



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801
October 4, 2007

10 CFR 30.36

U. S. Nuclear Regulatory Commission
Division of Nuclear Materials Safety
Region I
475 Allendale Road
King of Prussia, Pennsylvania 19406-1415

MS16
J-6

Gentlemen:

In the Matter of)
Tennessee Valley Authority)

Docket No. 030-34258

TENNESSEE VALLEY AUTHORITY (TVA) - RESPONSE TO REQUEST FOR
ADDITIONAL INFORMATION CONCERNING APPLICATION FOR AMENDMENT
TO LICENSE (NRC MAIL CONTROL NO. 140103)

Reference: NRC letter to TVA dated April 10, 2007, "Tennessee Valley Authority,
Request for Additional Information Concerning Application for
Amendment to License, Control No. 140103"

The Reference letter requested that additional information be provided to support
NRC review of TVA's request to terminate License No. 41-25370-01. The requested
information was not only associated with this specific license, but also with licenses
that had been superseded by this license (41-08165-01, 41-08165-02, 41-08165-07,
41-06832-08, 41-06832-09, 01-16821-02, 01-06113-01, 01-06113-02, and
01-06113-03).

The enclosure to this letter provides the requested information.

There are no regulatory commitments contained in this letter. Please contact
Russell R. Thompson at (423) 751-7737 if you have any questions.

Sincerely,

Beth A. Wetzel, Manager
Corporate Nuclear Licensing
And Industry Affair

Enclosure
cc: See page 2

RECEIVED
REGION 1

2007 OCT -5 AM 10:57

140103
NMSS/RGN1 MATERIALS-002

U. S. Nuclear Regulatory Commission
Page 2
October 4, 2007

cc: U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

ENCLOSURE

Response to Request for Additional Information Concerning Application for Amendment to License 41-25370-01

- Item 1 One investigation of a leaking source was found for license 01-06113-03 from 1995. The source was a Ni-63 source in a gas chromatograph which would actually have been a generally licensed source. A copy of the investigation is provided as Attachment 1. No other records reporting leaking sources were identified.
- Item 2.a Records related to the release of the burial site included totals for radionuclides placed in the burial site. These records were part of the information submitted to the NRC that resulted in the 1999 release of the site. A copy of the letter requesting release of the burial site and the supporting data is provided in Attachment 2. Attachment 3 provides a record listing the radionuclide content for each hole in the burial site. There are no specific records on each disposal via sanitary sewerage system. Attachment 4 contains a memorandum from W. J. Rogers that provides a written description of the process that was followed for disposal by this method. Attachment 5 is the manifest for material that was shipped from the Environmental Research Center and Hickory Valley Building by GTS Duratek, Inc. Records related to other methods of disposal for materials from the Radiological Fertilizer Laboratory were included in the original submittal to the NRC requesting decommissioning of the associated license.
- Item 2.b There was only one underground structure, a tank, at the Radiological Fertilizer Laboratory. Samples of water in the tank and surrounding soil were analyzed and no contamination was identified. A copy of this survey is provided in Attachment 6.
- Item 3 Future correspondence regarding this license should be sent to: Beth A. Wetzel; Corporate Nuclear Licensing Manager; Tennessee Valley Authority; 1101 Market Street, BR 4X; Chattanooga, Tennessee 37402-2801.
- Item 4 A release survey was conducted of room F250 that included direct and smear surveys for beta/gamma which would have covered Ca-45. A copy of this survey is provided in Attachment 7.
- Item 5 A copy of the letter from the NRC to TVA, dated April 30, 1999 releasing the burial site is provided in Attachment 8.
- Item 6.a The referenced location is the TVA 10th Street Garage facility. No records were found related to this location and it is believed that no radioactive material was used at this location.
- Item 6.b No records were found related to this location and it is believed that no radioactive material was used at this location.

- Item 6.c A copy of the survey for this location is provided in Attachment 9.
- Items 6.d A copy of the survey for this facility is provided in Attachment 10. The 6.f survey indicates that the areas used were rooms 118 and 119. No record was found of the use of storage room 18. It should be noted that the correct address for this facility is: 1801 17th Street; Sheffield, Alabama.
- Items 6.e Material under license 41-25370-01 or the previous combined licenses at
6.g the River Oaks Building or the WARL facility would have been samples only sent for analysis by the TVA radioanalytical lab and would have been covered under the license for the laboratory, License 01-06113-04.
- Item 6.h No documentation specifically associated with Rooms L171 or L172 at this location was found.
- Item 6.i No survey data related to the release of the lab and greenhouse in 1979 was found. No records were found for the period 1964 - 1966.
- Item 7 One survey related to the Red Oak Tree Study was found. A copy is provided in Attachment 11.
- Item 8 Survey data for this facility is provided in Attachment 12.
- Item 9 Other than the actual field application of C-14 into the river for primary productivity studies, we have found no indications of the use of temporary job sites.
- Item 10.a The facility to be released is the TVA Environmental Research Center.
- Item 10.b The complex is approximately 1340 acres. The building is approximately 176,245 square feet on three floors. The area to be released is approximately 533 square feet.
- Item 10.c The building is used as general office and laboratory space.
- Item 10.d The TVA Environmental Research Center reservation is bounded on the west by Hatch Boulevard (commercial), on the north by Reservation Road (federal reservation riparian zone with some federally controlled laboratory, warehouse and office buildings and public use areas), on the east by Wilson Dam Road (Industrial) and on the south by Second Street (mixed retail, commercial, and industrial with nearby residential).
- Item 10.e The general type of activities at this facility authorized by the license were laboratory procedures typically performed on bench tops and in hoods.
- Item 10.f Licensed activities at this facility ceased August 24, 2006.

ATTACHMENT 1

Item 1

Information Associated with Leaking Ni-63 Source

TO: FOR DOCUMENTATION

RE: NASHVILLE FIELD SITE PROJECT - KEN OLSZYNA AND GEORGIA
INSTITUTE OF TECHNOLOGY

SUBJECT: CONTAMINATION FOUND ON LEAK TEST OF GAS CHROMATOGRAPH
GEORGIA TECH NO. 0044993, 15 mCi, Ni-63 SOURCE

Survey No. RS-95-121 and 122

This survey was performed on July 27, 1995 in a TVA trailer at the Nashville site location. The membrane smears were counted on Friday, July 28, 1995. The leak test smear was taken on the above referenced gas chromatograph in the source area and surrounding areas. The results of the count of the source area was 2703 dpm. I notified the Nashville site people of my findings and instructed them not to work in the trailer due to possible contamination.

On Monday, July 31, 1995, I had the WARL count the Ni-63 membrane smear and also to do an analysis to determine the nuclide. Ni-63 was identified as the nuclide and the contamination limits agreed with my findings.

I notified Ken Olszyzna of the findings and he instructed me to call Mike Rogers, the Georgia Tech lead in this project. I called him and suggested he have the Georgia Tech students that were working on this project have a urine analysis. He is having this done.

Ken Olsyzna informed me that Kim Nelson, ERC, Analytical Group. was also working in that trailer.* I am presently waiting on WARL to call concerning the urine analysis for Ni-63. Monica Cross said they did not have a procedure for this analysis. She will see what she can find out and will call me back on Tuesday, August 1.

Phillip left at noon today, July 31, 1995, to the Nashville site to do a survey of the trailer to determine spread of contamination.

This was reported to Jay McFeters, as Jesse Coleman was on annual leave.

Prepared by Judith H. Johnson

Attachments:

Survey results concerning this incident

Reference names and phone numbers:

Mike Rogers, Georgia Tech - 404-853-3094

Chris Stonkin, Georgia Tech - 615-826-2705 and 404-894-1753

Jim Pearson, Georgia Tech

Kim Nelson, TVA, 2642-M

Ken Olsyzna, TVA, 3647-M

* It was later learned that Kim

Radiological Survey and Smear Anal. Data Sheet

Survey No. RS-95-120 Location: TVA - Nashville Field Site

Date of Survey: 7-28-1995

Purpose of Survey: Pre-shipment

NRC License No.: 01-06113-03

Survey by: Judith H. Johnson

| Item or Location | Distance | Dose Rates | | | | Contamination | | | Instrument Serial Numbers | Remarks |
|--|----------|--------------|-----------------|---------------|---------------|----------------------|--------------------------------------|----------------|---------------------------|--|
| | | Beta mrad/hr | Neutron nrem/hr | Gamma mrem/hr | Total mrem/hr | Direct cpm (frisker) | Transferable dpm/100 cm ² | Type: | | |
| Gas Chromatograph, Ni-63 G.T.N. 0044993 | Ct. | | | | | NA | ① ② | β ⁻ | NMC 2658/ 2750 | membrane smears Disc/Smear, see results below 7-30-95 |
| | 30 cm | | | | | | | | | |
| Gas Chromatograph Ni-63-Shimadzu G.T.N. 0037323 | Ct. | | | | | NA | ③ ④ | β ⁻ | ↓ | membrane smears Disc/Smear, see results below 7-30-95 |
| | 30 cm | | | | | | | | | |
| | Ct. | | | | | | | | | Disc/Smear, see results below |
| | 30 cm | | | | | | | | | |
| | Ct. | | | | | | | | | Disc/Smear, see results below |
| | 30 cm | | | | | | | | | |
| | Ct. | | | | | | | | | Disc/Smear, see results below |
| | 30 cm | | | | | | | | | |

Smear Counting System ID: NMC: DS-3P # 2658 / PCC-11T # 2750

System LLD: 530 dpm

Counted: 7-30-95

| Smear No. | Specific Location | Gross Counts (cpm) | Back-ground (cpm) | Net (cpm) | Efficiency | Activity (dpm) |
|-----------|-------------------|--------------------|-------------------|-----------|------------|----------------|
| 1 | Source Area | 95 | 30.1 | 65 | 0.0240 | 2708* |
| 2 | Surrounding Area | 51 | 30.1 | 20.9 | 0.0240 | 871* |
| 3 | Source Area | 25 | 30.1 | 0 | 0.0240 | 0 |
| 4 | Surrounding Area | 28 | 30.1 | 0 | 0.0240 | 0 |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |

Reviewed by: William Gault

* Recounted (see RS-95-122) + sent to WARR for analyses
RDSV77.P1.1

(NA = Not Applicable; ND = Not Detectable; GA = General Area Dose-rate; NOA = Nearest Occupiable Area; Ct. = Contact; cm = centimeter; m = meter; Analyzes LLD = Lower Limit of Detection for smear counting equipment; dpm = disintegrations per minute; cpm = counts per minute; ID = Identification)

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Inst. Eff. Bkg.

Date and Time 31 JUL 95

Sampling Information

RS&C-

95-121

β - γ

Date Smears Taken

7-28-95

β 283

Location Smears Taken

Nashville Field Site

α

Name Jody Johnson

Address MPB 1B-M

Use Background

Phone No. 3719

Type of Analysis Requested

For Ni-63

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|--------------------------------------|----------|--------------|-------------------|-----------|-----------------|---------|--------------------|--------|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 1 | Ni-63 source of Gas Chromatograph | β | 13656 | 10 | 1365.6 | 12.6 | 1353.0 | .7399 | 1828.6 |
| | | α | | | | | | | |
| | No. 0044993 (G.T.M.) | β | | 10 | | | | | |
| | | α | | | | | | | |
| 2 | Blank (BKG) | β | | 10 | | | | | |
| | | α | | | | | | | |
| 3 | Blank (STD) | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | $1661.0 - 12.6 = 1648.4 \text{ cpm}$ | β | | 10 | | | | | |
| | | α | | | | | | | |
| | 2227.8 DPM | β | | 10 | | | | | |
| | | α | | | | | | | |
| | $= 0.7399 \text{ EFFICIENCY}$ | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by: M.H. Cross

Checked by: Robert M. Clay

Calculated by: M.H. Cross

Radiological Survey and Smear Analysis Data Sheet

Survey No. RS-95-122 Location: TVA - Nashville Field Site

Date of Survey: 7-28-95 1995

NRC License No.: 01-06113-03

Purpose of Survey: Recount of Smears (see RS-95-120)

Survey by: Judy Johnson

| Item or Location | Distance | Dose Rates | | | | Contamination | | | Instrument Serial Numbers | Remarks |
|--|----------|--------------|-----------------|---------------|---------------|----------------------|--------------------------------------|----------------|---------------------------|--|
| | | Beta mrad/hr | Neutron nrem/hr | Gamma mrem/hr | Total mrem/hr | Direct cpm (frisker) | Transferable dpm/100 cm ² | Type: | | |
| Gas chromatograph Ni-63 G.T.N. 0044593 | Ct. | | | | | | | | | |
| | 30 cm | | | | | NA | ①② | β ⁻ | NMC 26581 2750 | Membrane Smears Disc/Smear, see results below 7-21-95 |
| | Ct. | | | | | | | | | |
| | 30 cm | | | | | | | | | Disc/Smear, see results below |
| | Ct. | | | | | | | | | |
| | 30 cm | | | | | | N | | | Disc/Smear, see results below |
| | Ct. | | | | | | | | | |
| | 30 cm | | | | | | A | | | Disc/Smear, see results below |
| | Ct. | | | | | | | | | |
| | 30 cm | | | | | | | | | Disc/Smear, see results below |
| | Ct. | | | | | | | | | |
| | 30 cm | | | | | | | | | Disc/Smear, see results below |

Smear Counting System ID: NMC; DS-3P # 2658 / PCC-11T # 2750

System LLD: _____ dpm

Counted 7-31-95

| Smear No. | Specific Location | Gross Counts (cpm) | Back-ground (cpm) | Net (cpm) | Efficiency | Activity (dpm) |
|-----------|-------------------|--------------------|-------------------|-----------|------------|----------------|
| 1 | Source Area | 103 | 29.2 | 73.8 | 0.0240 | 3075 * |
| 2 | Surrounding Area | 24 | 29.2 | 0 | 0.0240 | 0 |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |

Reviewed by: Walter H. Hally

* Sent to WARC for Analysis

(NA = Not Applicable; ND = Not Detectable; GA = General Area Dose-rate; NOA = Nearest Occupiable Area; Ct. = Contact; cm = centimeter; m = meter;

LLD = Lower Limit of Detection for smear counting equipment; dpm = disintegrations per minute; cpm = counts per minute; ID = Identification)

L91 950731 800

July 31, 1995

J. H. Coleman, MPB 1B-M

RESULTS OF SURVEY RS&C 95-121 (NICKEL-63)

Analysis is complete on the subject survey. A nickel-63 analysis was performed using a liquid scintillation technique. Attached are the measured values.

If you have any questions, please call me at Extension 3769.

Monica H. Cross

Monica H. Cross
Chemist
Radioanalytical Laboratory
WAR 1A-M

MHC:DBC
Attachment
cc (Attachment):
RIMS, CST 13B-C

PLCRSDBC (914)

Radiological Survey and Smear Analysis Data Sheet

Survey No. RS&C: 95-130 Location: Nash - Air Quality Trailer Date of Survey: 7-31-95
 Purpose of Survey: Pre-shipment / Activity verification on H.P. G.C. NRC License No.: 01-06113-03
 Surveyed by: P.L. Lowellyn

| Item or Location | Distance | Dose Rates | | | | Contamination | | Type: alpha+ or beta- | Instrument Serial Numbers | Remarks |
|----------------------------------|----------|-----------------|--------------------|------------------|------------------|-----------------|---|-----------------------------|---------------------------------|--|
| | | Beta mrad/hr | Neutron nrem/hr | Gamma mrem/hr | Total mrem/hr | Direct (cpm) | Transferable dpm/100 cm ² | | | |
| Air Quality Trailer Misc Loc. | Cl. | | | | | ND | See Below | Ni63 Beta | Bicron 553746 | Disc & Membrane drawers (Cloth smears taken as back-up - only membrane activity recorded) |
| | 30 cm | | | | | | | | | |
| ← | Cl. | | | | | NA | | Note: | HP G.C. | wiped down with a damp paper towel before final smears taken on detector & surrounding surfaces |
| | 30 cm | | | | | | | | | |
| | Cl. | | | | | NA | | | | |
| | 30 cm | | | | | | | | | |
| | Cl. | | | | | NA | | | | Chris at Trailer 615-826-2705 |
| | 30 cm | | | | | | | | | |

Counting System LLD: 530 d/m Counting System ID: NMC-2658/2750 Radiation type: alpha + or beta-

| Smear No. | Specific Location | Gross (cpm) | BKG (cpm) | Net (cpm) | Eff. | Activity (dpm) |
|-----------|--|-------------|-----------|-----------|-------|----------------|
| 1 | See Map. Wall - Back | 31 | 27.9 | 3.1 | 0.024 | 130 |
| 2 | Wall - Front Side Rt | 27.9 | | 1.1 | | 46 |
| 3 | Wall - Above GC Back Rite Side | 30 | | 2.1 | | 88 |
| 4 | Wall - Opposit GC Back Left Side | 24 | | 0 | | 0 |
| 5 | Wall - Front Left Front | 29 | | 1.1 | | 46 |
| 6 | Front - Main Air Intake for H/C unit | 30 | | 2.1 | | 88 |
| 7 | Air Exhaust Front of trailer (#1 of 4) | 33 | | 5.1 | | 213 |
| 8 | Floor - Front | 34 | | 6.1 | | 255 |
| 9 | Floor - Front Middle | 33 | | 5.1 | | 88 |
| 10 | Air Exhaust Front Middle | 25 | | 0 | | 0 |

Reviewed by: Just N. [Signature] Date Reviewed: 8-29-95 Rec'd 8-29

Attachment 4
Smear Analysis Data Sheet

Survey No. RS&C: 95-130
Date of Survey: 7-31-95
Date Smears Counted: 7-31-95

Counting System: NMC-2658/1750 (a+ or B)
Smears Counted by: P. Llewellyn
System LLD: 530

| Smear No. | Specific Location | Gross (cpm) | BKG (cpm) | Net (cpm) | Eff. | Activity (dpm) |
|-----------|---|--------------------|-----------|------------------|-------|----------------|
| 11 | Air Vent Back Middle <i>See Map</i> | 25 | 21.9 | 0 | 0.024 | 0 |
| 12 | Floor Back Middle in front of H.P. G.C. | 31 | 27.9 | 3.1 | | 130 |
| 13 | Back Desk PC Air Vent | 25 | 21.9 | 0 | | 0 |
| 14 | Back Floor | 32 | | 4.1 | | 171 |
| 15 | Back Desk | 27 | | 0 | | 0 |
| 16 | Back Filing Cabinet | 33 | | 5.1 | | 213 |
| 17 | Back Small Frig. | 24 | | 0 | | 0 |
| 18 | Front P. 40 Boxes Front Side Left | 32 | | 4.1 | | 171 |
| 19 | Front Frig Left Side | 30 | | 2.1 | | 88 |
| 20 | Front Double Sink | 33 | | 5.1 | | 213 |
| 21 | Front Counter Top | 32 | | 4.1 | | 171 |
| 22 | Front Counter Top RT Side | 27 | | 0 | | 0 |
| 23 | Inst. Rack - Front - RI side | 31 | | 3.1 | | 130 |
| 24 | Inst. Rack - Back - RI Side | 30 | | 2.1 | | 88 |
| 25 | Gas Chromatograph Lab Table - H.P. 5870 | 31 | | 3.1 | | 130 |
| 26 | Initial GA Smear Top of H.P. G.C. - Pre wipe down | 26 | | 0 | | 0 |
| 27 | Initial Detector - Pre wipe down | 26.5 | | 0 | | 0 |
| 28 | G-A Post wipe down of detector Exhaust <i>GA</i> | 27.5 ^{PL} | | 1.1 | | 46 |
| 29 | Detector Post wipe down including Exhaust | 31 | | 2.1 | | 130 |
| 30 | O/S G.C. - Side | 30 | | 2.1 | | 88 |
| 31 | I/S G.C. - Heater Temp | 29 | | 1.1 | | 46 |
| 32 | O/S Shipping Box <i>Beta Count</i> | 27 | | 0 | | 0 |
| 33 | I/S Shipping Box <i>Beta Count</i> | 32 | | 4.1 | | 171 |
| 32 | O/S Shipping Box) alpha Count using Bicron # | 568014 | | Nothing detected | | 0 |
| 33 | I/S Shipping Box) " " " " " " | " | | Nothing detected | | 0 |

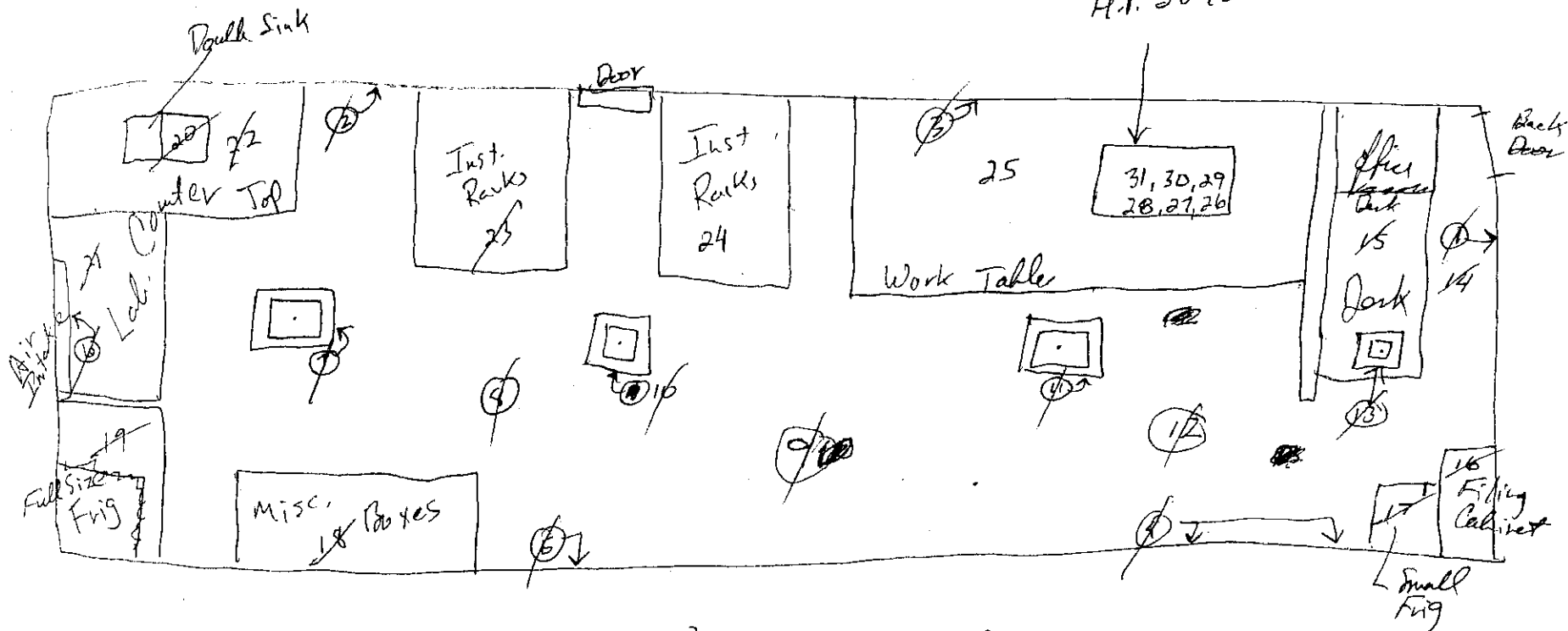
H.P. Tag 19233 B
 Sitt 2413A0 3232
 5321
 2919A22515

Air Quality Lab
 AQL 1022

G.T# 0044993

Si No M2038 Date 8/90

H.P. 5890 G.C.



10x40 ft Trailer

- 26 - GA Initial - Top
- 27 - Detector Initial
- 28 GA Post wipe down - Top
- 29 Detector Post wipe down
- 30 cc. of's - side
- 31 cc. of's
- 32 } of Shipping box
- 33 }

Friskey #
 553796

Hotel Room
 605-231-
 6053
 Chair Affixed

L91 950815 803

August 15, 1995

J. H. Coleman, MPB 1B-M

RESULTS OF SURVEY RS&C 95-130 (NICKEL-63)

Analysis is complete on the subject survey. A nickel-63 analysis was performed using a liquid scintillation technique. Attached are the measured values.

If you have any questions, please call me at Extension 3769.

M. H. Cross

M. H. Cross
Chemist
Radioanalytical Laboratory
WAR 1A-M

MHC:DBC
Attachments
cc (Attachments):
 Phillip Llewellyn, MPB 1B-M
 RIMS, CST 13B-C

Page 1 of 3

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date and Time 4 AUG 93

Inst. Eff. BKG _____

Sampling Information

β - γ _____

RS&C# 95-130

β ✓ #283

Date 8-2-95 (Ref 7-31-95)

α _____

Location Match Air Quality Trailer

Isotope Ni-63

Name Phillip Llewellyn Ph. 3778

Address MP B-1B -M

Page 1 of 3

Smear Number Sampling Location Analysis Total Counts \div Count Time (mins) = Total CPM - Average BKG CPM = Net CPM \div Counter Efficiency = DPM

| Smear Number | Sampling Location | Analysis | Total Counts \div | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|-----------------------------------|----------|---------------------|-------------------|-----------|-----------------|---------|--------------------|-----|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 1 | Wall Back | β | | 10 | | | | | |
| | | α | | | | | | | |
| 2 | Front Side Rt | β | | 10 | | | | | |
| | | α | | | | | | | |
| 3 | Above H.P.G.C. - Back Rt | β | | 10 | | | | | |
| | | α | | | | | | | |
| 4 | Wall Back Lft. | β | | 10 | | | | | |
| | | α | | | | | | | |
| 5 | Wall Front Lft. | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 6 | Front Air Intake | β | | 10 | | | | | |
| | | α | | | | | | | |
| 7 | Air Exhaust Vent # 1 of 4 Front | β | | 10 | | | | | |
| | | α | | | | | | | |
| 8 | Floor Front | β | | 10 | | | | | |
| | | α | | | | | | | |
| 9 | Floor middle. | β | | 10 | | | | | |
| | | α | | | | | | | |
| 10 | Air Exhaust # 2 of 4 Front middle | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 11 | Air Exhaust # 3 of 4 middle back | β | | 10 | | | | | |
| | | α | | | | | | | |
| 12 | Floor Back middle by G.C. | β | | 10 | | | | | |
| | | α | | | | | | | |
| 13 | Air Exhaust # 4 of 4 back | β | | 10 | | | | | |
| | | α | | | | | | | |
| 14 | Back Floor | β | | 10 | | | | | |
| | | α | | | | | | | |
| 15 | Back Desk | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by M.H. Cross

Checked by Charles & Frederick

Calculated by M.H. Cross

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date and Time 4 AUG 95

Inst. Eff. BKG

Sampling Information

β - γ _____

RS&C# 95-130

β ✓ #283

Date 8-2-95 (Ref 7-31-95)

α _____

Location Nash-Air Quality Trailer

Isotope Ni-63

Name Phillip Llewellyn Ph. 3778

Address MPB-1B-M

Page 2 of 3

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|--|----------|--------------|-------------------|-----------|-----------------|---------|--------------------|-----|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 16 | Beck Filing Cabinet | β | | 10 | | | | | |
| | | α | | | | | | | |
| 17 | Beck Small Frig. | β | | 10 | | | | | |
| | | α | | | | | | | |
| 18 | Front Lft. Misc Boxes. | β | | 10 | | | | | |
| | | α | | | | | | | |
| 19 | Front Lft Large Frig. | β | | 10 | | | | | |
| | | α | | | | | | | |
| 20 | Front Rt. Double Sink | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 21 | Front Counter Top - Front | β | | 10 | | | | | |
| | | α | | | | | | | |
| 22 | Front Counter Top - Rt side. | β | | 10 | | | | | |
| | | α | | | | | | | |
| 23 | Inst. Rack. Front - Rt. side. | β | | 10 | | | | | |
| | | α | | | | | | | |
| 24 | Inst. Rack Back - Rt. side | β | | 10 | | | | | |
| | | α | | | | | | | |
| 25 | G.C. Work Table - H.P. 5890 | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 26 | Initial G.A. Top of G.C. - Pre wipe down | β | | 10 | | | | | |
| | | α | | | | | | | |
| 27 | Initial ECD Detector - Pre wipe down | β | | 10 | | | | | |
| | | α | | | | | | | |
| 28 | G.A. Top of G.C. - Post wipe down | β | | 10 | | | | | |
| | | α | | | | | | | |
| 29a | Detector Exhaust - Post wipe down | β | | 10 | | | | | |
| | | α | | | | | | | |
| 29b | Detector Exhaust - Post wipe down | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by M.H. Cross
 Calculated by M.H. Cross

Checked by Charles E. Jradenich

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date and Time 4 AUG 95

Inst. Eff. BKG

Sampling Information

β - γ _____

RS&C# 95-130

β ✓ #283

Date 8-2-95 (Ref 7-31-95)

α _____

Location Wash. Air Quality Trunk

Isotope Ni-63

Name Phillip Levelly Ph. 3778

Address MPB-1B

Page 3 of 3

| Smear Number | Sampling Location | Analysis | Total Counts ÷ | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|---------------------|----------|----------------|-------------------|-----------|-----------------|---------|--------------------|-----|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 30 | 1/5 G.C. Sides | β | | 10 | | | | | |
| | | α | | | | | | | |
| 31 | 1/5 G.C. Heated Box | β | | 10 | | | | | |
| | | α | | | | | | | |
| 32 | 1/5 Shipping Box | β | | 10 | | | | | |
| | | α | | | | | | | |
| 33 | 1/5 Shipping Box | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by M. H. Cross
 Calculated by M. H. Cross

Checked by Charles A. Jurek

| | A | B | C | D | E | |
|----|--------------------|---------------|---------------|-----------------------------|----------------|---|
| 1 | ISOTOPE | NI-63 | | | | |
| 2 | STD DPM | 2227.8 | | DECAY FACTOR | 0.9999 | |
| 3 | STD DATE | 31-Jul-95 | | NET COUNTS | 1656.2000 | |
| 4 | COUNT DATE | 4-Aug-95 | | COR DPM | 2227.6309 | |
| 5 | STD VOL USED | 1 | | EFF | 0.7435 | |
| 6 | STD HALF-LIFE | 100 | | | | |
| 7 | STD CPM | 1668.2 | | | | |
| 8 | BACKGROUND | 12 | | | | |
| 9 | COUNT TIME | 10 | | | | |
| 10 | | | | | | |
| 11 | SURVEY RS&C-95-130 | CPM | DPM | ERR | LLD | |
| 12 | | 1 | 10.6 | -2 | 2 | 7 |
| 13 | | 2 | 13.5 | 2 | 2 | 7 |
| 14 | | 3 | 12.5 | 1 | 2 | 7 |
| 15 | | 4 | 18 | 8 | 2 | 7 |
| 16 | | 5 | 12.7 | 1 | 2 | 7 |
| 17 | | 6 | 10.9 | -1 | 2 | 7 |
| 18 | | 7 | 11.8 | 0 | 2 | 7 |
| 19 | | 8 | 29.3 | 23 | 3 | 7 |
| 20 | | 9 | 70.4 | 79 | 4 | 7 |
| 21 | | 10 | 15.5 | 5 | 2 | 7 |
| 22 | | 11 | 12.2 | 0 | 2 | 7 |
| 23 | | 12 | 18.4 | 9 | 2 | 7 |
| 24 | | 13 | 11.9 | 0 | 2 | 7 |
| 25 | | 14 | 13.9 | 3 | 2 | 7 |
| 26 | | 15 | 21.6 | 13 | 2 | 7 |
| 27 | | 16 | 13.3 | 2 | 2 | 7 |
| 28 | | 17 | 14.2 | 3 | 2 | 7 |
| 29 | | 18 | 11.8 | 0 | 2 | 7 |
| 30 | | 19 | 13.4 | 2 | 2 | 7 |
| 31 | | 20 | 11.9 | 0 | 2 | 7 |
| 32 | | 21 | 15.1 | 4 | 2 | 7 |
| 33 | | 22 | 13.5 | 2 | 2 | 7 |
| 34 | | 23 | 15.4 | 5 | 2 | 7 |
| 35 | | 24 | 48.4 | 49 | 3 | 7 |
| 36 | | 25 | 13.1 | 1 | 2 | 7 |
| 37 | | 26 | 14 | 3 | 2 | 7 |
| 38 | | 27 | 10.7 | -2 | 2 | 7 |
| 39 | | 28 | 12.3 | 0 | 2 | 7 |
| 40 | | 29A | 10.4 | -2 | 2 | 7 |
| 41 | | 29B | 11.6 | -1 | 2 | 7 |
| 42 | | 30 | 12.1 | 0 | 2 | 7 |
| 43 | | 31 | 13.3 | 2 | 2 | 7 |
| 44 | | 32 | 12.5 | 1 | 2 | 7 |
| 45 | | 33 | 11.5 | -1 | 2 | 7 |
| 46 | | | | | | |
| 47 | | CALCULATED BY | M.H.CROSS | <i>M.H. Cross</i> | <i>8/15/95</i> | |
| 48 | | REVIEWED BY | C.E.FREDERICK | <i>Charles E. Frederick</i> | <i>8/15/95</i> | |

ATTACHMENT 2

Item 2.a

TVA Letter to NRC Requesting Release of Burial Site

September 4, 1997

Ms. Dianne Heim
Materials Licensing Section
Nuclear Regulatory Commission
61 Forsyth Street SW, Suite 23T85
Atlanta, Georgia 30303

Dear Ms. Heim:

This is a decommissioning plan for the inactive low-level radioactive material burial site located on the Tennessee Valley Authority reservation in Muscle Shoals, Alabama. Burials of low-level radioactive materials were made at this site from 1966 to 1981 as authorized by the former 10 CFR 20.302 or 20.304. A detailed description of the contents of the burial site was transmitted to the NRC in a letter from TVA dated September 5, 1995. The low-level radioactive materials buried in this site were primarily wastes from fertilizer research and laboratory quality assurance tests.

This burial site contains isotopes with an atomic number greater than 88. Therefore, it fails screening tests 2 and 3 described in the NRC's "Branch Technical Position on Screening Methodology for Assessing Prior Land Burials of Radioactive Waste Authorized Under Former 10 CFR 20.304 and 20.302" (BTP), published in the Federal Register November 4, 1996. Because of the inability to use the screening methodologies described in the BTP, TVA performed a case-by-case evaluation of the burial site as instructed in the BTP. We used the RESRAD for Windows computer code Version 5.75, developed by the Environmental Assessment Division of the Argonne National Laboratory for the Department of Energy. The detailed listing of the radionuclides and their quantities buried in this site reported to NRC in the letter dated September 5, 1995, satisfies Step 1 (Records Review) of the BTP.

Of the 51 different radionuclides that TVA placed in the burial site, 27 are not analyzed by RESRAD. These are primarily short-lived isotopes. A conservative estimate of the maximum possible dose to an individual from these remaining materials is shown in Appendix A of the enclosed report. The analysis indicates that the 27 radionuclides would contribute much less than a mrem to any member of the public.

Ms. Dianne Heim
Page 2
September 4, 1997

The enclosed report describes the input parameters used for the RESRAD analysis and the hydrology and geology of the site. The report also includes the results of the computer analysis. Also attached is a report entitled NFERC Regional Groundwater Investigation, an extensive description of the hydrology and geology of the Muscle Shoals reservation. (NFERC stands for National Fertilizer and Environmental Research Center, a previous name for the Muscle Shoals reservation where this inactive burial site is located.)

According to computer analysis, the maximally exposed individual (MEI) would have received a total effective dose equivalent (TEDE) of 0.55 mrem during the year 1983. However, 92% of that calculated dose was from the drinking water pathway which assumes that drinking water is obtained from a well located in the center of or downgradient of the burial site. No wells are now nor have been located within 1,000 feet of the burial site, so the hypothetical dose was never delivered to any individual. Also, groundwater flow at the burial site is vertically downward. The maximum dose during 1997 is calculated to be only 2.5 E-6 mrem. RESRAD does not indicate any significant increase in this very low-dose rate at any time in the future. The low dose to the MEI is below the limits of both the BTP (100 mrem/yr) and 10 CRF 20, Subpart E (25 mrem/yr) published in the Federal Register on July 21, 1997.

ALARA considerations suggest that the removal of any remaining radioactive materials from the burial site should not be conducted. Such removal would be very expensive and would require considerable excavation to a depth of over 10 feet. The excavation would expose personnel to conventional safety hazards from the use of heavy equipment, excavation and transportation. These safety hazards to personnel removing and transporting the residual remaining material would probably exceed the minor hypothetical radiation risk to the public from the remaining radioactive materials.

Because of the low dose to the maximally exposed member of the public, TVA requests unrestricted access for this burial site.

If you have any questions regarding this matter, please contact Ms. Lenora Sheffey at (205) 386-3051.

David W. Sorrelle, Manager
Environmental Compliance
and Operations Support
Environmental Research Center

DWS:LCJ:HGG
Enclosures

cc: W. C. McArthur, BR 5D-C
Files, ERC, CEB 1B-M

AN ASSESSMENT OF THE ENVIRONMENTAL EFFECTS OF THE

**INACTIVE LOW-LEVEL RADIOACTIVE MATERIAL BURIAL
SITE**

LOCATED ON THE MUSCLE SHOALS RESERVATION

MUSCLE SHOALS, ALABAMA

INTRODUCTION

From 1966 to 1981, the Tennessee Valley Authority (TVA) buried small quantities of low-level radioactive materials at a site on the TVA reservation located in Muscle Shoals, Alabama. These materials were wastes from fertilizer research and quality control programs in laboratories, primarily radioanalytical laboratories. Burials were authorized by the former 10 CFR 20.302 or 20.304. Regulations were terminated by the U.S. Nuclear Regulatory Commission (NRC) in January 1981. At that time, TVA ceased burials of low-level radioactive materials at the site.

Recently enacted NRC regulations require that the environmental impacts of this site be evaluated and a decommissioning plan provided. This report provides that evaluation and also describes the hydrology and geology of the region and of the burial site. The primary tool for evaluating the environmental impact of the site was the RESRAD computer code. This code, developed at Argonne National Laboratory, evaluates the radiation dose of the buried material to members of the public from the most conceivable environmental pathways.

A total of 51 different radionuclides were buried in this site. RESRAD was used to analyze the impact of 27 of them. However, 24 of the radionuclides that were buried in this site are not included in RESRAD, which are primarily short-lived radionuclides. A conservative estimate of the impact of these isotopes is given in Appendix A. Appendix B is a listing of the 27 isotopes that are analyzed by RESRAD. Appendix C is the printed output from RESRAD.

DESCRIPTION OF REGIONAL GEOLOGY:

The TVA reservation in Muscle Shoals, Alabama, is located in the Interior Low Plateau, a karst plateau lying on the southern flank of the Nashville Dome in northern Alabama. Erosion over a long period of time has stripped off the Pennsylvanian and younger Mississippian clastic rocks to expose Mississippian limestone formations throughout much of Tennessee, Alabama, and Kentucky. The reservation lies on the Mississippian limestone rocks which have a regional south-southwestern dip of 25 to 30 feet per mile.

The most relevant stratigraphic units underlying the inactive burial site are the Chattanooga Shale, the Fort Payne Chert, and the Tuscumbia Limestone. The Chattanooga Shale is an extensive regional marker and unconformably overlies the undifferentiated Ordovician and Silurian rocks. It does not crop out in the area, but well drilling suggests that it underlies the entire region with a thickness of 5 to 37 feet. It ranges from 250 to 450 feet below the surface in the reservation area and probably serves as a hydraulic barrier to groundwater. The Chattanooga Shale is overlain by the Mississippian Fort Payne Chert in the northern Alabama region.

The Fort Payne Chert underlies all of the area and crops out along the southern bluffs of the Tennessee River. It is a distinctive lithologic marker at the base of the Mississippian system of northern Alabama. The thickness of the Fort Payne Chert in the subsurface ranges from 162 to 210 feet. The Fort Payne Chert is conformably overlain by the Tuscumbia Limestone; the contact is gradational. However, in the weathered outcrops the nodular thin beds of the Fort Payne Chert contrast with massive limestone beds of Tuscumbia Limestone along the southern Bluffs of the Tennessee River.

The Tusculmbia Limestone underlies all of the region and is the uppermost bedrock unit in the reservation area. Exposures are common along the Tennessee River and along valleys of the larger tributaries. The thickness of the Tusculmbia Limestone ranges up to 200 feet; however, the formation has been extensively weathered in the area and its thickness remains as little as 50 feet in places. Throughout most of the area the Tusculmbia Limestone is overlain by a clayey overburden.

DESCRIPTION OR REGIONAL HYDROLOGY:

The north Alabama area has a mild, humid climate. Average precipitation is almost 52 inches per year (1.32 m/yr) with average monthly highs of 6.2 inches and lows of 2.8 inches in March and September, respectively. Precipitation is the source of all natural recharge into the groundwater system. Groundwater recharge occurs either very slowly through soil infiltration, or very rapidly by direct entry through storm-drainage wells or natural openings such as sinkholes. Recharge also occurs from surface streams and impoundments as well as other sources such as leaky sewer lines. Average recharge for the regional area has been estimated to be 13 inches per year. Twenty or more stormwater drainage wells have been constructed in the region and have been used for flood alleviation in the area during the last 35 years.

Although the area surrounding the ERC is flood prone due to inadequate drainage, the burial site is not located in a flood prone area. The Tusculmbia-Fort Payne aquifer system underlying the area is the most important water-bearing unit in the region because it is the source of water for both wells and springs in the area. Tusculmbia (Big) Spring is the closest public water supply. The spring issues from the Tusculmbia-Fort Payne aquifer system and is located about three miles southwest of the burial site. This spring serves as the drinking water supply for the city of Tusculmbia. The city of Sheffield takes its drinking water supply from the Tennessee River several miles downstream from the burial site. There are no known water supply wells within 1,000 feet of the burial site.

HYDROLOGY AND GEOLOGY OF THE BURIAL SITE:

The unsaturated soil layer varies in thickness throughout the year. A representative value of 50 feet (15.25 m), based on studies of near-by wells, was used for this analysis. The unsaturated layer and an additional 30-foot thick layer are composed of a residual silty, sandy, clay soil overburden. Under that layer lies a 200-foot thick layer of karstic cherty limestone. Groundwater flow is nearly vertically downward for a depth of approximately 280 feet where an anisotropic and heterogeneous karst aquifer is encountered. Dye tracer tests in the area indicate that this aquifer carries the majority of all groundwater horizontally to either the Tennessee River or to Tusculmbia Spring. Rapid solute migration accompanied by high dilution occurs in this bedrock. Dye velocities of 100 ft/day are commonly reported. Based on borehole flowmeter data, the majority of groundwater flow occurs near the overburden-bedrock contact across a 3-foot to 5-foot vertical interval. The transmissivity of this epikarst zone varies more than 4 orders of magnitude and may be greater than 500 ft²/day.

This means that groundwater under the burial site flows slowly vertically downward for about 280 feet where it then flows rapidly horizontally and exits either in the Tennessee River (average flow is 32,800,000,000 gallons per day) where it is extensively diluted or to Tusculmbia Spring. Tusculmbia Spring has an average flow of 42,000,000 gallons per day with high seasonal variation.

Any radioactive materials reaching this spring from the burial site would be extensively diluted by this high flow and would present no hazard.

Dye studies indicate that material may flow either to the river or to the spring. To be conservative, we have assumed that groundwater is to Tuscumbia Spring which has an estimated recharge area of 84 square miles.

HYDROLOGICAL, GEOLOGICAL, AND OTHER INPUTS INTO RESRAD:

The following site-specific inputs to the RESRAD code were used:

| | |
|---|---|
| Area of the contaminated zone: | 308.5 m ² (3,319 ft ²) |
| Thickness of the Contaminated Zone: | 1.83 m (6 ft) |
| Length parallel to aquifer flow: | 17.6 m (square root of 308.5 m ²) |
| Basic radiation dose limit: | 10 mrem |
| Time since placement of material: | 0 yr. |
| Times for calculations: | 1, 5, 16, 40, 100, 300, 1000 yr |
| Cover depth: | 1.22 m (4 ft) |
| Density of all soil and other materials: | 1.5 g/cm ³ |
| Contaminated zone total porosity: | 0.4 |
| Contaminated zone effective porosity: | 0.06 |
| Contaminated zone hydraulic conductivity: | 0.3 m/yr |
| Contaminated zone b parameter: | 7.75 |
| Precipitation: | 1.32 m |
| Watershed area for nearby stream or pond: | 2.18 E+8 m ² (84 sq mi) |
| Saturated zone total porosity: | 0.3 |
| Saturated zone effective porosity: | 0.14 |
| Saturated zone hydraulic conductivity: | 53,400 m/yr |
| Saturated zone hydraulic gradient: | 0.003 |
| Water table drop rate: | 0.0 m/yr |
| Unsaturated layer thickness | 15.25 m (50 ft) |
| Unsaturated layer effective porosity | 0.06 |
| Unsaturated layer b parameter | 10.4 |
| Unsaturated layer hydraulic conductivity | 0.3 m/yr |

The initial concentrations of the 27 radionuclides in the burial site that were analyzed by RESRAD are listed in Appendix B.

Initial concentrations of radionuclides in groundwater was set to zero.

Default values were used for dose conversion factors, food transfer factors, bioaccumulation factors, distribution factors, dose shape factors, food consumption factors, contamination factors, all crop and livestock factors, all C-12 factors, and all building factors. The radon pathway was suppressed due to the small quantities of radon parents in the burial site.

The initial placement of all material was conservatively assumed to be 1981, the date the burial site was closed. This ignores the radiological decay that occurred from the time of actual burial to 1981. The date of 1981 corresponds to the year zero in the RESRAD run.

RESULTS OF THE RESRAD ANALYSIS:

| Year Number | Year | Dose Rate (mrem/yr) |
|-------------|------|---------------------|
| 0 | 1981 | 8.5 E-7 |
| 1 | 1982 | 7.5 E-7 |
| 5 | 1986 | 2.9 E-2 |
| 16 | 1997 | 2.5 E-6 |
| 40 | 2021 | 3.1 E-6 |
| 100 | 2081 | 2.9 E-7 |
| 300 | 2281 | 8.3 E-4 |
| 1000 | 2981 | 5.8 E-4 |

The maximum dose rate occurred at $t = 1.6$ years (1983) and was calculated to be 0.55 mrem/year. However, 92% of that calculated dose was from the drinking water pathway which assumes that a well was located in the center of or immediately downgradient of the burial site. No wells have been or are now located within 1,000 feet of the burial site and the flow of groundwater at the burial site is nearly vertically downward. Thus, this dose could not have been delivered.

RESRAD does not model the horizontal flow, with its rapid dilution, that occurs in the epikarst bedrock layer at an approximate depth of 280 feet. Because of the dilution that occurs in this layer and because of the additional dilution that occurs at the Tennessee River or at Tusculumbia Spring, we believe that no significant dose can result from any groundwater pathway. RESRAD's conservative modeling of the groundwater pathways supports this view.

RESRAD also indicates that the direct radiation and the various ingestion pathways do not deliver any significant doses.

APPENDIX A

Analysis of Buried Radionuclides Not Included in RESRAD

Of the 51 different radionuclides that were placed in TVA's inactive low-level burial site, 24 are not included in RESRAD. Thus, the computer model cannot estimate the dose to a member of the public from those 24 radionuclides. This appendix estimates the maximum possible dose to an individual that could result from the ingestion of all this material that remains in the burial site in 1997.

The 24 radionuclides are listed in Table A-1, with most of these radionuclides having rather short half-lives. Table A-1 lists the half-life of these isotopes and also the total activity that had been buried when the site was closed in 1981. The total activities listed in Table A-1 were taken from Appendices 2 and 3 of the report on the burial site submitted to the NRC in TVA's letter dated September 5, 1995. These total activities were assumed to have been buried in 1981, whereas they were actually buried at various times over a period of 15 years from 1966 to 1988 and had decayed to quantities lower than the total listed. These "total" activities were decayed for 16 years from 1981 to 1997. Table A-1 also lists the number of half-lives for each isotope for this 16-year period. With the exceptions of Ba-133 and Po-208, all radionuclides experienced from about 40 to several hundred half-lives and thus decayed to insignificant levels.

The ingestion Annual Limit on Intake (ALI) for each radionuclide is also listed in Table A-1. These ALIs were taken from Title 10 of the Code of Federal Regulations, Part 10, Appendix B, Table 1, Column 1 and from Federal Guidance Report 11 (EPA 1988). An ingestion ALI for Po-208 was not listed in either source. This ALI was conservatively estimated to be 2 μCi by a process described below.

In order to conservatively estimate the maximum environmental effect of the radionuclides remaining in the burial site and not included in RESRAD, we assume that all of this radioactive material that remained in 1997 was hypothetically gathered into a single small volume and was ingested by reference man in a single intake. The inhalation pathway is not considered credible for this hypothetical intake.

We now estimate the ingestion ALI for Po-208. The ingestion ALI for Po-208 is not listed in such standard references as Title 10 of the Code of Federal Regulations or Federal Guidance Report 10. For the purposes of this report, the ingestion ALI for Po-208 is estimated by considering the ALI for Po-210 and the properties of the radiations from Po-210 and Po-208. The ingestion ALI for Po-210 is 3 μCi (10CFR20). Po-210 is an alpha emitter with a maximum alpha energy of 5.3 MeV and a half-life of 138 days. Po-208 is an alpha emitter with a maximum energy of 5.1 MeV and a half-life of 2.9 years. All isotopes of polonium follow the same metabolic pathways in the body and have the same biological excretion rates from the same metabolic compartments. The biological half-lives for all isotopes of polonium in all systemic compartments is 50 days. Thus, the effective half-life for Po-210 in these compartments is 36.7 days and the effective half-life for Po-208 is 50 days. This means that Po-208 resides in systemic compartments about 33% longer, but has an alpha particle that is about 4% lower in energy. Thus, comparing unit intakes, Po-208 will be about 33% more hazardous than Po-210. Based on the ingestion ALI of 3 μCi for Po-210, we assign a value of 2 μCi to the ingestion ALI for Po-208.

Ingestion of one ALI results in an committed effective dose equivalent of 5,000 mrem. The hypothetical dose from the ingestion of each radionuclide in the burial site in 1997 was estimated by ratio. For example, 0.057 μCi of Ba-133 remains in the burial site and the ALI for this isotope is 2,000 μCi . The dose from the ingestion of 0.057 μCi of Ba-133 is $(5,000 \text{ mrem}) * (0.057 \mu\text{Ci}) / (2,000 \mu\text{Ci}) = 1.4 \text{ mrem}$. As shown in Table A-1, only one other radionuclide had a calculated dose greater than 0.000 mrem. The estimated dose from the ingestion of the entire quantity of Po-208 remaining in the burial site is only 0.4 mrem. These doses are listed in Table A-1.

The hypothetical dose that would result from the ingestion of the entire quantity of all of these 24 radionuclides would be less than 2 mrem. It is important to notice that this is an extremely conservative overestimate of any actual dose that could result from these radioactive materials. The actual dose that a person may actually receive from these materials is expected to be several orders of magnitude lower than this value of 2 mrem, primarily from dilution in environmental media and the isolation of the materials in the environment.

APPENDIX B

Radionuclide Inputs into RESRAD

Of the 51 different radionuclides that were placed in the burial site, the environmental impact of 27 of them is analyzed by RESRAD. As input, RESRAD requires the activity per unit mass (pCi/g) for each radionuclide, averaged over the volume of soil in which the radioactive material was buried.

The material was buried in 40 holes, 2 feet in diameter, from 4 to 10 feet deep. Thus, the material is in a layer 6 feet (1.83m) thick. The area covered by the 40 holes, including the spaces between the holes, is 308.5 sq m. Thus, the volume occupied by the material is $5.65 \text{ E}+8 \text{ cm}^3$. The density of the soil is 1.5 g/cm^3 , thus, the mass of the soil in which the material is buried is $8.47 \text{ E}+8$ grams.

The activity of the 27 radionuclides that are analyzed by RESRAD as of August 1995 was taken from the report on the burial site submitted to the NRC in TVA's letter dated September 5, 1995. These 27 radionuclides are listed in Table B-1, along with their half-lives and their activities as of 1995.

RESRAD was run using 1981, the date the burial site was closed, as the starting time. Thus, the activities listed in Table B-1 were decay-corrected from 1995 to 1981. The decay factor for this 14-year period is greater than unity because we are calculating the activity 14 years in the past based on a known activity in 1995. The decay factors for each of the 27 radionuclides are also listed in Table B-1.

The left column in Table B-1 is the activity per unit mass in the burial site in 1981 and was used as input data for the RESRAD computer code. These activities per unit mass in 1981 were calculated by multiplying the activity in 1995 (pCi) by the decay factor and dividing by the mass of soil in which the material was buried.

Natural uranium was listed as being in the burial site in TVA's letter to the NRC dated September 5, 1995. That activity of U-natural was added to that of U-235 and U-238, which is proportional to the activity fraction of these two isotopes in natural uranium.

APPENDIX C

RESRAD Output

Table A1

Radionuclides in the Burial Site That are not Included in RESRAD

| | Isotope | Half Life (yr) | Total Activity Buried (μCi) | Number of Half lives 1981 to 1997 (16 years) | Total Activity in 1997 (μCi) | Ingestion ALI (μCi) | Ingestion Dose (mrem) |
|----|---------|-------------------|---|---|--|--|-----------------------------|
| 1 | Be-7 | 0.146 | 0.767 | 110 | 7.9E-34 | 4.E+04 | 0.000 |
| 2 | P-32 | 0.039 | 41500 | 410 | 1.3E-119 | 6.E+02 | 0.000 |
| 3 | P-33 | 0.070 | 260 | 229 | 4.1E-67 | 6.E+03 | 0.000 |
| 4 | S-35 | 0.239 | 42510 | 67 | 3.0E-16 | 6.E+03 | 0.000 |
| 5 | Ca-45 | 0.446 | 0.030 | 36 | 4.8E-13 | 2.E+03 | 0.000 |
| 6 | Cr-51 | 0.076 | 2.180 | 211 | 9.2E-64 | 4.E+04 | 0.000 |
| 7 | Co-58 | 0.194 | 1.420 | 82 | 2.1E-25 | 1.E+03 | 0.000 |
| 8 | Fe-59 | 0.122 | 1.480 | 131 | 4.9E-40 | 8.E+02 | 0.000 |
| 9 | Se-75 | 0.328 | 0.850 | 49 | 1.8E-15 | 5.E+02 | 0.000 |
| 10 | Sr-85 | 0.177 | 1.090 | 90 | 6.7E-28 | 3.E+03 | 0.000 |
| 11 | Sr-89 | 0.138 | 1.130 | 116 | 1.4E-35 | 5.E+02 | 0.000 |
| 12 | Y-88 | 0.292 | 7.730 | 55 | 2.5E-16 | 1.E+03 | 0.000 |
| 13 | Zr-95 | 0.175 | 4.130 | 91 | 1.2E-27 | 1.E+03 | 0.000 |
| 14 | Mo-99 | 0.007 | 0.020 | 2286 | 0.0E+00 | 1.E+03 | 0.000 |
| 15 | Ru-103 | 0.107 | 0.010 | 150 | 9.7E-48 | 2.E+03 | 0.000 |
| 16 | Sn-113 | 0.315 | 1.540 | 51 | 7.9E-16 | 2.E+03 | 0.000 |
| 17 | I-131 | 0.022 | 9.860 | 727 | 1.2E-218 | 3.E+01 | 0.000 |
| 18 | Ce-139 | 0.377 | 0.800 | 42 | 1.3E-13 | 5.E+03 | 0.000 |
| 19 | Ce-141 | 0.089 | 0.048 | 180 | 3.7E-56 | 2.E+03 | 0.000 |
| 20 | Ba-133 | 10.740 | 1.600 | 1.5 | 5.7E-01 | 2.E+03 | 1.424 |
| 21 | Ba-140 | 0.035 | 0.660 | 457 | 1.6E-138 | 5.E+02 | 0.000 |
| 22 | Hg-203 | 0.128 | 2.670 | 125 | 6.3E-38 | 5.E+02 | 0.000 |
| 23 | Po-208 | 2.896 | 0.0067 | 6 | 1.5E-04 | 2.E+00 | 0.364 |
| 24 | Po-210 | 0.379 | 0.0023 | 42 | 4.6E-16 | 3.E+00 | 0.000 |
| | | | | | | Sum = | 1.79 |

Table B 1

Concentration of Radionuclides in Burial site in 1981
For Radionuclides in RESRAD

| | | Activity in 1995 (μCi) | Activity in 1995 (pCi) | Half Life (yr) | Decay Factor for -14 years | Act/Mass of Soil in 1981 (pCi/g) |
|----|---------|---|---|-------------------|----------------------------------|---|
| 1 | Ag-110m | 2.2E-07 | 2.2E-01 | 0.684 | 1.4E+06 | 3.76E-04 |
| 2 | Am-241 | 1.4E+01 | 1.4E+07 | 432.2 | 1.0E+00 | 1.73E-02 |
| 3 | Au-195 | 8.0E-13 | 8.0E-07 | 0.501 | 2.6E+08 | 2.43E-07 |
| 4 | Bi-207 | 8.4E+00 | 8.4E+06 | 38 | 1.3E+00 | 1.29E-02 |
| 5 | C-14 | 1.6E+04 | 1.6E+10 | 5730 | 1.0E+00 | 1.93E+01 |
| 6 | Cd-109 | 1.0E-01 | 1.0E+05 | 1.27 | 2.1E+03 | 2.45E-01 |
| 7 | Ce-144 | 6.0E-06 | 6.0E+00 | 0.778 | 2.6E+05 | 1.85E-03 |
| 8 | Cl-36 | 1.2E+00 | 1.2E+06 | 3.01E+05 | 1.0E+00 | 1.44E-03 |
| 9 | Co-57 | 1.0E-05 | 1.0E+01 | 0.742 | 4.8E+05 | 5.63E-03 |
| 10 | Co-60 | 1.9E+01 | 1.9E+07 | 5.27 | 6.3E+00 | 1.39E-01 |
| 11 | Cs-134 | 9.7E-02 | 9.7E+04 | 2.062 | 1.1E+02 | 1.27E-02 |
| 12 | Cs-137 | 3.9E+01 | 3.9E+07 | 30 | 1.4E+00 | 6.40E-02 |
| 13 | Eu-152 | 4.1E+01 | 4.1E+07 | 13.33 | 2.1E+00 | 9.98E-02 |
| 14 | H-3 | 3.9E+01 | 3.9E+07 | 12.35 | 2.2E+00 | 1.01E-01 |
| 15 | K-40 | 3.1E-01 | 3.1E+05 | 1.28E+09 | 1.0E+00 | 3.64E-04 |
| 16 | Mn-54 | 1.0E-05 | 1.0E+01 | 0.856 | 8.4E+04 | 9.88E-04 |
| 17 | Na-22 | 7.4E-05 | 7.4E+01 | 2.602 | 4.2E+01 | 3.64E-06 |
| 18 | Pb-210 | 7.5E-01 | 7.5E+05 | 22.3 | 1.5E+00 | 1.36E-03 |
| 19 | Ra-226 | 1.9E+00 | 1.9E+06 | 1600 | 1.0E+00 | 2.25E-03 |
| 20 | Ra-228 | 5.2E-05 | 5.2E+01 | 5.75 | 5.4E+00 | 3.32E-07 |
| 21 | Ru-106 | 2.00E-04 | 2.0E+02 | 1.01 | 1.5E+04 | 3.51E-03 |
| 22 | Sb-125 | 3.7E-01 | 3.7E+05 | 2.77 | 3.3E+01 | 1.47E-02 |
| 23 | Sr-90 | 7.0E+01 | 7.0E+07 | 29.12 | 1.4E+00 | 1.15E-01 |
| 24 | Th-230 | 7.8E-01 | 7.8E+05 | 7.70E+04 | 1.0E+00 | 9.21E-04 |
| 25 | U-235 | 3.4E-03 | 3.4E+03 | 7.00E+08 | 1.0E+00 | 4.06E-06 |
| 26 | U-238 | 4.3E-03 | 4.3E+03 | 4.47E+09 | 1.0E+00 | 5.02E-06 |
| 27 | Zn-65 | 5.0E-06 | 5.0E+00 | 0.668 | 2.0E+06 | 1.20E-02 |

1.5 = Density of soil (g/ml)

308.5 = Surface area of burial site (sq m)

1.83 = Thickness of pits (m)

5.65E+02 = Volume of burial site (cu m)

5.65E+08 = Volume of burial site (cu cm)

8.47E+08 = Mass of soil (g)

ATTACHMENT 3

Item 2.a Radionuclide Content of Burial Site

Activity of Long Lived Radioisotopes as of August 1995 (micro Ci)

| Isotope: | H-3 | C-14 | Na-22 | Cl-36 | K-40 | Co-60 | |
|--------------------|-------------|----------|----------|----------|----------|----------|--------|
| Half Life (yr.): | 12.35 | 5730 | 2.602 | 3.01E+05 | 1.28E+09 | 5.271 | |
| Hole No. | Date Closed | | | | | | |
| 1 | April 1966 | 0 | 0 | 0 | 0 | 0 | |
| 2 | Feb. 1967 | 0 | 0 | 0 | 0 | 0 | |
| 3 | Oct. 1967 | 0 | 0 | 0 | 0 | 0 | |
| 4 | Oct. 1967 | 0 | 0 | 0 | 0 | 0 | |
| 5 | May 1968 | 0 | 0 | 0 | 0 | 0 | |
| 6 | Oct. 1968 | 0 | 0 | 0 | 0 | 0.000765 | |
| 7 | Mar. 1969 | 0 | 0 | 0 | 0 | 0 | |
| 8 | Aug. 1969 | 0 | 0 | 0 | 0 | 0 | |
| 9 | Feb. 1970 | 0 | 0 | 0 | 0 | 0.00106 | |
| 10 | Feb. 1970 | 0.024 | 0.1 | 0 | 0 | 0.000707 | |
| 11 | Aug. 1970 | 0.0247 | 0.1 | 0 | 0 | 0.00755 | |
| 12 | Feb. 1971 | 0.0508 | 0.1 | 0 | 0 | 0.0806 | |
| 13 | Nov. 1971 | 0 | 0.2 | 0 | 0 | 1.11 | |
| 14 | April 1972 | 0.0572 | 0.1 | 0 | 0 | 0.951 | |
| 15 | Feb. 1973 | 0.0568 | 5000 | 0 | 0 | 0.262 | |
| 16 | April 1974 | 0.0607 | 0 | 0 | 0 | 0.00367 | |
| 17 | July 1975 | 0.0651 | 10000 | 0 | 0 | 0.00144 | |
| 18 | Jan. 1976 | 0 | 0 | 0 | 0 | 0 | |
| 19 | Jan. 1976 | 0.0067 | 0 | 0 | 0 | 0.00231 | |
| 20 | Aug. 1976 | 0 | 0 | 0 | 0 | 0 | |
| 21 | Aug. 1976 | 0.344 | 0 | 0 | 0 | 2.47 | |
| 22 | Oct. 1976 | 0 | 0 | 0 | 0 | 0 | |
| 23 | Oct. 1976 | 0.00349 | 0 | 0 | 0 | 0.017 | |
| 24 | Feb. 1977 | 0.00356 | 0.1 | 0 | 0.01 | 0.000888 | |
| 25 | Aug. 1977 | 0.331 | 1000 | 0 | 0.01 | 0.0422 | |
| 26 | Dec. 1977 | 16.5 | 0.001 | 0 | 0 | 0.008 | 0.0516 |
| 27 | May 1978 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | March 1978 | 0.189 | 0 | 0 | 0 | 0 | 0.0144 |
| 29 | June 1978 | 0.383 | 0 | 0 | 1.2 | 0 | 0.127 |
| 30 | Oct. 1978 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | Jan. 1979 | 1.58 | 86 | 0 | 0 | 0 | 0.491 |
| 32 | Nov. 1978 | 0.000392 | 0 | 0 | 0 | 0 | 0.702 |
| 33 | Jan. 1979 | 0.000396 | 0 | 0 | 0 | 0 | 0.0891 |
| 34 | Aug. 1979 | 2.31 | 14.1 | 0 | 0 | 0.3 | 2.05 |
| 35 | Nov. 1979 | 0.125 | 0 | 0 | 0 | 0 | 0.319 |
| 36 | Nov. 1979 | 0 | 0 | 0 | 0 | 0 | 0 |
| 37 | June 1980 | 16.8 | 100.08 | 0 | 0 | 0 | 0.307 |
| 38 | June 1980 | 0.0858 | 0 | 0 | 0 | 0 | 0.0044 |
| 39 | Jan. 1981 | 0.0137 | 100.4 | 0 | 0 | 0 | 8.97 |
| 40 | Jan. 1981 | 0.0239 | 0 | 0.000074 | 0 | 0.0001 | 0.542 |
| Totals by Isotope: | 39.03924 | 16301.28 | 0.000074 | 1.22 | 0.3081 | 18.61869 | |

Activity of Long Lived Radioisotopes as of August 1995 (micro Ci), Continued

| Isotope: Half Life (yr.): | Sr-90 29.12 | Sb-125 2.77 | Ba-133 10.74 | Cs-134 2.062 | Cs-137 30 | Eu-152 13.33 |
|------------------------------|----------------|----------------|-----------------|-----------------|--------------|-----------------|
| Hole No. | | | | | | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0.0658 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0.00546 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0.0546 | 0 | 0 | 0 | 0.0111 | 0 |
| 11 | 0.0553 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0.224 | 0 | 0 | 0 | 0.0114 | 0 |
| 13 | 0.342 | 0 | 0 | 0 | 0.232 | 0 |
| 14 | 0.236 | 0 | 0 | 0.000041 | 0.123 | 0 |
| 15 | 0.0117 | 0 | 0 | 0.000053 | 0.119 | 0 |
| 16 | 0.0603 | 0 | 0 | 0 | 0.0918 | 0 |
| 17 | 0.0621 | 0 | 0 | 0.00012 | 0.063 | 0 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0.0189 | 0 | 0.00284 | 0.00005 | 0.0191 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 3.22 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0.00732 | 0.00648 | 0 |
| 24 | 0 | 0 | 0 | 0.00002 | 6.6 | 0.768 |
| 25 | 0.0195 | 0 | 0 | 0.00262 | 1.056 | 9.81 |
| 26 | 0.0658 | 0 | 0 | 0.00006 | 0.554 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 5.9E-06 | 0.0415 | 0 |
| 29 | 0.000666 | 0 | 0 | 0.0468 | 2.7 | 20.6 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 0.00675 | 0 | 0 | 0.000039 | 1.5 | 0 |
| 32 | 0.000673 | 0 | 0 | 0 | 3.51 | 0 |
| 33 | 0.000675 | 0 | 0 | 0 | 0.13 | 0 |
| 34 | 3.3 | 0 | 0 | 0.0353 | 13.6 | 0 |
| 35 | 0 | 0 | 0 | 0.0017 | 0.195 | 0 |
| 36 | 0 | 0 | 0 | 0 | 0 | 0 |
| 37 | 0.00307 | 0 | 0.567 | 0.00261 | 0.882 | 9.67 |
| 38 | 65.1 | 0 | 0 | 0 | 0.0212 | 0 |
| 39 | 0.000708 | 0 | 0 | 0 | 3.3 | 0 |
| 40 | 0.0029 | 0.374 | 0.0353 | 0.000489 | 1.16 | 0 |
| Totals by Isotope: | 69.5711 | 0.374 | 0.60514 | 0.097228 | 39.21238 | 40.848 |

Activity of Long Lived Radioisotopes as of August 1995 (micro Ci), Continued

| Isotope: Half Life (yr.): | Bi-207 38 | Po-208 2.896 | Pb-210 22.3 | Ra-226 1600 | Ra-228 5.75 | Th-230 7.7E+04 |
|------------------------------|--------------|-----------------|----------------|----------------|----------------|-------------------|
| Hole No. | | | | | | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0.1 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0.01 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0.01 | 0 | 0 |
| 25 | 0 | 0 | 0.743 | 0.002 | 0 | 0.002 |
| 26 | 0 | 0.000022 | 0 | 0.0016 | 0 | 0.02 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0.000016 | 0 | 0.005 | 0 | 0.01 |
| 29 | 0 | 0.000017 | 0 | 0.005 | 0 | 0.01 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 0 | 0 | 0 | 0.1 | 0 | 0.1 |
| 32 | 0 | 0 | 0 | 0.075 | 0 | 0.075 |
| 33 | 0 | 0 | 0 | 1.08 | 0 | 0.08 |
| 34 | 0 | 2.4E-06 | 0 | 0.16 | 0 | 0.16 |
| 35 | 0 | 0 | 0 | 0.08 | 0 | 0.08 |
| 36 | 0 | 0 | 0 | 0 | 0 | 0 |
| 37 | 0 | 0 | 0 | 0.17 | 0 | 0.16 |
| 38 | 0 | 0 | 0 | 0.08 | 0 | 0.08 |
| 39 | 0 | 0.000034 | 0.00127 | 0.002 | 0 | 0.002 |
| 40 | 8.44 | 0.000031 | 0.000637 | 0.011 | 0.000052 | 0.001 |
| Totals by Isotope: | 8.44 | 0.000122 | 0.744907 | 1.8916 | 0.000052 | 0.78 |

Activity of Long Lived Radioisotopes as of August 1995 (micro Ci), Continued

| Isotope: Half Life (yr.): | U-235 7.0E+08 | U-238 4.468E+09 | U-Nat. 4.468E+09 | Am-241 432.2 | Total per Hole (micro Ci) |
|------------------------------|------------------|--------------------|---------------------|-----------------|---------------------------------|
| Hole No. | | | | | |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0.066565 |
| 7 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0.00652 |
| 10 | 0 | 0 | 0 | 0 | 0.190407 |
| 11 | 0 | 0 | 0 | 0 | 0.18755 |
| 12 | 0 | 0 | 0 | 0 | 0.4668 |
| 13 | 0 | 0 | 0 | 0 | 1.884 |
| 14 | 0 | 0 | 0 | 0 | 1.467241 |
| 15 | 0 | 0 | 0 | 0 | 5000.45 |
| 16 | 0 | 0 | 0 | 0 | 0.31647 |
| 17 | 0 | 0 | 0 | 0 | 10000.19 |
| 18 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 0.0499 |
| 20 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 1 | 0 | 1 | 8.044 |
| 22 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0.03429 |
| 24 | 0 | 0 | 0 | 0.01 | 7.502468 |
| 25 | 0 | 0 | 0.002 | 0 | 1012.02 |
| 26 | 0 | 0 | 0 | 0 | 17.20208 |
| 27 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 0.259922 |
| 29 | 0 | 0 | 0 | 0 | 25.07248 |
| 30 | 0 | 0 | 0 | 0 | 0 |
| 31 | 0.1 | 0 | 0 | 0 | 89.87779 |
| 32 | 0 | 0 | 0.075 | 0.003 | 4.441065 |
| 33 | 0 | 0.081 | 0 | 0 | 1.461171 |
| 34 | 0 | 0 | 3.18 | 10.001 | 49.1963 |
| 35 | 0 | 0 | 0.08 | 0 | 0.8807 |
| 36 | 0 | 0 | 0 | 0 | 0 |
| 37 | 0 | 0.00005 | 0.16 | 0.004 | 128.8057 |
| 38 | 0 | 0 | 0.08 | 0 | 65.4514 |
| 39 | 0.0045 | 2.388 | 0.002 | 0.009 | 115.0932 |
| 40 | 0 | 0 | 0.0022 | 3.31 | 13.90368 |
| Totals by Isotope: | 0.1045 | 3.46905 | 3.5812 | 14.337 | 16544.52 |

ATTACHMENT 4

Item 2.a

Memorandum Regarding Sanitary Sewer Disposal of C-14

Nuclear Regulatory Commission Materials License

September 5, 2007

EDMS Files, CTR 1B-M

MEMORANDUM FOR RECORD - SANITARY SEWER DISPOSAL OF C-14 AT TVA'S ENVIRONMENTAL RESEARCH CENTER (ERC) IN 2006

What follows is my understanding of the contents of the refrigerator in laboratory F250 which were disposed in 2006.

Prior to 2006, TVA's most recent research projects at the ERC involving radioisotopes were a bench-top degradation study of synthesized tear gas components (chloroacetophenone, chloropicrin, etc.) radiotagged with C-14. Chemical synthesis was chosen because radiotagged samples of the compounds of interest were not commercially available. Experiments started with 500 microcuries of C-14 as a chlorinated hydrocarbon which was reacted under controlled conditions, usually with a non-radioactive component of the same starting compound. The chemical synthesis was followed by separation on a large-bore gas chromatography system to obtain the pure radiotagged compound which was then dissolved in water and spiked into various soil matrices. Degradation tests in the soil usually were followed by analysis of C-14 as carbon dioxide produced from the reaction but may have also included solvent extraction or water extraction of the soil to determine concentrations of C-14 remaining in the soil. Absolute concentrations of the starting spike solutions were not known due to the inefficiencies of chemical synthesis, but they were not required since a ratio of count rates could be utilized to follow degradation. All were known to have contained less than the starting 500 microcuries due to the inefficiencies of synthesis.

Residuals from the soil studies, spiked soil, chromatography columns, reaction glassware, sample vials, synthesized spiking compound, etc., were disposed properly as solid radioactive waste or via sanitary sewer when the researcher left TVA employment. However, certain items (unopened vials of C-14 starting compounds, synthesized standards, reaction glassware, and the like) were retained in laboratory F250 should TVA have desired to continue the soil studies.

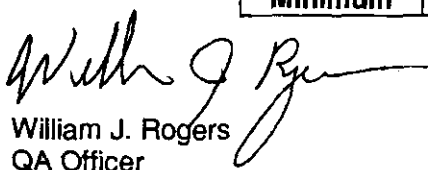
During 2006, certain of these C-14 solutions and all remaining experimental samples remaining in scintillation vials in the drawer of a single storage refrigerator were disposed by sanitary sewer. The standards and scintillation vials appeared all to remain from the degradation tracer studies described above. All compounds that were disposed in the sanitary sewer were liquid phase and readily water soluble (e.g., C-14 standards in water or samples in biodegradable scintillation cocktail). All other items were disposed in solid radioactive waste.

Sanitary sewer flows for 2006 are listed below as gallons per month. When compared to the minimum monthly flow for 2006 of 2.55×10^9 ml and the 3×10^{-4} microcurie/ml limit on the monthly average concentration, a maximum of 7.66×10^5 microcuries could have been disposed in any month.

Typical degradation experiments were run as batches with 500 microcuries total C-14 content as the starting amount for the chemical synthesis and separation process described in the first paragraph. No more than four experimental runs could have been represented as the entire contents of the refrigerator; that is, 2000 microcuries would represent the absolute maximum quantity of C-14 disposed. Consequently, disposal via sanitary sewer was well below the monthly limit during 2006. The sanitary sewer disposal practices described herein; that is, disposal of only water soluble solutions and biodegradable scintillation cocktails and comparison to monthly limits were consistent with all practices at ERC in recent years.

**Total Sanitary Sewer Flow – Gallons – 2006
for TVA's Environmental Research Center**

| Month | Total Flow in Gallons | ml/Month |
|----------------|-----------------------|-----------------|
| Jan | 1,576,230 | 5.97E+09 |
| Feb | 2,627,690 | 9.95E+09 |
| Mar | 964,630 | 3.65E+09 |
| Apr | 1,202,040 | 4.55E+09 |
| May | 1,584,540 | 6.00E+09 |
| Jun | 1,099,840 | 4.16E+09 |
| Jul | 778,320 | 2.95E+09 |
| Aug | 736,580 | 2.79E+09 |
| Sep | 674,290 | 2.55E+09 |
| Oct | 918,970 | 3.48E+09 |
| Nov | 1,296,980 | 4.91E+09 |
| Dec | 1,208,400 | 4.57E+09 |
| Minimum | 674,290 | 2.55E+09 |


William J. Rogers
QA Officer

WJR:RAR

cc: James B. Colagross, WAR 1A-M
Johnny S. McFall, CTR 2S-M
William L. Raines, WAR 1A-M

Reference NRC Materials License 41-25370-01

ATTACHMENT 5

Item 2.a
GTS Duratek Manifest



Tuesday, October 3, 2000

Floyd Spivey
TVA Environmental Research Center
P.O. Box 1010 Research Reactor
Western Area Radiological Lab
Muscle Shoals, AL 35662-1010

Dear Mr. Spivey:

In compliance with the requirements of 10 CFR 20, Appendix G, Section III, C.1, the attached signed shipping manifest copies are your notice of receipt and acceptance of the radioactive waste materials specified on the manifests.

| <u>Manifest Number</u> | <u>Date Received</u> |
|------------------------|----------------------|
| 2764-T001855 | 09/29/2000 |

This is acknowledgement of receipt only. Any manifest discrepancies found during manifest review, unloading or processing will be listed on page 2 of this letter.

Thank you for your business.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jim O'Connell', written in a cursive style.

Shipping and Receiving

cc: Manifest File
Shipping and Receiving file

| FORM 540 UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST SHIPPING PAPER | | GTS DURATEK | | 5. SHIPPER - NAME AND FACILITY TVA Environmental Research Center GIG: GTS Duratek Radioactive Per User Lab Reservation Rd., PO Box 1010 Muscle Shoals, AL 35882-1010 | | SHIPMENT ID. NUMBER RS-00-260 | | 7. FORM 540 AND 540A FORM 541 AND 541A FORM 542 AND 542A ADDITIONAL INFORMATION | | 8. MANIFEST NUMBER (Use this number on all continuation pages) 1001855 | |
|--|--|--|--|--|--|---|--|--|--|---|--|
| 1. EMERGENCY TELEPHONE NUMBER (Include Area Code) 865-481-0222 | | ORGANIZATION GTS Duratek Attn: Emergency Duty Officer | | NA | | SHIPMENT NUMBER RS-00280 | | X GENERATOR TYPE (Specify) | | 9. CONSIGNEE - Name and Facility Address GTS Duratek Bear Creek Operations 1560 Bear Creek Road Oak Ridge, TN 37830 | |
| 2. IS THIS AN "EXCLUSIVE USE" SHIPMENT? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO | | 3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST 8 | | 5. CARRIER - Name and Address GTS Duratek P.O. Box 2880 1560 Bear Creek Rd Oak Ridge, TN 37831-2830 | | Truck #: 640487 Trailer #: 290229 | | EPA ID. NUMBER TMD-88-218-7870 | | SIGNATURE - Authorized consignee acknowledging waste receipt <i>[Signature]</i> | |
| 4. DOES EPA REGULATED WASTE REQUIRING A MANIFEST ACCOMPANY THIS SHIPMENT? If "Yes," provide Manifest Number | | EPA MANIFEST NUMBER NA | | CONTACT Daniel Ladd | | TELEPHONE NUMBER (Include Area Code) 865-481-0222 | | SHIPPING DATE 9/29/00 | | 10. CERTIFICATION <i>GTS SLIP # T001855</i> | |
| 11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (including proper shipping name, hazard class, UN ID number, and any additional information) | | 12. DOT LABEL "RADIOACTIVE" | | 13. TRANSPORT INDEX | | 14. PHYSICAL AND CHEMICAL FORM | | 15. INDIVIDUAL RADIOISOTOPES | | 16. TOTAL PACKAGE ACTIVITY mCi | |
| Radioactive material, excepted package-limited quantity of material, 7, UN2910 | | NA | | NA | | Solid OXIDE | | Cs-137 | | 4.3200E-02 | |
| Radioactive material, excepted package-limited quantity of material, 7, UN2910 | | NA | | NA | | Solid OXIDE | | Cs-137 Sr-90 | | 1.6884E-01 | |
| Radioactive material, excepted package-limited quantity of material, 7, UN2910 | | NA | | NA | | Solid OXIDE | | Cs-137 | | 5.2910E-02 | |
| Radioactive material, excepted package-limited quantity of material, 7, UN2910 | | NA | | NA | | Solid OXIDE | | Cs-137 | | 1.7318E-02 | |
| Radioactive material, excepted package-limited quantity of material, 7, UN2910 | | NA | | NA | | Liquid OXIDE | | C-14 | | 1.6836E+02 | |
| Radioactive material, excepted package-limited quantity of material, 7, UN2910 | | NA | | NA | | Liquid OXIDE | | C-14 | | 5.1200E+00 | |
| Radioactive material, excepted package-limited quantity of material, 7, UN2910 | | NA | | NA | | Solid OXIDE | | C-14 | | 7.1780E+01 | |
| Radioactive material, excepted package-limited quantity of material, 7, UN2910 | | NA | | NA | | Solid OXIDE | | C-14 | | 7.1780E+01 | |
| 17. LS/ISO CLASS | | 18. TOTAL WEIGHT OR VOLUME (Use appropriate units) | | 19. IDENTIFICATION NUMBER OF PACKAGE | | 17. LS/ISO CLASS | | 18. TOTAL WEIGHT OR VOLUME (Use appropriate units) | | 19. IDENTIFICATION NUMBER OF PACKAGE | |
| NA | | 147.4 LBS; 7.8 FT3 | | 1 | | NA | | 134.2 LBS; 7.8 FT3 | | 2 | |
| NA | | 167.2 LBS; 7.8 FT3 | | 3 | | NA | | 181.8 LBS; 7.8 FT3 | | 4 | |
| NA | | 88.4 LBS; 4. FT3 | | 5 | | NA | | 61.6 LBS; 4. FT3 | | 6 | |
| NA | | 100.1 LBS; 7.8 FT3 | | 7 | | NA | | 77. LBS; 7.8 FT3 | | 8 | |
| NA | | 77. LBS; 7.8 FT3 | | 8 | | NA | | | | | |
| FOR CONSIGNEE USE ONLY | | | | 20. GENERATOR CERTIFICATION STATEMENT | | | | | | | |
| TENNESSEE "LICENSE FOR DELIVERY" NO _____ | | | | A) Radioactive Materials. Certification is hereby made to GTS Duratek, Inc. that this shipment of low-level radioactive material/waste has been prepared in accordance with radioactive waste management program which has been approved by the Nuclear Regulatory Commission or an Agreement State regulatory agency and with the current revision of the GTS Duratek Material Acceptance Criteria. | | | | | | | |
| SOUTH CAROLINA TRANSPORT PERMIT NO _____ | | | | B) Hazardous Materials. Generator hereby certifies that this material does not contain a hazardous waste as defined in 40 CFR 261. | | | | | | | |
| US ECOLOGY GENERATOR NO _____ | | | | C) Data. Generator hereby represents and warrants that all data set forth in this (UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST) are true and correct in all respects and in accordance with all applicable governmental laws, rules, regulations and GTS Duratek State of Tennessee Radioactive Material Licenses. | | | | | | | |
| US ECOLOGY PERMIT NO _____ | | | | <i>Judith H. Johnson</i> Print Name <i>[Signature]</i> Signature 9-29-00 Date | | | | | | | |
| Total weight: <u>407.6434 lbs</u> <u>898.7 lbs</u> | | | | | | | | | | | |

September 29, 2000

**Shipment Survey No. RS-00-260 - Radioactive Material from
Tennessee Valley Authority - ERC**

Drum No. 1 - Radioactive Material - Solid - from Radioactive Fertilizer Lab
Drum No. 2 - Radioactive Material - Solid - from Radioactive Fertilizer Lab
Drum No. 3 - Radioactive Material - Solid - from Radioactive Fertilizer Lab
Drum No. 4 - Radioactive Material - Solid - from Radioactive Fertilizer Lab
Container No. 5 - Radioactive Material - Liquid - from Hickory Valley Building
Container No. 6 - Radioactive Material - Liquid - from Hickory Valley Building
Container No. 7 - Radioactive Material - Solid - from ERC C-14 Labs
Container No. 8 - Radioactive Material - Solid - from ERC C-14 Labs

Survey Results:

The smearable contamination on the outside of all containers for this shipment are as follows:

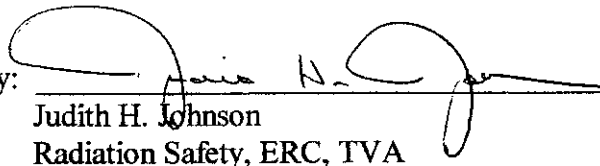
Beta/Gamma: <16.67 Bq/100 cm squared or <1000 dpm/100 cm squared

Alpha: <.33 Bq/100 cm squared or <20 dpm/100 cm squared

Contact Dose rates outside of all containers:

<.001 mSv/hr. or <0.1 mrem/hr

Prepared by:


Judith H. Johnson
Radiation Safety, ERC, TVA

ATTACHMENT 6

Item 2.b
Survey Data for Underground Tank

Radiological Survey Data Sheet

Survey No. : RS - 99-319

Location: ERC Catalyzer 4

Survey Date : 11-16-99

Survey Purpose: sample Lab Holding Tanks

Survey by : James R. Corley

| Item or Location | Dose Rates | | | Contamination | | | Inst. No. | Remarks | |
|---|------------|---------------|---------------|---------------|--------------------|--------------------------------------|--------------|------------------|---|
| | Distance | Beta mrad/hr | Gamma mrem/hr | Total mrem/hr | Direct cpm | Transferable dpm/100 cm ² | | | Type |
| Soil samples from under Tank, water samples from inside, and equipment Rinse. | Ct. | NA | NA | NA | <100 | <1000 | By | 509050 841814 | Sent To WARR soil sample # 1 water sample # 2 |
| | 30 cm | | | | | | | | |
| | Ct. | | | | | | | | |
| | 30 cm | | | | | | | | |
| | Ct. | | | | | | | | |
| | 30 cm | | | | | | | | |
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| | Ct. | | | | | | | | |
| | 30 cm | | | | | | | | |
| | Ct. | | | | | | | | |
| | 30 cm | | | | | | | | |
| | Ct. | | | | | | | | |
| | 30 cm | | | | | | | | |

(NA = Not Applicable; ND = Not Detectable; GA = General Area Dose-rate; NOA = Nearest Occupiable Area; Ct. = Contact; cm = centimeter; m = meter; BKG = background
dpm = disintegrations per minute; cpm = counts per minute; ID = Identification)

Reviewed by: _____

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

Sample # 906892

Sample Type SOIL
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS) SOIL #1BH
Collection Date 11/16/1999 09:00
Sample Volume 168 Grams
Reporting Units microCuries/Gram

| Analysis | Activity | Error | MDC |
|----------|----------|----------|----------|
| Gamma | | | |
| TL-208 | 3.76E-07 | 6.5E-08 | 1.17E-07 |
| PB-212 | 1.56E-06 | 3.60E-07 | 3.68E-07 |
| BI-214 | 5.41E-07 | 1.81E-07 | 4.52E-07 |
| PB-214 | 9.14E-07 | 2.05E-07 | 3.14E-07 |

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

Sample # 906893

Sample Type SOIL
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS.) SOIL #2BH
Collection Date 11/16/1999 09:30
Sample Volume 170 Grams
Reporting Units microCuries/Gram

| Analysis | Activity | Error | MDC |
|----------|----------|----------|----------|
| Gamma | | | |
| PB-212 | 7.25E-07 | 1.66E-07 | 2.84E-07 |
| BI-214 | 5.65E-07 | 1.52E-07 | 3.80E-07 |
| PB-214 | 6.73E-07 | 1.59E-07 | 4.33E-07 |
| RA-226 | 5.65E-07 | 1.52E-07 | 3.80E-07 |

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

Sample # 906894

Sample Type SOIL
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS.) SOIL #3BH
Collection Date 11/16/1999 10:00
Sample Volume 169 Grams
Reporting Units microCuries/Gram

| Analysis | Activity | Error | MDC |
|----------|----------|----------|----------|
| Gamma | | | |
| TL-208 | 3.65E-07 | 7.98E-08 | 1.9E-07 |
| PB-212 | 1.02E-06 | 2.28E-07 | 3.71E-07 |
| BI-214 | 8.32E-07 | 1.83E-07 | 3.66E-07 |
| PB-214 | 9.62E-07 | 1.34E-07 | 3.13E-07 |
| RA-226 | 8.32E-07 | 1.83E-07 | 3.66E-07 |
| AC-228 | 1.42E-06 | 3.08E-07 | 6.90E-07 |
| K-40 | 4.20E-06 | 8.57E-07 | 2.49E-06 |

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

Sample # 906895

Sample Type SOIL
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS.) SOIL #4BH
Collection Date 11/16/1999 10:30
Sample Volume 167 Grams
Reporting Units microCuries/Gram

| Analysis | Activity | Error | MDC |
|----------|----------|----------|----------|
| Gamma | | | |
| TL-208 | 4.00E-07 | 1.17E-07 | 2.35E-07 |
| PB-212 | 9.03E-07 | 2.70E-07 | 3.62E-07 |
| BI-214 | 1.11E-06 | 2.22E-07 | 4.41E-07 |
| PB-214 | 8.41E-07 | 2.20E-07 | 4.42E-07 |

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

Sample # 906896

Sample Type SOIL
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS.) SOIL #4BHD
Collection Date 11/16/1999 10:30
Sample Volume 161 Grams
Reporting Units microCuries/Gram

| Analysis | Activity | Error | MDC |
|----------|----------|----------|----------|
| Gamma | | | |
| TL-208 | 3.35E-07 | 7.04E-08 | 1.52E-07 |
| PB-212 | 8.66E-07 | 2.34E-07 | 3.92E-07 |
| BI-214 | 8.29E-07 | 1.46E-07 | 3.35E-07 |
| PB-214 | 7.74E-07 | 1.90E-07 | 3.91E-07 |
| RA-226 | 8.29E-07 | 1.46E-07 | 3.35E-07 |
| AC-228 | 1.78E-06 | 2.64E-07 | 3.30E-07 |

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

Sample # 906897

Sample Type SOIL
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS.) SOIL #6BH
Collection Date 11/16/1999 11:00
Sample Volume 164 Grams
Reporting Units microCuries/Gram

| Analysis | Activity | Error | MDC |
|----------|----------|----------|----------|
| Gamma | | | |
| TL-208 | 5.15E-07 | 1.13E-07 | 1.78E-07 |
| PB-212 | 1.20E-06 | 2.70E-07 | 3.27E-07 |
| BI-214 | 5.74E-07 | 1.25E-07 | 3.46E-07 |
| PB-214 | 6.90E-07 | 1.69E-07 | 3.21E-07 |
| AC-228 | 1.72E-06 | 3.79E-07 | 3.75E-07 |

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

Sample # 906898

Sample Type SOIL
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS.) SOIL #9BH
Collection Date 11/16/1999 13:15
Sample Volume 172 Grams
Reporting Units microCuries/Gram

| Analysis | Activity | Error | MDC |
|----------|----------|----------|----------|
| Gamma | | | |
| TL-208 | 1.98E-07 | 7.01E-08 | 2.01E-07 |
| PB-212 | 9.40E-07 | 2.15E-07 | 4.18E-07 |
| BI-214 | 8.97E-07 | 2.02E-07 | 4.35E-07 |
| PB-214 | 1.20E-06 | 1.98E-07 | 4.08E-07 |
| RA-226 | 8.97E-07 | 2.02E-07 | 4.35E-07 |
| K-40 | 4.38E-06 | 7.32E-07 | 1.98E-06 |

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

Sample # 906899

Sample Type LIQUID
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS.) H2O #5SW
Collection Date 11/16/1999 10:45
Sample Volume 100 mL
Reporting Units microCuries/mL

| Analysis | Activity | Error | MDC |
|------------|----------------------|-------|----------|
| Gamma Scan | No Activity Detected | | 1.8 E-07 |

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

9 of 11
16 DEC 1999

Sample # 906900

Sample Type LIQUID
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS.) H2O #5SWD
Collection Date 11/16/1999 10:45
Sample Volume 100 mL
Reporting Units microCuries/mL

| Analysis | Activity | Error | MDC |
|------------|----------------------|-------|----------|
| Gamma Scan | No Activity Detected | | 1.8 E-07 |

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

10 of 11
16 DEC 1999

Sample # 906901

Sample Type LIQUID
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS.) H2O #7B
Collection Date 11/16/1999 11:15
Sample Volume 100 mL
Reporting Units microCuries/mL

| Analysis | Activity | Error | MDC |
|------------|----------------------|-------|----------|
| Gamma Scan | No Activity Detected | | 1.8 E-07 |

Special Report

Tennessee Valley Authority
Radioanalytical Laboratory Database System

11 of 11
16 DEC 1999

Sample # 906902

Sample Type LIQUID
Sample Description HOLDING TANK @ CATALYZER 4 (MUSC.SHLS.) H2O #8B
Collection Date 11/16/1999 11:20
Sample Volume 100 mL
Reporting Units microCuries/mL

| Analysis | Activity | Error | MDC |
|------------|----------------------|-------|----------|
| Gamma Scan | No Activity Detected | | 1.8 E-07 |

ATTACHMENT 7

Item 4

Release Survey for Room F250

Radiological Survey Data Sheet

Survey No.: RS - 06-490, 476, 470, 456

Survey Date: 8.24.06

Survey Purpose: Decommission Survey

Location: ERC Bldg. - Room F250

Survey by: John Young

| Item or Location | Dose Rates | | | Contamination | | | Instrument Numbers | Remarks | |
|------------------|------------|--------------|---------------|---------------|------------|-------------------------------------|--------------------|--------------------------------------|--|
| | Distance | Beta mrad/hr | Gamma mrem/hr | Total mrem/hr | Direct cpm | Transferable dpm/100cm ² | | | Type |
| Room F250 | Contact | ND | <0.1 | <0.1 | | <1,000 | PS | RS0-5 841828 SURV 50 553798 | SMears masslinn Smears sent to WARL for C-14 Analysis |
| | 30 cm | ↓ | ↓ | ↓ | <100 | <100cpm | | | |
| GA | Contact | ↓ | ↓ | ↓ | | | | | |
| | 30 cm | | | | | | | | |
| NA | Contact | | | | | | | | |
| | 30 cm | | | | | | | | |
| NA | Contact | | | | | | | | |
| | 30 cm | | | | | | | | |
| NA | Contact | | | | | | | | |
| | 30 cm | | | | | | | | |
| NA | Contact | | | | | | | | |
| | 30 cm | | | | | | | | |
| NA | Contact | | | | | | | | |
| | 30 cm | | | | | | | | |

Reviewed by: James B. Colby

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 16 AUG 06

| Isotope | Inst. No. | Eff. (%) | Bkg (cpm) | LLD (dpm) |
|-----------------|-----------|----------|-----------|-----------|
| ¹⁴ C | 284 | .5387 | 8.38 | 11.2 |

Sampling Information

Survey No. 06 - 456
 Survey Date 8-15-06
 Submitted By : John Young
 Analysis C - 14

LLD = $2.71 + 4.66 \cdot \text{SQRT}[\text{bkg(CPM)} \cdot \text{ctime(min)}]$
 $\text{ctime(min)} \cdot \text{counting efficiency}$

| Smear Number | Sampling Location | Total Counts | Total CPM | BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|-------------------|--------------|-----------|---------|---------|--------------------|-----|
| 1 - 50 | ERC F250 Room | | | | | | |
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* See Attached sheet

ALL SAMPLES EXCEPT #37 & #38 COUNTED BELOW LLD

Counted by [Signature]

Checked by [Signature]

Calculated by [Signature]

284
Instrument No.

C-14

Beta Analysis By Liquid Scintillation Counting

SMEAR#37
Sample Number

| SUMMARY | Activity (uCi/Sample) | Error (uCi/Sample) | LLD (uCi/Sample) | Activity (dpm/Sample) | Error (dpm/Sample) | LLD (dpm/Sample) |
|---------|--------------------------|-----------------------|---------------------|--------------------------|-----------------------|---------------------|
| | 2.869E-05 | 2.733E-06 | 5.045E-06 | 63.69 | 6.07 | 11.20 |

Standard Information

| | Standard | Reference | Date/Time | | |
|--|---|-----------|-----------|----------------------------|---------|
| | year | month | day | hour | minute |
| Nuclide Name | C-14 | | | | |
| Standard I.D. | CFY-44#65D5 | 82 | 3 | 1 | 6 |
| Nuclide Half-Life (in days) | 2092882.50 | days | | | |
| Standard Activity | 584.80 | dpm/ml | | | |
| Geometry Description | (millipore filter, 3ml water, 18ml UG/AB, glass vial) | | | | |
| Decay Time from std reference date to count date | | 8935.05 | | days | |
| Decay Factor for std from reference date to count date | | 0.99705 | | | |
| Total Activity of standard at count date | | 1749.22 | | dpm | |
| | | | | Volume of standard used | 3.0000 |
| | | | | Total activity of standard | 1754.40 |

Sample Data

| | | | | | |
|---------------------------------------|-----------|---------|-----|------|--------|
| Sample Collection Date | year | month | day | hour | minute |
| | 2006 | 8 | 15 | 12 | 0 |
| Sample Volume | 1 | | | | |
| Standard CPM | 950.68 | | | | |
| Counting Efficiency (in decimal form) | 0.5387 | | | | |
| Date, Time Counted | year | month | day | hour | minute |
| | 2006 | 8 | 17 | 7 | 7 |
| Length of Count (in Minutes) | 5 | | | | |
| Instrument Number | 284 | | | | |
| Bkg Counts (in CPM) | 8.38 | | | | |
| Sample Number | SMEAR#37 | | | | |
| Sample Description | RS-06-456 | | | | |
| Sample Counts (in CPM) | 42.69 | | | | |
| No. of days from collection to count | | 1.80 | | | |
| Decay Factor, collection to counting | | 1.00000 | | | |

Analysis Results

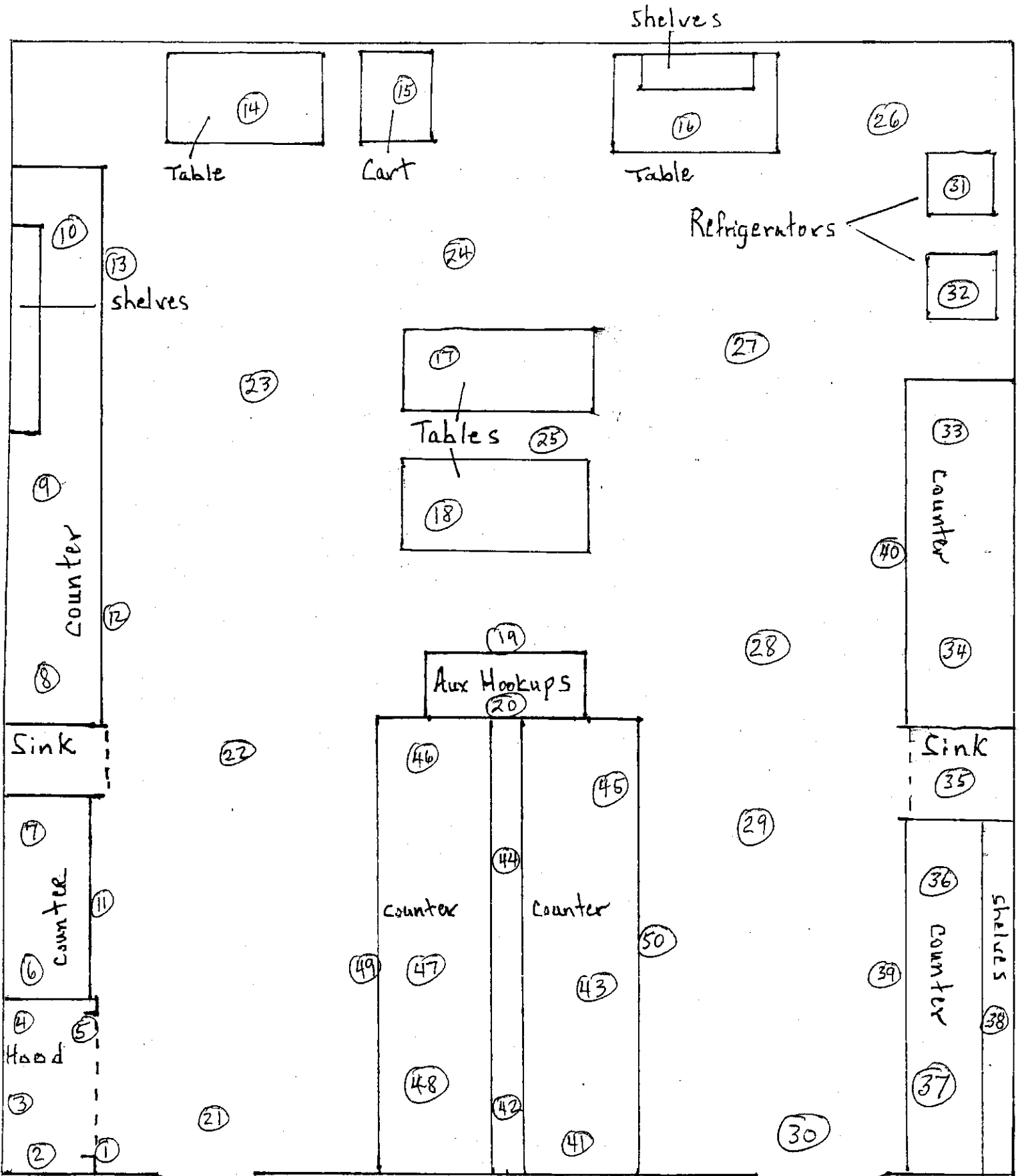
| | | | | | |
|----------|-----------|------------|----------|------|------------|
| Activity | 2.869E-05 | uCi/sample | Activity | 63.7 | dpm/sample |
| Error | 2.733E-06 | uCi/sample | Error | 6.1 | dpm/sample |
| LLD | 5.045E-06 | uCi/sample | LLD | 11.2 | dpm/sample |

Calculated By D.L. Lassett date 8-17-06

Reviewed By M.H. Cross date 8-18-06

ERC BLDG

F250 ROOM

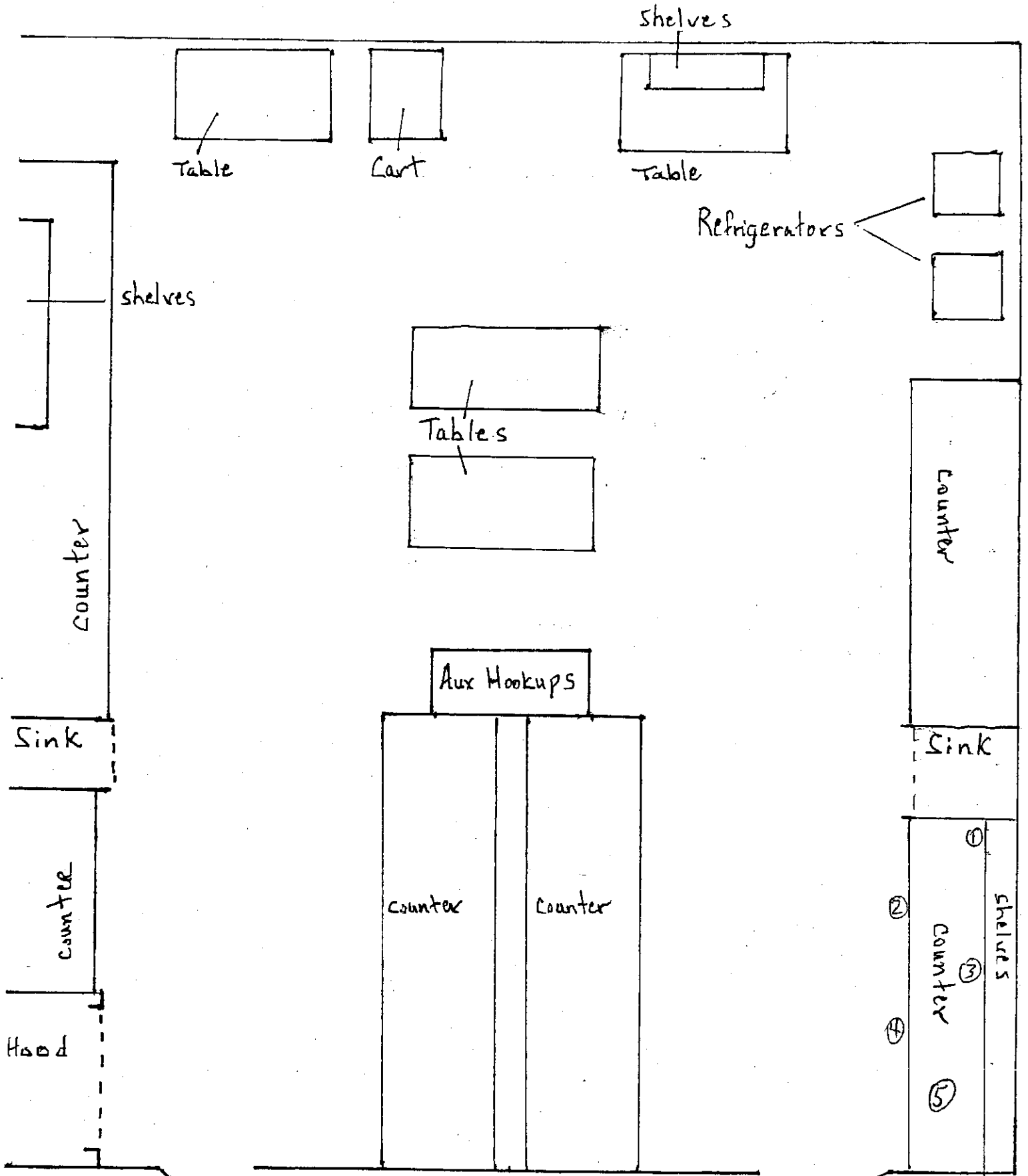


Survey # 06-456
 Date 8-15-06

= Smears

ERC BLDG

F250 ROOM



Survey # 06-470
Date: 8-17-06

Ⓝ = Smears

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 17 AUG 06

| Isotope | Inst. No. | Eff. (%) | Bkg (cpm) | LLD (dpm) |
|-----------------|-----------|----------|-----------|-----------|
| ¹⁴ C | 284 | .5413 | 8.27 | 11.1 |
| | | | | |
| | | | | |

Sampling Information

Survey No. 06-470

Survey Date 8-17-06

Submitted By John Young

Analysis C-14

ERC F250 Room

LLD = $2.71 + 4.66 \cdot \text{SQRT}[\text{bkg}(\text{CPM}) \cdot \text{ctime}(\text{min})]$
 ctime(min) * counting efficiency

| Smear Number | Sampling Location | Total Counts | Total CPM | BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|--|--------------|-----------|---------|---------|--------------------|-----|
| 1 - 5 | smears at refrigerator / counter / sink / cabinets | | | | | | |
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All SMEARS * EXCEPT #3 COUNTED BY DPH/ERC 8-17-06

* See Attached sheet

Counted by D.L. Bennett

Calculated by D.L. Bennett

Checked by M.H. Cross

284

C-14

Beta Analysis By Liquid Scintillation Counting

SMEAR#3
Sample Number

Instrument No.

| SUMMARY | Activity (uCi/Sample) | Error (uCi/Sample) | LLD (uCi/Sample) | Activity (dpm/Sample) | Error (dpm/Sample) | LLD (dpm/Sample) |
|---------|--------------------------|-----------------------|---------------------|--------------------------|-----------------------|---------------------|
| | 1.227E-05 | 2.096E-06 | 4.987E-06 | 27.23 | 4.65 | 11.07 |

Standard Information

| | Standard | Reference | Date/Time | | | |
|--|---|-----------|-----------|------|--------|---------------------------------------|
| | year | month | day | hour | minute | |
| Nuclide Name | C-14 | | | | | |
| Standard I.D. | CFY 44#65D5 | 82 | 3 | 1 | 6 | 0 |
| Nuclide Half-Life (in days) | 2092882.50 | days | | | | Volume of standard used 3.0000 |
| Standard Activity | 584.80 | dpm/ml | | | | Total activity of standard 1754.40 |
| Geometry Description | (millipore filter, 3ml water, 18ml UG/AB, glass vial) | | | | | |
| Decay Time from std reference date to count date | | | 8935.38 | days | | |
| Decay Factor for std from reference date to count date | | | 0.99705 | | | |
| Total Activity of standard at count date | | | 1749.22 | dpm | | |

Sample Data

| | year | month | day | hour | minute |
|---------------------------------------|--------|-------|-----|------|--------|
| Sample Collection Date | 2006 | 8 | 17 | 12 | 0 |
| Sample Volume | 1 | | | | |
| Standard CPM | 955.19 | | | | |
| Counting Efficiency (in decimal form) | 0.5413 | | | | |

| | year | month | day | hour | minute |
|------------------------------|------|-------|-----|------|--------|
| Date, Time Counted | 2006 | 8 | 17 | 15 | 4 |
| Length of Count (in Minutes) | 5 | | | | |
| Instrument Number | 284 | | | | |
| Bkg Counts (in CPM) | 8.27 | | | | |

| | |
|--------------------------------------|-----------|
| Sample Number | SMEAR#3 |
| Sample Description | RS-06-470 |
| Sample Counts (in CPM) | 23.01 |
| No. of days from collection to count | 0.13 |
| Decay Factor, collection to counting | 1.00000 |

Analysis Results

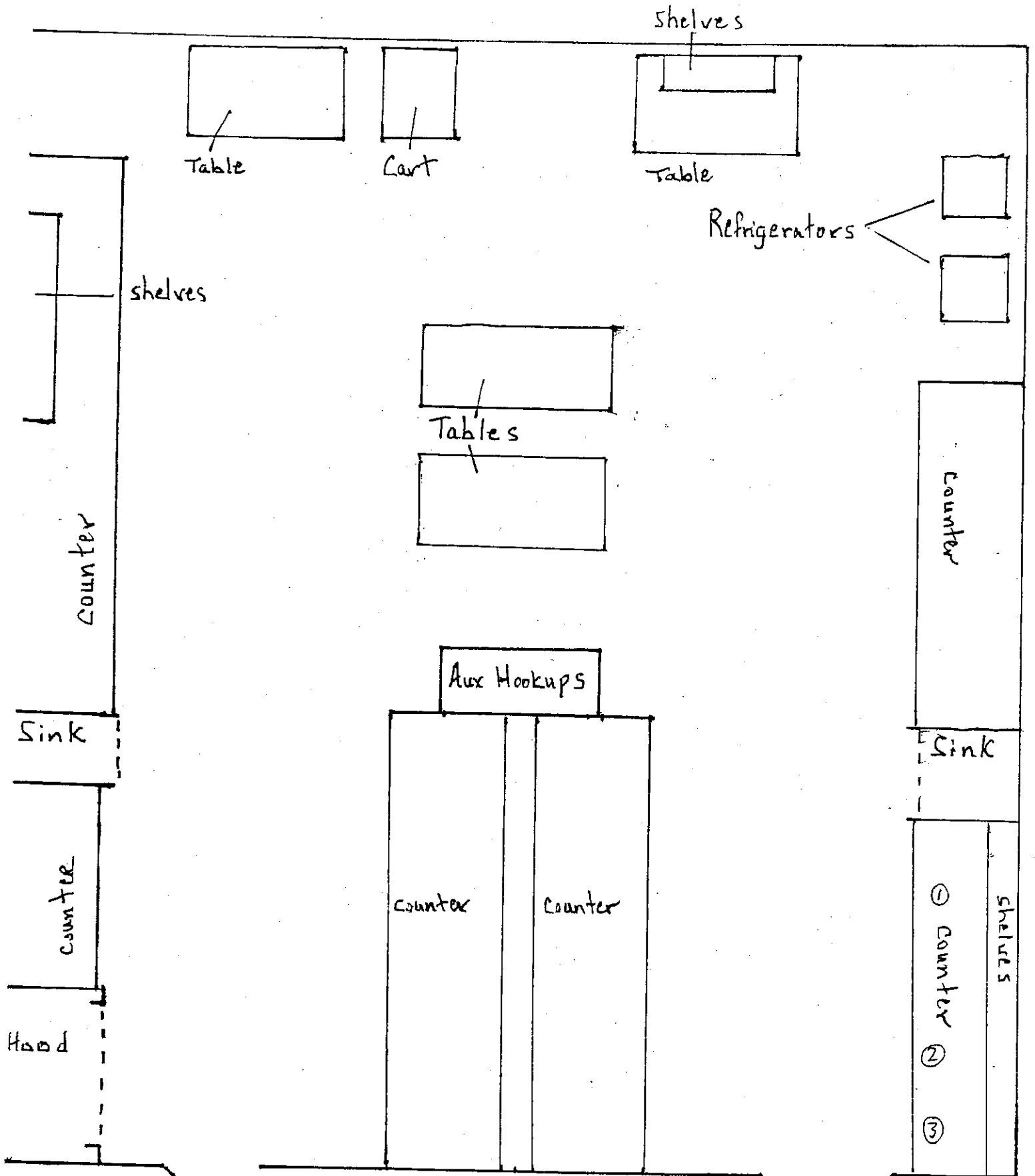
| | | | | | |
|----------|-----------|------------|----------|------|------------|
| Activity | 1.227E-05 | uCi/sample | Activity | 27.2 | dpm/sample |
| Error | 2.096E-06 | uCi/sample | Error | 4.7 | dpm/sample |
| LLD | 4.987E-06 | uCi/sample | LLD | 11.1 | dpm/sample |

Calculated By D.L. Donnet date 8-18-06

Reviewed By M.H. Cross date 8-18-06

ERC BLDG

F250 RDDM



Survey # 06-476
 Date 8-17-06

Ⓜ = Smears

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 17 AUG 06

| Isotope | Inst. No. | Eff. (%) | Bkg (cpm) | LLD (dpm) |
|-----------------|-----------|----------|-----------|-----------|
| ¹⁴ C | 284 | .5413 | 8.27 | 11.1 |

Sampling Information

Survey No. 06-476
 Survey Date 8/17/06
 Submitted By John Young
 Analysis C-14
 ERC F250

LLD = $2.71 + 4.66 \cdot \text{SORT}[\text{bkg}(\text{CPM}) \cdot \text{etime}(\text{min})]$
 etime(min) * counting efficiency

| Smear Number | Sampling Location | Total Counts | Total CPM | BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|-------------------|--------------|-----------|---------|---------|--------------------|-----|
| 1 - 3 | smears / cabinet | | | | | | |
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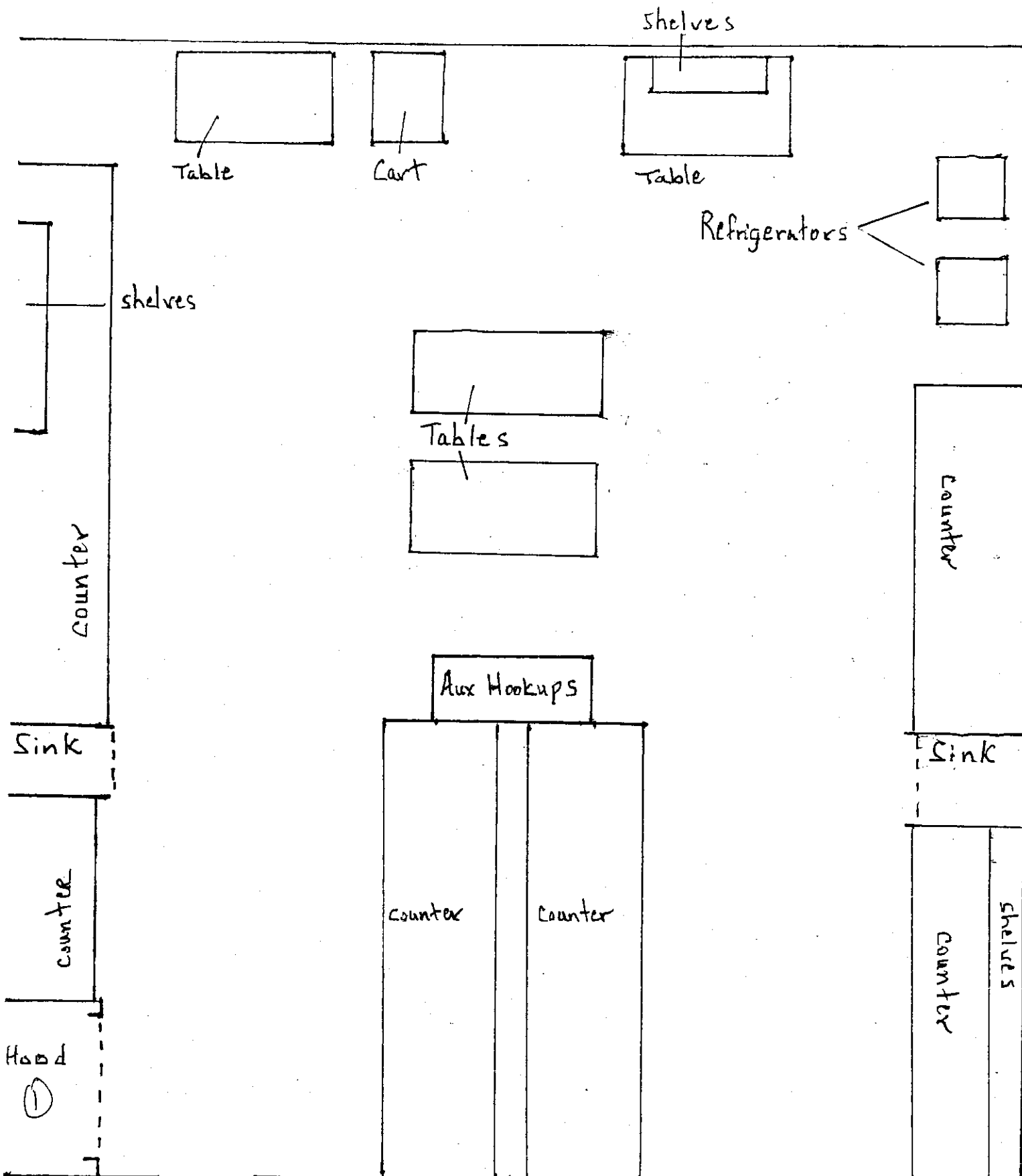
All 3 smears counted below LLD
 D.C.C. 8-18-06

Counted by D.L. Hensert
 Calculated by D.L. Hensert

Checked by M.D. Cross

ERC BLDG

F250 KDDM



Survey # 06-490
 Date 8-24-06

(#) = Smears

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 25 AUG 06

¹⁴C 284 284 .5096 8.71 12.1
0.20
8-25-06

Sampling Information

Survey No. 06-490
 Survey Date 08/24/06
 Submitted By : John Young
 Analysis : C-14
 Location : ERC F-250 Room

LLD = $2.71 + 4.66 * \text{SQRT}[\text{bkg}(\text{CPM}) * \text{etime}(\text{min})]$
 etime(min) * counting efficiency

| Smear Number | Sampling Location | Total Counts | Total CPM | BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|------------------------|--------------|-----------|---------|---------|--------------------|---------|
| 1 | smear : hood vent area | N/A | 9.48 | <LLD | | 0.5096 | 8-25-06 |
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Counted by D.S. Smith

Checked by M.H. Cross

Calculated by D.S. Smith

ATTACHMENT 8

Item 5

NRC Letter to TVA Releasing Burial Site



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

0
CXC 7-21
DWR 7-2

April 30, 1999

Tennessee Valley Authority
ATTN: David Sorrelle
Environmental Compliance
Officer at ERC
P. O. Box 1010
TVA Reservation Road
Muscle Shoals, AL 35662

SUBJECT: RELEASE OF FORMER BURIAL SITE FOR UNRESTRICTED USE

Dear Mr. Sorrelle:

This refers to the dose assessment dated September 4, 1997, submitted by the Tennessee Valley Authority (TVA) requesting unrestricted release of the inactive low-level radioactive material burial site located at the TVA-Muscle Shoals, Alabama, reservation. NRC has completed its review of the dose assessment and other supporting documents. Based on this review, the NRC considers that no further remediation is required and that the site may be released for unrestricted use.

If you have any questions concerning this letter, please contact Bryan Parker of my staff by telephone at (404) 562-4728 or by e-mail at bap@nrc.gov.

Sincerely,

Thomas R. Decker, Chief
Materials/Licensing Inspection Branch 1
Division of Nuclear Materials Safety

License No. 01-06113-03 (retired)
Docket No. 030-03571 (retired)

cc: Bobby Gray, TVA
Tim Harris, NMSS

5/5/99

pc: Chuck Gilbert, CEB 4C-M
Mark Hastings, ET 11A-K
Randy Weatherington, CTR 2Q-M
Ron Williams, CTR 2C-M
Bill Raines, WAR 1A-M
Wilson McArthur, LP 2R-C
Ed Vigluicci, ET 10A-K
Files, ER&S, CEB 1B-M

RECEIVED
MAY 05 1999
D.W. SORRELLE

ATTACHMENT 9

Item 6.c
Biothermal Research Facility Survey Data

170 Office Service Warehouse Annex

August 13, 1987

Mr. Earl G. Wright
Service License Reviewer
U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, Northwest
Atlanta, Georgia 30323

TERMINATION OF FACILITY SURVEY AT THE BROWNS FERRY NUCLEAR PLANT (BFN)
BIOTHERMAL RESEARCH FACILITY (BRF) - BY-PRODUCT LICENSE NO. 01-16821-02

Dear Mr. Wright:

On July 31, 1987, at a meeting with the NRC, Gerald Paulk and Charles Brooks, BFN Resident Inspectors, and Roy Wedington, Region II Inspector, TVA committed to a follow-up or confirmation radiation survey of a laboratory at BRF.

Carbon 14 (C^{14}) had been used in this laboratory under by-product materials license No. 01-16821-02. There were questions about breakdowns in material receipt, material accountability and control, and facility closeout.

The license was amended on January 21, 1986 (reference letter dated November 21, 1985, from Sherer to Wright), to remove BRF as an approved location for work. Even though closeout contamination surveys were conducted on August 30 and September 12, 1985, they were not submitted as part of the requested license amendment as is normally required for termination of work at a particular location. Copies of the August 30 and September 12, 1985, survey forms are enclosed.

As indicated above follow-up surveys were conducted on July 31 and August 3, 1987, to confirm the original survey. The results of these follow-up surveys are also enclosed and show no detectable contamination.

The August 30 and September 12, 1985, surveys and follow-up surveys on July 31 and August 3, 1987, are supplied as documentation of the requirements in 10 CFR 30.36 for the January 1986 amendment to license No. 01-16821-02, terminating work at BRF.

Mr. Earl G. Wright
August 13, 1987

TERMINATION OF FACILITY SURVEY AT THE BROWNS FERRY NUCLEAR PLANT (BFN)
BIOTHERMAL RESEARCH FACILITY (BRF) - BY-PRODUCT LICENSE NO. 01-16821-02

Other aspects of this license are under review by Lee Franklin, Region II
NRC Inspector, who visited this facility on August 4, 1987. Please call
R. B. Maxwell, Supervisor, Radiation Safety Staff, at (205) 386-2767
regarding this matter.

Sincerely,

original signed by:

George L. Sherer, Manager
Western Area Field Operations
Division of Services and Field Operations

RBM:CMG

Enclosures

- cc: Files, FO WEST, 170 OS WHA-M
- P. P. Carrier, BFN
- G. Paulk, BFN (Enclosure)
- A. W. Sorrell, BFN
- G. F. Stone, 215 MPB-M

FOWEST 0002Z

| | | |
|--|--------------|------|
| WESTERN AREA FIELD OPERATIONS AQUATIC BIOLOGY SECTION | | |
| 5 | | |
| AUG 14 '87 | | |
| TO | | |
| 1 | CRAVEN | MAC |
| | LOWERY | |
| 2 | TAYLOR, M. | -KOP |
| | TOOLE | |
| | | |
| | MALONE | |
| | FILES, TICEP | |

170 Office Service Warehouse Annex

November 21, 1985

Mr. Earl G. Wright
Senior License Reviewer
U.S. Regulatory Commission
Region II
101 Marietta Street, NW
Atlanta, Georgia 30323

Dear Mr. Wright:

Enclosed is an NRC Form 313 for an amendment to by-product materials license 01-16821-02. The present material that is authorized by this license is carbon 14, which is used in biological studies. We are requesting the present amendment so we may also possess environmental stream sediment and water that is contaminated with radionuclides. Organisms will be removed from this material for biological study. We would like to begin studies of the sediment from White Oak Creek, Oak Ridge, Tennessee, in early 1986.

Our present work, as authorized by this license, will also continue. In addition to the enclosed material that is essentially for an addition to this by-product materials license, we request three other deletions or changes to the license. They are as follows:

1. Condition 10--Delete "Browns Ferry Nuclear Plant, Decatur, Alabama." We no longer intend to conduct work under this license at Browns Ferry Nuclear Plant.
2. Condition 12--Delete "Brian J. Armitage" as a user of licensed material. Mr. Armitage is no longer employed with TVA.
3. In our October 4, 1982, letter concerning the Radiation Survey Program, please change "Air flow in the hood is checked quarterly and before any use involving carbon 14" to "During periods when radiological work is being conducted, air flow in the hood is checked quarterly and before any use involving carbon 14."

We appreciate your assistance with this amendment. If you have any questions, please let me know.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

os/gls

George L. Sherer
Manager, Western Area Field Operations
Division of Services and Field Operations

RECEIVED

NOV 26 1985

DOSIMETRY AND OFFSITE
SUPPORT STAFF

Earl G. Wright
November 21, 1985

JHC:MAM

Enclosures

bc (Enclosures):

E. A. Belvin, 401 UBB-C

R. B. Maxwell, 124 MPB-M

FO WEST Files, 10 EDB-M

FOWEST 0455K

11/27/85--RAQ

cc: NUC PR RIMS, LP 4S 132D-C

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date and Time 9-10-85

Inst. Eff. BKG

β - γ
 $\frac{2644.34 - 15.17}{4471.60} = 59.92\%$
 β
 α

Sampling Information

Biothermal Lab
(GFNP)
Aug. 30, 1985

Count for ^{14}C (Liquid Scint)

Rose/Wastrack

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|---------------------------|----------|--------------|-------------------|-----------|-----------------|---------|--------------------|--------|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 1 | 1st sink | β | 803 | 50 | 16.06 | 15.17 | 0.89 | .5992 | 1.44 |
| | | α | | | | | | | |
| 2 | 2nd sink | β | 780 | 50 | 15.60 | 15.17 | 0.43 | .5992 | 0.71 |
| | | α | | | | | | | |
| 3 | Hood (bottom) | β | 829 | 50 | 16.58 | 15.17 | 1.41 | .5992 | 2.35 |
| | | α | | | | | | | |
| 4 | Hood (back) | β | 831 | 50 | 16.62 | 15.17 | 1.45 | .5992 | 2.45 |
| | | α | | | | | | | |
| 5 | Hood (drain) | β | 860 | 50 | 17.20 | 15.17 | 2.03 | .5992 | 3.39 |
| | | α | | | | | | | |
| KG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 6 | Hood (glass) | β | 1441 | 50 | 28.82 | 15.17 | 13.65 | .5992 | 22.78 |
| | | α | | | | | | | |
| 7 | Floor | β | 778 | 50 | 15.56 | 15.17 | 0.39 | .5992 | 0.65 |
| | | α | | | | | | | |
| 8 | Counter top | β | 714 | 50 | 14.28 | 15.17 | -0.89 | .5992 | -1.49 |
| | | α | | | | | | | |
| 9 | Refrig. (inside) | β | 9745 | 50 | 194.90 | 15.17 | 179.73 | .5992 | 299.45 |
| | | α | | | | | | | |
| 10 | boxes inside refrigerator | β | 470 | 50 | 19.40 | 15.17 | 4.23 | .5992 | 7.06 |
| | | α | | | | | | | |
| G | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Prepared by Gene Ellison

Checked by Robert P. Patten

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date and Time 9/3/85

Inst. Eff. BKG

β - γ _____
 β 223/.0905/1.29
 α 223/.3068/.108

Sampling Information
Biothermal Lab
 (BFNP)
Aug 30, 1985

Count for ^{14}C α \rightarrow B γ

Rose/Waistrack

| near number | Sampling Location | Analysis | Total Counts \div | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency \div | DPM |
|-------------|------------------------|----------|---------------------|-------------------|-----------|-----------------|---------|---------------------------|--------|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 1 | Hood | β | 29 | 10 | 2.9 | 1.29 | 1.61 | .0905 | 17.740 |
| | | α | 3 | | .3 | .108 | .192 | .3068 | .625 |
| 2 | Floor | β | 19 | 10 | 1.9 | 1.29 | .61 | .0905 | 6.740 |
| | | α | 1 | | .1 | .108 | - | .3068 | 0 |
| 3 | Cabinet - counter tops | β | 7 | 10 | .7 | 1.29 | - | .0905 | 0 |
| | | α | 0 | | 0 | .108 | - | .3068 | 0 |
| 4 | Inside Cabinet | β | 16 | 10 | 1.6 | 1.29 | .31 | .0905 | 3.425 |
| | | α | 5 | | .5 | .108 | .392 | .3068 | 1.277 |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by SD
 Calculated by SD

Checked by MHC

000-05-0-89

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date and Time 9-19-85

Inst. Eff. BKG

Sampling Information

β - γ

$$\frac{2864.42 - 14.35}{4471.60} = 63.74\%$$

Biothermal Lab
BFNP

β

Sept. 12, 1985

α

Count for ^{14}C (Liquid scintillation) Lastrack

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|-------------------|----------|--------------|-------------------|-----------|-----------------|---------|--------------------|------|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 1 | Top of before | β | 796 | 50 | 15.92 | 14.35 | 1.57 | .6374 | 2.46 |
| | | α | | 10 | | | | | |
| 2 | bottom of freezer | β | 801 | 50 | 16.02 | 14.35 | 1.67 | .6374 | 2.63 |
| | | α | | 10 | | | | | |
| 3 | drawer | β | 792 | 50 | 15.84 | 14.35 | 1.49 | .6374 | 2.34 |
| | | α | | 10 | | | | | |
| 4 | 1st shelf | β | 791 | 50 | 15.82 | 14.35 | 1.47 | .6374 | 2.31 |
| | | α | | 10 | | | | | |
| 5 | 2nd shelf | β | 810 | 50 | 16.20 | 14.35 | 1.85 | .6374 | 2.90 |
| | | α | | 10 | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 6 | 3rd shelf | β | 784 | 50 | 15.68 | 14.35 | 1.33 | .6374 | 2.09 |
| | | α | | 10 | | | | | |
| 7 | 4th shelf | β | 771 | 50 | 15.42 | 14.35 | 1.07 | .6374 | 1.68 |
| | | α | | 10 | | | | | |
| 8 | walls of freezer | β | 860 | 50 | 17.20 | 14.35 | 2.85 | .6374 | 3.88 |
| | | α | | 10 | | | | | |
| 9 | door of freezer | β | 1034 | 50 | 20.68 | 14.35 | 6.33 | .6374 | 9.93 |
| | | α | | 10 | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| G | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

ed by Gene Cotton

Checked by 911/1

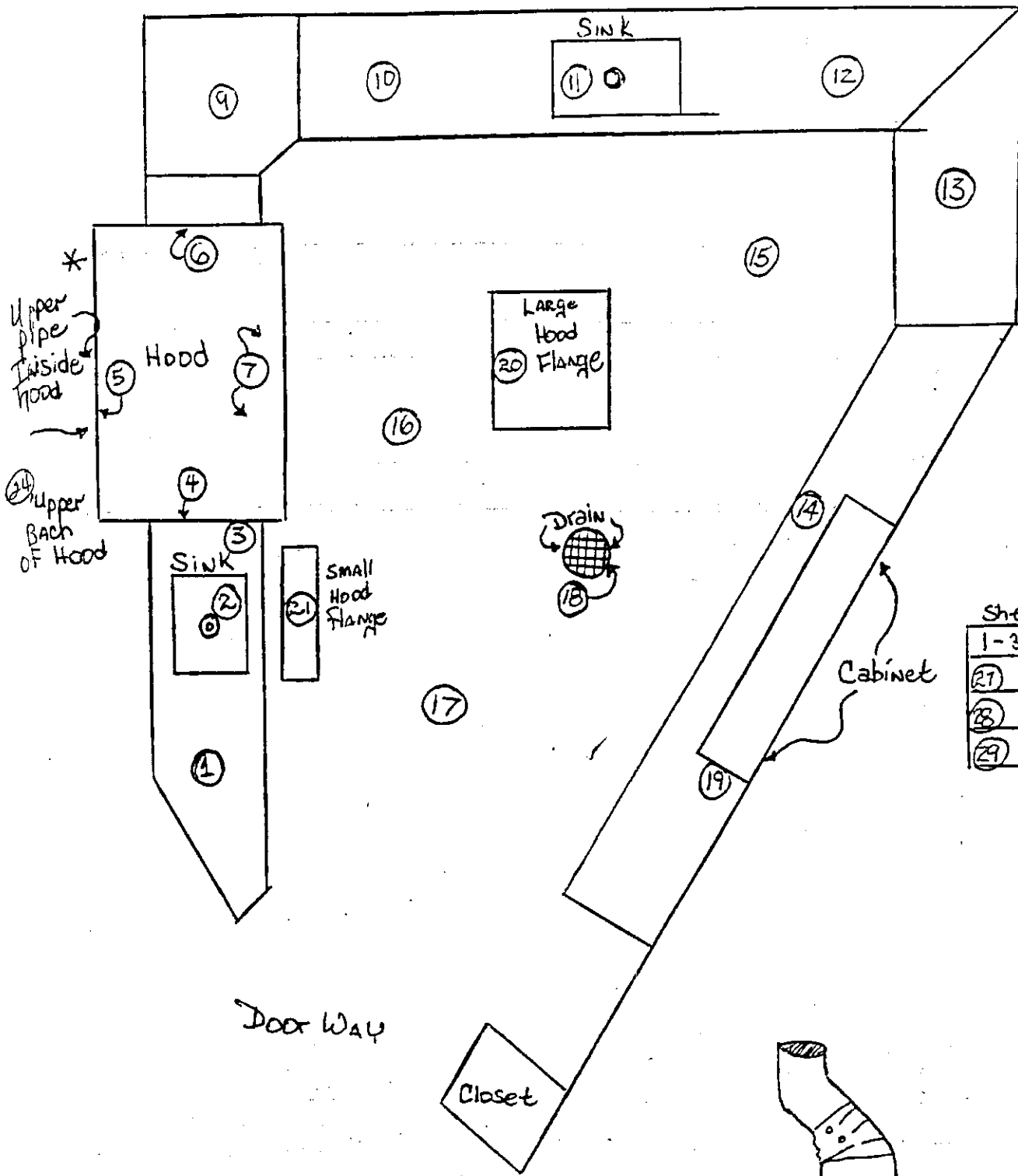
RADIOLOGICAL SURVEY
 Plant BEN - Bio-Thermal Unit
 Page _____ of _____

Date 7-31-87 Friday
 Shift Day

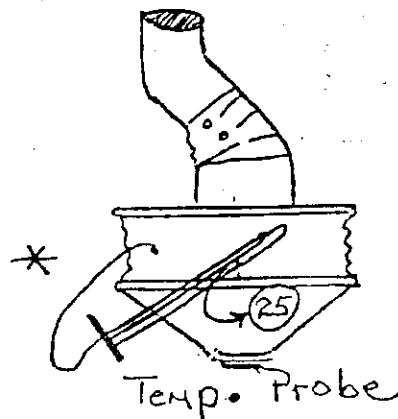
vey Number RSS-87-S-53
 ictor Power 1VA

| Item or Location | Time | Dist. | Dose Rates | | | | Contamination | | | Update of Card Index | Instr. Serial No. | Remarks | Surveyed By |
|----------------------------------|------|---------|--------------|-----------------|-------------|---------------|---------------|---------------------------------------|----------------|----------------------|-----------------------------|---|------------------------|
| | | | Beta mrad/hr | Neutron mrem/hr | Gamma mR/hr | Total mrem/hr | 4m Direct | Transferrable dpm/100 cm ² | Type | | | | |
| Lab Hood | 1300 | Contact | / | / | / | / | 150 | ① | β ⁻ | Yes | Bicron # 553800 Surveyor 50 | ① See RSS 87-C-97 SEE MAP Smears 4,5,6,7,20,21,24,8 | A.J. Amick P. Kelly |
| | | 18" | | N | A | | | | | No | | | |
| Lab Work Benches & Sinks | | Contact | / | / | / | / | 150 | ① | β ⁻ | Yes | | ① RSS-C-97 Smears 1,2,3,9,11,12,13,14 See MAP | A.J. Amick P. Kelly |
| | | 18" | | N | A | | | | | No | | | |
| Lab Floor | | Contact | / | / | / | / | 150 | ① | β ⁻ | Yes | | ① RSS-87-C-97 Smears # 16,17,15,18 See MAP | P. Kelly |
| | | 18" | | N | A | | | | | No | | | |
| Lab Cabinets & Shelves | 1530 | Contact | / | / | / | / | 150 | ① | β ⁻ | Yes | | ① RSS-87-C-97 Smears 27,28,29,30,31,32 See MAP | A.J. Amick P. Kelly |
| | | 18" | | N | A | | | | | No | | | |
| Exhaust Hood ON TOP OF Bldg roof | 1340 | Contact | / | / | / | / | <50 | * | β ⁻ | Yes | Bicron # 553800 Surveyor 50 | * See Results on RSS-87-C-97 Smears # 22 + 23 | A.J. Amick |
| | | 18" | | N | A | | | | | No | | | |
| Survey of Green Bags | 1355 | Contact | / | / | / | / | <50 | * | β ⁻ | Yes | | * See Results on RSS-87-C-97 Smears # 33,34,35 and 36 | A.J. Amick |
| | | 18" | | | | | | | | No | | | |
| | | Contact | / | / | / | / | | | | Yes | | | |
| | | 18" | / | / | / | / | | | | No | | | |
| | | Contact | / | / | / | / | | | | Yes | | | |
| | | 18" | / | / | / | / | | | | No | | | |

Reviewed By _____
 Shift Coordinator _____ Shift Supervisor _____ Clerk _____



| shelves | shelves |
|---------|---------|
| 1-34 | 1-35 |
| 27 | 30 |
| 28 | 31 |
| 29 | 32 |



RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

R55-87-C-97

Date and Time 8/4/87 @ 1413

Inst. Eff. BKG

1-15 Inst # 129

Sampling Information

B-X

16-23 Inst # 122

BFMP C-14

25-36 # 129 mhc
8/3/87

7-3-87

ⓑ 129 | .0962 8/5/87, mhc
4820 / 1.0

Liquid Scintillation

P. Llewellyn Arnold

355-MPB

Count for ¹⁴C

| Smear Number | Sampling Location | Analysis | Total Counts ÷ | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM ÷ | Counter Efficiency | DPM |
|--------------|-----------------------------------|----------|----------------|-------------------|-----------|-----------------|-----------|--------------------|------|
| BKG | | β | 9 | 10 | | N/A | N/A | N/A | N/A |
| | | α | 9 | 10 | | N/A | N/A | N/A | N/A |
| ① | | β | 9 | 10 | .9 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| ② | | β | 8 | 10 | .8 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| ③ | SINK AND Side of hood | β | 6 | 10 | .6 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| ④ | INSIDE OF HOOD | β | 9 | 10 | .9 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| ⑤ | BACK wall side of hood (inside) | β | 14 | 10 | 1.4 | 1.0 | .40 | .0962 | 4.16 |
| | | α | | | | | | | |
| BKG | | β | 9 | 10 | | N/A | N/A | N/A | N/A |
| | | α | 9 | 10 | | N/A | N/A | N/A | N/A |
| ⑥ | Right Side panel of hood (inside) | β | 9 | 10 | .9 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| ⑦ | | β | 10 | 10 | 1 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| ⑧ | | β | 11 | 10 | 1.1 | 1.0 | .10 | .0962 | 1.04 |
| | | α | | | | | | | |
| ⑨ | | β | 12 | 10 | 1.2 | 1.0 | .20 | .0962 | 2.08 |
| | | α | | | | | | | |
| ⑩ | | β | 8 | 10 | .8 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| BKG | | β | 9 | 10 | | N/A | N/A | N/A | N/A |
| | | α | 9 | 10 | | N/A | N/A | N/A | N/A |
| ⑪ | | β | 15 | 10 | 1.5 | 1.0 | .50 | .0962 | 5.20 |
| | | α | | | | | | | |
| ⑫ | | β | 7 | 10 | .7 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| ⑬ | | β | 8 | 10 | .8 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| ⑭ | | β | 8 | 10 | .8 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| ⑮ | | β | 11 | 10 | 1.1 | 1.0 | .10 | .0962 | 1.04 |
| | | α | | | | | | | |
| BKG | | β | 9 | 10 | | N/A | N/A | N/A | N/A |
| | | α | 9 | 10 | | N/A | N/A | N/A | N/A |

Counted by AK

Checked by MHC

Calculated by AK

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date and Time 8/4/87 @ 1413

Inst. Eff. BKG

Sampling Information

β - γ
129 | .0962 | 1.0
 (D) 122 | .0961 | 1.00

16-23 Inst # 122
 25-36 Inst # 129

Page 2 BFNPC14
7-30-87

α _____

Count for ^{14}C

355-MPB

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|-----------------------------|----------|---------------|-------------------|-----------|-----------------|---------|--------------------|-------|
| BKG | | β | 10 | 10 | | N/A | N/A | N/A | N/A |
| | | α | 10 | | | | | | |
| (16) | | β | 11 | 10 | 1.1 | 1.0 | .10 | .0961 | 1.04 |
| | | α | | | | | | | |
| (17) | | β | 25 | 10 | 2.5 | " | 1.5 | " | 15.59 |
| | | α | | | | | | | |
| (18) | | β | 22 | 10 | 2.2 | " | 1.2 | " | 12.47 |
| | | α | | | | | | | |
| (19) | | β | 20 | 10 | 2.0 | " | 1.0 | " | 10.40 |
| | | α | | | | | | | |
| (20) | | β | 14 | 10 | 1.4 | " | 1.40 | " | 4.16 |
| | | α | | | | | | | |
| BKG | | β | 10 | 10 | | N/A | N/A | N/A | N/A |
| | | α | 10 | | | | | | |
| (21) | | β | 12 | 10 | 1.2 | 1.0 | .20 | .0961 | 3.08 |
| | | α | | | | | | | |
| (22) | Roof Exhaust hood | β | 11 | 10 | 1.1 | 1.0 | .10 | .0961 | 1.04 |
| | | α | | | | | | | |
| (23) | Roof Exhaust hood | β | 19 | 10 | 1.9 | 1.0 | .90 | .0961 | 9.37 |
| | | α | | | | | | | |
| (24) | NO Sample - skid | β | | 10 | | | | | |
| | | α | | | | | | | |
| (25) | Induit Temp. Probe | β | 7 | 10 | .70 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| BKG | | β | 10 | 10 | | N/A | N/A | N/A | N/A |
| | | α | 10 | | | | | | |
| (26) | Induit. Temp probe | β | 23 | 10 | 2.3 | 1.0 | 1.3 | .0962 | 13.51 |
| | | α | | | | | | | |
| (27) | Skid # 1.34 Top | β | 5 | 10 | .50 | " | 0 | " | 0 |
| | | α | | | | | | | |
| (28) | Shelves # 1.34 Middle | β | 13 | 10 | 1.3 | " | .30 | " | 3.12 |
| | | α | | | | | | | |
| (29) | Shelves # 1.34 bottom | β | 11 | 10 | 1.1 | " | .10 | " | 1.04 |
| | | α | | | | | | | |
| (30) | Shelves # 1.35 Top | β | 10 | 10 | 1.0 | " | 0 | " | 0 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by AK
 Calculated by AK

Checked by MHC

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date and Time 8/4/07 0143

Inst. Eff. BKG

Sampling Information

β - γ _____

Page C-14 BFM

β 129 | .0962 | 1.00

7-30-87

α _____

RSS-87-C-97

Count for ^{14}C

355-MPB-4

| Smear Number | Sampling Location | Analysis | Total Counts \div | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM \div | Counter Efficiency | DPM |
|--------------|-------------------|----------|---------------------|-------------------|-----------|-----------------|----------------|--------------------|------|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 31 | | β | 7 | 10 | .70 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| 32 | | β | 8 | 10 | .80 | " | 0 | " | 0 |
| | | α | | | | | | | |
| 33 | Green Bag # 1 | β | 5 | 10 | .50 | " | 0 | " | 0 |
| | | α | | | | | | | |
| 34 | Green Bag # 2 | β | 12 | 10 | 1.2 | " | .20 | " | 2.08 |
| | | α | | | | | | | |
| 35 | Green Bag # 3 | β | 10 | 10 | 1.0 | " | 0 | " | 0 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 36 | Green Bag # 4 | β | 6 | 10 | .6 | 1.0 | 0 | .0962 | 0 |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

8/4/07
d.l.g.
NO STAMP

Entered by JLC
 Calculated by AK

Checked by MHC

RADIOLOGICAL SURVEY

Plant Bio Thermal Unit

Page _____ of _____

Survey Number RSS-87-S-54
 Factor Power _____

Date 9-3-87
 Shift Day - Monday

Bio Thermal Unit

| Item or Location | Time | Dist. | Dose Rates | | | | Contamination | | | Update of Card Index | Instr. Serial No. | Remarks | Surveyed By |
|---------------------------------|------|---------|--------------|-----------------|-------------|---------------|---------------|---------------------------------------|----------------|----------------------|--------------------|-----------------------------|-------------|
| | | | Beta mrad/hr | Neutron nrem/hr | Gamma mR/hr | Total nrem/hr | Direct | Transferrable dpm/100 cm ² | Type | | | | |
| Hood & Sink Drain Line | 0730 | Contact | | | | | | | | | | Smears see ① RSS-87-C-99 | P. Rowley |
| | | 18" | | N | A | | L50 %/m | ① | β ⁻ | Yes <u>No</u> | Brom # 53800 | | |
| Dress 1-1 through 1-33 | 0745 | Contact | | | | | | | | | | Smears # 5-37 | P. Rowley |
| | | 18" | | N | A | | L50 %/m | ① | β ⁻ | Yes <u>No</u> | " | | |
| Closet Beside Entrance Door | 0830 | Contact | | | | | | | | | | Smear # 39 | P. Rowley |
| | | 18" | | N/A | | | L50 %/m | ① | β ⁻ | Yes <u>No</u> | " | | |
| Cabinet Beside Entrance Door | | Contact | | | | | | | | | | Smear # 40 | P. Rowley |
| | | 18" | | N | A | | L50 %/m | ① | β ⁻ | Yes <u>No</u> | " | | |
| Ceiling Room | | Contact | | | | | | | | | | Smears # 41, 42, 43 | P. Rowley |
| | | 18" | | N | A | | L50 %/m | ① | β ⁻ | Yes <u>No</u> | " | | |
| Cabinet Area under Window | | Contact | | | | | | | | | | Smear # 44 | P. Rowley |
| | | 18" | | N | A | | L50 %/m | ① | β ⁻ | Yes <u>No</u> | " | | |
| Freezer used to Store C-14 | | Contact | | | | | | | | | | Smear # 45-50 | P. Rowley |
| | | 18" | | N | A | | L50 %/m | ① | β ⁻ | Yes <u>No</u> | " | | |
| Colman Coolers under Window | | Contact | | | | | | | | | | Smear # 51 | P. Rowley |
| | | 18" | | N | A | | L50 %/m | ① | β ⁻ | Yes <u>No</u> | " | | |

Shift Coordinator _____ Reviewed By _____ Shift Supervisor _____ Clerk _____

White - HP Office
 Yellow - HP Lab

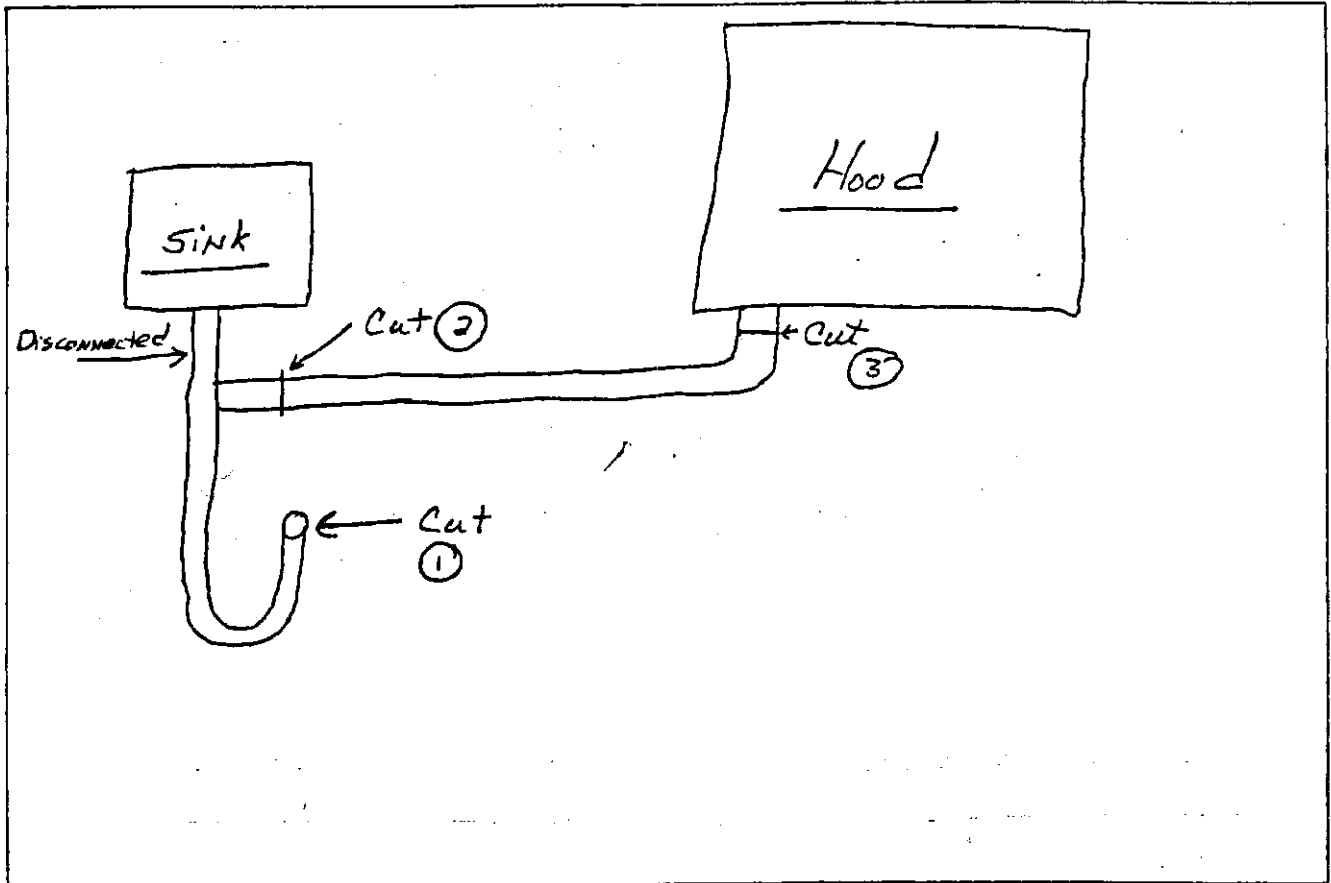
Att. 1

Radiological Survey Addendum Sheet

Attach to Radiological Survey Number RSS-87-5-54

Date 8-3-87

Time 0730



Comments:

Smears 1, 2 & 3 on Cut Area of Pipe

Smear 4 taken on Hack Saw used to cut pipe

INDIVIDUAL COUNTING RECORD SHEET FOR SMEARS

194

Date and Time 8/4/70 @ 1400

Inst. Eff. BKG
B-8

1-4 Inst # 122 *OK*
5-20 Inst # 129 *OK*
21-51 Inst # 122

Sampling Information
Bio Thermal Unit BFA
8-3-70 P. Llewellyn
Phone # 3778

β 122 / .0961 / 1.00
B 129 / .0962 / 1.00

Count for C-14

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DP |
|--------------|-------------------|----------|---------------|-------------------|------------|-----------------|---------|--------------------|------|
| BKG | | β α | 32 | 10 | | N/A | N/A | N/A | N/A |
| 1 | Drain Pipe | β α | 32 28 | 10 | 3.2 2.8 | 1.00 | 2.20 | .0961 | 22.8 |
| 2 | " | β α | 28 | 10 | 2.8 | " | 1.80 | " | 18.7 |
| 3 | " | β α | 61 | 10 | 6.1 | " | 5.10 | " | 53.5 |
| 4 | Hack Saw | β α | 67 | 10 | 6.7 | " | 5.70 | " | 59.7 |
| 5 | Draw # 1-1 | β α | 8 | 10 | .80 | " | 0 | .0962 | 0 |
| BKG | 1-2 | β α | 6 | 10 | | N/A | N/A | N/A | N/A |
| 6 | 1-2 | β α | 6 | 10 | .60 | 1.0 | 0 | .0962 | 0 |
| 7 | 1-3 | β α | 7 | 10 | .70 | " | 0 | " | 0 |
| 8 | 1-4 | β α | 10 | 10 | 1 | " | 0 | " | 0 |
| 9 | 1-5 | β α | 10 | 10 | 1 | " | 0 | " | 0 |
| 10 | 1-6 | β α | 11 | 10 | 1.1 | " | .10 | " | 1.0 |
| BKG | | β α | 10 | 10 | | N/A | N/A | N/A | N/A |
| 11 | 1-7 | β α | 10 | 10 | 1 | " | 0 | " | 0 |
| 12 | 1-8 | β α | 12 | 10 | 1.2 | " | .20 | " | 2.0 |
| 13 | 1-9 | β α | 9 | 10 | .9 | " | 0 | " | 0 |
| 14 | 1-10 | β α | 13 | 10 | 1.3 | " | .30 | " | 3.15 |
| 15 | 1-11 | β α | 6 | 10 | .6 | " | 0 | " | 0 |
| BKG | | β α | 10 | 10 | | N/A | N/A | N/A | N/A |

Counted by OK
Calculated by OK

Checked by MHC

Date and Time 5/4/87 @ 1400

Inst. Eff. BKG
 β - γ _____

Sampling Information

B.T.U. - B.F.M.

8-3-87 P. Llewellyn

Ph 3778

129 / .0962 / 1.00
122 / .0961 / 1.00

Count for 0-14

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DP |
|--------------|-------------------|----------|--------------|-------------------|-----------|-----------------|---------|--------------------|------|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 16 | Draw # 1-12 | β | 12 | 10 | 1.2 | 1.0 | .20 | .0962 | 2.0 |
| | | α | | | | | | | |
| 17 | 1-13 | β | 4 | 10 | .4 | " | 0 | " | 0 |
| | | α | | | | | | | |
| 18 | 1-14 | β | 12 | 10 | 1.2 | " | .20 | " | 2.0 |
| | | α | | | | | | | |
| 19 | 1-15 | β | 5 | 10 | .5 | " | 0 | " | 0 |
| | | α | | | | | | | |
| 20 | 1-16 | β | 8 | 10 | .8 | " | 0 | " | 0 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 21 | 1-17 | β | 26 | 10 | 2.6 | 1.0 | 1.6 | .0961 | 16.7 |
| | | α | | | | | | | |
| 22 | 1-18 | β | 28 | 10 | 2.8 | " | 1.8 | " | 18.7 |
| | | α | | | | | | | |
| 23 | 1-19 | β | 24 | 10 | 2.4 | " | 1.4 | " | 14.5 |
| | | α | | | | | | | |
| 24 | 1-20 | β | 31 | 10 | 3.1 | " | 2.1 | " | 21.8 |
| | | α | | | | | | | |
| 25 | 1-21 | β | 12 | 10 | 1.2 | " | .20 | " | 2.0 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 26 | 1-22 | β | 12 | 10 | 1.2 | 1.0 | .20 | .0961 | 2.0 |
| | | α | | | | | | | |
| 27 | 1-23 | β | 14 | 10 | 1.4 | " | .40 | " | 4.11 |
| | | α | | | | | | | |
| 28 | 1-24 | β | 11 | 10 | 1.1 | " | .10 | " | 1.05 |
| | | α | | | | | | | |
| 29 | 1-25 | β | 9 | 10 | .90 | " | 0 | " | 0 |
| | | α | | | | | | | |
| 30 | 1-26 | β | 22 | 10 | 2.2 | " | 1.20 | " | 12.9 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by JK

Checked by MHC

Calculated by JK

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Page 3 of 4

Date and Time 8/4/87 0140

Inst. Eff. BKG

Sampling Information

B-8

B-T-6 - BFN

β 128 / .0961 / 100

8-3-87 P. Llewellyn

Ph 3778

Count to C-14

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPM | |
|--------------|-------------------------------------|---------------|---------------|-------------------|-----------|-----------------|---------|--------------------|------|------|
| BKG | | β | 10 | 10 | | N/A | N/A | N/A | N/A | |
| | | α | 10 | 10 | | N/A | N/A | N/A | N/A | |
| 31 | Draw # 1-27 | β | 10 | 10 | 1.0 | 1.0 | 0 | .0961 | 0 | |
| | | α | | | | | | | | |
| 32 | | 1-28 | β | 8 | 10 | .80 | " | 0 | " | 0 |
| | | α | | | | | | | | |
| 33 | | 1-29 | β | 11 | 10 | 1.1 | " | .10 | " | 1.00 |
| | | α | | | | | | | | |
| 34 | | 1-30 | β | 8 | 10 | .80 | " | 0 | " | 0 |
| | | α | | | | | | | | |
| 35 | | 1-31 | β | 5 | 10 | .50 | " | 0 | " | 0 |
| | | α | | | | | | | | |
| BKG | | β | 10 | 10 | | N/A | N/A | N/A | N/A | |
| | | α | 10 | 10 | | N/A | N/A | N/A | N/A | |
| 36 | 1-32 | β | 9 | 10 | .90 | 1.0 | 0 | .0961 | 0 | |
| | α | | | | | | | | | |
| 37 | 1-33 | β | 9 | 10 | .90 | " | 0 | " | 0 | |
| | α | | | | | | | | | |
| 38 | Skip | β | 10 | 10 | | " | | " | | |
| | α | 10 | | | | | | | | |
| 39 | Closet Besid door | β | 5 | 10 | .50 | " | 0 | " | 0 | |
| | α | | | | | | | | | |
| 40 | Cabinet Besid door | β | 16 | 10 | 1.6 | " | .60 | " | 6.2 | |
| | α | | | | | | | | | |
| BKG | | β | 10 | 10 | | N/A | N/A | N/A | N/A | |
| | | α | 10 | 10 | | N/A | N/A | N/A | N/A | |
| 41 | Ceiling Hall Area | β | 13 | 10 | 1.3 | 1.0 | .30 | .0961 | 3.15 | |
| | α | | | | | | | | | |
| 42 | Window Area | β | 8 | 10 | .80 | " | 0 | " | 0 | |
| | α | | | | | | | | | |
| 43 | Door Area | β | 13 | 10 | 1.3 | " | .30 | " | 3.15 | |
| | α | | | | | | | | | |
| 44 | Cabinet (Storage) area Under Window | β | 6 | 10 | .60 | " | 0 | " | 0 | |
| | α | | | | | | | | | |
| 45 | Refrigerator (Freezer) 1/2 Top | β | 15 | 10 | 1.5 | " | .50 | " | 5.20 | |
| | α | | | | | | | | | |
| BKG | | β | 10 | 10 | | N/A | N/A | N/A | N/A | |
| | | α | 10 | 10 | | N/A | N/A | N/A | N/A | |

Counted by JK

Checked by MHC

Calculated by JK

Date and Time 8/4/87 @ 1400

0147

Inst. Eff. BKG

B-8

Sampling Information

B. T. U. BEN

8-3-87 P. Llewellyn

PK 3778

122 | .0961 | 1.0

Cont for C-14

| Smear Number | Sampling Location | Analysis | Total Counts ÷ | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency ÷ | DPS |
|--------------|-----------------------------------|----------|----------------|-------------------|-----------|-----------------|---------|----------------------|------|
| BKG | | β | 17 | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 46 | Refrigerator (Freezer) I/s Bottom | β | 17 | 10 | 1.7 | 1.0 | .70 | .0961 | 7.2 |
| | | α | | | | | | | |
| 47 | I/s Sides | β | 9 | 10 | .90 | " | 0 | " | 0 |
| | | α | | | | | | | |
| 48 | I/s Door | β | 7 | 10 | .70 | " | 0 | " | 0 |
| | | α | | | | | | | |
| 49 | O/s Door | β | 15 | 10 | 1.5 | " | .50 | " | 5.1 |
| | | α | | | | | | | 15.2 |
| 50 | O/s Bottom | β | 15 | 10 | 1.5 | " | .50 | " | 5.2 |
| | | α | | | | | | | |
| BKG | | β | 18 | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 51 | Colman Cooler | β | 18 | 10 | .90 | 1.0 | 0 | .0961 | 0 |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | 10 | | | | | |
| | | β | | 10 | | | | | |
| | | α | | 10 | | | | | |
| | | β | | 10 | | | | | |
| | | α | | 10 | | | | | |
| | | β | | 10 | | | | | |
| | | α | | 10 | | | | | |
| | | β | | 10 | | | | | |
| | | α | | 10 | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | 10 | | | | | |
| | | β | | 10 | | | | | |
| | | α | | 10 | | | | | |
| | | β | | 10 | | | | | |
| | | α | | 10 | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by AK

Checked by MHC

Calculated by AK

UNITED STATES GOVERNMENT

Memorandum

L91 870811 802

TENNESSEE VALLEY AUTHORITY

TO : R. B. Maxwell, Supervisor, Radiation Safety Staff, 324B MPB-M
FROM : W. L. Raines, Supervisor, Laboratory Section, WARL-M
DATE : August 10, 1987
SUBJECT: LIQUID SCINTILLATION COUNTING RESULTS FOR SMEAR FROM BIOTHERMAL UNIT
LABORATORY AT BROWNS FERRY NUCLEAR PLANT (BFN)

The four smears marked drain pipe and hacksaw from the biothermal laboratory at BFN which had indicated some activity from the gross beta counts were counted by liquid scintillation for carbon-14. These liquid scintillation counts indicated only background activity with the highest count rate smear producing 0.3 dpm. These results are attached.

If you have any questions, please call me.


W. L. Raines

WLR:TJ
Attachment
cc: RIMS, MR 4N 72A-C



LIQUID SCINTILLATION RESULTS CARBON-14 SMEARS
Counting Efficiency - 0.96
Background - 38.7 cpm

| <u>SAMPLE</u> | <u>DPM</u> |
|---------------|----------------------|
| 1-Drain Pipe | LESS THAN BACKGROUND |
| 2-Drain Pipe | LESS THAN BACKGROUND |
| 3-Drain Pipe | 0.21 |
| 4-Hacksaw | 0.31 |

SMEAR COUNTING DATA SHEET

RS&C Survey No.: RS&C-94- 260
 Date of Survey: Sept 1, 1994
 Purpose of survey: Clearance of work area
 NRC License # 01-06113-03, Activity K
 ROVE Study - Regional Ozone - Vegetation Study
 Date Smears Counted: Sept 1, 1994

Sheet 2 of 2

Counting System ID: Ludlum 2200 # 534286
 Date of Chi Square test: Aug 31, 1994
 Efficiency: 6.45 %
 Background: 31.5 cpm
 Type of radiation: Beta (C-14)

| Smear Number | Location Of Smears: | Gross Counts in 2 min. | Gross Count Rate (cpm) | Net Count Rate (cpm) | Activity (dpm) |
|--------------|---------------------|------------------------|------------------------|----------------------|----------------|
| 1 | Oven Top & Bottom | 45 | 22.5 | -9.0 | 0 |
| 2 | Oven Door & Walls | 67 | 33.5 | 2.0 | 31 |
| 3 | Oven Pan & Tray | 49 | 24.5 | -7.0 | 0 |
| 4 | Oven - Bottles | 53 | 26.5 | -5.0 | 0 |

Notes: _____

Counted by: Jessie H. Coleman & Date Sept 94 Reviewed by: R. Maxwell Date: 9/7/94

ATTACHMENT 10

Items 6.d and 6.f
Survey Data for E&D Building

RADIOLOGICAL SURVEY

Survey Number RS+C-88-185

LOCATION E+D Room 119

Date 11-28-88

Special - Final Survey - Clear Room No. 119 - E+D Building

| Item or Location | Time | Dist. | Dose Rates | | | | Contamination | | | Instrument Serial No. | Remarks | Surveyed By |
|---|------|---------|-----------------|--------------------|----------------|------------------|-------------------|--|----------------|--|---|-----------------|
| | | | Beta mrad/hr | Neutron nrem/hr | Gamma mR/hr | Total mrem/hr | CPM Direct | Transferrable dpm/100 cm ² | Type | | | |
| E+D Building - Room 119 (Smear Survey) | 0700 | Contact | ND | NA | <.1 | <.1 | | | | | | |
| | | 18" | ↓ | ↓ | ↓ | ↓ | NA | (1)-(38)* | β ⁻ | R505- 552079 Ludlum 2200-552057 | * See attached map and Smear counting Sheet for location and results. | J.H. Johnson |
| Miscellaneous items: Chairs, beakers, books, pads, instruments, etc. | | Contact | NA | NA | NA | NA | 750% _m | | | | | |
| | | 18" | ↓ | ↓ | ↓ | ↓ | ND | NA | β ⁻ | 552057 Bicron ** Surveyor 50 No. 562847 | Cleared ** All items Fixed 750% By Fischer | ↓ |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |

Reviewed by: Philby Dewilly

Sink

Survey No. RS8C-88-185

Date: 11-28-88

Technician:

James H. Johnson
Phillip Levelly

\bar{x} = GA dose rate

\underline{x} = contact dose rate
 x 18" dose rate

\textcircled{Q} = smear location

All dose rates
in mR/hr.

$< 50\%m$ - *Frisher Result*

Instruments
Used:

RS05-552079

Ludlum 2200 -

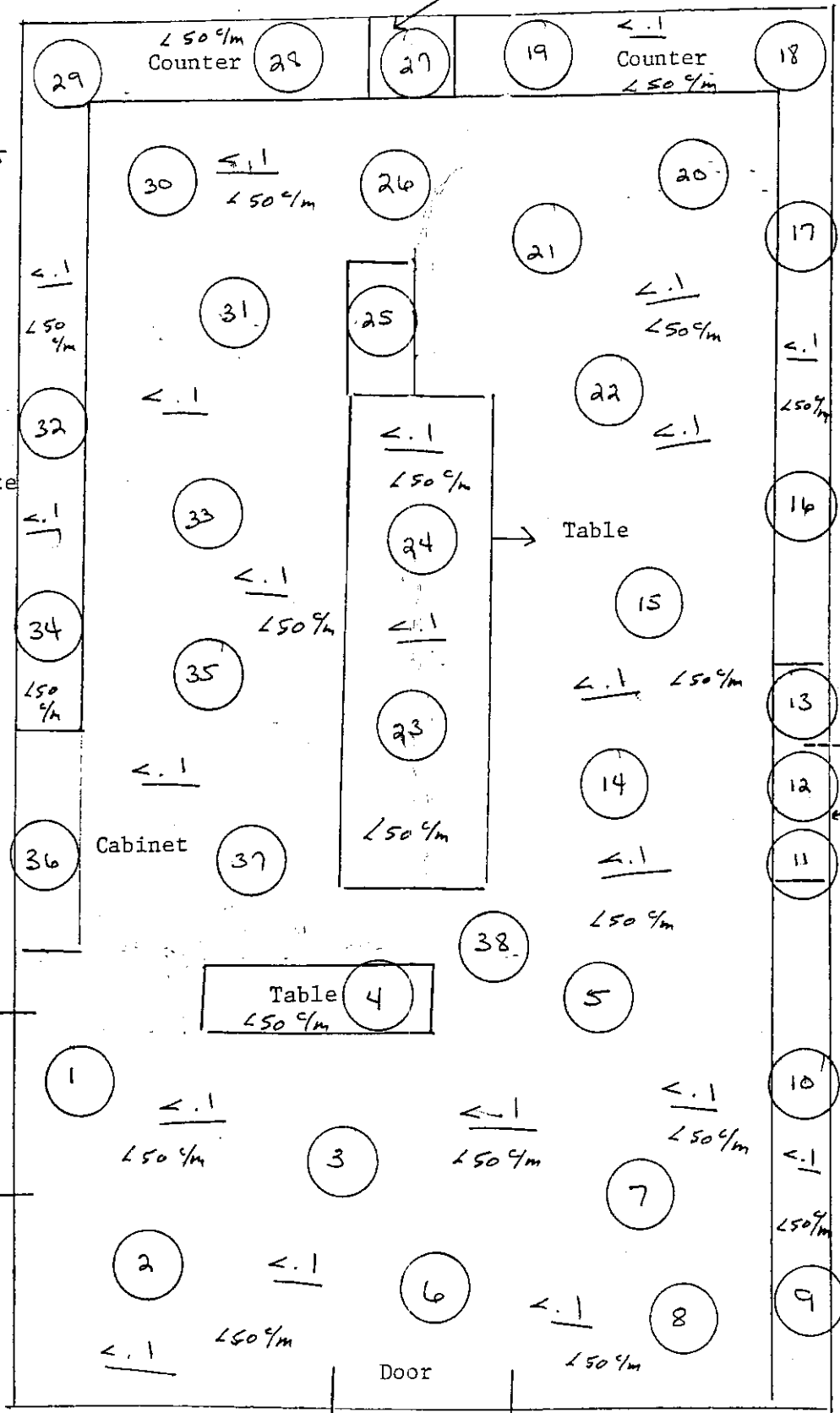
552057

Bicron

Surveyor 50

No. 562847

All locations $< 50\%m$
Door



Hood $< 50\%m$

Door

Survey No. RSK-88-185

Attachment IV

Detector Serial Number 552057/491614

Date 11-28-88

SMEAR COUNTING DATA SHEET

Efficiency (Eff.) 5 (%)

Chi-square Test Date 11-17-88

Background (10 min) 26.9

Purpose of this survey:

Type of Radiation β^- C-14

Final Survey - Clean Room 119 - E+D Building

| Smear No. | Specific Location | Gross Counts 2-min | Gross (cpm) | Bkg (cpm) | Net (cpm) \div | Eff | Activity (dpm) | Counted By (initials) |
|-----------|-------------------|--------------------|-------------|-----------|-----------------------|-----|----------------|-----------------------|
| 1 | See Attached map | 36 | 18 | 26.9 | 0 | .05 | 0 | JJ |
| 2 | | 68 | 34 | | 0.1 2.1 | | 142 | |
| 3 | | 40 | 20 | | 0 | | 0 | |
| 4 | | 42 | 21 | | 0 | | 0 | |
| 5 | | 50 | 25 | | 0.1 | | 2 | |
| 6 | | 54 | 27 | | 0 | | 0 | |
| 7 | | 42 | 21 | | 0 | | 0 | |
| 8 | | 48 | 24 | | 0 | | 0 | |
| 9 | | 46 | 23 | | 0 | | 0 | |
| 10 | | 30 | 15 | | 0 | | 0 | |
| 11 | | 50 | 25 | | 0 | | 0 | |
| 12 | | 40 | 20 | | 0 | | 0 | |
| 13 | | 44 | 22 | | 0 | | 0 | |
| 14 | | 54 | 27 | | 0.1 | | 2 | |
| 15 | | 42 | 21 | | 0 | | 0 | |
| 16 | | 40 | 20 | ✓ | 0 | ✓ | 0 | ✓ |

Survey No. RSAC-88-185

Attachment IV

Detector Serial Number 552057/49164

Date 11-28-88

Efficiency (Eff.) 5 (%)

Chi-square Test Date 11-17-88

SMEAR COUNTING DATA SHEET

Background (10 min) 26.9

Purpose of this survey:

Final Survey - Clear - Room No. 119 - E4D Building

Type of Radiation B- C-14

| Smear No. | Specific Location | Gross Counts 2-min | Gross (cpm) | Bkg (cpm) | Net (cpm) = Gross - Bkg | Eff | Activity (dpm) = Net ÷ Eff | Counted By (initials) |
|-----------|-------------------|--------------------|-------------|-----------|-------------------------|-----|----------------------------|-----------------------|
| 17 | See Attached map | 46 | 23 | 26.9 | 0 | .05 | 0 | JJ |
| 18 | | 40 | 20 | | 0 | | 0 | |
| 19 | | 42 | 21 | | 0 | | 0 | |
| 20 | | 46 | 23 | | 0 | | 0 | |
| 21 | | 44 | 22 | | 0 | | 0 | |
| 22 | | 44 | 22 | | 0 | | 0 | |
| 23 | | 40 | 20 | | 0 | | 0 | |
| 24 | | 46 | 23 | | 0 | | 0 | |
| 25 | | 58 | 29 | | 2.1 | | 42 | |
| 26 | | 72 | 36 | | 9.1 | | 182 | |
| 27 | | 34 | 17 | | 0 | | 0 | |
| 28 | | 62 | 31 | | 4.1 | | 82 | |
| 29 | | 48 | 24 | | 0 | | 0 | |
| 30 | | 40 | 20 | | 0 | | 0 | |
| 31 | | 50 | 25 | | 0 | | 0 | |
| 32 | | 82 | 41 | ✓ | 14.1 | ✓ | 282 | ✓ |

Survey No. RS+C-88-185

Attachment IV.

Detector Serial Number 552057/49164

Date 11-28-88

SMEAR COUNTING DATA SHEET

Efficiency (Eff.) 5 (%)

Chi-square Test Date 11-17-88

Background (10 min) 26.9

Purpose of this survey:

Type of Radiation B C-14

Final Survey - Clear Room No. 119. E+P Building

| Smear No. | Specific Location | Gross Counts 2-min | Gross (cpm) | Bkg (cpm) | Net (cpm) ÷ | Eff = | Activity (dpm) | Counted By (initials) |
|-----------|-------------------|--------------------|-------------|-----------|-------------|-------|----------------|-----------------------|
| 33 | See Attached Map | 34 | 17 | 26.9 | 0 | .05 | 0 | JJ |
| 34 | | 52 | 26 | | 0 | | 0 | |
| 35 | | 48 | 24 | | 0 | | 0 | |
| 36 | | 48 | 24 | | 0 | | 0 | |
| 37 | | 30 | 15 | | 0 | | 0 | |
| 38 | ↓ | 54 | 27 | ↓ | 0.1 | ↓ | 2 | ↓ |
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N
A

Recounts - Addendum Sheet

Survey No. RS&C-88-185

Attachment IV

Detector Serial Number 5520571
491614

5 (%)

Efficiency (Eff.)

Date 11-28-88

SMEAR COUNTING DATA SHEET

Background (10 min) 26.9

26.9

(%)

Chi-square Test Date 11-17-88

Type of Radiation B⁻ C-14

B⁻ C-14

Purpose of this survey:

Final Survey - Clear Room No. 118 - E+O Building

| Smear No. | Specific Location | Gross | Gross | Bkg | Net | Eff | Activity | Counted By (initials) |
|-----------|-------------------|-----------------|-------|---------|-----------|-----|----------|-----------------------|
| | | Counts 2-min | (cpm) | - (cpm) | = (cpm) ÷ | | = (dpm) | |
| 2 | Recount | 58 | 29 | 26.5 | 2.1 | .05 | 42 | JJ |
| 26 | Recount | 54 | 27 | 26.5 | 0.1 | .05 | 2 | JJ |
| 32 | Recount | 60 | 30 | 26.5 | 3.5 | .05 | 70 | JJ |
| | | | | | | | | |
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N
A

RADIOLOGICAL SURVEY

Survey Number RSAC-88-182

LOCATION E+D Building - Room 118

Date 11-21-88

Clearing of Room 118 - E+D Building - Final Survey

| Item or Location | Time | Dist. | Dose Rates | | | | Contamination | | | Instrument Serial No. | Remarks | Surveyed By |
|--|------|---------|-----------------|--------------------|----------------|------------------|---------------|--|----------------|---|---|---------------------|
| | | | Beta mrad/hr | Neutron nrem/hr | Gamma mR/hr | Total nrem/hr | Direct | Transferrable dpm/100 cm ² | Type | | | |
| E+D - Room 118 | 1000 | Contact | ND | NA | <.1 | <.1 | | | | | | |
| | ↓ | 18" | ↓ | ↓ | ↓ | ↓ | NA | ①-42 | β ⁻ | Ludlum 2200 - 552057 RS05 - | See Attached map + Survey Sheet for RESULTS. | Janis H. Johnson |
| Chairs, drums, brooms, misc. items | 1010 | Contact | | | | | | | | | | |
| | ↓ | 18" | / | | | | ND | NA | β ⁻ | 552067 Bicron Surveyor 50 No. 553796 | Room + items released + cleared | ↓ |
| ↓ | GA | | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |

Reviewed by: *Philip Lowery*

Survey No. RS&C-88-182

Attachment IV

Detector Serial Number 552057

Date 11-21-88

SMEAR COUNTING DATA SHEET

Efficiency (Eff.) 11.76 (%)

Chi-square Test Date 11-9-87

Background (10 min) 238

Type of Radiation β^-

Purpose of this survey: Clear Room 118 - E+O Building - Final Survey

| Smear No. | Specific Location | Gross Counts 2-min | Gross (cpm) | Bkg (cpm) | Net (cpm) \div | Eff = | Activity (dpm) | Counted By (initials) |
|-----------|-------------------|-----------------------|-------------|-----------|------------------|-------|----------------|-----------------------|
| 1 | See Attached Map | 34 | 17 | 23.8 | NA | .1176 | NA | JJ |
| 2 | | 52 | 26 | | 2.2 | | 18.91 | |
| 3 | | 70 | 35 | | 11.2 | | 95.23 | |
| 4 | | 46 | 23 | | NA | | NA | |
| 5 | | 36 | 18 | | NA | | NA | |
| 6 | | 46 | 23 | | NA | | NA | |
| 7 | | 50 | 25 | | 1.2 | | 10.20 | |
| 8 | | 54 | 27 | | 3.2 | | 27.21 | |
| 9 | | 38 | 19 | | NA | | NA | |
| 10 | | 72 | 36 | | 12.2 | | 103.74 | |
| 11 | | 42 | 21 | | NA | | NA | |
| 12 | | 52 | 26 | | 2.2 | | 18.91 | |
| 13 | | 46 | 23 | | NA | | NA | |
| 14 | | 40 | 20 | | NA | | NA | |
| 15 | | 48 | 24 | | 0.2 | | 1.70 | |
| 16 | | 54 | 27 | | 3.2 | | 27.21 | |

Survey No. RS&C-88-182

Attachment IV

Detector Serial Number 552057

Date 11-21-88

SMEAR COUNTING DATA SHEET

Efficiency (Eff.) 11.76 (%)

Chi-square Test Date 11-9-88

Background (10 min) 238

Type of Radiation β^-

Purpose of this survey: Clear Room 118 - E + D Building - Final Survey

| Smear No. | Specific Location | Gross Counts 2-min | Gross (cpm) | Bkg (cpm) | Net (cpm) ÷ | Eff | Activity (dpm) | Counted By (initials) |
|-----------|-------------------|-----------------------|-------------|-----------|-------------|-------|----------------|-----------------------|
| 17 | See Attached map | 62 | 31 | 23.8 | 1.3 | .1176 | 11.08 | JJ |
| 18 | | 38 | 19 | | NA | | NA | |
| 19 | | 48 | 24 | | 0.2 | | 1.70 | |
| 20 | | 56 | 28 | | 4.2 | | 35.71 | |
| 21 | | 54 | 27 | | 1.1 | | 9.65 | |
| 22 | | 56 | 28 | | 4.2 | | 35.71 | |
| 23 | | 28 | 14 | | NA | | NA | |
| 24 | | 40 | 20 | | NA | | NA | |
| 25 | | 44 | 22 | | NA | | NA | |
| 26 | | 58 | 29 | | 5.2 | | 44.22 | |
| 27 | | 46 | 23 | | NA | | NA | |
| 28 | | 42 | 21 | | NA | | NA | |
| 29 | | 50 | 25 | | 1.2 | | 10.20 | |
| 30 | | 56 | 28 | | 4.2 | | 35.71 | |
| 31 | | 56 | 28 | | 4.2 | | 35.71 | |
| 32 | | 48 | 24 | | 0.2 | | 1.70 | |

Survey No. RS&C-88-182

Attachment IV

Detector Serial Number 552057

Efficiency (Eff.) 11.76 (%)

Date 11-21-88

SMEAR COUNTING DATA SHEET

Background (10 min) 238

Chi-square Test Date 11-9-88

Type of Radiation B⁻

Purpose of this survey: Clear Room 118 - E + D Building Final Survey

| Smear No. | Specific Location | Gross Counts 2-min | Gross (cpm) | Bkg (cpm) | Net (cpm) ÷ Eff | Activity (dpm) | Counted By (Initials) | |
|-----------|--------------------------------|--------------------|-------------|-----------|-----------------|----------------|-----------------------|----|
| 33 | See Attached Map | 52 | 26 | 23.8 | 2.2 | .1176 | 18.71 | JJ |
| 34 | | 68 | 34 | | 10.2 | | 86.73 | |
| 35 | | 86 | 40 | | 16.2 | | 139.76 | |
| 36 | | 68 | 34 | | 10.2 | | 86.73 | |
| 37 | | 52 | 26 | | 2.2 | | 18.71 | |
| 38 | | 46 | 23 | | NA | | NA | |
| 39 | | 50 | 25 | | 1.2 | | 10.20 | |
| 40 | | 42 | 21 | | NA | | NA | |
| 41 | | 40 | 20 | | NA | | NA | |
| 42 | ↓ | 44 | 22 | ↓ | NA | ↓ | NA | ↓ |
| | Work Area for Counting Samples | 46 | 23 | 23.8 | NA | .1176 | NA | JJ |
| | | | NA | | | | | |

Addendum Sheet

Recounts

Survey No. RS+C-88-182

Attachment IV

Detector Serial Number 552057

Date 11-21-88

SMEAR COUNTING DATA SHEET

Efficiency (Eff.) 11.76 (%)

Chi-square Test Date 11-9-88

Background (10 min) 238

Type of Radiation β^-

Purpose of this survey: Clear Room 118 - E+D Building - Final Survey

| Smear No. | Specific Location | Gross Counts 2-min | Gross (cpm) | Bkg (cpm) | Net (cpm) | Eff | Activity (dpm) | Counted By (initials) |
|-----------|-------------------|--------------------|-------------|-----------|-----------|-------|----------------|-----------------------|
| | | | | - | = | ÷ | = | |
| 10 | Recount of Smear | 58 | 29 | 23.8 | 5.2 | .1176 | 44.22 | JJ |
| 35 | Recount of Smear | 61 | 30.5 | 23.8 | 6.7 | .1176 | 56.97 | JJ |
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N
A

Overhead Air Conditioner

North

Survey No. RSTC-88-182

Technician(s):

James N. Johnson

Date: 11-21-88

x = general area dose rate

x = contact dose rate

x = 18" dose rate

E & D BUILDING

ROOM 118

BENTHIC INVERTEBRATE

LAB

⊗ = disc smear location

All dose rates in mr/hr.

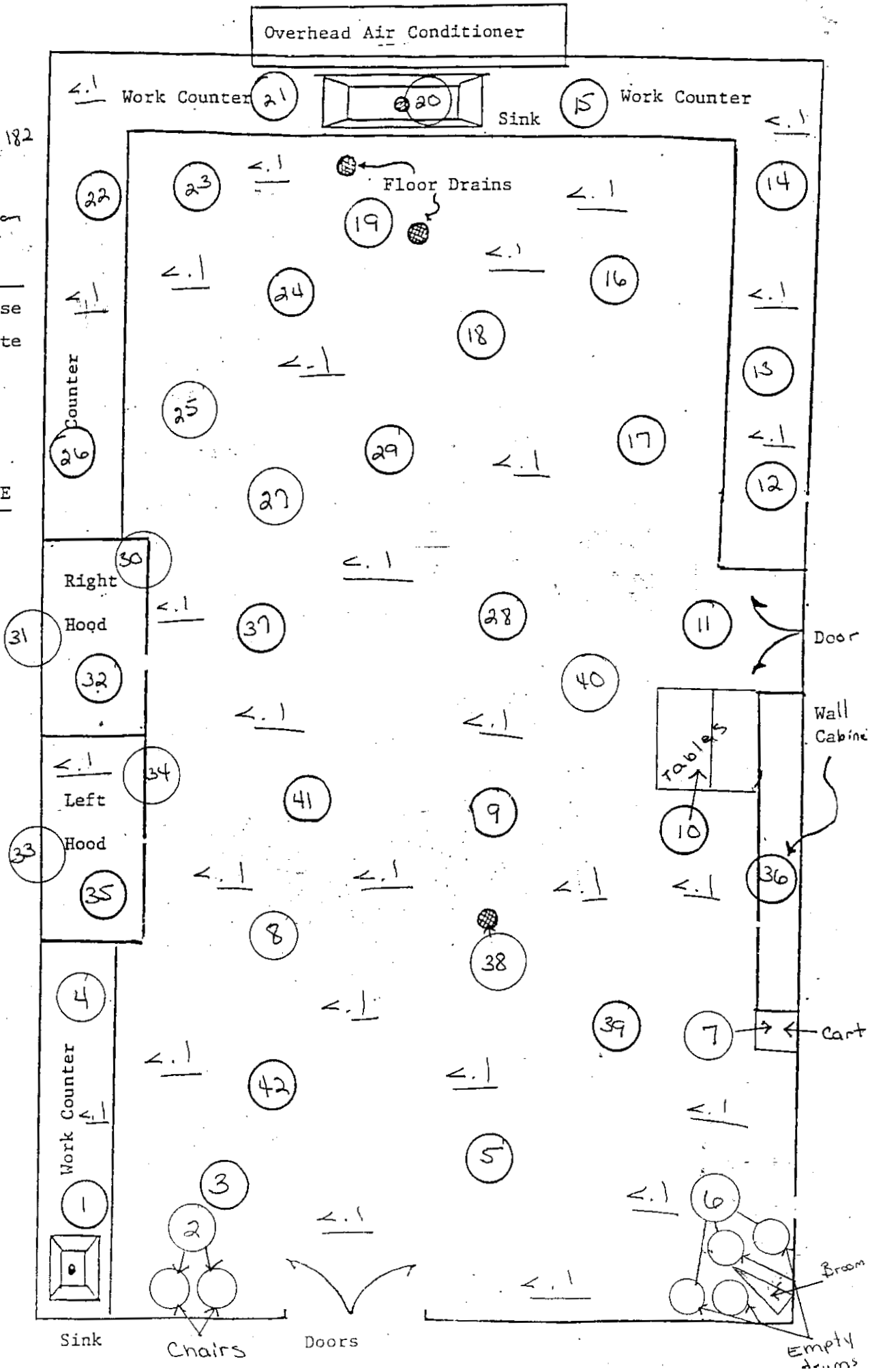
Instruments used:

RSO 5-552057

Ludlum 2200-

552057

Bicron Surveyor
SO No. 553796



RADIOLOGICAL SURVEY

Survey Number RSS- 88-172

LOCATION E+D Building Roof

Date 10-12-78

Special - Exhaust Vents From Lab #118 E+D

| Item or Location | Time | Dist. | Dose Rates | | | | Contamination | | | Instrument Serial No. | Remarks | Surveyed By |
|---|------|---------|-----------------|--------------------|----------------|------------------|---------------|--|----------------|---|--|--------------------------------------|
| | | | Beta mrad/hr | Neutron mrem/hr | Gamma mR/hr | Total mrem/hr | Direct | Transferrable dpm/100 cm ² | Type | | | |
| Exhaust Vent #2 Deep inside vent duct | 1315 | Contact | ND | NA | <.1 | <.1 | | | | Ludlum 2200 SS2057 RS05- SS3757 Bicron 50 SS3796 | See map for Exhaust Vent Location. Smear results Attached | D. Johnson G. Calam P. Hensley |
| | | 18" | | | | | ND | ① | β ⁻ | | | |
| | | GA | | | | | | | | | | |
| Exhaust Vent #2 Inside Shaft on top cover | | Contact | | | | | | | | | | |
| | | 18" | | | | | ND | ② | β ⁻ | | | |
| | | GA | | | | | | | | | | |
| Exhaust vent #2 Inside vent cover | | Contact | | | | | | | | | | |
| | | 18" | | | | | ND | ③ | β ⁻ | | | |
| | | GA | | | | | | | | | | |
| Exhaust vent #5 Inside vent Duct | | Contact | | | | | | | | | | |
| | | 18" | | | | | ND | ④ | β ⁻ | | | |
| | | GA | | | | | | | | | | |
| Exhaust vent #5 Inside vent Cover - Roof | | Contact | | | | | | | | | | |
| | | 18" | ↓ | | | | ND | ⑤ | β ⁻ | | | |
| | | GA | ↓ | ↓ | ↓ | ↓ | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | GA | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | GA | | | | | | | | | | |
| | | Contact | | | | | | | | | | |
| | | 18" | | | | | | | | | | |
| | | GA | | | | | | | | | | |

Reviewed by:

Philly Hensley

Survey No. R55-88-172

Attachment IV

Detector Serial Number 491614

Date 10-12-88 - Counted 10-14

SMEAR COUNTING DATA SHEET

Efficiency (Eff.) 11.64 (%)

Chi-square Test Date 10-7-88

Background (10 min) 26.5

Type of Radiation β^-

Purpose of this survey: Special - Exhaust Vents From Lab #118 - e + d Building

| Smear No. | Specific Location | Gross Counts 2-min | Gross (cpm) | Bkg (cpm) | Net (cpm) | Eff | Activity (dpm) | Counted By (initials) |
|-----------|----------------------------------|--------------------|-------------|-----------|--|-------|----------------|-----------------------|
| | | | | | $\text{Net} = \text{Gross} - \text{Bkg}$ | | | |
| 1 | See Rad Sheet For Smear location | 44 | 22 | 26.5 | NA | .1164 | NA | JJ |
| 2 | | 38 | 19 | 26.5 | NA | .1164 | NA | JJ |
| 3 | | 60 | 30 | 26.5 | 3.5 | .1164 | 30.06 | JJ |
| 4 | | 46 | 23 | 26.5 | NA | .1164 | NA | JJ |
| 5 | | 54 | 27 | 0.5 | NA | .1164 | NA | JJ |
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RS&C-10

TOP OF E&D BUILDING - MUSCLE SHOALS

Room #118
Lab Exhaust Vents

Survey Number RSS-88-172

Date 10-12-88

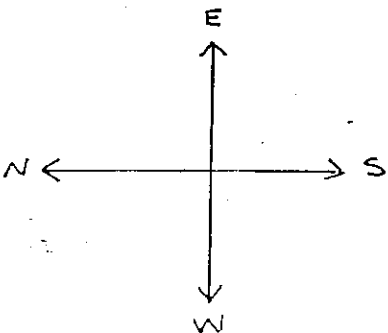
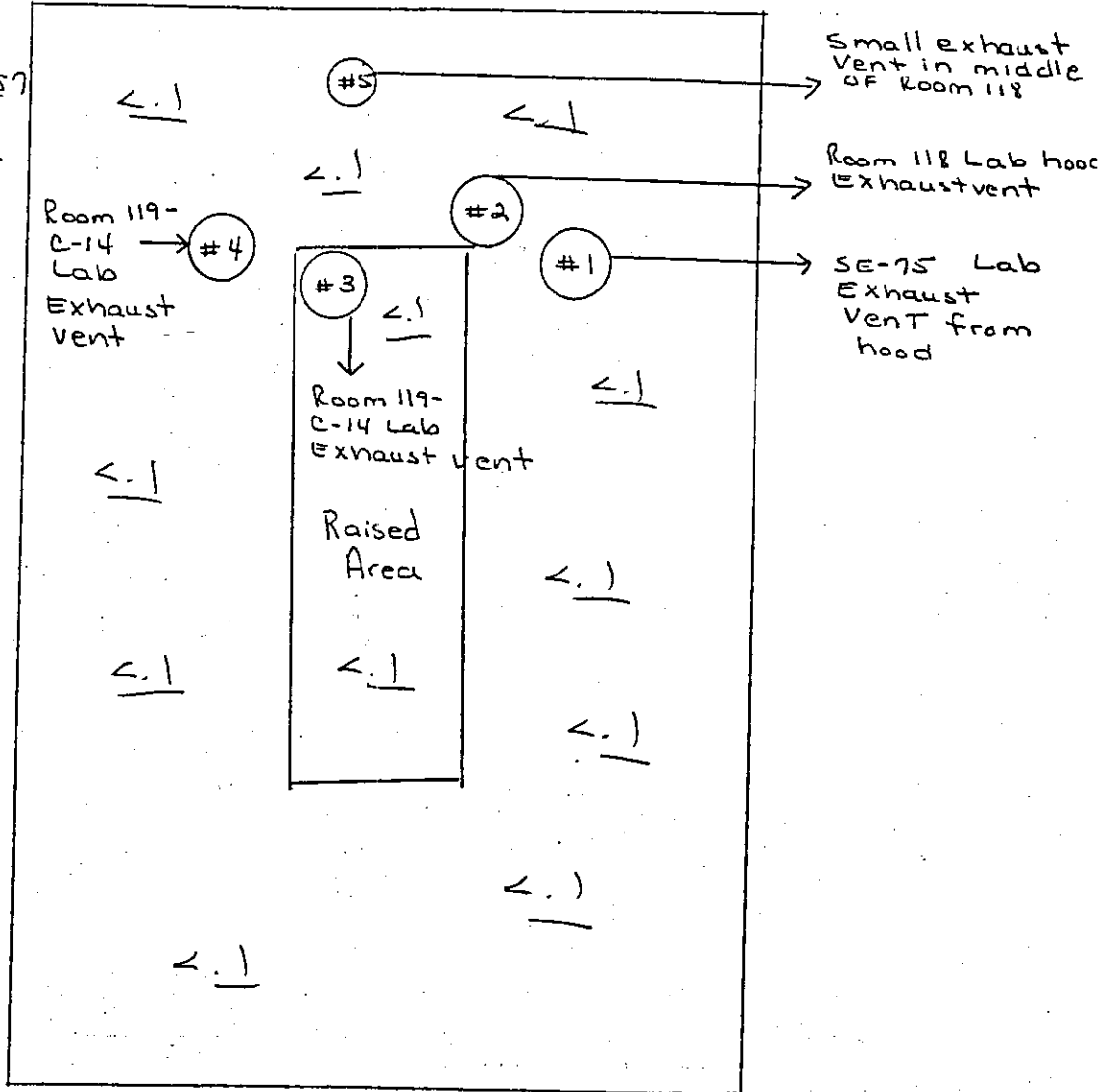
Instruments:

Ludlum 2200-552057
RSS-553757

Bicon Surveyor 50
553796

Technician(s):

Quint H. Johnson
J. Coleman
J. Johnson



ATTACHMENT 11

Item 7

Red Oak Tree Study Survey

Radiological Survey

Survey Number: RS&G-94-260
31 Aug 94

Location: Red Oak Tree Farm near Norris Dam

Date: 1 Sept 94 NRC License No.: 01-06113-03 (K) Reason for this survey: Coverage of ROVE Experiment

| ITEM OR LOCATION | TIME | DIST. | Dose Rates | | | | Contamination | | | Instrument Serial No. | Remarks | Surveyed By |
|---------------------------------------|---------|---------|-----------------|--------------------|----------------|------------------|---|--|------|-----------------------|---------|------------------|
| | | | Beta mRad/hr | Neutron mRem/hr | Gamma mR/hr | Total mRem/hr | Direct | Transferrable dpm/100 cm ² | Type | | | |
| Building where C-14 stored over-night | 10:00 | CONTACT | / | / | / | / | ND | ① ② | β | Bicron | | Jesse H. Coleman |
| | AM | 30 cm | / | N | / | / | | <1000 | | #562847 | | |
| | 9/1/94 | | / | A | / | / | | | | | | |
| Mal. Equip. used in study | 2:30 | CONTACT | / | / | / | / | ND | ③-④ | β | also | | R. Maffell |
| | PM | 30 cm | / | / | / | / | | <1000 | | #562811 | | |
| | 9/1/94 | | / | A | / | / | | | | | | |
| drying oven | 3:00 | CONTACT | / | / | / | / | ND | ①-④ | β | " | | R. Maffell |
| | PM | 30 cm | / | N | / | / | | sheet 2 | | | | |
| | 9/1/94 | | / | A | / | / | | <1000 | | | | |
| Gloves, bags, mal equip, people, etc | 10:00 | CONTACT | / | / | / | / | ND | / | β | " | | " |
| | -3:00 | 30 cm | / | N | / | / | | N | | A | | |
| | 9/1/94 | | / | A | / | / | | | | | | |
| Gloves, bags, mal Equip, people etc. | 10:00AM | CONTACT | / | / | / | / | ND | / | β | " | | " |
| | 1:00PM | 30 cm | / | N | / | / | | N | | A | | |
| | 8/31/94 | | / | A | / | / | | | | | | |
| | | CONTACT | | | | | Note: There were 2 teams. RBM covered team of J. J. Samuelson & S. Stroud - Nofal. JHC covered team of R.M. Mays & G. S. Edwards. | | | | | |
| | | 30 cm | | | | | | | | | | |
| | | CONTACT | | | | | | | | | | Jesse H. Coleman |
| | | 30 cm | | | | | N | | | | | |
| | | CONTACT | | | | | A | | | | | |
| | | 30 cm | | | | | | | | | | |

Reviewed by: R. B. Maffell Jesse H. Johnson

NA = Not Applicable
GA = General Area

ND = Not Detectable
NOA = Nearest Occupiable Area

ATTACHMENT 12

Item 8

Survey Data for Additional ERC Areas

December 6, 2000

William Rogers, CTR 1K-M

NUCLEAR REGULATORY COMMISSION LICENSE 41-25370-01
DECOMMISSIONING SURVEY OF ERC LAB T-140

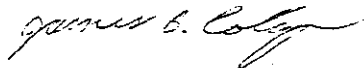
On September 9, 2000, Judy Johnson and I performed the decommissioning survey you requested for lab T-140. A detailed survey was completed and the smears were sent to the Western Area Radiological Lab (WARL) for analysis. Eighty five smears were taken and all were less than the lower level of detection (LLD) for counting equipment except smear # 72. See attached counting records.

On October 4, 2000, I returned and surveyed the area of smear #72. All smears were below LLD. I also surveyed the storage refrigerator and cooler used to store samples. These also were below LLD.

These areas are no longer under radiological control and may be used for any purpose you need.

Please place this information in your file and keep it available for employee or NRC review.

If you have any questions or comments please call me at 386-3019.



James B. Colagross
Radiation Safety
WAR 1A-M

Attachments

cc (Attachments):

David Sorrelle, CTR 2S-M
Files, WAR 1A-M

DECOMMISSIONING INFORMATION 10 CFR 30.35 & 30.36

NRC License No.: 41-25370-01 RWP No(s): NA

Survey No(s): RS-00-320

Location: Resource Group, Muscle Shoals AL - Lab T-140 @ ERC.

Dates the restricted area was established: from 5-12-97 to 10-12-00

Radiological materials involved in restricted area: mixed fission/activation products yes no . If no, list isotope(s): _____

Type of equipment, ie. motor(s) etc. worked on in restricted area work:

Sample vials

What operations were performed in the restricted area: _____

Sample Analysis

Typical contamination (dpm/100 cm²) and radiation (mrem/hr) levels during the operation of the restricted area):

2000 DPM/100 cm² < 0.1 mrem/hr

What were the radiation levels after the restricted area was removed?

< 0.1 mrem/hr

| | | |
|--|------------------|-----------------|
| Contamination levels (dpm/100 cm ²): | Transferable | Fixed |
| Alpha: | <u>< 20</u> | <u>< 30</u> |
| Beta/Gamma: | <u>< 1000</u> | <u>< 100</u> |

List the machine(s)' identification number(s) used in the restricted area:

NONE

Were there any spills or releases of radioactive material? (If yes, describe on a separate/attached sheet of paper). Yes No

Prepared by: James B. Clayton Date: 9-9-00

Reviewed by: James H. Jee Date: 9-9-00

Radiological Survey Data Sheet

Survey No. : RS - 00-320

Survey Date : 9-9-00

Location: ERC Lab T-140

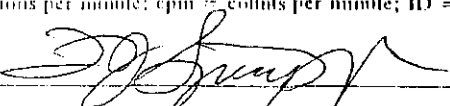
Judy Johnson

Survey Purpose: Decommission Survey

Survey by: Jim Colagross

| Item or Location | Dose Rates | | | Contamination | | | Inst. No. | Remarks | |
|------------------|------------|--------------|---------------|---------------|------------|--------------------------------------|-----------|----------|---------------------------------------|
| | Distance | Beta mrad/hr | Gamma mrem/hr | Total mrem/hr | Direct cpm | Transferable dpm/100 cm ² | | | Type |
| ERC Lab T-140 | Ct. | ND | <0.1 | <0.1 | ① | <1000 | Bx | R505 | ① Direct Frisk of All surfaces |
| | 30 cm | ↓ | ↓ | ↓ | <100 | <20 | L | 841827 | |
| Resource Group | GA | ↓ | ↓ | ↓ | | | | Surv. 50 | Smears sent to WARR |
| | Ct. | | | | | | | 562811 | |
| | 30 cm | | | | | ② | | Surv. M | ② masslinn on floor. |
| | | | | | | <100 cpm | Bx | 562876 | |
| | Ct. | | | | | | | | see attached map |
| | 30 cm | | | | | | | | |
| | Ct. | | | | | | | | contaminated waste |
| | 30 cm | | | | | | | | |
| | Ct. | | | | | | | | double bagged + placed in RCA in F250 |
| | 30 cm | | | | | | | | |
| | Ct. | | | | | | | | |
| | 30 cm | | | | | | | | |
| | Ct. | | | | | | | | |
| | 30 cm | | | | | | | | |
| | Ct. | | | | | | | | |
| | 30 cm | | | | | | | | |
| | Ct. | | | | | | | | |
| | 30 cm | | | | | | | | |

(NA = Not Applicable; ND = Not Detectable, GA = General Area Dose-rate; NOA = Nearest Occupiable Area; Ct. = Contact; cm = centimeter; m = meter; BKG = background
 dpm = disintegrations per minute; cpm = counts per minute; ID = Identification)

Reviewed by: 

Radioactivity Counting Record Sheet for Smears

Inst. Eff. Bkg. _____

Date and Time 11 SEP 68

Sampling Information

RS

00-320

Date Smears Taken

9-9-68

Location Smears Taken

EKG Lab T-140

Name

Judy Johnson

Address

WAK 1A-M

Phone No.

314-8162 or 386-3019

β - γ _____ LLD
 β 221 .0914 1.11 cpm 20 dpm
 α 221 NA cka 9-18-68

Use Background For

Type of Analysis Requested C-14

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPF |
|--------------|-------------------|----------|--------------|-------------------|-----------|-----------------|---------|--------------------|------|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 1 | | β | 11 | 10 | 1.1 | 1.11 | — | .0914 | — |
| | | α | | | | | | | |
| 2 | | β | 13 | 10 | 1.3 | | .19 | | 2.1 |
| | | α | | | | | | | |
| 3 | | β | 7 | 10 | 0.7 | | — | | — |
| | | α | | | | | | | |
| 4 | | β | 7 | 10 | 0.7 | | — | | — |
| | | α | | | | | | | |
| 5 | | β | 13 | 10 | 1.3 | ↓ | .19 | ↓ | 2.1 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 6 | | β | 17 | 10 | 1.7 | 1.11 | .59 | .0914 | 6.5 |
| | | α | | | | | | | |
| 7 | | β | 12 | 10 | 1.2 | | .09 | | 1.0 |
| | | α | | | | | | | |
| 8 | | β | 13 | 10 | 1.3 | | .19 | | 2.1 |
| | | α | 1 | | | | | | |
| 9 | | β | 14 | 10 | 1.4 | | .29 | | 3.2 |
| | | α | | | | | | | |
| 10 | | β | 12 | 10 | 1.2 | ↓ | .09 | ↓ | 1.0 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 11 | | β | 24 | 10 | 2.4 | 1.11 | 1.29 | .0914 | 14.1 |
| | | α | | | | | | | |
| 12 | | β | 18 | 10 | 1.8 | | .69 | | 7.5 |
| | | α | | | | | | | |
| 13 | | β | 15 | 10 | 1.5 | | .39 | | 4.3 |
| | | α | | | | | | | |
| 14 | | β | 10 | 10 | 1.0 | | — | | — |
| | | α | | | | | | | |
| 15 | | β | 11 | 10 | 1.1 | ↓ | — | ↓ | — |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by: D. L. Bennett

Checked by: M. A. Cross

Radioactivity Counting Record Sheet for Smears

Inst. Eff. Bkg.

Date and Time 11 SEP 00

Sampling Information

β - γ _____

LLD

RS

60-320

β 221 / 0.0914 1.11 cpm 20 dpm

Date Smears Taken

9-9-00

α 221 / CES 9-18-00

Location Smears Taken

Name

Address

Use Background For

Phone No.

Type of Analysis Requested

| Smear Number | Sampling Location | Analysis | Total Counts \div | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM \div | Counter Efficiency | DPM |
|--------------|-------------------|----------|---------------------|-------------------|-----------|-----------------|----------------|--------------------|-----|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 16 | | β | 16 | 10 | 1.6 | 1.11 | .49 | .0914 | 5.4 |
| | | α | | | | | | | |
| 17 | | β | 8 | 10 | 0.8 | | — | | — |
| | | α | | | | | | | |
| 18 | | β | 17 | 10 | 1.7 | | .59 | | 6.5 |
| | | α | | | | | | | |
| 19 | | β | 9 | 10 | 0.9 | | — | | — |
| | | α | | | | | | | |
| 20 | | β | 12 | 10 | 1.2 | ✓ | .09 | ↓ | 1.0 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 21 | | β | 12 | 10 | 1.2 | 1.11 | .09 | .0914 | 1.0 |
| | | α | | | | | | | |
| 22 | | β | 15 | 10 | 1.5 | | .39 | | 4.3 |
| | | α | | | | | | | |
| 23 | | β | 13 | 10 | 1.3 | | .19 | | 2.1 |
| | | α | | | | | | | |
| 24 | | β | 14 | 10 | 1.4 | | .49 | | 5.4 |
| | | α | | | | | | | |
| 25 | | β | 8 | 10 | 0.8 | ↓ | — | ↓ | — |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 26 | | β | 11 | 10 | 1.1 | 1.11 | — | .0914 | — |
| | | α | | | | | | | |
| 27 | | β | 9 | 10 | 0.9 | | — | | — |
| | | α | | | | | | | |
| 28 | | β | 9 | 10 | 0.9 | | — | | — |
| | | α | | | | | | | |
| 29 | | β | 7 | 10 | 0.7 | | — | | — |
| | | α | | | | | | | |
| 30 | | β | 15 | 10 | 1.5 | ↓ | .39 | ↓ | 4.3 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by:

D. L. Gossett

Checked by:

M. H. Cross

Radioactivity Counting Record Sheet for Smears

Inst. Eff. Bkg. _____

Date and Time 11 SEP 00

Sampling Information _____

RS _____

00-320

0-8

LLD

Date Smears Taken _____

9-9-00

¹⁴C 129 / 0.0989 1.14 cpm

20 dpm

Location Smears Taken _____

α 129 / CSD 9-18-00

Use Background For _____

Name Address _____

Phone No. _____

Type of Analysis Requested _____

| Smear Number | Sampling Location | Analysis | Total Coun'ts ÷ | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency ÷ | DPM |
|--------------|-------------------|----------|-----------------|-------------------|-----------|-----------------|---------|----------------------|------|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 31 | | β | 26 | 10 | 2.6 | 1.14 | 1.46 | 0.0989 | 14.8 |
| | | α | | | | | | | |
| 32 | | β | 17 | 10 | 1.7 | ↓ | 0.56 | ↓ | 5.7 |
| | | α | | | | | | | |
| 33 | | β | 23 | 10 | 2.3 | ↓ | 1.16 | ↓ | 11.7 |
| | | α | | | | | | | |
| 34 | | β | 10 | 10 | 1.0 | ↓ | — | ↓ | — |
| | | α | | | | | | | |
| 35 | | β | 7 | 10 | 0.7 | ↓ | — | ↓ | — |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 36 | | β | 11 | 10 | 1.1 | 1.14 | — | 0.0989 | — |
| | | α | | | | | | | |
| 37 | | β | 3 | 10 | 0.3 | ↓ | — | ↓ | — |
| | | α | | | | | | | |
| 38 | | β | 11 | 10 | 1.1 | ↓ | — | ↓ | — |
| | | α | | | | | | | |
| 39 | | β | 10 | 10 | 1.0 | ↓ | — | ↓ | — |
| | | α | | | | | | | |
| 40 | | β | 10 | 10 | 1.0 | ↓ | — | ↓ | — |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 41 | | β | 12 | 10 | 1.2 | 1.14 | 0.06 | 0.0989 | 0.6 |
| | | α | | | | | | | |
| 42 | | β | 7 | 10 | 0.7 | ↓ | — | ↓ | — |
| | | α | | | | | | | |
| 43 | | β | 17 | 10 | 1.7 | ↓ | 0.56 | ↓ | 5.7 |
| | | α | | | | | | | |
| 44 | | β | 12 | 10 | 1.2 | ↓ | 0.06 | ↓ | 0.6 |
| | | α | | | | | | | |
| 45 | | β | 8 | 10 | 0.8 | ↓ | — | ↓ | — |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by: D. J. G. [Signature]

Checked by: M. H. Cross

Radioactivity Counting Record Sheet for Smears

Pg. 7000

Inst. Eff. Bkg.

Date and Time 11 SEP 00

Sampling Information

RS

00-320

Date Smears Taken

9-9-00

Location Smears Taken

Name

Address

Phone No.

β - γ

LLD

¹⁴Cp 129 / 0.0989 1.14 cpm 20 dpm

α 129 / ckd 9-18-00

Use Background For

Type of Analysis Requested

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPI |
|--------------|-------------------|----------|--------------|-------------------|-----------|-----------------|---------|--------------------|-----|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 46 | | β | 15 | 10 | 1.5 | 1.14 | .36 | 0.0989 | 3.6 |
| | | α | | | | | | | |
| 47 | | β | 6 | 10 | 0.6 | | | | |
| | | α | | | | | | | |
| 48 | | β | 9 | 10 | 0.9 | | | | |
| | | α | | | | | | | |
| 49 | | β | 10 | 10 | 1.0 | | | | |
| | | α | | | | | | | |
| 50 | | β | 8 | 10 | 0.8 | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 51 | | β | 10 | 10 | 1.0 | 1.14 | | 0.0989 | |
| | | α | | | | | | | |
| 52 | | β | 14 | 10 | 1.4 | | .26 | | 2.6 |
| | | α | | | | | | | |
| 53 | | β | 10 | 10 | 1.0 | | | | |
| | | α | | | | | | | |
| 54 | | β | 8 | 10 | 0.8 | | | | |
| | | α | | | | | | | |
| 55 | | β | 14 | 10 | 1.4 | | .26 | | 2.6 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 56 | | β | 21 | 10 | 2.1 | 1.14 | .96 | 0.0989 | 9.6 |
| | | α | | | | | | | |
| 57 | | β | 9 | 10 | 0.9 | | | | |
| | | α | | | | | | | |
| 58 | | β | 8 | 10 | 0.8 | | | | |
| | | α | | | | | | | |
| 59 | | β | 10 | 10 | 1.0 | | | | |
| | | α | | | | | | | |
| 60 | | β | 13 | 10 | 1.3 | | .16 | | 1.6 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by: [Signature]

Checked by: M. H. [Signature]

Radioactivity Counting Record Sheet for Smears

Inst. Eff. Bkg. Date and Time 11SEP00 Sampling Information

β - γ LLD
 β 223 | 0.0958 1.17 20 dpm
 α 223 CE 9-18-00

RS 00-320
 Date Smears Taken 9-9-00
 Location Smears Taken _____
 Name _____
 Address _____
 Phone No. _____

Type of Analysis Requested _____
 Use Background For _____

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPM |
|--------------|-------------------|----------|------------------|-------------------|-----------|-----------------|-------------------|--------------------|------|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 61 | | β | 12 | 10 | 1.2 | 1.17 | 0.0958 | 0.0958 | 0.3 |
| | | α | | | | | 0.03 | | |
| 62 | | β | 25 | 10 | 2.5 | | 1.33 | | 13.9 |
| | | α | | | | | | | |
| 63 | | β | 12 | 10 | 1.2 | | 0.03 | | 0.3 |
| | | α | | | | | | | |
| 64 | | β | 11 | 10 | 1.1 | | | | |
| | | α | | | | | | | |
| 65 | | β | 12 | 10 | 1.2 | | 0.03 | | 0.3 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 66 | | β | 21 | 10 | 2.1 | 1.17 | 0.93 | 0.0958 | 9.7 |
| | | α | 2 | | | | | | |
| 67 | | β | 17 | 10 | 1.7 | | 0.53 | | 5.5 |
| | | α | 0 | | | | | | |
| 68 | | β | 12 | 10 | 1.2 | | 0.03 | | 0.3 |
| | | α | X | | | | | | |
| 69 | | β | 13 | 10 | 1.3 | | 0.13 | | 1.4 |
| | | α | | | | | | | |
| 70 | | β | 13 | 10 | 1.3 | | 0.13 | | 1.4 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 71 | | β | 28 29 | 10 | 2.9 | 1.17 | 1.73 | 0.0958 | 18.1 |
| | | α | | | | | | | |
| 72 | | β | 37 | 10 | 3.7 | | 2.53 | | 26.4 |
| | | α | | | | | | | |
| 73 | | β | 14 | 10 | 1.4 | | 0.23 | | 2.4 |
| | | α | | | | | | | |
| 74 | | β | 27 | 10 | 2.7 | | 1.53 | | 16.0 |
| | | α | | | | | | | |
| 75 | | β | 28 | 10 | 2.8 | | 1.63 | | 17.0 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by: [Signature] Checked by: M.H. Cross

Radioactivity Counting Record Sheet for Smears

pg 6076

Inst. Eff. Bkg. Date and Time 11 Sep 00

Sampling Information
RS 00-320

β - γ LLD
 β 223 / 0.0958 1.17 20 dpm
 α 223 / LLD 9-18-00

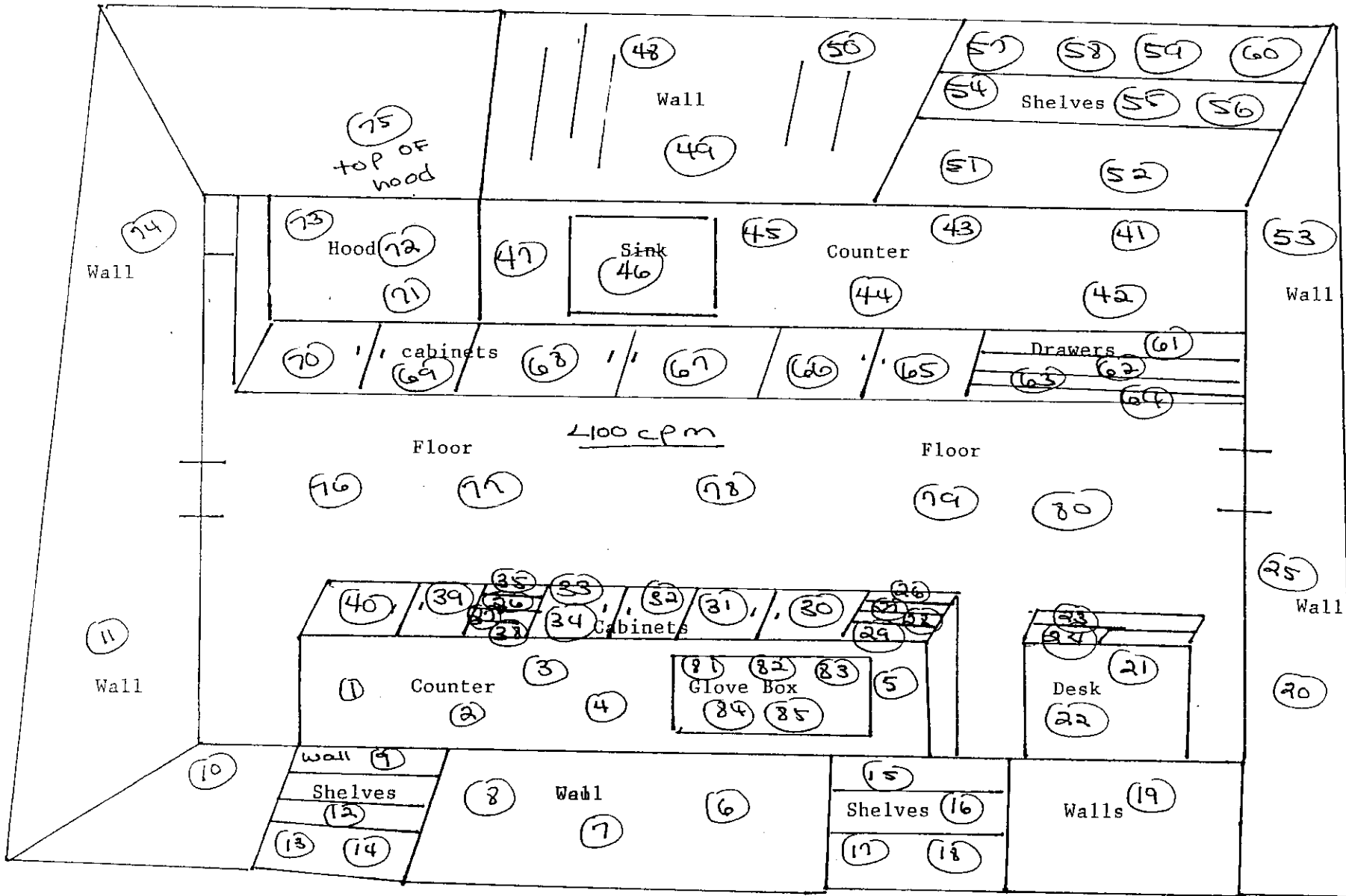
Date Smears Taken 9-9-00
 Location Smears Taken _____
 Name _____
 Address _____
 Phone No. _____

Type of Analysis Requested _____

Use Background For _____

| Smear Number | Sampling Location | Analysis | Total Coun's \div | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency \div | DPI |
|--------------|-------------------|----------|---------------------|-------------------|-----------|-----------------|---------|---------------------------|------|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 76 | | β | 24 | 10 | 2.4 | 1.17 | 1.23 | 0.0958 | 12.8 |
| | | α | | | | | | | |
| 77 | | β | 16 | 10 | 1.6 | | .43 | | 4.5 |
| | | α | | | | | | | |
| 79 | | β | 17 | 10 | 1.7 | | .53 | | 5.5 |
| | | α | | | | | | | |
| 79 | | β | 20 | 10 | 2.0 | | .83 | | 8.7 |
| | | α | | | | | | | |
| 80 | | β | 23 | 10 | 2.3 | ↓ | 1.13 | ↓ | 11.8 |
| | | α | | | | | | | |
| BKG | | β | 13 ⁰⁵⁶ | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 81 | | β | 13 | 10 | 1.3 | 1.17 | .13 | 0.0958 | 1.4 |
| | | α | | | | | | | |
| 82 | | β | 16 | 10 | 1.6 | | .43 | | 4.5 |
| | | α | | | | | | | |
| 83 | | β | 11 | 10 | 1.1 | | | | |
| | | α | | | | | | | |
| 84 | | β | 23 | 10 | 2.3 | | 1.13 | | 11.8 |
| | | α | | | | | | | |
| 85 | | β | 17 | 10 | 1.7 | ↓ | .53 | ↓ | 5.5 |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

Counted by: [Signature] Checked by: [Signature]



Ⓝ = Disc Smear Location

Radiological Survey Data Sheet

Survey No. : RS - 00-396

Survey Date : 10-4-00

Location: ERC muscle Shoals AL.

Survey Purpose: Follow up Survey

Survey by: James B. [Signature]

| Item or Location | Dose Rates | | | Contamination | | | Inst. No. | Remarks |
|--|------------|--------------|---------------|---------------|------------|--------------------------------------|-----------|--|
| | Distance | Beta mrad/hr | Gamma mrem/hr | Total mrem/hr | Direct cpm | Transferable dpm/100 cm ² | | |
| Refrigerator cooler + Bucket | Ct. | ND | <0.1 | <0.1 | <30 | <20 | + | A505 530908 SURV. 50 562811 Released |
| | 30 cm | ↓ | ↓ | ↓ | <100 | <1000 | Bx | |
| | 1M | ↓ | ↓ | ↓ | | | | |
| Area of smelt # 72. Sample Hood IN ERC T 140 | Ct. | ND | <0.1 | <0.1 | <30 | <20 | + | SURV. M 568074 ↓ Released |
| | 30 cm | ↓ | ↓ | ↓ | <100 | <1000 | Bx | |
| | 1M | ↓ | ↓ | ↓ | | | | |
| | Ct. | | | | | | | |
| | 30 cm | | | | | | | |
| | Ct. | | | | | | | |
| | 30 cm | | | | | | | |
| | Ct. | | | | | | | |
| | 30 cm | | | | | | | |
| | Ct. | | | | | | | |
| | 30 cm | | | | | | | |
| | Ct. | | | | | | | |
| | 30 cm | | | | | | | |
| | Ct. | | | | | | | |
| | 30 cm | | | | | | | |
| | Ct. | | | | | | | |
| | 30 cm | | | | | | | |

(NA = Not Applicable; ND = Not Detectable; GA = General Area Dose-rate; NOA = Nearest Occupiable Area; Ct. = Contact; cm = centimeter; m = meter; BKG = background
dpm = disintegrations per minute; cpm = counts per minute; ID = Identification)

Reviewed by: [Signature]

Radioactivity Counting Record Sheet for Smears

Inst. Eff. Bkg. LLD Date and Time 10-05-00 @ 1447 ~~10-4-00 1430~~ Sampling Information 00-396

β - γ 223/.0958/1.17/19 Date Smears Taken 10-4-00
 β 223/.056 Location Smears Taken ERC Refrigerator
 α 1072-00 Name Jim Colagross
 Use Background For C-14 Address WARL
 Phone No. 3019

Type of Analysis Requested

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPI |
|--------------|-----------------------|----------|--------------|-------------------|-----------|-----------------|---------|--------------------|-----|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 1 | INSIDE - TOP AREA | β | 8 | 10 | | | | | |
| | | α | | | | | | | |
| 2 | 2 nd shelf | β | 18 | 10 | | | | | |
| | | α | | | | | | | |
| 3 | 3 rd shelf | β | 12 | 10 | | | | | |
| | | α | | | | | | | |
| 4 | 4 th shelf | β | 9 | 10 | | | | | |
| | | α | | | | | | | |
| 5 | Bottom | β | 14 | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 6 | Door TOP | β | 16 | 10 | | | | | |
| | | α | | | | | | | |
| 7 | ↓ middle | β | 15 | 10 | | | | | |
| | | α | | | | | | | |
| 8 | ↓ Bottom | β | 18 | 10 | | | | | |
| | | α | | | | | | | |
| 9 | Right wall | β | 11 | 10 | | | | | |
| | | α | | | | | | | |
| 10 | Left wall | β | 13 | 10 | | | | | |
| | | α | | | | | | | |
| BKG | Back wall | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 11 | ✓ Back wall | β | 13 | 10 | | | | | |
| | | α | | | | | | | |
| 12 | Cooler | β | 7 | 10 | | | | | |
| | | α | | | | | | | |
| 13 | Cooler | β | 9 | 10 | | | | | |
| | | α | | | | | | | |
| 14 | Bucket | β | 9 | 10 | | | | | |
| | | α | | | | | | | |
| 15 | Floor | β | 8 | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

ALL SMears OK
 Counted by
 10/05/00
 10-12-00
 LLD

Counted by: M.H. Gross Checked by: Charles E. Fredericks

Radioactivity Counting Record Sheet for Smears

Inst. Eff. Bkg. Date and Time 10-05-00 @ 1447 - 1450 Sampling Information

0-8 LD
 β 223/.0958/1.17/19
 α 223/05G
10-1200

RS 00 - 396
 Date Smears Taken 10-4-00
 Location SURVEY FOLLOW-UP ON SMEAR 72
 Smears Taken ERC T140 Hood
 Name Jim Colagross
 Address UMRL
 Phone No. 3019

Type of Analysis Requested Use Background For C-14

| Smear Number | Sampling Location | Analysis | Total Counts | Count Time (mins) | Total CPM | Average BKG CPM | Net CPM | Counter Efficiency | DPI |
|--------------|-------------------|----------|--------------|-------------------|-----------|-----------------|---------|--------------------|-----|
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 1 | TOP vent Right | β | 15 | 10 | | | | | |
| | | α | | | | | | | |
| 2 | center | β | 23 | 10 | | | | | |
| | | α | | | | | | | |
| 3 | LEFT | β | 13 | 10 | | | | | |
| | | α | | | | | | | |
| 4 | Right wall | β | 19 | 10 | | | | | |
| | | α | | | | | | | |
| 5 | Back wall | β | 17 | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| 6 | Left wall | β | 9 | 10 | | | | | |
| | | α | | | | | | | |
| 7 | UPPER knobs | β | 10 | 10 | | | | | |
| | | α | | | | | | | |
| 8 | lower knobs | β | 11 | 10 | | | | | |
| | | α | | | | | | | |
| 9 | Right Bottom | β | 13 | 10 | | | | | |
| | | α | | | | | | | |
| 10 | Left Bottom | β | 24 | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| | | β | | 10 | | | | | |
| | | α | | | | | | | |
| BKG | | β | | 10 | | N/A | N/A | N/A | N/A |
| | | α | | | | | | | |

ALL 4 SMEARS SURVEY DONE BY D11-00
 Below 10-12-00

Counted by: M.H. Cross Checked by: Charles S. Frederick

RADIOLOGICAL SURVEY

Survey No.: RS-97-181 Location: ERC - The Farm - C-14 Tear Gas Study

By: Judith A. Johnson

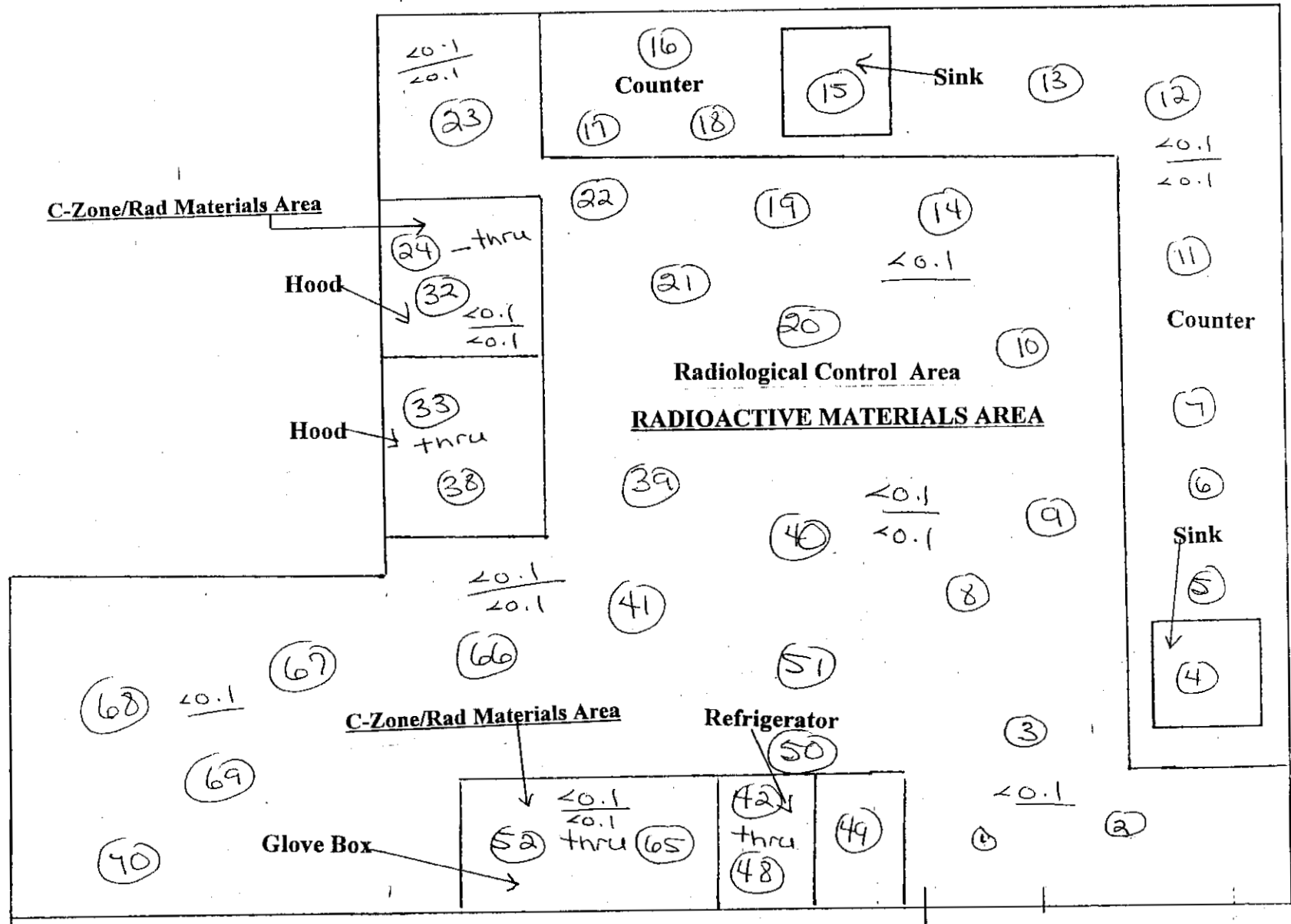
Date: 9-25-97 NRC License No.: 41-25370-01 Reason for this survey: Decommissioning Activity "C"

| Item or Location | Distance | Dose Rates | | | | Contamination | | | Instrument Serial No. | Remarks |
|------------------------------------|----------|-----------------|--------------------|------------------|------------------|---------------|---|------|----------------------------|--------------------------|
| | | Beta mrem/hr | Neutron mrem/hr | Gamma mrem/hr | Total mrem/hr | cpm Direct | Transferable dpm/100 cm ² | Type | | |
| ERC - The Farm - C-14 Tear Gas Lab | Contact | ND | NA | <0.1 | <0.1 | | * | B- | RS05 841828 Surveyor | *see map and smear |
| | 30 cm | ↓ | ↓ | ↓ | ↓ | <100 ** | <1000 | | | |
| | Contact | | | | | | | | SO 553798 | results attached. |
| | 30 cm | | | | | | | | | |
| | Contact | | | | | | | | | Area released |
| | 30 cm | | | | | | | | | |
| | Contact | | | | | | | | | as clean area. |
| | 30 cm | | | | | | | | | |
| | Contact | | | | | | | | | ** on counter tops/tools |
| | 30 cm | | | | | | | | | |
| | Contact | | | | | | | | | |
| | 30 cm | | | | | | | | | |
| | Contact | | | | | | | | | |
| | 30 cm | | | | | | | | | |
| | Contact | | | | | | | | | |
| | 30 cm | | | | | | | | | |

Reviewed By: [Signature]

NA = Not Applicable ND = Not Detectable GA = General Area NOA = Nearest Occupiable Area M = Meter

ERC - THE FARM C-14 LAB (TEAR GAS STUDY)



⊕ = Disc Smear location

$\frac{\#}{\#}$ = GA

$\frac{\#}{\#}$ = Contact dose rate in mrem/hr.
30 cm dose rate in mrem/hr.

Radiological Smear Analysis Data Sheet

No. RS-97- 181 Date: 9-25-97 Location: ERC-The Farm-C-14- By: Judith H. Johnson
Post Decon of
Decommissioning (Tea Gas study)

Counting System ID: NMC 2657/2750 System LLD: 80 dpm Radiation type: B-C-14

| No. | Smear Location | Counts (cpm) | BKG (cpm) | Net (cpm) | Efficiency | Activity (dpm) |
|-----|----------------|--------------|-----------|-----------|------------|----------------|
| 1 | See Map | 21 | 30.5 | 0.5 | 0.160 | 3 |
| 2 | | 28 | | 0 | | 0 |
| 2 | | 32 | | 1.5 | | 9 |
| 4 | | 29 | | 0 | | 0 |
| 5 | | 27 | | 0 | | 0 |
| 6 | | 30 | | 0 | | 0 |
| 7 | | 33 | | 2.5 | | 16 |
| 8 | | 26 | | 0 | | 0 |
| 9 | | 28 | | 0 | | 0 |
| 10 | | 30 | | 0 | | 0 |
| 11 | | 31 | | 0.5 | | 3 |
| 12 | | 27 | | 0 | | 0 |
| 13 | | 25 | | 0 | | 0 |
| 14 | | 22 | | 1.5 | | 9 |
| 15 | | 28 | | 0 | | 0 |
| 16 | | 31 | | 0.5 | | 3 |
| 17 | | 33 | | 2.5 | | 16 |
| 18 | | 26 | | 0 | | 0 |
| 19 | | 27 | | 0 | | 0 |
| 20 | | 29 | | 0 | | 0 |
| 21 | | 30 | | 0 | | 0 |
| 22 | | 27 | | 0 | | 0 |
| 23 | | 32 | | 1.5 | | 9 |
| 24 | | 31 | | 0.5 | | 3 |
| 25 | | 27 | | 0 | | 0 |
| 26 | | 28 | | 0 | | 0 |
| 27 | | 33 | | 2.5 | | 16 |
| 28 | | 31 | | 0.5 | | 3 |
| 29 | | 28 | | 0 | | 0 |
| 30 | | 32 | | 1.5 | | 9 |
| 31 | | 29 | | 0 | | 0 |
| 32 | | 30 | | 0 | | 0 |
| 33 | | 29 | | 0 | | 0 |
| 34 | | 27 | | 0 | | 0 |

Reviewed by: _____

RDSYS100

(BKG=background; LLD =Lower Limit of Detection for smear counting equipment; dpm = disintegrations per minute; cpm = counts per minute; ID = Identification)

Radiological Smear Analysis Data Sheet

No. RS-97- 181 Date: 9-25-97 Location: Post Decon of ELC-The Farm C-14 By: Judith H Johnson
Decommissioning (teargas)
 Counting System ID: NMC 2658/2750 System LLD: 20 dpm Radiation type: β- (C-14)

| No. | Smear Location | Counts (cpm) | BKG (cpm) | Net (cpm) | Efficiency | Activity (dpm) |
|-----|----------------|--------------|-----------|-----------|------------|----------------|
| 35 | See map | 30 | 30.5 | 0 | 0.160 | 0 |
| 36 | | 35 | | 4.5 | | 28 |
| 37 | | 31 | | 0.5 | | 3 |
| 38 | | 26 | | 0 | | 0 |
| 39 | | 32 | | 1.5 | | 9 |
| 40 | | 30 | | 0 | | 0 |
| 41 | | 25 | | 0 | | 0 |
| 42 | | 31 | | 0.5 | | 3 |
| 43 | | 30 | | 0 | | 0 |
| 44 | | 32 | | 1.5 | | 9 |
| 45 | | 29 | | 0 | | 0 |
| 46 | | 33 | | 2.5 | | 16 |
| 47 | | 27 | | 0 | | 0 |
| 48 | | 30 | | 0 | | 0 |
| 49 | | 31 | | 0.5 | | 3 |
| 50 | | 34 | | 3.5 | | 22 |
| 51 | | 28 | | 0 | | 0 |
| 52 | | 33 | | 2.5 | | 16 |
| 53 | | 30 | | 0 | | 0 |
| 54 | | 25 | | 0 | | 0 |
| 55 | | 32 | | 1.5 | | 9 |
| 56 | | 31 | | 0.5 | | 3 |
| 57 | | 35 | | 4.5 | | 28 |
| 58 | | 30 | | 0 | | 0 |
| 59 | | 32 | | 1.5 | | 9 |
| 60 | | 28 | | 0 | | 0 |
| 61 | | 29 | | 0 | | 0 |
| 62 | | 31 | | 0.5 | | 3 |
| 63 | | 27 | | 0 | | 0 |
| 64 | | 32 | | 1.5 | | 9 |
| 65 | | 33 | | 2.5 | | 16 |
| 66 | | 31 | | 0.5 | | 3 |
| 67 | | 30 | | 0 | | 0 |
| 68 | | 26 | | 0 | | 0 |

Reviewed by: _____

RDSYSM00

(BKG=background; LLD =Lower Limit of Detection for smear counting equipment; dpm = disintegrations per minute; cpm = counts per minute; ID = Identification)

