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BUILDING 310 RETENTION TANKS CHARACTERIZATION REPORT

Prepared by C.M. Sholeen
and D.C. Geraghty

ARGONNE NATIONAL LABORATORY, ARGONNE, ILLINOIS

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Argonne, Il 60439

December 1996

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TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF TABLES (Cont.)

LIST OF FIGURES

LIST OF FIGURES (Cont.)

LIST OF FIGURES (Cont.)

LIST OF FIGURES (Cont.)

ACKNOWLEDGMENTS

This characterization was simplified because of the previous characterization work done in August 1994 by George Mosho of ESH-HP.

Special thanks to Cindy Sullivan (ESH-HP) who compiled the final the document. We especially appreciate her patience and sense of humor in handling the report's numerous changes and additions.

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Thanks also to Sue Santarelli and Willis Ray who cooperated in scheduling the WMO efforts to clean the rubble from room A-068A; pump the water from the floor of room A-038A; and sample the transfer lines in Building 306, room B007.

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ABSTRACT

The Health Physics Section of ANL performed a characterization of the Building 310 Service Floor Retention Tank Facility during the months of July and August, 1996. The characterization included measurements for radioactivity, air sampling for airborne particles and sampling to determine the presence and quantity of hazardous materials requiring remediation. Copies of previous lead and asbestos sampling information was obtained from ESH-IH. The facility consists of ten retention tanks located in rooms, A-062A, A-050A, A-038A, A-026A, and an entry room A-068A which contained miscellaneous pumps and other scrap material.

Significant contamination was found in each room except room A-068A which had two contaminated spots on the floor and a discarded contaminated pump.

Room A-062A: This room had the highest radiation background. Therefore, beta readings reflected the background readings. The floor, west wall, and the exterior of tank #1 had areas of alpha contamination. The piping leading from the tank had elevated gamma readings. There were low levels of smearable contamination on the west wall.

Room A-050A: Alpha and Beta contamination is wide spread on the floor, west wall and the lower portion of the north wall. An area near the electrical box on the west wall had alpha and beta loose contamination. The exterior of tank #4 also had contaminated areas. The grate in front of tank #4 was contaminated. The piping leading from tanks #2, 3, and 4 had elevated gamma readings. There were low levels of smearable contamination on tank #4 and on the tar paper that is glued to the floor.

Room A-038A: There is a considerable amount of alpha contamination on tanks 5, 6, and 7 with a contaminated strip approximately two feet wide on the middle of the west side of tank 5 that is up to 375K dis/min - 100 cm^2 α. Also, a small area smear of this area had loose contamination of 8,400 dis/min α, and 5,700 dis/min β. The north wall also had a large area of alpha contamination. The piping along the ceiling and ductwork by this wall seems to have leaked. The pipe joint along the ductwork was 27.5K dis/min α, 1,004K dis/min β - 100 cm^2 direct and 12,700 $\pm$ 300 dis/min α, 11,300 $\pm$ 200 dis/min β on smears. Contamination was also noted on the west wall, and in samples of tar paper from the floor. The grate in front of tanks 6 and 7 is contaminated. The piping leading from tanks #5, 6, and 7 had elevated gamma readings. Water comes into this room through the tunnel.

Room A-026A: Contamination was noted on the cover plates of tanks 8 and 10 and also on the exterior of the tanks. The large area smear of tank 9 indicated loose activity. One area on the south wall and three areas on the floor were contaminated. There were low levels of loose activity on the tanks, pipes, south wall, east wall, and floor. Water seeps into this room at the bottom of the brick wall.

Tunnel from 306 to 310: The east pipe of the tunnel from the 310 side had elevated gamma readings. There were low levels of smearable contamination on the piping in the tunnel but not on the tunnel walls.

Air Samples: ^{137}Cs and ^{60}Co was seen on the gamma spectrum of fifteen air samples. Elevated alpha activities were measured during two of the sampling periods. The DAC values are <2%.

The internal and external activities associated with each room are summarized below.

Summary of Activity by Room (μCi)

Location	A-026A	A-038A	A-050A	A-062A	A-068A
Internal Tank α	26,000	240	4,000	3,800	NA
Internal Tank β	75,000	670	11,000	11,000	NA
External Tank α	0.15	25	0.24	0.014	NA
External Tank β	3.9	25	0.29	2.0	NA
Walls & Floors α	2.0	2.6	94	0.87	0.009
Walls & Floors β	63	68	110	43	0.28
Pipes α	0.003	0.24	0.022	0.007	NA
Pipes β	0.11	0.80	0.45	0.14	NA

The activities associated with individual items that either services all rooms or are unique to one of the rooms are summarized below.

Activity of Other Items

Item	μCi α	μCi β
Mud from A-038A floor	3.4	24
Transfer line in A-038A	0.009	0.15
Lab drain	0.038	1.4
Tunnel under paved area	0.34	12
Tunnel in Bldg 306	0.077	36
Liquid in transfer lines	3.9	72

BUILDING 310 RETENTION TANKS CHARACTERIZATION REPORT

I. OBJECTIVE

The two primary goals to be achieved by a characterization are:

- Collection of enough data on the amount of contamination present to allow realistic cost estimates for radioactive and otherwise contaminated waste disposal.

- Identification of the extent of contaminated materials, areas, and equipment, to allow optimum task planning for the eventual Decontamination and Decommissioning (D&D) process.

This facility was the subject of a previous sampling and preliminary characterization effort. Data from those studies helped to define the approximate condition so that an appropriate Field Characterization Plan could be designed. Lead was sampled in 1994 and a thorough sampling of asbestos had been performed by ESH-IH prior to the start of the characterization. Also, the previous data from the composite sludge sample inside the tanks will suffice to meet the data requirements of the Characterization Plan dated June 1996, reducing work to be done.

The 310 Retention Tank Facility has been slated for a D&D Project leading to complete decontamination and full release for unrestricted use. Thus, the identification of radioactivity levels above free release levels is critical for accurate D&D planning.

II. HISTORY OF THE RETENTION TANK FACILITY

The Building 310 service floor retention tank facility was originally installed over 30 years ago. The facility consists of three rooms containing three tanks each, and a larger room containing one tank, for a total of ten tanks (see Figure 1). Access to the tanks is via a metal grate walkway about one meter above the floor in each room. Pipe tunnels connect the tanks to the Building 306 service floor "tank farm" (see Figure 2). One pipe tunnel runs under the paved area south of 310 to a space under the 306 north dock, room B007. This tunnel was sealed at the 306 end; in Building 310, access is blocked by a steel grate. The door to the entrance to room A-068A has a sign that reads "EBR-II Storage Retention Tank Area".

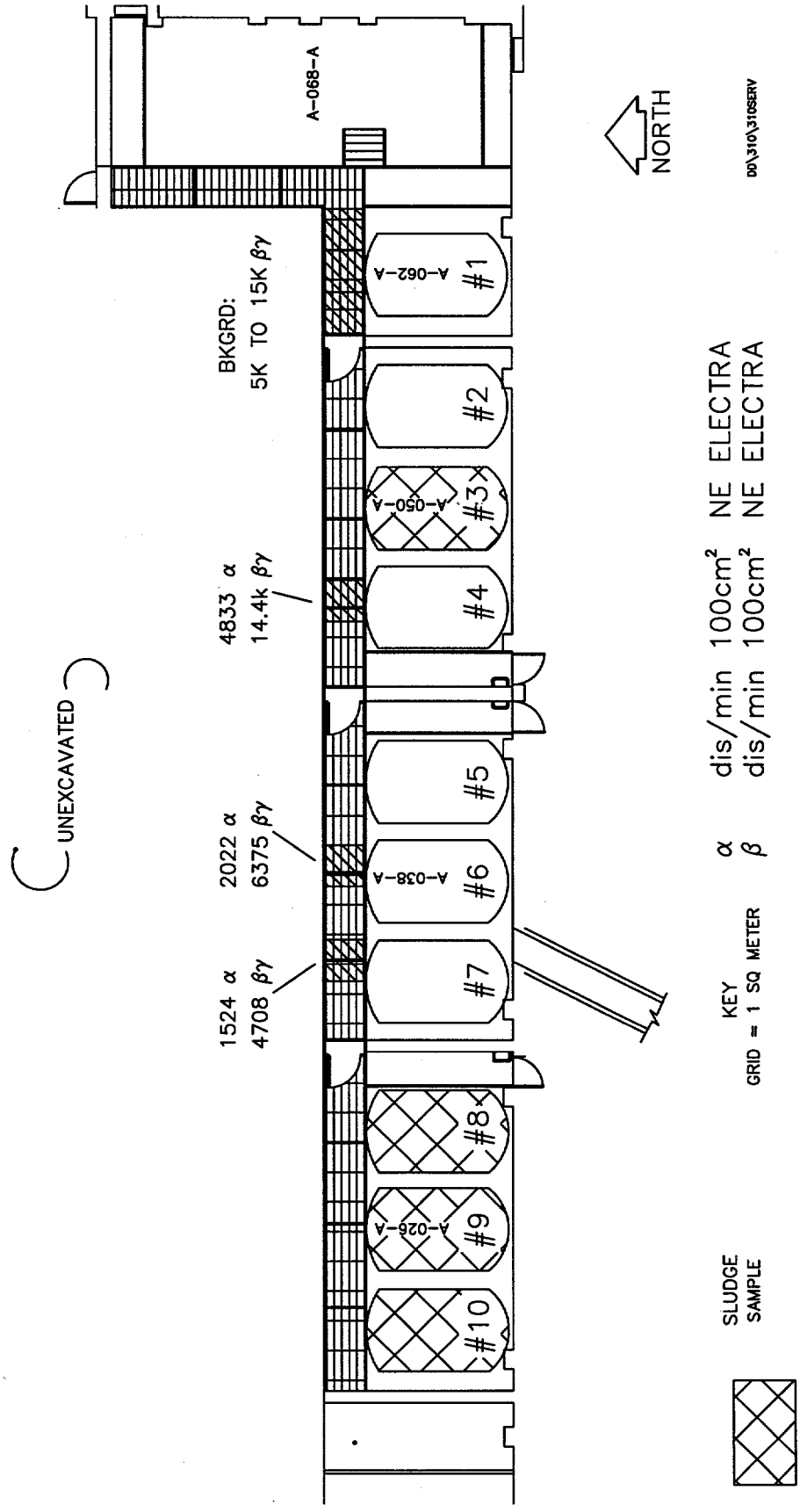


FIGURE 1 Building 310 Retention Tanks; Service Floor

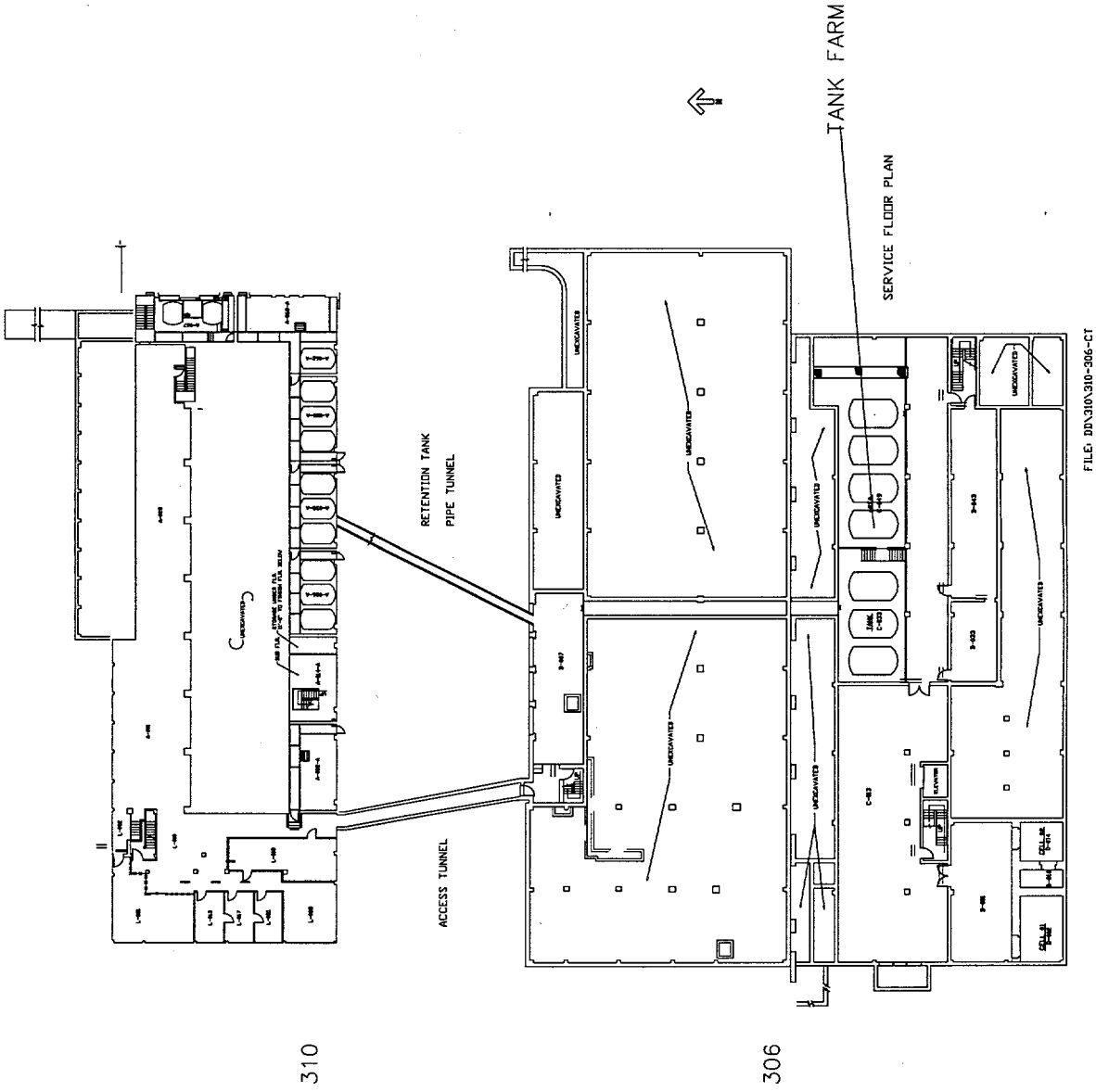


FIGURE 2 Buildings 310 and 306 with Connecting Tunnels

The primary purpose of the tanks was to act as excess storage capacity for the Building 306 tanks when necessary. The operator of the 306 liquid waste system recalls that the 310 tanks were infrequently used for this purpose. The tanks were reportedly isolated from the 306 system about 15 years ago when it was decided that the excess capacity was no longer necessary. The tanks have remained dormant since that date. Third party information indicates that waste water was also pumped from tanks on trucks in the paved area into the retention tanks. A hose would have been used to transfer the waste. At the beginning of the characterization, there was a black hose in room A-038A.

Ventilation flow through the three rooms is poor but adequate to maintain a breathable atmosphere. Several pipe openings to the outside exist along the south upper wall of each room. There is also a small door with ventilation louvers in each room. After these doors were opened, the musty odor in the rooms disappeared. The middle room, A-038A, is continuously flooded by groundwater to a maximum of about 75 cm (30 inches), and the tank supports and metal grate steps have corroded excessively. The black hose was eventually used to pump the standing water from the floor of the room to one of the active building retention tanks in room A-067. This water was tested according to ANL procedures before it was released. The remaining rooms show no extensive signs of water damage.

A composite sludge sample from the four tanks indicated in Figure 1, was obtained on 7/23/95 during the preliminary characterization effort. The sample shows minimal levels of hazardous chemicals (below the RCRA levels defined in 40 CFR 261), but significant levels of radioactive contaminants, that are listed in Table 1. A copy of the sampling results from TAM Thermo Analytical Inc., can be found in Appendix D (page D-12) with letters from J. Demski (page D-15) and R. Rose (page D-16).

TABLE 1 Sludge Sample Composition

β Radionuclide	Activity (pCi/g)	α Radionuclide	Activity (pCi/g)
^{137}Cs	107,200	^{238}U	23,270
^{234m}Pa	6,173	^{234}U	16,560
^{234}Th	3,994	^{235}U	2,276
^{60}Co	2,369	^{239}Pu	65
^{40}K	171	^{241}Am	11
^{90}Sr	88	^{238}Pu	3
β Sum	119,995.0	α Sum	42,185.0

III. CHARACTERIZATION METHODOLOGY

The general approach of the characterization can be summarized by the following steps:

- took samples for airborne radon daughters and airborne radioactive particulates,
- thoroughly alpha and beta scanned the floor, the brick wall and the other walls up to one meter for each room to look for localized regions or spots with elevated radiation levels,
- gamma scanned the tanks and pipes to measure maximum radiation exposure rates,
- collected or reviewed available data for hazardous constituent content in tank sludges and standing water,
- randomly selected locations at which smear samples were taken on walls, floors, ceilings, pipes and tanks. Recorded X, Y coordinates of each location (if a spot or area with elevated radiation levels was identified during the general gamma scan, that location was selected for additional smear sampling),
- at each selected location large area smears or 100 cm^2 smears were taken to determine removable α and $\beta\gamma$ dpm/100 cm^2. Analyze some elevated smears by gamma spectrometry,
- took smear samples from inside the tanks to determine removable α and $\beta\gamma$ activities,
- tested paint on the tanks and on the walls for lead,

Samples were pre-numbered and labels for the sample envelopes or plastic bags were pre-printed. An example of a sheet of sample labels is given in Appendix A. The samples were checked off when completed and also when analyzed for gross α and β activity. Full lists of sample results are given in Appendix B for smear and brick samples; Appendix C for air samples; and Appendix D for samples sent to Industrial Hygiene (ESH-IH), Bioassay (ESH-DA), Heritage Environmental Services, TMA Thermo Analytical Inc., or the Control Lab (ESH-DA) for analysis.

Elevated field measurements were recorded on special maps. Maps of field data with elevated readings are included in the body of the report as they are discussed for each room.

Special procedures were prepared for the tunnel survey. The procedure is given in Appendix E along with the Confined Pace Entry Permit.

IV. SCHEDULE

The Health Physics Section of the ANL-E Environment Safety and Health Division began characterization field work on June 26, 1996 and completed field work on August 13, 1996. The water in room A-038A was sampled on June 25, 1996. Analyses of the water samples were completed on July 22, 1996. Water was initially pumped from the room on July 25 and 26 into an active retention tank in room A-067. The active retention tank was sampled by the Control Lab according to the ANL retention tank requirements before the water was released to the site drains. The analysis results are included in Appendix D (pages D-17 through D-20), retention tank sample no's 119990 through 19996. A large fan was used in an attempt to dry the floor on July 27 and 28. However, on Monday July 29, there was still water on the floor. The sump pump was used but even this did not dry the floor completely.

V. QUALITY ASSURANCE

The Quality of the characterization process was assured by the following actions:

- All work was performed in compliance to the QA plans of the ESH Division, and the Health Physics Section.

- Calibration and Operational Checks - all instrumentation used in the characterization surveys were checked daily for proper operation. A log was maintained for operational checks. All radiation detection instrumentation were calibrated with NIST traceable radioactive sources. Instruments' calibration records are given in Appendix F.

- Data Protection - all data stored on computers were backed up daily.

- Special attention was given to contamination control during sampling of potentially contaminated materials to assure that the characterization process did not alter or bias the true condition of the facility.

VI. SAMPLES AND MEASUREMENTS IDENTIFICATION SYSTEM

Samples were identified by a five element code:

Type sample	Element 1
Room no. or Tunnel	Element 2
Location	Element 3
Sequential Number	Element 4
X, Y coordinate	Element 5

Following are the notations used for each element.

Type of sample

SA Smear	100 cm^2 smears
LA Smear	>100 cm^2 smears
internal smear	>100 cm^2 smears inside pipe flange at the tank
brick	scrapings from a brick knock out wall
air	retrospective air samples

Room No. or Area

A-026A	Tank Room shown in Figure 1
Tunnel # 1	pipe tunnel from Bldg 310 to Bldg 306 shown in Figure 2
Tunnel # 2	pipe tunnel from Bldg 306, room B-007 to the tank farm

Location

North Wall
South Wall
East Wall
West Wall
Floor
Ceiling
Tank #
Pipe # - pipes at the top of tank #

X,Y Coordinate (all distances in feet)

- For walls, the origin 0,0 is at the lower left corner
- For floors the origin 0,0 is at the southwest corner
- For the tanks a letter designation indicates the side of the tank that was smeared, the origin 0,0 i.e. at the lower left edge
- For the tank pipes the origin 0,0 is at the floor and left side of the tank when facing the south wall.
- For the overhead pipes in room A-038A the origin 0,0 is at the floor and the west wall

VII. RELEASE CRITERIA AND BACKGROUND VALUES

To interpret the quantitative results of the characterization, the data were compared to currently accepted release criteria and background values typically found in the natural environment.

Following are the principal release and background values:

Surface Contamination Release Criteria- Removable and total surface contamination limits (for unrestricted release of nonporous materials) used by the USNRC and by DOE are given in USNRC Regulatory Guide 1.86 (reference 1) and are listed in the following Table 2. The Regulatory Guide 1.86 values were adopted by DOE and are also listed in DOE Order 5400.5A (reference 2) and the draft rule 10 CFR 834 (reference 3).

Lead in paint release criteria - paint is considered to be lead-containing if it has greater than 0.5% lead by weight.

Background radiation exposure rate - the radiation exposure rate inside most buildings at ANL-E is typically 10-15 μR/h. This value is consistent with the natural background exposure rate in the midwestern USA (reference 4). The environmental penetrating radiation from areas surrounding ANL were 82 $\pm$ 10 mrem/y (9.4 $\pm$ 1.1 μR/h); from the ANL boundaries the penetrating radiation ranged from 67 mrem/y (7.7 μR/h) to 95 mrem/y (10.9 μR/h) (from reference 8).

Background radioactivity in soil - the activity concentration in soil is predominantly due to naturally occurring radionuclides in the uranium and thorium series. Some non natural radionuclides found in soil are due to atmospheric fallout. Typical concentrations in soil of the major natural and fallout radionuclides are listed in Table 3 from reference 8.

TABLE 2 Allowable Residual Surface Contamination Limits (dpm/100 cm^2)

Total (fixed and removable) Radionuclides	Average	Maximum	Removable
Transuranics, I-125, I-129, Ra-226, Ac-227, Ra-228, Th-228, Th-230, Pa-231	100	300	20
Th-Natural, Sr-90, I-126, I-131, I-133, Ra-233, Ra-224, U-232, Th-232	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay product, alpha emitters	5,000	15,000	1,000
Beta-gamma emitters (except Sr-90)	5,000	15,000	1,000

TABLE 3 Typical Background Concentrations in Soil and Sediments

	Soil Average		Bottom Sediments Average	
Radionuclide	ANL Perimeter	Off-Site	ANL Perimeter	Off-Site
	Activity pCi/g			
^{40}K	18.62 ± 2.39	19.03 ± 7.01	8.28 ± 3.16	11.09 ± 11.53
^{137}Cs	0.49 ± 0.40	0.33 ± 0.31	0.36 ± 0.19	0.13 ± 0.35
^{226}Ra	1.07 ± 0.39	1.22 ± 0.88	0.48 ± 0.16	0.80 ± 1.03
^{228}Th	1.11 ± 0.32	1.10 ± 0.44	0.38 ± 0.15	0.65 ± 0.83
^{232}Th	0.86 ± 0.17	0.81 ± 0.29	0.30 ± 0.09	0.52 ± 0.60
	Activity fCi/g			
^{238}Pu	0.5 ± 0.2	0.3 ± 0.1	0.7 ± 0.7	0.1 ± 0.4
^{239}Pu	13.2 ± 2.7	8.7 ± 2.3	10.3 ± 6.8	3.7 ± 9.0
^{241}Am	4.5 ± 0.9	3.4 ± 1.0	4.0 ± 2.7	1.9 ± 2.7

pCi = 10^{-12} Ci
fCi = 10^{-15} Ci

Asbestos release criteria - a material (e.g., insulation, pipe joint compound, floor tile) is considered asbestos-containing if it contains greater than 1% asbestos by weight.

Hazardous material release criteria - a RCRA (Resource Conservation Recovery Act) hazardous waste is defined as waste which meets one of the following two criteria:

1. it exhibits the 40 CFR 261.20 (reference 7) specific properties of

   - ignitability
   - corrosivity
   - reactivity
   - toxicity, and

2. it is listed in 40 CFR 265 (reference 7) as a RCRA hazardous waste, and it exceeds the specified concentration limits.

Airborne radioactivity limits - annual average concentration guidelines for the workplace are listed as derived air concentrations (DAC) in the DOE rule 10 CFR 835 (reference 5). However, the concentration of non naturally occurring radionuclides is expected to be non detectable in non radiological areas. The DAC values (reference 6) are listed in Table 6 for the radionuclides identified in the tank sludge sample, or on the air samples.

Retention tanks radioactivity release limits - at ANL-E, laboratory waste water is collected in retention tanks and is sampled and analyzed for alpha and beta radioactivity before being released to the laboratory waste water treatment plant. The release limits are ten times the drinking water standard: 0.03 pCi/ml (0.067 dpm/ml, the derived concentration guide for ^{239}Pu) for alpha activity, and 1.0 pCi/ml (2.22 dpm/ml, the derived concentration guide for ^{90}Sr) for beta activity. Liquid waste exceeding these limits is processed to remove the contamination, normally by evaporation, and the residue disposed of as radioactive waste.

VIII. INSTRUMENTATION

Instrumentation was chosen to assure that the MDAs for the selected instrument/technique was less than the release criteria. A listing of the principal instruments used and their typical MDAs is given in Table 4. Photographs of the principal instruments used for the characterization are shown in Figures 3 through 10.

IX. NUMBER OF MEASUREMENTS AND SAMPLES

A listing of the type and number of measurements performed and samples collected during the characterization is given in Table 5.

X. RESULTS

A. Surprises

The characterization identified the following unexpected conditions:

1. The radiation levels from the tanks were too high to perform a meaningful γ scan with the PG-2 detector.

TABLE 4 Instruments Used for Characterization

Purpose	Instrument	Detector Description	Measurement Units	Typical Characteristics	Typical MDA*
Total Surface (α)	NE Technology, Ltd. ELECTRA	Dual Scintillator 100 cm^2 sampling area 0.5 mg/cm^2	cpm	21% ^{241}Am efficiency, 30 sec residence time, ≤7 cpm background	98 dpm
Total Surface (β-γ)	NE Technology, Ltd. ELECTRA	Dual Scintillator 100 cm^2 sampling area ~ 6 mg/cm^2	cpm	29% ^{90}Sr-Y efficiency, 30 sec residence time, ≤400 cpm background	410 dpm
Removable Surface (α)	Tennelec APC	Gas Proportional 5 cm dia. 0.1 mg/cm^2	cpm	30% ^{241}Am efficiency, 2 min count time, ≤1 cpm background	17 dpm
Removable Surface (β-γ)	Tennelec APC	Gas Proportional 5 cm dia. 0.1 mg/cm^2	cpm	42% ^{90}Sr-Y efficiency, 2 min count time, ≤40 cpm background	86 dpm
Removable Surface (α)	DABRAS	Gas Proportional 200 cm^2 0.4 mg/cm^2	cpm	27% ^{241}Am efficiency, 2 min count time, ≤2 cpm background	18 dpm
Removable Surface (β-γ)	DABRAS	Gas Proportional 200 cm^2 0.4 mg/cm^2	cpm	49% ^{90}Sr-Y efficiency, 2 min count time, ≤270 cpm background	86 dpm
Exposure Rate (γ)	Ludlum Model 3	Energy Compensated GM Side Window	mR/h	2 sec residence time 12 cpm (i.e., 0.01 mR/h) Bkgd	0.1 mR/h net
Exposure Rate (γ)	Eberline RO-20	Air Ionization Chamber 220 cc interleaved	mR/h; R/h	5 sec response time, ≤0.1 mR/h background	0.1 mR/h net
Find Elevated x-γ	Eberline PRM 5-3 with PG-2 detector	5 cm diameter x 2 mm thick NaI (Tl)	cpm	2 sec residence time 500 cpm background	1500 cpm net
Continuous Air Monitor	Eberline Alpha Air Monitor Alpha 6A	Silicon diffused Junction 25 mm dia.	pCi/L & WL	45% ^{239}Pu efficiency 2Pi, gross count 1 hour integrate	0.05 mWl .05 pCi/L

* Note: The typical MDA for the NE Technology, Ltd. ELECTRA, the Ludlum Model 3 and the Eberline PRM 5-3 with a PG-2 detector is based upon the use of audio output to enhance the discernment of recordable measurements.

TABLE 5 Measurements & Samples Required for Retention Tank Characterization

Item	Total Number
Type of measurement	
General α and β scan	24
General exposure rate	20
Spot direct αβγ	282
Spot exposure rate	40
Spot direct γ	12
Type of samples collected	
Smears	289
Tank paint scrapings	10
Brick wall scrapings	13
Air	19
Sludge (Composite from four tanks)	1
Water	10
Type of sample analyses	
Gross αβγ	395
γ spectroscopy	6
α spectroscopy	1
Lead	10
Hazardous materials	2
PCB	1

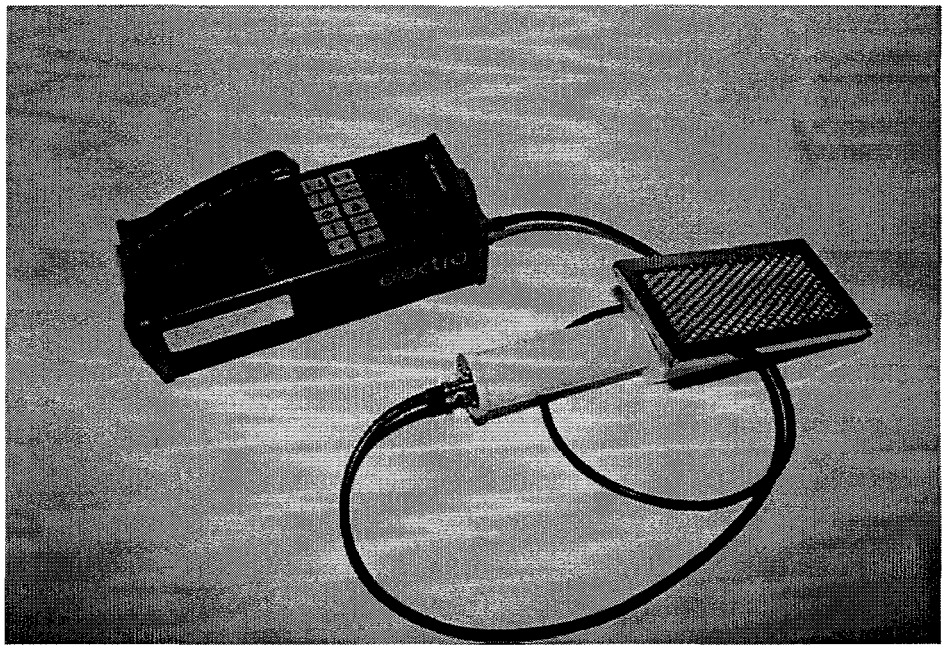


FIGURE 3 NE Technology Model Electra with 100 cm^2 Detector for Measuring $\alpha\beta\gamma$ Surface Contamination

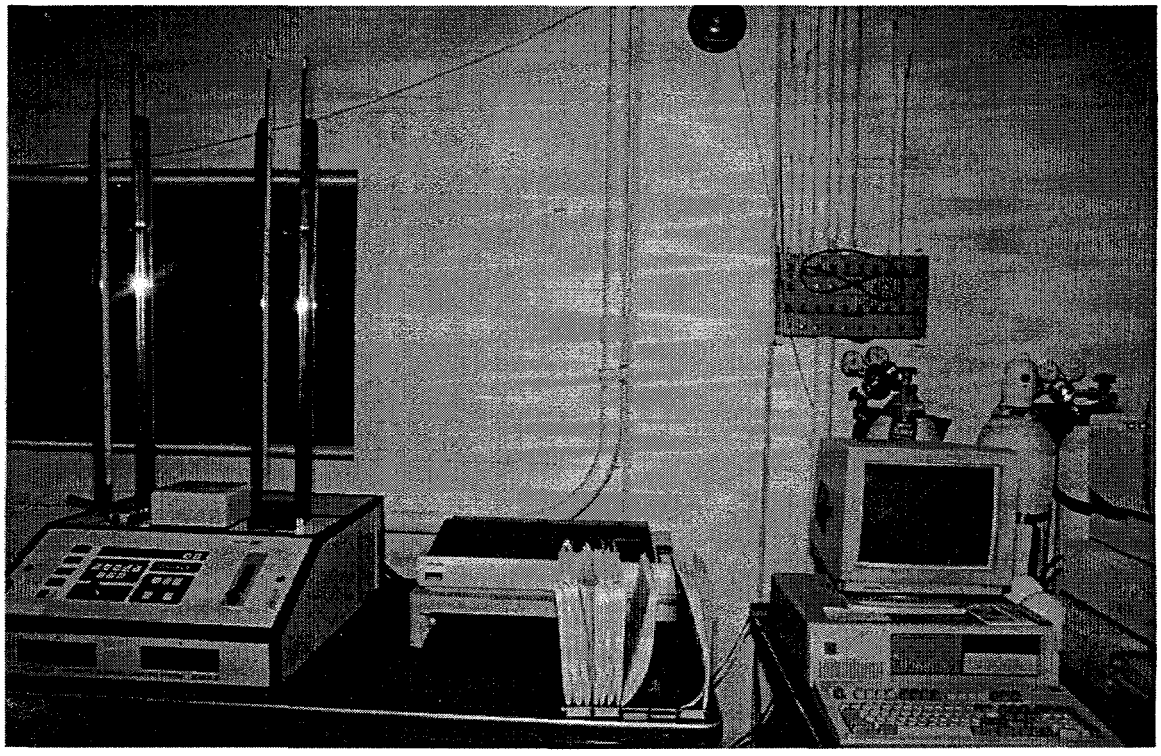


FIGURE 4 Tennelec APC MII Smear Counting System

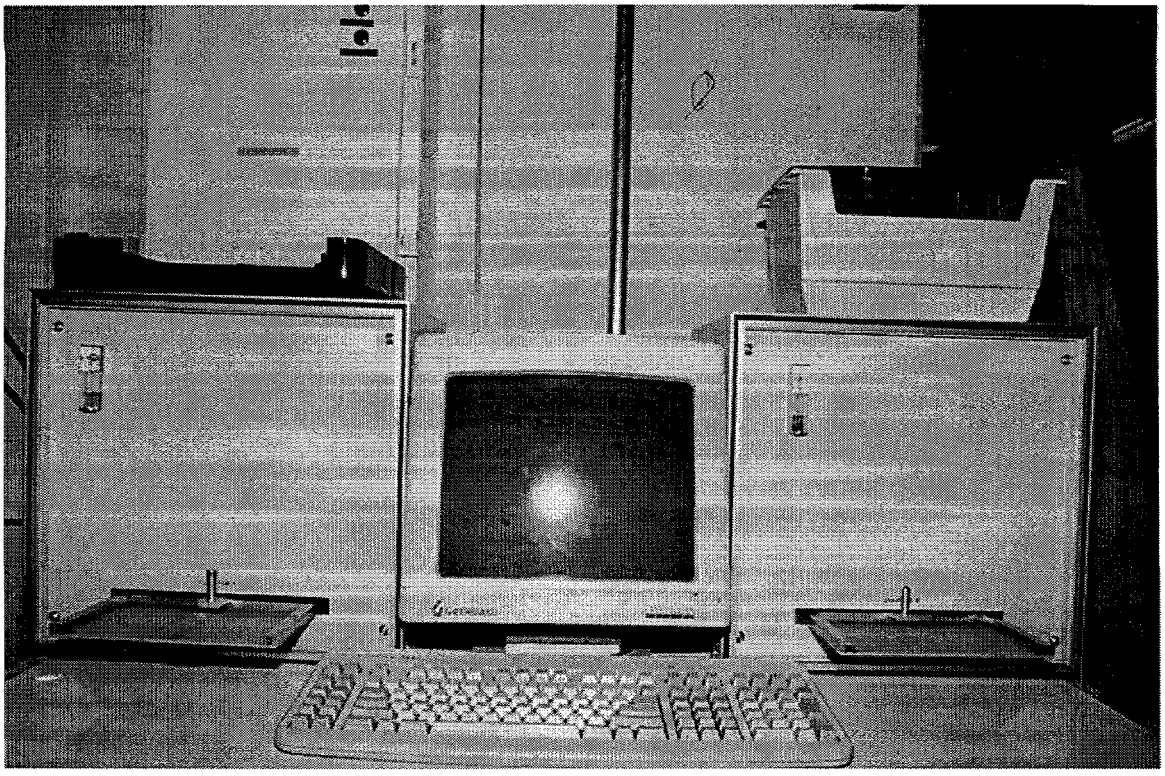


FIGURE 5 Dual Alpha Beta Radioactivity Assay System (DABRAS) for smear counting

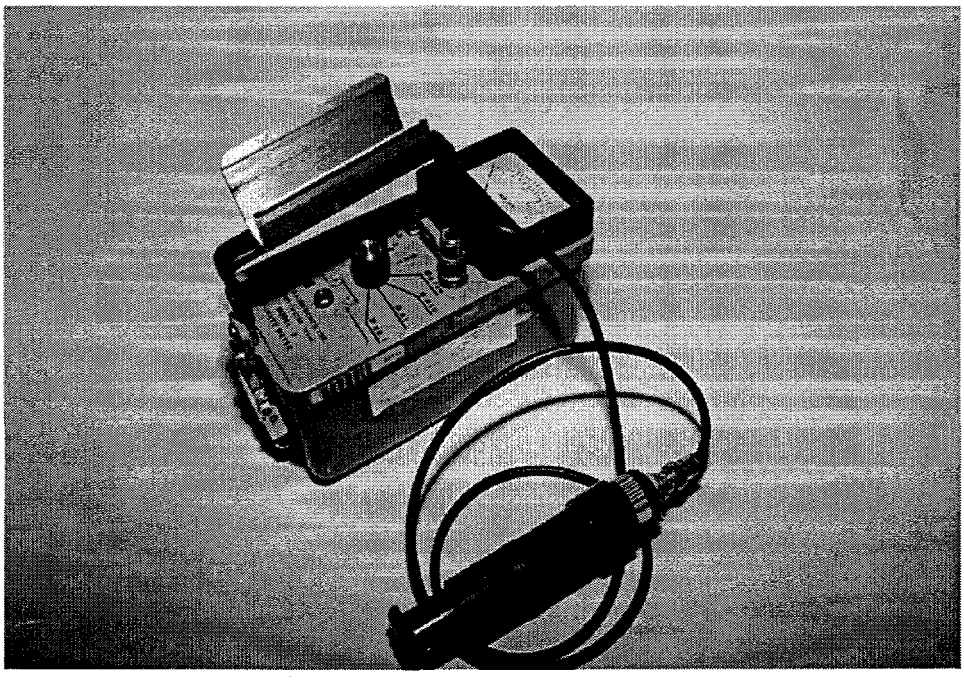


FIGURE 6 Ludlum Model 3 Energy Compensated GM

FIGURE 7 Eberline RO-20 Air Ionization Chamber

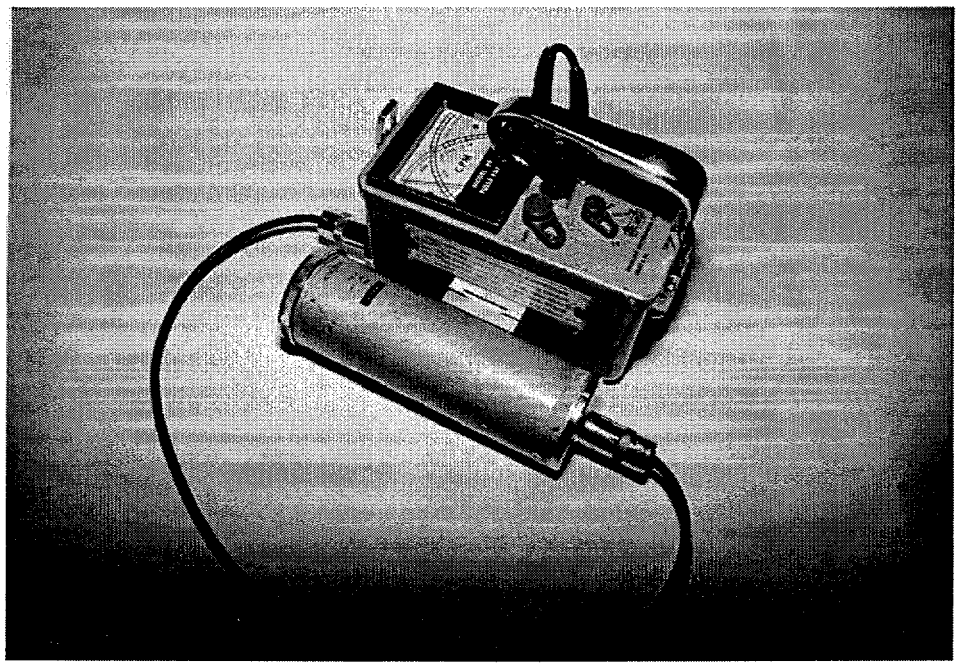


FIGURE 8 Eberline PRM-5-3 with PG-2 Scintillation Detector (2" x 2mm thick NaI detector)

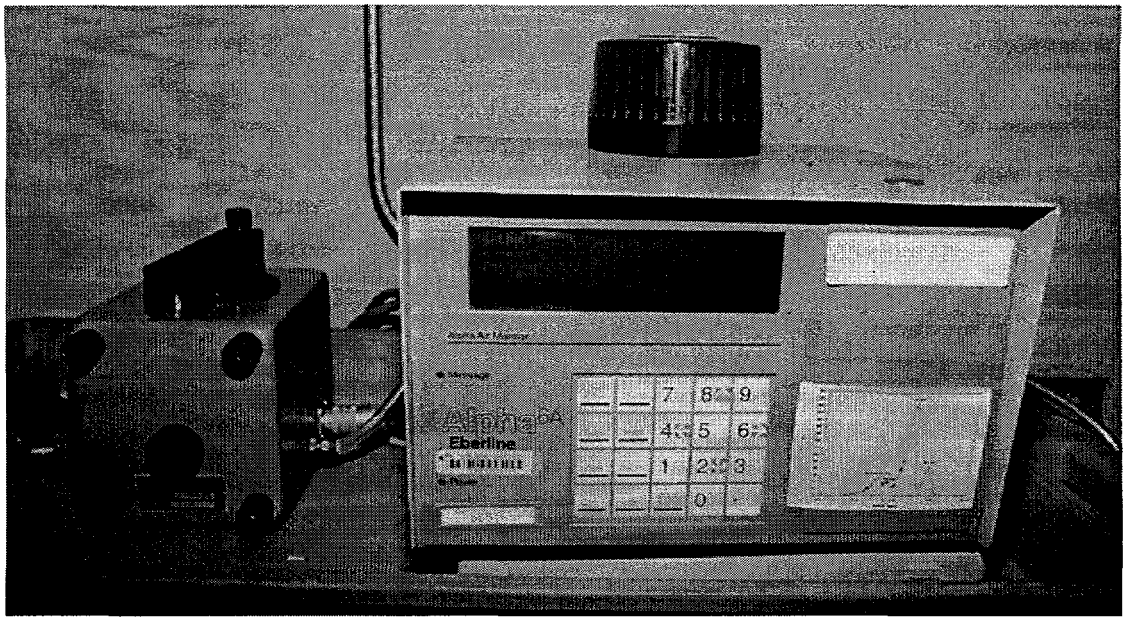


FIGURE 9 Eberline Alpha Air Monitor

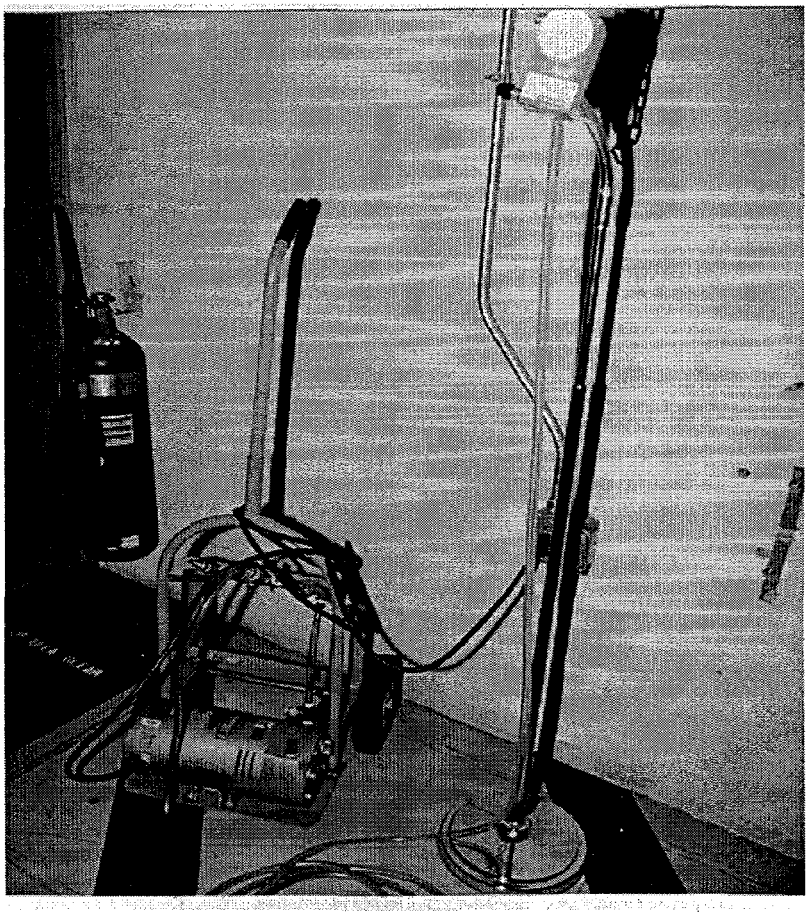


FIGURE 10 Retrospective Air Sampling System

2. Tar paper was found on floors and lower walls in rooms A-050A and A-038A.

3. Direct surface contamination was found on floors and/or walls in rooms A-062A, A-050A, A-038A and A-026A.

4. Fixed and loose contamination was found on the outside of tanks #1, #3, #4, #5, #6, #7, #8, #9, and #10.

5. Because of the close quarters in the rooms, the floor monitor was not used. Therefore only room A-068A had the debris vacuumed from the floor.

6. Direct and loose contamination on pipes in A-038A suggest a leaking pipe.

7. Airborne β contamination, ^{137}Cs and ^{60}Co (see Table 15).

B. Lead in Tank Paint Results

Paint was removed from tanks in rooms A-026A, A-038A, A-050A and A-062A and analyzed for lead. The paint did not contain lead. The memos from ESH-IH documenting the inspection results are contained in Appendix D (from M. Bonkalski dated January 9, 1995 [page D-21] and from D.R. Lucas dated August 21, 1996 [page D-23]). The paint on the walls of rooms A-026A, A-038A and A-050A was sampled in September. The memo is in Appendix D dated September 26, 1996 (page D-34).

C. Asbestos Results

The elbows and some of the straight runs of the pipes are covered with asbestos containing insulation. The memo from ESH-IH documenting the inspection results is contained in Appendix D (from M. Bonkalski, dated January 9, 1995) along with the HSA Database Table for Building 310 documenting the asbestos study that was performed in the building (pages D-24 through D-33).

D. Air Sample Results

Two types of air samples were collected, a continuous sample in room A-026A for naturally occurring radon, ^{220}Rn and ^{222}Rn; and grab samples in rooms A-026A, A-038A, A-050A, and A-062A for long lived radioactivity.

For the continuous sample, both the alpha energy spectrum and the air concentrations were stored and plotted (see Figures 11 through 14). The spectrum is typical for ^{220}Rn and ^{222}Rn daughter products. Both the ^{222}Rn concentration and working level exhibit strong diurnal variations (see Figures 11 and 12). The ^{222}Rn concentrations indicate that the yearly average will be below the residentially permitted yearly average concentration of 4 pCi/l. The ^{220}Rn working level exhibits much weaker diurnal variations. Examinations of the α spectrum from the Alpha 6 Continuous Air Monitor reveled oscillations on the low energy tail of the 6 MeV peak from ^{218}Po and ^{212}Bi, decay daughters of ^{222}Rn and ^{220}Rn respectively (see Figures 13 and 14). Long-lived radionuclides could not be distinguished. On July 9, 1996 the air monitor was turned off for several hours; then turned on for a short collection time, before the spectrum was stored. The predominant radionuclides in the alpha spectrum were the thoron daughters ^{212}Bi at 6 MeV and ^{212}Po at 8.8 MeV. A copy of the alpha spectrum is presented in Appendix C (C5 and C6).

The grab samples were changed at least once each week during the characterization effort from June 26 through July 26. The flow rate of each sample was 40 l/min. The sample collection times ranged from 3 days to 7 days. The initial counts after at least five days indicate low levels of activity, up to 7.6 $\pm$ 3.7 dis/min α and 43 $\pm$ 10 dis/min β. The air samples are tabulated and presented in Appendix C, Table C1. The air samples were recounted on a low background detector 26 to 47 days after removal. With the low background counter, there was between 3.2 and 8.6 dis/min α and between 16 and 38 dis/min β on the filters. The data sheets are in Appendix D (Tennelec LB4000 count started August 19, 1996 and August 21, 1996 [pages D-35 through D-39]). Although these levels are low $<2\%$ of a DAC for ^{239}Pu and $<0.02\%$ of a DAC for ^{90}Sr (see Table 6 for DAC values), they are above background levels. Fifteen air filters from the first four sampling periods were analyzed by γ spectroscopy as a single sample. The major beta emitters are ^{7}Be (84.6%) and ^{210}Pb (13.9%), naturally occurring radionuclides. ^{7}Be is a spallation product from the interaction of cosmic rays with ^{14}N. ^{210}Pb is the long-lived daughter of ^{222}Rn. However, there were also low levels of ^{137}Cs (1.4% of the gamma emitting betas) and ^{60}Co (0.2% of the gamma emitting betas). The analysis results are presented in Table 15 and the original data sheets are presented in Appendix D (310 retention room AFS #194, 195, 197 - 209 [page D-40]). The major alpha emitter could be ^{210}Po, a ^{210}Pb daughter since no ^{241}Am was seen in the gamma spectra. The only way to determine the actual alpha emitters is by ashing the sample and measuring the alpha spectra.

Depending on the dust loading, the alpha efficiency is between 5% and 35%; for calculation of the activities on the air samples, a 25% α efficiency was used. Depending on the radionuclide collected on the air filter, the beta efficiency is between 20% for ^{14}C and 50% for ^{90}Sr; for calculation of the activities on the air samples, a 40% β efficiency was used. The alpha DAC value of 5 dpm/m^3 for ^{238}Pu, ^{239}Pu or ^{241}Am (see Table 6) was used to calculate %DAC values. For calculational purposes, it was assumed that all of the α activity was due to transuranic

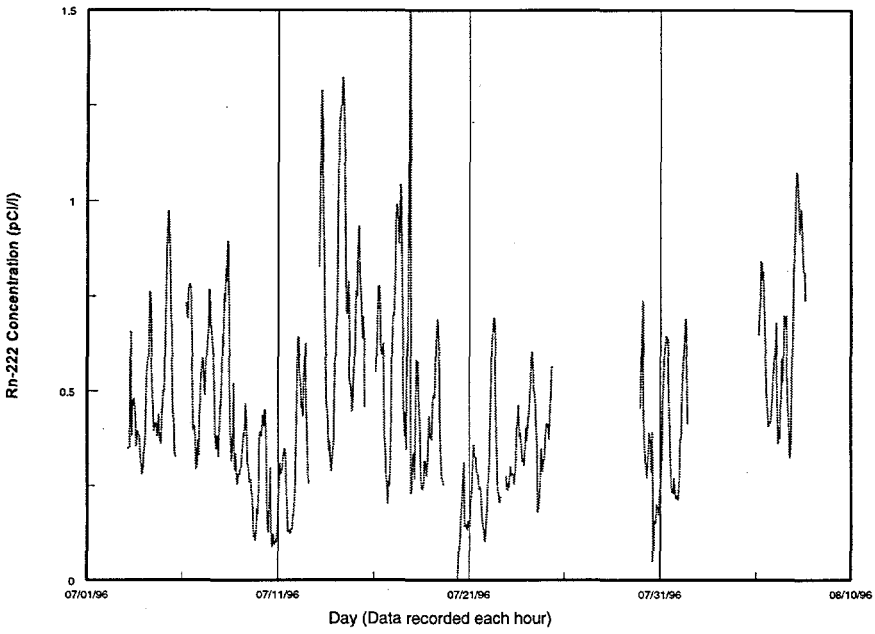


FIGURE 11 Radon Gas Concentrations

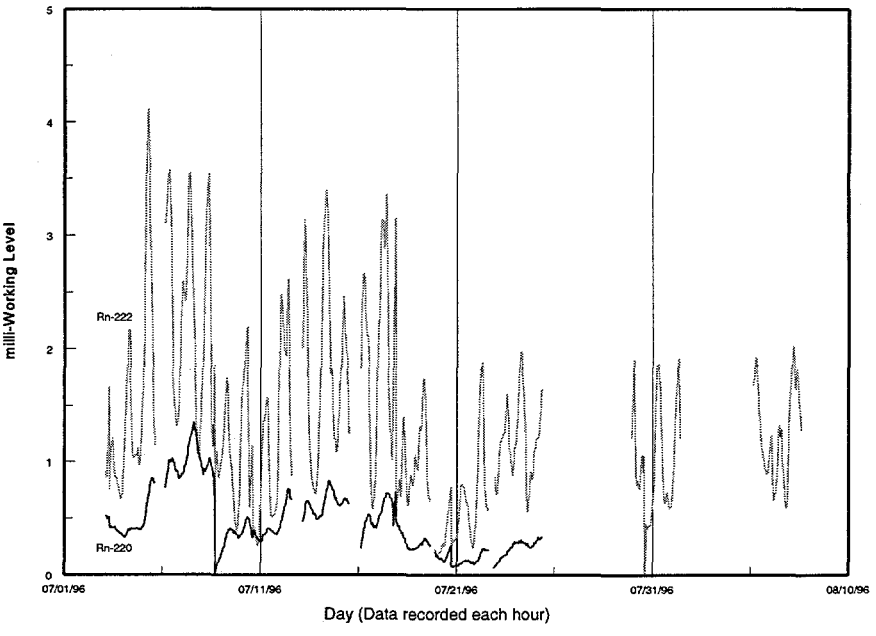


FIGURE 12 Radon Daughter Concentrations

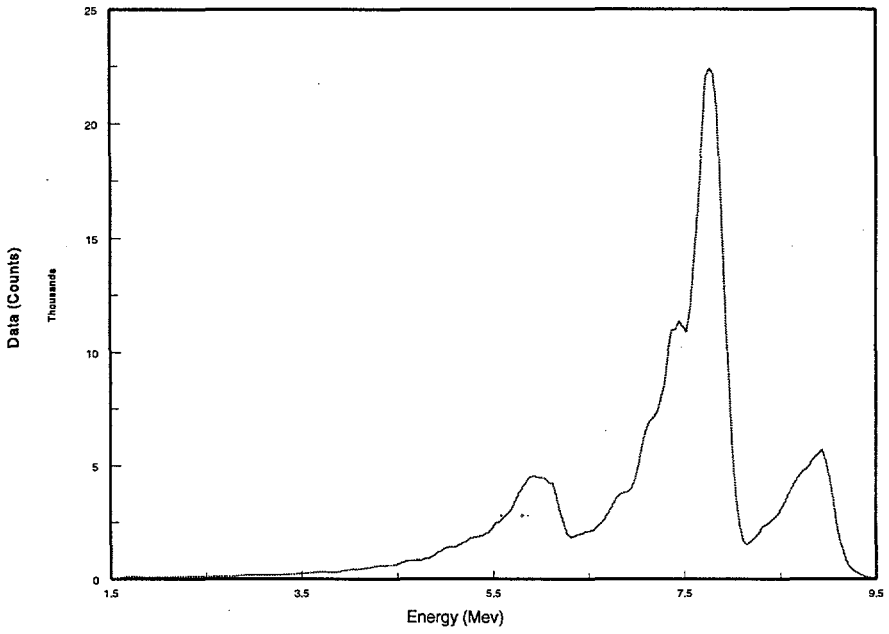


FIGURE 13 Airborne Alpha Particulate Spectra Collected 7/15

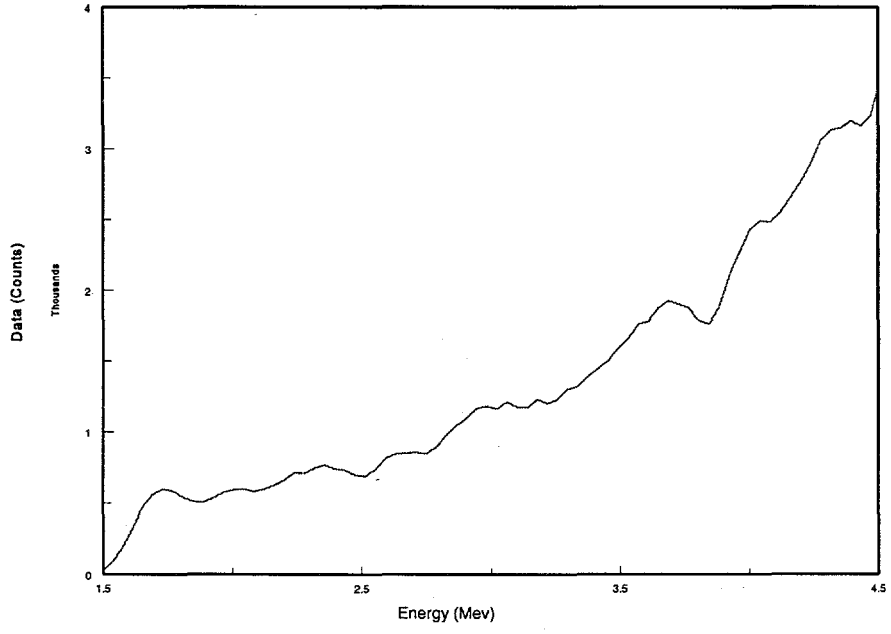


FIGURE 14 Low Energy Alpha Spectra Collected 7/15/1996

TABLE 6 Sludge Sample and Air Sample DAC Values

β Radionuclide	DAC dpm/m^3	α Radionuclide	DAC dpm/m^3
^{137}Cs	1 x 10^5	^{238}U	40
^{234m}Pa	6 x 10^6	^{234}U	40
^{234}Th	1 x 10^5	^{235}U	40
^{60}Co	3 x 10^4	^{239}Pu	5
^{40}K	4 x 10^5	^{241}Am	5
^{90}Sr	4 x 10^3	^{238}Pu	5
^{7}Be	2 x 10^7	^{210}Po	600
^{210}Pb	240		

radionuclides. The beta DAC value of 4,000 dpm/m^3 for ^{90}Sr was used to calculate %DAC values. If 240 dpm/m^3 (the DAC value for ^{210}Pb) was used to calculate % DAC for the β emitters, the maximum value would be < 0.2%. For calculational purposes, it was assumed that all of the β activity was due to ^{90}Sr. Graphs of the %DAC values for the air samples are plotted for each room as a function of the removal date in Figures 15 and 16. According to the ESH Manual, Chapter 5-02, section 235, if the airborne concentrations is >10% of any DAC value, the area shall be posted with a sign that reads "CAUTION AIRBORNE RADIOACTIVE AREA" and controlled to reduce the potential for internal exposure.

Most of the characterization efforts in rooms A-026A, A-050A, A-062A and A-068A were conducted between July 9 and July 12. This corresponds to the elevated concentrations of alpha radionuclides in the air of room A-050 and A-062A. Between July 19 and July 26, the tar paper on the floor of A-050A was smeared, brick samples were taken from the south wall of all four rooms, the inside of the tanks were smeared and the contaminated spots were smeared. Elevated airborne alpha activity was noted during this time. There were no noteworthy increases in the airborne beta activities.

E. Room A-026A Radiological Survey

The north, east and west wall of this room are painted from the grate to a height of ~5 feet. The south wall, except for the portion that is constructed of bricks, is also painted from ~3 feet to ~5 feet. The walls under the paint were not checked for either direct alpha or loose alpha and beta contamination. The direct exposure rates at the bottom of tanks 8, 9, and 10 range from 0.2 mR/h to 0.6 mR/h (see Figures 17 through 19). On tank 8 there is one location with direct

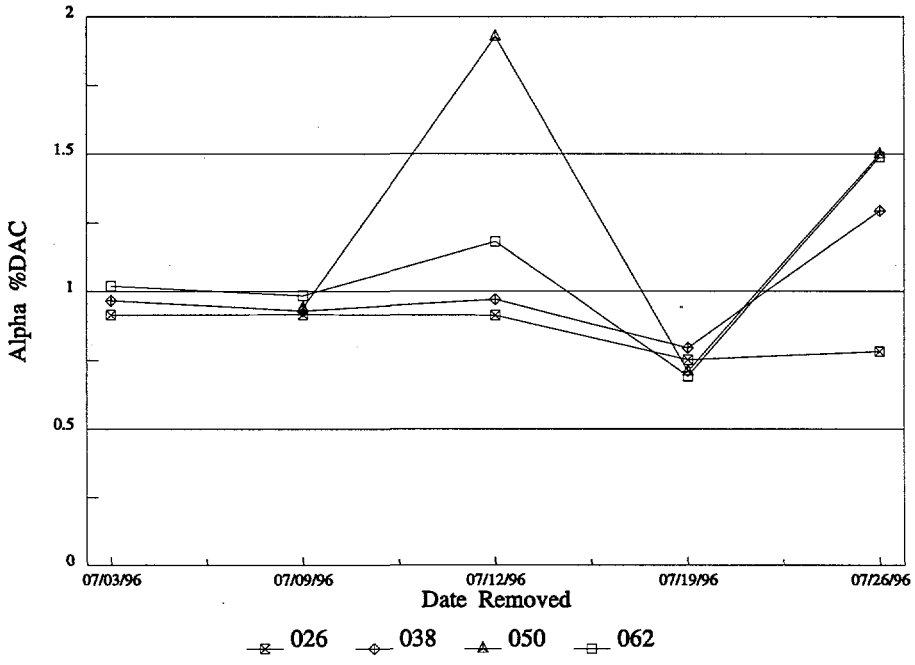


FIGURE 15 Retrospective Air Sample; Alpha Data

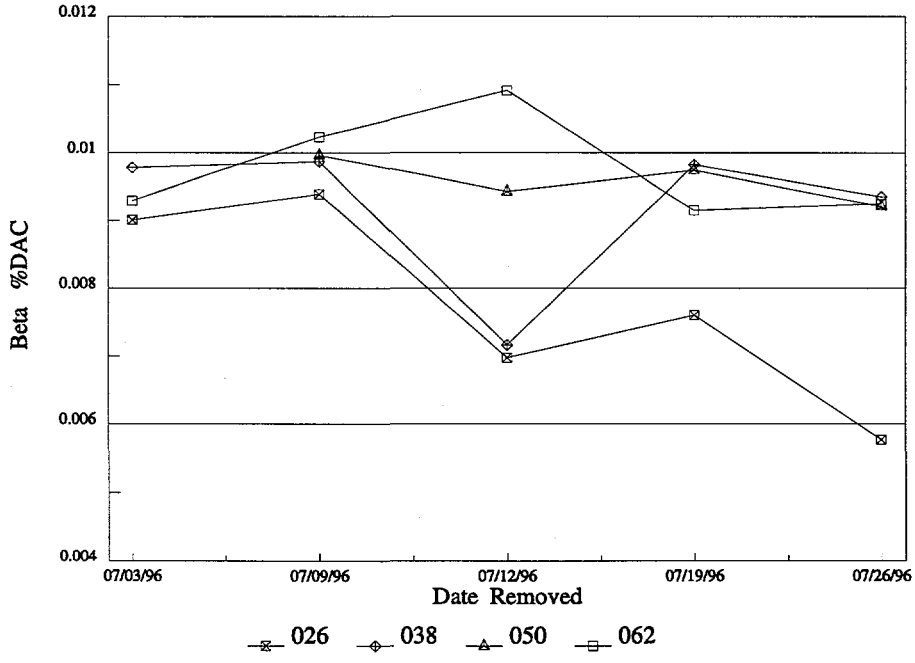


FIGURE 16 Retrospective Air Sample; Beta Data

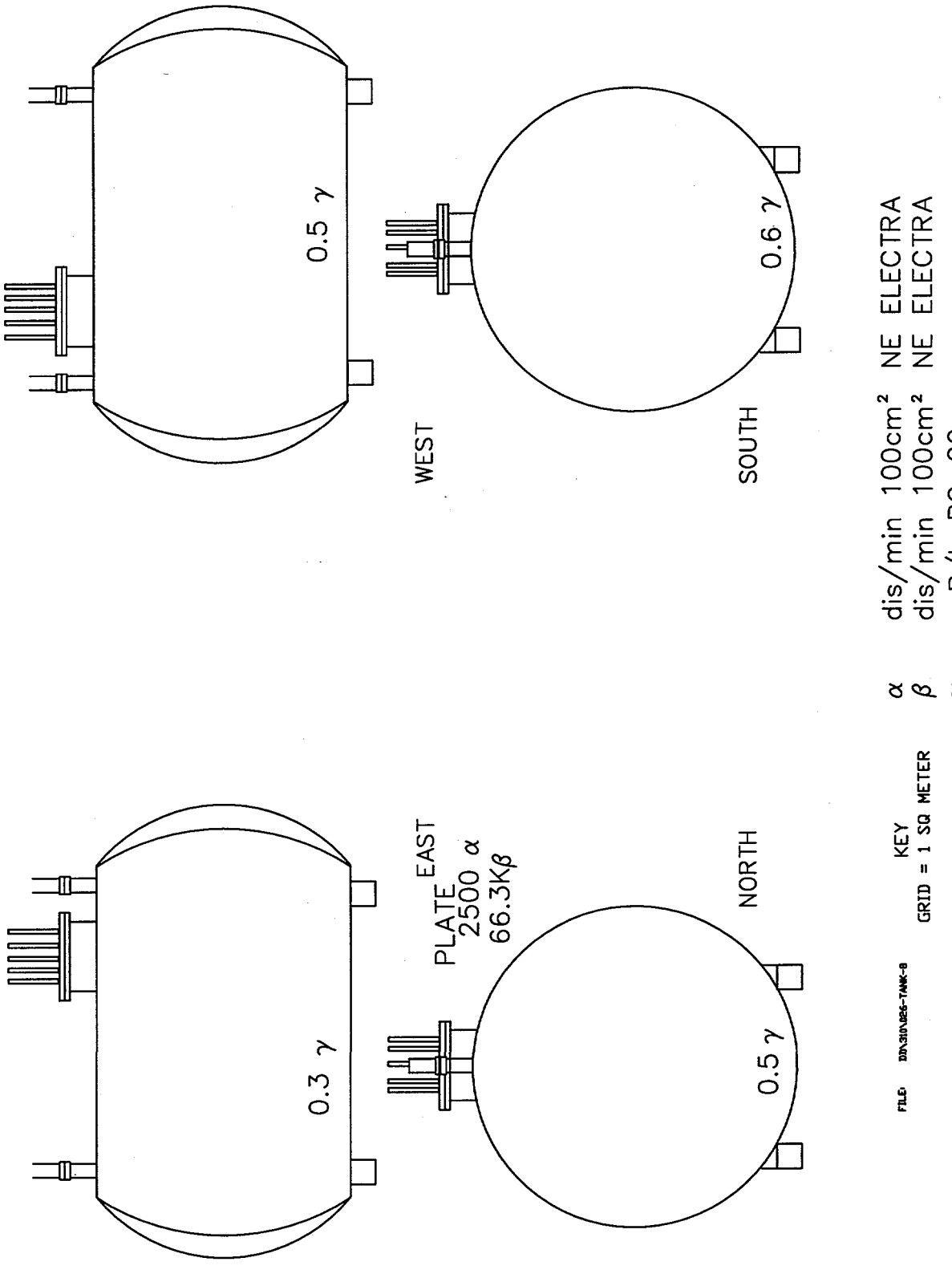


FIGURE 17 Building 310 Retention Tanks; Room 026 Tank 8

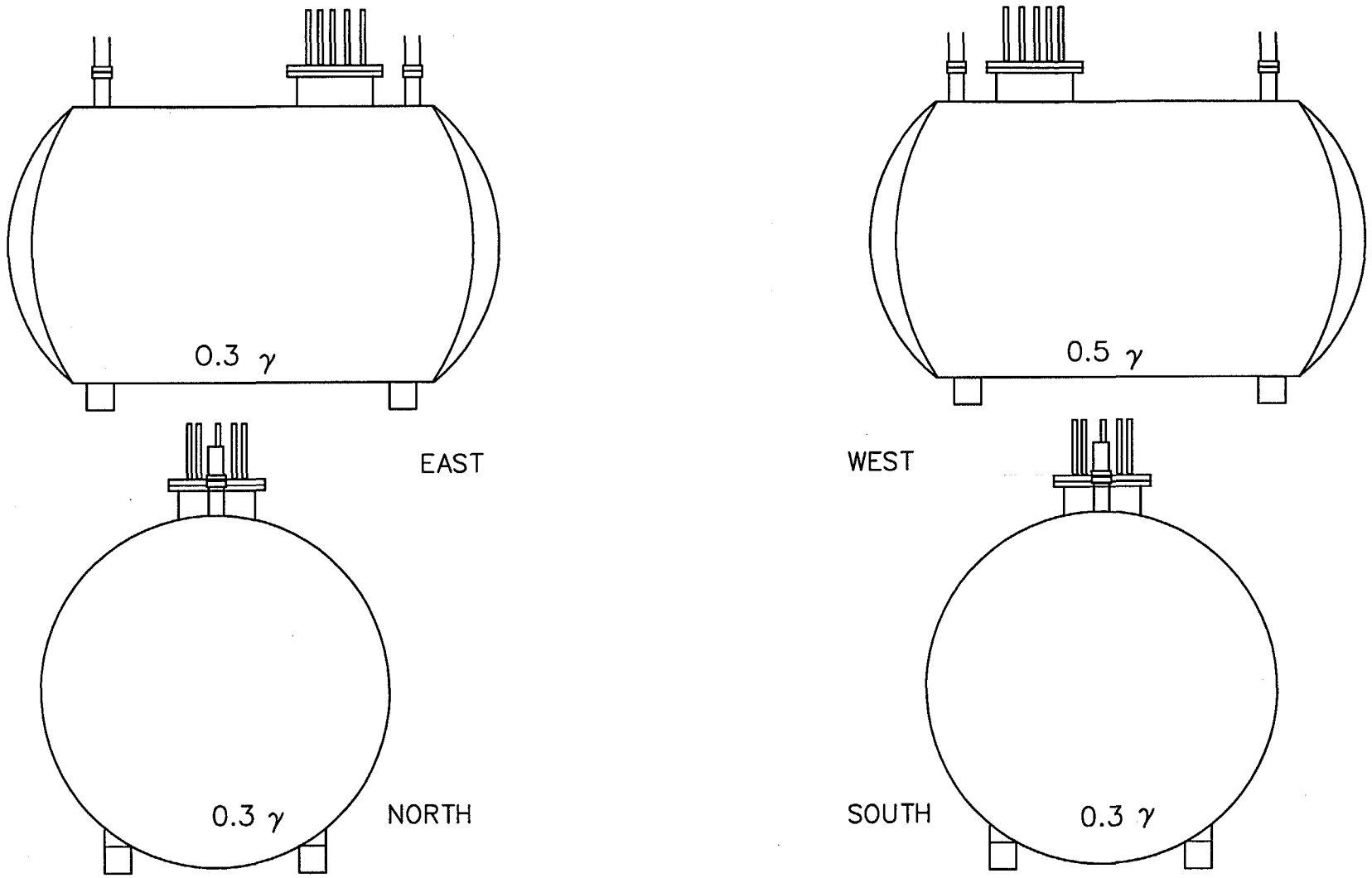


FIGURE 18 Building 310 Retention Tanks; Room 026 Tank 9

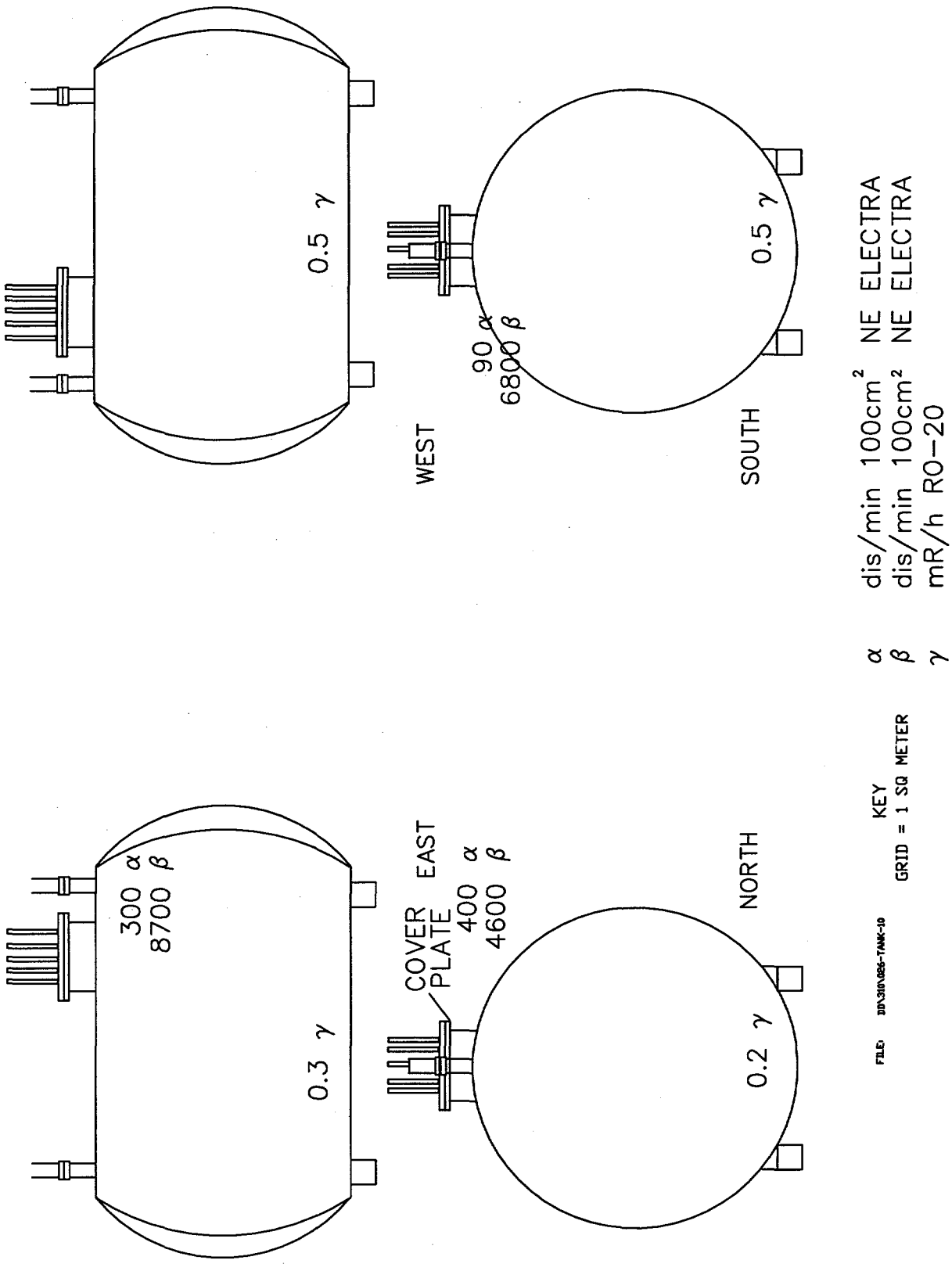


FIGURE 19 Building 310 Retention Tanks; Room 026 Tank 10

α activity of 2,500 dis/min-100 cm^2; the associated β activity is 66.3k dis/min-100 cm^2. On tank 10 there are three locations with direct α activity up to 400 dis/min-100 cm^2; the associated β activity is up to 8,700 dis/min-100 cm^2. There are also low levels of loose activity on the outside of the tanks and pipes, up to 28 $\pm$ 15 dis/min α and 103 $\pm$ 28 dis/min β from a smear of the entire surface of tank 9. The smear results are tabulated in Appendix B, Table B1.

Because of the contamination in the bottom of the tanks, direct surveys for β or γ contamination on the floor and walls was difficult. From Table 7 below, the level of activity that could be present and not detected is recorded. However, some contamination was detected above the background levels on the floor and south wall (see Figures 20 and 21). The direct activity was up to 1,900 dis/min α and 59.3k dis/min β using a 100 cm^2 detector. There were also low levels of loose activity, up to 32 $\pm$ 16 dis/min α and 105 $\pm$ 28 dis/min β on 100 cm^2 smears.

During the survey of this room, the walls and floor were dry. After a heavy rain storm on July 17, water was observed still seeping into the room on July 22 along the south wall at the edge where the brick wall and the concrete wall meet (see Figure 21). There was also water on the floor and around the sump pump. The smear of the two sump pumps indicated no detectable loose activity.

F. Room A-038A Radiological Survey

The north, east and west walls of this room are painted from the grate to a height of ~5 feet. The south wall, except for the portion that is constructed of bricks, is also painted from ~3 feet to ~5 feet. The walls under the paint were not checked for either direct alpha or loose alpha and beta contamination. This room measures 19 feet 10 inches north to south and 29 feet 10 inches east to west. The direct exposure rates at the bottom of tanks 5, 6, and 7 range from 0.1 mR/h to 1.0 mR/h (see Figures 22 through 24). On tank 5 there were three spots and a large area with

TABLE 7 Background Ranges in Room A-026A

	NE α dis/min		NE β dis/min	
Location	min	max	min	max
Ceiling	0	0	6,000	9 k
East Wall	0	27	8,479	21 k
Floor	0	0	3,000	11.3 k
North Wall	0	44.5	5,000	18.6 k
South Wall	0	32	4,000	10.8 k
West Wall	0	0	3,000	12 k

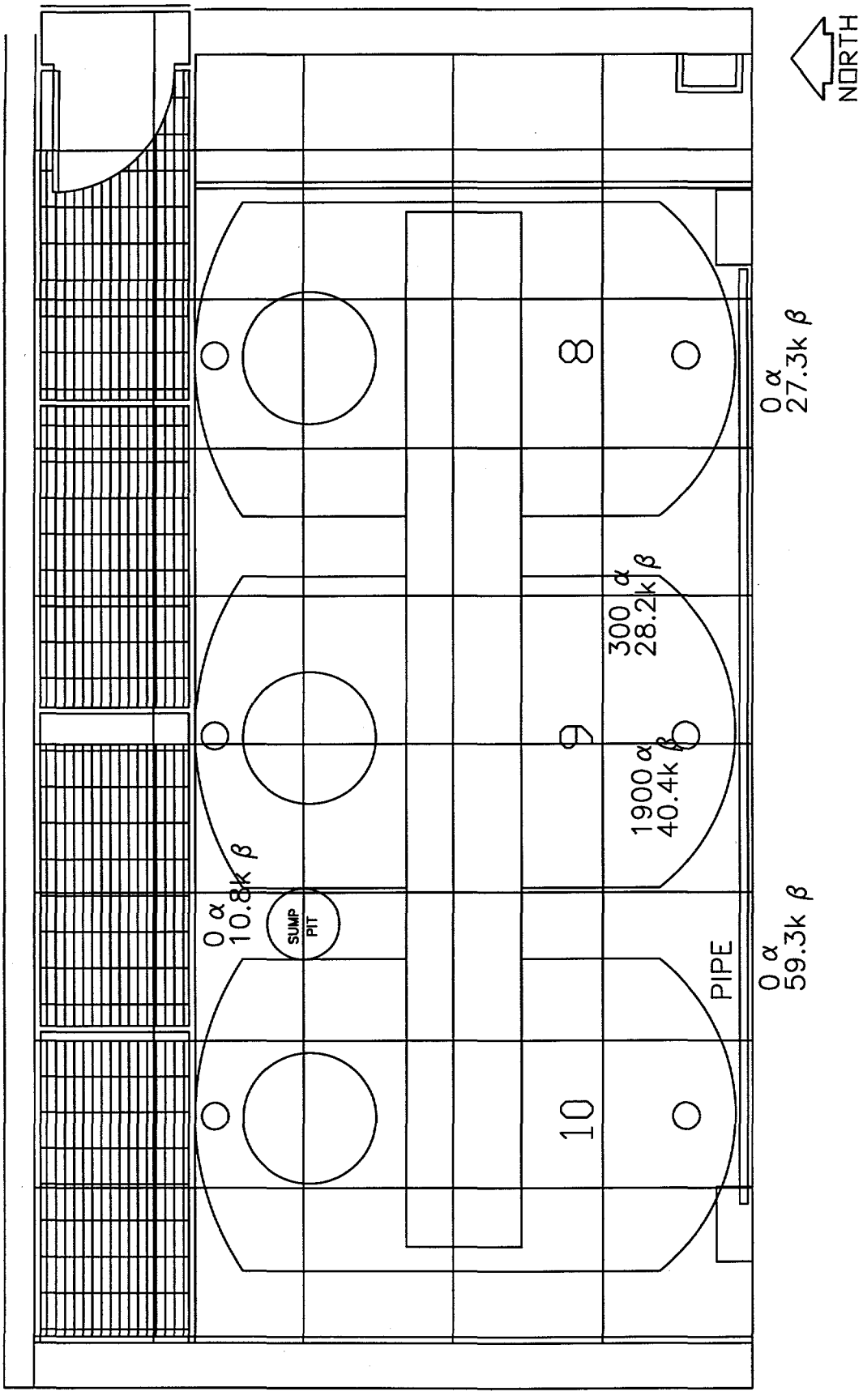


FIGURE 20 Building 310 Retention Tanks; Room 026 Floor

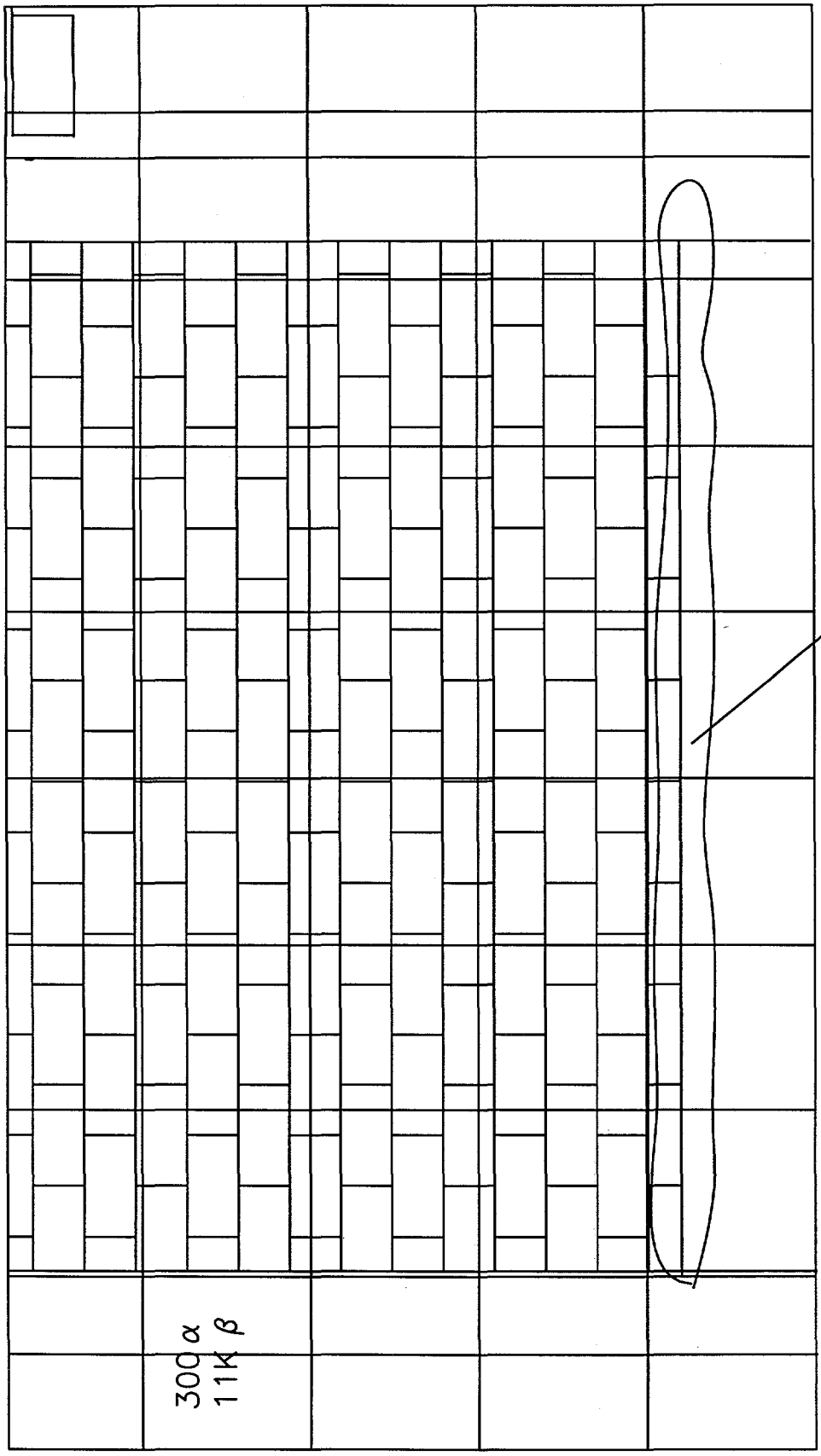


FIGURE 21 Building 310 Retention Tanks; Room 026 South Wall

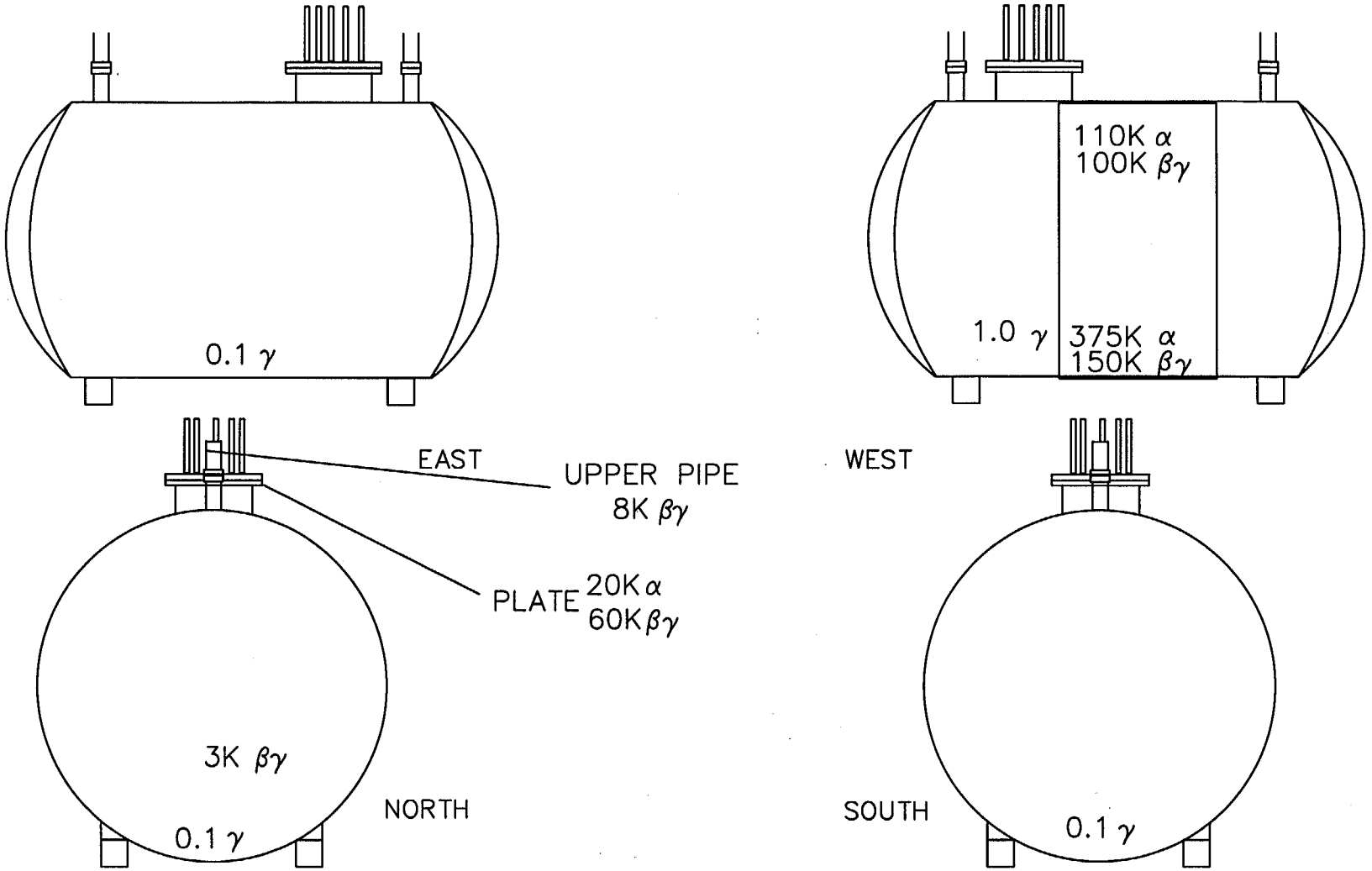


FIGURE 22 Building 310 Retention Tanks; Room 038 Tank 5

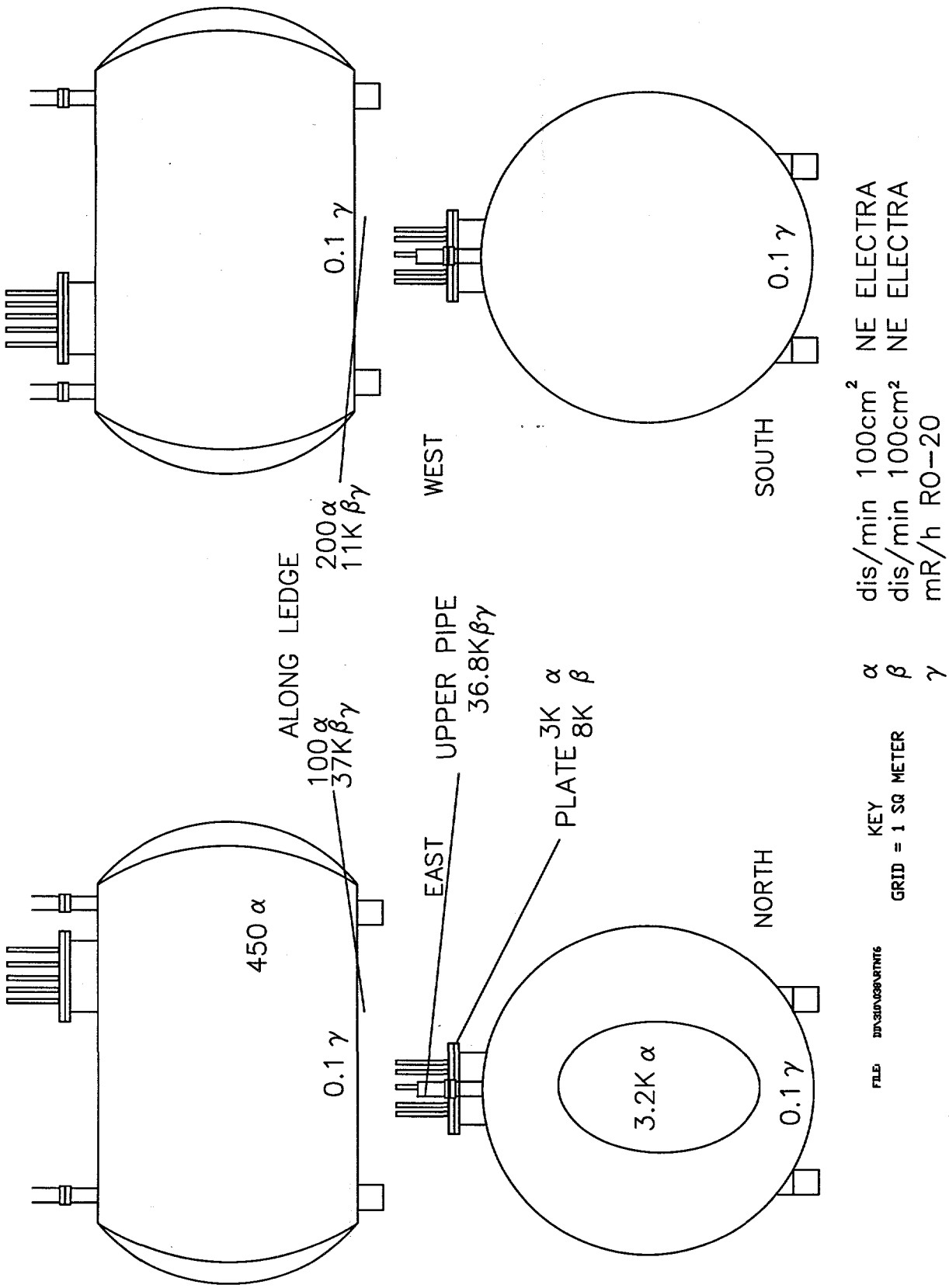


FIGURE 23 Building 310 Retention Tanks; Room 038 Tank 6

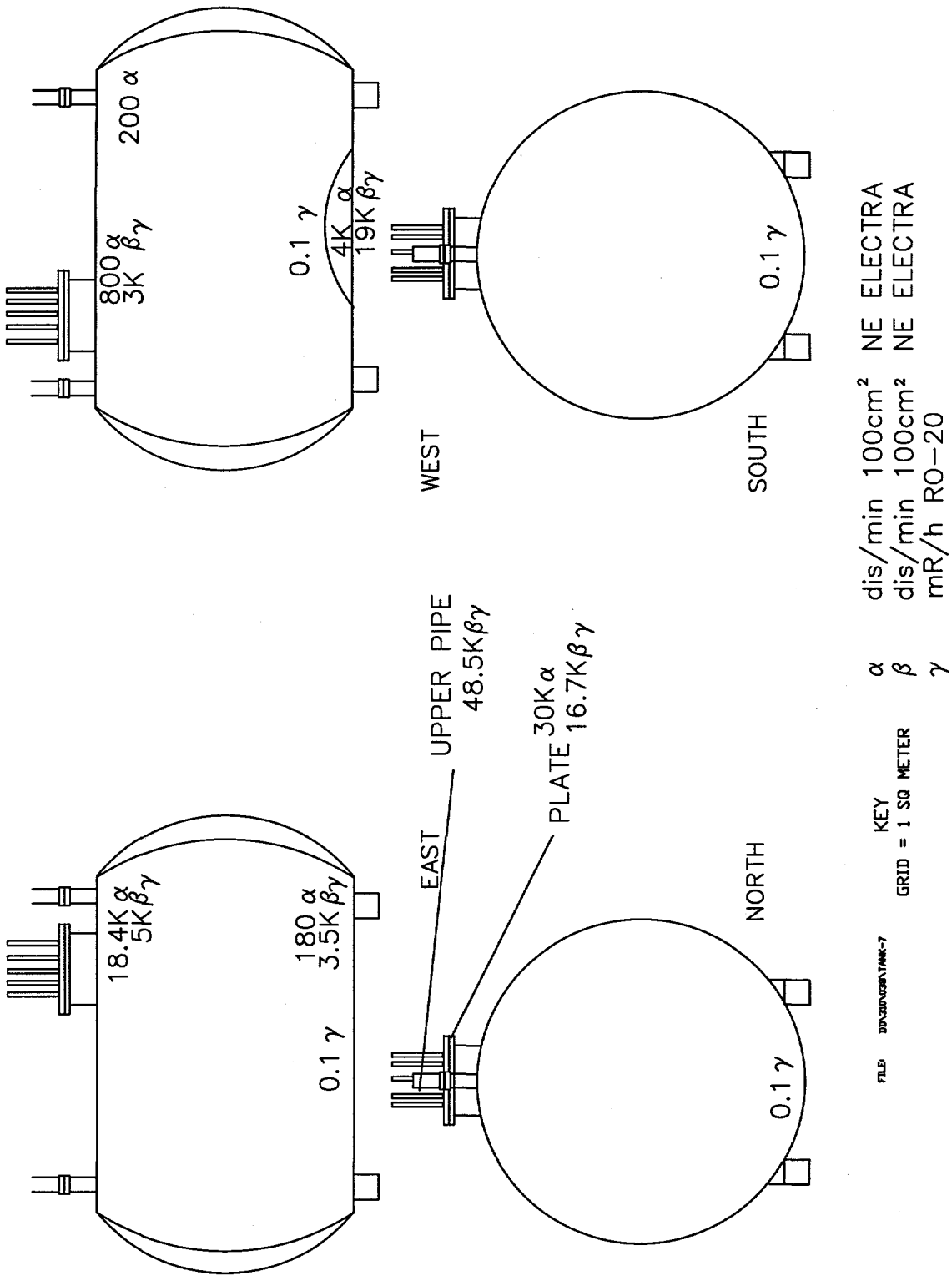


FIGURE 24 Building 310 Retention Tanks; Room 038 Tank 7

direct α activity up to 375k dis/min-100 cm^2; the associated β activity is 150k dis/min-100 cm^2. On tank 6 there were five spots and a large area with direct α activity up to 3.2k dis/min-100 cm^2; the associated β activities are up to 37k dis/min-100 cm^2. On tank 7 there are seven locations with direct α activity up to 30k dis/min-100 cm^2; the associated β activities are up to 48.5k dis/min-100 cm^2. There are also elevated levels of loose activity on the outside of the tanks and pipes, up to 8,437 ± 260 dis/min α and 5,736 ± 163 dis/min β. All the large area smears on the tanks and pipes indicated contamination. Smear 270 from tank 5 had ^{137}Cs and ^{241}Am activity as detected by gamma spectrometry (See Table 15). There were also non gamma emitting radionuclides that contributed >½ of the activity, perhaps ^{239}Pu and ^{90}Sr. The $^{239}Pu/^{241}Am$ ratio in this smear is less than that in the composite tanks sludge sample. The smear results are tabulated in Appendix B tables B1and B2.

Because of the contamination in the bottom of the tanks, direct surveys for β or γ contamination on the floor and walls was difficult. From Table 8 below, the level of activity that could be present and not detected is recorded. However, some contamination was detected above the background levels on the north, west and south walls (see Figures 25 through 27). The direct activity on the walls was up to 7k dis/min α and 24k dis/min β using a 100 cm^2 detector. The left pipe from the tunnel had a direct reading of 32.6k dis/min β.

There was a large area of contamination on the north wall. There was also an open area at the top of the north wall which was inaccessible. Because of the appearance of the area and the levels of contamination on near-by surfaces, it is assumed to be contaminated. By the north wall and near tank 6, piping along the ductwork is contaminated with up to 1,004k dis/min β activity and 27.5k dis/min α activity (see Figure 28) as measured with a portable survey instrument. A smear, of the north wall and pipe had 7,758 ±249 dis/min α and 5,740 ± 160 dis/min β. This smear number 271, had ^{137}Cs and ^{241}Am activity as detected by gamma spectrometry (see Table 15).

TABLE 8 Background Ranges in Room A-038A

	NE α dis/min		NE β dis/min	
Location	min	max	min	max
Ceiling	20	50	1,186	1,982
East Wall	0	65.7	1,231	1,458
Floor under tar paper	9.6	57	1,726	3,112
North Wall	25	65	1,154	2,575
South Wall	0	37.6	2,408	3,000
West Wall	0	28.2	1,398	1,652

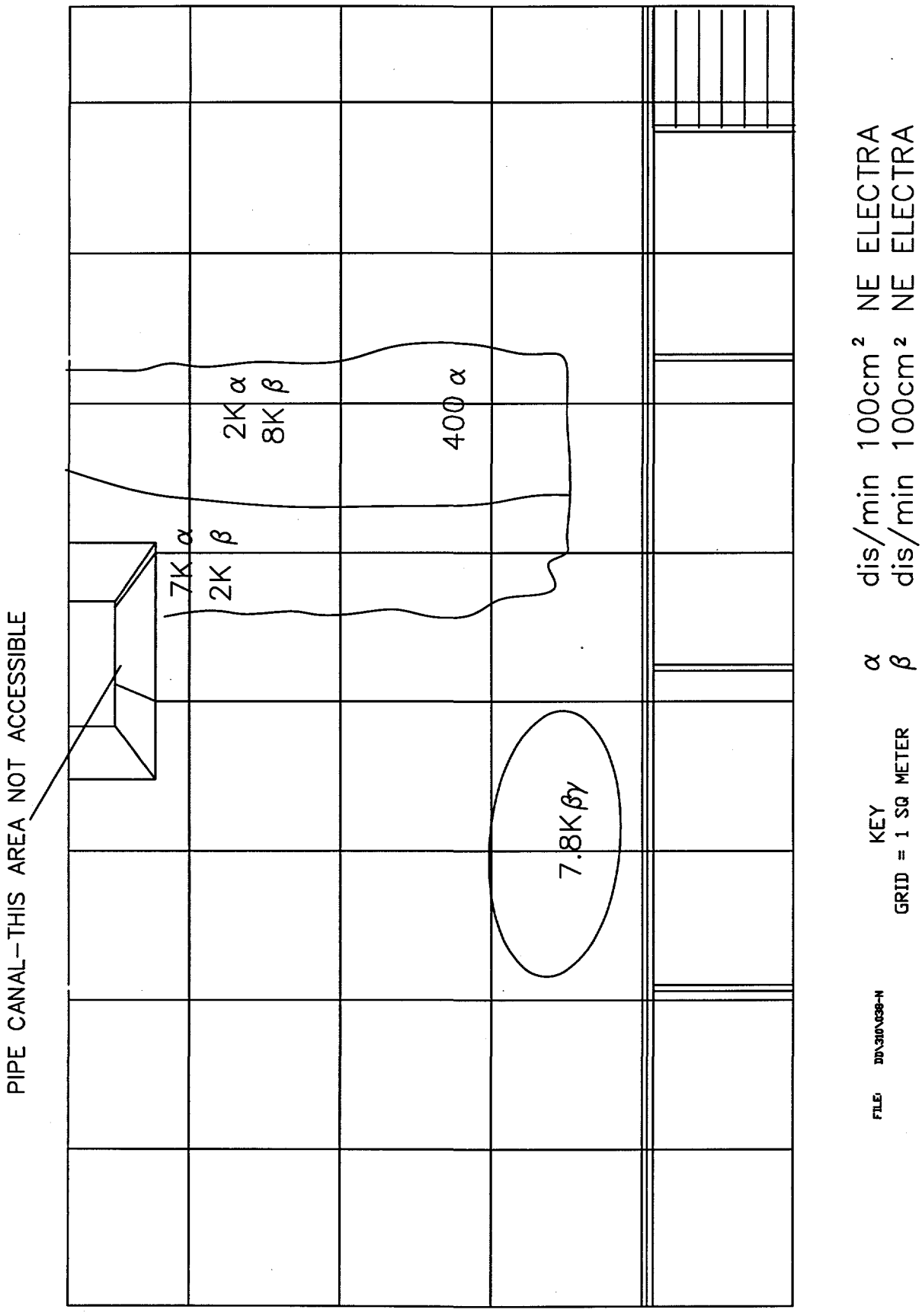


FIGURE 25 Building 310 Retention Tanks; Room 038 North Wall

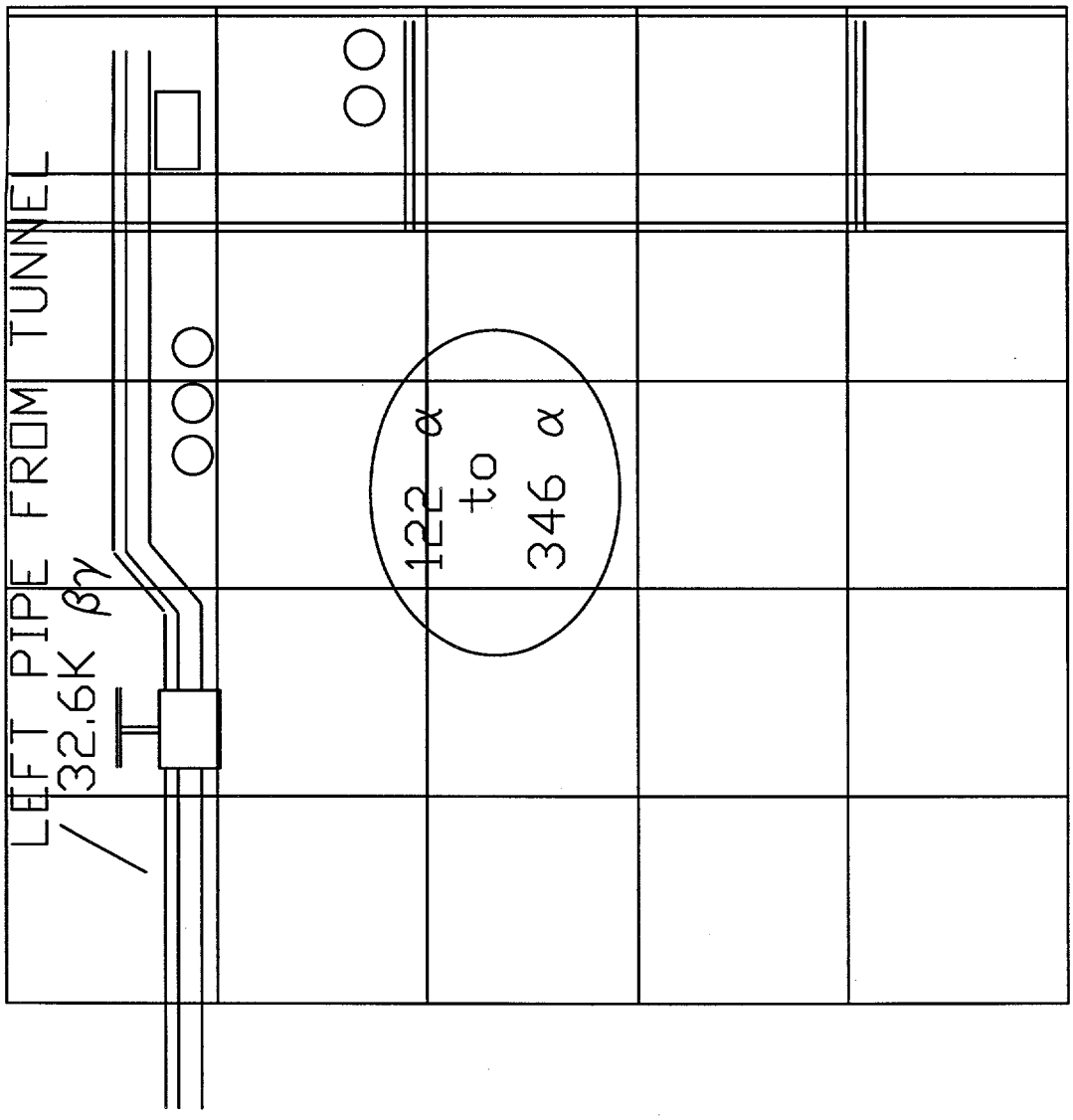


FIGURE 26 Building 310 Retention Tanks; Room 038 West Wall

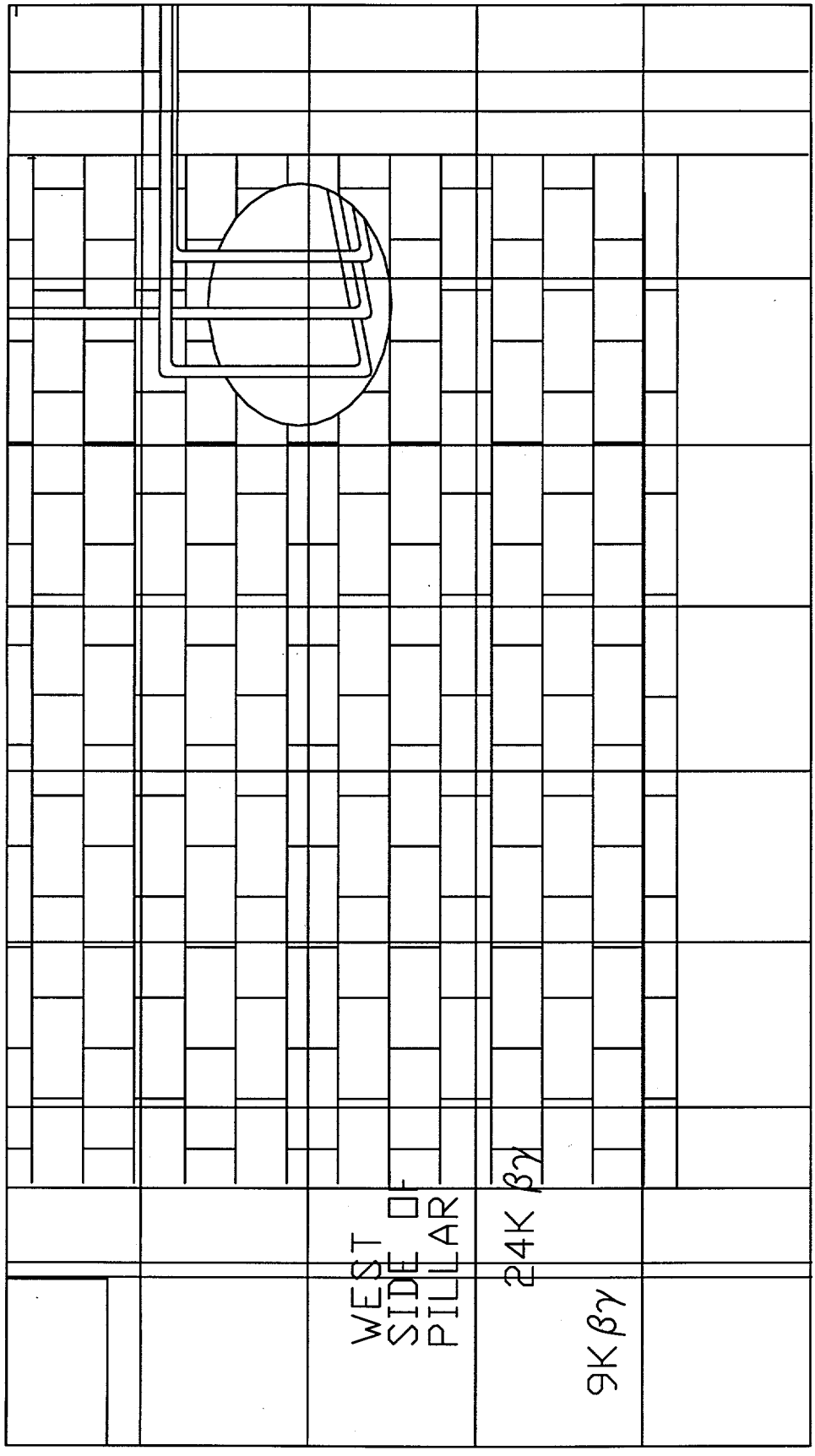


FIGURE 27 Building 310 Retention Tanks; Room 038 South Wall

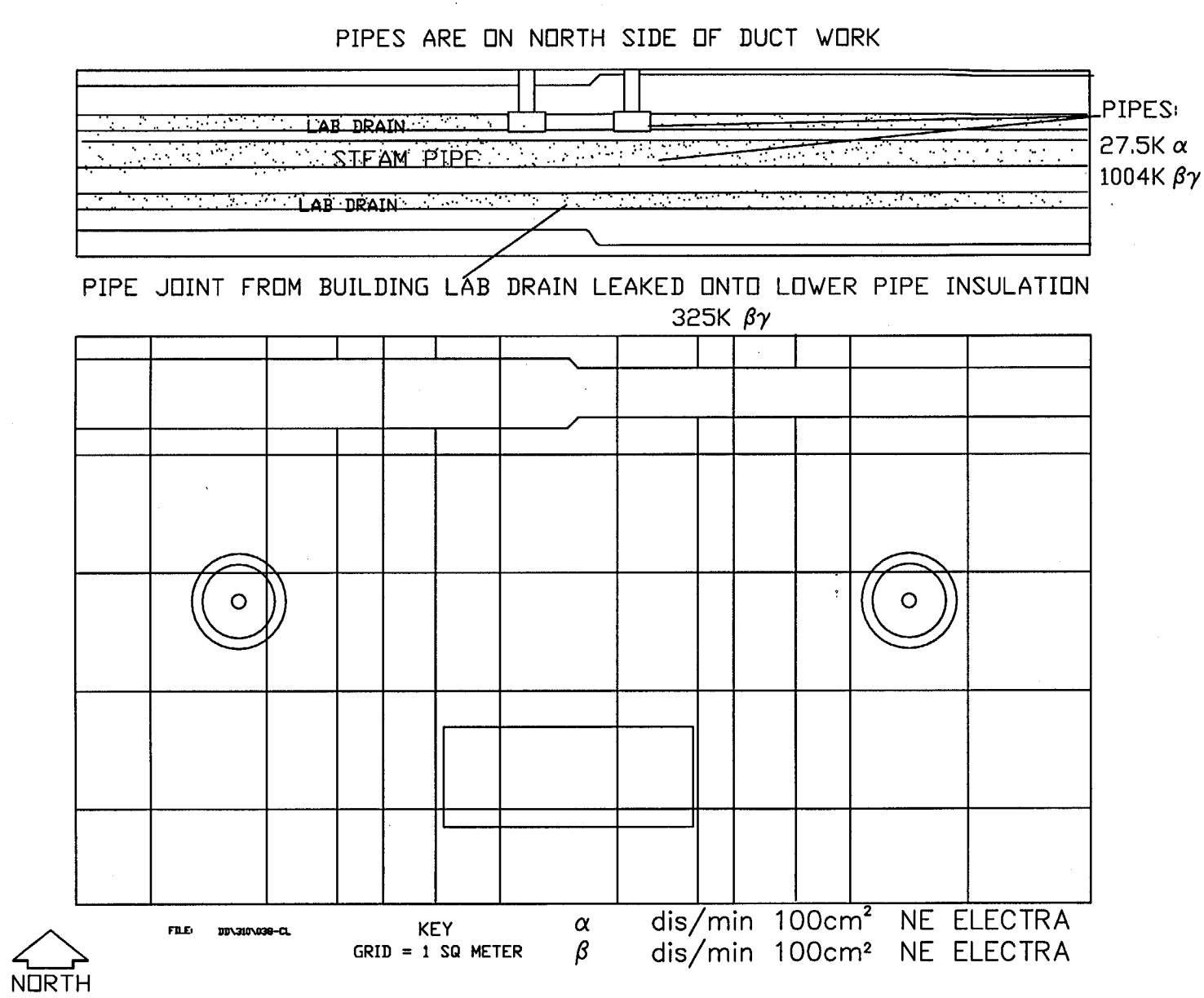


FIGURE 28 Building 310 Retention Tanks; Room 038 Ceiling

There were non gamma emitting radionuclides that contributed ~ ¾ of the activity. Again the $^{239}Pu/^{241}Am$ ratio is not the same as the composite sludge sample. Separate smears of the wall and pipes were taken at a later date. The smear of the wall number 273 had 282 ± 43 dis/min α and 371 ± 59 dis/min β. The smear of the upper pipe number 277 had 12,683 ± 283 dis/min α and 11,295 ± 215 dis/min β. This piping seems to have dripped onto an asbestos wrapped pipe below with direct activity up to 325k dis/min β. The smear of the lower pipe number 275 had no activity. There was other loose activity on the walls and floors, up to 49 ± 20 dis/min α and 119 ± 29 dis/min β on 100 cm^2 smears. The results of the floor survey are given in Section G. The copies of the printouts from the gamma spectrometer are given in Appendix D (310 smear 271 8/14/96 north wall white streak (page D-54) and 310 smear 270 8/6/96 smear of tank 5 [page D-53]).

G. Room A-038A Water Problem

Water on the floor of this room is assumed to be flood water. After a heavy rain storm, 11.57 inches between 11 AM July 17 and 11 AM July 18 (reference 9), water was seen flowing from both ends of the tunnel between Buildings 310 and 306 on July 22. Water samples were collected from the water standing in the room on June 23. The samples were tested for radioactive and other hazardous constituents. The ANL-ESH Control Laboratory tested one of the samples for gross alpha and beta, gamma activity. The activity was found to be below the release level. The results are presented in Table 9 and a copy of the REQUEST FOR ANALYSIS form 6303 with the analysis results is presented in Appendix D (pages D-41 and D-42).

Two of the samples from the standing water were tested for low energy beta in a liquid scintillation counter. An aliquot of 0.1 ml of water was mixed with 10 ml of Ultima Gold. The detected activities in the energy bands established for ^{3}H and ^{14}C were indistinguishable from the detected activities in the blank sample. A copy of the print out from the Liquid Scintillation Counter is presented in Appendix D (July 1996 15:38) (pages D-45 and D-46).

Three of the samples from the standing water were sent to Heritage Environmental Services, Inc. in order to analyze for non-radiological hazardous constituents. A copy of the Certificate of Analysis is presented in Appendix D (pages D-47 through D-52).

The standing water in this room was pumped into an active 2,000 gallon retention tank and retested before it was released to the site drains. The test results are presented in Table 11. The water level before the initial removal of water was up to the bottom of a small pipe on the east wall. After of the water was pumped down to the floor level at the edge of the east wall, the distance from the floor to the pipe measured 12 inches; away from the wall the depth of the remaining water measured 2 inches. The approximate volumes of water in this room for a given depth are listed in Table 10. Water continues to enter the room. The one obvious source of the

TABLE 9 Water from Floor of A-038A

Analysis	Highest Concentration/ Activity	Limit or Background Values
pH	8.16	≤2 or ≥12.5
Cyanide	none detected	EPA 250 mg HCN/kg[1]
Sulfide	none detected	EPA 500 mg H_2S/kg[2]
Volatile Organic	none detected	> detection level[3]
Semivolatile Organic	none detected	> detection level[3]
Pesticides	none detected	> detection level[3]
Chlorinated Herbicides	none detected	> detection level[3]
Metals	none detected	> detection level[3]
Tritium	none detected	2×10^{-3} μCi/mL
Gross α	0.04 dpm/mL	0.067 dpm/mL
Gross β	0.75 dpm/mL	2.22 dpm/mL

[1] Total releasable cyanide

[2] Total releasable sulfide

[3] The current list of compounds/metals regulated under RCRA has individual limits above the detection levels.

TABLE 10 Estimated Volume of Water in Room A-038A

Depth (inches)	feet[3]	gallon
6	300	2,200
10	490	3,700
14	690	5,200
18	890	6,700

water was the tunnel. Eventually the sump pump was connected to the retention tanks for continuous pumping to prepare the room and tunnel for access. However, this failed to completely dry the room so the survey was performed with some water on the floor and in the tunnel. During the survey of this room between August 5 and 9, the south wall was damp from the bottom of the tunnel to the floor. The dampness extended 2 feet west of the tunnel hole and 3 feet east of the hole (see Figure 27). At the east and west walls the floor was dry on August 13, 1996, even though there was water in the center of the floor and in the hole for the sump pump. The sump pump was not working at that time.

In order to prepare the room for the survey, the mud and water on the floor of the room was shoveled into a 55 gallon drum filling it ~½ full. A survey of this shovel revealed a couple hundred dis/min β with a direct survey instrument. It was cleaned to below the detectable activity. Because contamination was found on the tar paper, the mud from the floor of this room is assumed to be contaminated even though the water was not contaminated. Any activity found in this material can be compared to the levels presented in Table 3 to determine if there has been radioactivity added to the mud by the operations in this facility. The only analysis of this material was water on a smear paper that had no contamination; and another smear with dried mud with 16 ± 0.6 dis/min α and 117 ± 2 dis/min β. The dose rate from this drum was < 0.1 mR/h.

Because of the remaining water and mud on the floor, a complete survey was not possible. Therefore, tar paper was removed from four locations; direct readings and smears were taken of the exposed floor. Nothing above instrument background levels indicated in Table 8 could be detected from the direct measurements. Low levels of β activity, up to 114 ± 50 dis/min, were seen on the smears. The activities on both sides of the removed tar paper were measured. For most of the samples, the bottom (b) side, the one near the concrete, had higher activities (861 ± 74 dis/min α and 1,817 ± 96 dis/min β) than the top (t) side, the one exposed to the water and mud (46 ± 18 dis/min α and 569 ± 65 dis/min β).

The water in room A-038A is coming, at least in part, from the tunnel. After rain storms water was seen flowing from the tunnel into room A-038A and from the tunnel through a pipe into a drain in building 306 room B007 (see Figure 29). From a telephone conversation with A. N. Lowing (PFS-FPE) an investigation of the source of the water in the tunnel and A-038A would require ~2 days effort (cost $2,000), a recommendation for repair would require an additional ~1 day effort (cost $1,000). He indicated that there was no indication of a structural safety concern for a person making an entry into the tunnel. At most he recommended that trucks be restricted from driving over the tunnel while a person was in the tunnel.

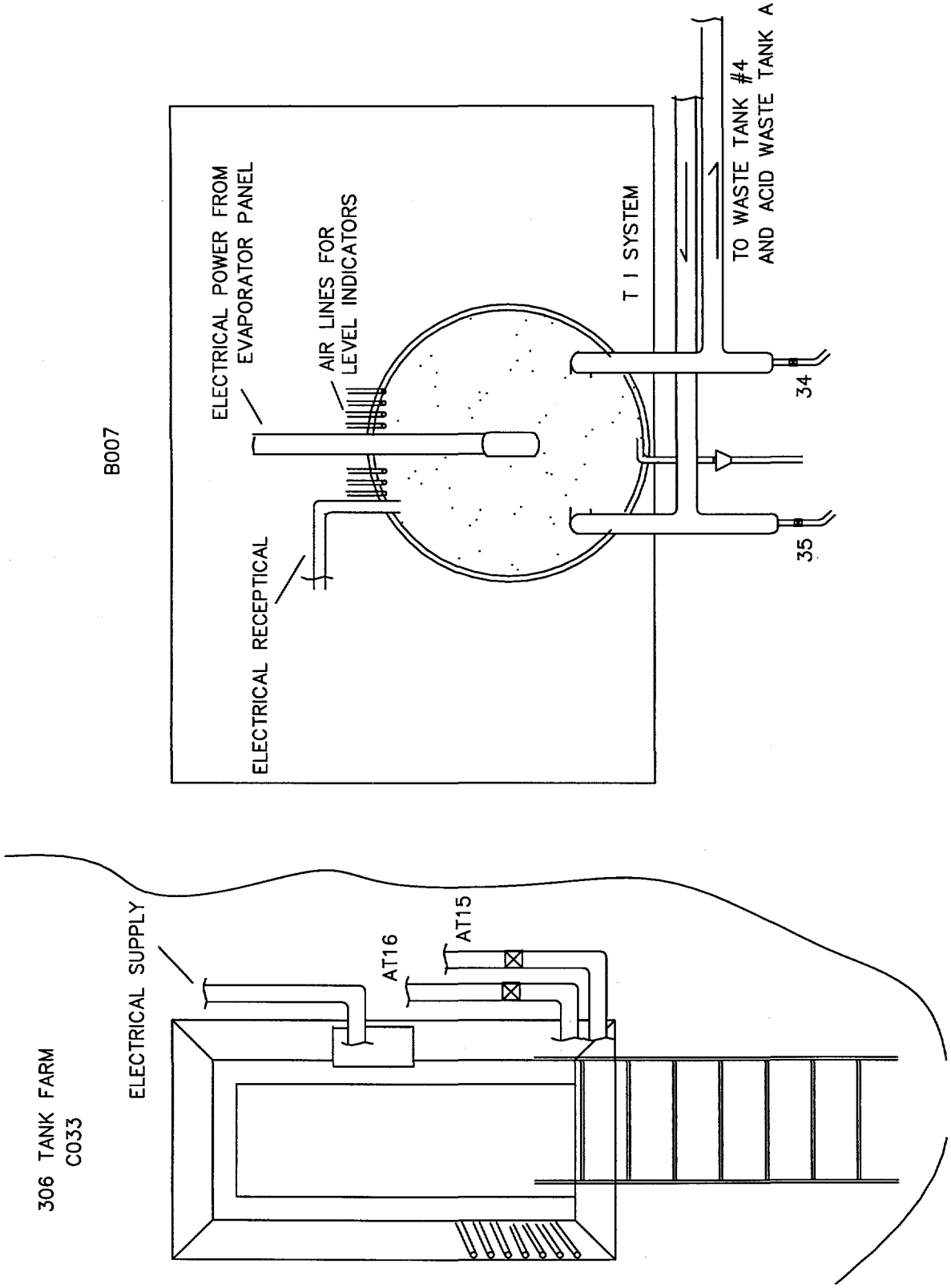


FIGURE 29 Entrance to Tunnel from Building 306

H. Tunnel Radiological Survey

After a 11.57 inch rain storm on July 17 and 18, water was seen draining from a pipe at the bottom of the tunnel in Building 306 room B-007. Water was also flowing out of the tunnel in Building 310 room A-038A. On July 19, a water sample was collected from the drain pipe in B-007 and analyzed by the Control Laboratory for gross alpha and beta activity. The results as presented in Table 11 are below release criteria. A copy of the REQUEST FOR ANALYSIS form 6310 with the analysis results is presented in Appendix D (pages D-43 and D-44).

TABLE 11 Gross α and β Activity in Water Samples

			dpm/mL	
Date	Location	Request Number	α	β
6/25/96	A-038A Floor	6303	0.040	0.75
7/19/96	Tunnel Drain	6310	0.043	0.06
8/15/96	Transfer Line[2]	6410	**5.140**	**132**
7/23/96	310 Tank 1[3]	119990	**0.068**	0.28
7/23/96	310 Tank 2	119991	0.022	0.04
7/25/96	310 Tank 2	119992	0.017	0.13
7/26/96	310 Tank 1	119993	0.031	0.22
7/26/96	310 Tank 2	119994	0.025	0.10
7/31/96	310 Tank 1	119995	0.039	0.14
7/31/96	310 Tank 2	119996	0.024	0.15
	Drinking Water Standard		0.067	2.22

[1] The Department of Energy Derived Concentration Guide (DCG) limits

[2] This water is in a drum in Bldg. 306, Room B007.

[3] ANL release limit is 10 times the Drinking Water Standard.

During the survey of the tunnel, there was water along the bottom. The pipes in the tunnel were surveyed for γ as well as α and β activity. The tunnel entrances are depicted in Figures 27 for Building 310 and Figure 29 for Building 306. The east pipe had elevated levels of β and γ activity ~3 feet from the building 310 entrance as shown in Table 12. The tunnel surfaces had levels of loose activity close to the counting uncertainties (maximum α activity 9 ± 9 dis/min and β activity 39 ± 22 dis/min). The pipe surfaces had higher levels of loose activities, up to 117 ± 28 dis/min α and up to $1{,}281 \pm 84$ dis/min β.

The two pipes used to transfer the liquid waste between buildings 310 and 306 were sampled at the 306 side of the tunnel (see Figure 29). The internal sample from the line used to transfer liquids from building 310 to building 306 had 543 ± 59 dis/min α and $19{,}105 \pm 277$ dis/min β. The internal sample from the line used to transfer liquids from building 306 to building 310 had 144 ± 31 dis/min α and $7{,}005 \pm 172$ dis/min β.

When the samples from the transfer lines were taken from the values numbered 34 and 35 in Figure 29, a 55 gal drum was filled with liquid. The Control Lab determined that there was 5.14 dpm/mL α activity and 132 dpm/mL β activity. Samples of this water were sent to ACL for Analysis. Elevated concentrations of RCRA metals were found in the water. The alpha activity was 30% ^{238}U, 35% ^{234}U, 24% $^{238/240}Pu$ and 6% ^{241}Am + ^{238}Pu as determined by alpha spectroscopy. The proportion of Pu and Am in the total alpha activity is greater than that found in the sludge sample collected in June 1995 where it was $<1\%$. The results are presented in Table 13 below.

A copy of the REQUEST FOR ANALYSIS form 6401 is in Appendix D along with the Analytical Chemistry Laboratory and Reports of Analytical Results (pages D-60 through D-67).

TABLE 12 Tunnel Pipe Survey Results

Location	α dis/min-100 cm^2	β dis/min-100 cm^2	γ cts/min
East (left) pipe	0	9,000	15,000
West (right) pipe	66	1,480	500
Background	66	1,480	500

TABLE 13 Water from Radioactive Waste Transfer Line

Analysis	Highest Concentration/ Activity	Limit or Background Values
pH	8.16	≤2 or ≥12.5
γ Spec	127 ± 13 pCi/mL ^{137}Cs	$<1 \times 10^{-3}$ pCi/mL ^{137}Cs
γ Spec	7.2 ± 0.7 pCi/mL ^{241}Am	$<1 \times 10^{-6}$ pCi/mL ^{241}Am
γ Spec	5.2 ± 0.5 pCi/mL ^{60}Co	$<1 \times 10^{-3}$ pCi/mL ^{60}Co
Metals	**6.77 μg/mL Cd**	1.0 μg/mL Cd
Metals	**15.1 μg/mL Pb**	5.0 μg/mL Pb
Gross α	**5.14 dpm/mL**	0.067 dpm/mL
Gross β	**132.1 dpm/mL**	2.22 dpm/mL
α Spec*	46 pCi/mL ^{238}U	4×10^{-4} pCi/mL ^{238}U
α Spec*	54 pCi/mL ^{234}U	5×10^{-4} pCi/mL ^{234}U
α Spec*	37 pCi/mL $^{239/240}$Pu	$<1 \times 10^{-6}$ pCi/mL $^{239/240}$Pu

*Calculated from ^{241}Am γ Spec and the alpha spectrum.

I. Room A-050A Radiological Survey

The north, east and west walls of this room are painted from the grate to a height of ~5 feet. The south wall, except for the portion that is constructed of bricks, is also painted from ~3 feet to ~5 feet. The walls under the paint were not checked for either direct alpha or loose alpha and beta contamination. This room measures 16 feet 7 inches north to south and 27 feet 6 inches east to west. Direct exposure rates at the bottom of tanks 2, 3, and 4 ranged from 0.1 mR/h to 0.7 mR/h (see Figures 30 through 32). On tank 3 there was one location with fixed α contamination; 250 dis/min-100 cm^2. On tank 4 there are six locations with direct α contamination; up to 1500 dis/min-100 cm^2, most on the north end of the tank. There are also low levels of loose activity on the outside of the tanks and pipes, up to 49 ± 20 dis/min α and 381 ± 45 dis/min β. A smear of the contaminated spots was 61 ± 22 dis/min α and 458 ± 49 dis/min β. The smear results are tabulated in Appendix B Table B1.

The floor and walls up to one meter were covered with tar paper. It is assumed that the paper was used to fix activity from a spill. The β contamination below the levels presented in Table 14 below could not be seen because of the activity at the bottom of the tanks. Detectable direct contamination

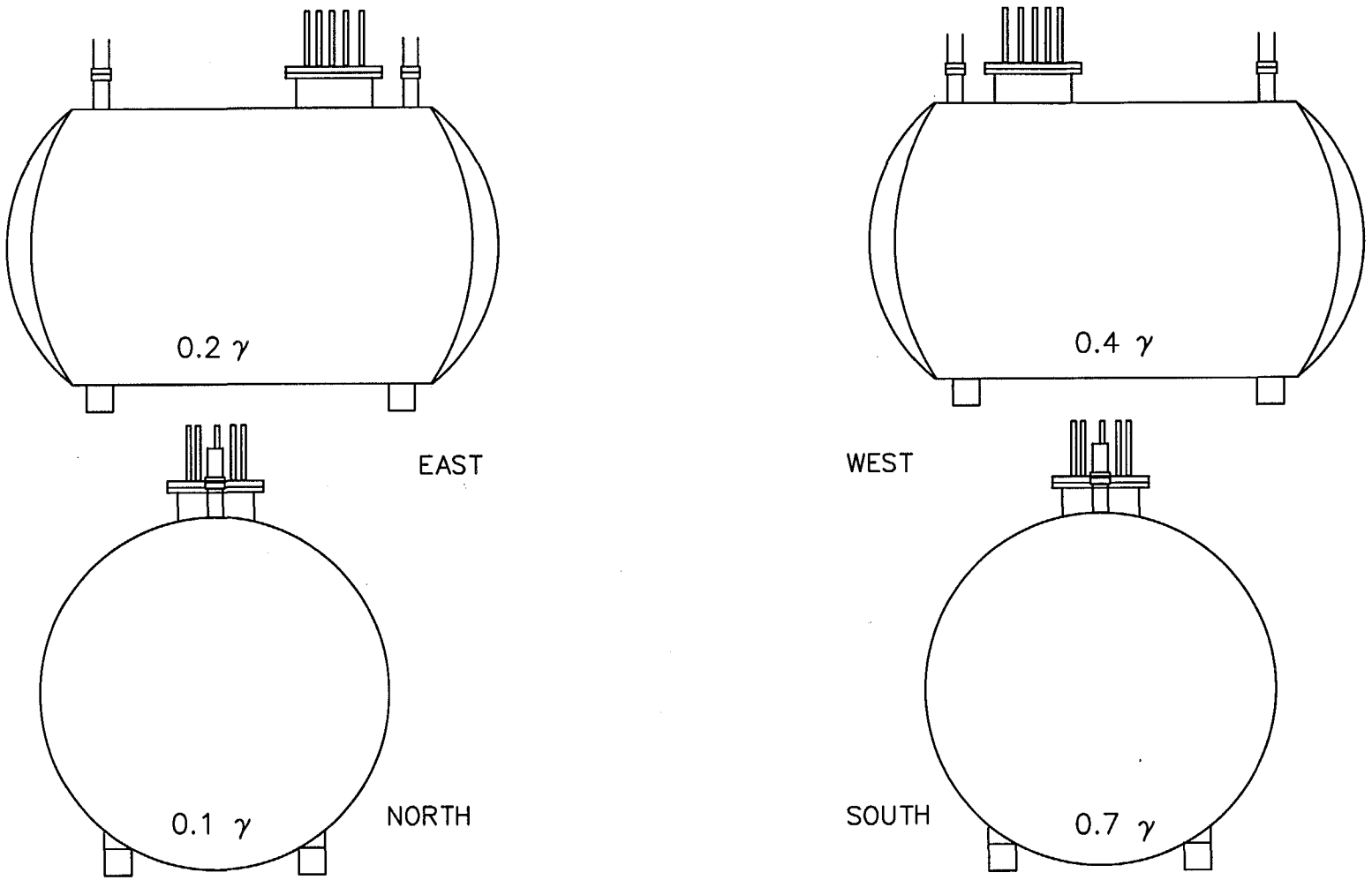


FIGURE 30 Building 310 Retention Tanks; Room 050 Tank 2

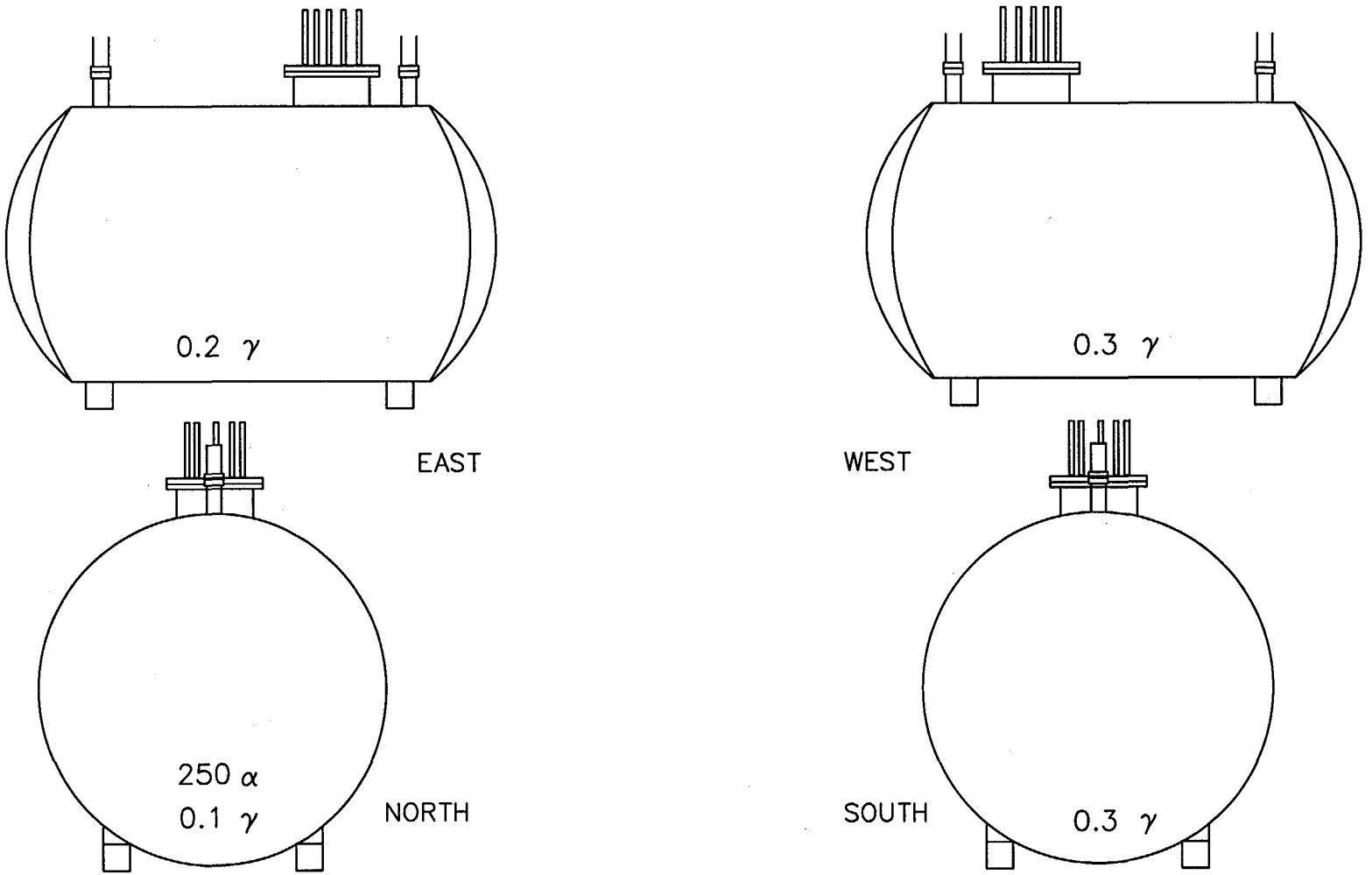


FIGURE 31 Building 310 Retention Tanks; Room 050 Tank 3

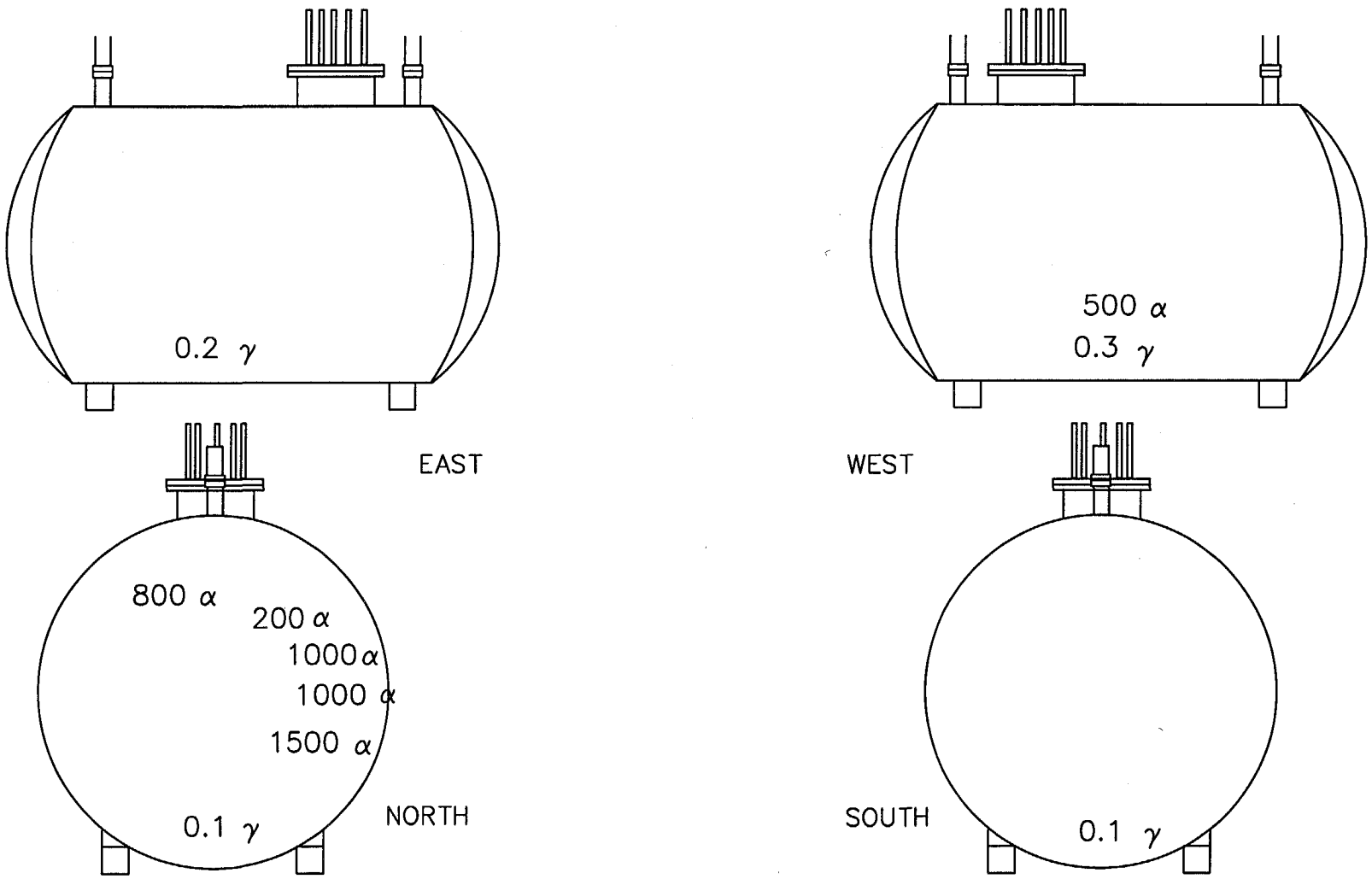


FIGURE 32 Building 310 Retention Tanks; Room 050 Tank 4

TABLE 14 Background Ranges in Room A-050A

	NE α dis/min		NE β dis/min	
Location	min	max	min	max
Ceiling	0	57	1,370	1,860
East Wall	0	50	2,940	7,200
Floor	0	35	3,000	7,936
North Wall	0	57	1,860	3,000
South Wall	0	57	3,100	5,500
West Wall	0	57	1,400	2,022

levels on the floor are presented in Figures 33 and 34. Considerable contamination was detected on the tar paper on the floor; up to 800k dis/min α and 96k dis/min βγ using a 100 cm^2 detector. The loose activity on the tar paper was up to 35 ± 17 dis/min α and 639 ±57 dis/min β. There are also nine locations where the tar paper was either missing or removed. The direct activities were measured up to 3,141 dis/min α and up to 150k dis/min β. The loose activity under the tar paper was up to 7.6 ± 8.2 dis/min α and up to 82 ± 26 dis/min β. The north and west walls also had direct contamination up to 5.8k dis/min α and 105k dis/min βγ using a 100 cm^2 detector (see Figures 35 and 36).

Large area smears, number 500 through 502, from the hot spots on the west wall had activity up to 1,125 ± 85 dis/min α and 26,007 ± 323 dis/min β around the electric box. The gross α and β analyses of these smears are presented in Appendix B Table B2. A gamma spectral analysis of the hottest smear (502) by the ESH-DA internal dosimetry laboratory indicated ^{137}Cs, ^{60}Co and ^{241}Am. A copy of the analysis results are presented in Appendix D (page D-55). A comparison of the radionuclide composition of smear with that of the composite tank sludge sample is presented in Table 15. Although the beta activity of both samples is dominated by the ^{137}Cs, the ^{241}Am fraction of the gross alpha activity from the smear is much greater than the ^{241}Am fraction from the sludge sample. If the ratio of ^{239}Pu to ^{241}Am is assumed to be the same for both samples, then the alpha contamination of the smear is entirely ^{239}Pu and ^{241}Am as indicated in column 5.

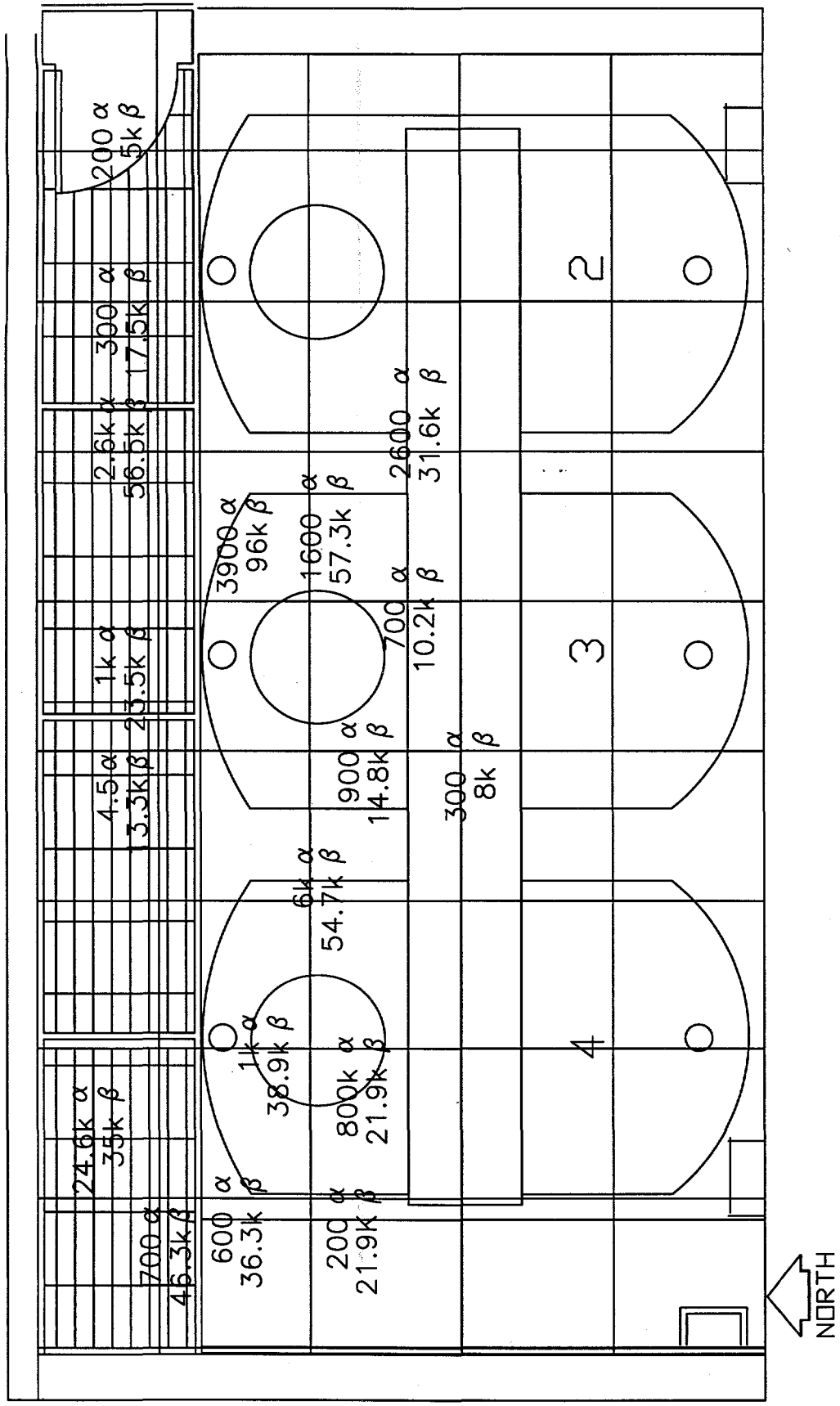


FIGURE 33 Building 310 Retention Tanks; Room 050 Floor

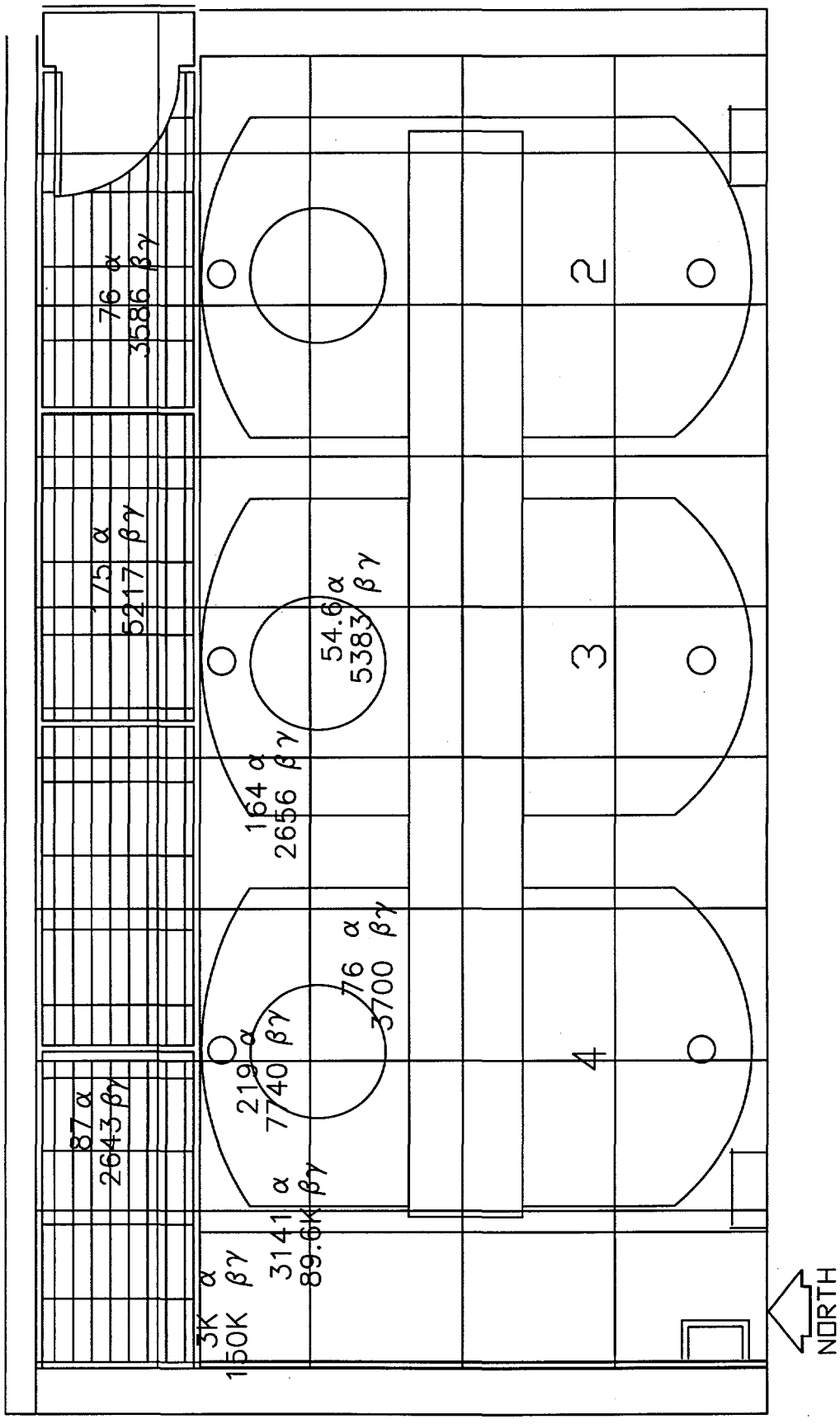


FIGURE 34 Building 310 Retention Tanks; Room 050 Floor under Tar Paper

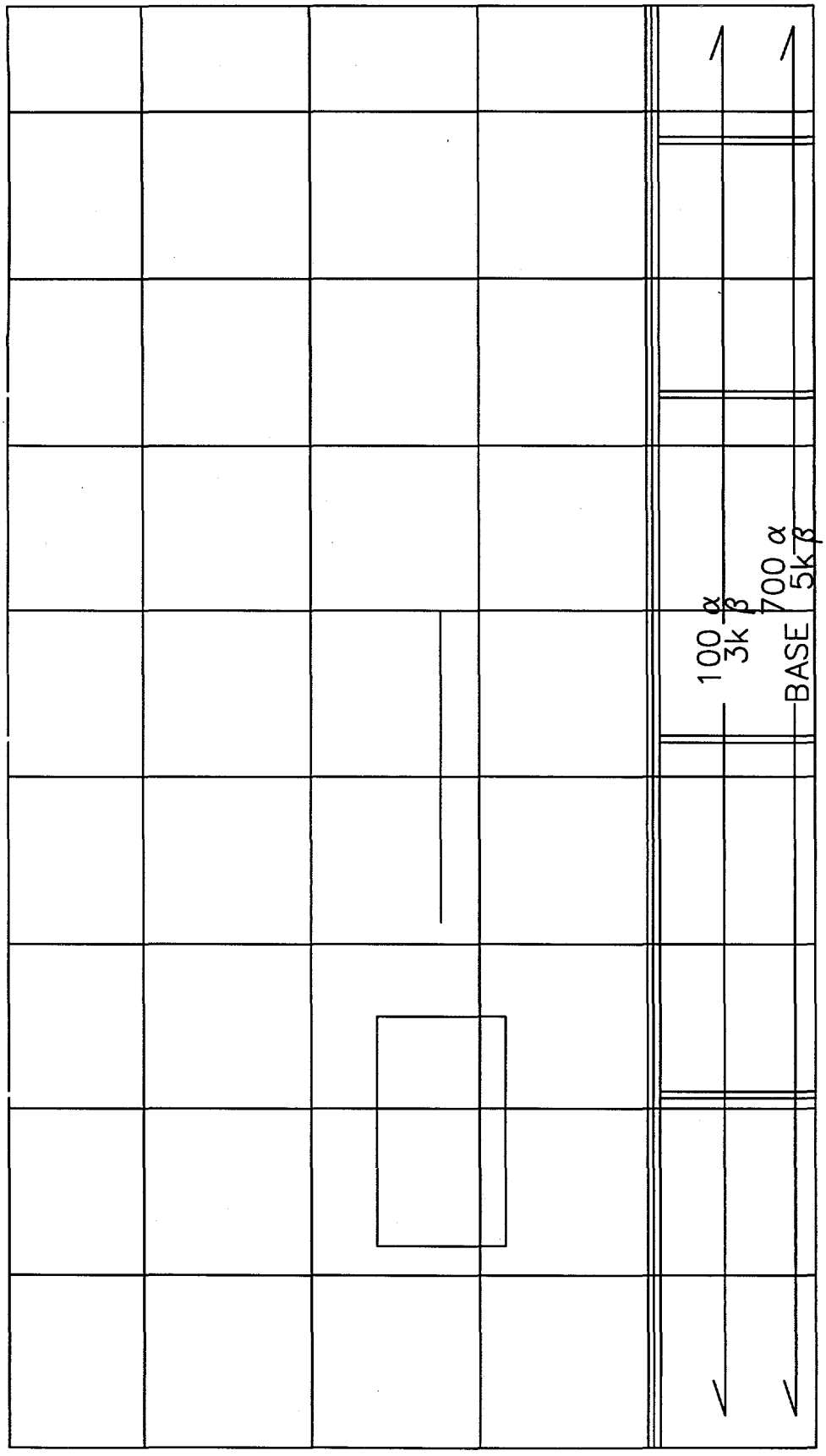


FIGURE 35 Building 310 Retention Tanks; Room 050 North Wall

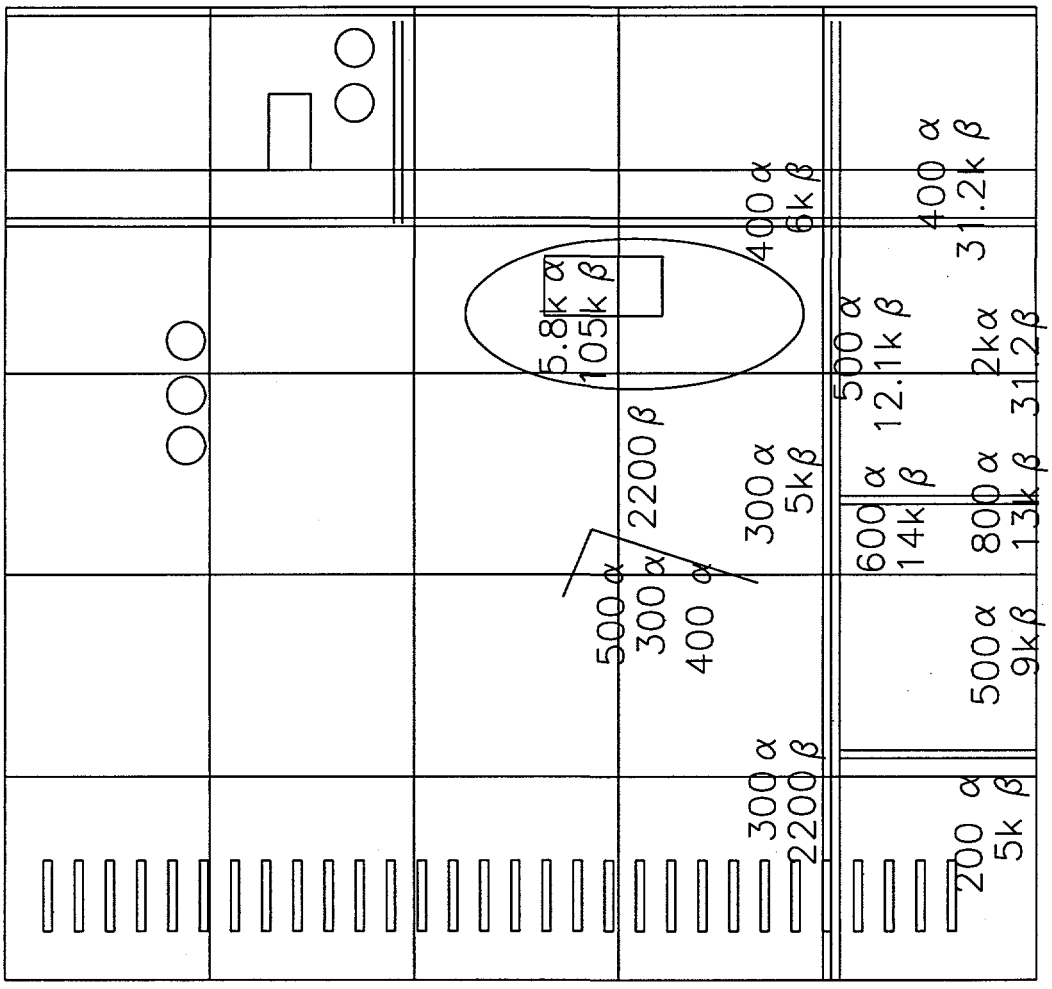


FIGURE 36 Building 310 Retention Tanks; Room 050 West Wall

TABLE 15 Isotopic Analysis of Contamination

	Composite Tank Sludge Sample[1]		Smear #502 W Wall 050		Smear #270 Tank 5 Bottom 038		Smear #271 N wall & Pipe 038		Smear #536 Pump 068		Air Samples #194 - #209	
Radionuclide	pCi/g	% Sum	dis/min	% Gross	dis/min	% Gross	dis/min	% Gross	dis/min	% Gross	dis/min	% Sum
Gross α	23,050.4		1,125		8,437		1,295		153			
Gross β	73,047.8		5,736		5,736		1,335		396			
^{239}Pu	62.1	0.15		85.04		252.91		147.32				
^{241}Am	11.1	0.03	171	15.20	3,814	45.21	341	26.33				
^{137}Cs	107,200	89.34	20,500	357.39	2,667	46.50	294	27.02	25	6.31	21.7	1.41
^{60}Co	2,369	1.97	30	0.52							2.5	0.16
^{210}Pb											214	13.88
^{7}Be											1304	84.55
α Sum	42,185	0.18	171	100.24	3,814	298.12	341	173.65	0.00	0.00	0.0	0.00
β Sum	119,995	91.31	20,530	357.91	2,667	46.50	294	22.02	25.00	6.31	1,542.2	100.00
%Sum/Gross α	183		15		45		26		0.00			
% Sum/Gross β	16,438		358		47		22		6.31			

[1] The pCi/g sums for this sample are taken from Table 1.

J. Room A-062A Radiological Survey

This room measures 15 feet 8 inches north to south and 12 feet east to west. Direct exposure rates at the bottom of tank 1 ranged from 0.5 mR/h to 1 mR/h (see Figure 37). There was one location with fixed α contamination; 300 dis/min-100 cm^2 with 44.5k dis/min-100 cm^2 β. Low levels of loose β activity, up to 104 ± 28 dis/min, was measured on the outside of the tank and pipes. The smear from the area with direct contamination had 111 ± 30 dis/min α and 2,185 ± 101 dis/min β. The smear of the bottom of the tank had 454 ± 54 dis/min α and 20,560 ± 288 dis/min β. The smear results are tabulated in Appendix B Tables B1 and B2.

Because of the contamination in the bottom of the tank, direct surveys for β or γ contamination on the floor and walls was difficult. From Table 16 below, the level of activity that could be present and not detected is recorded. However, some contamination was detected above the background levels on the floor and west wall (see Figures 38 and 39). The direct activity was up to 4,300 dis/min α and 63.4k dis/min β using a 100 cm^2 detector. There was also loose activity, up to 55 ± 21 dis/min α and 1,756 ± 91 dis/min β on 100 cm^2 smears.

TABLE 16 Background Ranges in Room A-062A

	NE α dis/min		NE β dis/min	
Location	min	max	min	max
Ceiling	0	66	1284	2722
East Wall	NA	NA	NA	NA
Floor	0	20	22.7 k	61.3 k
North Wall	0	57	4828	50 k
South Wall	0	66	1284	6400
West Wall	0	57	3750	6480

NA Not Applicable, no east wall

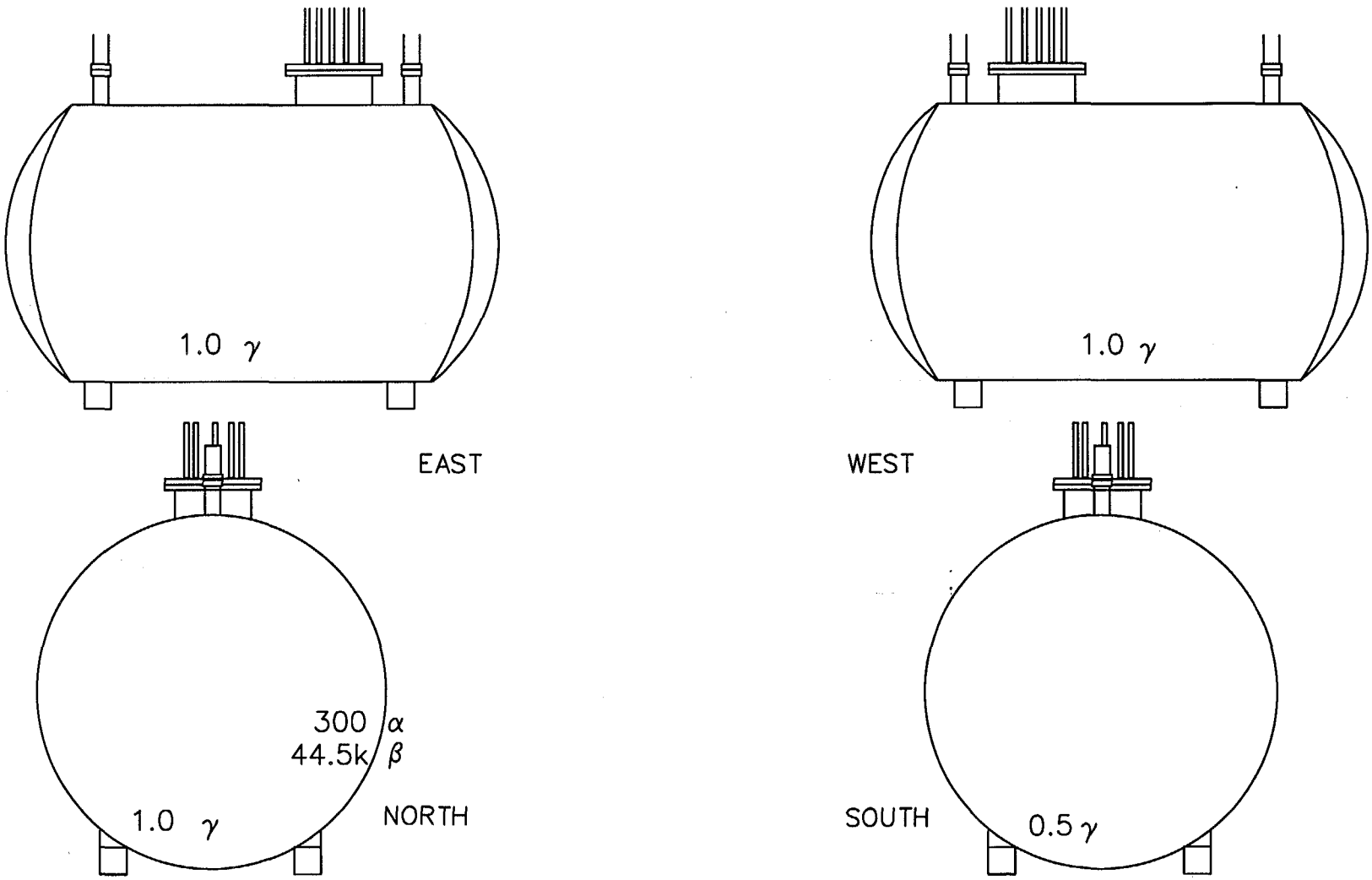


FIGURE 37 Building 310 Retention Tanks; Room 062 Tank 1

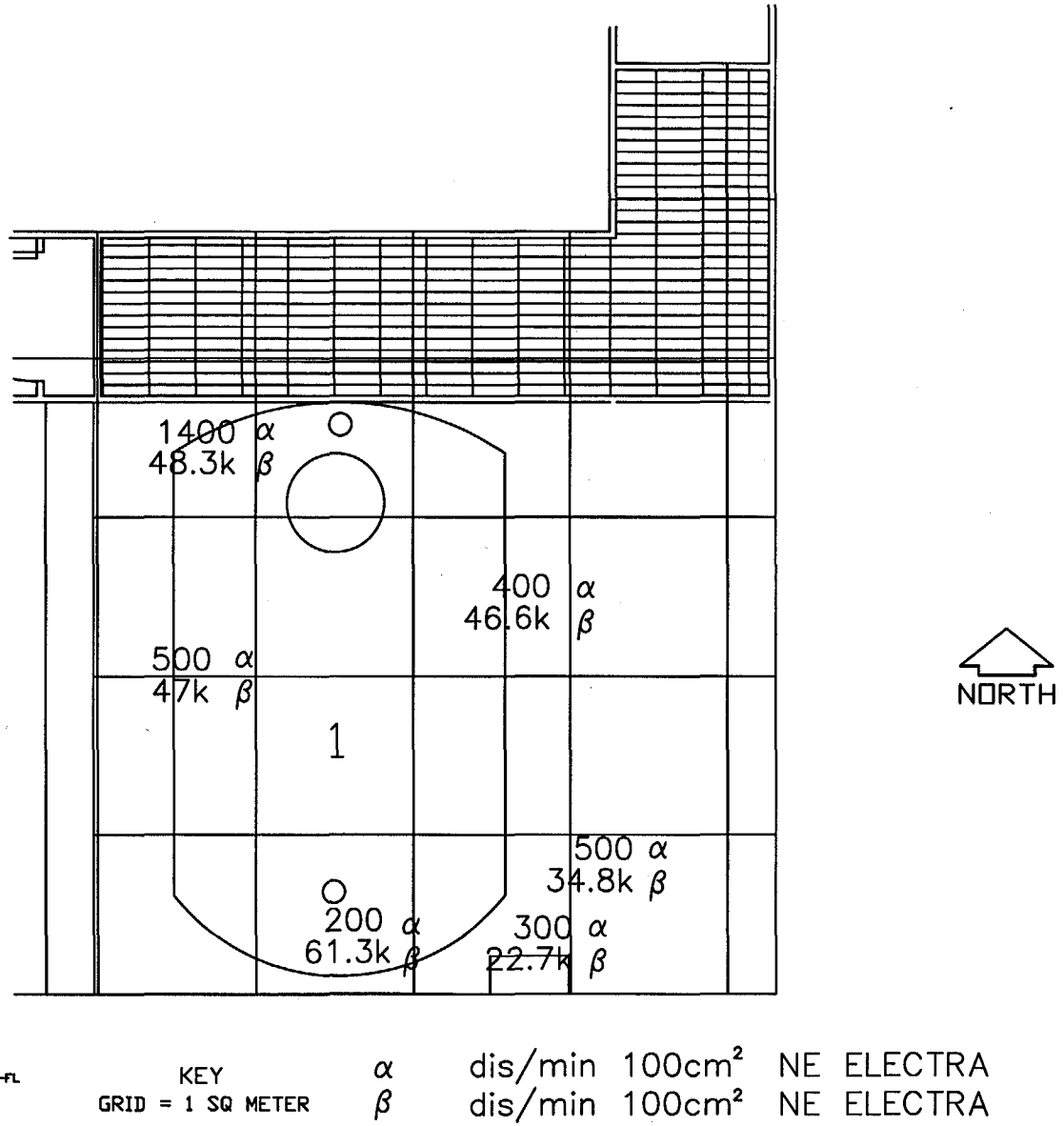
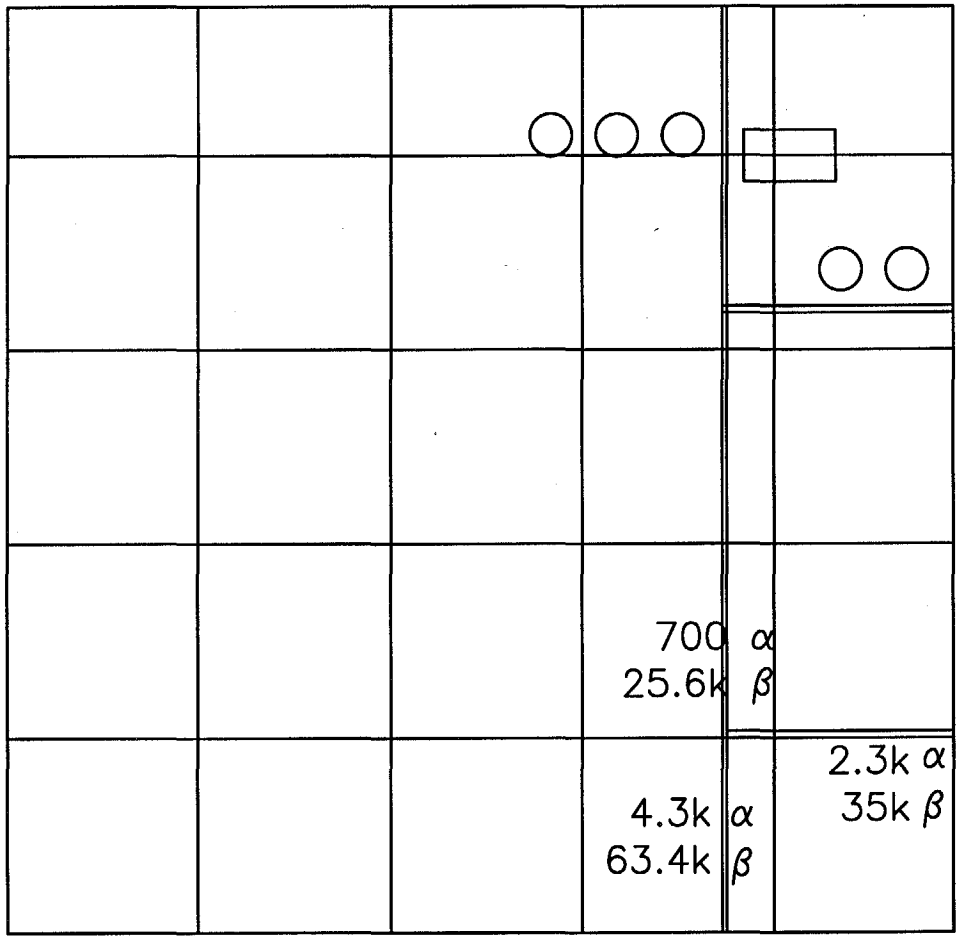


FIGURE 38 Building 310 Retention Tanks; Room 062 Floor



FILE: DD\310\062-W

KEY
GRID = 1 SQ METER

α dis/min 100cm² NE ELECTRA
β dis/min 100cm² NE ELECTRA

FIGURE 39 Building 310 Retention Tanks; Room 062 West Wall

K. Room A-068A Radiological Survey

The dry debris was vacuumed from the floor of this room and collected in a 55 gallon drum (~½ full). The exposure rate at the surface of this drum was < 0.1 mR/h. All waste that was accumulated during the characterization is in plastic bags in this room. The waste consists of gloves, shoe covers and tyveks. The exposure rate from the waste is < 0.1 mR/h.

For consistency Table 17 below was compiled for this room even though the β background measurements were much lower. The level of activity that could be present and not detected is recorded. Some contamination was detected above the background levels on the floor (see Figure 40). The fixed activity was up to 140 dis/min α and 3.1k dis/min β using a 100 cm^2 detector. There was no loose activity on 100 cm^2 smears. The smear results are tabulated in Appendix B Table B1.

There were numerous items that were found in this room including; scrub buckets, pumps, cabinets and shelves. One of the pumps had an old sticker indicating internal contamination. The direct reading over the top of the pump after the cover was removed was 80 dis/min α and 8,500 dis/min β using a 100 cm^2 detector. Smear number 536, of the internal surfaces of the contaminated pump, had elevated activity 215 ± 63 dis/min α and 20,020 ± 528 dis/min β as measured on the NE in the integrate mode. The activity as measured by the DABRAS was 153 ± 32 dis/min α and 396 ± 60 dis/min β. Smear number 536 was sent for gamma spectral analysis, the only gamma emitting radionuclide was ^{137}Cs with an activity of 25 dis/min (see Table 15). The beta activity measured by both the NE and the DABRAS indicated that there is a non gamma

TABLE 17 Background Ranges in Room A-068A

	NE α dis/min		NE β dis/min	
Location	min	max	min	max
Ceiling	0	40	939	2151
East Wall	0	55	850	2300
Floor	0	50	939	3000
North Wall	0	40	800	1007
South Wall	0	45	939	2824
West Wall	0	35	900	2036

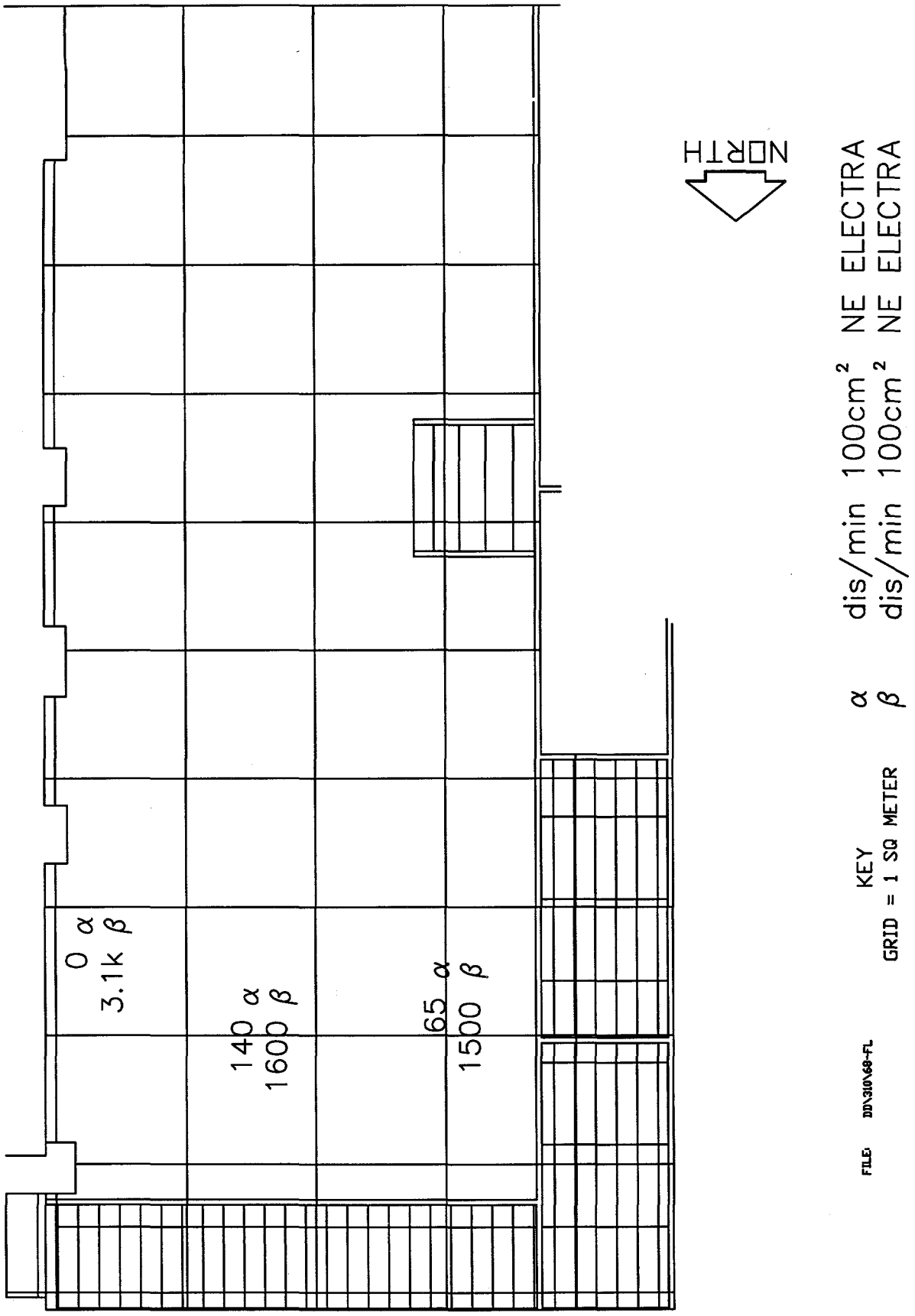


FIGURE 40 Building 310 Retention Tanks; Room 068 Floor

emitting radionuclide, probably ^{90}Sr. The rim of this pump had 183 ± 38 dis/min α and 429 ± 48 dis/min β. The maximum activity on any of the other smears of the miscellaneous equipment was 14 ± 11 dis/min α and 29 ± 21 dis/min β. There was a cap on the contaminated pump that was sent to ESH-DA for gamma spectral analysis. It contained 200 mg to 300 mg of ^{232}Th. The direct survey results had detected no α contamination in any orientation. The cap containing ^{232}Th is an exempted material as defined in reference 10. The memo from Don Nelson containing the results of the gamma spectrometric analysis con be found in Appendix D (Building 310 samples [page D-56]). Three pages from reference 10 are also included in Appendix D (pages D-57 through D-59).

L. Internal Conditions of Tanks

The internal smears were originally taken of a single pipe at the top flange of one of the set of three tanks in each room. The smear from A-038A had the highest activity 57 ± 22 dis/min α and 266 ± 39 dis/min β. In addition the inside of each tank was smeared with a ball of tissue at the end of a pole. The smears were counted both on the NE in the integrate mode and on the DABRAS. The results of both analyses are presented in Appendix B Table B2 and again in Table B4 for ease of viewing. In general, the tissue was arranged so that the activity measured by the DABRAS was greater than that measured by the NE. In both cases, an attempt was made to arrange the tissue so that the maximum activity could be measured.

A composite sludge sample was removed from four of the ten inactive retention tanks on June 23, 1995. The radionuclides found in the sample are given in Table 1 and a summary of the non-radiological results are given in Table 18. The TMA Thermo analytical Inc. documentation is presented in Appendix D. The memo from J. Demski (EMO/WM) indicates that the concentrations of hazardous materials "were low enough so that the sludge would not be considered characteristically hazardous... the sludge in the tanks would be classified as low level radioactive waste."

A visual inspection of the tanks was made using a flashlight for illumination. The tanks appear to have a glass or metal liner. The depths of the water and residue that were estimated, not measured, are presented in Table 19. The smear was taken inside each tank at the same time the inspection was made. The smear results are presented below and in Appendix B Table B4. The exposure rates in this table are the maximum external measurements.

TABLE 18 Retention Tank Sample dated 6/23/95

Analysis	Highest Concentration/Activity	Limit or Background Values
pH	7	≤2 or ≥12.5
Mercury	0.631 mg/kg	4 mg/kg Hg
PCB's	0.0017 mg/L Aroclor-1253	
Volatile Organic	none detected	> detection level[1]
Semivolatile Organic	none detected	> detection level[1]
Pesticides	none detected	> detection level[1]
Metals	0.111 mg/L Ba	EPA 5.0 mg/L Ba
Gross α & Gross β	see Table 1	

[1] The current list of compounds regulated under RCRA has individual limits above the detection level.

TABLE 19 Retention Tanks; Internal Conditions

Room No.	Tank No.	Water	Visual Inspection	Smears (dis/min) α	Smears (dis/min) β	Max mR/h
A-062A	1	dry	~1" of scale	208	17,700	1.0
A-050A	2	dry	small amount of scale < ½"	518	24,250	0.7
A-050A	3	water	~1" to 2"	226	10,050	0.3
A-050A	4	dry	~½" of scale	407	11,140	0.3
A-038A	5	dry	dust	144	6,264	1.0
A-038A	6	dry	dust	89	4,700	0.1
A-038A	7	dry	small amount of scale < ½"	96	5,625	0.1
A-026A	8	water	~2" of mud and water	2,749	46,420	0.6
A-026A	9	water	~2" to 3"	1,560	53,360	0.5
A-026A	10	water	~2" to 3"	64	1,703	0.5

M. Brick Breakout Wall

The current plans for the decontamination of the inactive tanks is to remove them intact from the building after removing the brick break out wall. Therefore in addition to direct and smear surveys, samples were scraped from the brick walls. The scrapings were counted for gross α and β activity similar to the smears. The scrapings with the highest measured activity were from room A-038A with 9 $\pm$ 9 dis/min α and 14 $\pm$1 9 dis/min β. The brick scrapping results are tabulated in Appendix B Table B1 and complied in Table B3 for ease of viewing. No contamination was found in the brick scrapings.

N. Grate Walk Ways

There are grate walk ways ~1 meter above the floor of each room. Direct and smear surveys were performed. In rooms A-038A and A-050A, there were three locations with direct contamination, up to 4,833 dis/min α and up to 14.4k dis/min β using a 100 cm^2 probe (see Figure 1). The exposure rate from tank 1 in room A-062A was too high to determine if the activity was from the grate or background from the tank. The smear results indicated loose activity up to 22 $\pm$ 13 dis/min α and 63 $\pm$ 48 dis/min β in room A-038A; and up to 9 $\pm$ 10 dis/min α and 107 $\pm$ 50 dis/min β in room A-050A. The loose activity on the grates of A-026A and A-062A was statically insignificant.

XI. SUMMARY OF RESULTS ABOVE BACKGROUND OR RELEASE CRITERIA

Past experience found direct surveys of the 317 vaults with significant activity on the concrete. During scabbling of the concrete from these vaults, airborne radioactivity was detected on the retrospective air samples. Past experience also found that direct surveys of the building 200 "hot dock" did not detect any radioactivity. However, during removal and repair of the concrete from the building 200 dock airborne radioactivity was detected on the retrospective air samples. Therefore, it must be assumed that any scabbling of the concrete walls in the 310 retention tank area will produce measurable airborne radioactivity.

Contamination was found in all of the rooms, 068A, 062A, 050A, 038A, 026A, of the Building 310 Retention Tank Facility. Because of the significant amounts of contamination, efforts to decontaminate the exteriors of the tanks, walls and floor will have to include respiratory protection measures for the personnel completing this work. Because of the high exposure rates from the contamination in the bottom of the tanks, the walls and floor will have to have a thorough survey by Health Physics after the tanks are removed and after the tar paper is removed.

The elbows and some of the pipes are covered with asbestos insulation.

The results of the air samples showed that during the characterization slight amounts of radioactive particles were detected in the air.

There is a contaminated pump in Room 068 that will have to be disposed of as solid radioactive waste.

XII. ESTIMATE OF INVENTORY OF ACTIVITY

A. Tanks

The estimated amount of radioactivity in each tank is presented in Table 20. The activities given in Table 1 were used as the average activity from tanks 3, 8, 9, and 10. The estimated depth of the scale or sludge in each tank was determined from the information in Table 19 and used to estimate the volume of contaminated material. The density of the material was assumed to be 1.5 g/cm^2. The maximum dose rates at the outside of the tanks was also used in the estimate of the activities inside the tanks. The total estimated α activity is 34.3 mCi; and the total estimated β activity is 97.5 mCi.

Estimates of the amount of activity on the external surface of each tank is given in Table 21. The estimates are based on the direct activities that are shown in the maps of the tanks. If the direct surveys could not measure anything above the high background from the material inside the tank, then the estimate is based on a weighted average of the individual smears (for α, tanks 2 and 9; for β tanks 2, 3, 4 and 9). The surface area of each tank is 3.17×10^5 cm^2. Without additional information, it should be assumed that 50% of the α activity is ^{241}Am and 50% is ^{239}Pu; and 50% of the β activity is ^{137}Cs and 50% is $^{90}Sr/^{90}Y$.

TABLE 20 Inventory Estimate inside Tanks

	Tank #									
	1	2	3	4	5	6	7	8	9	10
Scale (in)	1	¼	2	½	⅛	⅛	¼	2	3	3
Vol (gal)	7.59	0.95	21.39	2.69	0.34	0.34	0.95	21.39	39.16	39.16
Mass (kg)	43.10	5.40	121.47	15.27	1.91	1.91	5.40	121.47	222.33	222.33
nuclide	Activity in each tank (μCi)									
^{137}Cs	9,727.0	853.40	8,223.8	1,033.56	431.23	43.123	121.915	16,447.7	25,088.7	25,088.7
^{234m}Pa	560.1	49.14	473.6	59.52	24.83	2.483	7.020	947.1	1,444.7	1,444.7
^{234}Th	362.4	31.80	306.4	38.51	16.07	1.607	4.542	612.8	934.7	934.7
^{60}Co	215.0	18.86	181.7	22.84	9.53	0.953	2.694	363.5	554.4	554.4
^{40}K	15.5	1.36	13.1	1.65	0.69	0.069	0.194	26.2	40.0	40.0
^{90}Sr	8.0	0.70	6.8	0.85	0.35	0.035	0.100	13.5	20.6	20.6
β Sum	10,887.9	955.26	9,205.4	1,156.92	482.70	48.270	136.466	18,410.8	28,083.2	28,083.2
^{238}U	2,111.4	185.25	1,785.2	224.35	93.61	9.361	26.464	3,570.3	5,446.0	5,446.0
^{234}U	1,502.6	131.83	1,270.4	159.66	66.61	6.661	18.833	2,540.8	3,875.6	3,875.6
^{235}U	206.5	18.12	174.6	21.94	9.16	0.916	2.588	349.2	532.7	532.7
^{239}Pu	5.9	0.52	5.0	0.63	0.26	0.026	0.074	10.0	15.2	15.2
^{241}Am	1.0	0.09	0.8	0.11	0.04	0.004	0.013	1.7	2.6	2.6
^{238}Pu	0.3	0.02	0.2	0.03	0.01	0.001	0.003	0.5	0.7	0.7
α Sum	3,827.7	335.83	3,236.2	406.72	169.69	16.969	47.976	6,472.4	9,872.8	9,872.8

TABLE 21 Tank External Inventory Estimate

Tank #	μCi α	μCi β
1	0.014	2.005
2	0.004	0.090
3	0.011	0.095
4	0.225	0.108
5	22.973	14.414
6	0.315	4.189
7	2.432	6.757
8	0.113	2.973
9	0.003	0.018
10	0.036	0.901

B. Walls and Floors

The total amount of contamination on the walls and floors was estimated from the direct readings that are displayed on the maps. For calculational purposes, it was assumed that all of the alpha contamination was due to either ^{241}Am or ^{239}Pu; and the total beta contamination was due to either ^{137}Cs or ^{90}Sr. The ratios of the isotopes were based on the gamma spectral analyses presented in Table 15. The estimates are presented in Table 22.

In addition to the radioactivity on the wall and floor surfaces, there are low levels of radionuclides in the mud that was removed from room A-038A floor. With the limited amount of data that is available, the estimates in Table 23 were generated. Because of the gamma spectroscopy information, it is assumed that 50% of the α activity is ^{241}Am and 50% is ^{239}Pu; and 50% of the β activity is ^{137}Cs and 50% is $^{90}Sr/^{90}Y$. The total volume of mud is assumed to be 30 gal (113,600 mL). Most of the mud was removed from the floor and is now in a 55 gal drum in room A-068A.

TABLE 22 Inventory Estimate on Walls & Floors

	μCi				
Radionuclide	A-026A	A-038A	A-050A	A-062A	A-068A
Total α	2.041	2.644	93.541	0.869	0.009
^{241}Am	0.735	1.243	14.031	0.313	0.001
^{239}Pu	1.306	1.401	79.509	0.556	0.008
Total β	63.108	68.063	110.856	43.423	0.279
^{137}Cs	39.758	37.435	87.576	27.357	0.221
^{90}Sr	23.350	30.628	23.280	16.067	0.059

TABLE 23 Inventory Estimate in the Floor Mud

Radionuclide	pCi/mL	μCi
Total α	30	3.41
^{241}Am	15	1.70
^{239}Pu	15	1.70
Total β	210	23.86
^{137}Cs	105	11.93
$^{90}Sr/^{90}Y$	105	11.93

C. Pipes

The estimate for the internal and external activity on the pipes was combined. It is assumed that the pipes are drained of all liquid. In Table 24 below is the estimate.

In the process of taking a sample of the residue from the transfer lines, it was learned that there was water in the lines. If both transfer lines were full of water, they would contain 144 gallons (545,000 mL). One 55 gallon drum was filled. The radionuclide content listed in Table 25 is estimated from analysis results for both the drum and the liquid remaining in the lines.

TABLE 24 Pipe Inventory Estimate

Room	μCi α	μCi β
A-026A	0.003	0.109
A-038A	0.239	0.802
A-050A	0.022	0.450
A-062A	0.007	0.135
A-038A Transfer Line	0.009	0.147
Lab drain	0.038	1.351
Tunnel under paved area	0.342	12.162
Tunnel in Bldg 306	0.077	36.036
Sum	0.737	51.192

TABLE 25 Liquid from the Transfer Lines

Radionuclide	pCi/mL	μCi
^{241}Am	7.2	3.92
^{137}Cs	127	69.22
^{60}Co	5.2	2.83

XIII. LESSONS LEARNED

- Old abandoned facilities have radioactive contamination
- A thorough characterization is needed for an accurate assessment
- Pre-numbering the samples and pre-printing the sample labels helped keep the data organized

XIV. REFERENCES

1. USNRC Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors" 1974

2. DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (1990)

3. Draft DOE Rule 10 CFR 834, "Radiation Protection of the Public" (1995)

4. NCRP Report No. 94, "Exposure of the Population in the United States and Canada from Natural Background Radiation," National Council on Radiation Protection and Measurements, Bethesda, Maryland (1987)

5. DOE 10 CFR 835, "Occupational Radiation Protection" (1993)

6. EPA-5201/1-88-020, "Limiting Values of Radionuclide Intake And Air Concentration and Dose Conversion Factors For Inhalation, Submersion, and Ingestion", Federal Guidance Report No. 11

7. 40 CFR Parts 260-299, Code of Federal Regulations, Protection of Environment (July 1, 1995), U. S. Government Printing Office, Washington

8. "Argonne National Laboratory-East, Site Environmental Report for Calendar Year 1994" by N. W. Golchert and R. G. Kolzow, ANL-95/8, May 1995 (UC-607)

9. "Heavy rainstorms cause widespread but minor damage at Argonne-East", Argonne News, Monday, July 29, 1996

10. Illinois Department of Nuclear Safety, Regulation 52 Illinois Administrative Code: Chapter II Section 330.30

11. Micro Shield Version 4, Grove Engineering, 1992

APPENDIX A: Documentation of Samples

Type: **LA Smears** Date: _____

310/ 026 - **Pipes 10 -** **1.0**

Bldg/Room Location Sample #

Coordinates ↑ : _____

→ : _____

Sampler: _____ Counter: _____

Type: **LA Smears** Date: _____

310/ 026 - **Pipes 8 -** **2.0**

Bldg/Room Location Sample #

Coordinates ↑ : _____

→ : _____

Sampler: _____ Counter: _____

Type: **LA Smears** Date: _____

310/ 026 - **Pipes 9 -** **3.0**

Bldg/Room Location Sample #

Coordinates ↑ : _____

→ : _____

Sampler: _____ Counter: _____

Type: **LA Smears** Date: _____

310/ 026 - **Tank 10 -** **4.0**

Bldg/Room Location Sample #

Coordinates ↑ : _____

→ : _____

Sampler: _____ Counter: _____

Type: **LA Smears** Date: _____

310/ 026 - **Tank 8 -** **5.0**

Bldg/Room Location Sample #

Coordinates ↑ : _____

→ : _____

Sampler: _____ Counter: _____

Type: **LA Smears** Date: _____

310/ 026 - **Tank 9 -** **6.0**

Bldg/Room Location Sample #

Coordinates ↑ : _____

→ : _____

Sampler: _____ Counter: _____

Type: **SA Smears** Date: _____

310/ 026 - **Pipes 10 -** **7.0**

Bldg/Room Location Sample #

Coordinates ↑ : _____

→ : _____

Sampler: _____ Counter: _____

Type: **SA Smears** Date: _____

310/ 026 - **Pipes 10 -** **8.0**

Bldg/Room Location Sample #

Coordinates ↑ : _____

→ : _____

Sampler: _____ Counter: _____

FIGURE A1 Sample Labels

TABLE A1 Building 310 Characterization Sample Labels

Type	Room	Location	No.	Coordinates (feet) up	Coordinates (feet) right	Sample Date	Count Date	Count time
LA Smear	A-026A	Pipes 10	1	Horizontal	& Vertical	07/12/96	07/15/96	10:30:07
LA Smear	A-026A	Pipes 8	2	Horizontal	& Vertical	07/12/96	07/15/96	10:32:15
LA Smear	A-026A	Pipes 9	3	Horizontal	& Vertical	07/12/96	07/15/96	10:34:23
LA Smear	A-026A	Tank 10	4	Entire	Tank	07/12/96	07/15/96	10:36:31
LA Smear	A-026A	Tank 8	5	Entire	Tank	07/12/96	07/15/96	10:38:39
LA Smear	A-026A	Tank 9	6	Entire	Tank	07/12/96	07/15/96	10:40:47
SA Smear	A-026A	Pipes 10	7	12	3	07/12/96	07/15/96	10:42:55
SA Smear	A-026A	Pipes 10	8	10	3	07/12/96	07/15/96	10:45:02
SA Smear	A-026A	Pipes 8	9	N12	3	07/12/96	07/15/96	10:47:10
SA Smear	A-026A	Pipes 8	10	N8	3	07/12/96	07/15/96	10:49:18
SA Smear	A-026A	Pipes 9	11	12	3	07/12/96	07/15/96	10:51:26
SA Smear	A-026A	Pipes 9	12	10	3	07/12/96	07/15/96	10:53:34
Internal Smear	A-026A	Pipes	13	10	3	07/12/96	07/15/96	10:55:42
SA Smear	A-026A	Tank 10	14	E7	12	07/12/96	07/15/96	10:57:50
SA Smear	A-026A	Tank 10	15	N8	3	07/12/96	07/15/96	10:59:58
SA Smear	A-026A	Tank 8	16	E7	4	07/12/96	07/15/96	11:02:06
SA Smear	A-026A	Tank 8	17	S6	5	07/12/96	07/15/96	11:04:13
SA Smear	A-026A	Tank 9	18	N4	3	07/12/96	07/15/96	11:06:21
SA Smear	A-026A	Tank 9	19	W5	3	07/12/96	07/15/96	11:08:29
SA Smear	A-026A	Ceiling	20	8	24	07/11/96	07/15/96	11:10:37
SA Smear	A-026A	Ceiling	21	8	12	07/11/96	07/15/96	11:12:44
SA Smear	A-026A	East Wall	22	3	10	07/12/96	07/15/96	11:14:52
SA Smear	A-026A	East Wall	23	12	14	07/12/96	07/15/96	11:17:00
SA Smear	A-026A	East Wall	24	3	14	07/12/96	07/15/96	11:19:08
SA Smear	A-026A	East Wall	25	2	4	07/12/96	07/15/96	11:21:15
SA Smear	A-026A	Floors	26	12	12	07/12/96	07/15/96	11:23:23
SA Smear	A-026A	Floors	27	6	22	07/12/96	07/15/96	11:25:31
SA Smear	A-026A	Floors	28	3	15	07/12/96	07/15/96	11:27:39
SA Smear	A-026A	Floors	29	3	3	07/12/96	07/15/96	11:29:46
SA Smear	A-026A	North Wall	30	4	22	07/12/96	07/15/96	11:31:54
SA Smear	A-026A	North Wall	31	4	13	07/12/96	07/15/96	11:34:02
SA Smear	A-026A	North Wall	32	10	25	07/12/96	07/15/96	11:36:10
SA Smear	A-026A	North Wall	33	12	4	07/12/96	07/15/96	11:38:18
SA Smear	A-026A	South Wall	34	2	5	07/12/96	07/15/96	11:40:26
SA Smear	A-026A	South Wall	35	12	25	07/12/96	07/15/96	11:42:34
SA Smear	A-026A	South Wall	36	8	12	07/12/96	07/15/96	11:44:42
SA Smear	A-026A	South Wall	37	8	2	07/12/96	07/15/96	11:46:50
SA Smear	A-026A	West Wall	38	3	15	07/12/96	07/15/96	11:48:58
SA Smear	A-026A	West Wall	39	16	6	07/12/96	07/15/96	11:51:06
SA Smear	A-026A	West Wall	40	2	12	07/12/96	07/15/96	11:53:13
SA Smear	A-026A	West Wall	41	6	8	07/12/96	07/15/96	11:55:21

TABLE A1 Building 310 Characterization Sample Labels

				Coordinates (feet)			Count	
Type	Room	Location	No.	up	right	Sample Date	Date	time
LA Smears	A-038A	Pipes 5	42	Horizontal	& Vertical	08/05/96	08/06/96	13:33:57
LA Smears	A-038A	Pipes 6	43	Horizontal	& Vertical	08/05/96	08/06/96	13:53:38
LA Smears	A-038A	Pipes 7	44	Horizontal	& Vertical	08/05/96	08/06/96	13:58:04
LA Smears	A-038A	Tank 5	45	Entire	Tank	08/05/96	08/06/96	14:01:58
LA Smears	A-038A	Tank 6	46	Entire	Tank	08/05/96	08/06/96	14:05:43
LA Smears	A-038A	Tank 7	47	Entire	Tank	08/05/96	08/06/96	14:09:19
SA Smear	A-038A	Pipes 5	48	13	2	08/13/96	08/14/96	09:20:34
SA Smear	A-038A	Pipes 5	49	11	0	08/13/96	08/14/96	09:22:42
SA Smear	A-038A	Pipes 6	50	13	2	08/13/96	08/14/96	09:24:50
SA Smear	A-038A	Pipes 6	51	11	0	08/13/96	08/14/96	09:26:58
SA Smear	A-038A	Pipes 7	52	13	2	08/13/96	08/14/96	09:29:06
SA Smear	A-038A	Pipes 7	53	11	0	08/13/96	08/14/96	09:31:13
Internal Smear	A-038A	Pipes	54	10	3	08/13/96	08/14/96	09:33:22
SA Smear	A-038A	Tank 5	55	W5.5	5.33	08/13/96	08/14/96	09:35:30
SA Smear	A-038A	Tank 5	56	E5.6	5.33	08/13/96	08/14/96	09:37:37
SA Smear	A-038A	Tank 6	57	E5.5	5.33	08/13/96	08/14/96	09:39:45
SA Smear	A-038A	Tank 6	58	W5.5	5.33	08/13/96	08/14/96	09:41:53
SA Smear	A-038A	Tank 7	59	E5.5	5.33	08/13/96	08/14/96	09:44:01
SA Smear	A-038A	Tank 7	60	W5.5	5.33	08/13/96	08/14/96	09:46:09
SA Smear	A-038A	Ceiling	61	4	10	08/05/96	08/06/96	15:07:19
SA Smear	A-038A	Ceiling	62	center		08/05/96	08/06/96	15:09:27
SA Smear	A-038A	East Wall	63	2	3.5	08/05/96	08/06/96	15:11:35
SA Smear	A-038A	East Wall	64	7	2	08/05/96	08/06/96	15:13:43
SA Smear	A-038A	East Wall	65	7	6	08/05/96	08/06/96	15:15:50
SA Smear	A-038A	East Wall	66	2	10.67	08/05/96	08/06/96	15:17:58
SA Smear	A-038A	Floors	67	4	24	08/05/96	08/06/96	15:20:06
SA Smear	A-038A	Floors	68	13.75	18	08/05/96	08/06/96	15:22:14
SA Smear	A-038A	Floors	69	13.75	11	08/05/96	08/06/96	15:24:22
SA Smear	A-038A	Floors	70	13.75	1.33	08/05/96	08/06/96	15:26:30
SA Smear	A-038A	North Wall	71	2	8.58	08/05/96	08/06/96	15:28:38
SA Smear	A-038A	North Wall	72	7	15	08/05/96	08/06/96	15:30:46
SA Smear	A-038A	North Wall	73	2	19.67	08/05/96	08/06/96	15:32:54
SA Smear	A-038A	North Wall	74	7	24	08/05/96	08/06/96	15:35:01
SA Smear	A-038A	South Wall	75	2	8.58	08/05/96	08/06/96	15:37:09
SA Smear	A-038A	South Wall	76	2	19.67	08/05/96	08/06/96	15:39:17
SA Smear	A-038A	South Wall	77	0.83	0.58	08/05/96	08/06/96	15:41:25
SA Smear	A-038A	South Wall	78	6	24	08/05/96	08/06/96	15:43:33
SA Smear	A-038A	West Wall	79	2	2	08/05/96	08/06/96	15:45:41
SA Smear	A-038A	West Wall	80	6.67	6.67	08/05/96	08/06/96	15:47:49
SA Smear	A-038A	West Wall	81	2	9.75	08/05/96	08/06/96	15:49:56
SA Smear	A-038A	West Wall	82	6.67	12.5	08/05/96	08/06/96	15:52:04

TABLE A1 Building 310 Characterization Sample Labels

Type	Room	Location	No.	Coordinates (feet) up	Coordinates (feet) right	Sample Date	Count Date	Count time
LA Smear	A-050A	Pipes 2	83	Horizontal	& Vertical	07/10/96	07/11/96	12:42:19
LA Smear	A-050A	Pipes 3	84	Horizontal	& Vertical	07/10/96	07/11/96	12:44:27
LA Smear	A-050A	Pipes 4	85	Horizontal	& Vertical	07/10/96	07/11/96	12:46:35
LA Smear	A-050A	Tank 2	86	Entire	Tank	07/10/96	07/11/96	12:48:43
LA Smear	A-050A	Tank 3	87	Entire	Tank	07/10/96	07/11/96	12:50:51
LA Smear	A-050A	Tank 4	88	Entire	Tank	07/10/96	07/11/96	12:52:59
SA Smear	A-050A	Pipes 2	89	10	3	07/10/96	07/11/96	12:55:07
SA Smear	A-050A	Pipes 2	90	12	3	07/10/96	07/11/96	12:57:15
SA Smear	A-050A	Pipes 3	91	10	3	07/10/96	07/11/96	12:59:23
SA Smear	A-050A	Pipes 3	92	12	3	07/10/96	07/11/96	13:01:31
SA Smear	A-050A	Pipes 4	93	12	3	07/10/96	07/11/96	13:03:39
SA Smear	A-050A	Pipes 4	94	10	3	07/10/96	07/11/96	13:05:47
Internal Smear	A-050A	Pipes	95	9	3	07/10/96	07/11/96	13:07:55
SA Smear	A-050A	Tank 2	96	S8	3	07/10/96	07/11/96	13:10:03
SA Smear	A-050A	Tank 2	97	N8	3	07/10/96	07/11/96	13:12:10
SA Smear	A-050A	Tank 3	98	S8	3	07/10/96	07/11/96	13:14:18
SA Smear	A-050A	Tank 3	99	N8	3	07/10/96	07/11/96	13:16:26
SA Smear	A-050A	Tank 4	100	N8	3	07/10/96	07/11/96	13:18:34
SA Smear	A-050A	Tank 4	101	S8	3	07/10/96	07/11/96	13:20:42
SA Smear	A-050A	Ceiling	102	15	2	07/10/96	07/11/96	13:22:50
SA Smear	A-050A	Ceiling	103	25	10	07/10/96	07/11/96	13:24:58
SA Smear	A-050A	East Wall	104	2	8	07/10/96	07/11/96	13:27:06
SA Smear	A-050A	East Wall	105	2	15	07/10/96	07/11/96	13:29:14
SA Smear	A-050A	East Wall	106	8	4	07/10/96	07/11/96	13:31:21
SA Smear	A-050A	East Wall	107	12	1	07/10/96	07/11/96	13:33:29
SA Smear	A-050A	Floors	108	3	10	07/10/96	07/11/96	13:35:37
SA Smear	A-050A	Floors	109	3	25	07/10/96	07/11/96	13:37:45
SA Smear	A-050A	Floors	110	13	27	07/10/96	07/11/96	13:39:52
SA Smear	A-050A	Floors	111	15	15	07/10/96	07/11/96	13:42:00
SA Smear	A-050A	North Wall	112	2	21	07/10/96	07/11/96	13:44:08
SA Smear	A-050A	North Wall	113	3	12	07/10/96	07/11/96	13:46:16
SA Smear	A-050A	North Wall	114	20	9	07/10/96	07/11/96	13:48:24
SA Smear	A-050A	North Wall	115	10	10	07/10/96	07/11/96	13:50:31
SA Smear	A-050A	South Wall	116	2	7	07/10/96	07/11/96	13:52:39
SA Smear	A-050A	South Wall	117	2	14	07/10/96	07/11/96	13:54:47
SA Smear	A-050A	South Wall	118	2	25	07/10/96	07/11/96	13:56:55
SA Smear	A-050A	South Wall	119	2	19	07/10/96	07/11/96	13:59:02
SA Smear	A-050A	West Wall	120	5	8	07/10/96	07/11/96	14:01:10
SA Smear	A-050A	West Wall	121	8	11	07/10/96	07/11/96	14:03:18
SA Smear	A-050A	West Wall	122	3	10	07/10/96	07/11/96	14:05:26
SA Smear	A-050A	West Wall	123	2	10	07/10/96	07/11/96	14:07:34

TABLE A1 Building 310 Characterization Sample Labels

				Coordinates (feet)			Count	
Type	Room	Location	No.	up	right	Sample Date	Date	time
LA Smear	A-062A	Pipes 1	124	Horizontal	& Vertical	07/11/96	07/11/96	15:39:19
LA Smear	A-062A	Tank 1	125	Entire	Tank	07/11/96	07/11/96	15:41:27
SA Smear	A-062A	Pipes 1	126	12	3	07/11/96	07/11/96	15:43:35
SA Smear	A-062A	Pipes 1	127	10	3	07/11/96	07/11/96	15:45:43
SA Smear	A-062A	Tank 1	128	N5	3	07/11/96	07/11/96	15:47:51
SA Smear	A-062A	Tank 1	129	W6	8	07/11/96	07/11/96	15:49:59
SA Smear	A-062A	Ceiling	130	7	2	07/11/96	07/11/96	15:52:07
SA Smear	A-062A	Ceiling	131	7	10	07/11/96	07/11/96	15:54:15
SA Smear	A-062A	East Wall	132	NA	NA			
SA Smear	A-062A	East Wall	133	NA	NA			
SA Smear	A-062A	East Wall	134	NA	NA			
SA Smear	A-062A	East Wall	135	NA	NA			
SA Smear	A-062A	Floors	136	12	4	07/11/96	07/11/96	15:56:22
SA Smear	A-062A	Floors	137	7	3	07/11/96	07/11/96	15:58:30
SA Smear	A-062A	Floors	138	12	14	07/11/96	07/11/96	16:00:38
SA Smear	A-062A	Floors	139	3	14	07/11/96	07/11/96	16:02:45
SA Smear	A-062A	North Wall	140	3	5	07/11/96	07/11/96	16:04:53
SA Smear	A-062A	North Wall	141	2	10	07/11/96	07/11/96	16:07:01
SA Smear	A-062A	North Wall	142	2	10	07/11/96	07/11/96	16:09:08
SA Smear	A-062A	North Wall	143	8	11	07/11/96	07/11/96	16:11:16
SA Smear	A-062A	South Wall	144	14	2	07/11/96	07/11/96	16:13:24
SA Smear	A-062A	South Wall	145	4	4	07/11/96	07/11/96	16:15:32
SA Smear	A-062A	South Wall	146	12	8	07/11/96	07/11/96	16:17:39
SA Smear	A-062A	South Wall	147	3	0	07/11/96	07/11/96	16:19:47
SA Smear	A-062A	West Wall	148	8	12	07/11/96	07/11/96	16:21:55
SA Smear	A-062A	West Wall	149	2	2	07/11/96	07/11/96	16:24:02
SA Smear	A-062A	West Wall	150	6	6	07/11/96	07/11/96	16:26:10
SA Smear	A-062A	West Wall	151	4	14	07/11/96	07/11/96	16:28:18
SA Smear	A-068A	Ceiling	152	5	12	07/11/96	07/11/96	14:09:42
SA Smear	A-068A	Ceiling	153	5	22	07/11/96	07/11/96	14:11:50
SA Smear	A-068A	East Wall	154	12	30	07/11/96	07/11/96	14:13:58
SA Smear	A-068A	East Wall	155	8	27	07/11/96	07/11/96	14:16:06
SA Smear	A-068A	East Wall	156	3	18	07/11/96	07/11/96	14:18:14
SA Smear	A-068A	East Wall	157	10	2	07/11/96	07/11/96	14:20:22
SA Smear	A-068A	Floors	158	6	12	07/11/96	07/11/96	14:22:30
SA Smear	A-068A	Floors	159	12	5	07/11/96	07/11/96	14:24:38
SA Smear	A-068A	Floors	160	10	28	07/11/96	07/11/96	14:26:46
SA Smear	A-068A	Floors	161	4	21	07/11/96	07/11/96	14:28:54
SA Smear	A-068A	North Wall	162	10	15	07/11/96	07/11/96	14:31:02
SA Smear	A-068A	North Wall	163	6	4	07/11/96	07/11/96	14:33:10
SA Smear	A-068A	North Wall	164	2	2	07/11/96	07/11/96	14:35:18
SA Smear	A-068A	North Wall	165	2	10	07/11/96	07/11/96	14:37:26

TABLE A1 Building 310 Characterization Sample Labels

				Coordinates (feet)			Count	
Type	Room	Location	No.	up	right	Sample Date	Date	time
SA Smear	A-068A	South Wall	166	2	2	07/11/96	07/11/96	14:39:33
SA Smear	A-068A	South Wall	167	5	12	07/11/96	07/11/96	14:41:41
SA Smear	A-068A	South Wall	168	6	11	07/11/96	07/11/96	14:43:49
SA Smear	A-068A	South Wall	169	4	16	07/11/96	07/11/96	14:45:57
SA Smear	A-068A	West Wall	170	10	10	07/11/96	07/11/96	14:48:05
SA Smear	A-068A	West Wall	171	3	0	07/11/96	07/11/96	14:50:13
SA Smear	A-068A	West Wall	172	11	5	07/11/96	07/11/96	14:52:21
SA Smear	A-068A	West Wall	173	4	17	07/11/96	07/11/96	14:54:29
SA Smear	Tunnel	Floors #1	174	Entrance	from 310	08/06/96	08/08/96	13:36:35
SA Smear	Tunnel	Floors #2	175	3	from 310	08/06/96	08/08/96	13:38:43
SA Smear	Tunnel	Floors #3	176	15	from 310	08/06/96	08/08/96	13:40:51
SA Smear	Tunnel	Floors #4	177	25	from 310	08/06/96	08/08/96	13:42:59
SA Smear	Tunnel	Floors #5	178	35	from 310	08/06/96	08/08/96	13:45:07
SA Smear	Tunnel	Floors #6	179	45	from 310	08/06/96	08/08/96	13:47:15
SA Smear	Tunnel	Floors #7	180	55	from 310	08/06/96	08/08/96	13:49:22
SA Smear	Tunnel	Floors #8	181	65	from 310	08/06/96	08/08/96	13:51:30
SA Smear	Tunnel	Floors #9	182	75	from 310	08/06/96	08/08/96	13:53:38
SA Smear	Tunnel	Floors #10	183	85	from 310	08/06/96	08/08/96	13:55:46
LA Smear	Tunnel	Pipes #1	184	0 to 3	from 310	08/06/96	08/20/96	15:45:59
LA Smear	Tunnel	Pipes #2	185	3	from 310	08/06/96	08/08/96	10:50:49
LA Smear	Tunnel	Pipes #3	186	15	from 310	08/06/96	08/08/96	10:55:35
LA Smear	Tunnel	Pipes #4	187	25	from 310	08/06/96	08/12/96	11:24:00
LA Smear	Tunnel	Pipes #6	188	45	from 310	08/06/96	08/12/96	11:16:08
LA Smear	Tunnel	Pipes #5	189	35	from 310	08/06/96	08/12/96	11:20:46
LA Smear	Tunnel	Pipes #7	190	55	from 310	08/06/96	08/12/96	11:12:49
LA Smear	Tunnel	Pipes #8	191	65	from 310	08/06/96	08/12/96	11:27:00
LA Smear	Tunnel	Pipes #9	192	75	from 310	08/06/96	08/12/96	11:30:54
LA Smear	Tunnel	Pipes #10	193	85	from 310	08/06/96	08/12/96	11:34:14
Air	A-026A	Period 1	194			07/03/96	07/08/96	11:50:43
Air	A-038A	Period 1	195			07/03/96	07/08/96	12:00:50
Air	A-050A	Period 1	196			no air sample collected		
Air	A-062A	Period 1	197			07/03/96	07/08/96	12:10:58
Air	A-026A	Period 2	198			07/09/96	07/15/96	14:15:47
Air	A-038A	Period 2	199			07/09/96	07/15/96	14:25:55
Air	A-050A	Period 2	200			07/09/96	07/15/96	14:36:03
Air	A-062A	Period 2	201			07/09/96	07/15/96	14:46:11
Air	A-026A	Period 3	202			07/12/96	07/22/96	14:43:02
Air	A-038A	Period 3	203			07/12/96	07/22/96	14:53:10
Air	A-050A	Period 3	204			07/12/96	07/22/96	15:03:18
Air	A-062A	Period 3	205			07/12/96	07/22/96	15:13:26

TABLE A1 Building 310 Characterization Sample Labels

Type	Room	Location	No.	Coordinates (feet) up	Coordinates (feet) right	Sample Date	Count Date	Count time
Air	A-026A	Period 4	206			07/19/96	07/29/96	10:05:16
Air	A-038A	Period 4	207			07/19/96	07/29/96	10:15:24
Air	A-050A	Period 4	208			07/19/96	07/29/96	10:25:32
Air	A-062A	Period 4	209			07/19/96	07/29/96	10:35:40
LA Smear	A-068A	cabinet	210			07/16/96	07/16/96	17:29:14
LA Smear	A-068A	wood skids	211	two		07/16/96	07/16/96	17:31:22
LA Smear	A-068A	doors	212			07/16/96	07/16/96	17:33:30
LA Smear	A-068A	pump	213	w/rad stickers		07/16/96	07/16/96	17:35:38
LA Smear	A-068A	scrub buckets	214	two		07/16/96	07/16/96	17:37:46
LA Smear	A-068A	hose	215			07/16/96	07/16/96	17:39:54
LA Smear	A-068A	pumps	216	under shelves		07/16/96	07/16/96	17:42:02
LA Smear	A-068A	pumps	217	under grate		07/16/96	07/16/96	17:44:10
LA Smear	A-068A	shelves	218			07/16/96	07/16/96	17:46:18
LA Smear	A-068A	ladder	219	under grate		07/16/96	07/16/96	17:48:25
LA Smear	A-068A	misc. scrap	220			07/16/96	07/16/96	17:50:33
LA Smear	A-068A	E Wall & Floor	221	7 from N	0 from E	07/22/96	07/22/96	13:16:48
LA Smear	A-068A	drum	222			07/16/96	07/16/96	17:52:41
LA Smear	A-050A	Floor; tar paper	223	8.7	0	07/22/96	07/22/96	13:21:03
LA Smear	A-050A	Floor; tar paper	224	11.2	2.7	07/22/96	07/22/96	13:23:11
LA Smear	A-050A	Floor; tar paper	225	14.7	5.7	07/22/96	07/22/96	13:25:19
LA Smear	A-050A	Floor; tar paper	226	13.7	12.7	07/22/96	07/22/96	13:27:27
LA Smear	A-050A	Floor; tar paper	227	13.7	17.1	07/22/96	07/22/96	13:29:34
LA Smear	A-050A	Floor; tar paper	228	11.7	9.7	07/22/96	07/22/96	13:31:42
LA Smear	A-050A	Floor; tar paper	229	10.7	6.7	07/22/96	07/22/96	13:33:50
LA Smear	A-050A	Floor; tar paper	230	10.7	11.7	07/22/96	07/22/96	13:35:58
LA Smear	A-068A	pump - rim	231	w/rad stickers		07/22/96	07/22/96	13:38:05
Brick	A-050A	South Wall	232	5	18 from E	07/22/96	07/23/96	11:44:41
LA Smear	A-062A	Tank 1	233	Contaminated Spots		07/23/96	07/23/96	16:20:02
Brick	A-050A	South Wall	234	5	9	07/22/96	07/23/96	11:46:49
Brick	A-026A	South Wall	235	8	11	07/22/96	07/23/96	11:48:57
LA Smear	A-026A	pump	236	2 Sump pumps		07/22/96	07/23/96	11:51:04
Brick	A-038A	South Wall	237	8	9	07/22/96	07/23/96	11:53:12
Brick	A-050A	South Wall	238	2	9 from E	07/22/96	07/23/96	11:55:20
Brick	A-062A	South Wall	239	7	18	07/22/96	07/23/96	11:57:28
Brick	A-026A	South Wall	240	7	19	07/22/96	07/23/96	11:59:35
Brick	A-062A	South Wall	241	7	25 from E	07/22/96	07/23/96	12:01:43
Brick	A-038A	South Wall	242	9	18 from E	07/22/96	07/23/96	12:03:51
LA Smear	A-050A	Tank 4	243	Contaminated Spots		07/23/96	07/23/96	16:22:09
SA Smear	A-026A	East Wall	244	9	7	07/23/96	07/23/96	16:24:17
SA Smear	A-026A	North Wall	245	2	9.58	07/23/96	07/23/96	16:26:25
SA Smear	A-026A	North Wall	246	2	13	07/23/96	07/23/96	16:28:33
SA Smear	A-026A	South Wall	247	1.25	5.25	07/23/96	07/23/96	16:30:41

TABLE A1 Building 310 Characterization Sample Labels

Type	Room	Location	No.	Coordinates (feet) up	Coordinates (feet) right	Sample Date	Count Date	Count time
SA Smear	A-062A	North Wall	248	8.67	8.5	07/23/96	07/23/96	16:32:49
SA Smear	A-062A	South Wall	249	1.75	8.58	07/23/96	07/23/96	16:34:57
SA Smear	A-062A	West Wall	250	0.75	6.25	07/23/96	07/23/96	16:37:05
SA Smear	A-050A	South Wall	251	7.58	9	07/23/96	07/23/96	16:39:12
SA Smear	A-050A	South Wall	252	7.58	15	07/23/96	07/23/96	16:41:20
SA Smear	A-068A	South Wall	253	1.5	6.17	07/23/96	07/23/96	16:43:28
SA Smear	A-068A	West Wall	254	2	4	07/23/96	07/23/96	16:45:36
SA Smear	A-068A	East Wall	255	1	11	07/23/96	07/23/96	16:47:43
LA Smear	A-068A	pump , etc	256	Internal	SE Corner	07/23/96	07/23/96	16:49:51
LA Smear	A-068A	pump #2	257	Internal	by E Wall	07/23/96	07/23/96	16:51:59
LA Smear	A-068A	pump #3	258	Internal	by E Wall	07/23/96	07/23/96	16:54:07
LA Smear	A-068A	Container #4	259	Internal	by E Wall	07/23/96	07/23/96	16:56:14
LA Smear	A-068A	pumps-2 #5	260	Internal	by N Wall	07/23/96	07/23/96	16:58:22
LA Smear	A-068A	pump #6	261	Internal	by W Wall	07/23/96	07/23/96	17:00:30
Brick	A-038A	South Wall	262	0.83	7	08/05/96	08/06/96	15:54:12
Brick	A-038A	South Wall	263	6	24	08/05/96	08/06/96	15:56:20
Brick	A-038A	South Wall	264	2	17	08/05/96	08/06/96	15:58:27
Brick	A-038A	South Wall	265	2	18	08/05/96	08/06/96	16:00:35
Air	A-026A	Period 5	266			07/26/96	08/15/96	18:26:49
Air	A-038A	Period 5	267			07/26/96	08/15/96	18:36:57
Air	A-050A	Period 5	268			07/26/96	08/15/96	18:47:04
Air	A-062A	Period 5	269			07/26/96	08/15/96	18:57:12
LA Smear	A-038A	Tank 5	271	W3	2.67	08/06/96	09/18/96	12:25:13
LA Smear	A-038A	Pipe 1.67 from N Wall	270	11.83	13.75	08/06/96	09/18/96	12:29:29
LA Smear	A-038A	Tank 5	272	W8.25	2.67	08/06/96	09/18/96	12:27:21
LA Smear	A-038A	North Wall	273	3 12.8 to 15.8		09/19/96	09/19/96	15:54:42
Water	A-038A	Floor	274	Drum of mud & water		9/12/96	9/15/96	
LA Smear	A-038A	Pipe 1.75" from N. Wall	275	11.83	14	09/19/96	09/19/96	15:51:01
Mud	A-038A	Floor	276	Drum of mud & water		9/12/96	9/18/96	00:53:00
LA Smear	A-038A	Pipe 1.75" from N. Wall	277	13.83	14	09/19/96	09/19/96	15:46:20
LA Smear	A-050A	LA Smear	500	lower		07/10/96	07/11/96	15:36:29
LA Smear	A-050A	West Wall	501			07/10/96	07/11/96	15:40:59
LA Smear	A-050A	Floor	503	Under Grate	Tank 4	07/14/96	07/15/96	17:18:25
LA Smear	A-050A	West Wall	502	Electric Box		07/14/96	07/15/96	17:25:56
LA Smear	A-062A	Grate	504	all		08/07/96	08/08/96	11:13:14
LA Smear	A-050A	Grate	505	all		08/07/96	08/08/96	11:22:31
LA Smear	A-038A	Grate	506	Hot Spot by Tank 7		08/07/96	08/08/96	11:29:52
LA Smear	A-038A	Grate	507	In front of Tank 6		08/07/96	08/08/96	11:33:06
LA Smear	A-038A	Grate	508	all		08/07/96	08/08/96	11:36:16

TABLE A1 Building 310 Characterization Sample Labels

Type	Room	Location	No.	Coordinates (feet) up	Coordinates (feet) right	Sample Date	Count Date	Count time
LA Smear	A-026A	Grate	509	all		08/07/96	08/08/96	11:38:56
LA Smear	A-050A	Grate	510	Hot Spot by Tank 4		08/07/96	08/08/96	11:41:39
LA Smear	A-050A	Tank #4	511	Internal	DABRAS	07/22/96	08/12/96	08:54:00
LA Smear	A-050A	Tank #2	512	Internal	DABRAS	07/22/96	08/12/96	08:59:47
LA Smear	A-062A	Tank #1	513	Bottom of tank-external		07/22/96	08/12/96	09:06:10
LA Smear	A-062A	Tank #1	514	Internal	DABRAS	07/22/96	08/12/96	09:09:39
LA Smear	A-038A	Tank #5	515	Internal	DABRAS	07/22/96	08/12/96	09:17:04
LA Smear	A-038A	Tank #6	516	Internal	DABRAS	07/22/96	08/12/96	09:23:05
LA Smear	A-050A	Tank #3	517	Internal	DABRAS	07/22/96	08/12/96	09:29:31
LA Smear	A-026A	Tank #8	518	Internal	DABRAS	07/22/96	08/12/96	09:34:11
LA Smear	A-026A	Tank #10	520	Internal	DABRAS	07/22/96	08/12/96	09:50:34
LA Smear	A-038A	Tank #7	521	Internal	DABRAS	07/22/96	08/12/96	09:53:51
LA Smear	A-026A	Tank #9	519	Internal	DABRAS	07/22/96	08/12/96	10:23:43
Tarpaper-t	A-038A	Floor	522	9	1	08/06/96	08/14/96	09:43:15
Tarpaper-b	A-038A	Floor	523	9	1	08/06/96	08/14/96	09:45:56
Tarpaper-t	A-038A	Floor	524	9.42	10	08/06/96	08/14/96	09:53:09
Tarpaper-b	A-038A	Floor	525	9.42	10	08/06/96	08/14/96	10:17:33
Tarpaper-t	A-038A	Floor	526	9.33	19	08/06/96	08/14/96	10:25:03
Tarpaper-b	A-038A	Floor	527	9.33	19	08/06/96	08/14/96	10:32:44
Tarpaper-t	A-038A	Floor	528	9.42	25	08/06/96	08/14/96	10:35:34
Tarpaper-b	A-038A	Floor	529	9.42	25	08/06/96	08/14/96	10:38:23
LA Smear	A-038A	Floor	530	9	1	08/06/96	08/14/96	10:44:04
LA Smear	A-038A	Floor	531	9.42	10	08/06/96	08/14/96	10:52:20
LA Smear	A-038A	Floor	532	9.33	19	08/06/96	08/14/96	10:58:16
LA Smear	A-038A	Floor	533	9.42	25	08/06/96	08/14/96	11:01:52
Internal Smear	B-007	Pipe	534	Internal from 310		08/15/96	08/15/96	14:13:53
Internal Smear	B-007	Pipe	535	Internal to 310		08/15/96	08/15/96	14:26:02
LA Smear	A-068A	pump-cont	536	Internal	DABRAS	07/22/96	08/19/96	15:54:51

APPENDIX B: Smear & Brick Sample Data

TABLE B1 Smear Sample Data from Tennelec for 310 Retention Tanks

				Coordinates (feet)		dis/min	
Type	Room	Location	No.	up	right	Alpha	Beta
LA Smear	A-026A	Pipes 10	1	Horizontal	& Vertical	5.19 ± 7.08	27.2 ± 20.5
LA Smear	A-026A	Pipes 8	2	Horizontal	& Vertical	3.10 ± 5.78	72.5 ± 25.1
LA Smear	A-026A	Pipes 9	3	Horizontal	& Vertical	7.27 ± 8.17	7.0 ± 18.2
LA Smear	A-026A	Tank 10	4	Entire	Tank	9.35 ± 9.14	72.5 ± 25.1
LA Smear	A-026A	Tank 8	5	Entire	Tank	11.44 ± 10.01	27.2 ± 20.5
LA Smear	A-026A	Tank 9	6	Entire	Tank	28.10 ± 15.28	103.4 ± 27.8
SA Smear	A-026A	Pipes 10	7	12	3	3.10 ± 5.78	30.8 ± 20.9
SA Smear	A-026A	Pipes 10	8	10	3	23.94 ± 14.15	17.7 ± 19.5
SA Smear	A-026A	Pipes 8	9	N12	3	7.27 ± 8.17	27.2 ± 20.5
SA Smear	A-026A	Pipes 8	10	N8	3	1.02 ± 4.09	-7.3 ± 16.3
SA Smear	A-026A	Pipes 9	11	12	3	3.10 ± 5.78	16.5 ± 19.3
SA Smear	A-026A	Pipes 9	12	10	3	5.19 ± 7.08	18.9 ± 19.6
Internal Smear	A-026A	Pipes	13	10	3	3.10 ± 5.78	1.0 ± 17.4
SA Smear	A-026A	Tank 10	14	E7	12	1.02 ± 4.09	23.6 ± 20.1
SA Smear	A-026A	Tank 10	15	N8	3	5.19 ± 7.08	23.6 ± 20.1
SA Smear	A-026A	Tank 8	16	E7	4	9.35 ± 9.14	40.3 ± 22.0
SA Smear	A-026A	Tank 8	17	S6	5	3.10 ± 5.78	4.6 ± 17.9
SA Smear	A-026A	Tank 9	18	N4	3	1.02 ± 4.09	8.2 ± 18.3
SA Smear	A-026A	Tank 9	19	W5	3	7.27 ± 8.17	26.0 ± 20.4
SA Smear	A-026A	Ceiling	20	8	24	1.02 ± 4.09	2.2 ± 17.5
SA Smear	A-026A	Ceiling	21	8	12	-1.06 ± 4.09	-12.1 ± 15.6
SA Smear	A-026A	East Wall	22	3	10	19.77 ± 12.92	15.3 ± 19.2
SA Smear	A-026A	East Wall	23	12	14	5.19 ± 7.08	4.6 ± 17.9
SA Smear	A-026A	East Wall	24	3	14	1.02 ± 4.09	1.0 ± 17.4
SA Smear	A-026A	East Wall	25	2	4	32.27 ± 16.34	104.6 ± 27.9
SA Smear	A-026A	East Wall	244	9	7	-1.02 ± 4.09	-8.2 ± 16.1
SA Smear	A-026A	Floors	26	12	12	5.19 ± 7.08	24.8 ± 20.3
SA Smear	A-026A	Floors	27	6	22	-1.06 ± 4.09	1.0 ± 17.4
SA Smear	A-026A	Floors	28	3	15	-1.06 ± 4.09	15.3 ± 19.2
SA Smear	A-026A	Floors	29	3	3	1.02 ± 4.09	14.1 ± 19.0
SA Smear	A-026A	North Wall	30	4	22	5.19 ± 7.08	47.5 ± 22.7
SA Smear	A-026A	North Wall	31	4	13	3.10 ± 5.78	10.5 ± 18.6
SA Smear	A-026A	North Wall	32	10	25	1.02 ± 4.09	-0.2 ± 17.2
SA Smear	A-026A	North Wall	33	12	4	11.44 ± 10.01	71.3 ± 25.0
SA Smear	A-026A	North Wall	245	2	9.58	3.15 ± 5.78	6.1 ± 18.0
SA Smear	A-026A	North Wall	246	2	13	-1.02 ± 4.0	15.7 ± 19.2
SA Smear	A-026A	South Wall	34	2	5	28.10 ± 15.28	57.0 ± 23.6
SA Smear	A-026A	South Wall	35	12	25	7.27 ± 8.17	-0.2 ± 17.2
SA Smear	A-026A	South Wall	36	8	12	13.52 ± 10.81	-0.2 ± 17.2
SA Smear	A-026A	South Wall	37	8	2	5.19 ± 7.08	17.7 ± 19.5
SA Smear	A-026A	South Wall	247	1.25	5.25	3.15 ± 5.78	-12.9 ± 15.4
SA Smear	A-026A	West Wall	38	3	15	-1.06 ± 4.09	-7.3 ± 16.3
SA Smear	A-026A	West Wall	39	16	6	-1.06 ± 4.09	-2.5 ± 16.9

TABLE B1 Smear Sample Data from Tennelec for 310 Retention Tanks

				Coordinates (feet)		dis/min	
Type	Room	Location	No.	up	right	Alpha	Beta
SA Smear	A-026A	West Wall	40	2	12	-1.06 ± 4.09	1.0 ± 17.4
SA Smear	A-026A	West Wall	41	6	8	-1.06 ± 4.09	-3.7 ± 16.8
LA Smear	A-026A	pump	236	2 Sump pumps		-1.02 ± 4.09	0.2 ± 17.2
Brick	A-026A	South Wall	235	8	11	-1.02 ± 4.09	8.5 ± 18.3
Brick	A-026A	South Wall	240	7	19	1.06 ± 4.09	9.7 ± 18.5
SA Smear	A-038A	Pipes 5	48	13	2	2.98 ± 5.78	9.2 ± 18.6
SA Smear	A-038A	Pipes 5	49	11	0	19.65 ± 12.92	98.4 ± 27.5
SA Smear	A-038A	Pipes 6	50	13	2	9.23 ± 9.14	5.6 ± 18.2
SA Smear	A-038A	Pipes 6	51	11	0	11.31 ± 10.01	24.6 ± 20.4
SA Smear	A-038A	Pipes 7	52	13	2	2.98 ± 5.78	-9.9 ± 16.1
SA Smear	A-038A	Pipes 7	53	11	0	13.40 ± 10.81	48.4 ± 22.9
Internal Smear	A-038A	Pipes	54	10	3	57.15 ± 21.61	266.3 ± 39.0
SA Smear	A-038A	Tank 5	55	W5.5	5.33	5.06 ± 7.08	18.7 ± 19.7
SA Smear	A-038A	Tank 5	56	E5.6	5.33	-1.19 ± 4.09	-6.3 ± 16.6
LA Smear	A-038A	Tank 5	270	W3	2.67	8,436.77± 259.86	5,736.0± 162.9
LA Smear	A-038A	Tank 5	270	W3	2.67	7,757.77 ± 249.18	4,238.3 ±140.2
LA Smear	A-038A	Tank 5	272	E8.25	2.67	826.42 ± 81.36	1,649.1 ± 88.6
LA Smear	A-038A	Tank 5	272	E8.25	2.67	734.85 ± 76.72	1,353.8 ± 80.4
SA Smear	A-038A	Tank 6	57	E5.5	5.33	5.06 ± 7.08	13.9 ± 19.2
SA Smear	A-038A	Tank 6	58	W5.5	5.33	11.31 ± 10.01	6.8 ± 18.3
SA Smear	A-038A	Tank 7	59	E5.5	5.33	-1.19 ± 4.09	6.8 ± 18.3
SA Smear	A-038A	Tank 7	60	W5.5	5.33	7.15 ± 8.17	17.5 ± 19.6
SA Smear	A-038A	Ceiling	61	4	10	-0.98 ± 4.09	2.3 ± 17.7
SA Smear	A-038A	Ceiling	62	center		-0.98 ± 4.09	11.8 ± 18.9
SA Smear	A-038A	East Wall	63	2	3.5	1.10 ± 4.09	-9.6 ± 16.1
SA Smear	A-038A	East Wall	64	7	2	7.35 ± 8.17	24.9 ± 20.4
SA Smear	A-038A	East Wall	65	7	6	1.10 ± 4.09	-4.9 ± 16.8
SA Smear	A-038A	East Wall	66	2	10.67	-0.98 ± 4.09	10.6 ± 18.7
SA Smear	A-038A	Floors	67	4	24	19.85 ± 12.92	119.0 ± 29.1
SA Smear	A-038A	Floors	68	13.75	18	-0.98 ± 4.09	28.5 ± 20.8
SA Smear	A-038A	Floors	69	13.75	11	9.44 ± 9.13	17.8 ± 19.6
SA Smear	A-038A	Floors	70	13.75	1.33	9.44 ± 9.13	97.5 ± 27.4
SA Smear	A-038A	North Wall	71	2	8.58	3.19 ± 5.78	20.1 ± 19.9
SA Smear	A-038A	North Wall	72	7	15	-0.98 ± 4.09	-15.6 ± 15.2
SA Smear	A-038A	North Wall	73	2	19.67	1.10 ± 4.09	16.6 ± 19.5
SA Smear	A-038A	North Wall	74	7	24	1.10 ± 4.09	9.4 ± 18.6
SA Smear	A-038A	South Wall	75	2	8.58	-0.98 ± 4.09	-10.8 ± 15.9
SA Smear	A-038A	South Wall	76	2	19.67	1.10 ± 4.09	7.0 ± 18.3
SA Smear	A-038A	South Wall	77	10	0.58	-0.98 ± 4.09	13.0 ± 19.0
SA Smear	A-038A	South Wall	78	6	24	-0.98 ± 4.09	-4.9 ± 16.8
SA Smear	A-038A	West Wall	79	2	2	3.19 ± 5.78	4.7 ± 18.0
SA Smear	A-038A	West Wall	80	6.67	6.67	3.19 ± 5.78	-2.5 ± 17.1
SA Smear	A-038A	West Wall	81	2	9.75	49.02 ± 20.01	28.5 ± 20.8
SA Smear	A-038A	West Wall	82	6.67	12.5	1.10 ± 4.09	-15.6 ± 15.2

TABLE B1 Smear Sample Data from Tennelec for 310 Retention Tanks

Type	Room	Location	No.	Coordinates (feet) up	Coordinates (feet) right	dis/min Alpha	dis/min Beta
Brick	A-038A	South Wall	237	8	9	9.40 ± 9.14	10.9 ± 18.6
Brick	A-038A	South Wall	242	9	18 from E	-1.02 ± 4.09	-7.0 ± 16.3
Brick	A-038A	South Wall	262	0.83	7	3.19 ± 5.78	-1.3 ± 17.2
Brick	A-038A	South Wall	263	6	24	1.10 ± 4.09	-8.4 ± 16.3
Brick	A-038A	South Wall	264	2	17	1.10 ± 4.09	2.3 ± 17.7
Brick	A-038A	South Wall	265	2	18	1.10 ± 4.09	14.2 ± 19.2
LA Smear	A-038A	Pipe 1.67 from N Wall	271	11.83	13.75	1,295.17 ±101.84	1,334.8 ±80.0
LA Smear	A038A	Pipe 1.67 from N Wall	271	11.83	13.75	772.35 ± 78.65	618.01 ±55.7
Water	A-038A	Floor	274	Drum of mud & water		0.85 ±0.27	3.8 ±1.8
Mud	A-038A	Floor	276	Drum of mud & water		16.11 ± 0.56	116.6 ± 2.1
LA Smear	A-050A	Pipes 2	83	Horizontal	& Vertical	-0.75 ± 4.09	6.8 ± 18.2
LA Smear	A-050A	Pipes 3	84	Horizontal	& Vertical	22.17 ± 13.55	54.4 ± 23.4
LA Smear	A-050A	Pipes 4	85	Horizontal	& Vertical	-0.75 ± 4.09	44.9 ± 22.4
LA Smear	A-050A	Tank 2	86	Entire	Tank	7.58 ± 8.17	61.6 ± 24.1
LA Smear	A-050A	Tank 3	87	Entire	Tank	5.50 ± 7.08	67.5 ± 24.6
LA Smear	A-050A	Tank 4	88	Entire	Tank	49.25 ± 20.01	380.6 ± 45.2
SA Smear	A-050A	Pipes 2	89	10	3	1.33 ± 4.09	-1.5 ± 17.1
SA Smear	A-050A	Pipes 2	90	12	3	15.92 ± 11.55	18.7 ± 19.6
SA Smear	A-050A	Pipes 3	91	10	3	-0.75 ± 4.09	3.2 ± 17.7
SA Smear	A-050A	Pipes 3	92	12	3	1.33 ± 4.09	-2.7 ± 16.9
SA Smear	A-050A	Pipes 4	93	12	3	3.42 ± 5.78	16.3 ± 19.3
SA Smear	A-050A	Pipes 4	94	10	3	15.92 ± 11.55	-2.7 ± 16.9
Internal Smear	A-050A	Pipes	95	9	3	1.33 ± 4.09	22.3 ± 20.0
SA Smear	A-050A	Tank 2	96	S8	3	13.83 ± 10.81	22.3 ± 20.0
SA Smear	A-050A	Tank 2	97	N8	3	1.33 ± 4.09	8.0 ± 18.3
SA Smear	A-050A	Tank 3	98	S8	3	5.50 ± 7.08	-13.4 ± 15.4
SA Smear	A-050A	Tank 3	99	N8	3	1.33 ± 4.09	-2.7 ± 16.9
SA Smear	A-050A	Tank 4	100	N8	3	3.42 ± 5.78	-5.1 ± 16.6
SA Smear	A-050A	Tank 4	101	S8	3	9.67 ± 9.13	62.8 ± 24.2
LA Smear	A-050A	Tank 4	243	Contaminated Spots		61.48 ± 22.37	458.5 ± 48.9
SA Smear	A-050A	Ceiling	102	15	2	5.50 ± 7.08	0.9 ± 17.4
SA Smear	A-050A	Ceiling	103	25	10	-0.75 ± 4.09	-8.7 ± 16.1
SA Smear	A-050A	East Wall	104	2	8	-0.75 ± 4.09	-17.0 ± 14.9
SA Smear	A-050A	East Wall	105	2	15	15.92 ± 11.55	-3.9 ± 16.8
SA Smear	A-050A	East Wall	106	8	4	11.75 ± 10.01	-15.8 ± 15.0
SA Smear	A-050A	East Wall	107	12	1	1.33 ± 4.09	94.9 ± 27.1
SA Smear	A-050A	Floors	108	3	10	3.42 ± 5.78	19.9 ± 19.7
SA Smear	A-050A	Floors	109	3	25	7.58 ± 8.17	81.8 ± 25.9
SA Smear	A-050A	Floors	110	13	27	3.42 ± 5.78	46.1 ± 22.6
SA Smear	A-050A	Floors	111	15	15	7.58 ± 8.17	78.2 ± 25.6
SA Smear	A-050A	North Wall	112	2	21	7.58 ± 8.17	14.0 ± 19.0
SA Smear	A-050A	North Wall	113	3	12	7.58 ± 8.17	62.8 ± 24.2

TABLE B1 Smear Sample Data from Tennelec for 310 Retention Tanks

				Coordinates (feet)		dis/min	
Type	Room	Location	No.	up	right	Alpha	Beta
SA Smear	A-050A	North Wall	114	20	9	7.58 ± 8.17	3.2 ± 17.7
SA Smear	A-050A	North Wall	115	10	10	-0.75 ± 4.09	2.0 ± 17.5
SA Smear	A-050A	South Wall	116	2	7	3.42 ± 5.78	-7.5 ± 16.3
SA Smear	A-050A	South Wall	117	2	14	-0.75 ± 4.09	-3.9 ± 16.8
SA Smear	A-050A	South Wall	118	2	25	1.33 ± 4.09	-18.2 ± 14.7
SA Smear	A-050A	South Wall	119	2	19	3.42 ± 5.78	17.5 ± 19.5
SA Smear	A-050A	South Wall	251	7.58	9	1.06 ± 4.09	-3.4 ± 16.8
SA Smear	A-050A	South Wall	252	7.58	15	-1.02 ± 4.09	4.9 ± 17.9
SA Smear	A-050A	West Wall	120	5	8	3.42 ± 5.78	0.9 ± 17.4
SA Smear	A-050A	West Wall	121	8	11	-0.75 ± 4.09	-0.3 ± 17.2
SA Smear	A-050A	West Wall	122	3	10	3.42 ± 5.78	23.5 ± 20.1
SA Smear	A-050A	West Wall	123	2	10	1.33 ± 4.09	31.8 ± 21.1
LA Smear	A-050A	Floor; tar paper	223	8.7	0	34.71 ± 16.84	638.9 ± 56.7
LA Smear	A-050A	Floor; tar paper	224	11.2	2.7	20.13 ± 12.91	111.5 ± 28.3
LA Smear	A-050A	Floor; tar paper	225	14.7	5.7	9.71 ± 9.13	15.1 ± 19.0
LA Smear	A-050A	Floor; tar paper	226	13.7	12.7	3.46 ± 5.78	80.6 ± 25.7
LA Smear	A-050A	Floor; tar paper	227	13.7	17.1	-0.71 ± 4.09	7.9 ± 18.2
LA Smear	A-050A	Floor; tar paper	228	11.7	9.7	5.54 ± 7.08	24.6 ± 20.1
LA Smear	A-050A	Floor; tar paper	229	10.7	6.7	1.38 ± 4.09	57.9 ± 23.6
LA Smear	A-050A	Floor; tar paper	230	10.7	11.7	11.79 ± 10.00	115.1 ± 28.6
Brick	A-050A	South Wall	232	5	18 from E	-1.02 ± 4.09	-1.0 ± 17.1
Brick	A-050A	South Wall	234	5	9	1.06 ± 4.09	3.8 ± 17.7
Brick	A-050A	South Wall	238	2	9 from E	1.06 ± 4.09	9.7 ± 18.5
LA Smear	A-062A	Pipes 1	124	Horizontal	& Vertical	9.67 ± 9.13	104.4 ± 27.9
LA Smear	A-062A	Tank 1	125	Entire	Tank	1.33 ± 4.09	-2.7 ± 16.9
SA Smear	A-062A	Pipes 1	126	12	3	5.50 ± 7.08	12.8 ± 18.9
SA Smear	A-062A	Pipes 1	127	10	3	5.50 ± 7.08	-8.7 ± 16.1
SA Smear	A-062A	Tank 1	128	N5	3	1.33 ± 4.09	79.4 ± 25.7
SA Smear	A-062A	Tank 1	129	W6	8	-0.75 ± 4.09	11.6 ± 18.7
LA Smear	A-062A	Tank 1	233	Contaminated Spots	18 from E	111.48 ± 30.01	2,184.7 ±101.4
SA Smear	A-062A	Ceiling	130	7	2	-0.75 ± 4.09	0.9 ± 17.4
SA Smear	A-062A	Ceiling	131	7	10	-0.75 ± 4.09	-2.7 ± 16.9
SA Smear	A-062A	East Wall	132	NA	NA	There is no East Wall	
SA Smear	A-062A	East Wall	133	NA	NA	There is no East Wall	
SA Smear	A-062A	East Wall	134	NA	NA	There is no East Wall	
SA Smear	A-062A	East Wall	135	NA	NA	There is no East Wall	
SA Smear	A-062A	Floors	136	12	4	-0.75 ± 4.09	2.0 ± 17.5

TABLE B1 Smear Sample Data from Tennelec for 310 Retention Tanks

				Coordinates (feet)		dis/min	
Type	Room	Location	No.	up	right	Alpha	Beta
SA Smear	A-062A	Floors	137	7	3	11.75 ± 10.01	6.8 ± 18.2
SA Smear	A-062A	Floors	138	12	14	-0.75 ± 4.09	8.0 ± 18.3
SA Smear	A-062A	Floors	139	3	14	-0.75 ± 4.09	9.2 ± 18.5
SA Smear	A-062A	North Wall	140	3	5	1.33 ± 4.09	6.8 ± 18.2
SA Smear	A-062A	North Wall	141	2	10	-0.75 ± 4.09	-0.3 ± 17.2
SA Smear	A-062A	North Wall	142	2	10	-0.75 ± 4.09	22.3 ± 20.0
SA Smear	A-062A	North Wall	143	8	11	1.33 ± 4.09	-5.1 ± 16.6
SA Smear	A-062A	North Wall	248	8.67	8.5	1.06 ± 4.09	-5.8 ± 16.4
SA Smear	A-062A	South Wall	144	14	2	-0.75 ± 4.09	-1.5 ± 17.1
SA Smear	A-062A	South Wall	145	4	4	-0.75 ± 4.09	-9.9 ± 15.9
SA Smear	A-062A	South Wall	146	12	8	1.33 ± 4.09	6.8 ± 18.2
SA Smear	A-062A	South Wall	147	3	0	3.42 ± 5.78	5.6 ± 18.0
SA Smear	A-062A	South Wall	249	1.75	8.58	1.06 ± 4.09	6.1 ± 18.0
SA Smear	A-062A	West Wall	148	8	12	11.44 ± 10.01	217.7 ± 36.0
SA Smear	A-062A	West Wall	149	2	2	19.77 ± 12.92	545.1 ± 52.8
SA Smear	A-062A	West Wall	150	6	6	13.52 ± 10.81	409.4 ± 46.6
SA Smear	A-062A	West Wall	151	4	14	15.60 ± 11.55	165.3 ± 32.5
SA Smear	A-062A	West Wall	250	0.75	6.25	55.23 ± 21.22	1,756.1 ± 91.3
Brick	A-062A	South Wall	239	7	18	3.15 ± 5.78	-4.6 ± 16.6
Brick	A-062A	South Wall	241	7	25 from E	1.06 ± 4.09	8.5 ± 18.3
SA Smear	A-068A	Ceiling	152	5	12	-0.75 ± 4.09	-13.4 ± 15.4
SA Smear	A-068A	Ceiling	153	5	22	-0.75 ± 4.09	2.0 ± 17.5
SA Smear	A-068A	East Wall	154	12	30	1.33 ± 4.09	-7.5 ± 16.3
SA Smear	A-068A	East Wall	155	8	27	-0.75 ± 4.09	-0.3 ± 17.2
SA Smear	A-068A	East Wall	156	3	18	9.67 ± 9.13	-1.5 ± 17.1
SA Smear	A-068A	East Wall	157	10	2	-0.75 ± 4.09	-8.7 ± 16.1
SA Smear	A-068A	East Wall	255	1	11	13.56 ± 10.81	-24.8 ± 13.5
LA Smear	A-068A	E Wall & Floor	221	16.3	26.3	3.46 ± 5.78	4.4 ± 17.7
LA Smear	A-068A	E Wall & Floor	221	16.3	26.3	3.46 ± 5.78	-15.9 ± 14.9
SA Smear	A-068A	Floors	158	6	12	-0.75 ± 4.09	-7.5 ± 16.3
SA Smear	A-068A	Floors	159	12	5	-0.75 ± 4.09	-12.2 ± 15.6
SA Smear	A-068A	Floors	160	10	28	-0.75 ± 4.09	4.4 ± 17.9
SA Smear	A-068A	Floors	161	4	21	-0.75 ± 4.09	-5.1 ± 16.6
SA Smear	A-068A	North Wall	162	10	15	-0.75 ± 4.09	-11.0 ± 15.7
SA Smear	A-068A	North Wall	163	6	4	-0.75 ± 4.09	-17.0 ± 14.9
SA Smear	A-068A	North Wall	164	2	2	3.42 ± 5.78	-9.9 ± 15.9
SA Smear	A-068A	North Wall	165	2	10	1.33 ± 4.09	-2.7 ± 16.9
SA Smear	A-068A	South Wall	166	2	2	-0.75 ± 4.09	-14.6 ± 15.2
SA Smear	A-068A	South Wall	167	5	12	1.33 ± 4.09	-8.7 ± 16.1
SA Smear	A-068A	South Wall	168	6	11	1.33 ± 4.09	-12.2 ± 15.6
SA Smear	A-068A	South Wall	169	4	16	-0.75 ± 4.09	-3.9 ± 16.8
SA Smear	A-068A	South Wall	253	1.5	6.17	1.06 ± 4.09	-2.2 ± 16.9

TABLE B1 Smear Sample Data from Tennelec for 310 Retention Tanks

				Coordinates (feet)		dis/min	
Type	Room	Location	No.	up	right	Alpha	Beta
SA Smear	A-068A	West Wall	170	10	10	1.33 ± 4.09	5.6 ± 18.0
SA Smear	A-068A	West Wall	171	3	0	1.33 ± 4.09	-13.4 ± 15.4
SA Smear	A-068A	West Wall	172	11	5	-0.75 ± 4.09	2.0 ± 17.5
SA Smear	A-068A	West Wall	173	4	17	1.33 ± 4.09	-15.8 ± 15.0
SA Smear	A-068A	West Wall	254	2	4	-1.02 ± 4.09	-14.1 ± 15.2
LA Smear	A-068A	cabinet	210			-1.10 ± 4.09	-0.4 ± 17.2
LA Smear	A-068A	wood skids	211	two		3.06 ± 5.78	-11.1 ± 15.7
LA Smear	A-068A	doors	212			-1.10 ± 4.09	4.3 ± 17.9
LA Smear	A-068A	pump	213	w/rad stickers		0.98 ± 4.09	-12.3 ± 15.6
LA Smear	A-068A	scrub buckets	214	two		0.98 ± 4.09	-2.8 ± 16.9
LA Smear	A-068A	hose	215			-1.10 ± 4.09	4.3 ± 17.9
LA Smear	A-068A	pumps	216	under shelves		0.98 ± 4.09	21.0 ± 19.9
LA Smear	A-068A	pumps	217	under grate		-1.10 ± 4.09	-6.4 ± 16.4
LA Smear	A-068A	shelves	218			0.98 ± 4.09	10.3 ± 18.6
LA Smear	A-068A	ladder	219	under grate		9.31 ± 9.14	29.3 ± 20.8
LA Smear	A-068A	misc. scrap	220			5.15 ± 7.08	12.7 ± 18.9
LA Smear	A-068A	drum	222			-1.10 ± 4.09	-6.4 ± 16.4
LA Smear	A-068A	pump - rim	231	w/rad stickers		182.63 ± 38.31	429.4 ± 47.5
LA Smear	A-068A	pump , etc	256	Internal	SE Corner	13.56 ± 10.81	3.8 ± 17.7
LA Smear	A-068A	pump #2	257	Internal	by E Wall	-1.02 ± 4.09	-1.0 ± 17.1
LA Smear	A-068A	pump #3	258	Internal	by E Wall	1.06 ± 4.09	-8.2 ± 16.1
LA Smear	A-068A	Container #4	259	Internal	by E Wall	1.06 ± 4.09	6.1 ± 18.0
LA Smear	A-068A	pumps-2 #5	260	Internal	by N Wall	1.06 ± 4.09	-10.5 ± 15.7
LA Smear	A-068A	pump #6	261	Internal	by W Wall	-1.02 ± 4.09	-5.8 ± 16.4
SA Smear	Tunnel	Floors	174	Entrance	from 310	5.04 ± 7.08	24.5 ± 20.3
SA Smear	Tunnel	Floors	175	3	from 310	5.04 ± 7.08	22.1 ± 20.0
SA Smear	Tunnel	Floors	176	15	from 310	5.04 ± 7.08	17.3 ± 19.5
SA Smear	Tunnel	Floors	177	25	from 310	-1.21 ± 4.10	16.1 ± 19.3
SA Smear	Tunnel	Floors	178	35	from 310	2.96 ± 5.78	38.8 ± 21.8
SA Smear	Tunnel	Floors	179	45	from 310	2.96 ± 5.78	6.6 ± 18.2
SA Smear	Tunnel	Floors	180	55	from 310	9.21 ± 9.14	18.5 ± 19.6
SA Smear	Tunnel	Floors	181	65	from 310	-1.21 ± 4.10	24.5 ± 20.3
SA Smear	Tunnel	Floors	182	75	from 310	0.88 ± 4.10	38.8 ± 21.8
SA Smear	Tunnel	Floors	183	85	from 310	5.04 ± 7.08	24.5 ± 20.3
					Minimum	-1.21 ± 0.27	-24.8 ± 1.8
					Maximum	8,436.83 ± 259.86	5,736.0±162.9
					Average	89.59 ± 10.02	107.2 ± 22.4
					Standard Deviation	747.61 ± 25.06	520.7 ± 16.9
					Count	238	238

TABLE B2 Building 310 Smear Data logged on the DABRAS or NE

				Coordinates		dis/min	
Type	Room	Location	No.	up	right	Alpha	Beta
LA Smear	A-026A	Grate	509	all		15.7 ± 11.8	39 ± 47
LA Smear	A-026A	Tank #8	518	Internal	DABRAS	2,749.3 ±131.9	46,419 ±429
LA Smear	A-026A	Tank #8	518	Internal	NE	461.0 ±102.8	19,529 ±525
LA Smear	A-026A	Tank #9	519	Internal	DABRAS	1,560.8 ± 99.5	53,362 ±460
LA Smear	A-026A	Tank #9	519	Internal	NE	89.0 ± 51.2	26,429 ±601
LA Smear	A-026A	Tank #10	520	Internal	DABRAS	64.6 ± 21.2	1,703 ± 93
LA Smear	A-026A	Tank #10	520	Internal	NE	50.0 ± 42.3	803 ±210
LA Smear	A-038A	Pipes 5	42	Horizontal	& Vertical	134.1 ± 29.8	815 ± 72
LA Smear	A-038A	Pipes 6	43	Horizontal	& Vertical	77.2 ± 23.0	663 ± 68
LA Smear	A-038A	Pipes 7	44	Horizontal	& Vertical	374.0 ± 49.0	1,623 ± 92
LA Smear	A-038A	Tank 5	45	Entire	Tank	613.9 ± 62.6	2,753 ±113
LA Smear	A-038A	Tank 6	46	Entire	Tank	236.6 ± 39.2	1,476 ± 89
LA Smear	A-038A	Tank 7	47	Entire	Tank	364.5 ± 48.4	3,696 ±129
LA Smear	A-038A	North Wall	273	3 12.8 to 15.8		282.4 ± 42.7	371 ± 59
LA Smear	A-038A	Pipe 1.75' from N Wall 275		11.83	14	-6.4±0.9	-40 ±108
LA Smear	A-038A	Pipe 1.75' from N Wall 277		13.83	14	12,683.0±283.0	11,295±215
LA Smear	A-038A	Hot Spot	506	In front of Tank 7		7.8 ± 9.5	2 ± 45
LA Smear	A-038A	Grate	507	In front of Tank 6		14.1 ± 11.4	51 ± 47
LA Smear	A-038A	Grate	508	all		22.0 ± 13.4	63 ± 48
LA Smear	A-038A	Tank #5	515	Internal	DABRAS	143.5 ± 30.8	6,264 ±163
LA Smear	A-038A	Tank #5	515	Internal	NE	83.0 ± 50.0	3,887 ±287
LA Smear	A-038A	Tank #6	516	Internal	DABRAS	83.6 ± 23.8	4,699 ±143
LA Smear	A-038A	Tank #6	516	Internal	NE	89.0 ± 51.2	3,642 ±281
LA Smear	A-038A	Tank #7	521	Internal	DABRAS	96.2 ± 25.5	5,625 ±155
LA Smear	A-038A	Tank #7	521	Internal	NE	50.0 ± 42.3	3,258 ±273
Tarpaper-t	A-038A	Floor	522	9	1	18.8 ± 12.7	569 ± 65
Tarpaper-b	A-038A	Floor	523	9	1	9.4 ± 10.0	139 ± 51
Tarpaper-t	A-038A	Floor	524	9.42	10	45.7 ± 18.2	258 ± 55
Tarpaper-b	A-038A	Floor	525	9.42	10	861.6 ± 74.0	1,817 ± 96
Tarpaper-t	A-038A	Floor	526	9.33	19	12.5 ± 11.0	196 ± 53
Tarpaper-b	A-038A	Floor	527	9.33	19	37.8 ± 16.7	531 ± 64
Tarpaper-t	A-038A	Floor	528	9.42	25	23.6 ± 13.8	152 ± 51
Tarpaper-b	A-038A	Floor	529	9.42	25	93.0 ± 25.1	935 ± 76
LA Smear	A-038A	Floor	530	9	1	11.0 ± 10.5	114 ± 50
LA Smear	A-038A	Floor	531	9.42	10	11.0 ± 10.5	62 ± 48
LA Smear	A-038A	Floor	532	9.33	19	4.6 ± 8.4	33 ± 47
LA Smear	A-038A	Floor	533	9.42	25	6.2 ± 9.0	58 ± 48
LA Smear	A-050A	West Wall	500	lower		75.7 ± 22.8	1,430 ± 88
LA Smear	A-050A	West Wall	501			135.6 ± 30.0	2,396 ±107
LA Smear	A-050A	West Wall	502	Electric Box		1,125.2 ± 84.5	26,007 ±323
LA Smear	A-050A	Floor	503	Under Grate	Tank 4	20.4 ± 13.0	-26 ± 44
LA Smear	A-050A	grate	505	all		7.8 ± 9.5	83 ± 49

TABLE B2 Building 310 Smear Data logged on the DABRAS or NE

				Coordinates		dis/min	
Type	Room	Location	No.	up	right	Alpha	Beta
LA Smear	A-050A	Hot Spot	510	Infront of tank 4		9.4 ± 10.0	107 ± 50
LA Smear	A-050A	Tank #4	511	Internal	DABRAS	407.1 ± 51.1	11,13 ±214
LA Smear	A-050A	Tank #4	511	Internal	NE	272.0 ± 80.8	7,059 ±349
LA Smear	A-050A	Tank #2	512	Internal	DABRAS	517.6 ± 57.5	24,254 ±312
LA Smear	A-050A	Tank #2	512	Internal	NE	255.0 ± 78.5	9,329 ±387
LA Smear	A-050A	Tank #3	517	Internal	DABRAS	225.6 ± 38.3	10,047 ±204
LA Smear	A-050A	Tank #3	517	Internal	NE	72.0 ± 47.6	4,365 ±297
LA Smear	A-062A	grate	504	all		-4.8 ± 3.3	39 ± 47
LA Smear	A-062A	Tank #1	513	Bottom of tank-external		454.5 ± 53.9	20,561 ±288
LA Smear	A-062A	Tank #1	514	Internal	DABRAS	208.2 ± 36.8	17,699 ±267
LA Smear	A-062A	Tank #1	514	Internal	NE	127.0 ± 58.6	6,511 ±339
LA Smear	A-068A	pump-cont	536	Internal	DABRAS	153.0 ± 31.7	396 ± 60
LA Smear	A-068A	pump-cont	536	Internal	NE	215.3 ± 63.5	20,020 ±528
LA Smear	B007	Pipe	534	Internal from 310		542.8 ± 58.9	19,105 ±277
LA Smear	B007	Pipe	535	Internal to 310		143.5 ± 30.8	7,005 ±172
LA Smear	Tunnel	Pipes #1	184	0 to 3	from 310	66.2 ± 21.4	1,281 ± 84
LA Smear	Tunnel	Pipes #2	185	3	from 310	116.7 ± 27.9	473 ± 62
LA Smear	Tunnel	Pipes #3	186	15	from 310	78.8 ± 23.2	549 ± 65
LA Smear	Tunnel	Pipes #4	187	25	from 310	26.7 ± 14.5	258 ± 55
LA Smear	Tunnel	Pipes #6	188	45	from 310	22.0 ± 13.4	173 ± 52
LA Smear	Tunnel	Pipes #5	189	35	from 310	22.0 ± 13.4	189 ± 53
LA Smear	Tunnel	Pipes #7	190	55	from 310	20.4 ± 13.0	248 ± 55
LA Smear	Tunnel	Pipes #8	191	65	from 310	9.4 ± 10.0	89 ± 49
LA Smear	Tunnel	Pipes #9	192	75	from 310	-0.1 ± 6.4	204 ± 53
LA Smear	Tunnel	Pipes #10	193	85	from 310	11.0 ± 10.5	166 ± 52
					Minimum	-6.4 ± 0.9	-40 ± 44
					Maximum	12,683.0±283.0	53,362 ±601
					Average	400.2 ± 37.8	5, 887 ±156
				Standard Deviation		1,567.2 ± 40.3	10,441 ±140
					Count	67	67

TABLE B3 Brick Sample Data from Tennelec for 310 Retention Tanks

				Coordinates (feet)		dis/min	
Type	Room	Location	No.	up	right	Alpha	Beta
Brick	A-026A	South Wall	235	8	11	-1.02 ± 4.09	8.5 ± 18.3
Brick	A-026A	South Wall	240	7	19	1.06 ± 4.09	9.7 ± 18.5
Brick	A-038A	South Wall	237	8	9	9.40 ± 9.14	10.9 ± 18.6
Brick	A-038A	South Wall	242	9	18 from E	-1.02 ± 4.09	-7.0 ± 16.3
Brick	A-038A	South Wall	262	0.83	7	3.19 ± 5.78	-1.3 ± 17.2
Brick	A-038A	South Wall	263	6	24	1.10 ± 4.09	-8.4 ± 16.3
Brick	A-038A	South Wall	264	2	17	1.10 ± 4.09	2.3 ± 17.7
Brick	A-038A	South Wall	265	2	18	1.10 ± 4.09	14.2 ± 19.2
Brick	A-050A	South Wall	232	5	18 from E	-1.02 ± 4.09	-1.0 ± 17.1
Brick	A-050A	South Wall	234	5	9	1.06 ± 4.09	3.8 ± 17.7
Brick	A-050A	South Wall	238	2	9 from E	1.06 ± 4.09	9.7 ± 18.5
Brick	A-062A	South Wall	239	7	18	3.15 ± 5.78	-4.6 ± 16.6
Brick	A-062A	South Wall	241	7	25 from E	1.06 ± 4.09	8.5 ± 18.3
					Minimum	-1.02 ± 4.09	-8.4 ± 16.3
					Maximum	9.40 ± 9.14	14.2 ± 19.2
					Average	1.56 ± 4.74	3.5 ± 17.7
					Standard Deviation	2.60 ± 1.41	7.1 ± 0.9
					Count	13	13

TABLE B4 Internal Tank Data form Building 310 Retention Tanks

				Coordinates (feet)		dis/min	
Type	Room	Location	No.	up	right	Alpha	Beta
LA Smear	A-062A	Tank #1	514	Internal	DABRAS	208.2 ± 36.8	17,699 ± 267
LA Smear	A-062A	Tank #1	514	Internal	NE	127.0 ± 58.6	6,511 ± 339
LA Smear	A-050A	Tank #2	512	Internal	DABRAS	517.6 ± 57.5	24,254 ± 312
LA Smear	A-050A	Tank #2	512	Internal	NE	255.0 ± 78.5	9,329 ± 387
LA Smear	A-050A	Tank #3	517	Internal	DABRAS	225.6 ± 38.3	10,047 ± 204
LA Smear	A-050A	Tank #3	517	Internal	NE	72.0 ± 47.6	4,365 ± 297
LA Smear	A-050A	Tank #4	511	Internal	DABRAS	407.1 ± 51.1	11,138 ± 214
LA Smear	A-050A	Tank #4	511	Internal	NE	272.0 ± 80.8	7,059 ± 349
LA Smear	A-038A	Tank #5	515	Internal	DABRAS	143.5 ± 30.8	6,264 ± 163
LA Smear	A-038A	Tank #5	515	Internal	NE	83.0 ± 50.0	3,887 ± 287
LA Smear	A-038A	Tank #6	516	Internal	DABRAS	83.6 ± 23.8	4,699 ± 143
LA Smear	A-038A	Tank #6	516	Internal	NE	89.0 ± 51.2	3,642 ± 281
LA Smear	A-038A	Tank #7	521	Internal	DABRAS	96.2 ± 25.5	5,625 ± 155
LA Smear	A-038A	Tank #7	521	Internal	NE	50.0 ± 42.3	3,258 ± 273
LA Smear	A-026A	Tank #8	518	Internal	DABRAS	2,749.3 ±131.9	46,419 ± 429
LA Smear	A-026A	Tank #8	518	Internal	NE	461.0 ±102.8	19,529 ± 525
LA Smear	A-026A	Tank #9	519	Internal	DABRAS	1,560.8 ± 99.5	53,362 ± 460
LA Smear	A-026A	Tank #9	519	Internal	NE	89.0 ± 51.2	26,429 ± 601
LA Smear	A-026A	Tank #10	520	Internal	DABRAS	64.6 ± 21.2	1,703 ± 93
LA Smear	A-026A	Tank #10	520	Internal	NE	50.0 ± 42.3	803 ± 210
					Minimum	50.0 ± 21.2	803 ± 93
					Maximum	2,749.3 ±131.9	53,362 ± 601
					Average	380.2 ± 56.1	13,301 ± 299
					Standard Deviation	650.6 ± 28.7	14,480 ± 131
					Count	20	20

APPENDIX C: Air Sample Data

TABLE C1 Air Sample Data from Tennelec for 310 Retention Tanks

Room	Sample No.	Date Removed	initial dis/min α	initial dis/min β	Date Count #1	Low Bkgd dis/min α	Low Bkgd dis/min β	Date Counted	Vol (m^3)	%DAC α DAC 5[b]	%DAC β DAC 4000[c]
026	194	07/03/96	2.27 ± 2.33	16.8 ± 8.8	07/08/96	5.27 ± 0.16	34.60 ± 0.32	08/19/96	96	0.91 ± 0.03	0.0090 ± 0.0001
038	195	07/03/96	2.69 ± 2.47	17.3 ± 8.8	07/08/96	5.56 ± 0.16	37.56 ± 0.33	08/19/96	96	0.97 ± 0.03	0.0098 ± 0.0001
050	196					No air sample collected					
062	197	07/03/96	1.44 ± 2.02	25.8 ± 9.3	07/08/96	5.87 ± 0.16	35.72 ± 0.33	08/19/96	96	1.02 ± 0.03	0.0093 ± 0.0001
026	198	07/09/96	2.27 ± 2.33	15.3 ± 8.7	07/15/96	4.22 ± 0.14	28.87 ± 0.30	08/19/96	76.8	0.92 ± 0.03	0.0094 ± 0.0001
038	199	07/09/96	1.85 ± 2.18	21.3 ± 9.0	07/15/96	4.28 ± 0.14	30.31 ± 0.30	08/19/96	76.8	0.93 ± 0.03	0.0099 ± 0.0001
050	200	07/09/96	2.69 ± 2.47	26.3 ± 9.3	07/15/96	4.33 ± 0.14	30.60 ± 0.30	08/19/96	76.8	0.94 ± 0.03	0.0100 ± 0.0001
062	201	07/09/96	1.44 ± 2.02	23.9 ± 9.2	07/15/96	4.53 ± 0.14	31.43 ± 0.31	08/19/96	76.8	0.98 ± 0.03	0.0102 ± 0.0001
026	202	07/12/96	4.71 ± 2.95	31.3 ± 9.5	07/22/96	3.16 ± 0.12	16.07 ± 0.23	08/19/96	57.6	0.91 ± 0.03	0.0070 ± 0.0001
038	203	07/12/96	1.38 ± 1.84	42.9 ±10.0	07/22/96	3.35 ± 0.12	16.50 ± 0.23	08/19/96	57.6	0.97 ± 0.04	0.0072 ± 0.0001
050	204	07/12/96	2.63 ± 2.32	21.0 ± 9.0	07/22/96	6.66 ± 0.17	21.74 ± 0.26	08/19/96	57.6	1.93 ± 0.05	0.0094 ± 0.0001
062	205	07/12/96	6.79 ± 3.47	32.0 ± 9.5	07/22/96	4.08 ± 0.14	25.14 ± 0.28	08/19/96	57.6	1.18 ± 0.04	0.0109 ± 0.0001
026	206	07/19/96	1.35 ± 1.84	19.3 ± 9.0	07/29/96	4.33 ± 0.14	29.19 ± 0.30	08/19/96	96	0.75 ± 0.02	0.0076 ± 0.0001
038	207	07/19/96	0.94 ± 1.65	23.1 ± 9.2	07/29/96	4.58 ± 0.14	37.71 ± 0.33	08/19/96	96	0.79 ± 0.03	0.0098 ± 0.0001
050	208	07/19/96	2.60 ± 2.32	22.2 ± 9.1	07/29/96	4.09 ± 0.14	37.41 ± 0.33	08/19/96	96	0.71 ± 0.02	0.0097 ± 0.0001
062	209	07/19/96	1.35 ± 1.84	17.7 ± 8.9	07/29/96	3.99 ± 0.14	35.16 ± 0.32	08/19/96	96	0.69 ± 0.02	0.0092 ± 0.0001
026	266	07/26/96	3.06 ± 2.46	16.6 ± 8.8	08/15/96	4.50 ± 0.14	22.16 ± 0.26	08/21/96	96	0.78 ± 0.03	0.0058 ± 0.0001
038	267	07/26/96	6.40 ± 3.38	35.6 ± 9.7	08/15/96	7.45 ± 0.18	35.94 ± 0.33	08/21/96	96	1.29 ± 0.03	0.0094 ± 0.0001
050	268	07/26/96	6.81 ± 3.47	28.0 ± 9.4	08/15/96	8.64 ± 0.20	35.39 ± 0.32	08/21/96	96	1.50 ± 0.03	0.0092 ± 0.0001
062	269	07/26/96	7.65 ± 3.66	14.9 ± 8.7	08/15/96	8.58 ± 0.20	35.56 ± 0.32	08/21/96	96	1.49 ± 0.03	0.0093 ± 0.0001
		Minimum	0.94 ± 1.65	14.9 ± 8.7		3.16 ± 0.12	16.1 ± 0.2			0.69 ± 0.02	0.0058 ± 0.0001
		Maximum	7.65 ± 3.66	42.9 ±10.0		8.64 ± 0.20	37.7 ± 0.3			1.93 ± 0.05	0.0109 ± 0.0001
		Average	3.17 ± 2.48	23.7 ± 9.1		5.13 ± 0.15	30.4 ± 0.3			1.04 ± 0.03	0.0091 ± 0.0001
		Standard Deviation	2.11 ± 0.60	7.4 ± 0.3		1.58 ± 0.02	6.8 ± 0.0			0.31 ± 0.01	0.0012 ± 0.0000
		Count	19	19		19	19			19	19

[a] Working Volume (m^3) = 40 liters/min x time (time = 60 min/hr x 8 hours x number of week days)

[b] Alpha DAC = 6 for ^{239}Pu, ^{214}Am & ^{238}Pu

[c] Beta DAC = 4,000 for ^{90}Sr

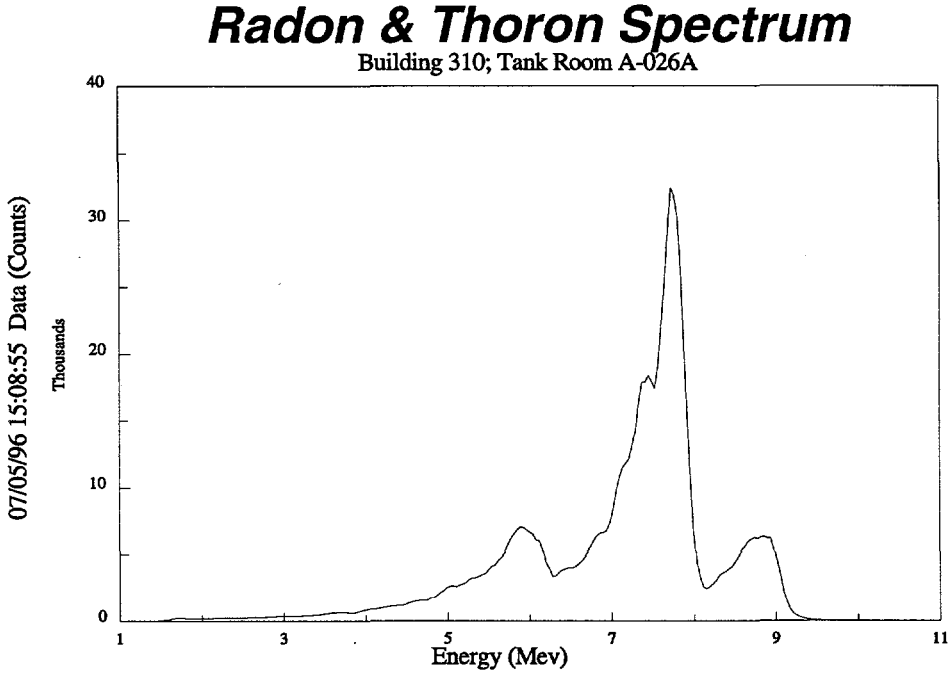


FIGURE C1 Airborne Alpha Particulate Spectra Collected 7/5/96

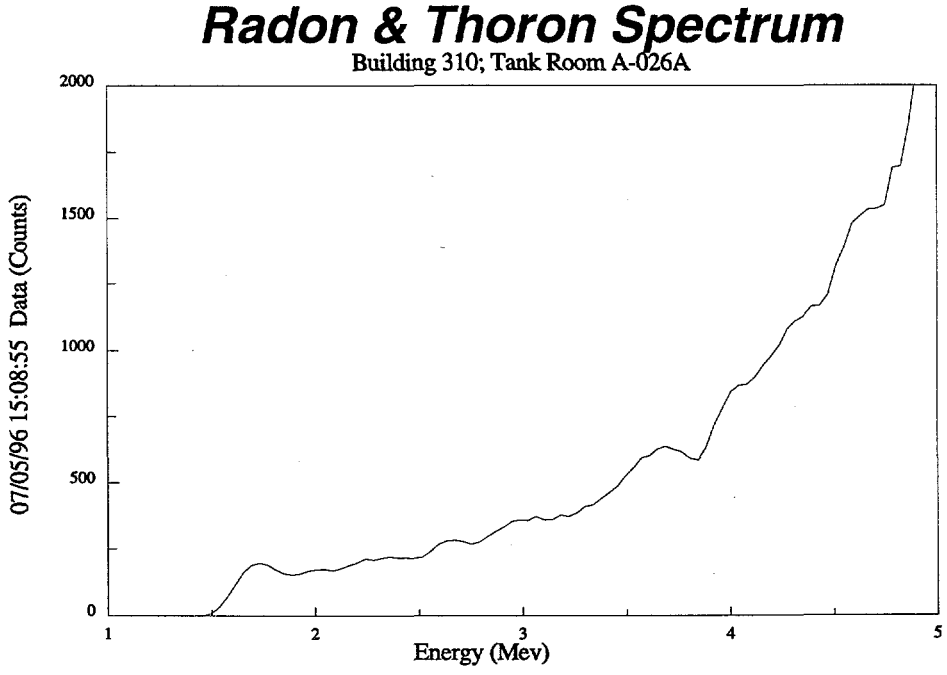


FIGURE C2 Low Energy Alpha Spectrum Collected 7/5/1996

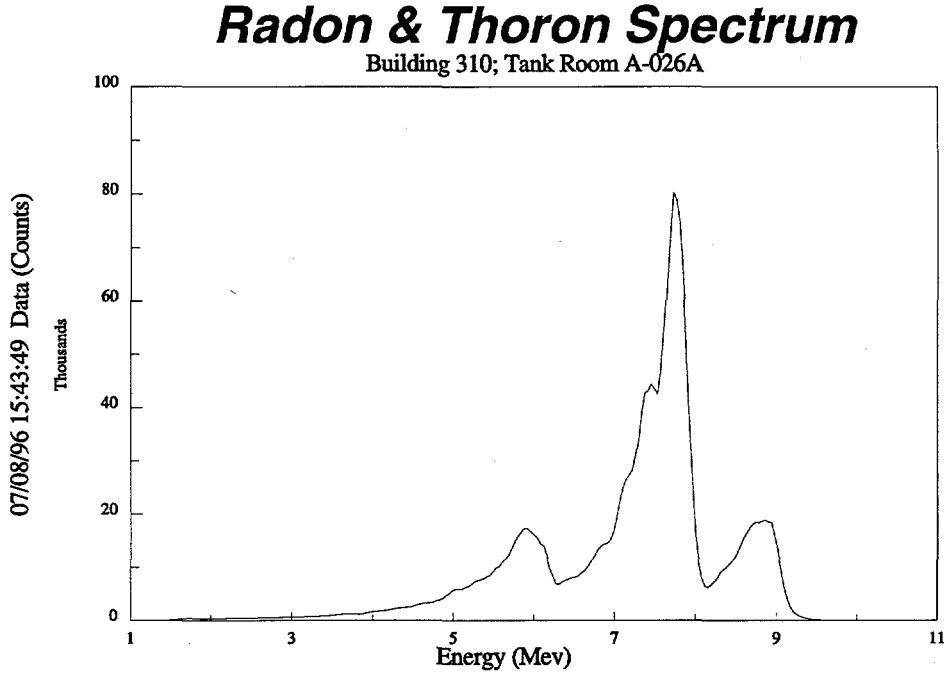


FIGURE C3 Airborne Alpha Particulate Spectra Collected 7/8/96

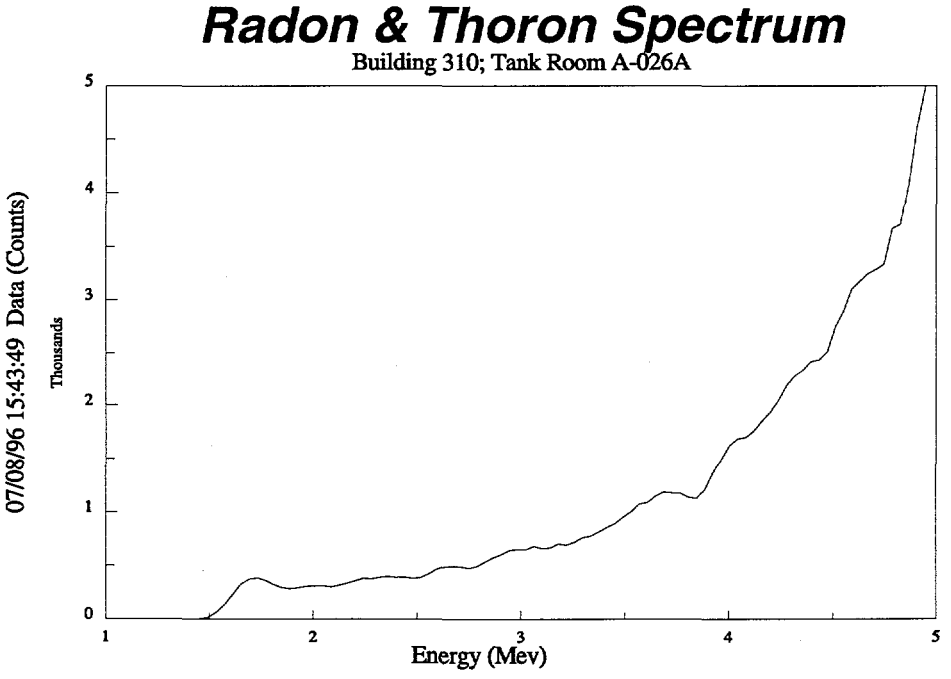


FIGURE C4 Low Energy Alpha Spectrum Collected 7/8/1996

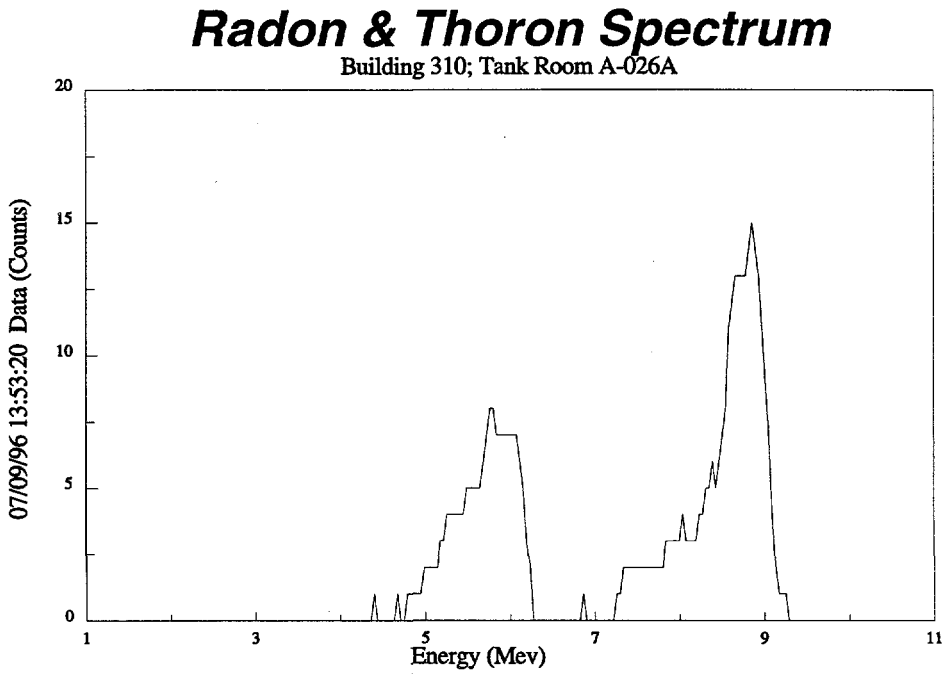


FIGURE C5 Airborne Alpha Particulate Spectra Collected 7/9/96

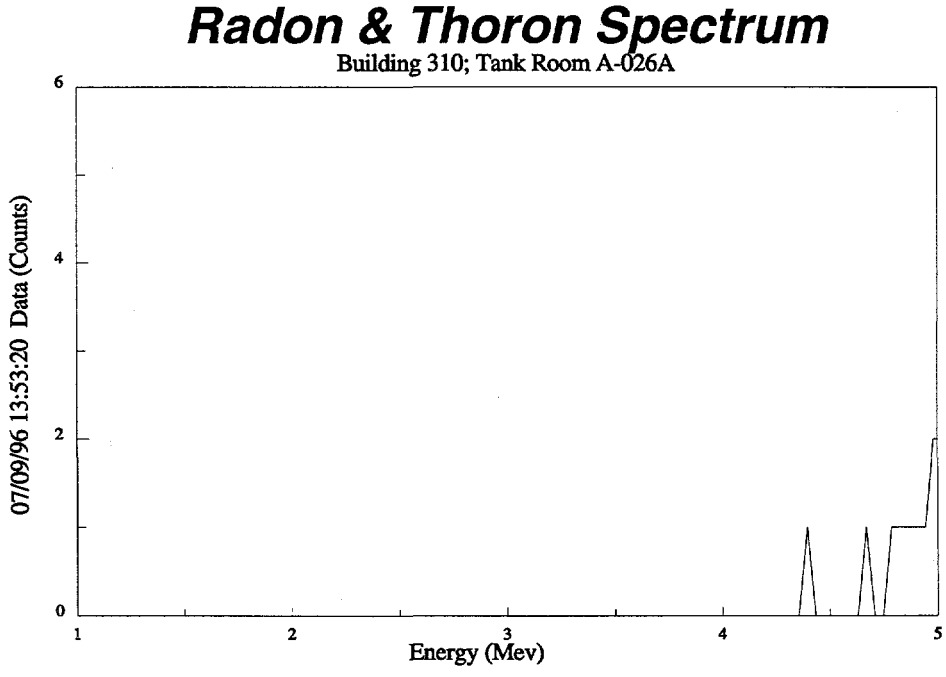


FIGURE C6 Low Energy Alpha Spectrum Collected 7/9/96

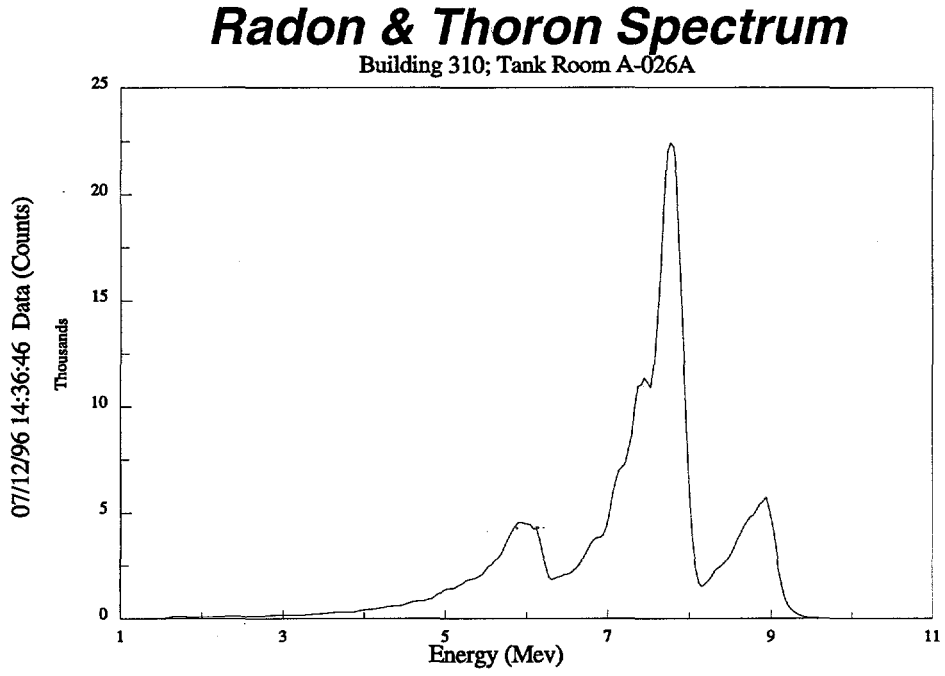


FIGURE C7 Airborne Alpha Particulate Spectra Collected 7/12/96

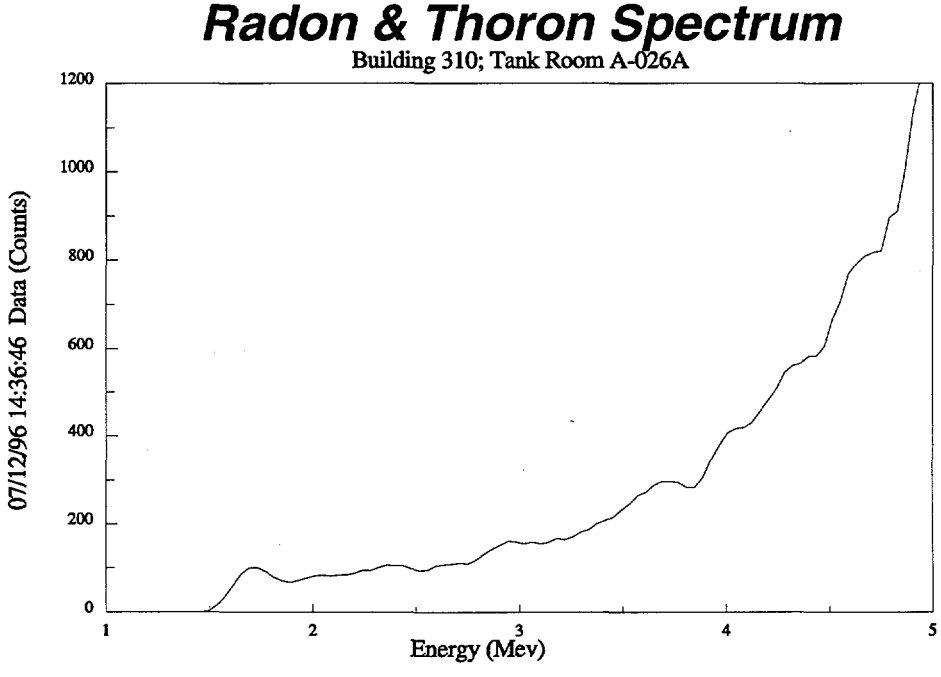


FIGURE C8 Low Energy Alpha Spectrum Collected 7/12/1996

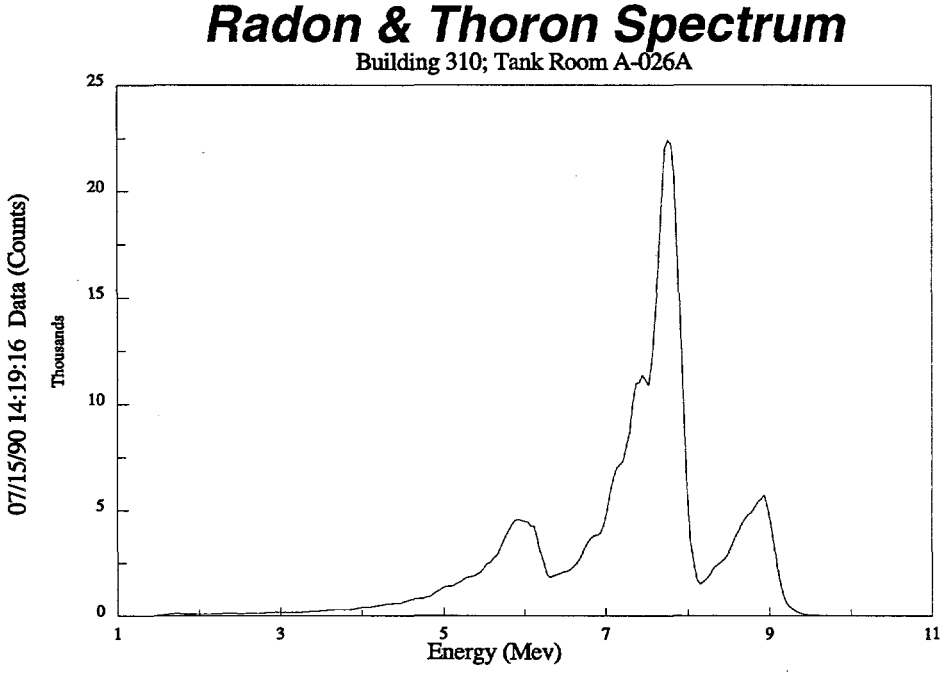


FIGURE C9 Airborne Alpha Particulate Spectra Collected 7/15/96

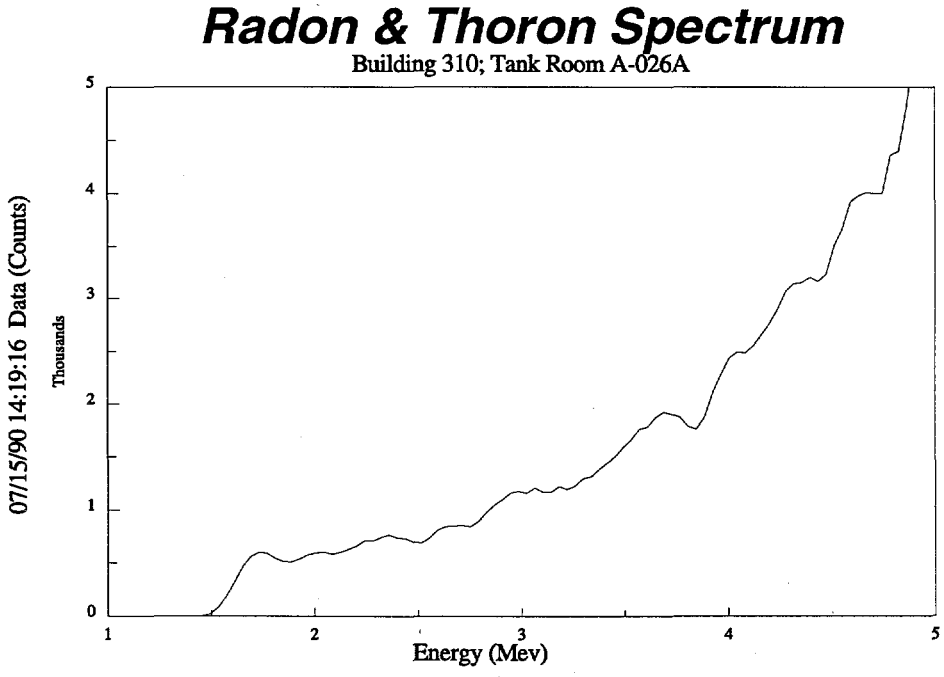


FIGURE C10 Low Energy Alpha Spectrum Collected 7/15/1996

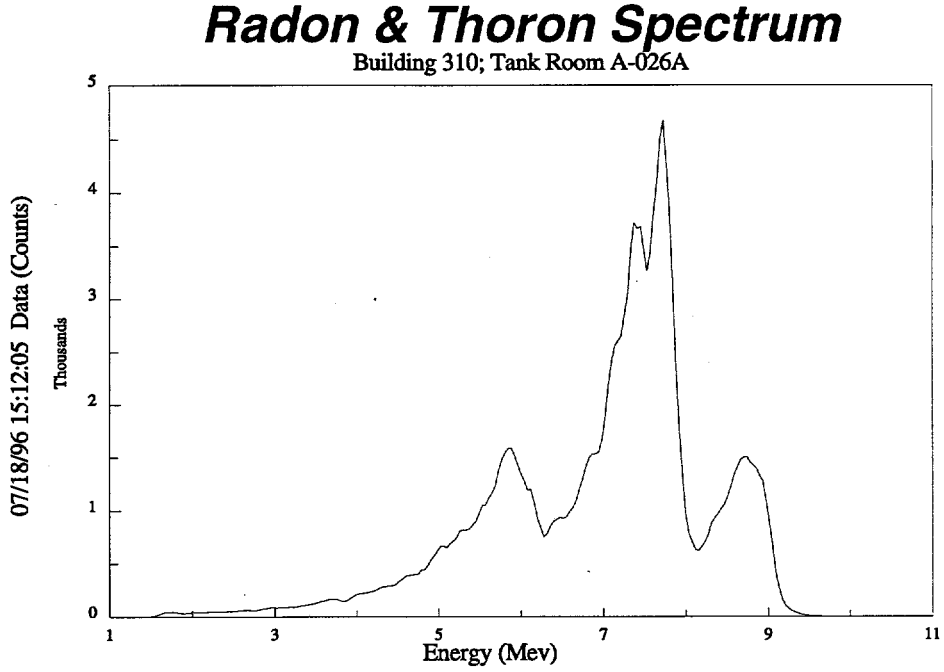


FIGURE C11 Airborne Alpha Particulate Spectra Collected 7/18/96

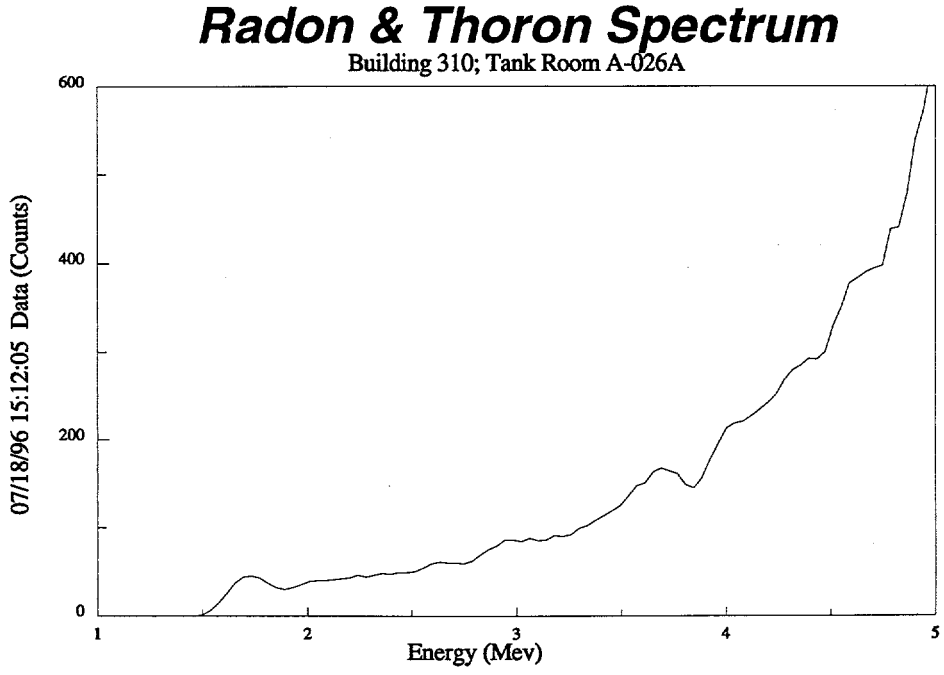


FIGURE C12 Low Energy Alpha Spectrum Collected 7/18/1996

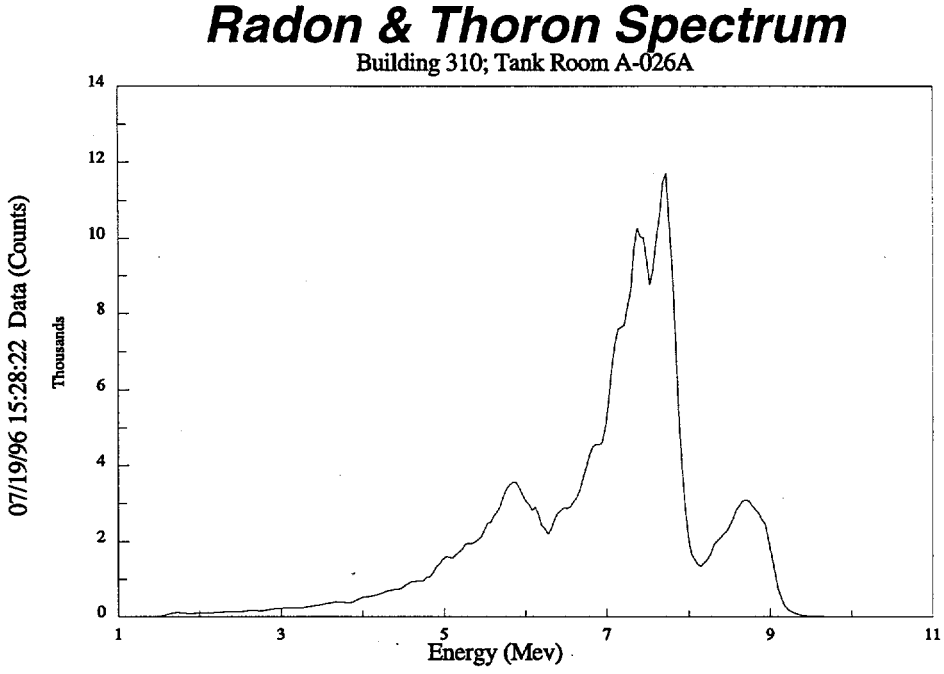


FIGURE C13 Airborne Alpha Particulate Spectra Collected 7/19/96

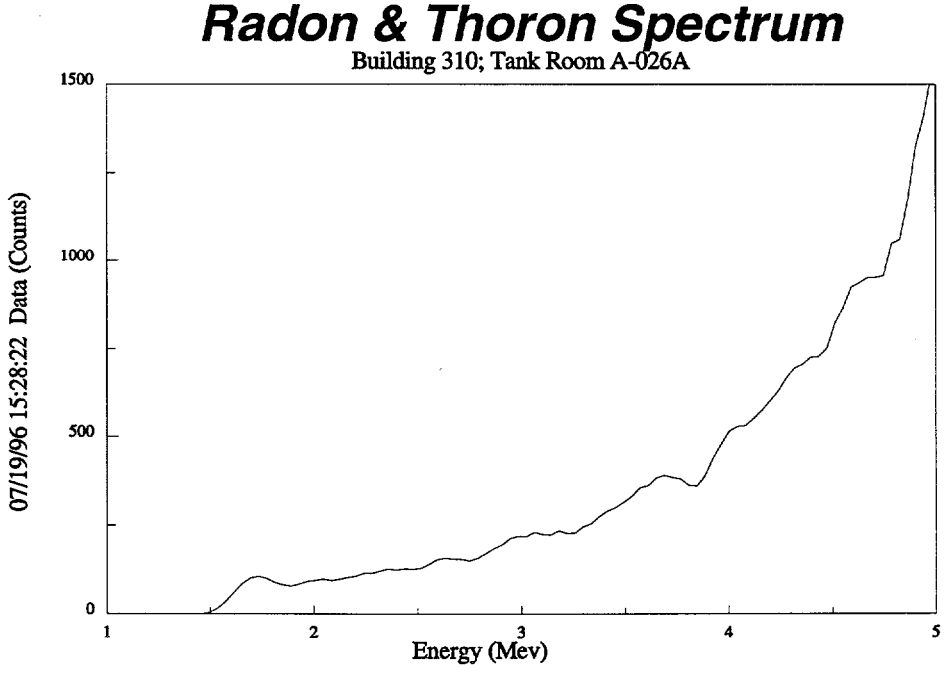


FIGURE C14 Low Energy Alpha Spectrum Collected 7/19/1996

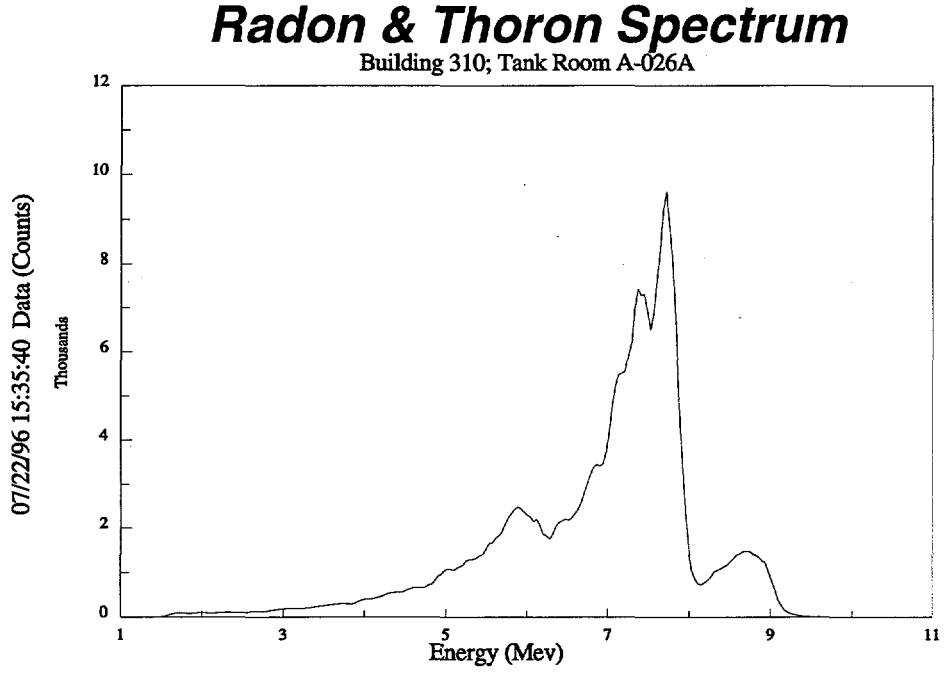


FIGURE C15 Airborne Alpha Particulate Spectra Collected 7/22/96

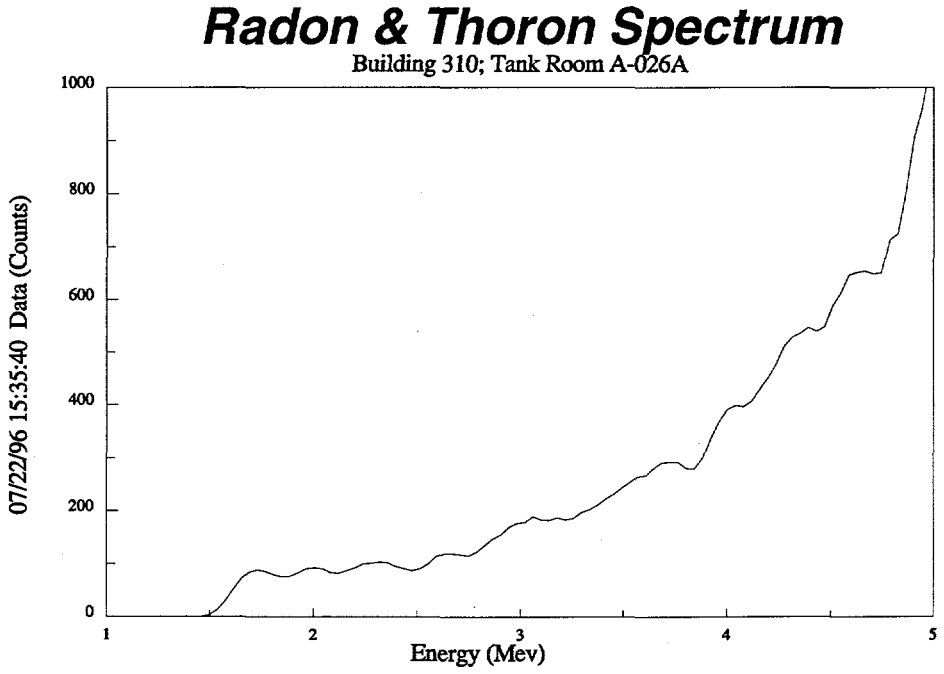


FIGURE C16 Low Energy Alpha Spectrum Collected 7/22/1996

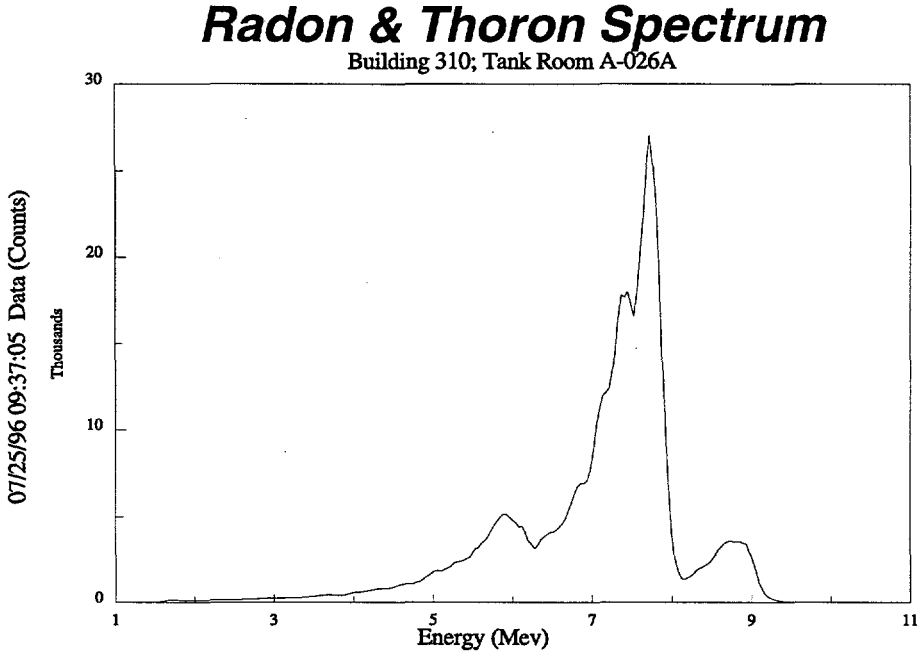


FIGURE C17 Airborne Alpha Particulate Spectra Collected 7/25/96

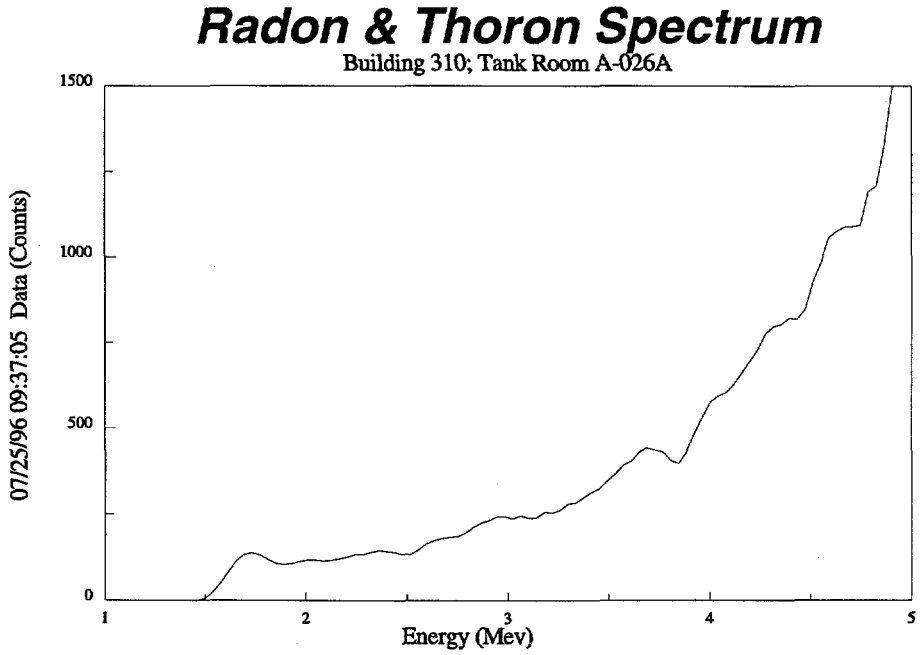


FIGURE C18 Low Energy Alpha Spectrum Collected 7/25/1996

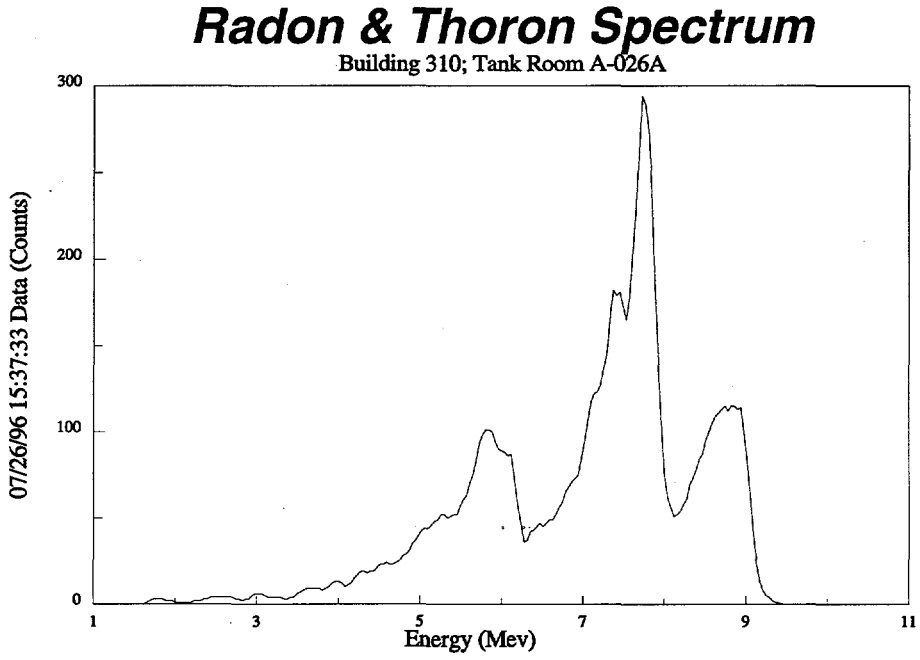


FIGURE C19 Airborne Alpha Particulate Spectra Collected 7/26/96

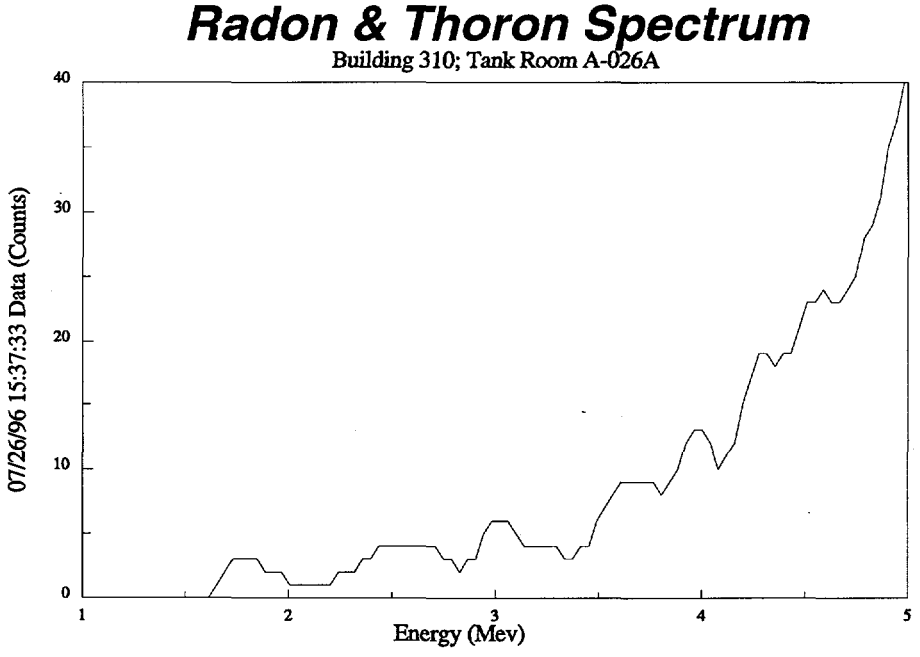


FIGURE C20 Low Energy Alpha Spectrum Collected 7/26/1996

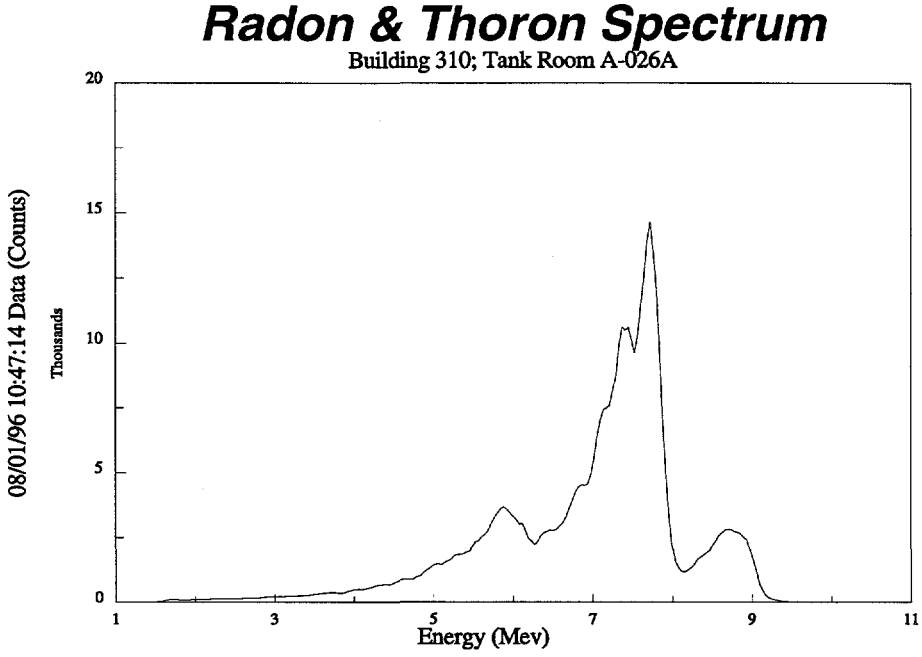


FIGURE C21 Airborne Alpha Particulate Spectra Collected 8/1/96

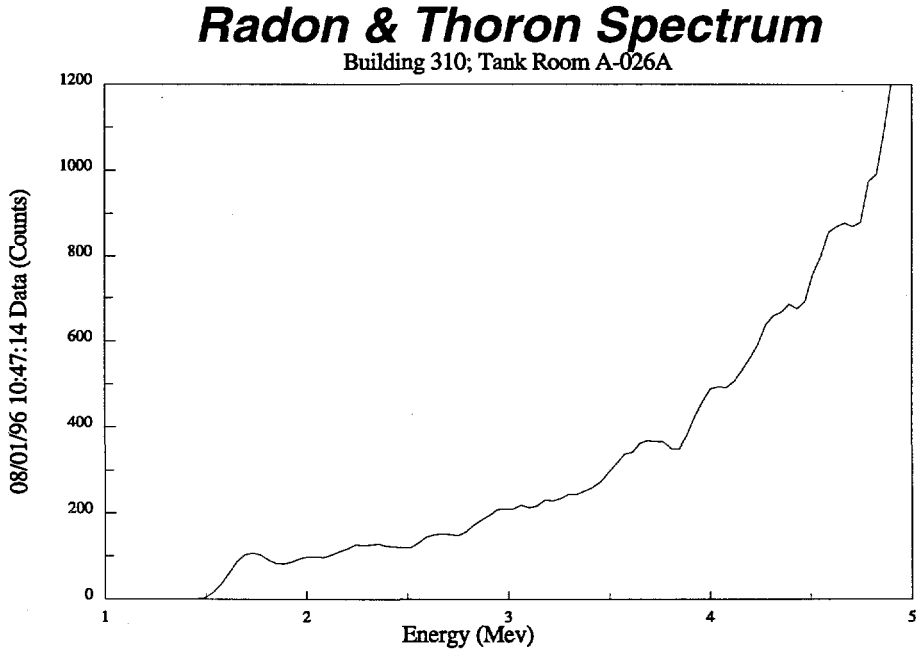


FIGURE C22 Low Energy Alpha Spectrum Collected 8/1/1996

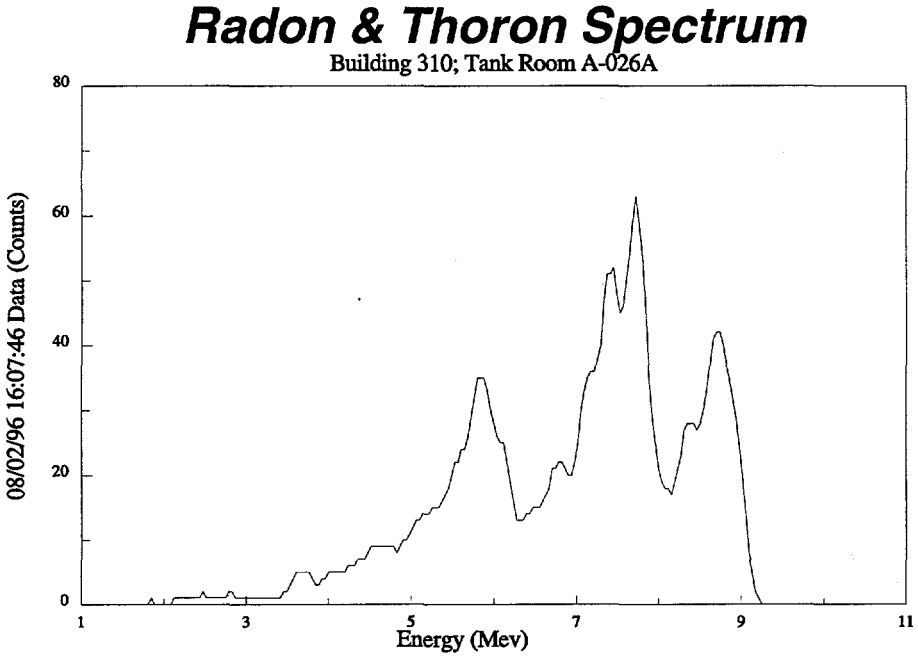


FIGURE C23 Airborne Alpha Particulate Spectra Collected 8/2/96

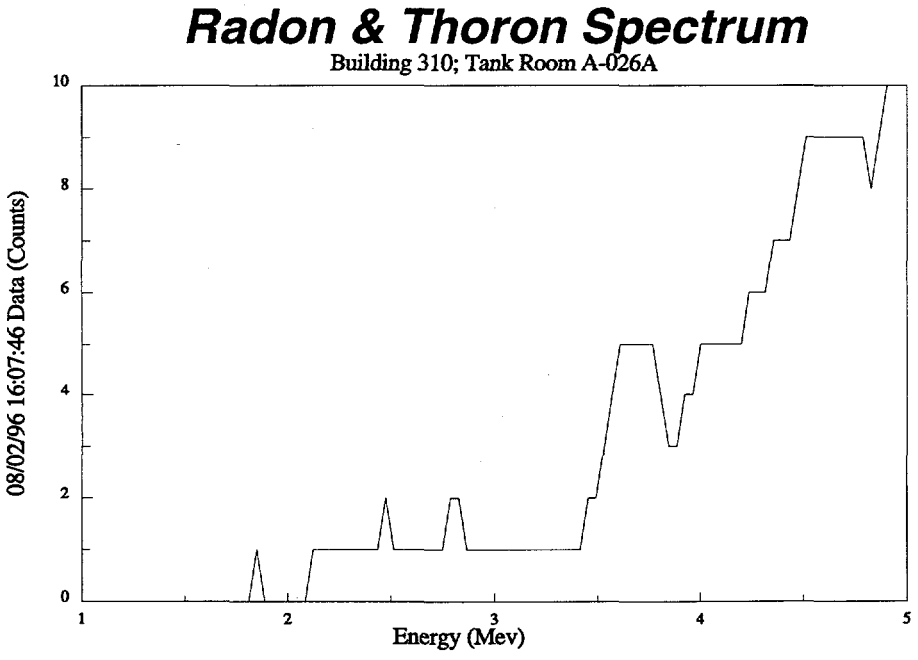


FIGURE C24 Low Energy Alpha Spectrum Collected 8/2/1996

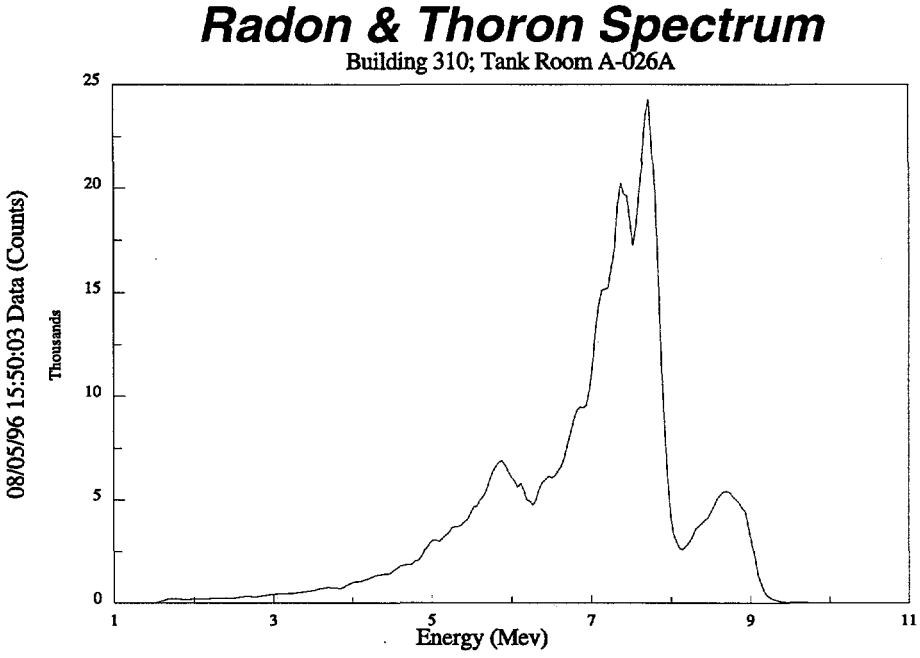


FIGURE C25 Airborne Alpha Particulate Spectra Collected 8/5/96

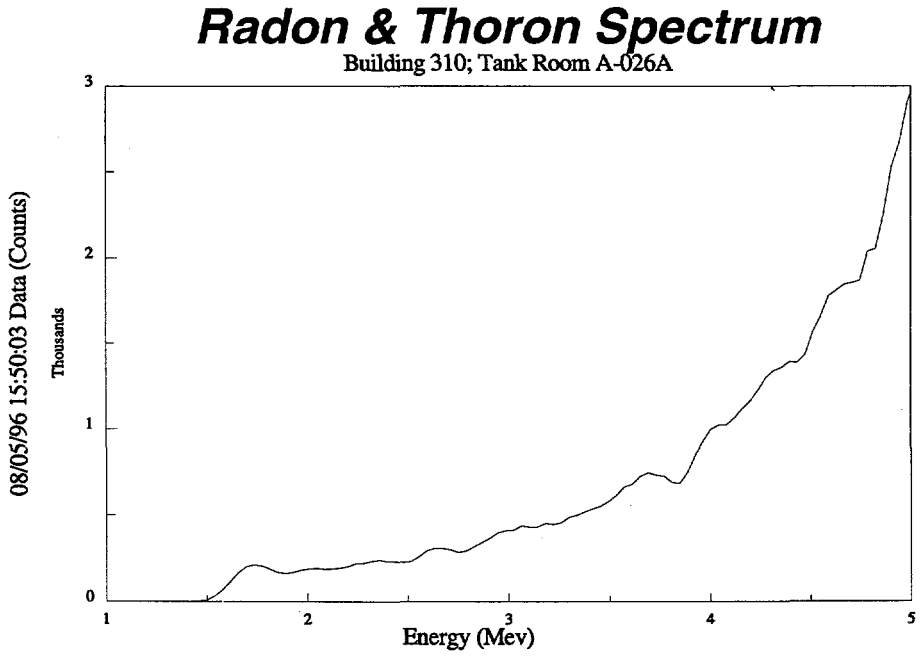


FIGURE C26 Low Energy Alpha Spectrum Collected 8/5/1996

APPENDIX D: Analytical Results

TABLE D1 Documents Containing Analytical Results

JOB TITLE: SAMPLING 310 RETENTION TANKS

JOB DESCRIPTION: The purpose of this JOB PLAN is to provide guidance and instructions for the safe sampling of ten (10) retention tanks on the Service Floor of Building 310. This testing is needed for the Characterization of contents from each tank to ensure proper disposal after the tank clean-out.

WRITER: SUE SANTARELLI **JOB NUM:** JP950015

PRECAUTIONS:

1. The material inside the retention tanks is potentially radioactive and significant coordination with ESH-Health Physics is required.

2. ESH Industrial Hygiene and ESH Industrial Safety and ESH Health Physics must be consulted about personal protective equipment and the spread of radioactive contamination prior to beginning work.

3. Material associated with decontamination and contaminated clothing must be put into separate containers designated to Minimize Radioactive waste generation.

4. The pipeline that connects Building 306 to the10 Retention Tanks in Building 310 do not have a valve that can be opened or closed. This line has been capped off and liquid cannot be transferred from Buildings 306 to 310.

REFERENCE: None

PREREQUISITES:

1. Prepare a Radiation Work Permit and Work Clearance Permit and post in work area.

EMO/WMO

_____
INITIAL/DATE

2. Hold a preplan meeting before starting this JOB PLAN with the WMO and PFS-BM

Foreman, PFS-BM, WMO Mechanics, ESH-Health Physics and ESH-Industrial Hygiene

EMO/WMO

_____
INITIAL/DATE

3. Set up the forced air ventilation in work area if necessary.

EMO/WMO

_____
INITIAL/DATE

4. Verify ESH-HEALTH PHYSICS coverage is available for the scheduled work.

EMO/WMO

_____
INITIAL/DATE

5. Gather the following tools/items.
   a. 5/8 socket
   b. Wipes
   c. 815 solution/soap/water
   d. poly bags for wipes
   e. sampling scoop
   f. sampling jars/id tags
   h. ladders

EMO/WMO

_____
INITIAL/DATE

PROCEDURE:

1. Don personnel protective equipment according to the RADIATION WORK PERMIT.

   A. Tyvek Suit
   C. Gloves

2. Surround the manhole opening with plastic sheeting.

3. Verify ESH-HP has surveyed opening of the manhole. NOTE: if opening is contaminated, decon area using soap and water.

4. UNBOLT manhole using the appropriate tools such as an impact wrench or socket.

5. Open manhole.

6. Verify ESH-IH monitors each tank atmosphere for combustible gases, oxygen content and organic.

7. Using a long handled scoop, take sludge sample and place into a labeled jar. **NOTE:** IF SLUDGE IS DRIED, USE THE LONG HANDLE OF THE SCOOP TO SCRAPE ENOUGH SLUDGE FOR A (20 OZ.) SAMPLE.

8. Have ESH-HP survey the sample jar(s). **NOTE:** If sample jar is deemed Radioactively contaminate, wipe jar using soap and water.

9. After sample has been taken, ensure ESH-HP has surveyed opening of the manhole
10. Close manhole and secure.

11. Remove Plastic sheeting surrounding the manhole.

12. Remove ladder from tank.

13. Decontaminate sampling equipment before proceeding to next tank to be sample.

14. Repeat Steps 2-13 until all tanks have been sampled.

ATTACHED IS THE SIGN-OFF SHEETS FOR EACH STEP REQUIRED FOR COMPLETION OF THIS JOB PLAN.

PROCEDURE/STEPS	GROUP	TANK #1 INITIAL/ DATE	TANK #2 INITIAL/ DATE	TANK #3 INITIAL/ DATE
1. Don personnel protective equipment	WMO			
2. Surround the manhole opening with plastic sheeting.	EMO			
3. Verify ESH-HP has surveyed opening	ESH-HP			
4. UNBOLT manhole	WMO			
5. Open manhole	WMO			
6. Verify ESH-IH monitors each tank	WMO			
7. Using a long handled scoop, take sludge sample and place into a labeled jar.	WMO			
8. Have ESH-HP survey the sample jar(s)	ESH-HP			
9. ESH-HP has surveyed opening of the manhole	ESH-HP			
10. Close manhole	WMO			
11. Remove Plastic sheeting surrounding the manhole.	WMO			
12. Remove ladder from tank.	WMO			
13. Decontaminate sampling equipment	WMO			
14. Repeat Steps 2-13 until all tanks have been sampled.				

PROCEDURE/STEPS	GROUP	TANK#4 INITIAL/ DATE	TANK#5 INITIAL/ DATE	TANK#6 INITIAL/ DATE
1. Don personnel protective equipment	WMO			
2. Surround the manhole opening with plastic sheeting.	EMO			
3. Verify ESH-HP has surveyed opening	ESH-HP			
4. UNBOLT manhole	WMO			
5. Open manhole	WMO			
6. Verify ESH-IH monitors each tank	WMO			
7. Using a long handled scoop, take sludge sample and place into a labeled jar.	WMO			
8. Have ESH-HP survey the sample jar(s)	ESH-HP			
9. ESH-HP has surveyed opening of the manhole	ESH-HP			
10. Close manhole	WMO			
11. Remove Plastic sheeting surrounding the manhole.	WMO			
12. Remove ladder from tank.	WMO			
13. Decontaminate sampling equipment	WMO			
14. Repeat Steps 2-13 until all tanks have been sampled.				

PROCEDURE/STEPS	GROUP	TANK #7 INITIAL/ DATE	TANK #8 INITIAL/ DATE	TANK #9 INITIAL/ DATE
1. Don personnel protective equipment	WMO			
2. Surround the manhole opening with plastic sheeting.	EMO			
3. Verify ESH-HP has surveyed opening	ESH-HP			
4. UNBOLT manhole	WMO			
5. Open manhole	WMO			
6. Verify ESH-IH monitors each tank	WMO			
7. Using a long handled scoop, take sludge sample and place into a labeled jar.	WMO			
8. Have ESH-HP survey the sample jar(s)	ESH-HP			
9. ESH-HP has surveyed opening of the manhole	ESH-HP			
10. Close manhole	WMO			
11. Remove Plastic sheeting surrounding the manhole.	WMO			
12. Remove ladder from tank.	WMO			
13. Decontaminate sampling equipment	WMO			

PROCEDURE/STEPS	GROUP	TANK #10 INITIAL/ DATE
1. Don personnel protective equipment	WMO	
2. Surround the manhole opening with plastic sheeting.	EMO	
3. Verify ESH-HP has surveyed opening	ESH-HP	
4. UNBOLT manhole	WMO	
5. Open manhole	WMO	
6. Verify ESH-IH monitors each tank	WMO	
7. Using a long handled scoop, take sludge sample and place into a labeled jar.	WMO	
8. Have ESH-HP survey the sample jar(s)	ESH-HP	
9. ESH-HP has surveyed opening of the manhole	ESH-HP	
10. Close manhole	WMO	
11. Remove Plastic sheeting surrounding the manhole.	WMO	
12. Remove ladder from tank.	WMO	
13. Decontaminate sampling equipment	WMO	

RETURN TO NORMAL:

1. Clean up and decontaminate general work area as necessary.

EWM/WMO

_____
INITIAL/DATE

2. Collect, properly package and document all contaminated Waste generated during the operation. Waste Generator shall prepare a EWM 195 for disposal of waste generated.

EWM/WMO

_____
INITIAL/DATE

3. Clean and return all equipment used in performing this job to its proper place.

EWM/WMO

_____
INITIAL/DATE

4. Survey the work area and verify that area is free of contamination and available for normal use.

EWM/WMO

_____
INITIAL/DATE

5. Return the competed JOB PLAN to the Foreman for review.

EWM/WMO

_____
INITIAL/DATE

Summary of Analytical Results
Building 310 Laboratory Wastewater Retention Tank Sampling
Argonne National Laboratory – Argonne, Illinois

Sample Date:	**6/23/95**
Matrix:	**Sludge**
Building:	**310**
Tank I.D.:	**310Tank**

RCRA Characterization			
	TCLP Volatiles (mg/L)		
	None Above Detection		
	TCLP Semivolatiles (mg/L)		
	None Above Detection		
	TCLP Metals (mg/L)		Cleanup Criteria*
	Barium	0.111	100
	Chromium	0.0285	5
	Mercury	0.00094	0.2
	Silver	0.0103	5
	TCLP Pesticides (mg/L)		
	None Above Detection		
Reactivity			
	Corrosivity by pH (pH)	7	
Ignitability		Not Ignitable	
Mercury, Total (mg/kg)		0.0631	
PCBs (mg/L)			
	Aroclor-1254	0.0017	
Radiochemistry			
	Radionuclides (pCi/g)**		
	Gross Alpha	32,050.40	
	Gross Beta	73,047.80	
	Plutonium-239	65.1	
	Plutonium-238	2.7	
	Americium-241	11.1	
	Uranium-234	16,560	
	Uranium-235	2276	
	Uranium-238	23,270	
	Strontium-90	88.25	
	Cesium-137	107,200	
	Potassium-40	170.9	
	Thorium-234	3994	
	Uranium-235	1881	
	Cobalt-60	2369	
	Protactinium-234m	6173	

This table is only a summary of those analytes detected

*Cleanup Criteria is derived from 40 CFR 261.24 - Table 1

**The maximum result is listed

TMA
Thermo Analytical Inc.
TMA/Eberline

SPECIAL PROBLEMS OR UNUSUAL CIRCUMSTANCES CONTINUED

GROSS ALPHA/BETA

Sample demonstrated positive activity for Gross Alpha/Beta. Samples contained elevated total dissolved solids, (TDS) and total suspended solids, (TSS), which required limited aliquots (20 ml) for analysis. Due to this condition, and after consideration of all Alpha and Beta emitting radionuclides present, the evaluation is that the results for Gross Alpha/Beta activity may be biased low. Samples were counted several times for informational purposes only. Results for the replicate and first set of analyses are reported. No other significant problems were noted during the analysis process.

STRONTIUM-90

Sample demonstrated slightly positive Strontium-90 activity. No significant problems were noted during the analysis process.

ISOTOPIC URANIUM

Sample demonstrated very elevated Uranium activity and was reanalyzed. During final precipitation of Uranium with Neodymium fluoride, the sample was physically green indicating excessive amounts of Uranium on the filter to be counted by Alpha spectroscopy. Results seem to indicate the presence of Depleted Uranium. However, this may not be the case due to inherent self absorption problems which caused the Uranium-234 spectra to be somewhat degraded. The presence of excessive Uranium within this sample caused interference problems with other analytes as reported within this data package. No other significant problems were noted during the analysis process.

ISOTOPIC PLUTONIUM

Sample appears to contain only slightly positive Plutonium-238 activity and significant Plutonium-239 activity. Evaluation of spectral data indicates the possibility that some Uranium bleedover during the elution of Plutonium may have occurred. Consideration of this may be necessary during evaluation of these results. No other significant problems were noted during the analysis process.

AMERICIUM-241

Sample results indicate slightly positive Americium-241 activity. During the evaluation of Alpha spectroscopy data it was noted the there is the possibility of some Curium-244 activity within this sample (see raw data from the Americium-241 section). Uranium bleedover during the Americium-241 elution procedure may have occurred. No other significant problems were noted during the analysis process.

000021

TMA
Thermo Analytical Inc.
TMA/Eberline

SPECIAL PROBLEMS OR UNUSUAL CIRCUMSTANCES CONTINUED

GAMMA SPECTROSCOPY

Samples demonstrated significant Cobalt-60 and Cesium-137 activity. No significant problems were noted during the analysis process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package and in the electronic data submitted on diskette has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

M. R. McDougall
Laboratory Manager

Date: 7/28/95

000022

ARGONNE
NATIONAL
LABORATORY

Intra-Laboratory Memo

September 5, 1995

TO: L. Boing TD&DD

FROM: J. Demski EMO/WM

SUBJECT: **Building 310 Retention Tank Sampling Results**

Per your request, I have summarized the analytical results for the above project in the attached table. In general, only limited concentrations of contaminants were detected in the tank. TCLP volatiles, semivolatiles, and pesticides and herbicides were not detected. Several TCLP metals and TCL Mercury were detected; however, the concentrations were low enough so that the sludge would not be considered characteristically hazardous. PCB analysis revealed a low concentration of Aroclor-1254 well below the TSCA defining limit of 50 mg/kg. Based upon the radiochemical analysis, the sample was found to be radioactive, and as a result, the sludge from the tank would be classified as low level radioactive waste. A detailed discussion of the radiochemical results is attached.

I will charge a total of 10 hours to cost code 54114-4B-113. Please feel free to contact me if you have any questions at extension 2-9733.

JF:dm

cc: File
s:\shared\fallbac\boing.2

ARGONNE
NATIONAL
LABORATORY

INTRA-LABORATORY MEMO

June 18, 1996

TO: Bldg. 310 Retention Tank Facility D&D Project File

FROM: R. Rose TD

SUBJECT: **Results of Tank Sampling Performed by EMO/WM in June 1995**

Phone conversations with Sue Santarelli and a discussion with Earl Beavers on 6/14/96 indicate that when the sampling plan for the Bldg. 310 Retention Tanks was executed by EMO/WM in June 1995 only 4 of the 10 tanks contained liquid which could be sampled and that of the 4 which held liquid, there was insufficient quantity to take an individual sample from each. Therefore, a composite sample was obtained and sent to the vendor laboratory for analysis. The tanks containing sufficient liquid for sampling were #'s 3, 8, 9, &10. The location of these tanks is indicated on the attached floor plan of Bldg. 310 basement. As the attachment indicates, none of the tanks containing residual liquid are within the room designated as a SWMU (Room A-038-A).

cc:(w/attachment)

E. Beavers	EMO/WM
N. Golchert	EMO
W. Munyon	ESH/HP
B. Murdock	ESH/HP
S. Santarelli	EMO/WM
T. Yule	TD
File(310)	

THOUSANDS | HUNDREDS | TENS | UNITS

B RETENTION TANK SAMPLE NO **№ 119991**

Bldg. No. 310 Date 7-23-96

Tank No. 2 Gallons of Waste in Tank 2000

Counter No.	3		4	
Sample Size				
Count For	β	α	β	α
Total Counts	1273	8	1251	8
Counting Time	30	—		—
c/m	42.4	.27	41.7	.27
Background	41.6	.06	40.8	.03
BKGD + Net α c/m	41.8		41.0	
Net c/m	.6	.21	.7	.24
Volume Factor	20	—		—
c/m/ml	.03	.0105	.035	.012
Yield Factor	1.35	1.96	1.35	1.96
d/m/ml	.04	.021	.05	.024
Average Beta				
Average Alpha				
Gross d/m/ml				

Sample Relinquished By HARKEY 12-4-96

Sample Received By 12-4-96

Results Reported To RCB

Analyst

PFS-11 (3-92) (Submit With Sample to ESH-Control Lab)

THOUSANDS | HUNDREDS | TENS | UNITS

B RETENTION TANK SAMPLE NO **№ 119990**

Bldg. No. 310 Date 7-23-96

Tank No. 1 Gallons of Waste in Tank 2000

Counter No.	1		2	
Sample Size				
Count For	β	α	β	α
Total Counts	1303	23	1326	19
Counting Time	30	—		—
c/m	43.4	.77	44.2	.63
Background	36.9	.02	41.1	.01
BKGD + Net α c/m	37.7		41.7	
Net c/m	5.7	.75	2.5	.62
Volume Factor	20	—		—
c/m/ml	.285	.0375	.125	.031
Yield Factor	1.35	1.96	1.35	1.96
d/m/ml	.38	.074	.17	.061
Average Beta	0.28			
Average Alpha	0.068			
Gross d/m/ml				

Sample Relinquished By HARKEY 12-4-96

Sample Received By 12-4-96

Results Reported To RCB

Analyst

PFS-11 (3-92) (Submit With Sample to ESH-Control Lab)

4 2 1	7 4 2 1	7 4 2 1	7 4 2 1
4 2 1	7 4 2 1	7 4 2 1	7 4 2 1
THOUSANDS	HUNDREDS	TENS	UNITS

B RETENTION TANK SAMPLE NO. No. 119992

Bldg. No. 310 Date 7-25-96

Tank No. #2 Gallons of Waste in Tank 1,700

Counter No.	1		2	
Sample Size				
Count For	β	α	β	α
Total Counts	1189	4	1735	8
Counting Time	30			
c/m	39.6	.13	44.5	.27
Background	36.4	.02	43.4	.04
BKGD + Net α c/m	36.51		43.63	
Net c/m	3.09	.11	.87	.23
Volume Factor	20			
c/m/ml	.155	.006	.044	.012
Yield Factor	1.35	1.96	1.35	1.96
d/m/ml	.209	.011	.059	.023
Average Beta				
Average Alpha				
Gross d/m/ml				

Sample Relinquished By JS Harmon

Sample Received By DA 1/26/96

Results Reported To RB

Analyst JS Harmon

PFS-11 (3-92) (Submit With Sample to ESH-Control Lab)

THOUSANDS | HUNDREDS | TENS | UNITS

B RETENTION TANK SAMPLE NO. **No. 119994**

Bldg. No. 310 Date 7/~~26~~25/96 (WD)

Tank No. 2 Gallons of Waste in Tank 2000t

Counter No.	21		22	
Sample Size				
Count For	β	α	β	α
Total Counts	1424	10	1290	9
Counting Time	30			
c/m	47.4	.33	43.0	.30
Background	44.8	.05	42.0	.07
BKGD + Net α c/m	45.08		42.23	
Net c/m	2.32	.28	.77	.23
Volume Factor	20			
c/m/ml	.116	.014	.039	.012
Yield Factor	1.35	1.96	1.35	1.96
d/m/ml	.157	.027	.052	.023
Average Beta				
Average Alpha				
Gross d/m/ml				

Sample Relinquished By L. Wesley

Sample Received By DM

Results Reported To RB

Analyst D Thomas

W 7-30-96

PFS-11 (3-92) (Submit With Sample to ESH-Control Lab)

THOUSANDS | HUNDREDS | TENS | UNITS

B RETENTION TANK SAMPLE NO. **No. 119993**

Bldg. No. 310 Date 7/~~26~~25/96 (WK)

Tank No. 1 Gallons of Waste in Tank 2000t

Counter No.	19		20	
Sample Size				
Count For	β	α	β	α
Total Counts	1197	9	1520	20
Counting Time	30			
c/m	39.9	.30	50.7	.67
Background	35.9	.06	47.7	.28
BKGD + Net α c/m	36.14		48.09	
Net c/m	3.76	.24	2.61	.39
Volume Factor	20			
c/m/ml	.188	.012	.131	.020
Yield Factor	1.35	1.96	1.35	1.96
d/m/ml	.254	.024	.176	.038
Average Beta				
Average Alpha				
Gross d/m/ml				

Sample Relinquished By L. Wesley

Sample Received By DM

Results Reported To RB

Analyst D Thomas

W 7-30-96

PFS-11 (3-92) (Submit With Sample to ESH-Control Lab)

THOUSANDS | HUNDREDS | TENS | UNITS

B RETENTION TANK SAMPLE NO **№ 119996**

Bldg. No. 310 Date 7-31

Tank No. 2 Gallons of Waste in Tank 2000 +

Counter No.	23		24	
Sample Size				
Count For	β	α	β	α
Total Counts	1145	9	1283	7
Counting Time	30			
c/m	38.2	.30	42.8	.23
Background	32.2	.02	38.8	.02
BKGD + Net α c/m	32.48		39.01	
Net c/m	.72	.28	3.79	.21
Volume Factor	20			
c/m/ml	.036	.014	.190	.011
Yield Factor	1.35	1.96	1.35	1.96
d/m/ml	.049	.027	.256	.021
Average Beta				
Average Alpha				
Gross d/m/ml				

Sample Relinquished By Swanson 8/1

Sample Received By MB 8/1/96

Results Reported To Swanson 8/1

Analyst D Hanson

PFS-11 (3-92) (Submit With Sample to ESH-Control Lab)

THOUSANDS | HUNDREDS | TENS | UNITS

B RETENTION TANK SAMPLE NO **№ 119995**

Bldg. No. 510 Date 7-31-96

Tank No. 1 Gallons of Waste in Tank 2000 +

Counter No.	21		22	
Sample Size				
Count For	β	α	β	α
Total Counts	1467	13	1322	15
Counting Time	30			
c/m	48.9	.43	44.1	.50
Background	44.6	.03	43.5	.10
BKGD + Net α c/m	45.00		43.90	
Net c/m	3.90	.40	.20	.40
Volume Factor	20			
c/m/ml	.195	.020	.010	.020
Yield Factor	1.35	1.96	1.35	1.96
d/m/ml	.263	.039	.014	.039
Average Beta				
Average Alpha				
Gross d/m/ml				

Sample Relinquished By Swanson 8/1

Sample Received By MB 8/1/96

Results Reported To Swanson 8/1

Analyst D Hanson

PFS-11 (3-92) (Submit With Sample to ESH-Control Lab)

Date: January 9, 1995

To: G. Mosho ESH-HP

From: M. Bonkalski ESH-IH
J. Woodring ESH-IH

Subject: **INDUSTRIAL HYGIENE SURVEY SUMMARY REPORT**

Operation Surveyed: Pre-Demolition Survey

Location Surveyed: Building 310 Retention Tanks, Building 202 JANUS Reactor
Building 211 60" Cyclotron

Material or Hazard Measured: Asbestos and Lead

Method of Measurement: Polarized Light Microscopy
BGI Lead Check Test Kit

Sample Description and Results:

All of the materials associated with previously stated locations were characterized for asbestos and lead. The following were found to contain asbestos or lead:

Building 310 Retention Tanks:

Asbestos-containing - Overhead Steam Lines (chrysotile/Amosite);

Lead-containing - All painted materials are less than 0.5% lead by weight (BGI Lead Check Swab Detection Limit - 0.5% lead by weight).

Building 202 JANUS Reactor:

Asbestos-containing - Refer to the *Boelter Environmental Consultants Site Asbestos Characterization* of Building 202 to determine which materials are to be treated as asbestos-containing.

Lead-containing - The following areas are to be treated as lead-containing (greater than 0.5% lead by weight): Shutter Cylinder Platform (Blue Paint), Blocks from Low Flux Room (Red Paint), Floor Blocks in room J-105 (Gray Paint w/ Red Undercoating), Air Tanks from rooms J-101/-010 (Green Paint), and the Gasometer from room J-010 (Gray Paint). All other associated materials are less than 0.5% lead by weight.

Building 211 60" Cyclotron:

Asbestos-containing - Refer to the *Boelter Environmental Consultants Site Asbestos Characterization* of building 211 to determine which materials are to be treated as asbestos-containing.

Lead-containing - The following materials are to be treated as lead-containing (greater than 0.5% lead by weight): Westinghouse Transformer/Rectifier in room A-119 (Blue/Gray Exterior and Green Interior), and the AB Quality E-PWR-A2 in room A-119 (Gray paint). All other associated material are less than 0.5% lead by weight.

For materials which have been identified as asbestos-containing and lead-containing, employees working near the identified material should be notified and precautions should be taken during the removal of the material.

For the asbestos-containing material, only PFS/FPE-administered licensed asbestos removal contractors or qualified EWM-Waste Management Mechanics can handle, repair, and/or remove the identified material.

Demolition or renovation work is required to meet the provisions of the OSHA Lead Standard, which specifies maintaining exposures below 50 $\mu g/m^3$ with certain items triggered at an Action Level of 30 $\mu g/m^3$. No specific definition of "lead-containing paint" is included in the standard.

However, an amendment to the Toxic Substance Control Act (TOSCA), PL 102-550, SEC 1021, Title IV, "Lead Exposure Reduction," defines lead-based paint as a surface coating containing lead in excess of 1 mg/cm^2, or 0.5% lead by weight. The Consumer Product Safety Act (CPSA), 16 CFR 1303, defines lead-containing paint as that in excess of 0.06% by weight. The survey results indicate which materials have paint with lead. The Steel Structures Painting Council reports that many contractors use the 0.06% level to define their lead projects.

Operations presumed by OSHA to present the highest air contaminated potential are abrasive blasting, welding, cutting, and torch-burning (these may produce exposure levels greater than 2500 micrograms per cubic meter of air). Therefore, precautions are recommended for these operations where the paint concentration is greater than 0.06% lead and where torch-cutting or dusty methods will be used in the demolition. A HEPA-filtered local exhaust unit should be used to capture fume from torch-cutting. If feasible, the lead-containing paint can be chemically stripped from the area needing to be cut or welded. The paint must be stripped down to bare metal and expose an area around the projected cut or weld so that the torch or arc will not come in contact with paint. Workers should use NIOSH-approved respirators for lead dust and fumes.

Painted materials with a negative result from the BGI Lead Check Swab can exceed the CPSA definition. Depending on demolition activities, a bulk sample of the paint from these materials may need to be taken and analyzed to a lower detection limit. Contact Industrial Hygiene (2-3310) to determine if bulk samples need to be taken of the material in question.

The demolition contractor should assure that employees are informed of the Lead Standard requirements and that good work practices are followed to keep the job site as free as practicable from accumulation of lead.

The results of this survey, pertaining to lead-containing paint, should be discussed with Mark Kamiya - EWM. He will assist you in determining whether or not the waste from this project will be considered hazardous.

If you or your employees have any questions regarding the results, please contact Industrial Hygiene at 2-3310 or 2-9856.

ct: J. Woodring
R. Wynveen
File: Building 310, 202, and 211
Lead-ANL Projects
Asbestos-ANL Projects

Date: August 21, 1996

To: C. Sholeen — ESH-HP

From: D. R. Lucas — ESH-Industrial Hygiene
G. E. Myers — ESH-Industrial Hygiene

Subject: **INDUSTRIAL HYGIENE SURVEY SUMMARY REPORT**

Operation Surveyed: Gray paint off of tanks

Location: Building 310, Rooms A-026, A-038, A-050, and A-062

Material or Hazard Measured: Lead

Method of Measurement: Bulk Sample

Sample Description and Results:

Sample Number (Book N39-23-)	Location/Description	Lead Test Result Flame AA
22006	Gray paint off of tanks	0.02%

Applicable Standards:

The Consumer Product Safety Act defines a "lead-containing paint" as a paint in which the lead content exceeds 0.06% by weight.

OSHA Lead Standard, 1926.62 (Construction)

Recommendations:

No recommendations at this time.

Date of Survey: August 1, 1996
Surveyed by: D. R. Lucas
Lab Analysis by: R. Kasper

ct: D. Geraghty
C. Grandy
J. Woodring
R. Wynveen
File:Bldg. 310

drl.ihs310

HSA DATABASE TABLE
HSA LIST BY BUILDING
ARGONNE NATIONAL LABORATORY

BUILDING

310

HSA #	MATERIAL DESCRIPTION	MATERIAL TYPE	SAMPLE #	ANALYTICAL RESULT
001	STEAM SUPPLY PIPE INSULATION	TSI	22657	3-5% CHRYSOTILE / 5-10% AMOSITE
			22658	NA
			22659	NA
002	STEAM SUPPLY PJC	TSI	22660	30-40% CRYSOTILE / 1-3 % AMOSITE
			22661	NA
			22662	NA
003	LAB COLD PIPE INSULATION	TSI	22663	1-3% CHRYSOTILE
			22664	NA
			22665	NA
004	LAB COLD PJC	TSI	22666	30-40% CHRYSOTILE / 1-3% AMOSITE
			22667	NA
			22668	NA
005	LAB HOT PIPE INSULATION	TSI	22669	30-40% CHRYSOTILE
			22670	NA
			22671	NA

HSA DATABASE TABLE
HSA LIST BY BUILDING
ARGONNE NATIONAL LABORATORY

BUILDING

310

HSA #	MATERIAL DESCRIPTION	MATERIAL TYPE	SAMPLE #	ANALYTICAL RESULT
007	LAB HOT RETURN PIPE INSULATION	TSI	22675	20-30% CHRYSOTILE
			22676	NA
			22677	NA
009	STORM DRAIN PIPE INSULATION	TSI	22681	3-5% CHRYSOTILE
			22682	NA
			22683	NA
010	STORM DRAIN PJC	TSI	22684	20-30% CHRYSOTILE / TRACE AMOSITE
			22685	NA
			22686	NA
011	CONDENSATE RETURN PIPE INSULATION	TSI	22687	40-50% CHRYSOTILE
			22688	NA
			22689	NA
012	CONDENSATE RETURN PJC	TSI	22690	20-30% CHRYSOTILE / TRACE AMOSITE
			22691	NA
			22692	NA

HSA DATABASE TABLE
HSA LIST BY BUILDING
ARGONNE NATIONAL LABORATORY

BUILDING

310

HSA #	MATERIAL DESCRIPTION	MATERIAL TYPE	SAMPLE #	ANALYTICAL RESULT
013	DOMESTIC COLD PIPE INSULATION	TSI	22693	TRACE CHRYSOTILE
			22694	1-3% CHRYSOTILE
			22695	NA
014	DOMESTIC COLD PJC	TSI	22696	20-30% CHRYSOTILE
			22697	NA
			22698	NA
015	CONDENSATE TANK	TSI	22699	10-20% CHRYSOTILE / 1-3% AMOSITE
			22700	NA
			22701	NA
016	AIR CONDITION DUCT GASKET	VIB	22702	80-90% CHRYSOTILE
			22703	NA
			22704	NA
017	AIR CONDITION CORK INSULATION & SEAMS	TSI	22705	ND
			22706	ND
			22707	ND

HSA DATABASE TABLE
HSA LIST BY BUILDING
ARGONNE NATIONAL LABORATORY

BUILDING

310

HSA #	MATERIAL DESCRIPTION	MATERIAL TYPE	SAMPLE #	ANALYTICAL RESULT
018	DOMESTIC HOT PIPE INSULATION	TSI	22708	40-50% CHRYSOTILE
			22709	NA
			22710	NA
019	DOMESTIC HOT PJC	TSI	22711	50-60% CHRYSOTILE / TRACE AMOSITE
			22712	NA
			22713	NA
020	12X12 WHITE FLR TILE - CREAM STREAKS	FT	22714	1-3% CHRYSOTILE
			22715	NA
			22716	NA
021	12X12 WHITE FLR TILE - CREAM STREAKS MASTIC	FTM	22717	ND
			22718	ND
			22719	ND
022	12X12 BLACK FLR TILE	BB	22720	1-3% CHRYSOTILE
			22721	NA
			22722	NA

HSA DATABASE TABLE
HSA LIST BY BUILDING
ARGONNE NATIONAL LABORATORY

BUILDING

310

HSA #	MATERIAL DESCRIPTION	MATERIAL TYPE	SAMPLE #	ANALYTICAL RESULT
023	12X12 BLACK FLR TILE MASTIC	BBM	22723	ND
			22724	ND
			22725	ND
024	6" BLACK BASEBOARD	BB	22726	ND
			22727	ND
			22728	ND
025	6" BLACK BASEBOARD MASTIC	BBM	22729	ND
			22730	TRACE AMOSITE
			22731	ND
026	2X4 LAYIN CEILING TILE - SMALL WORMS & DOTS	CT	22732	ND
			22733	ND
			22734	ND
027	12X12 GRAY FLR TILE - WHITE STREAKS	FT	22735	1-3% CHRYSOTILE
			22736	NA
			22737	NA

HSA DATABASE TABLE
HSA LIST BY BUILDING
ARGONNE NATIONAL LABORATORY

BUILDING

310

HSA #	MATERIAL DESCRIPTION	MATERIAL TYPE	SAMPLE #	ANALYTICAL RESULT
028	12X12 GRAY FLR TILE - WHITE STREAKS MASTIC	FTM	22738	ND
			22739	ND
			22740	ND
029	BROWN BASEBOARD	BB	22741	ND
			22742	ND
			22743	ND
030	BROWN BASEBOARD MASTIC	BBM	22744	ND
			22745	ND
			22746	ND
031	RED CAULK	SM	22747	ND
			22748	ND
			22749	ND
032	FIRE DOOR	DOOR	XXXXX	ASSUMED ACM
			XXXXX	ASSUMED ACM
			XXXXX	ASSUMED ACM

HSA DATABASE TABLE
HSA LIST BY BUILDING
ARGONNE NATIONAL LABORATORY

BUILDING

310

HSA #	MATERIAL DESCRIPTION	MATERIAL TYPE	SAMPLE #	ANALYTICAL RESULT
033	DRYWALL	DW	22750	ND
			22751	ND
			22752	ND
034	RUST CARPET MASTIC	CM	22753	ND
			22754	TRACE CHRYSOTILE
			22755	1-3% CHRYSOTILE
035	2X4 PATTERENED LAYIN CEILING TILE	CT	22756	ND
			22757	ND
			22758	ND
036	9X9 RED FLOOR TILE	FT	22759	3-5% CHRYSOTILE
			22760	NA
			22761	NA
037	9X9 RED FLOOR TILE MASTIC	FTM	22762	5-10% CHRYSOTILE
			22763	NA
			22764	NA

HSA DATABASE TABLE
HSA LIST BY BUILDING
ARGONNE NATIONAL LABORATORY

BUILDING

310

HSA #	MATERIAL DESCRIPTION	MATERIAL TYPE	SAMPLE #	ANALYTICAL RESULT
038	2X4 LAYIN DIVIDED CEILING TILE	CT	22765	ND
			22766	ND
			22767	ND
039	4" BLACK BASEBOARD	BB	22768	ND
			22769	ND
			22770	ND
040	4" BLACK BASEBOARD MASTIC	BBM	22771	ND
			22772	ND
			22773	ND
041	12X12 ACOUSTIC WALL TILE	SM	22774	ND
			22775	ND
			22776	ND
042	BLUE CARPET MASTIC	CM	22777	1-3% CHRYSOTILE
			22778	NA
			22779	NA

HSA DATABASE TABLE
HSA LIST BY BUILDING
ARGONNE NATIONAL LABORATORY

BUILDING

310

HSA #	MATERIAL DESCRIPTION	MATERIAL TYPE	SAMPLE #	ANALYTICAL RESULT
043	2X2 LAYIN CEILING TILES SHORT WORMS & DOTS	CT	22780	ND
			22781	ND
			22782	ND
044	STRIPED BROWN CARPET- MASTIC	CM	22783	ND
			22784	ND
			22785	ND
045	YELLOW CARPET - MASTIC	CM	22786	ND
			22787	ND
			22788	ND
046	LIGHT GREEN CARPET MASTIC	CM	22789	ND
			22790	ND
			22791	ND
047	BROWN CARPET MASTIC	CM	22792	ND
			22793	ND
			22794	ND

HSA DATABASE TABLE
HSA LIST BY BUILDING
ARGONNE NATIONAL LABORATORY

BUILDING

310

HSA #	MATERIAL DESCRIPTION	MATERIAL TYPE	SAMPLE #	ANALYTICAL RESULT
048	SPECKLED YELLOW, BROWN, ORANGE CARPET MASTIC	CM	22795	ND
			22796	ND
			22797	ND
049	LIGHT BROWN BASEBOARD	BB	22798	ND
			22799	ND
			22800	ND
050	LIGHT BROWN BASEBOARD MASTIC	BBM	22801	ND
			22802	ND
			22803	ND

Author: Michael Bonkalski at ESH_200
Date: 9/26/96 3:42 PM
Priority: Normal
TO: Dolores Geraghty
CC: James Woodring
Subject: Lead Check on Paint

---------- Message Contents ----------

Date: September 26, 1996

To: Charlotte Sholeen ESH-HP

From: Michael Bonkalski ESH-IH

Subject: Industrial Hygiene Survey Summary Report

Operation: Lead Check on Paint from Walls and Retention Tanks

Location: Building 310, Retention Tank Rooms

Material: Lead

Sample Results:

The survey was performed on 9/26/96 using a TN Technologies XRF Pb Analyzer in order to determine lead levels in paint prior to D&D work involving the Building 310 retention tanks.

Results from the survey indicate that lead is not present in the gray paint on the walls and the retention tanks.

Applicable Standards:

None

Recommendations:

No recommendations based on results.

TENNELEC LB4000 COUNT STARTED 8-19-96 , 100 MIN COUNTS

	310 194		310 195		310 197		310 198		
	xxxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxxx		
	A1	A1	A2	A2	A3	A3	A4	A4	
	ALPHA	BETA	ALPHA	BETA	ALPHA	BETA	ALPHA	BETA	
1	136	1497	122	1607	148	1528	98	1278	8-19-96 18:05
2	119	1508	134	1585	152	1609	120	1280	8-19-96 19:45
3	128	1444	136	1527	151	1530	97	1245	8-19-96 21:26
4	122	1469	154	1600	148	1598	121	1220	8-19-96 23:06
5	136	1491	138	1631	151	1549	112	1193	8-20-96 0:47
6	139	1506	156	1605	145	1490	102	1260	8-20-96 2:27
7	134	1474	137	1540	160	1562	109	1282	8-20-96 4:08
8	149	1506	150	1616	138	1570	104	1205	8-20-96 5:49
9	151	1472	151	1663	156	1560	117	1251	8-20-96 7:29
AVG	134.9	1485.2	142.0	1597.1	149.9	1555.1	108.9	1246.0	
OBS_SD	10.2	20.6	10.7	39.9	6.0	34.4	8.7	31.4	
OBS/EXP	0.9	0.5	0.9	1.0	0.5	0.9	0.8	0.9	
CPM	1.349	14.852	1.420	15.971	1.499	15.551	1.089	12.460	
STD_ERR	0.039	0.128	0.040	0.133	0.041	0.131	0.035	0.118	
BKG	0.032	1.014	0.030	0.947	0.032	1.264	0.033	0.912	
NET CPM	1.317	13.838	1.390	15.024	1.467	14.287	1.056	11.548	

The elements of this data set are all within 4 Standard Deviations of the mean.

TENNELEC LB4000 COUNT STARTED 8-19-96 , 100 MIN COUNTS

	310 199		310 200		310 201		310 202		
	xxxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxxx		
	B1 ALPHA	B1 BETA	B2 ALPHA	B2 BETA	B3 ALPHA	B3 BETA	B4 ALPHA	B4 BETA	
1	103	1275	124	1333	120	1374	74	763	8-19-96 18:05
2	114	1323	117	1359	116	1342	85	750	8-19-96 19:45
3	111	1300	111	1303	128	1313	84	762	8-19-96 21:26
4	114	1303	117	1301	117	1340	86	703	8-19-96 23:06
5	116	1295	111	1321	109	1383	83	769	8-20-96 0:47
6	112	1271	125	1373	113	1337	80	723	8-20-96 2:27
7	111	1333	103	1309	118	1337	89	689	8-20-96 4:08
8	98	1347	102	1281	105	1368	79	734	8-20-96 5:49
9	113	1328	92	1368	125	1384	76	757	8-20-96 7:29
AVG	110.2	1308.3	111.3	1327.6	116.8	1353.1	81.8	738.9	
OBS_SD	5.5	24.7	10.2	30.9	6.8	23.4	4.6	26.9	
OBS/EXP	0.5	0.7	1.0	0.8	0.6	0.6	0.5	1.0	
CPM	1.102	13.083	1.113	13.276	1.168	13.531	0.818	7.389	
STD_ERR	0.035	0.121	0.035	0.121	0.036	0.123	0.030	0.091	
BKG	0.031	0.958	0.031	1.035	0.035	0.958	0.029	0.961	
NET CPM	1.071	12.125	1.082	12.241	1.133	12.573	0.789	6.428	

The elements of this data set are all within 4 Standard Deviations of the mean.

TENNELEC L84000 COUNT STARTED 8-19-96 , 100 MIN COUNTS

	310 203				310 204		310 205		
	C1 ALPHA	C1 BETA	C2 ALPHA	C2 BETA	C3 ALPHA	C3 BETA	C4 ALPHA	C4 BETA	
1	97	750	5	1046*	168	983	90	1071	8-19-96 18:05
2	94	748	3	167*	155	976	90	1090	8-19-96 19:45
3	102	712	1	108*	165	938	107	1135	8-19-96 21:26
4	72	770	2	90*	188	982	101	1086	8-19-96 23:06
5	102	759	1	92*	176	940	110	1023	8-20-96 0:47
6	76	740	5	225	151	919	115	1112	8-20-96 2:28
7	83	750	3	137*	180	916	114	1115	8-20-96 4:08
8	80	748	4	83*	171	949	106	1092	8-20-96 5:49
9	81	775	4	120*	175	997	112	1134	8-20-96 7:29
AVG	87.4	750.2	3.1	220.0	169.9	955.6	105.0	1095.3	
OBS_SD	10.8	17.2	1.4	291.6	11.1	28.1	9.0	32.8	
OBS/EXP	1.2	0.6	0.8	19.2	0.8	0.9	0.9	1.0	
CPM	0.874	7.502	0.031	2.300	1.699	9.556	1.050	10.953	
STD_ERR	0.031	0.091	0.006	0.051	0.043	0.103	0.034	0.110	
BKG	0.036	0.901	0.029	3.173	0.035	0.861	0.030	0.897	
NET CPM	0.838	6.601	0.002	-0.873	1.664	8.695	1.020	10.056	

This data contains elements which are 4 Standard Deviations OUTSIDE of the mean.

TENNELEC LB4000 COUNT STARTED 8-19-96 , 100 MIN COUNTS

	310 206		310 207		310 208		310 209		
	D1 ALPHA	D1 BETA	D2 ALPHA	D2 BETA	D3 ALPHA	D3 BETA	D4 ALPHA	D4 BETA	
1	122	1326	121	1634	105	1578	76	1499	8-19-96 18:05
2	126	1225	122	1646	89	1549	95	1481	8-19-96 19:45
3	95	1216	122	1599	93	1619	92	1496	8-19-96 21:26
4	109	1209	120	1573	108	1573	94	1440	8-19-96 23:06
5	102	1324	108	1573	105	1633	124	1522	8-20-96 0:47
6	124	1270	112	1575	119	1537	111	1518	8-20-96 2:27
7	112	1221	118	1561	113	1590	119	1510	8-20-96 4:08
8	101	1245	116	1599	117	1569	107	1513	8-20-96 5:48
9	120	1249	125	1601	98	1553	106	1445	8-20-96 7:29
AVG	112.3	1253.9	118.2	1595.7	105.2	1577.9	102.7	1491.6	
OBS_SD	10.7	42.0	5.1	27.3	9.8	30.0	14.1	28.7	
OBS/EXP	1.0	1.2	0.5	0.7	1.0	0.8	1.4	0.7	
CPM	1.123	12.539	1.182	15.957	1.052	15.779	1.027	14.916	
STD_ERR	0.035	0.118	0.036	0.133	0.034	0.132	0.034	0.129	
BKG	0.041	0.864	0.038	0.872	0.030	0.815	0.029	0.851	
NET CPM	1.082	11.675	1.144	15.085	1.022	14.964	0.998	14.065	

The elements of this data set are all within 4 Standard Deviations of the mean.

TENNELEC LB4000 COUNT STARTED 8-21-96 , 100 MIN COUNTS

	310 266		310 267		310 268		310 269		
	xxxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxxx		
	D1	D1	D2	D2	D3	D3	D4	D4	
	ALPHA	BETA	ALPHA	BETA	ALPHA	BETA	ALPHA	BETA	
1	132	980	196	1541	223	1510	212	1534	8-21-96 17:36
2	99	950	189	1516	218	1455	207	1455	8-21-96 19:16
3	116	958	195	1483	238	1500	227	1541	8-21-96 20:57
4	126	932	175	1537	216	1490	243	1493	8-21-96 22:38
5	111	993	195	1532	222	1516	203	1505	8-22-96 0:18
6	125	1003	198	1514	184	1500	221	1517	8-22-96 1:59
7	123	998	177	1592	229	1534	239	1542	8-22-96 3:39
8	116	1006	195	1530	224	1492	193	1505	8-22-96 5:20
9	102	941	192	1488	216	1492	215	1479	8-22-96 7:00
AVG	116.7	973.4	190.2	1525.9	218.9	1498.8	217.8	1507.9	
OBS_SD	10.5	26.9	8.0	30.4	14.0	20.4	15.5	27.7	
OBS/EXP	1.0	0.9	0.6	0.8	0.9	0.5	1.1	0.7	
CPM	1.167	9.734	1.902	15.259	2.189	14.988	2.178	15.079	
STD_ERR	0.036	0.104	0.046	0.130	0.049	0.129	0.049	0.129	
BKG	0.041	0.872	0.039	0.885	0.029	0.831	0.032	0.857	
NET CPM	1.126	8.862	1.863	14.374	2.160	14.157	2.146	14.222	

The elements of this data set are all within 4 Standard Deviations of the mean.

VAX/VMS Nuclide Identification Report V2.2 Generated 19-AUG-1996 12:33:54

310 Retention Room AFs
194, 195, 197 → 209

Configuration : $DISK1:[USER]NORB3.CNF;1
Analyses by : PEAK V15.8,PEAKEFF V2.1,ENBACK V1.2,NID V2.1
Sample date : 1-MAR-1996 12:00:00 Acquisition date : 16-AUG-1996 16:01:30
Sample ID : 310 AF Sample quantity : 1.0000 M3
Sample type : AD Sample geometry : 15 FILTERS
Detector name : 74 cc Detector geometry:
Elapsed live time: 2 18:40:00.00 Elapsed real time: 2 18:40:09.00 0.0%
Energy tolerance : 1.40 keV Half life ratio : 8.00
Errors propagated: No Systematic Error : 0.00 %
Efficiency type : Spline Efficiencies at : Peak Energy
Abundance limit : 50.00

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	30.91	210	5656	1.66	31.54	31	6	57.3		
0	46.39A	2466	6886	1.86	47.03	43	9	7.5		
0	75.68A	222	6914	4.15	76.34	72	10	96.7		RA-226
										TH-228
3	238.17A	300	2826	1.91	238.94	233	12	41.2	3.22E+00	TH-228
3	241.04A	101	2356	1.81	241.82	233	12	106.2		RA-226
0	294.23A	140	3567	1.78	295.05	292	8	94.0		RA-226
0	337.76A	26	2255	1.99	338.63	336	7	420.8		
0	351.70A	196	2696	2.36	352.59	348	10	66.6		RA-226
6	472.52	131	785	1.31	473.56	472	19	30.4	2.27E+00	
6	477.35	16009	1040	1.93	478.40	472	19	0.9		BE-7
0	583.06A	25	1000	2.19	584.28	580		939.1		TH-228
0	609.33A	36	918	2.36	610.59	608		824.6		RA-226
0	661.56	1611	862	2.15	662.91	658	9	4.2		CS-137
0	846.33A	100	687	2.26	848.06	842	12	66.6		
0	969.23A	2	450	2.41	971.26	967	8	*****		
0	1172.24	127	465	3.50	1174.83	1168	12	35.1		CO-60
0	1237.14	50	403	2.61	1239.93	1236	10	75.4		RA-226
0	1331.68	118	328	2.07	1334.78	1330	11	32.4		CO-60
0	1460.65A	419	246	2.70	1464.19	1459	12	13.9		K-40

Pb^{210} $\frac{2466}{4000 \times 0.0405 \times 0.071} = 214 \pm 16$ dpm

Am^{241} $\frac{3495 - 3476}{4000 \times 0.359 \times 0.0836} = 0.2 \pm 0.7$

Be^{7} $\frac{16009}{4000 \times 0.104 \times 0.0295} = 1304 \pm 12$

Cs^{137} $\frac{1611}{4000 \times 0.851 \times 0.0218} = 21.7 \pm 0.9$

Co^{60} $\frac{299 - 193 + 246 - 140}{4000 \times 1.99 \times 0.0107} = 2.5 \pm 0.4$

COUNTER DATA SHEET

Sample D-310 WATER FROM RET. TANK FLOOR (6303) Volume > 110

Sample Date 6-25-96 ☐ PFS-11 ☐ PO-97 Counted By A Date Counted 6-26-96

ALPHA-BETA COUNTING			SPIKED SAMPLE PERCENT RECOVERY DETERMINATION				
	☐ SPIKED	☐ UNSPIKED					
Counter Numbers	18	33	Counter Numbers				
Total α Counts	11	22		ALPHA	BETA	ALPHA	BETA
Counting Time	30	30	Standard Solution d/m/ml ÷ 50 = Known d/m/ml	29.9/50 = .598	983/50 = 19.66	29.9/50 = .598	983/50 = 19.66
Total α c/m	.37	.73					
Background	0.3	0.4					
Net α c/m	.07	.33	Spiked Sample α & β Results in d/m/ml				
ml Sample	10	10					
α c/m/ml	.007	.033					
α Yield Factor	1.96	1.96	Unspiked sample α & β Results (from PFS-11)				
α d/m/ml	.014	.065					
Total β Counts	1676	1622	Spiked d/m/ml minus Unspiked d/m/ml = Recovered d/m/ml				
Counting Time	30	30					
Total β c/m	55.87	54.07					
β Background	50.4	48.0	Recovered d/m/ml ÷ Known d/m/ml x 100 = Percent Recovery				
BKGD + Net α c/m	50.47	48.33					
Net β c/m	5.40	5.74					
ml Sample	10	10	REMARKS				
β c/m/ml	.540	.574					
β Yield Factor	1.35	1.35					
β d/m/ml	.729	.775					
REMARKS							
Ave α — 0.040							
Ave. β — 0.752							

REQUEST FOR ANALYSIS 6303

Date: 6/25/96 Bldg: 310 CL. Sample: _____

Type of Sample: Water from floor under RET Tank

Gallons: > 110 Requestor: Julius Bryant

ANALYSES DESIRED: ☒ α, ☒ β, ☐ pH, ☐ Hg, ☐ Ammonia Nitrogen
☐ Total Solids, ☐ Volume for 20% Bottoms

Other: _____

Date Analyzed: 6-26-96 Analyst: Kevin McCue

Results: α - 0.04 d/m/mL
β - 0.15 d/m/mL

Size	Determination	Reading	Result	

	Total Solids	Total Solids
Dish Number		
Wt. Dish + Wet Sample		
Wt. Dish		
Wt. Sample		
Wt. Dish + Dry Sample		
Wt. Dish		
Wt. Dry Sample		
Remarks and Calculations:		

ESH-228 (6-93)

COUNTER DATA SHEET

Sample D-306 WATER (6310) Volume _____

Sample Date 7-19-96 ☐ PFS-11 ☐ PO-97 Counted By _____ Date Counted _____

ALPHA-BETA COUNTING			SPIKED SAMPLE PERCENT RECOVERY DETERMINATION				
☐ SPIKED	☐ UNSPIKED						
Counter Numbers	1	2	Counter Numbers				
Total α Counts	9	19		ALPHA	BETA	ALPHA	BETA
Counting Time	30	30	Standard Solution d/m/ml ÷ 50 = Known d/m/ml	29.9/50 = .598	983/50 = 19.66	29.9/50 = .598	983/50 = 19.66
Total α c/m	.3	.63					
Background	.03	.03					
Net α c/m	.27	.60	Spiked Sample α & β Results in d/m/ml				
ml Sample	20	20					
α c/m/ml	.0135	.0300					
α Yield Factor	1.96	1.96	Unspiked sample α & β Results (from PFS-11)				
α d/m/ml	.026	.059					
Total β Counts	1146	1295	Spiked d/m/ml minus Unspiked d/m/ml = Recovered d/m/ml				
Counting Time	30	30					
Total β c/m	38.20	43.17					
β Background	39.7	40.7	Recovered d/m/ml ÷ Known d/m/ml x 100 = Percent Recovery				
BKGD + Net α c/m		41.30					
Net β c/m		1.87					
ml Sample	20	20	REMARKS				
β c/m/ml		.0935					
β Yield Factor	1.35	1.35					
β d/m/ml		.1262					
REMARKS							
Ave. α - 0.043							
Ave. β - 0.0631							

SH 203 (3-92)

A. Wt. 7-9-96 **REQUEST FOR ANALYSIS** 6310

Date: ~~7-20-96~~ Bldg: 306 CL. Sample: _____

Type of Sample: WATER

Gallons: 60 mL Requestor: [redacted], SHARLOT SHOLEEN

ANALYSES DESIRED: ☒ α, ☒ β, ☐ pH, ☐ Hg, ☐ Ammonia Nitrogen
☐ Total Solids, ☐ Volume for 20% Bottoms

Other: _____

Date Analyzed: 7-19-96 Analyst: [redacted]

Results: α - 0.04 d/m/ml.
β - 0.06 d/m/ml.

Size	Determination	Reading	Result	

	Total Solids	Total Solids
Dish Number		
Wt. Dish + Wet Sample		
Wt. Dish		
Wt. Sample		
Wt. Dish + Dry Sample		
Wt. Dish		
Wt. Dry Sample		
Remarks and Calculations:		

ESH-228 (6-93)

0.1 ml in Ultima Gold.

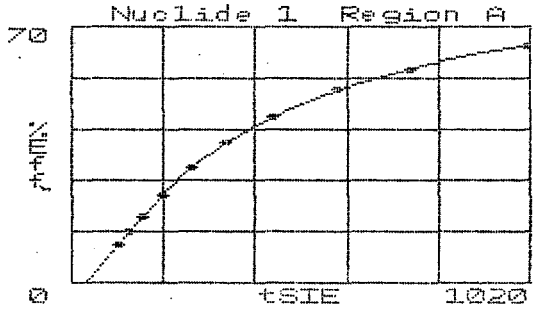
02 Jul 96 15:38 Page #1
Protocol #: 3 3H, 14C, GROSS User :

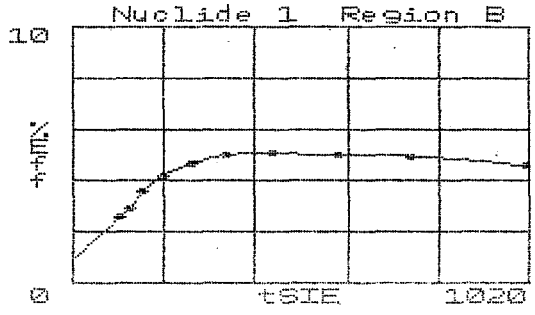
Time: 2.00
Data Mode: Dual DPM Nuclides: 3H14C GROS Quench Sets
Low Energy: 3H
Background Subtract: None High Energy: 14C

	LL	UL	LCR	2S%	BKG
Region A:	0.0	12.0	0	0.0	0.00
Region B:	12.0	156	0	0.0	0.00
Region C:	160	2000	0	0.0	0.00

Quench Indicator: tSIE/AEC
Ext Std Terminator: Count

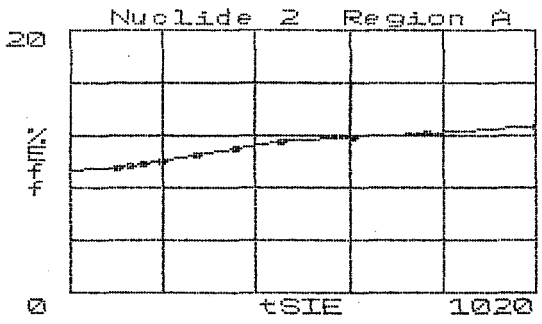
Luminescence Correction On
High Sensitivity Count Mode On

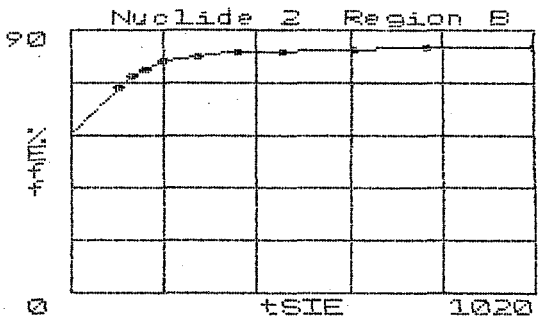




tSIE	%EffA	tSIE	%EffA
1016.4	64.96	754.34	58.58
593.58	52.82	444.73	45.22
344.44	38.37	269.05	31.74
201.88	24.00	156.86	17.97
126.54	13.75	103.23	10.34

tSIE	%EffB	tSIE	%EffB
1016.4	4.54	754.34	4.95
593.58	5.00	444.73	5.07
344.44	5.02	269.05	4.67
201.88	4.20	156.86	3.58
126.54	2.91	103.23	2.55





tSIE	%EffA	tSIE	%EffA	tSIE	%EffB	tSIE	%EffB
1018.3	12.75	782.88	12.18	1018.3	84.35	782.88	83.87
619.36	11.89	463.71	11.56	619.36	83.49	463.71	82.70
366.47	11.01	278.16	10.55	366.47	82.80	278.16	81.01
203.21	10.06	160.48	9.84	203.21	79.35	160.48	76.55
131.31	9.63	105.83	9.58	131.31	74.17	105.83	70.39

02 Jul 96 15:39 Page #2

Protocol #: 3 3H, 14C, GROSS User :

S#	TIME	CPMA	CPMB	CPMC	DPM1 DP	DPM2	tSIE	LUM	
1	2.00	8.50	8.00	11.00	15.99	8.69	473.50	4	# 1
2	2.00	5.00	10.50	7.50	7.64	12.22	474.11	2	# 2
3	2.00	5.00	7.00	7.00	8.28	7.93	517.03	0	Blank

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, INC. COMMERCIAL LABORATORY OPERATIONS 1319 MARQUETTE DRIVE ROMEOVILLE, IL 60441 (708)378-1600	26-JUN-96		C179131
	Complete 19-JUL-96	PO Number 61280301	
	Printed 22-JUL-96	Sampled 25-JUN-96	

Report To	Bill To
R. ROSE ARGONNE NATIONAL LABORATORIES 9700 CASS AVENUE PFS/306 ARGONNE, IL 60439-4819	R. ROSE ARGONNE NATIONAL LABORATORIES PFS/306 9700 SOUTH CASS AVENUE ARGONNE, IL 60439-4819

Sample Description

CLIENT ID: 310-A-038-FLI
BOTTLES: #1,2 & 3
SITE: ARGONNE LAB BLDG 310 S.F.

PH (AQUEOUS) SW846-9040A

Analyst: A. SNAPP Analysis Date: 27-JUN-96 Test: G607.5.0

Parameter	Result	Det. Limit	Units
PH	8.16	0.1	Std. Units

TOTAL AVAILABLE SULFIDE EXTRACTION SW 7.3.4.1

Analyst: A. SNAPP Analysis Date: 02-JUL-96 Instrument: PREP Test: P116.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50.26		Grams
FINAL VOLUME	250		mL

SULFIDE SW846-9030A

Analyst: A. SNAPP Analysis Date: 02-JUL-96 Test: G110.4.0
Prep: TOTAL AVAILABLE SULFIDE EXTRACTION SW 7.3.4.1 P116.2.0

Parameter	Result	Det. Limit	Units
SULFIDE	BDL	10	mg/kg

CYANIDE, TOTAL AVAILABLE (MANUAL) SW 7.3.3.2

Analyst: J. MATTEI Analysis Date: 03-JUL-96 Test: G115.1.0
Prep: TOTAL AVAILABLE SULFIDE EXTRACTION SW 7.3.4.1 P116.2.0

Parameter	Result	Det. Limit	Units
CYANIDE	BDL	0.05	mg/kg

FLASH POINT BY PENSKY-MARTENS CLOSED TESTER ASTM D-93

Analyst: T. NAKUM Analysis Date: 03-JUL-96 Instrument: PENSKY MARTENS Test: G509.9.0

Parameter	Result	Det. Limit	Units
FLASH POINT	> 215		Degrees F
Sample boiled over			

HERITAGE ENVIRONMENTAL SERVICES, INC. Sample ID: C179131 310-A-038-FLI

TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311
Analyst: B. EBERHART Analysis Date: 01-JUL-96 Instrument: PREP Test: P107.2.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	NA		Grams
LIQUID FRACTION (GRAMS)	NA		Grams
EXTRACTED SAMPLE	NA		Grams
SOLIDS	NA		Percent
9.5 MM SIEVE TEST	NA		Passed
INITIAL PH	NA		Std. Units
ADJUSTED PH	NA		Std. Units
BUFFER SOLUTION PH	NA		Std. Units
FINAL PH	NA		Std. Units
VOLUME BUFFERED SOLUTION	NA		mL
VOLUME EXTRACT FILTERED	NA		mL
VOLUME LIQUID (ADD BACK)	NA		mL
TOTAL VOLUME FILTRATE	NA		mL
AMBIENT TEMPERATURE	NA		Degrees C
INITIAL TIME	NA		HRS
FINAL TIME	NA		HRS

Pull through

FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A
Analyst: B. EBERHART Analysis Date: 03-JUL-96 Instrument: PREP Test: P130.8.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL WEIGHT OR VOLUME	50		mL

BARIUM ICP (1 POINT MSA) SW846-6010A
Analyst: C. HERRO Analysis Date: 03-JUL-96 Instrument: ICP Test: M604.7.0
Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
BARIUM	BDL	2.0	mg/L
ADDITION 1	1.0		mg/L
SAMPLE	0.1457		Conc
SAMPLE + ADD 1	1.063		Conc
DILUTION	1		

CADMIUM ICP (1 POINT MSA) SW846-6010A
Analyst: C. HERRO Analysis Date: 03-JUL-96 Instrument: ICP Test: M608.7.0
Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.005	mg/L
ADDITION 1	1.0		mg/L
SAMPLE	0.0017		Conc
SAMPLE + ADD 1	0.9532		Conc
DILUTION	1		

CHROMIUM ICP (1 POINT MSA) SW846-6010A
Analyst: C. HERRO Analysis Date: 03-JUL-96 Instrument: ICP Test: M610.7.0
Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.01	mg/L
ADDITION 1	1.0		mg/L

HERITAGE ENVIRONMENTAL SERVICES, INC. Sample ID: C179131 310-A-038-FLI

Parameter	Result	Det. Limit	Units
SAMPLE	-0.0003		Conc
SAMPLE + ADD 1	0.9666		Conc
DILUTION	1		

LEAD ICP (1 POINT MSA) SW846-6010A
Analyst: C. HERRO Analysis Date: 03-JUL-96 Instrument: ICP Test: M616.7.0
Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.05	mg/L
ADDITION 1	1.0		mg/L
SAMPLE	-0.0104		Conc
SAMPLE + ADD 1	0.9654		Conc
DILUTION	1		

SILVER ICP (1 POINT MSA) SW846-6010A
Analyst: C. HERRO Analysis Date: 03-JUL-96 Instrument: ICP Test: M630.7.0
Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
SILVER	BDL	0.02	mg/L
ADDITION 1	1.0		mg/L
SAMPLE	-0.0055		Conc
SAMPLE + ADD 1	0.9275		Conc
DILUTION	1		

ARSENIC ICP (1 POINT MSA) SW846-6010A
Analyst: C. HERRO Analysis Date: 03-JUL-96 Instrument: ICP Test: M603.7.0
Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.05	mg/L
ADDITION 1	1.0		mg/L
SAMPLE	0.0083		Conc
SAMPLE + ADD 1	0.9824		Conc
DILUTION	1		

SELENIUM ICP (1 POINT MSA) SW846-6010A
Analyst: C. HERRO Analysis Date: 03-JUL-96 Instrument: ICP Test: M628.7.0
Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.10	mg/L
ADDITION 1	1.0		mg/L
SAMPLE	-0.0115		Conc
SAMPLE + ADD 1	0.9896		Conc
DILUTION	1		

MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A
Analyst: M. FLETCHER Analysis Date: 03-JUL-96 Instrument: PREP Test: P131.9.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	100		mL
FINAL VOLUME	100		mL

HERITAGE ENVIRONMENTAL SERVICES, INC. Sample ID: C179131 310-A-038-FLI

MERCURY CVAA (1 POINT MSA) SW846-7470A
Analyst: M. FLETCHER Analysis Date: 03-JUL-96 Instrument: CVAA Test: M620.6.0
Prep: MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A P131.9.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.005	mg/L
ADDITION 1	0.01		mg/L
SAMPLE	0.00007		Conc
SAMPLE + ADD 1	0.0048		Conc
DILUTION	1		

GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION SW846-3510B
Analyst: R. CAMPBELL, JR. Analysis Date: 02-JUL-96 Instrument: PREP Test: P233.4.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	200		mL
FINAL VOLUME	1		mL

TCLP SEMIVOLATILE ORGANICS (TOXICITY CHARACTERISTIC) SW846-8270B
Analyst: M. QIAN Analysis Date: 02-JUL-96 20:08 Instrument: GC/MS SVOA Test: 0514.3.0
Prep: GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION SW846-3510B P233.4.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
1,4-DICHLOROBENZENE	BDL	50	ug/L
2,4-DINITROTOLUENE	BDL	50	ug/L
HEXACHLOROBENZENE	BDL	50	ug/L
HEXACHLOROBUTADIENE	BDL	50	ug/L
HEXACHLOROETHANE	BDL	50	ug/L
NITROBENZENE	BDL	50	ug/L
PYRIDINE	BDL	250	ug/L
2-METHYL PHENOL	BDL	130	ug/L
3-METHYL PHENOL	BDL	130	ug/L
4-METHYLPHENOL	BDL	130	ug/L
PENTACHLOROPHENOL	BDL	250	ug/L
2,4,5-TRICHLOROPHENOL	BDL	130	ug/L
2,4,6-TRICHLOROPHENOL	BDL	130	ug/L
SURROGATE RECOVERY			
2-FLUOROPHENOL	49		% Rec
PHENOL-D5	47		% Rec
NITROBENZENE-D5	70		% Rec
2-FLUOROBIPHENYL	75		% Rec
2,4,6-TRIBROMOPHENOL	68		% Rec
TERPHENYL-D14	95		% Rec

1:1 dilution
3 & 4 Methyl Phenol co-elute so identification is tentative.

ZERO HEADSPACE EXTRACTION (TCLP) SW846-1311
Analyst: T. MCDEVITT, JR. Analysis Date: 26-JUN-96 Instrument: PREP Test: P108.1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	NA		Grams
LIQUID FRACTION (GRAMS)	107.1		Grams
LIQUID PORTION	107.1		mL
EXTRACTED SAMPLE	NA		Grams
PHASE ONE VOLUME (REP 0)	107.1		mL
PHASE TWO VOLUME (REP 1)	NA		mL

HERITAGE ENVIRONMENTAL SERVICES, INC. Sample ID: C179131 310-A-038-FLI

Parameter	Result	Det. Limit	Units
FINAL PH	8.10		Std. Units

TCLP VOLATILE ORGANICS (TOXICITY CHARACTERISTIC) SW846-8240B
Analyst: G. SWANEY Analysis Date: 27-JUN-96 15:19 Instrument: GC/MS VOA Test: 0513.3.0
Prep: ZERO HEADSPACE EXTRACTION (TCLP) SW846-1311 P108.1.0

Parameter	Result	Det. Limit	Units
BENZENE	BDL	50	ug/L
CARBON TETRACHLORIDE	BDL	50	ug/L
CHLOROBENZENE	BDL	50	ug/L
CHLOROFORM	BDL	50	ug/L
1,2-DICHLOROETHANE	BDL	50	ug/L
1,1-DICHLOROETHYLENE	BDL	50	ug/L
METHYL ETHYL KETONE	BDL	100	ug/L
TETRACHLOROETHYLENE	BDL	50	ug/L
TRICHLOROETHYLENE	BDL	50	ug/L
VINYL CHLORIDE	BDL	100	ug/L
.			
SURROGATE RECOVERY			

DICHLOROETHANE-D4	105		% Rec
TOLUENE-D8	99		% Rec
BROMOFLUOROBENZENE	95		% Rec

1:10 dilution

GC SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION SW846-3510B
Analyst: R. CAMPBELL, JR. Analysis Date: 08-JUL-96 Instrument: PREP Test: P233.1.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	200		mL
FINAL VOLUME	1		mL

ORGANOCHLORINE PESTICIDES BY GC:ECD (7 PESTICIDES) SW846-8080A
Analyst: S. BUSSEY Analysis Date: 16-JUL-96 Instrument: GC/ECD Test: D164.3.0
Prep: GC SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION SW846-3510B P233.1.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
GAMMA-BHC (LINDANE)	BDL	0.00025	mg/L
HEPTACHLOR	BDL	0.00025	mg/L
HEPTACHLOR EPOXIDE	BDL	0.00025	mg/L
ENDRIN	BDL	0.00050	mg/L
METHOXYCHLOR	BDL	0.0025	mg/L
CHLORDANE	BDL	0.0025	mg/L
TOXAPHENE	BDL	0.0050	mg/L

DIAZOMETHANE HERBICIDE DERIVATIZATION SW846-8150B
Analyst: M. SIMS Analysis Date: 11-JUL-96 Instrument: PREP Test: P201.4.0 INDI
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	200		mL
FINAL VOLUME	10		mL

HERITAGE ENVIRONMENTAL SERVICES, INC. **Sample ID: C179131 310-A-038-FLI**

CHLORINATED HERBICIDES (2,4 D AND SILVEX) SW846-8150B

Analyst: M. SIMS Analysis Date: 13-JUL-96 Instrument: GC/ECD Test: 0253.2.0 IND1
Prep: DIAZOMETHANE HERBICIDE DERIVATIZATION SW846-8150B P201.4.0
Prep: TOX CHAR LEACHING PROCEDURE (TCLP W/ORG+PEST+HERBS) SW846-1311 P107.2.0

Parameter	Result	Det. Limit	Units
2,4-DICHLOROPHENOXYACETIC ACID	BDL	0.010	mg/L
SILVEX (2,4,5-TP)	BDL	0.0010	mg/L

Sample Comments

> Greater Than Upper Detection Limit
BDL Below Detection Limit
NA Not Applicable

Sample chain of custody number 00164.

Approved : _____

VAX/VMS Nuclide Identification Report V2.2 Generated 16-AUG-1996 15:56:21 310 270 Smear 8/6/96

Configuration : $DISK1:[USER1JUNK.CNF;5
Analyses by : PEAK V15.8,PEAKEFF V2.1,ENBACK V1.2,NID V2.1 Smear of Tank #5
Sample date : 1-MAR-1996 12:00:00 Acquisition date : 16-AUG-1996 14:45:40
Sample ID : Sample quantity : 1.0000 L
Detector name : 74 cc Detector geometry:
Elapsed live time: 0 01:00:00.00 Elapsed real time: 0 01:00:00.00 0.0%
Energy tolerance : 1.40 keV Half life ratio : 8.00
Errors propagated: No Systematic Error : 0.00 %
Efficiency type : Spline Efficiencies at : Peak Energy
Abundance limit : 50.00

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	32.04	282	1057	1.84	32.68	30	7	21.0		
9	56.74	450	1172	2.63	57.39	55	11	10.7	4.41E+00	
9	59.57	6868	726	1.80	60.21	55	11	1.4		AM-241
0	92.66*	26	246	1.10	93.32	90	7	101.7		
0	511.05*	39	141	8.96	512.15	507	13	72.8		
0	609.36*	26	42	2.98	610.62	607	9	54.8		
0	661.70	2969	47	2.10	663.05	659	10	1.9		CS-137
0	1293.00	8	1	1.38	1295.96	1293	6	47.9		

^{241}Am $\frac{6868}{60 \times 0.359 \times 0.0836} = 3814 \times 54$

^{137}Cs $\frac{2969}{60 \times 0.851 \times 0.0218} = 2667 \pm 51$

VAX/VMS Nuclide Identification Report V2.2 Generated 16-AUG-1996 14:44:12 310 27# smear 8/14/96

NORTH WALL, white streak

Configuration : $DISK1:[USER1]JUNK.CNF;4
Analyses by : PEAK V15.8,PEAKEFF V2.1,ENBACK V1.2,NID V2.1
Sample date : 1-MAR-1996 12:00:00 Acquisition date : 16-AUG-1996 13:38:12
Sample ID : Sample quantity : 1.0000 L
Detector name : 74 cc Detector geometry:
Elapsed live time: 0 01:00:00.00 Elapsed real time: 0 01:00:00.00 0.0%
Energy tolerance : 1.40 keV Half life ratio : 8.00
Errors propagated: No Systematic Error : 0.00 %
Efficiency type : Spline Efficiencies at : Peak Energy
Abundance limit : 50.00

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	59.46	614	245	1.84	60.10	54	12	6.5		AM-241
0	92.74k	12	101	1.71	93.40	89	9	171.3		
0	185.72k	28	59	3.52	186.45	182	9	60.2		U-235
0	510.79k	6	36	2.56	511.89	505	12	233.9		
0	661.59	327	9	2.36	662.94	657	12	6.0		CS-137
0	776.78	12	2	2.43	778.36	776	7	43.2		
0	846.44k	5	14	2.85	848.17	845	8	160.8		
0	1460.52k	4	7	3.27	1464.07	1459	9	127.9		K-40

Am^{241} $\frac{614}{60 \times 0.359 \times 0.0836} = 341 \pm 22$

Cs^{137} $\frac{327}{60 \times 0.851 \times 0.0218} = 294 \pm 18$

2"x2" gff

VAX/VMS Peak Search Report V1.3 Generated 17-JUL-1996 12:35:20

502 Smear 310 Rm 050 West wall electrical box

Configuration : $DISK1:[USER1]JUNK.CNF;11
Analyses by : PEAK V15.8
Sample title : ~~[illegible]~~
Sample date : 6-MAR-1996 12:00:00 Acquisition date : 17-JUL-1996 10:42:27
Sample ID : 87-0000-0000 Sample quantity : 0.40000 L
Sample type : Routine Sample geometry : 400ml/400 low po
Detector name : BIDASSAY-GE Detector geometry: J-UP
Elapsed live time: 0 01:00:00.00 Elapsed real time: 0 01:00:04.00 0.1%
Start energy : 43.00 keV End energy : 2066.44 keV
Sensitivity : 3.50 Gaussian : 10.00

1500 dpm α
25000 dpm β

Pk	Ty	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	59.35	124	499	0.87	98.48	89	7	3.44E-02	31.9	
2	0	116.35	86	528	1.66	205.66	202	8	2.43E-02	48.7	
3	0	609.06	15	139	0.62	1184.19	1182	8	4.07E-03	144.7	
4	0	622.20	26	67	1.42	1210.29	1208	6	7.77E-03	55.0	
5	0	661.54	32426	293	1.51	1288.44	1281	15	9.01E+00	0.6	
6	0	706.68	8	6	1.43	1378.11	1376	7	2.31E-03	57.9	
7	0	1172.81	34	6	1.60	2304.12	2295	15	9.32E-03	27.0	
8	0	1332.18	23	3	1.37	2620.78	2615	11	6.30E-03	22.5	
9	0	1599.11	4	4	0.74	3151.19	3143	10	1.02E-03	77.1	

ch 90-94 = 483
95-99 = 346
137

$$Am^{241} = \frac{137}{60 \times 0.36 \times 0.037} = 171 \pm 36 \text{ dpm}$$

$$Cs^{137} \quad \frac{32426}{60 \times 0.85 \times 0.031} = 20509 \pm 123$$

$$Co^{60} \quad \frac{34+23}{60 \times 2.0 \times 0.017} = 30 \pm 6$$

ARGONNE NATIONAL LABORATORY

Intra-Laboratory Memo

July 29, 1996

To: Charlotte Sholeen ESH

From: Don Nelson DN ESH

Subject: Building 310 Samples

On 07/25/96 Tim Branch delivered 2 samples to the radiochemistry laboratory and requested gamma spectral analyses.

The first sample was a smear (on a piece of paper towel) and was believed to contain ~2100 dpm of beta activity (based on survey data). An overnight count on our spectrometer found only 25 dpm of Cs-137 with no other significant gamma activity. The remainder of the beta act must therefore be from isotope(s) with no gamma emissions (e.g. Sr-90 or Tc-99). 536

The second sample was identified as a cap from a pump and was labeled as having beta/gamma activity of 25,000 dpm/100 cm^2 . This sample was counted for 1 hour in each of two orientations and displayed the gamma spectra of Th-232 daughters. Based on the ratios of the gamma peaks, I believe this activity is supported by Th-232 itself and not by Ra-228 or Th-228. Because of the irregular geometry of the sample, a precise measure of the quantity of Th-232 present is not possible. My best estimate would be 60,000 to 100,000 dpm. This would correspond to 0.3 to 0.5 g of thorium in the sample (which weighted ~ 1 Kg). This amount would be unlikely to be external contamination and leads to the conclusion that thorium was probably a trace component of the material from which the cap was fabricated.

DMN:se

cc: R. A. Schlenker
File
DA Log

ILLINOIS DEPARTMENT OF NUCLEAR SAFETY

Regulations

32 Illinois Administrative Code: Chapter II

August 1995

Illinois Department of Nuclear Safety
1035 Outer Park Drive
Springfield, Illinois 62704

Jim Edgar
Governor

Thomas W. Ortciger
Director

TITLE 32: ENERGY
CHAPTER II: DEPARTMENT OF NUCLEAR SAFETY
SUBCHAPTER b: RADIATION PROTECTION

PART 330
LICENSING OF RADIOACTIVE MATERIAL

SUBPART A: GENERAL PROVISIONS

SUBPART B: TYPES OF LICENSES

SUBPART C: SPECIFIC LICENSES

SUBPART D: TRANSPORTATION (Repealed)

AUTHORITY: Implementing and authorized by the Radiation Protection Act of 1990 (Ill. Rev. Stat. 1991, ch. 111½, par. 210-1 et seq.) [420 ILCS 40].

SOURCE: Filed April 20, 1974, by the Department of Public Health; transferred to the Department of Nuclear Safety by P.A. 81-1516, effective December 3, 1980; amended at 5 Ill. Reg. 9586, effective September 10, 1981; codified at 7 Ill. Reg. 17492; recodified at 10 Ill. Reg. 11268; amended at 10 Ill. Reg. 17315, effective September 25, 1986; amended at 15 Ill. Reg. 10632, effective July 15, 1991; amended at 18 Ill. Reg. 5553, effective March 29, 1994.

SUBPART A: GENERAL PROVISIONS

Section 330.10 Purpose and Scope

a) This Part provides for the licensing of radioactive material. No person shall receive, possess, utilize, manufacture, distribute, transfer, own or acquire radioactive material or devices or equipment utilizing or producing such materials except as authorized in a specific or general license issued pursuant to this Part or as otherwise provided in this Part.

b) In addition to the requirements of subsection (a) above, all licensees are subject to the requirements of this Part and 32 Ill. Adm. Code 310, 320, 331, 340, 341 and 400. Licensees engaged in source material milling or possessing byproduct material as defined in Section 4(a)(2) of the Radiation Protection Act of 1990 (Ill. Rev. Stat. 1991, ch. 111½, par. 210-1 et seq.) [420 ILCS 40/4(a)(2)], are also subject to the requirements of 32 Ill. Adm. Code 332. Licensees engaged in industrial radiographic operations are also subject to the requirements of 32 Ill. Adm. Code 350. Licensees using radioactive material in the healing arts are also subject to the requirements of 32 Ill.

§§330.10 - 30

Adm. Code 335. Licensees engaged in wireline and subsurface tracer studies are also subject to the requirements of 32 Ill. Adm. Code 351. The requirements of this Part do not apply to carriers. Carriers are subject to the requirements of 32 Ill. Adm. Code 341.

(Source: Amended at 18 Ill. Reg. 5553, effective March 29, 1994)

Section 330.15 Incorporations by Reference

All rules, standards and guidelines of agencies of the United States or nationally recognized organizations or associations that are incorporated by reference in this Part are incorporated as of the date specified in the reference and do not include any later amendments or editions. Copies of these rules, standards and guidelines that have been incorporated by reference are available for public inspection at the Department of Nuclear Safety, 1035 Outer Park Drive, Springfield, Illinois.

(Source: Added at 18 Ill. Reg. 5553, effective March 29, 1994)

Section 330.30 License Exemption - Source Material

a) Any person is exempt from this Part to the extent that such person receives, possesses, uses, owns or transfers source material in any chemical mixture, compound, solution or alloy in which the source material is by weight less than one-twentieth of one percent (0.05 percent) of the mixture, compound, solution or alloy.

b) Any person is exempt from this Part to the extent that such person receives, possesses, uses or transfers unrefined and unprocessed ore containing source material; provided that, except as authorized in a specific license, such person shall not refine or process such ore.

c) Any person is exempt from this Part to the extent that such person receives, possesses, uses or transfers:

1) Any quantities of thorium contained in:

A) Incandescent gas mantles;

B) Vacuum tubes;

C) Welding rods;

D) Electric lamps for illuminating purposes provided that each lamp does not contain more than 50 milligrams of thorium;

E) Germicidal lamps, sunlamps and lamps for outdoor or industrial lighting provided that each lamp does not contain more than 2 grams of thorium;

F) Rare earth metals and compounds, mixtures and products containing not more than 0.25 percent by weight thorium, uranium or any combination of these; or

G) Personnel neutron dosimeters, provided that each dosimeter does not contain more than 50 milligrams of thorium.

2) Source material contained in the following products:

A) Glazed ceramic tableware, provided that the glaze contains not more than 20 percent by weight source material;

B) Piezoelectric ceramic containing not more than two percent by weight source material;

C) Glassware containing not more than ten percent by weight source material, but not including commercially manufactured glass brick, pane glass, ceramic tile or other glass or ceramic used in construction; and

D) Glass enamel or glass enamel frit containing not more than ten percent by weight source material imported or ordered for importation into the United States, or initially distributed by manufacturers in the United States, before July 25, 1983.

3) Photographic film, negatives and prints containing uranium or thorium.

4) Any finished product or part fabricated of, or containing, tungsten-thorium or magnesium-thorium alloys, provided that the thorium content of the alloy does not exceed four percent by weight and that this exemption shall not be deemed to authorize the chemical, physical, or metallurgical treatment or processing of any such product or part.

5) Uranium contained in counterweights installed in aircraft, rockets, projectiles and missiles, or stored or handled in connection with installation or removal of such counterweights, provided that:

A) The counterweights are manufactured in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission or the Atomic Energy Commission authorizing distribution by the licensee pursuant to 10 CFR 40.13(c)(5)(i), as in effect on June 30, 1969, exclusive of subsequent amendments or editions;

B) Each counterweight has been impressed with the following legend clearly legible through

COUNTER DATA SHEET

Sample D-310 from W.S.T. line 310 → 306 6401 Volume 50

Sample Date 8-15-96 ☐ ~~PFS-11~~ ☐ ~~PO-97~~ Counted By SXJ Date Counted 8-15-96

ALPHA-BETA COUNTING			SPIKED SAMPLE PERCENT RECOVERY DETERMINATION				
☐ SPIKED	☒ UNSPIKED						
Counter Numbers	17	18	Counter Numbers				
Total α Counts	257	267		ALPHA	BETA	ALPHA	BETA
Counting Time	10	10	Standard Solution d/m/ml ÷ 50 = Known d/m/ml	29.9/50 = .598	983/50 = 19.66	29.9/50 = .598	983/50 = 19.66
Total α c/m	25.7	26.7					
Background	0.05	0.05					
Net α c/m	25.7	26.7	Spiked Sample α & β Results in d/m/ml				
ml Sample	10	10					
α c/m/ml	2.57	2.67					
α Yield Factor	1.96	1.96	Unspiked sample α & β Results (from PFS-11)				
α d/m/ml	5.04	5.23					
Total β Counts	10814	10167	Spiked d/m/ml minus Unspiked d/m/ml = Recovered d/m/ml				
Counting Time	~~3~~ 10	10					
Total β c/m	1081.4	1016.7					
β Background	44.4	44.0	Recovered d/m/ml ÷ Known d/m/ml x 100 = Percent Recovery				
BKGD + Net α c/m	70.1	70.7					
Net β c/m	1011.3	946.0					
ml Sample	10	10	REMARKS				
β c/m/ml	101.13	94.60					
β Yield Factor	1.35	1.35					
β d/m/ml	136.5	127.7					
REMARKS							
α - 5.140/m/ml							
β - 132.10/m/ml							

SH 203 (3-92)

CC-960815-1000
6401

REQUEST FOR ANALYSIS

Date: 8-15-96 Bldg: 310 CL. Sample: 6401

Type of Sample: WATER FROM W.S.T. LINES 310-306

Gallons: 50 Requestor: W. RAY

ANALYSES DESIRED: ☒ α, ☒ β, ☒ pH, ☐ Hg, ☐ Ammonia Nitrogen
☐ Total Solids, ☐ Volume for 20% Bottoms

Other: _____

Date Analyzed: 8-15 Analyst: SJN

Results:

α - 5.14 D/m/mL
β - 132 D/m/mL

Size	Determination	Reading	Result	

	Total Solids	Total Solids
Dish Number		
Wt. Dish + Wet Sample		
Wt. Dish		
Wt. Sample		
Wt. Dish + Dry Sample		
Wt. Dish		
Wt. Dry Sample		
Remarks and Calculations:		

ESH-228 (6-93)

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Water, Bldg. 310 Waste Storage Tanks — Date Received: 8/20/96

Submitted by: C. Grandy — Date Reported: 9/4/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/mL)		
		^{137}Cs	^{60}Co	^{241}Am
B310-001	96-8206-01	$(1.27 \pm 0.13) \times 10^2$	5.2 ± 0.5	7.2 ± 0.7

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291.

Reference(s): CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 127; CMT Logbook No. 1111, Pg. 119.

Copies To: C. Grandy, C. Sholeen, J. Johnson, D. Green, D. Bowers, D. Graczyk, F. Martino, L. TenKate, L. Smith, T. TenKate

Analyst(s): T. TenKate

T2

/hlt
9/4/96
CMT-84 (4-94)

Addnl. Copies:
ACL Results File
ACL 200 File

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Building 310 Waste Water — Date Received: 8/20/96

Submitted by: C. Grandz — Date Reported: 8/23/96

Submitter's Sample No.	ACL Sample No.	Hg, µg/L
B310-001	96-8206-01	32.6
--	-01 Duplicate	32.5
--	-01 Spike	42.3 (Spike Added: 10 µg/L; Recovery: 97%)
	Prep Blank	<0.02
		Laboratory Control Sample (LCS)
		ICV-5 (0689): 1.24 µg/L Recovery: 99%
		Estimated accuracy is ±5%.
		Mercury was determined by Cold Vapor Atomic Absorption (CVAA) according to U.S. EPA Method 7470A, SW-846. Samples were digested according to SOP: ACL-209.

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call J. Kiely at 2- 7399.

Reference(s): CMT Notebook No. 1262, p. 130.

Copies To: C. Grandz, C. Sholeen, J. Johnson, F. Martino, D. Green, D. Graczyk, P. Lindahl, J. Kiely, ACL Results File, ACL 200 File

Analyst(s): J. Kiely JK

/ads
8/26/96
CMT-84 (4-94)

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Waste Water — Date Received: 8/19/96

Submitted by: C. Grandy — Date Reported: 9/24/96

Submitter's Sample No.	ACL Sample No.	µg/mL As	Ba	Cd	Cr	Pb	Se	Ag
B310-001	96-8206-01	<0.50	0.33	6.77	2.90	15.1	<0.50	0.09
					QA Data			
B310-001	96-8206-01S	Spike:						
	Added	5.00	10.00	1.00	1.00	5.00	1.00	1.00
	Found	5.30	9.94	6.86	3.28	17.4	1.08	0.13
	% Recovery	106.0	96.4	76.0	67.0	76.0	108.0	5.0

Note: Samples were digested by U.S. EPA Method 3015 and digestates were analyzed by U.S. EPA Method 6010A (ICP), as described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Thrid Edition, July 1992 update.

NOTE: Unused sample material will be returned to the Client. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call D. Graczyk at 2- 3489

Reference(s): A. Essling Notebook No. 001400, p. 91.

Copies To: C. Grandy, C. Sholeen, D. Green, D. Graczyk, F. Martino, A. Essling, E. Huff, D. Huff, ACL Results File, ACL 200 File

Analyst(s): A. Essling, E. Huff, D. Huff

/ads
9/24/96
CMT-84 (9-96)

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Water, Bldg. 310 Waste Storage Tanks — Date Received: 8/19/96

Submitted by: Chris Grandy, EMO, 306 — Date Reported: 11/11/96

Submitter's Sample No.	ACL Sample No.	Alpha Scan
B310-001	96-8206-01	(See Attachment)

NOTE: Unused sample material will be returned to the Client. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. Smith at 2- 1890 .

Reference(s): CMT Notebook No. 1033, Pg. 137.

Copies To: C. Grandy, C. Sholeen, J. Johnson, D. Green, D. Bowers, F. Martino, L. Smith, ACL Results File

Analyst(s): L. Smith

/hlt
11/12/96

CMT-84 (9-96)

Report of Analytical Results for ACL Sample No. 96-8206-01

The analytical sample listed below consisted of a water sample from ANL-E Bldg. 310 Waste Storage Tanks. Due to the large quantity of solids present in the solution, direct electrodeposition of the sample was not possible. Therefore, the actinides and lanthanides were separated as a group from the other matrix constituents. A TruSpec™ extraction chromatographic column was utilized for this purpose. The sample was then electrodeposited prior to alpha spectrometry.

The resulting alpha spectrum is attached. Since tracers were not added to the samples, standard alpha sources were counted in the appropriate detectors to define the proper energy calibration for each detector.

ACL ID#	Peak Energy (MeV)	Isotope[1]	% Activity[2]
96-8206-01	4.16	^{238}U	30
	4.39	$^{235/236}U$	1
	4.73	$^{233/234}U$	35
		^{237}Np	
	5.13	$^{239/240}Pu$	24
	5.47	^{241}Am	6
		^{238}Pu	
	5.80	$^{243/244}Cm$	3
		^{236}Pu	

[1] Because no elemental separations were performed, alpha emitters of equivalent energies may be present in the spectra, and, therefore, more than one alpha emitter may be listed for each peak. Process knowledge of the data user may be used to eliminate some of the listed nuclides.

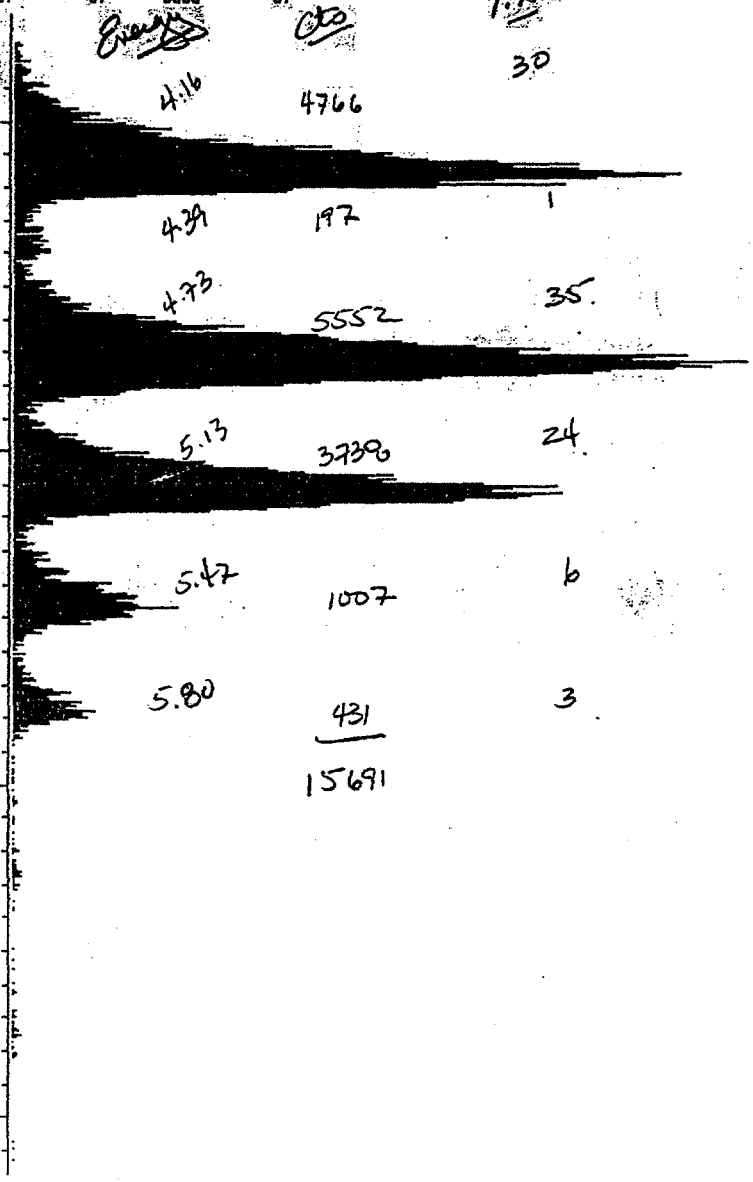
[2] This value is based upon the ratio of the counts under the individual peak to the total counts of all the peaks. This value also assumes equivalent electrodeposition efficiencies for all analytes, which is only true to a gross approximation for different elements.

96-8206-01 alpha scan recount

SYSTEM LARSEN DETECTOR # 3 11-11-1996 15:45:59
CHANNEL ZERO = 3682 KeV CALIBRATION = 6.823 KeV/ch DETECTOR EFFICIENTY = 32.0 %
BCKGND COUNT STARTED 10-25-1996 14:55:20 BCKGND COUNTING TIME = 8588 minutes live
SAMPLE COUNT STARTED 11-11-1996 12:08:10 SAMPLE COUNTING TIME = 218 minutes live
SAMPLE SIZE = 1 SPIKE ACTIVITY = 0 dpm TOTAL COUNTS IN SPECTRUM = 15979

ISOTOPE	FIRST chan	LAST chan	FIRST KeV	LAST KeV	CENTROID KeV	STD_DEV KeV	SAMPLE counts	BCKGND counts	ACTIVITY +/- 2 sigma	RECOVERY %
234-U	144	168	4661	4832	4736	40	4337	12		
239,240-Pu	200	226	5043	5227	5120	39	3145	10		
238-Pu	252	274	5398	5555	5465	37	775	56		
237-Np	150	174	4702	4873	4754	34	3429	14		
230-Th	129	156	4559	4750	4688	46	3650	14		
232-Th	32	57	3897	4074	4018	44	909	59		
238-U	60	83	4088	4252	4157	37	3563	37		

0 :	0	0	0	0	0	0	0	0			
8 :	0	0	0	0	2	3	1	1			
16 :	2	2	3	2	6	0	3	4			
24 :	6	6	5	3	3	3	11	13			
32 :	7	5	9	11	13	16	17	14			
40 :	17	24	21	32	28	25	37	22			
48 :	42	49	59	47	55	54	62	80			
56 :	73	90	120	106	131	143	140	146			
64 :	157	183	214	189	214	227	253	247			
72 :	221	182	161	209	160	105	103	76			
80 :	46	26	14	14	9	10	7	10			
88 :	5	7	5	7	4	4	11	11			
96 :	10	1	11	10	13	7	11	10			
104 :	14	14	10	8	9	1	3	7			
112 :	4	6	5	7	4	4	14	14			
120 :	12	9	15	16	13	21	21	18			
128 :	29	26	28	22	37	46	53	46			
136 :	61	63	87	77	59	101	115	120			
144 :	123	147	153	175	203	191	191	255			
152 :	243	234	278	252	264	250	226	219			
160 :	198	162	155	116	102	70	48	42			
168 :	40	25	17	19	7	11	5	8			
176 :	9	2	6	6	9	12	11	2			
184 :	14	15	24	17	23	27	26	30			
192 :	37	32	51	38	49	60	72	71			
200 :	25	96	100	110	144	134	145	140			
208 :	178	206	189	181	208	196	191	171			
216 :	167	120	116	96	74	36	24	13			
224 :	15	15	5	8	6	2	4	5			
232 :	1	5	8	5	3	7	13	11			
240 :	8	14	9	8	9	19	21	20			
248 :	14	12	18	37	32	31	34	33			
256 :	43	47	46	39	45	47	62	46			
264 :	42	44	45	35	25	29	13	13			
272 :	8	11	5	4	4	1	4	1			
280 :	2	0	5	0	3	4	2	2			
288 :	5	4	4	7	4	8	9	4			
296 :	7	10	15	22	18	13	14	26			
304 :	22	24	20	31	26	26	28	21			
312 :	14	14	6	3	6	1	3	0			
320 :	1	0	1	0	0	0	0	1			
328 :	1	0	1	0	0	1	1	1			
336 :	0	1	1	1	0	0	1	0			
344 :	0	1	1	2	2	1	0	0			
352 :	0	0	1	1	1	1	0	0			
360 :	0	1	0	0	1	0	1	0			
368 :	2	3	1	0	0	2	1	2			
376 :	2	2	4	3	4	1	1	1			
384 :	3	1	2	0	0	0	0	1			
392 :	0	0	1	1	0	0	0	0			
400 :	0	0	0	0	0	0	0	0			
408 :	0	0	0	0	1	0	0	0			
416 :	0	1	0	0	0	1	0	0			
424 :	0	0	0	1	0	0	1	2			
432 :	1	0	0	0	0	0	0	2			
440 :	1	1	2	0	1	1	1	2			
448 :	3	1	4	2	0	1	0	1			
456 :	1	0	2	2	1	0	0	0			
464 :	0	0	0	0	0	0	0	0			
472 :	0	0	0	0	0	0	0	0			
480 :	0	0	0	0	0	0	0	0			
488 :	0	0	0	0	0	0	0	0			
496 :	0	1	0	0	1	0	0	0			
504 :	0	1	0	0	0	0	0	0			



APPENDIX E: Procedures & Confined Space Entry Permit for Tunnel

Attachment 2
Chapter 7-4

Confined Space Entry Permit

Page 1 of 2

This permit must be reissued each workshift or when conditions change.

Date: 7/17/96 Confined Space Number: _____ Location: 310 Division: ESH/HP

Nature of Work: Inspection ( ) Repair ( ) Cleaning ( ) Other (X)

Description of Work: Radiological assessment of Tunnel
(Approved procedure must be attached)

Other Permits Required No Valid Until: (/ /) : a/p
date time

Hazards of Confined Space: O_2 deficiency

Answer all questions.	Yes	No	N/A
1. Were hazards, testing and emergency procedures explained to all members of the crew?	✓		
2. Are all lines isolated and/or disconnected?			✓
3. Are all valves locked and tagged?			✓
4. Are all motors and electrical switches in the confined space locked and tagged?	✓		✓
5. Have engulfment hazards been controlled? ELP-1 BREAKER #5, B007	✓		
6. Has the confined space been decontaminated and purged?	✓		
7. Is oxygen at least 19.5% and less than 23.5% by volume?	✓		
8. Are combustible gases/vapors less than 10% LEL?	✓		
9. Are toxic gas concentrations acceptable?	✓		
10. Is forced supply/exhaust ventilation operating?	✓		
11. Has adequate illumination been provided?	✓		
12. Has a standby person been designated and trained to (a) observe the person working in the confined space and (b) take emergency action if necessary?	✓		
13. Is all safety equipment in place?	✓		
14. Are retrieval lines and safety harnesses used, if necessary?	✓		
15. Is the confined space safe for entry without special clothing?	✓		
16. Have the workers involved in this job been given instructions regarding the safe and efficient method of doing the work?	✓		
17. Is continuous monitoring necessary?			

Explain any "No" answers here. See attached procedure

How will attendants call fire department in case of emergency? Radio

How will entrants and attendant communicate? Verbal

List any special precautions necessary: See Procedure
Refer to attached procedure as necessary

List safety equipment used: See Procedure

Approved confined space entry procedure must be attached.

I have personally examined the above and attest that entry permit requirements have been met and the above noted precautions are being taken.

Signature of entrant	date	Signature of entrant	date	Signature of entrant	date
[signature]	8/6/96				

Signature of attendant	date	Signature of supervisor	date
Tim Branch	8/6/96	Dolores A Geraghty	8/6/96

Keep one copy at worksite. Use the back of this form to record air monitoring data.

ESH-215 (4-93)

Confined Space Entry

Confined Space Name/ID S10 Tunnel

Date	Time	Measured Concentration*			Surveyed by (Signature)	Instrument	Concentration OK?
		O2 (%)	COMB (% LEL)	TOX (PPM)			
8/6/96	1400	21.0	00 %	00 ppm	M. Bonhotal	GX-82	YES

*Allowable levels: O2 = 19.5-23.5%
Combustible = <10% LEL
Toxic = H2S <10 ppm
CO <35 ppm

CONFINED SPACE ENTRY PERMIT PROCEDURE FOR BUILDING 310 RETENTION TANK ROOM TUNNEL TO BUILDING 306.

Site General: Radiological assessment of tunnel : (Entry to tunnel --- survey direct with instruments and smear surveys of surfaces).

*Supervisors and employees involved with entry will have received confined space training.

*Tunnel will be monitored for 19.5 - 23.5% oxygen, <10% LEL, <10ppm H2S. If pit fails to meet parameters contact department supervision for additional instructions.

*Continuous ventilation and monitoring as determined by ESH/IH.

*Body harness with attached line for retrieval will be worn. Also, protective clothing and respirator may be worn if determined needed by ESH/HP.

*Attendant (safety person will remain stationed at point of entry and in verbal communication with the pit occupant.

*Attendant will be capable of communicating a 911 emergency to the ANL Fire Department by radio. Request communication check of ANL-FD, advise ANL-FD of location of tunnel being entered.

*Attendant will not leave the pit entrance unless properly relieved or occupant has exited pit.

*Attendant will order occupant to leave pit should any threatening problems develop.

*Confined space permit, confined space procedure will be posted at the job site.

Reviewed and approved by: Date:

ESH/HP Supervisor Dolores C Geraghty 7/17/96

ESH/IH Ralph Hunt 7/22/96

ESH/SE Signature on attached page

APPENDIX F: Instrument Calibration Records

TABLE F1 Background Data from Tennelec for 310 Retention Tanks

Clock Real Time				counts/min	
	Day	Time	Count Time (min)	alpha	beta
MON	07/08/96	11:36:12	200	0.255 ± 0.036	27.26 ± 0.37
THU	07/11/96	08:20:14	200	0.180 ± 0.030	27.14 ± 0.37
FRI	07/12/96	08:20:14	200	0.260 ± 0.036	27.59 ± 0.37
MON	07/15/96	09:12:10	200	0.255 ± 0.036	27.07 ± 0.37
TUE	07/16/96	17:22:42	200	0.265 ± 0.036	27.18 ± 0.37
MON	07/22/96	12:21:07	200	0.170 ± 0.029	26.67 ± 0.37
TUE	07/23/96	11:38:08	200	0.245 ± 0.035	26.93 ± 0.37
THU	07/25/96	08:20:15	200	0.210 ± 0.032	27.38 ± 0.37
FRI	07/26/96	09:52:20	200	0.260 ± 0.036	26.82 ± 0.37
SAT	07/27/96	08:20:14	200	0.170 ± 0.029	27.13 ± 0.37
SUN	07/28/96	08:20:27	200	0.220 ± 0.033	26.55 ± 0.36
MON	07/29/96	08:20:27	200	0.175 ± 0.030	27.69 ± 0.37
TUE	08/06/96	15:00:46	200	0.235 ± 0.034	27.54 ± 0.37
WED	08/07/96	08:20:14	200	0.260 ± 0.036	27.82 ± 0.37
THU	08/08/96	12:41:31	200	0.290 ± 0.038	27.23 ± 0.37
FRI	08/09/96	11:11:48	200	0.195 ± 0.031	26.72 ± 0.37
SAT	08/10/96	08:20:27	200	0.350 ± 0.042	27.22 ± 0.37
SUN	08/11/96	08:20:27	200	0.215 ± 0.033	26.88 ± 0.37
MON	08/12/96	08:20:27	200	0.160 ± 0.028	27.39 ± 0.37
TUE	08/13/96	08:20:14	200	0.280 ± 0.037	26.79 ± 0.37
WED	08/14/96	08:20:27	200	0.285 ± 0.038	27.66 ± 0.37
THU	08/15/96	18:12:18	200	0.165 ± 0.029	27.14 ± 0.37
FRI	08/16/96	08:20:14	200	0.235 ± 0.034	26.88 ± 0.37
SAT	08/17/96	08:20:14	200	0.215 ± 0.033	27.43 ± 0.37
SUN	08/18/96	08:20:27	200	0.220 ± 0.033	27.66 ± 0.37
MON	09/16/96	18:51:37	200	0.150 ±0.027	25.71 ± 0.36
WED	09/18/96	12:18:41	200	0.135±0.026	24.93 ± 0.35
			Minimum	0.135 ± 0.026	24.93 ± 0.35
			Maximum	0.350 ± 0.042	27.82 ± 0.37
			Average	0.224 ± 0.033	27.05 ± 0.37
			Standard Deviation	0.050 ± 0.004	0.60 ± 0.00
			Count	27	27

TABLE F2 Source Data from Tennelec for 310 Retention Tanks

	Real Time		counts/min		efficiency		% cross talk	
	Day	Time	alpha	beta	alpha	beta	a to ß	ß to a
MON	07/08/96	11:38:23	13,514 ± 82	6,603 ± 57	0.243		32.8	
MON	07/08/96	11:40:33	8 ± 2	39,665 ± 141		0.412		0.0202
THU	07/11/96	12:00:10	13,558 ± 82	6,633 ± 58	0.244		32.9	
THU	07/11/96	12:02:19	3 ± 1	39,738 ± 141		0.413		0.0063
THU	07/11/96	12:12:31	13,544 ± 82	6,636 ± 58	0.244		32.9	
THU	07/11/96	12:14:40	2 ± 1	39,701 ± 141		0.412		0.0050
MON	07/15/96	10:16:34	13,371 ± 82	6,917 ± 59	0.240		34.1	
MON	07/15/96	10:18:44	3 ± 1	39,685 ± 141		0.412		0.0076
TUE	07/16/96	17:24:54	4 ± 1	39,519 ± 141		0.410		0.0089
TUE	07/16/96	17:27:03	13,603 ± 82	6,590 ± 57	0.245		32.6	
MON	07/22/96	13:12:27	12,976 ± 81	7,075 ± 59	0.233		35.3	
MON	07/22/96	13:14:36	1 ± 1	39,431 ± 140		0.409		0.0025
MON	07/22/96	14:30:42	13,104 ± 81	6,992 ± 59	0.236		34.8	
MON	07/22/96	14:32:52	2 ± 1	39,559 ± 141		0.411		0.0051
TUE	07/23/96	11:40:20	13,010 ± 81	7,118 ± 60	0.234		35.4	
TUE	07/23/96	11:42:29	3 ± 1	39,431 ± 140		0.409		0.0063
THU	07/25/96	09:13:43	13,245 ± 81	6,874 ± 59	0.238		34.2	
THU	07/25/96	09:15:53	3 ± 1	39,511 ± 141		0.410		0.0076
MON	07/29/96	09:52:56	12,912 ± 80	7,168 ± 60	0.232		35.7	
MON	07/29/96	09:55:06	1 ± 1	39,786 ± 141		0.413		0.0025
TUE	08/06/96	15:02:58	12,834 ± 80	7,255 ± 60	0.231		36.1	
TUE	08/06/96	15:05:08	2 ± 1	39,698 ± 141		0.412		0.0050
THU	08/08/96	12:43:42	13,212 ± 81	6,827 ± 58	0.238		34.1	
THU	08/08/96	12:45:52	3 ± 1	39,649 ± 141		0.412		0.0076
MON	08/12/96	16:03:03	13,468 ± 82	6,807 ± 58	0.242		33.6	
MON	08/12/96	16:05:13	5 ± 2	39,722 ± 141		0.412		0.0126
WED	08/14/96	09:16:12	13,144 ± 81	6,956 ± 59	0.236		34.6	
WED	08/14/96	09:18:22	2 ± 1	39,603 ± 141		0.411		0.0038
THU	08/15/96	18:14:30	3 ± 1	39,653 ± 141		0.412		0.0063
THU	08/15/96	18:16:39	13,645 ± 83	6,652 ± 58	0.245		32.8	
FRI	08/16/96	08:33:56	13,303 ± 82	6,840 ± 58	0.239		34.0	
FRI	08/16/96	08:36:06	3 ± 1	39,600 ± 141		0.411		0.0063
WED	09/18/96	12:20:52	13,192 ± 81	6,723 ± 58	0.237		33.8	
WED	09/18/96	12:23:01	1 ± 1	39,624 ±141		0.411		0.0025
		Minimum	1 ± 1	6,590 ± 57	0.231	0.409	32.6	0.0025
		Maximum	13,645 ± 83	39,786 ± 141	0.245	0.413	36.1	0.0202
		Average	6,638 ± 41	23,242 ± 100	0.239	0.411	34.1	0.0071
		Standard Deviation	6,637 ± 40	16,380 ± 41	0.005	0.004	1.1	0.0041
		Count	34	34	17	17	17	17

The alpha source is Am-241
The beta source is Sr-90/Y-90

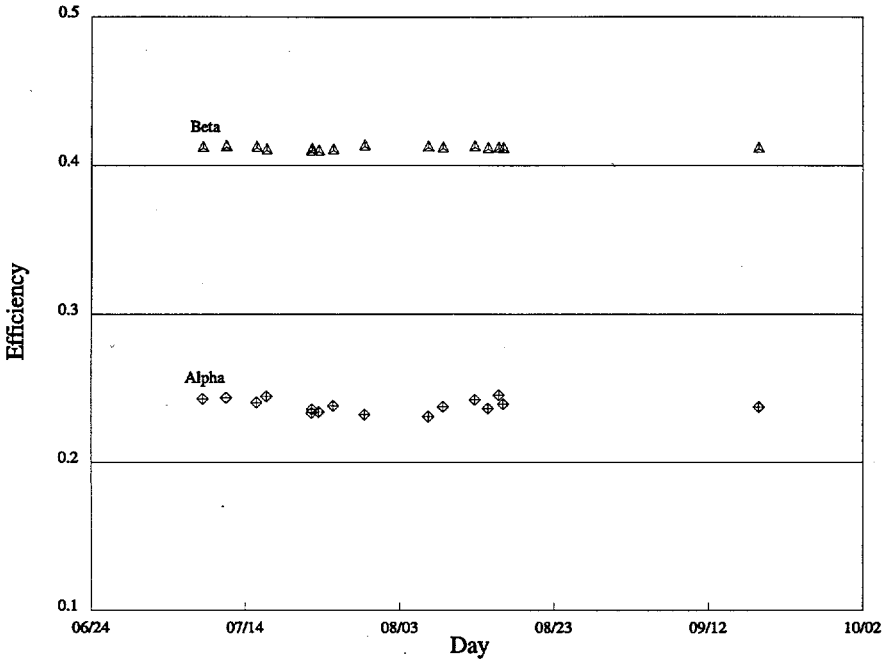


FIGURE F1 Calibration Check Data for the Tennelec System

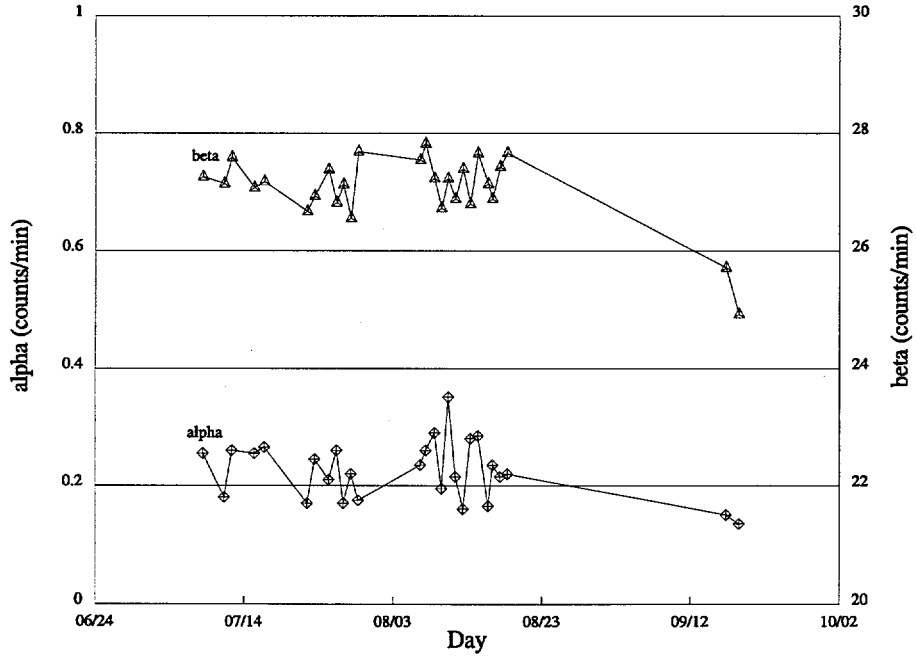


FIGURE F2 Background Check Data for the Tennelec System

3-3

DABRAS UTILITIES : Determine Instrument Parameters - COUNTER 1

05/21/96 09:59:57	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Determination ALPHA	Today's Determination BETA
Bkgd Time (min)	100.00	100.00	100.00	100.00
Bkgd Cnts	139	25514	170	26429
Bkgd Rate (cpm)	0.00	0.00	1.70	264.29
Bkgd 2*Sig (± cpm)	0.00	0.00	0.26	3.25
Std Cnt Time (min)	10.00	10.00	10.00	10.00
Std Cts	144109	482099	152339	494075
Std Rate (cpm)	14410.90	48209.90	15233.90	49407.50
Std Net Rate (cpm)	0.00	0.00	15232.20	49143.21
Std Eff (cts/dis)	0.00	0.00	0.27	0.50

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : Determine Instrument Parameters - COUNTER 2

05/21/96 12:59:38	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Determination ALPHA	Today's Determination BETA
Bkgd Time (min)	100.00	100.00	100.00	100.00
Bkgd Cnts	134	25514	203	26087
Bkgd Rate (cpm)	0.00	0.00	2.03	260.87
Bkgd 2*Sig (± cpm)	0.00	0.00	0.28	3.23
Std Cnt Time (min)	10.00	10.00	10.00	10.00
Std Cts	173567	500576	176478	506531
Std Rate (cpm)	17356.70	50057.60	17647.80	50653.10
Std Net Rate (cpm)	0.00	0.00	17645.77	50392.23
Std Eff (cts/dis)	0.00	0.00	0.32	0.51

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 1

07/11/96 08:18:14	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	170	26429	28	2709
Bkgd Rate (cpm)	1.70	264.29	2.80	270.90
Bkgd 2*Sig (± cpm)	0.26	3.25	1.06	10.41
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	152339	494075	15536	48339
Std Rate (cpm)	15233.90	49407.50	15536.00	48339.00
Std Net Rate (cpm)	15232.20	49143.21	15533.20	48068.10
Std Eff (cts/dis)	0.27	0.50	0.28	0.49

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 2

07/11/96 08:42:12	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	203	26087	13	2424
Bkgd Rate (cpm)	2.03	260.87	1.30	242.40
Bkgd 2*Sig (± cpm)	0.28	3.23	0.72	9.85
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	176478	506531	16817	49888
Std Rate (cpm)	17647.80	50653.10	16817.00	49888.00
Std Net Rate (cpm)	17645.77	50392.23	16815.70	49645.60
Std Eff (cts/dis)	0.32	0.51	0.30	0.50

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 1

07/15/96 07:54:35	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	170	26429	30	2587
Bkgd Rate (cpm)	1.70	264.29	3.00	258.70
Bkgd 2*Sig (± cpm)	0.26	3.25	1.10	10.17
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	152339	494075	15216	48868
Std Rate (cpm)	15233.90	49407.50	15216.00	48868.00
Std Net Rate (cpm)	15232.20	49143.21	15213.00	48609.30
Std Eff (cts/dis)	0.27	0.50	0.27	0.49

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 2

07/15/96 08:12:01	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	203	26087	24	2524
Bkgd Rate (cpm)	2.03	260.87	2.40	252.40
Bkgd 2*Sig (± cpm)	0.28	3.23	0.98	10.05
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	176478	506531	16821	49855
Std Rate (cpm)	17647.80	50653.10	16821.00	49855.00
Std Net Rate (cpm)	17645.77	50392.23	16818.60	49602.60
Std Eff (cts/dis)	0.32	0.51	0.30	0.50

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 1

08/06/96 07:51:34	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	170	26429	65	2678
Bkgd Rate (cpm)	1.70	264.29	6.50	267.80
Bkgd 2*Sig (± cpm)	0.26	3.25	1.61	10.35
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	152339	494075	14406	48497
Std Rate (cpm)	15233.90	49407.50	14406.00	48497.00
Std Net Rate (cpm)	15232.20	49143.21	14399.50	48229.20
Std Eff (cts/dis)	0.27	0.50	0.26	0.49

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 2

08/06/96 08:05:15	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	203	26087	58	2573
Bkgd Rate (cpm)	2.03	260.87	5.80	257.30
Bkgd 2*Sig (± cpm)	0.28	3.23	1.52	10.14
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	176478	506531	17119	49513
Std Rate (cpm)	17647.80	50653.10	17119.00	49513.00
Std Net Rate (cpm)	17645.77	50392.23	17113.20	49255.70
Std Eff (cts/dis)	0.32	0.51	0.31	0.50

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 1

08/08/96 07:54:41	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	170	26429	14	2347
Bkgd Rate (cpm)	1.70	264.29	1.40	234.70
Bkgd 2*Sig (± cpm)	0.26	3.25	0.75	9.69
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	152339	494075	13259	47781
Std Rate (cpm)	15233.90	49407.50	13259.00	47781.00
Std Net Rate (cpm)	15232.20	49143.21	13257.60	47546.30
Std Eff (cts/dis)	0.27	0.50	0.24	0.48

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 2

08/08/96 08:08:56	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	203	26087	19	2479
Bkgd Rate (cpm)	2.03	260.87	1.90	247.90
Bkgd 2*Sig (± cpm)	0.28	3.23	0.87	9.96
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	176478	506531	17409	49505
Std Rate (cpm)	17647.80	50653.10	17409.00	49505.00
Std Net Rate (cpm)	17645.77	50392.23	17407.10	49257.10
Std Eff (cts/dis)	0.32	0.51	0.31	0.50

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 1

08/12/96 07:46:54	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	170	26429	23	2589
Bkgd Rate (cpm)	1.70	264.29	2.30	258.90
Bkgd 2*Sig (± cpm)	0.26	3.25	0.96	10.18
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	152339	494075	14501	48870
Std Rate (cpm)	15233.90	49407.50	14501.00	48870.00
Std Net Rate (cpm)	15232.20	49143.21	14498.70	48611.10
Std Eff (cts/dis)	0.27	0.50	0.26	0.49

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 2

08/12/96 08:00:12	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	203	26087	28	2642
Bkgd Rate (cpm)	2.03	260.87	2.80	264.20
Bkgd 2*Sig (± cpm)	0.28	3.23	1.06	10.28
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	176478	506531	17043	49858
Std Rate (cpm)	17647.80	50653.10	17043.00	49858.00
Std Net Rate (cpm)	17645.77	50392.23	17040.20	49593.80
Std Eff (cts/dis)	0.32	0.51	0.31	0.50

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 1

08/14/96 07:44:12	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	170	26429	29	2497
Bkgd Rate (cpm)	1.70	264.29	2.90	249.70
Bkgd 2*Sig (± cpm)	0.26	3.25	1.08	9.99
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	152339	494075	14529	48594
Std Rate (cpm)	15233.90	49407.50	14529.00	48594.00
Std Net Rate (cpm)	15232.20	49143.21	14526.10	48344.30
Std Eff (cts/dis)	0.27	0.50	0.26	0.49

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 2

08/14/96 08:05:59	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	203	26087	27	2502
Bkgd Rate (cpm)	2.03	260.87	2.70	250.20
Bkgd 2*Sig (± cpm)	0.28	3.23	1.04	10.00
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	176478	506531	14531	48340
Std Rate (cpm)	17647.80	50653.10	14531.00	48340.00
Std Net Rate (cpm)	17645.77	50392.23	14528.30	48089.80
Std Eff (cts/dis)	0.32	0.51	0.26	0.49

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 1

08/19/96 07:48:25	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	170	26429	17	2544
Bkgd Rate (cpm)	1.70	264.29	1.70	254.40
Bkgd 2*Sig (± cpm)	0.26	3.25	0.82	10.09
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	152339	494075	13792	48113
Std Rate (cpm)	15233.90	49407.50	13792.00	48113.00
Std Net Rate (cpm)	15232.20	49143.21	13790.30	47858.60
Std Eff (cts/dis)	0.27	0.50	0.25	0.48

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 2

08/19/96 08:29:26	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	203	26087	23	2493
Bkgd Rate (cpm)	2.03	260.87	2.30	249.30
Bkgd 2*Sig (± cpm)	0.28	3.23	0.96	9.99
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	176478	506531	14302	48782
Std Rate (cpm)	17647.80	50653.10	14302.00	48782.00
Std Net Rate (cpm)	17645.77	50392.23	14299.70	48532.70
Std Eff (cts/dis)	0.32	0.51	0.26	0.49

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 1

08/20/96 07:46:58	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	170	26429	29	2523
Bkgd Rate (cpm)	1.70	264.29	2.90	252.30
Bkgd 2*Sig (± cpm)	0.26	3.25	1.08	10.05
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	152339	494075	13018	47905
Std Rate (cpm)	15233.90	49407.50	13018.00	47905.00
Std Net Rate (cpm)	15232.20	49143.21	13015.10	47652.70
Std Eff (cts/dis)	0.27	0.50	0.23	0.48

Hit "Q" Anytime to Abort

3-3

DABRAS UTILITIES : DAILY Op CHECK - COUNTER 2

08/20/96 08:03:22	CURRENT PARAMETERS ALPHA	CURRENT PARAMETERS BETA	Today's Check ALPHA	Today's Check BETA
Bkgd Time (min)	100.00	100.00	10.00	10.00
Bkgd Cnts	203	26087	31	2613
Bkgd Rate (cpm)	2.03	260.87	3.10	261.30
Bkgd 2*Sig (± cpm)	0.28	3.23	1.11	10.22
Std Cnt Time (min)	10.00	10.00	1.00	1.00
Std Cts	176478	506531	14026	47893
Std Rate (cpm)	17647.80	50653.10	14026.00	47893.00
Std Net Rate (cpm)	17645.77	50392.23	14022.90	47631.70
Std Eff (cts/dis)	0.32	0.51	0.25	0.48

Hit "Q" Anytime to Abort

Certificate #015-D2
rev. 1.0, January 1996

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1051 Procedure#: **015** Configuration: **Surface Contam**
Type: _X_ Dual Scintillator (**dpm units**)
Unit#: 5491 Mfr/Model: **NE Technology Electra** S/N: 574
Unit#: 6816 Mfr/Model: **NE Technology DP6A** S/N: 591

Pulse Generator, Eberline MP- 1, S/N 200
Electrostatic KiloVoltmeter: ESD, S/N 950556
Alpha Source: Am241, S/N DV457, Activity 64,900 dpm
Beta Source: Sr Y90, S/N DV652, Activity 122,000 dpm

I) MAINTENANCE/PRECALIBRATION:
Window: OK Cabling: OK Mechanical/Cleanliness: OK
Battery Voltage (Parameter # 0): 4.5 (ref: > 4)
Threshold: 23 mV (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator (Parameter #6): 2.00 V (ref: 2.00 V), then INHIBIT: ✓
Count Rate Check @ 10 k cpm: OK
HV Calib.: OK (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:
Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 35.9K Alpha cpm: 14 (e.g., 0.04 % of beta)
HV = 925 ✓, and INHIBIT: ✓

Parameter Settings:
As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 µA, then INHIBIT: ✓
Parameter #5 (Deadtime): 3 µsec, then INHIBIT: ✓
Parameter #8 (Units): cpm ✓
Parameter #A (inhibit bkgd subt): set to OFF ✓
Parameter #b (inhibit integrate): set to OFF ✓
Parameter #C (rate mode): set to preset ✓
Parameter #d (preset response time): set to 3 sec ✓
Parameter #E (pulse mode): set to dUAL
Parameter #F (ohms): set to S66 ✓

II) PRIMARY CALIBRATION: 13.5K
Response to Alpha Std: ~~Am241~~ cpm; 20.8 % efficiency (alpha)
Alpha Mode Bkgd: 3 cpm (ref.: < 7 cpm)
Response to Beta Std: 35.9K cpm; 29.4 % efficiency (beta)
Beta Mode Bkgd: 401 cpm (ref.: < 400 cpm)
Integrate Check: OK Audible Functional Check: OK

Parameter #8 (Units): change from cpm to **dpm** ✓
Parameter #9 (Efficiencies): enter efficiencies from above ✓
Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). ✓

REMARKS: _____

Calibrated by: Robert Kaan Date: 6/11/96

Certificate #015-D2
rev. 1.0, January 1996

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1258 Procedure#: **015** Configuration: **Surface Contam**
Type: _X_ Dual Scintillator (**dpm units**)
Unit#: 5496 Mfr/Model: **NE Technology Electra** S/N: 495
Unit#: 6041 Mfr/Model: **NE Technology DP6A** S/N: 1046

Pulse Generator, Eberline MP-___, S/N 536
Electrostatic KiloVoltmeter: ESI 2K, S/N 900147
Alpha Source: Am241, S/N NV965, Activity 60820 dpm
Beta Source: Sr90, S/N DW636, Activity 9780 dpm

I) MAINTENANCE/PRECALIBRATION:
Window: ___ Cabling: ___ Mechanical/Cleanliness: ___
Battery Voltage (Parameter # 0): 4.2 (ref: > 4)
Threshold: ___ (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator (Parameter #6): 2 V (ref: 2.00 V), then INHIBIT: ___
Count Rate Check @ 10 k cpm: ___
HV Calib.: ___ (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:
Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 27K Alpha cpm: 3 (e.g., 2.1 % of beta)
HV = 1040v, and INHIBIT: ___

Parameter Settings:
As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 µA, then INHIBIT: ___
Parameter #5 (Deadtime): 3 µsec, then INHIBIT: ___
Parameter #8 (Units): cpm
Parameter #A (inhibit bkgd subt): set to OFF
Parameter #b (inhibit integrate): set to OFF
Parameter #C (rate mode): set to preset
Parameter #d (preset response time): set to 3 sec
Parameter #E (pulse mode): set to dUAL
Parameter #F (ohms): set to S66

II) PRIMARY CALIBRATION:
Response to Alpha Std: 12K cpm; .197 % efficiency (alpha)
Alpha Mode Bkgd: 3 cpm (ref.: < 7 cpm)
Response to Beta Std: 27K cpm; .276 % efficiency (beta)
Beta Mode Bkgd: 366 cpm (ref.: < 400 cpm)
Integrate Check: ___ Audible Functional Check: ___

Parameter #8 (Units): change from cpm to **dpm**
Parameter #9 (Efficiencies): enter efficiencies from above
Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). ___

REMARKS: _____

Calibrated by: _____ Date: 4-18-96

Certificate #015-D2
rev. 1.0, January 1996

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1682 Procedure#: **015** Configuration: **Surface Contam**
Type: **X** Dual Scintillator (**dpm units**)
Unit#: 6235 Mfr/Model: **NE Technology Electra** S/N: 1433
Unit#: 6286 Mfr/Model: **NE Technology DP6A** S/N: 149

Pulse Generator, Eberline MP- 1, S/N 545
Electrostatic KiloVoltmeter: ESA-9, S/N ES-12104
Alpha Source: Am241, S/N QV965, Activity 64800 dpm
Beta Source: Sr90, S/N QV436, Activity 97800 dpm

I) MAINTENANCE/PRECALIBRATION:
Window: X Cabling: X Mechanical/Cleanliness: X
Battery Voltage (Parameter # 0): 4.8 (ref: > 4)
Threshold: 25mV (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator (Parameter #6): 2 V (ref: 2.00 V), then INHIBIT: X
Count Rate Check @ 10 k cpm: 10
HV Calib.: X (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:
Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 30.4K Alpha cpm: 24 (e.g., <.1% of beta)
HV = 905, and INHIBIT: X

Parameter Settings:
As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 µA, then INHIBIT: X
Parameter #5 (Deadtime): 3 µsec, then INHIBIT: X
Parameter #8 (Units): cpm
Parameter #A (inhibit bkgd subt): set to OFF
Parameter #b (inhibit integrate): set to OFF
Parameter #C (rate mode): set to preset
Parameter #d (preset response time): set to 3 sec
Parameter #E (pulse mode): set to dUAL
Parameter #F (ohms): set to S66

II) PRIMARY CALIBRATION:
Response to Alpha Std: 11K cpm; .180 % efficiency (alpha)
Alpha Mode Bkgd: 2 cpm (ref.: < 7 cpm)
Response to Beta Std: 30.4K cpm; .310 % efficiency (beta)
Beta Mode Bkgd: 452 cpm (ref.: < 400 cpm)
Integrate Check: X Audible Functional Check: X

Parameter #8 (Units): change from cpm to **dpm**
Parameter #9 (Efficiencies): enter efficiencies from above
Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). X

REMARKS: _____

Calibrated by: _____ Date: 2-26-96

Certificate #015-D2
rev. 1.0, January 1996

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1259 Procedure#: **015** Configuration: **Surface Contam**
Type: _X_ Dual Scintillator (**dpm units**)
Unit#: 5497 Mfr/Model: **NE Technology Electra** S/N: 516
Unit#: 6907 Mfr/Model: **NE Technology DP6A** S/N: 534

Pulse Generator, Eberline MP- 1, S/N 535
Electrostatic KiloVoltmeter: ESD 2K, S/N 900147
Alpha Source: Am241, S/N DV965, Activity 60P00 dpm
Beta Source: SrY90, S/N DN636, Activity 97800 dpm

I) MAINTENANCE/PRECALIBRATION:
Window: ✓ Cabling: ✓ Mechanical/Cleanliness: ✓
Battery Voltage (Parameter # 0): 4.5 (ref: > 4)
Threshold: 27 (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator (Parameter #6): 2 V (ref: 2.00 V), then INHIBIT: ✓
Count Rate Check @ 10 k cpm: ✓
HV Calib.: ✓ (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:
Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 27.3K Alpha cpm: 11 (e.g., 2.1% of beta)
HV = 990, and INHIBIT: Y

Parameter Settings:
As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 µA, then INHIBIT: ✓
Parameter #5 (Deadtime): 3 µsec, then INHIBIT: ✓
Parameter #8 (Units): cpm
Parameter #A (inhibit bkgd subt): set to OFF
Parameter #b (inhibit integrate): set to OFF
Parameter #C (rate mode): set to preset
Parameter #d (preset response time): set to 3 sec
Parameter #E (pulse mode): set to dUAL
Parameter #F (ohms): set to S66

II) PRIMARY CALIBRATION:
Response to Alpha Std: 12.2K cpm; .200 % efficiency (alpha)
Alpha Mode Bkgd: 5 cpm (ref.: < 7 cpm)
Response to Beta Std: 27.3K cpm; .279 % efficiency (beta)
Beta Mode Bkgd: 360 cpm (ref.: < 400 cpm)
Integrate Check: ✓ Audible Functional Check: ✓

Parameter #8 (Units): change from cpm to **dpm**
Parameter #9 (Efficiencies): enter efficiencies from above
Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). ✓

REMARKS: _____

Calibrated by: [signature] Date: 5-1-96

Certificate #015-D2
rev. 1.0, January 1996

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 96C Procedure#: **015** Configuration: **Surface Contam**
Type: _X_ Dual Scintillator (**dpm units**)
Unit#: 5348 Mfr/Model: **NE Technology Electra** S/N: 489
Unit#: 6643 Mfr/Model: **NE Technology DP6A** S/N: 1049

Pulse Generator, Eberline MP- 1, S/N 595
Electrostatic KiloVoltmeter: ESI 2K, S/N 900417
Alpha Source: Am 241, S/N 60800, Activity 04 965 dpm
Beta Source: Sr 90, S/N 97800, Activity 04 636 dpm

I) MAINTENANCE/PRECALIBRATION:
Window: X Cabling: X Mechanical/Cleanliness: X
Battery Voltage (Parameter # 0): 4.4 (ref: > 4)
Threshold: 25m (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator (Parameter #6): 2 V (ref: 2.00 V), then INHIBIT:___
Count Rate Check @ 10 k cpm: 10K
HV Calib.: X (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:
Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 30.7K Alpha cpm: 23 (e.g., .1 % of beta)
HV = 1050, and INHIBIT: X

Parameter Settings:
As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 µA, then INHIBIT: +
Parameter #5 (Deadtime): 3 µsec, then INHIBIT: X
Parameter #8 (Units): cpm
Parameter #A (inhibit bkgd subt): set to OFF
Parameter #b (inhibit integrate): set to OFF
Parameter #C (rate mode): set to preset
Parameter #d (preset response time): set to 3 sec
Parameter #E (pulse mode): set to dUAL
Parameter #F (ohms): set to S66

II) PRIMARY CALIBRATION:
Response to Alpha Std: 11.1K cpm; .182 % efficiency (alpha)
Alpha Mode Bkgd: 2 cpm (ref.: < 7 cpm)
Response to Beta Std: 30.7K cpm; .314 % efficiency (beta)
Beta Mode Bkgd: 384 cpm (ref.: < 400 cpm)
Integrate Check: X Audible Functional Check: X

Parameter #8 (Units): change from cpm to **dpm**
Parameter #9 (Efficiencies): enter efficiencies from above
Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). X

REMARKS: _____

Calibrated by: [signature] Date: 3-25-96

Certificate #015-D2
rev. 1.0, January 1996

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1041 Procedure#: **015** Configuration: **Surface Contam**
Type: **X** Dual Scintillator (**dpm units**)
Unit#: 5445 Mfr/Model: **NE Technology Electra** S/N: 526
Unit#: 6806 Mfr/Model: **NE Technology DP6A** S/N: 595

Pulse Generator, Eberline MP-1, S/N 595
Electrostatic KiloVoltmeter: EKD-5, S/N ES-17368
Alpha Source: Am 241, S/N DV 965, Activity 68800 dpm
Beta Source: Sr 90, S/N DV 636, Activity 97800 dpm

I) MAINTENANCE/PRECALIBRATION:
Window: ✓ Cabling: ✓ Mechanical/Cleanliness: ✓
Battery Voltage (Parameter # 0): 4.1 (ref: > 4)
Threshold: ✓ (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator (Parameter #6): 2 V (ref: 2.00 V), then INHIBIT: ✓
Count Rate Check @ 10 k cpm: ✓
HV Calib.: ✓ (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:
Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 29.3K Alpha cpm: 8 (e.g., <.01% of beta)
HV = 820, and INHIBIT: ✓

Parameter Settings:
As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 µA, then INHIBIT: ✓
Parameter #5 (Deadtime): 3 µsec, then INHIBIT: ✓
Parameter #8 (Units): cpm
Parameter #A (inhibit bkgd subt): set to OFF
Parameter #b (inhibit integrate): set to OFF
Parameter #C (rate mode): set to preset
Parameter #d (preset response time): set to 3 sec
Parameter #E (pulse mode): set to dUAL
Parameter #F (ohms): set to S66

II) PRIMARY CALIBRATION:
Response to Alpha Std: 13K cpm; .213 % efficiency (alpha)
Alpha Mode Bkgd: 7 cpm (ref.: < 7 cpm)
Response to Beta Std: 29.3K cpm; 299 % efficiency (beta)
Beta Mode Bkgd: 374 cpm (ref.: < 400 cpm)
Integrate Check: ✓ Audible Functional Check: ✓

Parameter #8 (Units): change from cpm to **dpm**
Parameter #9 (Efficiencies): enter efficiencies from above
Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). ✓

REMARKS: _____

Calibrated by: [signature] Date: 6-20-96

Certificate #018-A1
rev. 1.0, June 1993

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 641 Procedure#: **018** Configuration: **Scintillator**
Type: _X_ 2 mm NaI

Unit#: 5038 Mfr/Model: **Eberline PRM-5-3** S/N: 3012
Unit#: 2615 Mfr/Model: **Eberline PG-2** S/N: _____

Pulse Generator, Eberline MP- 1 , S/N 545
Electrostatic KiloVoltmeter: ESD-9 , S/N ES-12104
Source(s): Pu-239 ,S/N 7552 ,Activity 4150000 dpm
Am-241 ,S/N 7551 ,Activity 6028000 dpm
U-235 ,S/N 22B6102 ,Activity 1.06 g foil

I) MAINTENANCE/PRECALIBRATION:

Batteries: X Cabling: X Mechanical/Cleanliness: X

Threshold: 11 mV (fixed at 5 to 10 mV)
Window: 14 mV = 25 % (ref.: 25% of Threshold mV)
Audible Function Check: X

Joe CC — 3-1-96
Pre-Calibrator — Date

II) PRIMARY CALIBRATION:

Range (cpm)	Pulser Rate (cpm)	As Found (cpm)	As Left (cpm)	% Diff. Pulser vs As Left
500	400	400	400	0
5K	4K	4K	4K	0
50K	40K	40K	40K	0
500K	400K	400K	400K	0

With PHA in, adjust HV to maximize detector response to isotope of interest:

Mode	Isotope	Response As Found (cpm)	Response As Left (cpm)	Efficiency (If Applicable) (%)
HV- 1	Pu-239	15K	15K	N/A
HV- 2	Am-241	400K	400K	N/A
HV- 3	U-235	120K	200K	N/A

Mode of Operation: **HV- 1 , Gross**
Ambient Bkgd in chosen Oper. Mode: 50 cpm (ref.: > 300 cpm)

REMARKS: _____

Joe CC — 3-1-96
Primary-Calibrator — Date

Certificate #016-A4
rev. 0.0, March 1994

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 366 Procedure#: **016** Configuration: **GM Field**
Type: _**X**_ Energy Compensated

Unit#: 4786 Mfr/Model: **Ludlum 3** S/N: 27907
Unit#: 6617 Mfr/Model: **Eberline HP-270** S/N: NA

Pulse Generator, Eberline MP- 2, S/N 775
Electrostatic KiloVoltmeter: 5b 9, S/N 13443
Gamma Source Cs 137, S/N 7083

I) MAINTENANCE/PRECALIBRATION:

Batteries: ✓ Cabling: ✓ Mechanical/Handle: ✓
Meter Zero: ✓ Cleanliness: ✓

Threshold: 25 mV (fixed @ approx. 30 to 50 mV)
High Voltage: 900 Vdc (ref.: 900 V)
Audible Function Check: ✓

Jerry Letizia — Pre-Calibrator
11/29/96 — Date

II) PRIMARY CALIBRATION (Linear Scales):

Range	*****Mid-Field**** Field	As Found	As Left	**Low-Field*** Field	Response	**High-Field** Field	Response
(0 to 2 mR/h)							
x0.1	.09	.09	.09	n/a	n/a	.15	.15
x1	1.02	1	1	.3	.3	1.53	1.5
x10	8.7	9	9	3.6	3.8	14.9	15
x100	9.4	8.9	8.9	36	25	149	170

Off-Scale Response?: OK (field should be about 400 mR/h)

REMARKS: _____

A. Pinn — Primary-Calibrator
12-5-96 — Date

Certificate #017-A1
rev. 1.0, August 1993

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 665 Procedure#: **017** Configuration: **Ion Field**
Type: _X_ Ionization Chamber

Unit#: 511 Mfr/Model: **Eberline RO-20** S/N: 287

Gamma Source Cs 137, S/N 7083

I) MAINTENANCE/PRECALIBRATION:

Mechanical: ✓ Cleanliness: ✓
Detector Window: ✓ Meter Zero: ✓
Batteries: Supply ✓ ; Chamber Bias ✓

Robert Kram — Pre-Calibrator
6-4-96 — Date

II) PRIMARY CALIBRATION (Linear Scales):

Range	*****Mid-Field***** Field	As Found	As Left	**Low-Field*** Field Response		**High-Field** Field Response	
(0 to 5 mR/h)							
x1	2.1	2.0	2.0	1.0	1.0	4.1	4.0
x10	23.8	23.5	23.5	7.9	8	37.3	37
x100	228	230	230	84	80	367	360
(0 to 5 R/h)							
x1	2.32	2.3	2.3	.87	.9	4.12	4.1
x10	23	23.5	22.5	9.2	9.5	36.7	35

Off-Scale Response?: ✓ (field should be about 100 R/h)

Integrate Mode - N/A

Conditions: Pressure 746 mm Hg ; Temperature 68°

REMARKS:

Primary-Calibrator
6-5-96 — Date

NE Instrument Operational Check Log

Building 310			Location DIS/HIU		Retention Tank Rm.
SOURCE # Mantle		MINIMUM	α 1.7 K	βγ 32K	
		MAXIMUM	α 4.3 K	βγ 42K	
INSTRUMENT SET #	**DATE**	**A PASS**	**BG PASS**	**INITIALS**	**COMMENTS**
1051	7-9-96	✓	✓	TB	
1258	7-9-96	—	—	DCG	
1687	7-9-96	—	—	DC G	
1682	7-10-96	—	—	DCG	
1051	7-10-96	—	—	DCG	
1259	7-11-96	✓	✓	TB	
1259	7-12-96	✓	✓	MD	
960	7-12-96	—	—	DCG	
1682	7-12-96	—	—	DCG	
1682	7-15-96	—	—	DC G	
1682	7-16-96	—	—	DCG	
1682	7-17-96	—	—	DCG	
1682	7-19-96	—	—	DCG	
1682	7-22-96	—	—	DCG	
1682	7-23-96	—	—	DCG	
1259	8-5-96	✓	✓	TB	
1041	8-6-96	✓	✓	TB	37.6 α 850 β
1682	8-7-96	✓	✓	DC G	
1051	8-7-96	✓	✓	DCG	
1051	8-13-96	✓	✓	TB	62.5 α 1125 βγ

PRM 5-3 Operational Check Log

Building 310		Location Retention Tank Room		
SOURCE # Monitor	MINIMUM	7000	cts/min	
	MAXIMUM	12000	cts/min	
INSTRUMENT SET #	DATE	PASS/READING	INITIALS	COMMENTS
641	7-10-96	✓ 8000	DCC	
641	7-11-96	✓ 8000	DCC	
641	7-12-96	✓ 8000	DCC	
960	7-22-96	✓	YB	

54 & 741, 55

Ludlum Model 3

GM ~~End~~ SIDE Window Operational Check Log

Energy Compensated

Building 310	Location Containment Tank Room			
SOURCE #	MINIMUM	12	mR/Hr	
	MAXIMUM	16	mR/Hr	
INSTRUMENT SET #	DATE	PASS/READING	INITIALS	COMMENTS
366	8/7/96	✓	OEG	

RO20 (Shield Closed)

Bldg. 310		Retention Tank Room			
SOURCE #		MINIMUM	2.8	mR/Hr	
		MAXIMUM	3.9	mR/Hr	
SERIAL NUMBER	DATE	READING	PASS	INITIALS	COMMENTS
665	7/10		—	DCC	
665	7/11		—	DC6	
665	7/12		—	DC6	

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