.11%]
 Estimated Bkgd N Count Rate = 1.93636E+00 c/s  +/- 3.37728E-02     [    1.74%]
 Net Est  Neutron Count Rate = 1.00000E-20 c/s  +/- 6.19008E-02     [********%]
 Measured N Source Strength  = 2.58739E-18 n/s  +/- 1.60162E+01     [********%]

 PRELIMINARY TRU activity 1.2906E-12 nCi  +/- 7.9889E+06 nCi        [*******%]
              LESS THAN 1.3142E+07 nCi   (  1.64-sigma threshold)
 TRU activity Density 8.4867E-19 nCi/gram  +/- 5.2534E+00 nCi/gram  [*******%]
         LESS THAN 8.6418E+00 nCi/gram   based on GROSS WT=  1520712. grams
 TRU activity Density 1.6893E-18 nCi/gram  +/- 1.0457E+01 nCi/gram  [*******%]
          LESS THAN 1.7201E+01 nCi/gram   based on   NET WT=   763986. grams
 Total grams of TRU in barrel 1.5107E-20 gram  +/- 9.3513E-02 gram  [*******%]
                   LESS THAN 1.5383E-01 gram

 CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
 Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [  5.00%]
 Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [ 10.94%]
 Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [  4.52%]
 Meas Bkg Count Rate= 1.9364E+00 ( 3.3773E-02)  cps                 [  1.74%]
 Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
 TRU material assumed to be:  PRTR PuOxide(11%Pu24)
```

0

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * 95090702.nan * * *
 NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (13:48:45 on 10/17/95)

 Neutron ANALYSIS file:  \DATA\95090702.NAN
 Segment      CountTime   NeutronCount   Discard  Sigma from Median
       1         200.00          389.              1.04
       2         200.00          373.               .21
       3         200.00          382.               .68
       4         200.00          369.               .00
       5         200.00          346.             -1.20
       6         200.00          356.              -.68
       &        1200.00         2215.    6-Sample Median        369.00
  BARREL:  Rupture Loop Annex: Ion Exchange Column RLIX-1            TID
    SITE:  300 Area: 309 Building Ion Exchange Vault
OPERATOR:  mdw
Statistics on   6 counts                          (Differences in Sigma units)
CenMoment   Calc Value       Poisson Value       Diff/CalcSD  Diff/PoissonSD
 2        2.138056E+02       3.691667E+02             -1.96            -.73
 3       -7.907342E+02       3.691667E+02              -.67            -.16
 4        8.336133E+04       4.092212E+05             -8.22            -.59
Mean            369.17             369.17
SDofMEAN          6.54               7.84
Std Dev          16.02              19.21             -1.18            -.58
SD of SD          2.71               5.55
Skewness      -.252931            .052046              -.52            -.30
Kurtosis     -1.176412            .002709             -1.78            -.58
Median          369.00             369.17              -.02            -.02
SDof MED          8.20               9.83
*************************
** NO NET NEUTRON COUNT **
*************************

**********************************************************************
** Measurement error dominates detection efficiency error           **
** Can profitably increase measurement time by factor of  1.81D-01 **
**********************************************************************
EFFNEU=    3.86D-03    1.93D-04        5.00%
Y1=      10.147690  Y2=      23.880060

Only the  6 GOOD neutron counts used in TRU calculations
Measured Neutron Count Rate = 1.84583E+00 c/s  +/- 3.92198E-02     [    2.12%]
Estimated Bkgd N Count Rate = 1.96500E+00 c/s  +/- 3.34395E-02     [    1.70%]
Net Est  Neutron Count Rate = 1.00000E-20 c/s  +/- 5.15402E-02     [********%]
Measured N Source Strength  = 2.58739E-18 n/s  +/- 1.33355E+01     [********%]

PRELIMINARY TRU activity 1.2906E-12 nCi  +/- 6.6517E+06 nCi        [*******%]
          LESS THAN 1.0942E+07 nCi   (  1.64-sigma threshold)
TRU activity Density 8.4867E-19 nCi/gram  +/- 4.3741E+00 nCi/gram  [*******%]
       LESS THAN 7.1954E+00 nCi/gram   based on GROSS WT=  1520712. grams
TRU activity Density 1.6893E-18 nCi/gram  +/- 8.7066E+00 nCi/gram  [*******%]
       LESS THAN 1.4322E+01 nCi/gram   based on   NET WT=   763986. grams
Total grams of TRU in barrel 1.5107E-20 gram  +/- 7.7862E-02 gram  [*******%]
                LESS THAN 1.2808E-01 gram

CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  [cts/s]/[n/s]       [ 5.00%]
Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/[n/s]           [10.94%]
Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram            [ 4.52%]
Meas Bkg Count Rate= 1.9650E+00 ( 3.3439E-02)  cps                 [ 1.70%]
Bkg Gross Barrel Wt=  1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
TRU material assumed to be:  PRTR PuOxide(11%Pu24)
```

```
* * * * * * * * * * * * * * * * * * * * * * * * * 95090703.nan * * *
 NANAL: Neutron Analysis Code (Version 2.00)   Date Analyzed -- (17:20:54 on 11/10/95)

Neutron ANALYSIS file:  \DATA\95090703.NAN
Segment      CountTime   NeutronCount   Discard  Sigma from Median
      1         200.00          419.                      .00
      2         200.00          446.                     1.32
      3         200.00          418.                     -.05
      4         200.00          430.                      .54
      5         200.00          380.                    -1.91
      6        1000.00         2093.    5-Sample Median       419.00
  BARREL:  Rupture Loop Annex: Filter & Pipes                    TIO
    SITE:  300 Area: 309 Building Ion Exchange Vault
OPERATOR:  adu
Statistics on   5 counts                          (Differences in Sigma units)
CenMoment    Calc Value        Poisson Value       Diff/CalcSD  Diff/PoissonSD
 2         4.742400E+02         4.186000E+02              .21             .21
 3        -7.092057E+03         4.186000E+02            -2.12            -.30
 4         5.6010246+05         5.260965E+05              .13             .04
Mean             418.60               418.60
SDofMEAN          10.89                9.15
Std Dev           24.35               20.46              .65             .50
SD of SD           5.94                6.47
Skewness       -.686712             .048877            -1.18            -.67
Kurtosis       -.509589             .002389             -.28            -.23
Median            419.00               418.60              .03             .03
SDof MED          13.65                11.47
************************
** NO NET NEUTRON COUNT **
************************

*********************************************************************
** Measurement error dominates detection efficiency error          **
** Can profitably increase measurement time by factor of  2.710-01 **
*********************************************************************
EFFNEU=    3.860-03    1.930-04       5.00%
Y1=      14.086430  Y2=      27.077720

Only the  5 GOOD neutron counts used in TRU calculations
Measured Neutron Count Rate = 2.09300E+00 c/s  +/- 5.44426E-02     (    2.60%)
Estimated Bkgd N Count Rate = 2.14500E+00 c/s  +/- 5.97913E-02     (    2.79%)
Net Est  Neutron Count Rate = 1.00000E-20 c/s  +/- 8.08641E-02     (********%)
Measured N Source Strength  = 2.58739E-18 n/s  +/- 2.09227E+01     (********%)

PRELIMINARY TRU activity 1.2906E-12 nCi  +/- 1.0436E+07 nCi        (********%)
              LESS THAN 1.7168E+07 nCi   (  1.64-sigma threshold)
TRU activity Density 8.4867E-19 nCi/gram  +/- 6.8627E+00 nCi/gram  (********%)
          LESS THAN 1.1289E+01 nCi/gram   based on GROSS WT=  1520712. grams
TRU activity Density 1.6893E-18 nCi/gram  +/- 1.3660E+01 nCi/gram  (********%)
          LESS THAN 2.2471E+01 nCi/gram   based on   NET WT=   763366. grams
Total grams of TRU in barrel 1.5107E-20 gram  +/- 1.2216E-01 gram  (********%)
              LESS THAN 2.0096E-01 gram

CALCULATIONS BASED ON:  1520.712 kg   Net barrel weight          10 N-tubes
Neutron Efficiency = 3.8649E-03 ( 1.9325E-04)  (cts/s)/(n/s)      (  5.00%)
Calibration Factor = 4.9880E+05 ( 5.4580E+04)  nCi/(n/s)         ( 10.94%)
Specific Activity  = 8.5430E+07 ( 3.8600E+06)  nCi/gram          (  4.52%)
Meas Bkg Count Rate= 2.1450E+00 ( 5.9791E-02)  cps               (  2.79%)
Bkg Gross Barrel Wt= 1669.000 #  BkgAdjFactor= 1.0000000  CFERR= 0.0000E+00
TRU material assumed to be:  PRTR PuOxide(11%Pu240)
```

APPENDIX F

PRTR Fuel Isotopic Distribution Calculations

30 Year Decayed PRTR Fuel Transuranic Isotope Content

	Grams of Isotope per gram of 98% UO2 - 2% PuO2 fuel			Specific Activity Ci/g	Ci/g of fuel	Ci/g of fuel	Equivalent Grams
Isotope	Sample 1	Sample 2	Average	sp.ac.	2.5 Yr Activity	28 Yr Decay	Resulting grams/gram fuel
Am-241				3.4314E+00	***0.0000E+00***	5.1000E-03	***1.4863E-03***
Pa-233				2.0800E+04		4.9414E-08	2.3757E-12
U-234	5.1630E-05	4.8970E-05	**5.0300E-05**	6.2490E-03	**3.1432E-07**	3.2223E-07	5.1565E-05
U-235	6.5630E-03	6.5980E-03	**6.5805E-03**	2.1620E-06	**1.4227E-08**	1.4228E-08	6.5809E-03
U-236	7.8100E-05	6.3660E-05	**7.0880E-05**	6.4700E-05	**4.5859E-09**	7.3410E-09	1.1346E-04
U-238	9.7240E-01	9.7280E-01	**9.7260E-01**	3.3620E-07	**3.2699E-07**	3.3000E-07	9.8156E-01
Pu 238	6.8610E-06	6.3170E-06	**6.5890E-06**	1.7120E+01	**1.1280E-04**	9.0418E-05	5.2814E-06
Pu-239	1.6480E-02	1.6520E-02	**1.6500E-02**	6.2000E-02	**1.0230E-03**	1.0222E-03	1.6487E-02
Pu-240	2.1950E-03	2.0770E-03	**2.1360E-03**	2.2680E-01	**4.8444E-04**	4.8335E-04	2.1312E-03
Pu-241	3.7920E-04	3.4130E-04	**3.6025E-04**	1.0300E+02	**3.7106E-02**	9.6406E-03	***9.3598E-05***
Pu-242	2.6870E-05	2.4250E-05	**2.5560E-05**	3.9200E-03	**1.0020E-07**	1.3559E-07	3.4589E-05
	9.9818E-01	9.9848E-01	**9.9833E-01**	**Total**			

BNWL-1674 Table IV data reduction.

30 Year Decayed PRTR Fuel Transuranic Isotope Content

	Column R3	Daughter Curies	Column L3	Daughter Curies	Column L4	Daughter Curies	Column C2	Daughter Curies
Isotope	0.14	g tru	1.44	g TRU	0.41	g TRU	0.41	g TRU
Am-241	0.01	3.85E-02	0.11	3.88E-01	0.03	1.09E-01	0.03	1.09E-01
Pa-233	0.00	3.73E-07	0.00	3.76E-06	0.00	1.06E-06	0.00	1.06E-06
U-234	0.00	2.43E-06	0.00	2.45E-05	0.00	6.89E-06	0.00	6.89E-06
U-235	0.05	1.07E-07	0.50	1.08E-06	0.14	3.04E-07	0.14	3.04E-07
U-236	0.00	5.54E-08	0.01	5.58E-07	0.00	1.57E-07	0.00	1.57E-07
U-238	7.41	2.49E-06	74.63	2.51E-05	20.99	7.06E-06	20.99	7.06E-06
	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Pu 238	0.00	6.83E-04	0.00	6.87E-03	0.00	1.93E-03	0.00	1.93E-03
Pu-239	0.13	7.89E-03	1.28	7.95E-02	0.36	2.23E-02	0.36	2.23E-02
Pu-240	0.02	3.57E-03	0.16	3.59E-02	0.04	1.01E-02	0.04	1.01E-02
Pu-241	0.00	7.28E-02	0.01	7.33E-01	0.00	2.06E-01	0.00	2.06E-01
Pu-242	0.00	1.02E-06	0.00	1.03E-05	0.00	2.90E-06	0.00	2.90E-06

Note: 1st column is calculated grams of each isotope to 2 significant figures
2nd column shows curies of isotope

DISTRIBUTION SHEET

To	From	Page 1 of 1
Transition Project Engineering	Transition Project Engineering	Date 12-22-95
Project Title/Work Order		EDT No. 608800
RLA ION EXCHANGE VAULT ENTRY & CHARACTERIZATION		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
EJ Bitten	L5-70	X			
BC Cornwell	L5-70	X			
PW Griffin	X5-53	X			
JE Ham	L5-70	X			
LC Hulstrom	H9-11	X			
Central Files	A3-88	X			