



**GEORGIA INSTITUTE OF TECHNOLOGY  
RESEARCH REACTOR  
DECOMMISSIONING PROJECT  
RADIOLOGICAL CHARACTERIZATION REPORT**

**NES DOCUMENT NO. 82A9087**

**May, 1998**

**Prepared by:  
NES, Inc.  
44 Shelter Rock Road  
Danbury, CT 06810**

**Book 2 of 3**

**PART A of a/b**

## **Correction to Calibration Certificates of the Survey Instrumentation**

The calibration of the pancake GM and ZnS scintillation probes involves determining the relationship between the instrument reading and the true beta or alpha activity being measured. The results of such a calibration can be expressed as an efficiency for the instrument. For surveys, the activity of the unknown is calculated with the  $4\pi$  efficiency of the detector which is measured using the  $4\pi$  activity of a standard source.

NES sent the instruments used in the Georgia Tech NNRC characterization survey to a local Connecticut calibration lab. The lab misrepresented their information on the calibration certificates. Some of the calibration certificates mistakenly list the efficiency as a  $2\pi$  activity while they were actually  $4\pi$  activity. Others do not list the activity at which they were calibrated. The confusion was discussed with the lab in question and the matter was resolved. All corrections have been made directly on the calibration certificates.

# CERTIFICATE OF CALIBRATION (COUNT-RATE INSTRUMENT)



**RSA Laboratories, Inc.**  
21 Pendleton Drive, P.O. Box 61  
Hebron, Connecticut 06248  
(860) 228-0721 Fax (860) 228-4402

Customer and Contact: NES, Inc., Attn: Daryl Thomas (203) 796-5284

Customer Address: 44 Shelter Rock Road, Danbury, CT 06810-7095

Inst. Mfr. & Model Eberline ESP

Inst. Type Smart Portable

Inst. s/n 635

Det. Mfr. & Model Eberline HP-210

Det. Type Pancake G-M

Det. s/n 720694

Cal. Date 22 September 1997

Due Date 22 September 1998

Cal. Interval 1 year

Environmental conditions: Temperature: 71°F Relative Humidity 48% Atmospheric Pressure 29.68 inches Hg

Pre-calibration Checks:

■ Contamination survey

■ Battery check

□ Slow response check

■ Mechanical check

■ Audio check

□ Window operation

■ Det. volts 900 Vdc

■ Meter zero

■ Reset check

□ Plateau check

■ Geotropism check

□ Fast response check

□ Alarm set

■ Input sens. 10 mV

■ Pulse generator s/n 94926 (cal due 18 March 1997) □ Oscilloscope s/n 171-04928

■ Voltmeter s/n 57410002 (cal due 12 Nov 1997)

■ HV Readout (2 points) Ref./Inst. \_\_\_\_\_ V/ \_\_\_\_\_ V

Ref./Inst. \_\_\_\_\_ V/ \_\_\_\_\_ V

Comments: Replaced 6 "C" cell alkaline batteries. Dead time set to 5.06-07, CC set to 1.00+00. Pulse calibration performed with dead-time compensation disabled.

S/N of source used for precision check #6

Isotope Cs-137

Dedicated Source? □Yes ■No

Reading #1 3.12+04 cpm

Reading #2 3.53+04 cpm

Reading #3 3.43+04 cpm

Mean 3.36+04 cpm

Precision: ■ ±10% □ ±10-20% □ Out of tolerance

Range Multiplier	Reference Calibration Point	Instrument Indication
N/A	800,000 cpm	8.02+05 cpm
N/A	200,000 cpm	2.01+05 cpm
N/A	80,000 cpm	8.01+04 cpm
N/A	20,000 cpm	2.01+04 cpm
N/A	8,000 cpm	8.00+03 cpm
N/A	2,000 cpm	2.00+03 cpm
N/A	800 cpm	8.01+02 cpm
N/A	200 cpm	2.03+02 cpm
N/A	80 cpm	8.02+01 cpm
N/A	20 cpm	2.08+01 cpm

All ranges calibrated electronically.

Local background (cpm) = 50

Range Multiplier	Cal. Source Used (isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	4π Instrument Efficiency (%)
n/a	C-14 #D699	208,620	7.68+03	3.7
n/a	Pm-147 #D703	17,421	9.35+02	5.1
n/a	Tc-99 #D702	23,064	2.61+03	11.1
n/a	Cs-137 #2886	21,184	4.46+03	21.1
n/a	Cl-36 #D700	23,598	5.53+03	23.2
n/a	Sr/Y-90 #D711	54,876	1.38+04	25.1

RSA Laboratories ID# 1494. Instrument indicates within ±10% of calibration points unless otherwise indicated. Source-to-detector entry window distance for efficiency determinations is 1 cm unless otherwise specified. RSA Laboratories, Inc. certifies that the above instrument has been calibrated with standards traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio-type of calibration techniques.

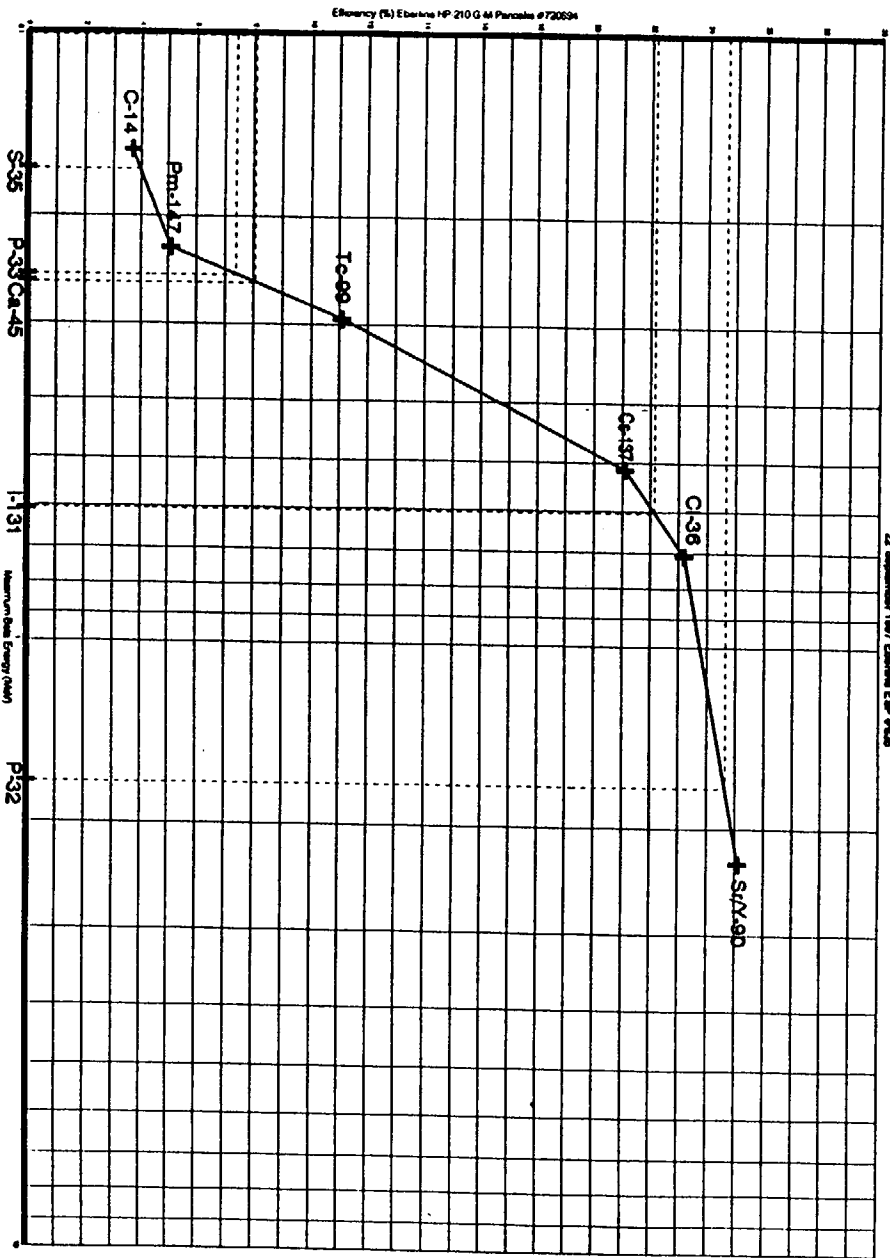
Calibrated by: Paul R. Steinacker

Date 22 Sept 97

Reviewed by: DAVID L. JUD

Date 22 SEPT 97

Interpolated Beta Efficiencies  
22 September 1997 Charles E. R. #123



RSA Laboratories ID# 1494.

Calibrated by:

Bob A. Steiner

Date

22 Sept 97

Reviewed by:

DAVID L. JORD

Date

22 SEP 97



NES, Inc. 82A8045 ATTACHMENT A  
INSTRUMENT RESPONSE RANGE CHECK

Meter Model #	ESP	Date	10/8/97
Meter Serial #	635		
Probe Model #	HP-210	Source Type	Tc-99
Probe Serial #	720694	Source Serial #	1097/87

location of source on the detector	Contact

Note: All source readings @ contact

	source reading (net counts)	(reading - mean)	squared
1	135,000	-6,700	44890000
2	140,000	-1,700	2890000
3	141,000	-700	490000
4	142,000	300	90000
5	143,000	1,300	1690000
6	143,000	1,300	1690000
7	144,000	2,300	5290000
8	144,000	2,300	5290000
9	143,000	1,300	1690000
10	142,000	300	90000
total	1,417,000		64100000
mean	141,700		
		total divide 9	7122222
		sqrt.	2669

upper range = mean +(1.96)(sqrt) =	146931	cpm	beta-gamma
lower range = mean - (1.96)(sqrt) =	136469	cpm	beta-gamma

Technician	Patricia Lopez
Reviewer	Darold Thomas

# CERTIFICATE OF CALIBRATION (COUNT-RATE INSTRUMENT)



**RSA Laboratories, Inc.**  
21 Pendleton Drive, P.O. Box 61  
Hebron, Connecticut 06248  
(860) 228-0721 Fax (860) 228-4402

Customer and Contact: NES, Inc., Attn: Daryl Thomas (203) 796-5284

Customer Address: 44 Shelter Rock Road, Danbury, CT 06810-7095

Inst. Mfr. & Model Ludlum Model 2220

Inst. Type Scaler/Ratemeter

Inst. s/n 48409

Det. Mfr. & Model Ludlum 44-65

Det. Type Alpha Scintillator

Det. s/n 062385

Cal. Date 26 September 1997

Due Date 26 September 1998

Cal. Interval 1 year

Environmental conditions: Temperature: 71°F Relative Humidity 43% Atmospheric Pressure 29.17 inches Hg

Pre-calibration Checks:

■ Contamination survey

■ Battery check

■ Slow response check

■ Det. volts 900 Vdc

■ Mechanical check

■ Audio check

■ Window operation

■ Meter zero

■ Reset check

■ Plateau check

■ Geotropism check

■ Fast response check

□ Alarm set

■ Input sens. 10 mV

■ Pulse generator s/n 94926 (cal due 25 March 1998) □ Oscilloscope s/n 171-04928

■ Voltmeter s/n 57410002 (cal due 06 June 1998)

■ HV Readout (2 points) Ref./Inst. 500V/ 500V Ref./Inst. 1500V/ 1500V

Comments: Replaced 4 "D" cell alkaline batteries. Replaced broken bottom plexi window in 44-65 probe #062385  
Background  $\alpha \approx 3$  cpm

S/N of source used for precision check #0210

Isotope Th-230

Dedicated Source? ☐ Yes ☒ No

Reading #1 7,000

Reading #2 7,000

Reading #3 7,000

Mean 7,000

Precision: ☒  $\pm < 10\%$  ☐  $\pm 10-20\%$  ☐ Out of tolerance

Range	Reference Calibration Point	"As Found" Instrument Indication	"As left" Instrument Indication
x 1000	400,000 cpm	400,000 cpm	400,000 cpm
x 1000	100,000 cpm	100,000 cpm	100,000 cpm
x 100	40,000 cpm	40,000 cpm	40,000 cpm
x 100	10,000 cpm	10,000 cpm	10,000 cpm
x 10	4,000 cpm	4,000 cpm	4,000 cpm
x 10	1,000 cpm	1,000 cpm	1,000 cpm
x 1	400 cpm	400 cpm	400 cpm
x 1	100 cpm	100 cpm	100 cpm
1 min. count	400,000 cpm	399,986 cpm	399,986 cpm

All ranges calibrated electronically.

Range Multiplier	Cal. Source Used (isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	Instrument Efficiency (%)
x 10	Th-230 #91TH2200210	38,900	7,000	18%

RSA Laboratories ID# 1492. Instrument indicates within  $\pm 10\%$  of calibration points unless otherwise indicated. Source-to-detector entry window distance for efficiency determinations is 1 cm unless otherwise specified. RSA Laboratories, Inc. certifies that the above instrument has been calibrated with standards traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio-type of calibration techniques.

Calibrated by: Paul R. Steinmeyer

Date 26 Sept 97

Reviewed by: DAVID L. JUD

Date 26 SEPT 97

NES, Inc.      82A8045      ATTACHMENT A  
INSTRUMENT RESPONSE RANGE CHECK

Meter Model # Ludlum 2220  
Meter Serial # 48409

Date 10/14/97

Probe Model #                       
Probe Serial # 62385

Source Type Pu 239  
Source Serial # 9798

location of source on the detector                                       
Contact                                     

Note: All source readings @ contact

	source reading (net counts)	(reading - mean)	squared
1	<u>66,181</u>	<u>193</u>	<u>37326.24</u>
2	<u>65,880</u>	<u>-108</u>	<u>11620.84</u>
3	<u>65,991</u>	<u>3</u>	<u>10.24</u>
4	<u>65,946</u>	<u>-42</u>	<u>1747.24</u>
5	<u>65,906</u>	<u>-82</u>	<u>6691.24</u>
6	<u>65,469</u>	<u>-519</u>	<u>269153.44</u>
7	<u>66,192</u>	<u>204</u>	<u>41697.64</u>
8	<u>65,938</u>	<u>-50</u>	<u>2480.04</u>
9	<u>66,052</u>	<u>64</u>	<u>4121.64</u>
10	<u>66,323</u>	<u>335</u>	<u>112359.04</u>
total	<u>659,878</u>		<u>487207.6</u>
mean	<u>65,988</u>		
			total divide 9
			<u>54134</u>
			sqrt. <u>233</u>

upper range = mean + (1.96)(sqrt) = 66444 cpm  
lower range = mean - (1.96)(sqrt) = 65532 cpm

Technician Peter Manion  
Reviewer Patricia Lopez

# CERTIFICATE OF CALIBRATION (COUNT-RATE INSTRUMENT)



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Hebron, Connecticut 06248

(860) 228-0721 Fax (860) 228-4402

Customer and Contact: NES, Inc., Attn: Daryl Thomas (203) 796-5284

Customer Address: 44 Shelter Rock Road, Danbury, CT 06810-7095

Inst. Mfr. & Model Ludlum Model 2220

Inst. Type Scaler/Ratemeter

Inst. s/n 50061

Det. Mfr. & Model Ludlum 43-65

Det. Type Alpha Scintillator

Det. s/n 063291

Cal. Date 19 September 1997

Due Date 19 September 1998

Cal. Interval 1 year

Environmental conditions: Temperature: 70°F Relative Humidity 48% Atmospheric Pressure 29.68 inches Hg

Pre-calibration Checks:

■ Contamination survey

■ Battery check

■ Slow response check

■ Mechanical check

■ Audio check

■ Window operation

■ Det. volts 950 Vdc

■ Meter zero

■ Reset check

■ Plateau check

■ Geotropism check

■ Fast response check

■ Alarm set

■ Input sens. 10 mV

■ Pulse generator s/n 94926 (cal due 25 March 1998) □ Oscilloscope s/n 171-04928

■ Voltmeter s/n 57410002 (cal due 06 June 1998)

■ HV Readout (2 points) Ref./Inst. 500V/ 450V Ref./Inst. 1500V/ 1500V

Comments: Local background  $\alpha = 1$  cpm

S/N of source used for precision check #0210

Isotope Th-230

Dedicated Source? ☐ Yes ☒ No

Reading #1 7,000

Reading #2 7,000

Reading #3 7,000

Mean 7,000

Precision: ☒  $\pm 10\%$  ☐  $\pm 10-20\%$  ☐ Out of tolerance

Range	Reference Calibration Point	"As Found" Instrument Indication	"As left" Instrument Indication
x 1000	400,000 cpm	400,000 cpm	400,000 cpm
x 1000	100,000 cpm	100,000 cpm	100,000 cpm
x 100	40,000 cpm	40,000 cpm	40,000 cpm
x 100	10,000 cpm	10,000 cpm	10,000 cpm
x 10	4,000 cpm	4,000 cpm	4,000 cpm
x 10	1,000 cpm	1,000 cpm	1,000 cpm
x 1	400 cpm	400 cpm	400 cpm
x 1	100 cpm	100 cpm	100 cpm
1 min. count	400,000 cpm	399,911 cpm	399,911 cpm

All ranges calibrated electronically.

Range Multiplier	Cal. Source Used (isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	Instrument Efficiency (%)
x 10	Th-230 #91TH2200210	38,900	7,000	18%

RSA Laboratories ID# 1491. Instrument indicates within  $\pm 10\%$  of calibration points unless otherwise indicated. Source-to-detector entry window distance for efficiency determinations is 1 cm unless otherwise specified. RSA Laboratories, Inc. certifies that the above instrument has been calibrated with standards traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio-type of calibration techniques.

Calibrated by: Paul R. Steinmeyer

Date 19 Sept 97

Reviewed by: DAVID L. JUD

Date 19 SEPT 97

NES, Inc. 82A8034 ATTACHMENT B  
INSTRUMENT RESPONSE RANGE CHECK

Meter Model # 2220  
Meter Serial # 50061

Date 10/7/97  
Technician W

Probe Model # 43-65  
Probe Serial # 063291

Reviewer Pf

Instrument Background CPM 1

Source Type Pu-239  
Source Serial # 9798

Location of Source on Probe

middle of probe

Count #	Source CPM	$(x - \bar{x})^2$
1	<u>68629</u>	<u>124609</u>
2	<u>68585</u>	<u>95481</u>
3	<u>68494</u>	<u>47524</u>
4	<u>67710</u>	<u>320356</u>
5	<u>68313</u>	<u>1369</u>
6	<u>68431</u>	<u>24025</u>
7	<u>67828</u>	<u>559504</u>
8	<u>68023</u>	<u>64009</u>
9	<u>68568</u>	<u>85264</u>
10	<u>68174</u>	<u>10404</u>
$\bar{x}$	<u>68276</u> sigma Range	<u>754</u>

Upper Range = 69030  
Lower Range = 67522

$$\sigma Range = 1.96 \sqrt{\frac{\sum (\bar{x} - x)^2}{n - 1}}$$

Upper Range =  $\bar{x} + \sigma Range$   
Lower Range =  $\bar{x} - \sigma Range$

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Customer and Contact: NES, Inc., Attn: Daryl Thomas (203) 796-5284

Customer Address: 44 Shelter Rock Road, Danbury, CT 06810-7095

Inst. Mfr. & Model Ludlum Model 2220

Inst. Type Scaler/Ratemeter

Inst. s/n 50062

Det. Mfr. & Model Eberline AC-3

Det. Type Alpha Scintillator

Det. s/n 408951

Cal. Date 19 September 1997

Due Date 19 September 1998

Cal. Interval 1 year

Environmental conditions: Temperature: 70°F Relative Humidity 48% Atmospheric Pressure 29.68 inches Hg

Pre-calibration Checks:

■ Contamination survey

■ Battery check

■ Slow response check

■ Mechanical check

■ Audio check

■ Window operation

■ Det. volts 1060 Vdc

■ Meter zero

■ Reset check

■ Plateau check

■ Geotropism check

■ Fast response check

■ Alarm set

■ Input sens. 12 mV

■ Pulse generator s/n 94926 (cal due 25 March 1998) □ Oscilloscope s/n 171-04928

■ Voltmeter s/n 57410002 (cal due 06 June 1998)

■ HV Readout (2 points) Ref./Inst. 500V/ 500V Ref./Inst. 1500V/ 1500V

Comments: Replaced 4 "D" cell alkaline batteries. Local background  $\alpha \approx 2$  cpm. Repaired broken high voltage wire connection.

S/N of source used for precision check #0210

Isotope Cs-137

Dedicated Source? ☐ Yes ☒ No

Reading #1 3,000

Reading #2 3,000

Reading #3 3,000

Mean 3,000

Precision: ☒  $\pm < 10\%$  ☐  $\pm 10-20\%$  ☐ Out of tolerance

Range	Reference Calibration Point	"As Found" Instrument Indication	"As left" Instrument Indication
x 1000	400,000 cpm	400,000 cpm	400,000 cpm
x 1000	100,000 cpm	100,000 cpm	100,000 cpm
x 100	40,000 cpm	40,000 cpm	40,000 cpm
x 100	10,000 cpm	10,000 cpm	10,000 cpm
x 10	4,000 cpm	4,000 cpm	4,000 cpm
x 10	1,000 cpm	1,000 cpm	1,000 cpm
x 1	400 cpm	400 cpm	400 cpm
x 1	100 cpm	100 cpm	100 cpm
1 min: count	400,000 cpm	399,054 cpm	399,054 cpm

All ranges calibrated electronically.

Range Multiplier	Cal. Source Used (isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	Instrument Efficiency (%)
x 10	Th-230 #91TH2200210	38,900	3,000	7.7%

RSA Laboratories ID# 1490. Instrument indicates within  $\pm 10\%$  of calibration points unless otherwise indicated. Source-to-detector entry window distance for efficiency determinations is 1 cm unless otherwise specified. RSA Laboratories, Inc. certifies that the above instrument has been calibrated with standards traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio-type of calibration techniques.

Calibrated by:

*Paul R. Steinmeyer*

Paul R. Steinmeyer

Date

19 Sept 97

Reviewed by:

*DAVID L. JUDD*

DAVID L. JUDD

Date

19 SEPT 97

NES, Inc.      82A8045      ATTACHMENT A  
INSTRUMENT RESPONSE RANGE CHECK

Meter Model #	Ludlum 2220	Date	9/23/97
Meter Serial #	50062		
Probe Model #		Source Type	Pu 239
Probe Serial #	408951	Source Serial #	9798

location of source on the detector      Contact

Note: All source readings @ contact

	source reading (net counts)	(reading - mean)	squared
1	27,246	545	296698.09
2	26,612	-89	7974.49
3	26,402	-299	89580.49
4	26,596	-105	11088.09
5	26,540	-161	26017.69
6	26,838	137	18686.89
7	26,668	-33	1108.89
8	26,682	-19	372.49
9	26,657	-44	1962.49
10	26,772	71	4998.49
total	267,013		458488.1
mean	26,701		
		total divide 9	50943
		sqrt.	226

upper range = mean + (1.96)(sqrt) = 27144 cpm  
lower range = mean - (1.96)(sqrt) = 26259 cpm

Technician Patricia Lopez  
Reviewer Pat Horkman

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Customer and Contact: NES, Inc., Attn: Daryl Thomas (203) 796-5284

Customer Address: 44 Shelter Rock Road, Danbury, CT 06810-7095

Inst. Mfr. & Model Ludlum Model 2220

Inst. Type Scaler/Ratemeter

Inst. s/n 52823

Det. Mfr. & Model Ludlum 44-9

Det. Type G-M Pancake

Det. s/n 011150

Cal. Date 16 September 1997

Due Date 16 September 1998

Cal. Interval 1 year

Environmental conditions: Temperature: 70°F Relative Humidity 49% Atmospheric Pressure 29.68 inches Hg

Pre-calibration Checks:

■ Contamination survey

■ Battery check

■ Slow response check

■ Mechanical check

■ Audio check

□ Window operation

■ Det. volts 900 Vdc

■ Meter zero

■ Reset check

□ Plateau check

■ Geotropism check

■ Fast response check

□ Alarm set

■ Input sens. 10 mV

■ Pulse generator s/n 94926 (cal due 25 March 1998) □ Oscilloscope s/n 171-04928

■ Voltmeter s/n 57410002 (cal due 06 June 1998)

■ HV Readout (2 points) Ref./Inst. 500V/ 450V Ref./Inst. 1500V/ 1500V

Comments: Replaced G-M tube in 44-9 #011150

S/N of source used for precision check #6

Isotope Cs-137

Dedicated Source? ☐ Yes ☒ No

Reading #1 60,000

Reading #2 60,000

Reading #3 60,000

Mean 60,000

Precision: ☒ ± < 10% ☐ ± 10-20% ☐ Out of tolerance

Range	Reference Calibration Point	"As Found" Instrument Indication	"As left" Instrument Indication
x 1000	400,000 cpm	400,000 cpm	400,000 cpm
x 1000	100,000 cpm	100,000 cpm	100,000 cpm
x 100	40,000 cpm	40,000 cpm	40,000 cpm
x 100	10,000 cpm	10,000 cpm	10,000 cpm
x 10	4,000 cpm	4,000 cpm	4,000 cpm
x 10	1,000 cpm	1,000 cpm	1,000 cpm
x 1	400 cpm	400 cpm	400 cpm
x 1	100 cpm	100 cpm	100 cpm
1 min. count	400,000 cpm	400,105 cpm	400,105 cpm

All ranges calibrated electronically.

Local background (cpm) =

27.2 ± 0.8  
50 ± 1.5

Range Multiplier	Cal. Source Used (isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	Instrument Efficiency (%)
1 min. count	C-14 #D699	208,620	16,179	7.73
1 min. count	Pm-147 #D703	17,421	2255	12.66
1 min. count	Tc-99 #D702	23,064	6041	25.98
1 min. count	Cs-137 #2886	21,184	9313	43.73
1 min. count	Cl-36 #D700	23,598	10,424	43.96
1 min. count	Sr/Y-90 #D711	54,876	24,384	44.34
1 min. count	Th-230 #91TH4700001	32,999	4906	14.85

RSA Laboratories ID# 1489. Instrument indicates within ±10% of calibration points unless otherwise indicated. Source-to-detector entry window distance for efficiency determinations is 1 cm unless otherwise specified. RSA Laboratories, Inc. certifies that the above instrument has been calibrated with standards traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio-type of calibration techniques.

Calibrated by:

*Paul R. Steinmeyer*

*Paul R. Steinmeyer*

Date 16 Sept 97

Reviewed by:

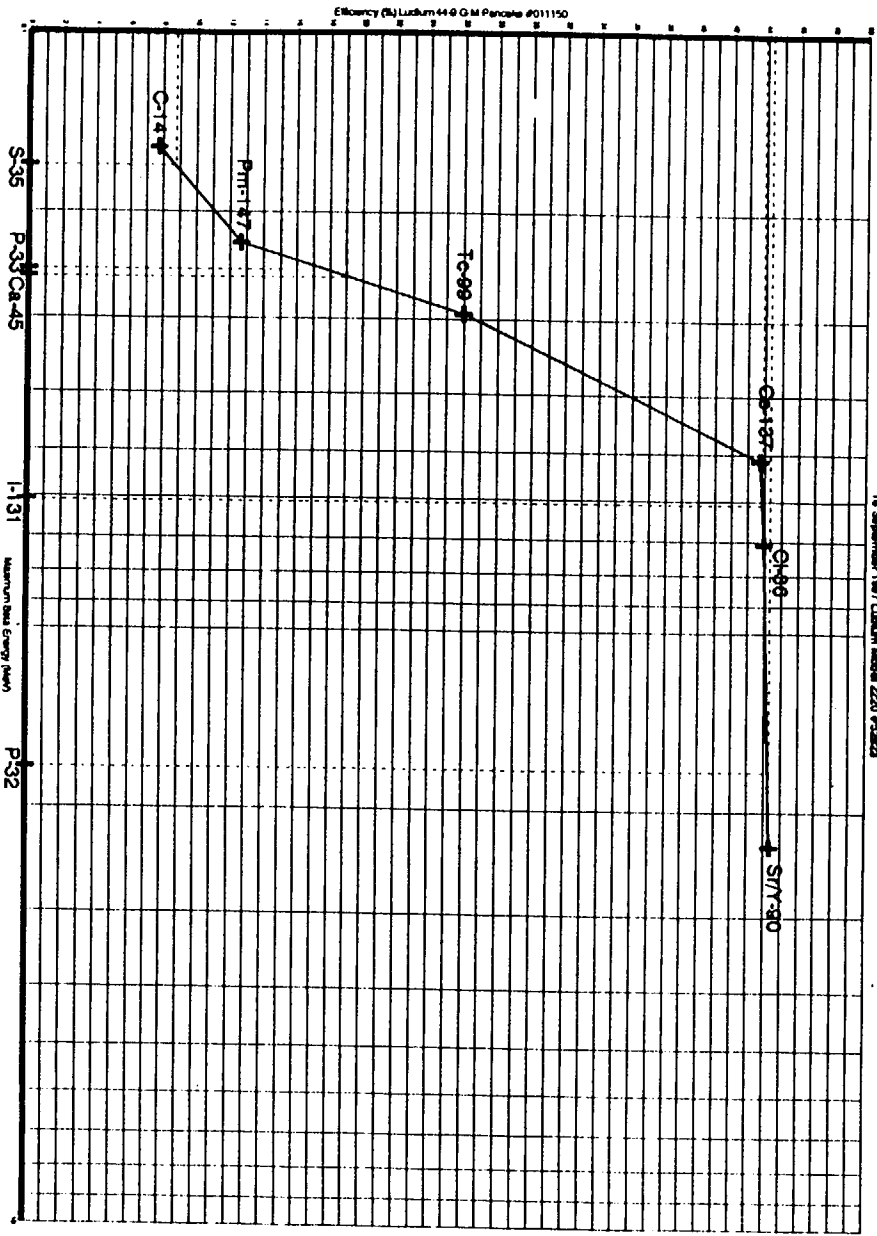
*DAVID L. JUDD*

*DAVID L. JUDD*

Date 16 SEPT 97



Interpolated Beta Efficiencies  
16 September 1997 Ludlum Model 220 075022



RSA Laboratories ID# 1489.

Calibrated by:

*Rad R. Steiner*

*B. R. Steiner*

Date

*16 Sep 97*

Reviewed by:

*John M. David & J. J. J. J.*

*DAVID & J. J. J. J.*

Date

*16 SEP 97*

NES, Inc. 82A8045 ATTACHMENT A  
INSTRUMENT RESPONSE RANGE CHECK

Meter Model # Ludlum 2220  
Meter Serial # 52823

Date 10/7/97

Probe Model # 44-9  
Probe Serial # 11150

Source Type Tc-99  
Source Serial # 1097/87

location of source on the detector

Contact

Note: All source readings @ contact

	source reading (net counts)	(reading - mean)	squared
1	152,646	1,908	3641227.24
2	151,617	879	772892.64
3	151,921	1,183	1399962.24
4	151,178	440	193776.04
5	151,178	440	193776.04
6	150,275	-463	214183.84
7	150,317	-421	177072.64
8	149,979	-759	575777.44
9	149,528	-1,210	1463616.04
10	148,739	-1,999	3995201.44
total	1,507,378		total 12627585.6
mean	150,738		total divide 9 1403065
			sqrt. 1185

upper range = mean + (1.96)(sqrt) = 153059 cpm  
lower range = mean - (1.96)(sqrt) = 148416 cpm

Technician Patricia Lopez

Reviewer Pat Horkman



SECT 1 BY: SECOND FLOOR  
Designer and Manufacturer  
of  
Scientific and Industrial  
Instruments

10-15-97 10:08AM :  
CERTIFICATE OF CALIBRATION

NES INC- 4048949325-# 2/ 4  
LUDLUM MEASUREMENTS, INC.  
POST OFFICE BOX 810 PH. 915-235-5494  
501 OAK STREET FAX NO. 915-235-4672  
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER NES, INC.

ORDER NO. 225872

Mfg. Ludlum Measurements, Inc. Model 2221 Serial No. 68537

Mfg. Ludlum Measurements, Inc. Model 44-9 Serial No. PRO66762

Cal. Date 04/21/97 Cal Due Date 10/21/97 Cal. interval 6 Months Meterface 202-159

Check mark ☒ applies to applicable Instr. and/or detector IAW mfg. spec. T. 74 °F RH 38 % Alt 694.8 mm Hg

☐ New Instrument Instrument Received ☒ Within Toler.  $\pm 10\%$  ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair

☒ Mechanical ck. ☒ Meter Zeroed ☐ Background Subtract ☒ Input Sens. Linearity

☒ F/S Resp. ck. ☒ Reset ck. ☒ Window Operation ☒ Geotopism

☒ Audio ck. ☐ Alarm Setting ck. ☒ Batt. ck. (Min. Volt) 4.4 VDC

☒ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 12/19/89.

Instrument Volt Set 900 V Input Sens. 50 mV Det. Oper. 900 V at 50 mV Threshold Dial Ratio 100 = 10 mV

☒ HV Readout (2 points) Ref./Inst. 506 / 500 V Ref./Inst. 1922 / 2000 V

### COMMENTS:

Firmware # 261010

Conversion factor cpm to dpm for U-238: 3.15

(U-238  $\gamma$  90423804393)

0.2%

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
X 1000	400 K cpm	400	400
X 1000	100 K cpm	100	100
X 100	40 K cpm	40	40
X 100	10 K cpm	10	10
X 10	4 K cpm	4	4
X 10	1 K cpm	1	1
X 1	400 cpm	400	400
X 1	100 cpm	100	100

\*Uncertainty within  $\pm 10\%$  C.F. within  $\pm 20\%$

All Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400 K cpm	400.356	Log Scale	500 K cpm	475K
	40 K cpm	40.27		50 K cpm	50K
	4 K cpm	4.03		5 K cpm	5K
	400 cpm	401		500 cpm	525
	40 cpm	40			

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration technique. The calibration system conforms to the requirements of MIL-STD-45662A and ANSI N123-1978. State of Texas Calibration License No. LO-1963

### Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☒ G112 ☐ M363 ☐ S105 ☐ T1008 ☐ T879 ☐ S12

☐ Neutron Am-241 Be S/N T-304

☐ Alpha S/N ☐ Beta S/N ☐ Other

☒ m 500 S/N 121036 ☐ Oscilloscope S/N ☒ Multimeter S/N 61730074

Calibrated By: Gain Martin Date: 4-21-97

Reviewed By: Rhonda Hansen Date: 4-23-97

FORM C22A 02/11/97

CONVERSION CHART

4/15/97

Customer NES, INC. Date 04/21/97 Order #. 225872

Model 2221 Serial No. 68537 Detector Model 44-9 Serial No. PR066762

Source Cs-137 194.6 mCi High Voltage 900 V

Input Sensitivity 50 mV

Reference Point	"As Found" Readings (CPM):		After Adjustment Readings (CPM):	
	Analog	Range/Scale	Analog	Range/Scale
150 mR/hr	236	X1K	230	X1K
50 mR/hr	120	"	120	"
15 mR/hr	440	X100	440	X100
5 mR/hr	160	"	160	"
1.5 mR/hr	450	X10	450	X10
1.0 mR/hr	300	"	300	"

Reference Point	"As Found" Readings:		After Adjustment Readings:	
	Digital	Count Time	Digital	Count Time
150 mR/hr	22932	.1 min	22932	.1 min
50 mR/hr	11864	"	11864	"
15 mR/hr	4452	"	4452	"
5 mR/hr	1523	"	1523	"
1.5 mR/hr	437	"	437	"
1.0 mR/hr	299	"	299	"

Signature: Lain Martin Date 4-21-97

## INSTRUMENT RESPONSE CHECK RANGE

model# L2221  
 serial# 68537

date 10/7/97

probe type 44-9  
 serial# 68917

source type Tc-99  
 serial# 1096/87

source reading		reading - mean	squared
1	<u>78633</u>	<u>646.5</u>	<u>417962.25</u>
2	<u>78223</u>	<u>236.5</u>	<u>55932.25</u>
3	<u>78178</u>	<u>191.5</u>	<u>36672.25</u>
4	<u>77765</u>	<u>-221.5</u>	<u>49062.25</u>
5	<u>77919</u>	<u>-67.5</u>	<u>4556.25</u>
6	<u>78184</u>	<u>197.5</u>	<u>39006.25</u>
7	<u>77417</u>	<u>-569.5</u>	<u>324330.25</u>
8	<u>77979</u>	<u>-7.5</u>	<u>56.25</u>
9	<u>77768</u>	<u>-218.5</u>	<u>47742.25</u>
10	<u>77799</u>	<u>-187.5</u>	<u>35156.25</u>
total	<u>779865</u>	<u>total</u>	<u>1010476.5</u>
mean	<u>77986.5</u>	<u>total divide 9</u>	<u>112275.17</u>
			<u>335.07</u>

upper range = mean + (1.96)(sq.rt.) = 78643  
 lower range = mean - (1.96)(sq.rt.) = 77330

technician \_\_\_\_\_

reviewer \_\_\_\_\_

**Eberline** A subsidiary of  
**Thermo Instrument**  
**Systems Inc.**

**CERTIFICATION OF CALIBRATION**  
**Teletector 6112D**

Instrument \_\_\_\_\_

37266

Serial No. \_\_\_\_\_

Cs-137 S/N 124

Type of Source \_\_\_\_\_

Cs-137 S/N 125

Cs-137 S/N 123

Cs-137 S/N 120

Range	Calibration Point	Reading
<u>10 R/hr</u>	<u>9.5 to 10.5 R/hr</u>	<u>10</u> R/hr
<u>150 R/hr</u>	<u>142.5 to 157.5 R/hr</u>	<u>150.4</u> R/hr
<u>200 R/hr</u>	<u>190.0 to 210.5 R/hr</u>	<u>201.6</u> R/hr
<u>250 R/hr</u>	<u>225.0 to 275.0 R/hr</u>	<u>273.8</u> R/hr
<u>750 R/hr</u>	<u>712.5 to 787.5 R/hr</u>	<u>738.8</u> R/hr
<u>1000 R/hr</u>	<u>900.0 to 999.9 R/hr</u>	<u>999.9</u> R/hr
<u>1 mR/hr</u>	<u>.9 to 1.1 mR/hr</u>	<u>1.0</u> mR/hr
<u>10 mR/hr</u>	<u>9.5 to 10.5 mR/hr</u>	<u>10.2</u> mR/hr
<u>150 mR/hr</u>	<u>135.0 to 165.0 mR/hr</u>	<u>156.4</u> mR/hr
<u>250 mR/hr</u>	<u>225.0 to 275.0 mR/hr</u>	<u>262.8</u> mR/hr
<u>750 mR/hr</u>	<u>712.5 to 787.5 mR/hr</u>	<u>749.6</u> mR/hr

Calibration sources used have calibration traceable to the National Institute Of Standards And Technology.

Date 9-23-95 Signature Lib Teyria



**SCITEC**

An Andros Company



## Limited Warranty

Scitec Corporation warrants its XRF Spectrum Analyzers and accessories to be free from defects in manufacturing and materials for a period of one year from date of delivery. Repair services are warranted to be free from defects in labor and materials for ninety days after return to customer. Instances of misuse, theft, abuse, or accident are not covered.

MAP Serial No. 4-1412

Effective Date 10-10-96



**TMA**  
Thermo Analytical Inc.

TMA/Eberline

563h Jefferson Street NE

Post Office Box 3874

Albuquerque, NM 87190-3874

(505) 345-9931

CUSTOMER: McClellan AFB  
Bldg. #628  
Sacramento, CA 95652

ADDRESS:

Quality Control & Inspection

P.O. NUMBER: N15599

TMA/EBERLINE S.O. NUMBER: S-02018

DATE SHIPPED: 3/2/90

CERTIFICATE OF COMPLIANCE

The radioactive sources or services comprising this order have been subjected to and have passed all examinations, inspections, tests and calibrations of the TMA/Eberline quality assurance procedures, and, as applicable, are in compliance with specifications imposed by the above referenced contract/purchase order number.

Calibration has been accomplished in accordance with TMA/Eberline calibration procedures. Sources for calibration and/or dose rates have calibration traceable to National Bureau Standards.

The undersigned as the authorized representative of TMA/Eberline warrants the information contained within this document to be a true statement of fact.

  
Quality Assurance Manager

## CERTIFICATE OF CALIBRATION

### Electroplated Alpha Standard

S.O. # S-01994  
P.O. # N15599

#### Description of Standard:

Model No. S94-1sp Serial No. 9796 Isotope Plutonium-239  
Electroplated on polished N1 disc, 0.79 mm thick.

Total diameter of 3.18 cm and an active diameter of 2.54 cm.

Radioactive material permanently fixed to the disc by heat treatment, without any covering over the active surface

#### Measurement Method:

The  $2\pi$  alpha emission rate was measured using an internal gas flow proportional chamber. Absolute counting of alpha particles emitted in the hemisphere above the active surface was verified by counting above, below and at the operating voltage. The calibration is traceable to NBS by reference to an NBS calibrated alpha source. Intercomparisons testings between EAC-NBS show an agreement within 0.2%.

#### Measurement Result:

The total number of alpha particles emitted from the surface of the disc per minute (cpm) on the calibration date was

1,630  $\pm$  163

The total disintegration rate (dpm)

3,250  $\pm$  325 (0.00147  $\mu\text{Ci}$ )

The uncertainty of the measurement is 10 % which is the sum of random counting error at the 99% confidence level and the estimated upper limit of systematic error in this measurement.

Calibrated by: Gloria Madrid

(print)

Gloria Madrid  
(signature)

Reviewed by: Arthur Shanks

(print)

Arthur Shanks  
(signature)

Calibration Date: February 6, 1990

Date: February 6, 1990

Note: It is recommended that this source be recertified on an annual basis.

TMA/Eberline Albuquerque Laboratory  
7021 Pan American Hwy. NE  
Albuquerque, NM 87109  
(505) 345-3461

## CERTIFICATE OF CALIBRATION

### Electroplated Beta Standard

S.O. # S-01994

P.O. # N15599

#### Description of Standard:

Model No. DNS-18sp Serial No. 1097/87 Isotope Technetium-99  
Electroplated on polished Ni disc, 0.79 mm thick.

Total diameter of 3.18 cm and an active diameter of 2.54 cm.

Radioactive material permanently fixed to the disc by heat treatment without any covering over the active surface.

#### Measurement Method:

The  $^{99}\text{Tc}$  beta emission rate was measured using an internal gas flow proportional chamber. Absolute counting of beta particles emitted in the hemisphere above the active surface was verified by counting above, below and at the operating voltage. The calibration is traceable to NBS or reference to an NBS calibrated beta source. Intercomparisons resulting between EAC-NBS show an agreement within 0.3%.

#### Measurement Result:

The total number of beta particles emitted from the surface of the disc per minute (cpm) on the calibration date was

225,000  $\pm$  22,500

The total disintegration rate (dpm) assuming 25% backscatter of beta particles from the surface of the disc, was

359,000  $\pm$  35,900 (0.162  $\mu\text{Ci}$ )

The uncertainty of the measurement is 10 % which is the sum of random counting error at the 99% confidence level and the estimated upper limit of systematic error in this measurement.

Calibrated by: Gloria Madrid Reviewed by: Arthur Shanks  
(print) (print)

Gloria Madrid  
(signature)

Arthur Shanks A.C.  
(signature)

Calibration Date: February 6, 1990 Date: February 6, 1990

Note: It is recommended that this source be recertified on an annual basis.

TMA/Eberline

5635 Jefferson Street NE

Post Office Box 3874

Albuquerque, NM 87190-3874

505, 345-9931

## CERTIFICATE OF CALIBRATION

### Gamma Standard

S.O. # S-02008  
P.O. # N15599

#### Description of Standard:

Model No. Cs-7A Serial No. 1699/90 Isotope Cesium-137

The source of gamma radiation is mounted on a 1.27 cm diameter SS disc.  
.10 mm thick and sealed in a Plastic disc 1" dia x 1/8" thick.

#### Measurement Method:

The gamma ray emission rate was compared with a similar standard which was calibrated by the National Bureau of Standards. This comparison of relative gamma ray emission rates was accomplished using a high resolution gamma-ray detector (nominal active volume 100 cm<sup>3</sup>) and a multichannel pulse height analyzer.

#### Measurement Result:

The gamma ray activity of the standard on January 28, 1990 was 6.91 MC.

The uncertainty in the activity is 5 % which is the sum of the uncertainty assigned to the NBS reference standard ( 3%) the random error of counting at the 99% confidence level, and the estimated upper limit of systematic errors.

Calibrated by: Gloria Madrid Reviewed by: Arthur Shanks  
(print) (print)  
Gloria Madrid Arthur Shanks O.C.  
(signature) (signature)

Calibration Date: January 28, 1990 Date: January 28, 1990

Note: It is recommended that this source be recertified on an annual basis.

## Comparison of the Analysis Performed by the On-site and Independent Laboratories

Sample ID	Location	Radionuclide Specific Activity (pCi/l)					
		H-3		Co-60		Cs-137	
		On Site	Independent	On Site	Independent	On Site	Independent
		Lab	Lab	Lab	Lab	Lab	Lab
LIQ-14	Water-Filled Storage Hole First Floor	1.11x10 <sup>7</sup>	2.15x10 <sup>8</sup>	1.32x10 <sup>4</sup>	1.15x10 <sup>4</sup>	1.4x10 <sup>4</sup>	1.34x10 <sup>4</sup>
LIQ-16	Tank T-D1 in Process Equipment Room	5.46x10 <sup>5</sup>	1.17x10 <sup>7</sup>	8.94x10 <sup>2</sup>	2x10 <sup>2</sup>	ND	ND

Sample ID	Location	Radionuclide Specific Activity (pCi/kg)					
		K-40		Co-60		Cs-137	
		On Site	Independent	On Site	Independent	On Site	Independent
		Lab	Lab	Lab	Lab	Lab	Lab
BG1-5 Comp	Vacant Lot Behind 763 Techwood Drive	1.98x10 <sup>-2</sup>	9.6x10 <sup>-3</sup>	ND	ND	ND	1.0x10 <sup>1</sup>
SC-15	Facility Yard	ND	1.2x10 <sup>4</sup>	ND	ND	ND	3.8x10 <sup>1</sup>
BG-6A	Vacant Lot Behind 763 Techwood Drive	2.42x10 <sup>-2</sup>	1.8x10 <sup>4</sup>	ND	ND	ND	ND
MAT-1	Graphite from Horizontal Beam Port No. 2	1.22x10 <sup>-2</sup>	ND	3.49x10 <sup>-3</sup>	1.15x10 <sup>4</sup>	*	1.5x10 <sup>1</sup>

Sample ID	Location	Th-232		U-238	
		On Site	Independent	On Site	Independent
		Lab	Lab	Lab	Lab
BG1-5 Comp	Vacant Lot Behind 763 Techwood Drive	1.08x10 <sup>-3</sup>	ND	8.93x10 <sup>-4</sup>	8x10 <sup>2</sup>
SC-15	Facility Yard	1.91x10 <sup>-3</sup>	ND	ND	1.2x10 <sup>3</sup>
BG-6A	Vacant Lot Behind 763 Techwood Drive	1.48x10 <sup>-3</sup>	ND	1.39x10 <sup>-3</sup>	1.4x10 <sup>3</sup>
MAT-1	Graphite from Horizontal Beam Port No. 2	*	ND	ND	ND

\* No information provided

ND= Not Detected



GEORGIA INSTITUTE OF TECHNOLOGY

ENVIRONMENTAL RESOURCES CENTER  
620 CHERRY STREET  
104C ESM BUILDING  
ATLANTA, GEORGIA 30332-0225

PH.: (404) 894-3776  
FAX: (404) 894-3733

November 19, 1997

D. Reisenweaver  
NES Inc.  
44 Shelter Rock Road  
Danbury CT 06810-7095

Dear Mr. Reisenweaver:

In response to your request, we analyzed the six samples submitted by you on October 22, 1997, for photon-emitting radionuclides by gamma-ray spectral analysis and the three samples for tritium concentration by liquid scintillation counter. These analyses were performed for quality control purposes. Each sample was analyzed in duplicate. Results shown in the enclosed Tables 1 and 2, are given in units of picocuries per kilogram solids or per liter water. Radionuclides attributable to the facility were found in the graphite and the water. The plus/minus values represent the two standard deviation of counting. Duplicate results were within these limits. The detectors were calibrated for counting efficiency with radionuclide standards traceable to NIST.

The tritium concentrations reported in Table 2 were obtained for 3 samples by counting the vials submitted by you and for 2 of the samples by preparing vials from aliquots of the water samples submitted by you. Note the disagreement between the two sets of results. The sample tritium concentrations are about 60% of the vial tritium concentrations. We examined the spectrum for all samples and found no contribution at activity levels similar to tritium from radionuclides with higher beta particle energies.

Please let me know if we can be of further assistance

Sincerely yours,

Bernd Kahn

Table 1. Photon-emitting Radionuclide Concentration, in pCi/kg or pCi/L

Radionuclide	Soil		Concrete BG-66 S8221	Graphite MAT-1 S8222	Water	
	BG1-5 Comp S8219	SC-15 S8220			LIQ-14 S8223	LIQ-16 * S8224 **
K-40	9,600±1000	12,000±1000	18,000±2000	<50	<50	<50
Mn-54	<10	<10	<10	<10	80±20	<10
Co-60	<10	<10	<10	4,000±400	11,500±1,200	200±20
Zn-65	<10	<10	<10	380±100	110±40	<10
Cs-134	<10	<10	<10	<10	50±20	<10
Cs-137	10±10	38±10	<10	150±20	13,400±2,000	<10
Eu-152	<10	<10	<10	350±30	<20	<20
Ra-226	500±100	1,000±100	1,300±100	<10	<20	<20
Ra-228	800±100	1,300±100	1,200±100	<10	<20	<20
U-238	800±400	1,200±400	1,400±400	<60	<50	<40
Am-241	<10	<10	<10	340±100	<10	<10

\* Sample No.

\*\* Laboratory ID

Table 2. Tritium in Water, in pCi/L

Sample#	Lab. ID	Vial	Sample
LIQ- 14	S8223	2.15 E8	1.27 E8
LIQ- 16	S8224	1.17 E7	7.09 E6
T308B	S8225	3.34 E5	Not avail.

Note: 2- standard deviation value is 10%.



## Daily Indoor Backgrounds

Date	48409			50062			50061		
	Ground FI	First FI	Second FI	Ground FI	First FI	Second FI	Ground FI	First FI	Second FI
	(cpm)	(cpm)	(cpm)	(cpm)	(cpm)	(cpm)	(cpm)	(cpm)	(cpm)
10/7/97	-	-	-	5	5	5	5	5	5
10/8/97	-	-	-	5	5	5	5	5	5
10/9/97	-	-	-	5	5	5	5	5	5
10/10/97	-	-	-	5	5	5	5	5	5
10/11/97	-	-	-	5	5	5	5	5	5
10/12/97	-	-	-	-	-	-	-	-	-
10/13/97	-	-	-	5	5	5	5	5	5
10/14/97	5	5	5	5	5	5	5	5	5
10/15/97	5	5	5	5	5	5	5	5	5
10/16/97	5	5	5	5	5	5	5	5	5
10/17/97	5	5	5	5	5	5	5	5	5
10/18/97	-	-	-	-	-	-	-	-	-
10/19/97	-	-	-	-	-	-	-	-	-
10/20/98	5	5	5	5	5	5	5	5	5
10/21/97	5	5	5	5	5	5	5	5	5
10/22/97	5	5	5	5	5	5	5	5	5
10/23/97	5	5	5	5	5	5	5	5	5

Date	68537			52823		
	Ground FI	First FI	Second FI	Ground FI	First FI	Second FI
	(cpm)	(cpm)	(cpm)	(cpm)	(cpm)	(cpm)
10/7/97	152	225	323	153	226	323
10/8/97	150	226	320	158	230	331
10/9/97	154	225	321	157	232	331
10/10/97	150	220	321	156	230	327
10/11/97	150	220	323	159	230	325
10/12/97	-	-	-	-	-	-
10/13/97	152	224	325	155	231	322
10/14/97	150	225	325	156	230	323
10/15/97	152	221	320	156	231	321
10/16/97	152	225	322	155	230	320
10/17/97	154	220	322	156	225	327
10/18/97	-	-	-	-	-	-
10/19/97	-	-	-	-	-	-
10/20/98	154	225	322	153	231	320
10/21/97	152	220	320	152	229	322
10/22/97	150	225	321	153	231	322
10/23/97	150	221	320	150	231	324

# Survey Locations

Smear	Location	Description
1-20	NES Field Office	Before Project Began
21-32	First Floor	Entrance Door to Containment
33-49	First Floor	Northwest Wall of Containment
50	First Floor	West Wall of Containment
51-54	First Floor	Northwest Wall of Containment
55-65	First Floor	West Wall of Containment
66-90	First Floor	Emergency Air Lock Door
91	First Floor	West Wall of Containment
92	First Floor	Emergency Air Lock Door
93-94	First Floor	West Wall of Containment
95-96	First Floor	Northwest Wall of Containment
97-105	First Floor	Southeast Wall of Containment
106	First Floor	South Wall of Containment
107-108	First Floor	Southeast Wall of Containment
109-122	First Floor	South Wall of Containment
123-146	First Floor	East Wall of Containment
147-149	First Floor	East Wall of Containment
150-152	First Floor	East Wall of Containment
153-164	First Floor	East Wall of Containment
165-166	First Floor	North Wall of Containment
167	First Floor	East Wall of Containment
168-177	First Floor	North Wall of Containment
178-193	First Floor	North Wall of Reactor
194-210	First Floor	South Wall of Reactor
211	First Floor	Irradiation Tunnels
212-221	First Floor	South Wall of Reactor
222-235	First Floor	Southwest Wall of Reactor
236-239	First Floor	East Wall of Reactor
240-241	First Floor	Biomedical Irradiation Facility
242	First Floor	Biomedical Irradiation Facility, Ceiling
243-270	First Floor	Biomedical Irradiation Facility
271	First Floor	Biomedical Irradiation Facility, Ceiling
272	First Floor	Biomedical Irradiation Facility
273-279	First Floor	Biomedical Irradiation Facility, Ceiling
280-286	First Floor	Biomedical Irradiation Facility
287	First Floor	Biomedical Irradiation Facility, Ceiling
288-289	Second Floor	Southeast Wall of Inner Area in Control Room
290-295	Second Floor	Windows of Control Room
296-297	Second Floor	Northwest Wall of Inner Area of Control Room
298-299	Second Floor	Control Room, Ceiling
300	First Floor	Biomedical Irradiation Facility
301-303	Second Floor	Northwest Wall of Inner Area of Control Room
304-305	Second Floor	Inner Area of Control Room
306	Second Floor	Control Room, Ceiling

307-313	Second Floor	Southeast Wall of Inner Area in Control Room
314-316	Second Floor	Northeast Wall of Inner Area of Control Room
317	Second Floor	Inner Area of Control Room
318-319	Second Floor	Southeast Wall of Inner Area in Control Room
320	Second Floor	Inner Area of Control Room
321	Second Floor	Northeast Wall of Inner Area of Control Room
322-323	Second Floor	Inner Area of Control Room
324-325	Second Floor	Northeast Wall of Inner Area of Control Room
326	Second Floor	Inner Area of Control Room
327-328	Second Floor	Northeast Wall of Inner Area of Control Room
329-330	Second Floor	Ceiling of Control Room
331	Second Floor	Inner Area of Control Room
332	Second Floor	Windows of Control Room
333	Second Floor	Northeast Wall of Inner Area of Control Room
334-336	Second Floor	Ceiling of Control Room
337	Second Floor	Inner Area of Control Room
338	Second Floor	Ceiling of Control Room
339	Second Floor	Inner Area of Control Room
340-401	Second Floor	Outer Area of Control Room
402-407	Second Floor	Area West of Control Room
408-410	Second Floor	Area East of Control Room
411-414	Second Floor	Area East of Reactor Top
415	Second Floor	Area East of Control Room
416	Second Floor	Catwalk
417-421	Second Floor	Area East of Control Room
422-479	Second Floor	Catwalk
480-481	Second Floor	Northeast Wall of Containment
482	Second Floor	Catwalk
483	Second Floor	Northeast Wall of Containment
484	Second Floor	Catwalk
485-488	Second Floor	Northeast Wall of Containment
489-492	Second Floor	Area West of Control Room
493-539	Second Floor	Air-Conditioning Unit on Top of Control Room
540-545	Ground Floor	North Face of Reactor
546-552	Ground Floor	Center Columns
553-556	Ground Floor	Northeast Wall of Containment
557-563	Ground Floor	North Wall of Reactor
564-565	Ground Floor	North Wall of Containment
566	Ground Floor	Northeast Wall of Containment
567	Ground Floor	Center Columns
568-569	Ground Floor	North Wall of Reactor
570-571	Ground Floor	Southeast Corner of Conatinment
572-573	Ground Floor	Center Columns
574-576	Ground Floor	East Wall of Containment
577	Ground Floor	North Wall of Reactor
578-585	Ground Floor	East Wall of Containment
586-589	Ground Floor	Southeast Corner of Conatinment
590	Ground Floor	Center Columns
591	Ground Floor	Southeast Corner of Conatinment

592-593	Ground Floor	West Corner of Containment
594	Ground Floor	Center Columns
595-596	Ground Floor	Southeast Corner of Containment
597	Ground Floor	West Corner of Containment
598	Ground Floor	Southeast Corner of Containment
599-601	Ground Floor	West Corner of Containment
602-623	Ground Floor	Pump Room
624-629	Ground Floor	North Wall of Containment
630-634	Ground Floor	East Wall of Containment
635-641	Ground Floor	Southeast Wall of Containment
642	Ground Floor	Southwest Corner of Containment
643-646	Ground Floor	Southeast Wall of Containment
647-652	Ground Floor	Southwest Corner of Containment
653-663	Ground Floor	Experimental Room No. 1
664-677	Ground Floor	Experimental Room No. 2
678-685	Ground Floor	West Wall, Outside Experimental Rooms
686-687	Ground Floor	North Face of Reactor
688-699	Ground Floor	Experimental Room No. 2
700	Ground Floor	North Wall of Containment
701	Ground Floor	Southwest Corner of Containment
702	Ground Floor	East Wall of Containment
703	Ground Floor	East Wall, Outside Experimental Rooms
704	Ground Floor	Southeast Wall of Containment
705-707	Ground Floor	Southwest Corner of Containment
708-709	Ground Floor	Southeast Wall of Containment
710-719	Ground Floor	Experimental Room No. 1
720-734	Ground Floor	Experimental Room No. 2
735-737	Ground Floor	North Wall of Containment
738-739	Ground Floor	Center Columns
740-741	Ground Floor	North Face of Reactor
742	Ground Floor	East Corner of Containment
743-759	Ground Floor	Pump Room, Ceiling
760-762	Ground Floor	Northeast Wall of Containment
763-769	Stairs	From First Floor to Ground Floor
770-789	Ground Floor	Experimental Room No. 1
790	Ground Floor	East Wall, Outside Experimental Rooms
791-810	First Floor	Irradiation Tunnels
811-823	Rabbit System	Throughout Facility
824-826	First Floor	Water-Storage Hole
827-841	Ground Floor	Outer Wall of Process Equipment Room
842-866	Ground Floor	Process Equipment Room
867-868	Ground Floor	Process Equipment Room, Ceiling
869	Ground Floor	Process Equipment Room
870-872	Ground Floor	Process Equipment Room, Ceiling
873	Ground Floor	Process Equipment Room
874-876	Ground Floor	Process Equipment Room, Ceiling
877-886	Ground Floor	Reactor Faces in Process Equipment Room
887-900	Overhead Cranes	After Project Completion
901-1054	First Floor	Plug Storage Area

1055-1079	Manlift	After Project Completion
1080-1091	Chemical Addition Tanks	
1092-1099	Radiochemistry Room	Hood
1100-1108	Second Floor	Top of Crane Bridge
1109-1113	Miscellaneous Areas	Throughout Facility
1114-1118	Ground Floor	Process Equipment Room
1119-1122	Miscellaneous Areas	Throughout Facility
1123-1124	Ground Floor	Process Equipment Room
1125-1134	Miscellaneous Areas	Throughout Facility
1135	Second Floor	Air-Conditioning Unit on Top of Control Room
1136-1137	Miscellaneous Areas	Throughout Facility
1139-1142	Ground Floor	Hydraulic Sump
1143-1147	Elevator Shaft	Bottom
1148-1199	First Floor	Clean-Up
1200-1216	DECON Room	
1217-1226	DECON Room	Hood and Ventilation System
1227-1236	DECON Room	
1237-1269	Second Floor	Vertical Beam Ports
1270-1299	Second Floor	Reactor Top and Miscellaneous Equipment
1300-1317	First Floor	Horizontal Beam Ports
1318-1359	First Floor	Equipment in Front of Plug Storage Area
1360-1386	DECON Room	Walk-in Hood
1387-1394	DECON Room	
1395-1399	Radiochemistry Room	Hood
1400-1408	DECON Room	Walk-in Hood
1415-1424	HEPA Ventilation Unit	After Project Completion
1424-1428	Second Floor	Vertical Beam Ports
1429-1444	Scaffolding Equipment	After Project Completion
1445-1448	First Floor	Southeast Wall of Containment
1449	First Floor	South Wall of Containment
1450-1479	Second Floor	Vertical Beam Ports
1480-1493	Second Floor	Storage Holes on Reactor Top
1494-1496	Second Floor	Vertical Beam Ports
1497	Second Floor	Storage Holes on Reactor Top
1498-1520	First Floor	Horizontal Beam Ports
1521-1539	Second Floor	Clean-Up
1540-1557	NES Field Office	After Project Completion
1558-1578	Floor by Plug Storage Area	Clean-Up
1593-1597	Floor of DECON Room (by Hood)	Clean-Up
1598-1600	NES Field Office	After Project Completion
1601-1618	Circular Saw	After Project Completion
1619-1645	First Floor	Plug Storage Area- Before Project

**Factors for Comparison of Survey Data**

<b>Degrees of Freedom<sup>a</sup></b>	<b>t<sub>95%</sub></b>
1	6.314
2	2.92
3	2.353
4	2.132
5	2.015
6	1.943
7	1.895
8	1.86
9	1.833
10	1.812
11	1.796
12	1.782
13	1.771
14	1.761
15	1.753
16	1.746
17	1.74
18	1.734
19	1.729
20	1.725
21	1.721
22	1.717
23	1.714
24	1.711
25	1.708
26	1.706
27	1.703
28	1.701
29	1.699
30	1.697
40	1.684
60	1.671
120	1.658
400	1.649
99999999	1.645

\*Table B-1, "Factors for comparison of survey data with guidelines and determining additional data needs (condensed): from NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination

<sup>a</sup>Degrees of freedom is the number of items of data minus 1; for values of 'degrees of freedom not in table.

## Areas Outside of the Reactor Building Survey Data Summary

Survey Location	No. of Survey Points	Range of Activity (dpm/100 cm <sup>2</sup> )							
		Direct				Removable			
		Alpha	MDA	Beta-Gamma	MDA	Alpha	MDA	Beta-Gamma	MDA
Plant Operations Warehouse	30	0 to 53	24	1189 to 4298	1436	None Taken	-	None Taken	-
NES Field Office-Before Characterization	20	0 to 2	82	-3018 to -1859	1808	0 to 3	13	0 to 12	17
Chemical Addition Tanks	12	-47 to -9	123	-42 to 57365	1261	0 to 3	13	0 to 10	17
Radiochemistry Room Hood	13	-35 to 0	116	8349 to 343569	1808	0 to 74	13	0 to 988	17
Decontamination Room	31	0 to 4	123	-1428 to 17386	1245	0 to 7	13	0 to 102	17
Decontamination Room- Hood & Vent System	10	-47 to -9	123	-504 to 1092	1245	0 to 3	13	0 to 12	17
Decontamination Room-Walk-in Hood	40	-47 to 0	123	567 to 3931213	1245	0 to 7	13	0 to 46	17
HEPA Ventilation Unit	10	None Taken	-	None Taken	-	0 to 10	13	1 to 95	17
Scaffolding Equipment	16	None Taken	-	None Taken	-	0 to 7	13	0 to 42	17
Manlift	25	None Taken	-	None Taken	-	0 to 7	13	0 to 7	17
Clean-up Survey	115	None Taken	-	None Taken	-	0 to 10	13	0 to 111	17
NES Field Office-After Characterization	21	-26 to -18	95	-1311 to -152	1443	0 to 3	13	0 to 23	17

D-1

Shading represent areas where activities are above acceptable limits in  
U.S. Nuclear Regulatory Guide 1.86, "Termination for Operating License for Nuclear Reactors," June 1974.

## Survey Locations with Elevated Activity- Outside the NNRC Restricted Areas

Removable Alpha activity action level (DPM): 20/100 cm<sup>2</sup>

Removable Beta activity action level (DPM): 1000/100 cm<sup>2</sup>

Direct Alpha activity action level (DPM): 100 /100 cm<sup>2</sup>

Direct Beta activity action level (DPM): 5000/100 cm<sup>2</sup>

Survey	Removable Alpha Activity	Removable Beta/Gamma Activity	Direct Alpha Activity	Direct Beta/Gamma Activity	Location
Numbe	dpm/100 cm <sup>2</sup>	dpm/100 cm <sup>2</sup>	dpm/100 cm <sup>2</sup>	dpm/100 cm <sup>2</sup>	
1080	3	3	-9	5837	Chemical Addition Tanks
1081	0	0	-28	5837	Chemical Addition Tanks
1082	3	3	-28	57365	Chemical Addition Tanks
1083	3	5	-28	16336	Chemical Addition Tanks
1084	0	1	-28	5963	Chemical Addition Tanks
1089	0	1	-28	8273	Chemical Addition Tanks
1092	74	988	-28	115927	Radiochemistry Room- Hood
1093	0	10	-9	209785	Radiochemistry Room- Hood
1094	0	5	0	107240	Radiochemistry Room- Hood
1095	0	7	-9	112110	Radiochemistry Room- Hood
1096	0	5	9	166987	Radiochemistry Room- Hood
1097	3	5	-18	3435696	Radiochemistry Room- Hood
1098	0	5	-9	149783	Radiochemistry Room- Hood
1099	0	5	-9	198445	Radiochemistry Room- Hood
1215	0	1	-9	17386	Decon Room- Hood
1360	7	3	-28	76682	DECON Room- Walk-in Hood
1361	1	3	-9	87097	DECON Room- Walk-in Hood
1362	14	0	-38	78698	DECON Room- Walk-in Hood
1363	1	0	-9	96000	DECON Room- Walk-in Hood
1364	1	0	-19	453375	DECON Room- Walk-in Hood
1367	0	0	-9	245879	DECON Room- Walk-in Hood
1368	5	0	-28	5732	DECON Room- Walk-in Hood



Removable Alpha activity action level (DPM): 20/100 cm<sup>2</sup>

Removable Beta activity action level (DPM): 1000/100 cm<sup>2</sup>

Direct Alpha activity action level (DPM): 100 /100 cm<sup>2</sup>

Direct Beta activity action level (DPM): 5000/100 cm<sup>2</sup>

D-3

Survey	Removable Alpha Activity dpm/100 cm <sup>2</sup>	Removable Beta/Gamma Activity dpm/100 cm <sup>2</sup>	Direct Alpha Activity dpm/100 cm <sup>2</sup>	Direct Beta/Gamma Activity dpm/100 cm <sup>2</sup>	Location
Numbe					
1369	5	0	-9	771696	DECON Room- Walk-in Hood
1370	16	0	-9	539297	DECON Room- Walk-in Hood
1371	0	0	-9	12052	DECON Room- Walk-in Hood
1372	19	3	-19	15244	DECON Room- Walk-in Hood
1373	28	7	-19	7139	DECON Room- Walk-in Hood
1374	1	0	-28	33428	DECON Room- Walk-in Hood
1375	12	0	-28	5417	DECON Room- Walk-in Hood
1377	0	0	-47	3842562	DECON Room- Walk-in Hood
1378	0	0	-38	7601	DECON Room- Walk-in Hood
1379	0	0	-28	3931213	DECON Room- Walk-in Hood
1380	12	0	-38	48924	DECON Room- Walk-in Hood
1381	5	0	-38	110278	DECON Room- Walk-in Hood
1383	3	3	-47	7811	DECON Room- Walk-in Hood
1384	0	0	-28	5921	DECON Room- Walk-in Hood
1385	3	0	-28	28808	DECON Room- Walk-in Hood
1386	1	0	-47	7601	DECON Room- Walk-in Hood
1388	3	102	-38	7601	DECON Room
1389	3	14	-47	7391	DECON Room
1390	3	7	-28	7223	DECON Room
1391	0	1	-38	10913	DECON Room- Walk-in Hood
1392	3	3	-47	10822	DECON Room- Walk-in Hood
1393	0	1	-28	80719	DECON Room- Walk-in Hood
1395	0	7	-26	33440	Radiochemistry Room- Hood
1396	0	5	-9	75934	Radiochemistry Room- Hood
1397	0	0	-35	33531	Radiochemistry Room- Hood

Removable Alpha activity action level (DPM): 20/100 cm<sup>2</sup>  
 Removable Beta activity action level (DPM): 1000/100 cm<sup>2</sup>

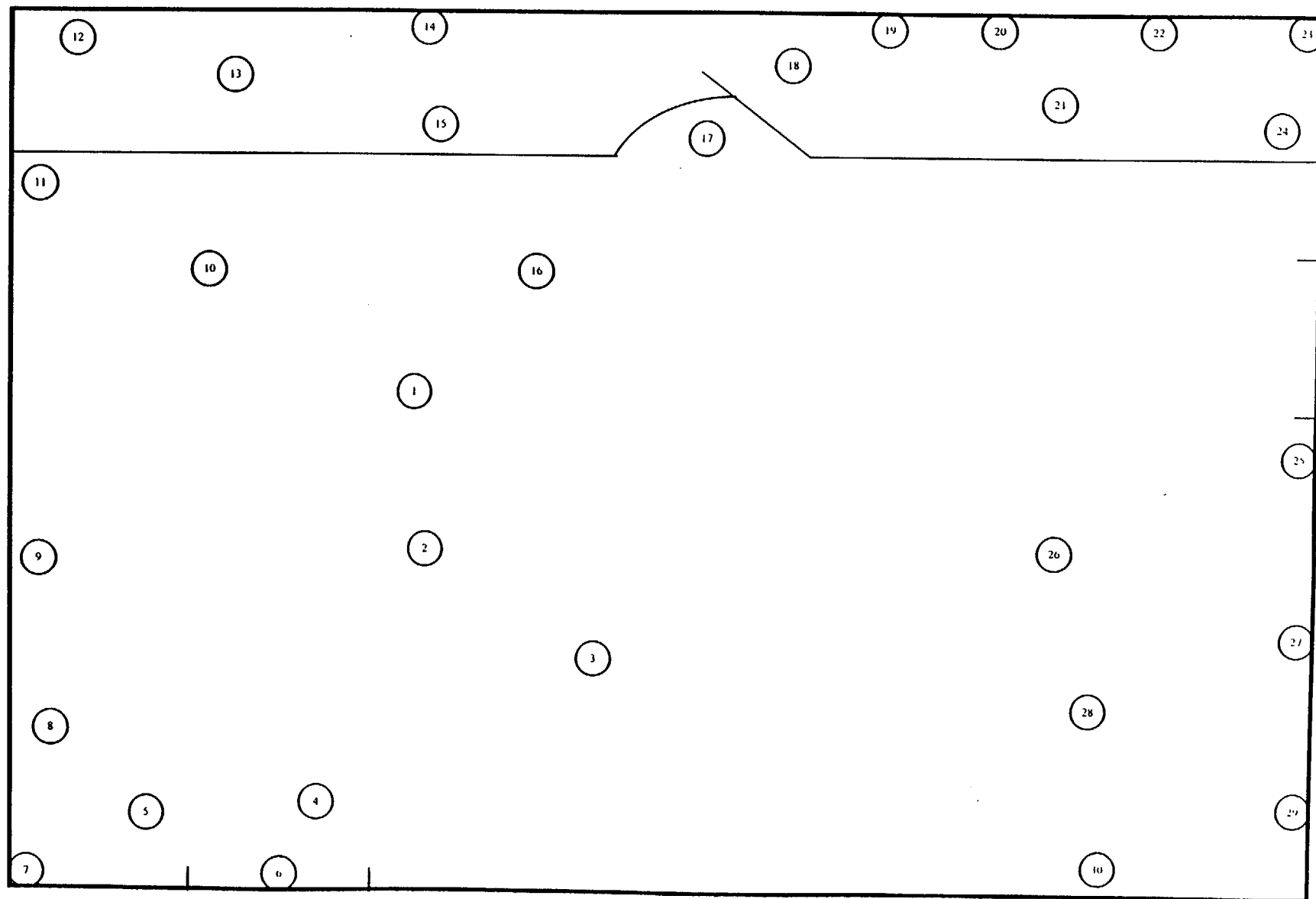
Direct Alpha activity action level (DPM): 100 /100 cm<sup>2</sup>  
 Direct Beta activity action level (DPM): 5000/100 cm<sup>2</sup>

	Removable	Removable	Direct	Direct	
Survey	Alpha Activity	Beta/Gamma Activity	Alpha Activity	Beta/Gamma Activity	
Numbe	dpm/100 cm <sup>2</sup>	dpm/100 cm <sup>2</sup>	dpm/100 cm <sup>2</sup>	dpm/100 cm <sup>2</sup>	Location
1398	0	0	-9	30117	Radiochemistry Room- Hood
1399	3	3	-26	79866	Radiochemistry Room- Hood
1400	3	46	-28	120866	DECON Room- Walk-in Hood
1401	0	7	-38	217375	DECON Room- Walk-in Hood
1402	0	19	-28	10547	DECON Room- Walk-in Hood
1403	0	3	-28	41091	DECON Room- Walk-in Hood
1407	0	3	-47	12071	DECON Room- Walk-in Hood
1408	3	23	-47	22283	DECON Room- Walk-in Hood

# Indoor Background Survey (Directs)- Plant Operations Building Warehouse

Top View  
Not Drawn To Scale

D-5



Survey Location



Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

## PROJECT TITLE:

Georgia Tech Characterization Survey

## SURVEY UNIT (Location):

Indoor Background Survey Plant Operations Warehouse

SURVEY TYPE: 1 (direct alpha)  
 METER: L2220  
 SERIAL #: 50061  
 PROBE #: 43-65  
 SERIAL #: 63291  
 GUIDELINE VALUE: 1000 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 2 (direct beta/gamma)  
 METER: L2220  
 SERIAL #: 52823  
 PROBE #: 44-9  
 SERIAL #: 11150  
 GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
 Tb = Background Time (min) = 1  
 Background counts in Tb = 0  
 Date background was taken = 10/10/97  
 Time background was taken = 7:15  
 Rb = Background rate (c/min) = 0  
 e = Probe Efficiency = 18.00%  
 a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 24

Ts = Sample Time (min) = 1  
 Tb = Background Time (min) = 1  
 Background counts in Tb = 91  
 Date background was taken = 10/10/97  
 Time background was taken = 7:15  
 Rb = Background rate (c/min) = 91  
 e = Probe Efficiency = 21.87%  
 a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1436

Individual Completing Form:

Reviewed By:

Date:

Date:

## Direct Alpha Data Sheet

Survey Type	GT Characterization Survey	Notes.
Project Title	Indoor Background Survey	
Survey Unit Location	Plant Operations Warehouse	
Date	10/10/97	

1. Identify Grid
2. Place total counts directly from meter. Activity column will correct for background.
3. Information for instrument and background taken directly from the VIDA spreadsheet.
4. Place "na" into any total counts cells not used
5. Must enter date survey was performed

Instrument  
Model: L2220  
Serial #: 50061  
Probe: 43-65  
Serial #: 63291  
Efficiency: 13.00%  
MDA: 24

Grd	Survey Point	Gross		Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA
		Total Counts	Minute				
	1	4	4		35	35	24
	2	2	2		18	24	24
	3	1	1		9	17	24
	4	1	1		9	17	24
	5	2	2		18	24	24
	6	3	3		26	30	24
	7	3	3		26	30	24
	8	0	0		0	0	24
	9	2	2		18	24	24
	10	4	4		35	35	24
	11	3	3		26	30	24
	12	3	3		26	30	24
	13	2	2		18	24	24
	14	1	1		9	17	24
	15	3	3		26	30	24
	16	6	6		53	42	24
	17	3	3		26	30	24
	19	4	4		35	35	24
	19	3	3		26	30	24
	20	6	6		53	42	24
	21	2	2		18	24	24
	22	2	2		18	24	24
	23	0	0		0	0	24
	24	6	6		53	42	24
	25	3	3		26	30	24
	26	4	4		35	35	24
	27	3	3		26	30	24
	28	2	2		18	24	24
	29	3	3		26	30	24
	30	3	3		26	30	24

**Individual Completing Form:**

Reviewed By:

Date:

Date:

### Calculation Sheet

SURVEY TYPE:	<u>1</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>Indoor Background Survey Plant Operations Warehouse</u>		2 for direct beta/gamma
Date	<u>10/10/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>24</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>1000</u> (dpm/100 cm2)		

### Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum (x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\sum (x_i)$ =	<u>738</u>
$n_s$ =	<u>30</u>
$x_{avg}$ =	<u>25</u>
Maximum value in population =	<u>53</u> (dpm/100 cm2)

### Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum (x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>25</u>
$n_s$ =	<u>30</u>
$\sum (x_{avg} - x_i)^2$ =	<u>80124</u>
$s_x$ =	<u>53</u>

### Calculation Sheet

Survey Unit: Indoor Background Survey Plant Operations Warehouse  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_a = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_a$  = value compared to guideline value to determine 95% Confidence Level  
 $x_{avg}$  = calculated mean for a survey unit  
 $t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)  
 $s_x$  = standard deviation of measurements in a survey unit  
 $n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>25</u>	
$t_{1-\alpha, df}$ =	<u>1.699</u>	(for values not on the table, the nearest greater value is used)
$s_x$ =	<u>53</u>	
$n_s$ =	<u>30</u>	
$\mu_a$ =	<u>41</u>	

Individual Completing Form: Pate JV

Date: 1/7/98

Reviewed by: Ken M. Torrey

Date: 1/17/98

## Direct Beta-Gamma Data Sheet

Survey Type 2  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit (Location) Indoor Background Survey Plant Operations Warehouse  
 Date 10-10-97

Instrument  
 Model 22220 Serial #: 52823  
 Probe 44-9 Serial #: 11150

- 1) Identify Gnd  
 2) Place total counts directly from meter. Activity column will correct for background.  
 3) Information for instrument and background taken directly from the MDA spreadsheet.  
 4) Place "n.a." into any total counts cells not used.  
 5) Must enter date survey was performed.

Efficiency 21.87%  
 MDA 1436

Gnd	Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
					(dpm/100 cm <sup>2</sup> )	
	1	178	178	2652	980	1436
	2	154	154	1920	935	1436
	3	178	178	2652	980	1436
	4	161	161	2134	948	1436
	5	196	196	3201	1012	1436
	6	168	168	2347	962	1436
	7	173	173	2500	971	1436
	8	162	162	2164	950	1436
	9	160	160	2103	947	1436
	10	170	170	2408	965	1436
	11	152	152	1859	931	1436
	12	143	143	1585	914	1436
	13	194	194	3140	1009	1436
	14	160	160	2103	947	1436
	15	164	164	2225	954	1436
	16	172	172	2469	969	1436
	17	220	220	3932	1054	1436
	18	220	220	3932	1054	1436
	19	232	232	4298	1074	1436
	20	155	155	1951	937	1436
	21	192	192	3079	1005	1436
	22	162	162	2164	950	1436
	23	130	130	1189	888	1436
	24	212	212	3688	1040	1436
	25	194	194	3140	1009	1436
	26	160	160	2103	947	1436
	27	132	132	1250	892	1436
	28	170	170	2408	965	1436
	29	212	212	3688	1040	1436
	30	154	154	1920	935	1436

Individual Completing Form:

*Pat VV*

Reviewed By:

Date:

*11/7/98*

Date:



### Calculation Sheet

SURVEY TYPE: 2 Input one of the following  
 Survey Unit Indoor Background Survey Plant Operations Warehouse  
 Date 10/10/97  
 Meter L2220  
 Serial # 52823  
 Probe 44-9  
 Serial # 11150  
 MDA 1436  
 Survey Type Direct Beta/Gamma  
 Guideline Value 5000 (dpm/100 cm2)

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

### Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum (x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\begin{aligned} \sum (x_i) &= \underline{76204} \\ n_s &= \underline{30} \\ x_{avg} &= \underline{2540} \end{aligned}$$

Maximum value in population = 4298 (dpm/100 cm2)

### Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum (x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\begin{aligned} x_{avg} &= \underline{2540} \\ n_s &= \underline{30} \\ \sum (x_{avg} - x_i)^2 &= \underline{792445496} \\ s_x &= \underline{5227} \end{aligned}$$

### Calculation Sheet

Survey Unit: Indoor Background Survey Plant Operations Warehouse  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level  
 $x_{avg}$  = calculated mean for a survey unit  
 $t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)  
 $s_x$  = standard deviation of measurements in a survey unit  
 $n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>2540</u>	
$t_{1-\alpha, df}$ =	<u>1.699</u>	(for values not on the table, the nearest greater value is used)
$s_x$ =	<u>5227</u>	
$n_s$ =	<u>30</u>	
$\mu_{\alpha}$ =	<u>4162</u>	

Individual Completing Form: Pat Ir

Date: 1/7/98

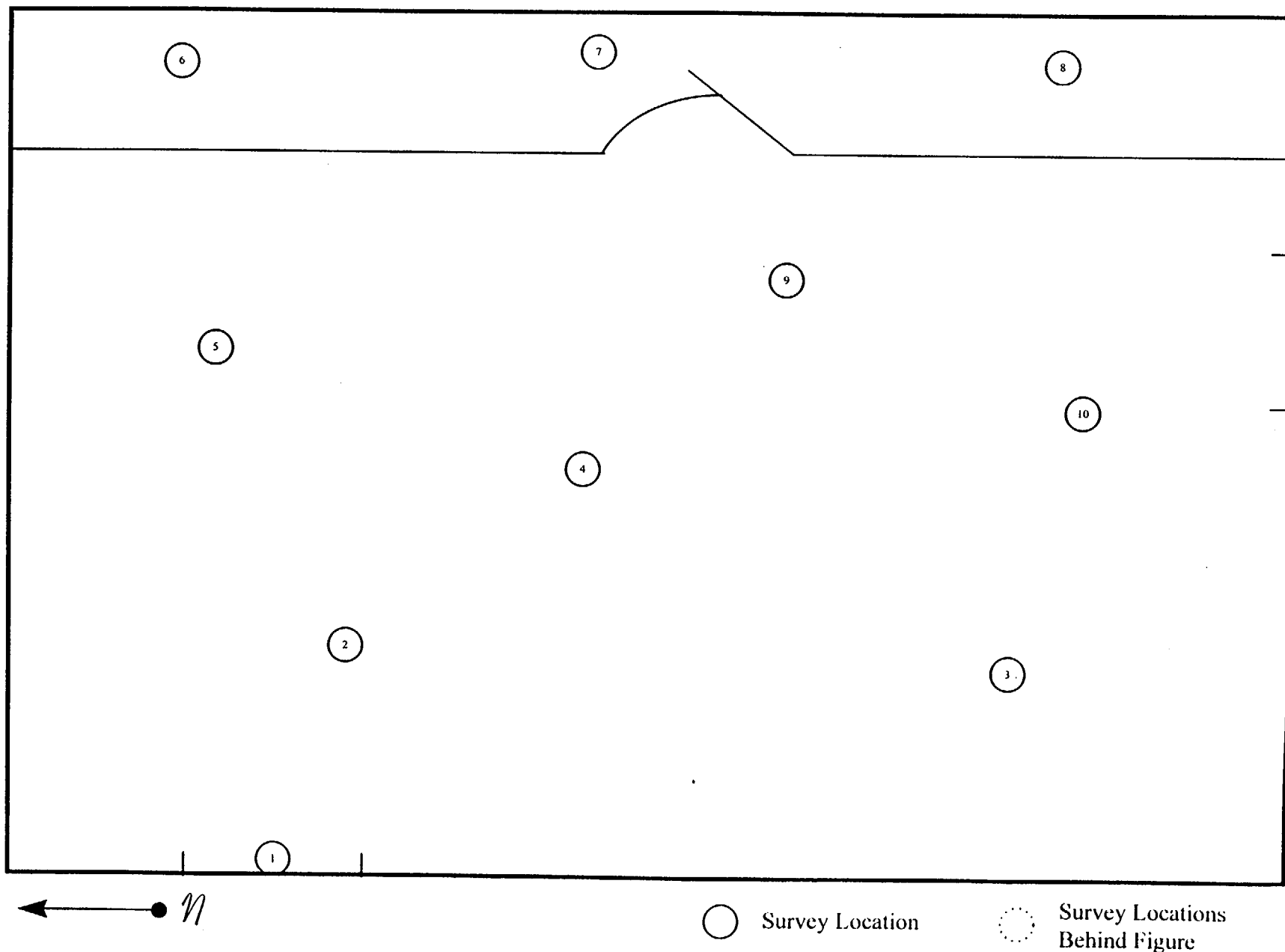
Reviewed by: Carol M. Young

Date: 1/17/98

# Indoor Background Survey (Exposure)- Plant Operations Building

Top View  
Not Drawn To Scale

D-13



## MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit. (NUREG/CR-5849)

$$MDA = \frac{2.71/T_s + 3.29(R_p/T_s + R_{\gamma}/T_s)^{1/2}}{e(a/100)}$$

### Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

**DO NOT CHANGE THIS SPREADSHEET**

**PROJECT TITLE** GT Characterization Survey  
**SURVEY UNIT:** Indoor Background Survey (Exposure) Plant Building

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

Individual Completing Form: *Pat JVR*

Reviewed By: *Paul W. Tacey*

Date: *1/7/98*

Date: *1/17/98*

Exposure Measurement Data Sheet

Survey Type  
Project Title  
Survey unit (Location)  
Date

5.6  
GT Characterization Survey  
Indoor Background Survey, Exposure, Plant Building  
10/10/97

Notes

- (1) Identify Grid
- (2) Place exposure directly into appropriate column from meter
- (3) Place "n.a." into any exposure rate cells not used
- (4) Survey Type "5" is for 1 cm
- (5) Survey Type "6" is for 1 m
- (6) Enter date survey was performed

Instrument

Model: Bicron microRem  
Background: 9.4 (in microR/hr)

Serial #: B218L  
Baseline value: 28KG (in microR/hr)

Exposure Rate	
Survey Point	(microR/hour)
1	7
2	8
3	8
4	11
5	10
6	11
7	10
8	10
9	9
10	10

Individual Completing Form:

*Pat L...*

Date:

11/7/98

Reviewed By:

*Frank P. ...*

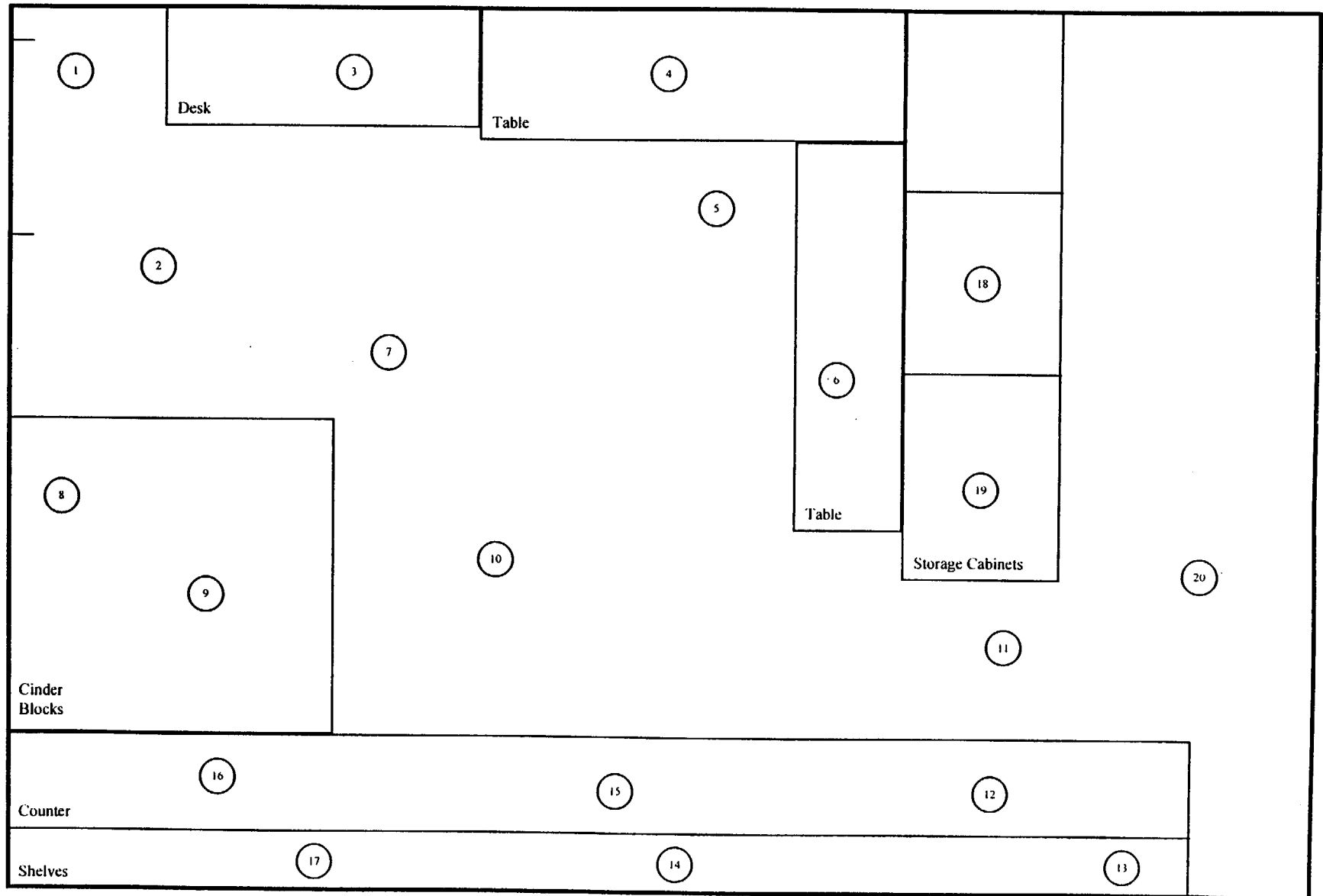
Date:

11/9/98

# NES Field Office- Before Project Began

Top View  
Not Drawn To Scale

D-16



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_b/T_s)}{e(a/100)}$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): NES Field Office-Before Project Began

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 2  
Date background was taken = 10/7/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 82

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 148  
Date background was taken = 10/7/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 148  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1808

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/7/97  
Time background was taken = 8:45  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/7/97  
Time background was taken = 8:45  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Type: Georgia Tech Characterization Survey  
 Project Title: NES Field Office Before Project Begins  
 Survey Unit (Location): 107797  
 Date: 10/7/97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument: L2220  
 Model: 43-65  
 Serial #: 50061  
 Serial #: 63291

Efficiency: 18.00%  
 MDA: 82

Survey Point	Gross Total Counts		Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)		MDA (dpm/100 cm <sup>2</sup> )
	Counts	Minute			(dpm/100 cm <sup>2</sup> )	(dpm/100 cm <sup>2</sup> )	
1	0	0	0	-18	24	24	82
2	1	1	1	-9	30	30	82
3	0	0	0	-18	24	24	82
4	1	1	1	-9	30	30	82
5	0	0	0	-18	24	24	82
6	1	1	1	-9	30	30	82
7	0	0	0	-18	24	24	82
8	0	0	0	-18	24	24	82
9	0	0	0	-18	24	24	82
10	1	1	1	-9	30	30	82
11	0	0	0	-18	24	24	82
12	2	2	2	0	35	35	82
13	0	0	0	-18	24	24	82
14	0	0	0	-18	24	24	82
15	0	0	0	-18	24	24	82
16	1	1	1	-9	30	30	82
17	0	0	0	-18	24	24	82
18	0	0	0	-18	24	24	82
19	0	0	0	-18	24	24	82
20	0	0	0	-18	24	24	82

Individual Completing Form:

Reviewed By:

Date:

Date:



# Calculation Sheet

SURVEY TYPE: 1

Survey Unit NES Field Office-Before Project Began

Date 10/23/97

Meter L2220

Serial # 50061

Probe 43-65

Serial # 63291

MDA 82

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\sum(x_i) = \underline{\underline{-297}}$$

$$n_s = \underline{\underline{20}}$$

$$x_{avg} = \underline{\underline{-15}}$$

$$\text{Maximum value in population} = \underline{\underline{0}} \text{ (dpm/100 cm2)}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$x_{avg} = \underline{\underline{-15}}$$

$$n_s = \underline{\underline{20}}$$

$$\sum(x_{avg} - x_i)^2 = \underline{\underline{531}}$$

$$s_x = \underline{\underline{5}}$$

## Calculation Sheet

Survey Unit: NES Field Office-Before Project Began

Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-15</u>
$t_{1-\alpha, df}$ =	<u>1.729</u>
$s_x$ =	<u>5</u>
$n_s$ =	<u>20</u>
$\mu_{\alpha}$ =	<u>-13</u>

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Patricia Lopez*

Date: 1/15/98

Reviewed by: *Gerard M. Toney*

Date: 1/15/98

## Direct Beta-Gamma Data Sheet

&lt;&lt;&lt;NOTE: SURVEY AND MDA DATES DO NOT MATCH&gt;&gt;&gt;

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): NES Field Office-Before Project Began  
 Date: 10/23/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: \_\_\_\_\_  
 Model: L2220  
 Probe: 44-9

Serial #: 52823  
 Serial #: 11:50

Efficiency: 21.87%  
 MDA: 1808

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
1	62	62	-2622	866	1808
2	67	67	-2469	876	1808
3	83	83	-1981	908	1808
4	54	54	-2865	849	1808
5	62	62	-2622	866	1808
6	72	72	-2317	886	1808
7	80	80	-2073	902	1808
8	70	70	-2378	882	1808
9	80	80	-2073	902	1808
10	76	76	-2195	894	1808
11	82	82	-2012	906	1808
12	81	81	-2042	904	1808
13	80	80	-2073	902	1808
14	74	74	-2256	890	1808
15	68	68	-2439	878	1808
16	56	56	-2804	853	1808
17	49	49	-3018	839	1808
18	87	87	-1859	916	1808
19	87	87	-1859	916	1808
20	87	87	-1859	916	1808

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit NES Field Office-Before Project Began

Date 10/23/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1808

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$$\Sigma(x_i) = \underline{\underline{-45816}}$$

$$n_s = \underline{\underline{20}}$$

$$x_{avg} = \underline{\underline{-2291}}$$

$$\text{Maximum value in population} = \underline{\underline{-1859}} \text{ (dpm/100 cm2)}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

- $s_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$$x_{avg} = \underline{\underline{-2291}}$$

$$n_s = \underline{\underline{20}}$$

$$\Sigma(x_{avg} - x_i)^2 = \underline{\underline{2350956}}$$

$$s_x = \underline{\underline{352}}$$

## Calculation Sheet

Survey Unit: NES Field Office-Before Project Began  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$  = -2291  
 $t_{1-\alpha, \text{df}}$  = 1.729  
 $s_x$  = 352  
 $n_s$  = 20  
 $\mu_{\alpha}$  = -2155

\*Note: for values of  $t_{1-\alpha, \text{df}}$  not on the table, the nearest greater value is used

Individual Completing Form:

Rate Jr

Date:

1/5/98

Reviewed by:

Edward M. Toney

Date:

1/17/98

# Removable Alpha Data Sheet

Survey Type: 3  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): NES Field Office-Before Project Began  
Date: 10/7/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
(2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1	0	13
2	0	13
3	0	13
4	0	13
5	0	13
6	0	13
7	0	13
8	0	13
9	0	13
10	0	13
11	3	13
12	0	13
13	0	13
14	0	13
15	0	13
16	0	13
17	0	13
18	3	13
19	0	13
20	0	13

Individual Completing Form: Pete

Reviewed By: Edward H. Hickey

Date: 4/8/98

Date: 4/8/98

Removable Beta-Gamma Data Sheet

Survey Type 4  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit (Location) NES Field Office Before Project Began  
 Date 10/7/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model LB 5100 W Serial # 13795 Efficiency: 43.45%  
 Probe N/A Serial # N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1	5	17
2	1	17
3	5	17
4	3	17
5	10	17
6	3	17
7	3	17
8	12	17
9	3	17
10	0	17
11	5	17
12	0	17
13	1	17
14	1	17
15	0	17
16	1	17
17	3	17
18	0	17
19	3	17
20	1	17

Individual Completing Form:

Reviewed By:

*[Signature]*  
*[Signature]*

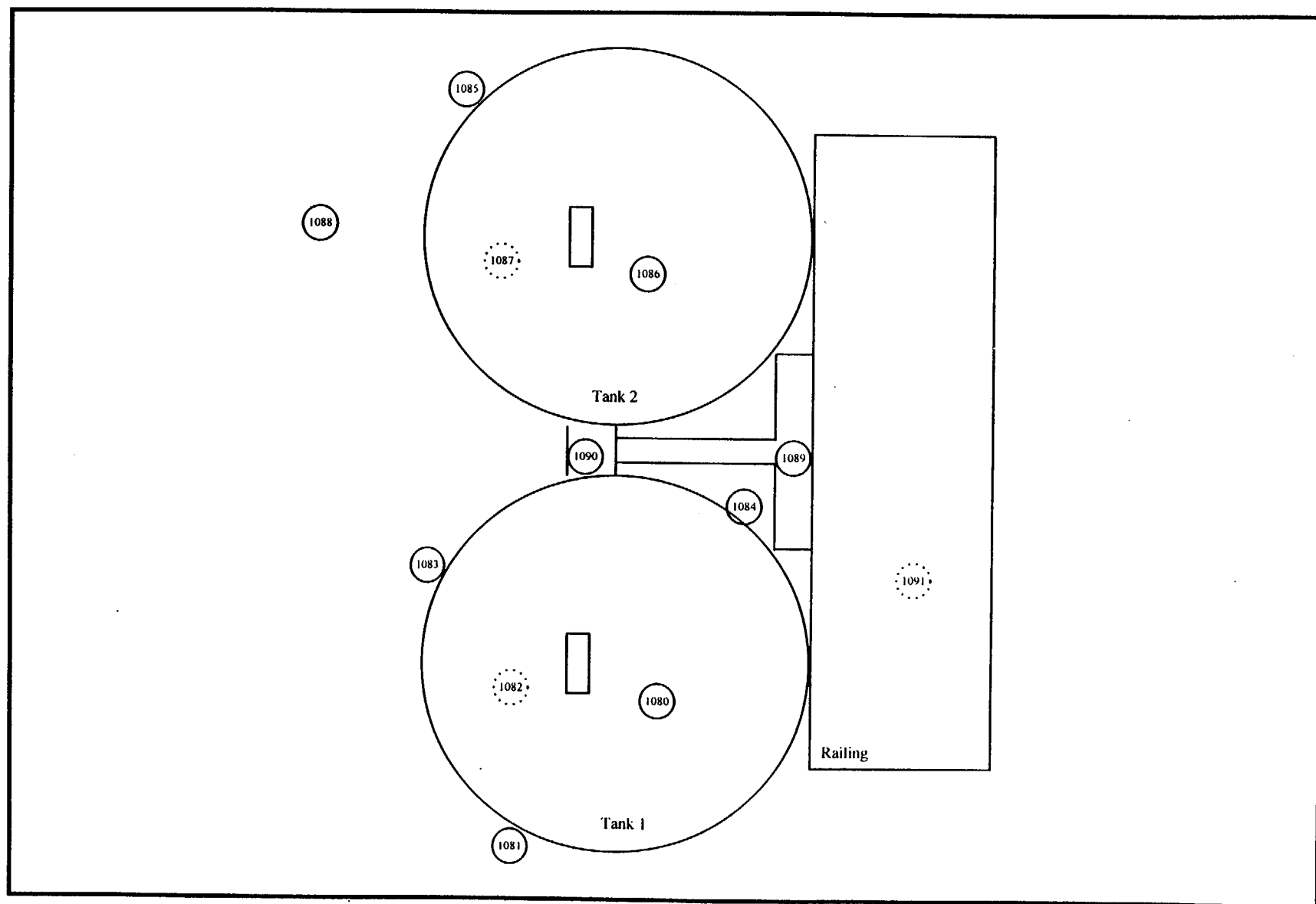
Date:

Date:

11/5/98  
1/15/98

# Chemical Addition Tanks

Top View  
Not Drawn To Scale



○ Survey Location

○ Survey Locations  
Behind Figure



# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_b/T_s)}{e(a/100)}^2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Chemical Addition Tanks

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 48409  
PROBE #: 43-65  
SERIAL #: 62385  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/16/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 123

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2221  
SERIAL #: 68537  
PROBE #: 44-9  
SERIAL #: 66762  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 152  
Date background was taken = 10/16/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 152  
e = Probe Efficiency = 31.75%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1261

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/22/97  
Time background was taken = 16:08  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/22/97  
Time background was taken = 16:08  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Title: Georgia Tech Characterization Survey  
 Project Title: Chemical Addition Tanks  
 Survey Unit Location: 10-16-97  
 Date: 10-16-97

## Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: L2220  
 Model: 43-65  
 Probe: 43-65

Serial #: 48409  
 Serial #: 62385

Efficiency: 18.00%  
 MDA: 123

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1080	4	4	-9	55	123
1081	2	2	-28	49	123
1082	2	2	-28	49	123
1083	2	2	-28	49	123
1084	2	2	-28	49	123
1085	4	4	-9	55	123
1086	4	4	-9	55	123
1087	0	0	-47	41	123
1088	0	0	-47	41	123
1089	2	2	-28	49	123
1090	0	0	-47	41	123
1091	4	4	-9	55	123

Individual Completing Form:

Reviewed By:

*Pat FVR*  
*Richard M. Torrey*

Date: 1/5/98

Date: 1/17/98

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Chemical Addition Tanks

Date 10/16/97

Meter L2220

Serial # 48409

Probe 43-65

Serial # 62385

MDA 123

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm<sup>2</sup>)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$$\sum(x_i) = \underline{\quad -317 \quad}$$

$$n_s = \underline{\quad 12 \quad}$$

$$x_{avg} = \underline{\quad -26 \quad}$$

$$\text{Maximum value in population} = \underline{\quad -9 \quad} \text{ (dpm/100 cm}^2\text{)}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

- $s_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$$x_{avg} = \underline{\quad -26 \quad}$$

$$n_s = \underline{\quad 12 \quad}$$

$$\sum(x_{avg} - x_i)^2 = \underline{\quad 2499 \quad}$$

$$s_x = \underline{\quad 15 \quad}$$

## Calculation Sheet

Survey Unit: Chemical Addition Tanks  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha,df} [s_x/(n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha,df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-26</u>	
$t_{1-\alpha,df}$ =	<u>1.796</u>	*Note: for values of $t_{1-\alpha,df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>15</u>	
$n_s$ =	<u>12</u>	
$\mu_{\alpha}$ =	<u>-18</u>	

Individual Completing Form:

Peter J. J. J.

Date: 12/23/97

Reviewed by:

Edward M. Toney

Date: 1/17/98

## Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Chemical Addition Tanks  
 Date: 10/16/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument:  
 Model: L2221 Serial #: 68537  
 Probe: 44-9 Serial #: 66762

Efficiency: 31.75%  
 MDA: 1261

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
1080	430	430	5837	993	1261
1081	430	430	5837	993	1261
1082	2884	2884	57365	2268	1261
1083	930	930	16336	1354	1261
1084	436	436	5963	998	1261
1085	238	238	1806	813	1261
1086	178	178	546	748	1261
1087	240	240	1848	815	1261
1088	188	188	756	759	1261
1089	546	546	8273	1087	1261
1090	150	150	-42	715	1261
1091	196	196	924	768	1261

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Chemical Addition Tanks

Date 10/16/97

Meter L2221

Serial # 68537

Probe 44-9

Serial # 66762

MDA 1261

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  105449  
 $n_s =$  12  
 $x_{avg} =$  8787  
 Maximum value in population = 57365 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  8787  
 $n_s =$  12  
 $\Sigma(x_{avg} - x_i)^2 =$  2811526791  
 $s_x =$  15987

## Calculation Sheet

Survey Unit: Chemical Addition Tanks  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 8787  
 $t_{1-\alpha, df}$  = 1.796  
 $s_x$  = 15987  
 $n_s$  = 12  
 $\mu_{\alpha}$  = 17076

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Patricia Ryz*

Date: 12/23/97

Reviewed by: *Michael M. Towner*

Date: 1/15/98

# Removable Alpha Data Sheet

Survey Type 3  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit (Location) Chemical Addition Tanks  
 Date 10/22/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1080	3	13
1081	0	13
1082	3	13
1083	3	13
1084	0	13
1085	0	13
1086	3	13
1087	0	13
1088	0	13
1089	0	13
1090	0	13
1091	3	13

Individual Completing Form:

Reviewed By:

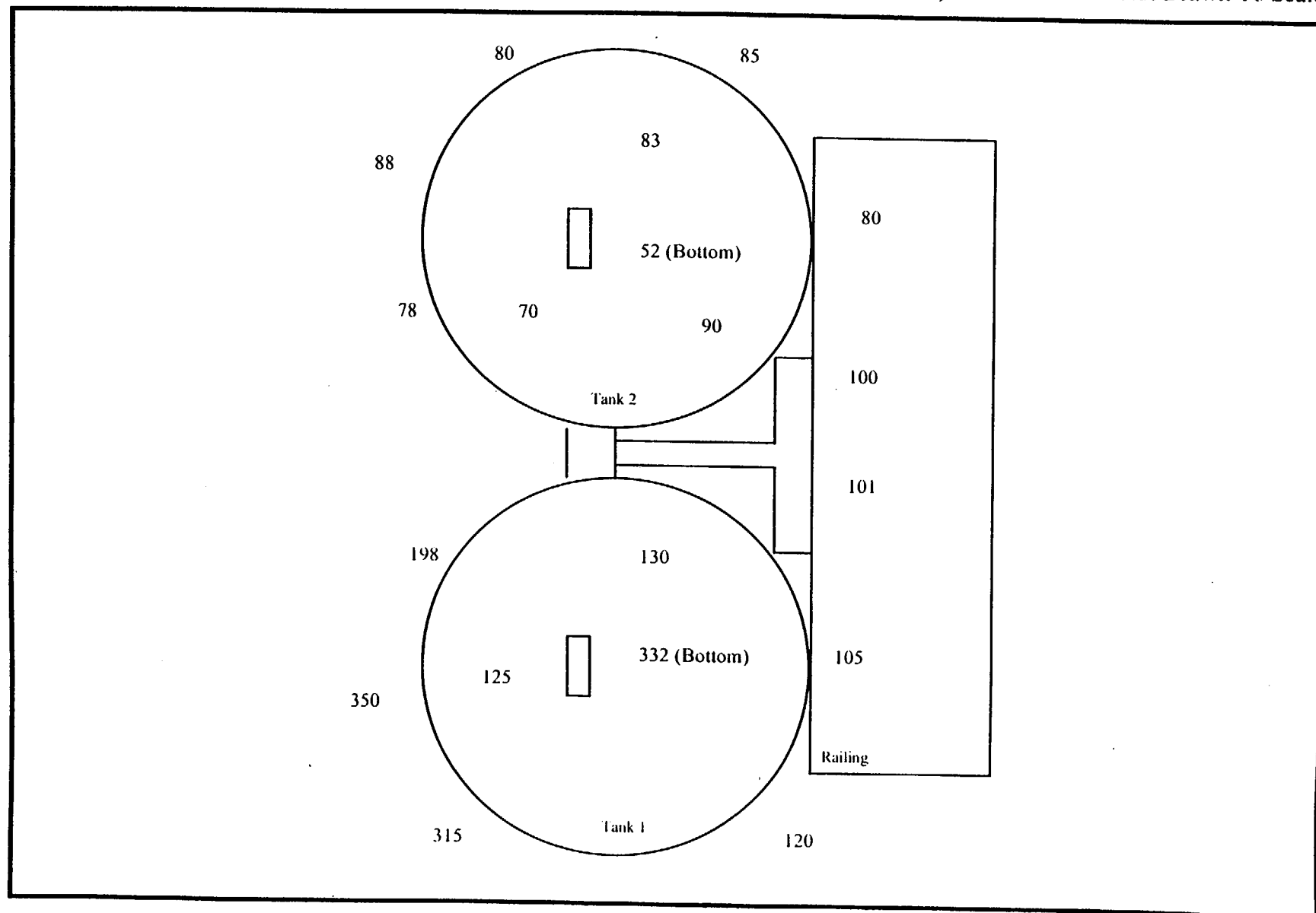
Date:

Date:



# Chemical Addition Tanks- Exposure ( $\mu\text{R/hr}$ )

Top View  
Not Drawn To Scale



# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Chemical Addition Tanks  
Date: 10/22/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1080	3	17
1081	0	17
1082	3	17
1083	3	17
1084	5	17
1085	1	17
1086	7	17
1087	5	17
1088	0	17
1089	1	17
1090	10	17
1091	1	17

Individual Completing Form:

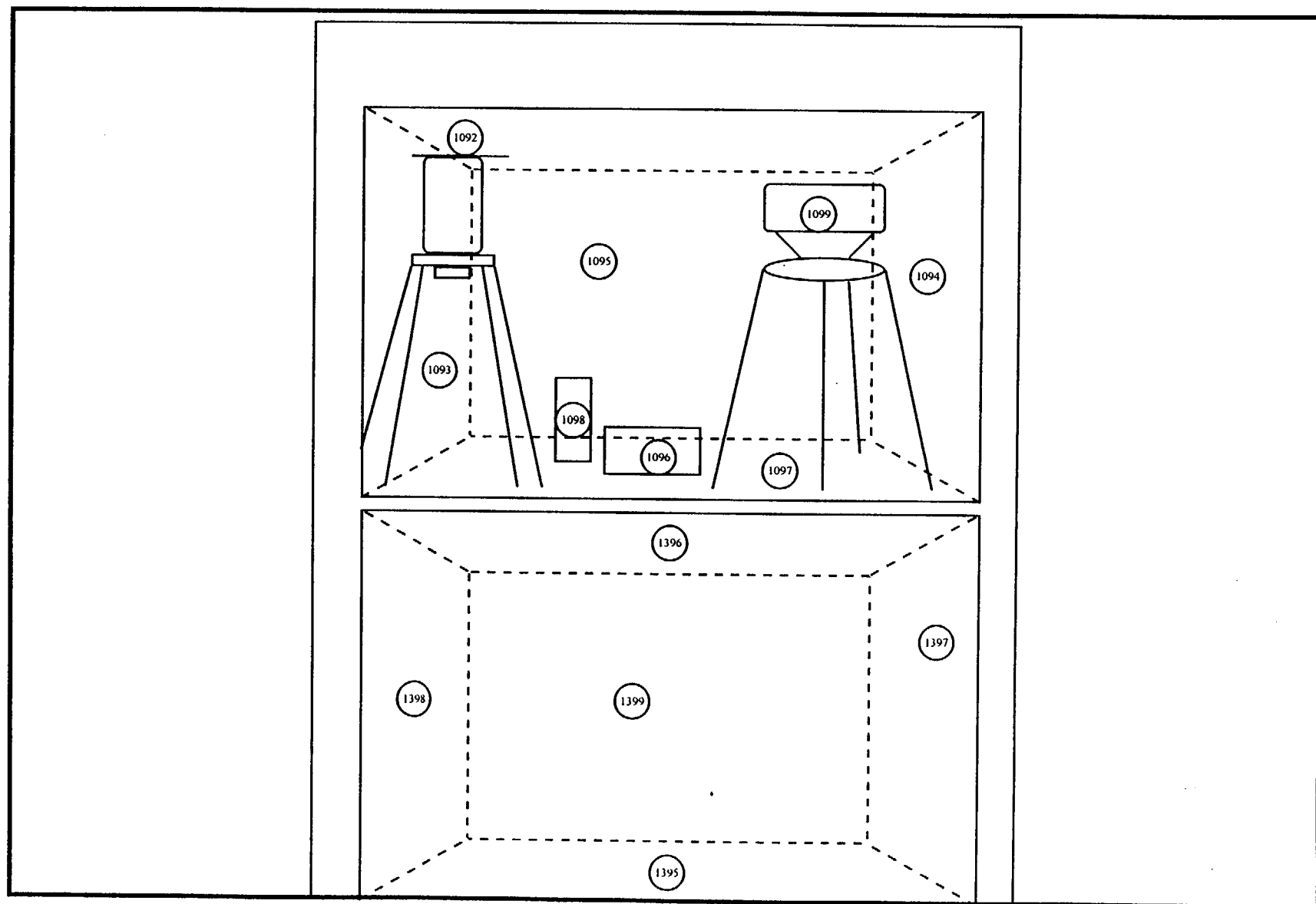
Reviewed By:

Date:

Date:

# Radiochemistry Room- Hood

Elevation View  
Not Drawn To Scale



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_b/T_s)}{e(a/100)} \cdot 2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Radiochemistry Room- Hood

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/22/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 148  
Date background was taken = 10/22/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 148  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1808

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/22/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/22/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Type \_\_\_\_\_  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit (Location) Radiochemistry Room-Hood  
 Date 10.22.97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument \_\_\_\_\_  
 Model: L2220 Serial #: 50061  
 Probe: 43-65 Serial #: 63291

Efficiency: 18.00%  
 MDA: 116

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1092	4	4	-9	52	116
1093	4	4	-9	52	116
1094	5	5	0	55	116
1095	6	6	9	57	116
1096	4	4	-9	52	116
1097	3	3	-18	49	116
1098	4	4	-9	52	116
1099	4	4	-9	52	116
1395	2	2	-26	46	116
1396	4	4	-9	52	116
1397	1	1	-35	42	116
1398	4	4	-9	52	116
1399	2	2	-26	46	116

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Radiochemistry Room- Hood

Date 10/23/97

Meter L2220

Serial # 50061

Probe 43-65

Serial # 63291

MDA 116

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$$\Sigma(x_i) = \underline{\hspace{2cm}} -159$$

$$n_s = \underline{\hspace{2cm}} 13$$

$$x_{avg} = \underline{\hspace{2cm}} -12$$

$$\text{Maximum value in population} = \underline{\hspace{2cm}} 9 \text{ (dpm/100 cm2)}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

- $s_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$$x_{avg} = \underline{\hspace{2cm}} -12$$

$$n_s = \underline{\hspace{2cm}} 13$$

$$\Sigma(x_{avg} - x_i)^2 = \underline{\hspace{2cm}} 1605$$

$$s_x = \underline{\hspace{2cm}} 12$$

## Calculation Sheet

Survey Unit: Radiochemistry Room- Hood  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for  $n-1$  degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$	=	<u>-12</u>	
$t_{1-\alpha, \text{df}}$	=	<u>1.782</u>	*Note: for values of $t_{1-\alpha, \text{df}}$ not on the table, the nearest greater value is used
$s_x$	=	<u>12</u>	
$n_s$	=	<u>13</u>	
$\mu_{\alpha}$	=	<u>-6</u>	

Individual Completing Form:

Dan J. J. J.

Date: 12/30/97

Reviewed by:

Grant M. Towner

Date: 1/17/98

## Direct Beta-Gamma Data Sheet

&lt;&lt;&lt;NOTE: SURVEY AND MDA DATES DO NOT MATCH&gt;&gt;&gt;

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Radiochemistry Room-Hood  
 Date: 10/21/97

Notes:

- 1) Place total counts directly from meter. Activity column will correct for background.  
 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument:  
 Model: L2220  
 Probe: 44-9

Serail #: 52823  
 Serail #: 11150

Efficiency: 21.37%  
 MDA: 1808

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1092	3951	3951	115927	3825	1808
1093	7030	7030	209785	5062	1808
1094	3666	3666	107240	3690	1808
1095	36926	36926	1121110	11504	1808
1096	5626	5626	166987	4540	1808
1097	112856	112856	3435696	20085	1808
1098	5060	5060	149733	4312	1808
1099	6658	6658	198445	4929	1808
1395	1187	1187	31672	2183	1808
1396	2581	2581	74166	3121	1808
1397	1190	1190	31763	2185	1808
1398	1078	1078	28349	2092	1808
1399	2710	2710	78098	3194	1808

Individual Completing Form:

Reviewed By:

*Pat [Signature]*  
*Richard M. [Signature]*

Date:

Date:

12/30/97  
11/17/98



# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Radiochemistry Room- Hood

Date 10/23/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1808

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm<sup>2</sup>)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$$\begin{aligned} \sum(x_i) &= \underline{5748971} \\ n_s &= \underline{13} \\ x_{avg} &= \underline{442229} \\ \text{Maximum value in population} &= \underline{3435696} \text{ (dpm/100 cm}^2\text{)} \end{aligned}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{\sum(x_{avg} - x_i)^2}{(n_s - 1)^{1/2}}$$

Where

- $S_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$$\begin{aligned} x_{avg} &= \underline{442229} \\ n_s &= \underline{13} \\ \sum(x_{avg} - x_i)^2 &= \underline{10691585436882} \\ S_x &= \underline{943910} \end{aligned}$$

## Calculation Sheet

Survey Unit: Radiochemistry Room- Hood  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 442229

$t_{1-\alpha, df}$  = 1.782

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

$s_x$  = 943910

$n_s$  = 13

$\mu_{\alpha}$  = 908745

Individual Completing Form:

Pete Pryor

Date:

12/30/97

Reviewed by:

Gerard M. Young

Date:

1/17/98

# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit / Location: Radiochemistry Room - Hood  
 Date: 10/22/97

Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1092	74	13
1093	0	13
1094	0	13
1095	0	13
1096	0	13
1097	3	13
1098	0	13
1099	0	13
1395	0	13
1396	0	13
1397	0	13
1398	0	13
1399	3	13

Individual Completing Form:

Reviewed By:

Pat Fry  
Gerard M. Bruner

Date:

Date:

12/30/97  
1/17/98

# Removable Beta-Gamma Data Sheet

Survey Type 4  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit / Location Radiochemistry Room - Hood  
 Date 10.22.97

Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1092	988	17
1093	10	17
1094	5	17
1095	7	17
1096	5	17
1097	5	17
1098	5	17
1099	5	17
1395	7	17
1396	5	17
1397	0	17
1398	0	17
1399	3	17

Individual Completing Form:

Reviewed By:

*Patricia J. [Signature]*  
*Renard M. [Signature]*

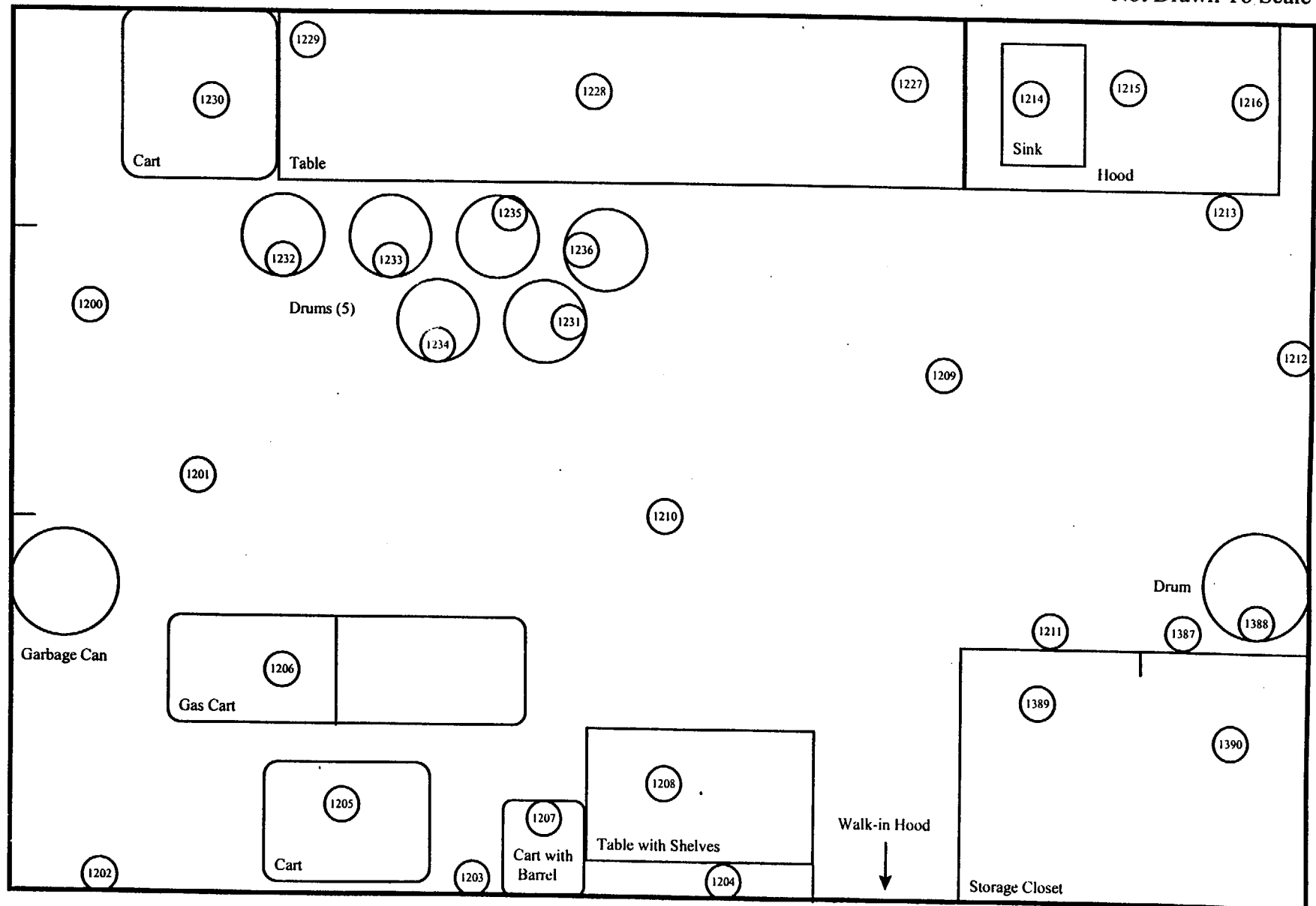
Date:

Date:

12/30/97  
1/17/98

# DECON Room

Top View  
Not Drawn To Scale



# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_s/T_s)}{e(a/100)}^2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): DECON Room

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 48409  
PROBE #: 43-65  
SERIAL #: 62385  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/16/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 123

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2221  
SERIAL #: 68537  
PROBE #: 44-9  
SERIAL #: 66762  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 148  
Date background was taken = 10/16/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 148  
e = Probe Efficiency = 31.75%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1245

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/17/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/17/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): DECON Room  
 Date: 10/16/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: L2220 Serial #: 48409 Efficiency: 18.00%  
 Probe: 43-65 Serial #: 62385 MDA: 123

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1200	2	2	-28	49	123
1201	2	2	-28	49	123
1202	0	0	-47	41	123
1203	0	0	-47	41	123
1204	0	0	-47	41	123
1205	2	2	-28	49	123
1206	0	0	-47	41	123
1207	0	0	-47	41	123
1208	0	0	-47	41	123
1209	2	2	-28	49	123
1210	0	0	-47	41	123
1211	0	0	-47	41	123
1212	0	0	-47	41	123
1213	2	2	-28	49	123
1214	0	0	-47	41	123
1215	4	4	-9	55	123
1216	0	0	-47	41	123
1227	4	4	-9	55	123
1228	0	0	-47	41	123
1229	2	2	-28	49	123
1230	0	0	-47	41	123
1231	1	1	-38	45	123
1232	1	1	-38	45	123
1233	2	2	-28	49	123
1234	1	1	-38	45	123
1235	3	3	-19	52	123
1236	2	2	-28	49	123
1387	1	1	-38	45	123
1388	1	1	-38	45	123
1389	0	0	-47	41	123
1390	2	2	-28	49	123

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit DECON Room

Date 10/16/97

Meter L2220

Serial # 48409

Probe 43-65

Serial # 62385

MDA 123

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\sum(x_i) =$  -1137  
 $n_s =$  31  
 $x_{avg} =$  -37  
 Maximum value in population = -9 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -37  
 $n_s =$  31  
 $\sum(x_{avg} - x_i)^2 =$  4026  
 $s_x =$  12



# Calculation Sheet

Survey Unit: DECON Room  
 Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha,df} [s_x/(n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha,df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-37</u>	
$t_{1-\alpha,df}$ =	<u>1.697</u>	*Note: for values of $t_{1-\alpha,df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>12</u>	
$n_s$ =	<u>31</u>	
$\mu_{\alpha}$ =	<u>-33</u>	

Individual Completing Form:

*Patricia J. [Signature]*

Date: 1/10/98

Reviewed by:

*Donald S. [Signature]*

Date: 1/18/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): DECON Room  
 Date: 10/16/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: L2221 Serial #: 68537  
 Probe: 44-9 Serial #: 66762

Efficiency: 31.75%  
 MDA: 1245

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1200	142	142	-126	701	1245
1201	142	142	-126	701	1245
1202	92	92	-1176	638	1245
1203	96	96	-1092	643	1245
1204	168	168	420	732	1245
1205	114	114	-714	666	1245
1206	108	108	-840	658	1245
1207	94	94	-1134	640	1245
1208	80	80	-1428	621	1245
1209	184	184	756	750	1245
1210	234	234	1806	804	1245
1211	92	92	-1176	638	1245
1212	256	256	2268	827	1245
1213	122	122	-546	676	1245
1214	168	168	420	732	1245
1215	976	976	17386	1380	1245
1216	194	194	966	761	1245
1227	158	158	210	720	1245
1228	156	156	168	718	1245
1229	152	152	84	713	1245
1230	250	250	2142	821	1245
1231	241	241	1953	812	1245
1232	240	240	1932	811	1245
1233	200	200	1092	768	1245
1234	198	198	1050	766	1245
1235	201	201	1113	769	1245
1236	350	350	4241	918	1245
1387	310	310	3402	881	1245
1388	510	510	7601	1056	1245
1389	500	500	7391	1048	1245
1390	492	492	7223	1041	1245

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit DECON Room

Date 10/16/97

Meter L2221

Serial # 68537

Probe 44-9

Serial # 66762

MDA 1245

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\Sigma(x_i) = \underline{\underline{55266}}$$

$$n_s = \underline{\underline{31}}$$

$$x_{avg} = \underline{\underline{1783}}$$

$$\text{Maximum value in population} = \underline{\underline{17386}} \text{ (dpm/100 cm2)}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$x_{avg} = \underline{\underline{1783}}$$

$$n_s = \underline{\underline{31}}$$

$$\Sigma(x_{avg} - x_i)^2 = \underline{\underline{432719577}}$$

$$s_x = \underline{\underline{3798}}$$

## Calculation Sheet

Survey Unit: DECON Room  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>1783</u>	
$t_{1-\alpha, df}$ =	<u>1.697</u>	*Note: for values of $t_{1-\alpha, df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>3798</u>	
$n_s$ =	<u>31</u>	
$\mu_{\alpha}$ =	<u>2941</u>	

Individual Completing Form:

*Pete J...*  
*Dell Shun*

Date: 1/16/98

Reviewed by:

Date: 1/19/98

# Removable Alpha Data Sheet

Survey Type: 3  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): DECON Room  
Date: 10/17/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
(2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument

Model: LB 5100 W

Probe: N/A

Serial #: 13795

Serial #: N/A

Efficiency: 28.35%

MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1200	0	13
1201	3	13
1202	0	13
1203	0	13
1204	0	13
1205	0	13
1206	0	13
1207	0	13
1208	0	13
1209	0	13
1210	3	13
1211	3	13
1212	0	13
1213	3	13
1214	0	13
1215	0	13
1216	0	13
1227	0	13
1228	0	13
1229	7	13
1230	0	13
1231	0	13
1232	0	13
1233	3	13
1234	0	13
1235	3	13
1236	0	13
1387	3	13
1388	3	13
1389	3	13
1390	3	13

Individual Completing Form:

Reviewed By:

Date:

Date:

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): DECON Room  
 Date: 10/17/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1200	3	17
1201	3	17
1202	0	17
1203	3	17
1204	3	17
1205	26	17
1206	1	17
1207	7	17
1208	26	17
1209	5	17
1210	10	17
1211	63	17
1212	10	17
1213	7	17
1214	40	17
1215	3	17
1216	1	17
1227	0	17
1228	10	17
1229	0	17
1230	1	17
1231	0	17
1232	0	17
1233	0	17
1234	7	17
1235	3	17
1236	0	17
1387	14	17
1388	102	17
1389	14	17
1390	7	17

Individual Completing Form:

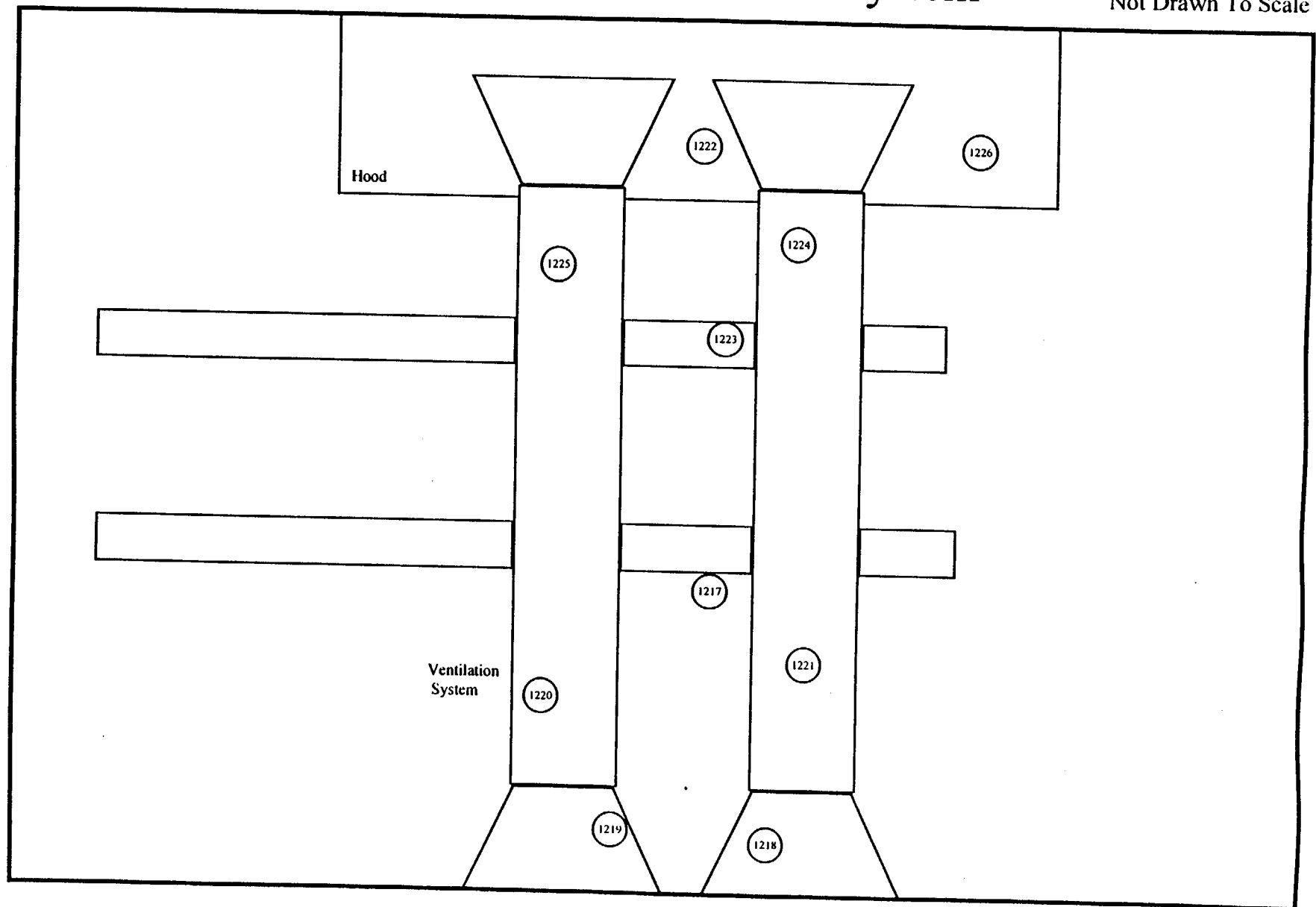
Reviewed By:

Date:

Date:

# DECON Room- Hood and Ventilation System

Top View  
Not Drawn To Scale



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_b/T_s)}{e(a/100)} \cdot 2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): DECON Room- Hood and Ventilation System

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 48409  
PROBE #: 43-65  
SERIAL #: 62385  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/16/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 123

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2221  
SERIAL #: 68537  
PROBE #: 44-9  
SERIAL #: 66762  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 148  
Date background was taken = 10/16/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 148  
e = Probe Efficiency = 31.75%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1245

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/17/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/17/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 11/7/98

Date: 11/7/98



# Direct Alpha Data Sheet

Survey Type: 1  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): DECON Room- Hood and Ventilation System  
Date: 10/16/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

## Instrument

Model: L2220  
Probe: 43-65

Serial #: 48409  
Serial #: 62385

Efficiency: 18.00%  
MDA: 123

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
1217	0	0	-47	41	123
1218	0	0	-47	41	123
1219	0	0	-47	41	123
1220	4	4	-9	55	123
1221	0	0	-47	41	123
1222	0	0	-47	41	123
1223	2	2	-28	49	123
1224	0	0	-47	41	123
1225	0	0	-47	41	123
1226	4	4	-9	55	123

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: 11/7/98

Date: 1/17/98

# Calculation Sheet

SURVEY TYPE: <u>1</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>DECON Room- Hood and Ventilation System</u>		2 for direct beta/gamma
Date	<u>10/16/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>48409</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>62385</u>		
MDA	<u>123</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-375</u>
$n_s$ =	<u>10</u>
$x_{avg}$ =	<u>-38</u>
Maximum value in population =	<u>-9</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-38</u>
$n_s$ =	<u>10</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>2349</u>
$s_x$ =	<u>16</u>

## Calculation Sheet

Survey Unit: DECON Room- Hood and Ventilation System

Survey Type: 1

This sheet uses the following equation to determine the 95%

Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = -38

$t_{1-\alpha, df}$  = 1.833

$s_x$  = 16

$n_s$  = 10

$\mu_{\alpha}$  = -29

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

Patricia W.

Date: 1/7/98

Reviewed by:

General M. Young

Date: 1/17/98

# Direct Beta-Gamma Data Sheet

Survey Type: Georgia Tech Characterization Survey  
 Project File: DECON Room - Food and Ventilation System  
 Survey Unit/Location: IC-5697  
 Date: \_\_\_\_\_

Instrument: \_\_\_\_\_  
 Model: L2221 Serial #: 58537  
 Probe: 44-9 Serial #: 58762

Notes:  
 (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Efficiency: 31.75%  
 MDA: 1245

Survey Point	Gross		Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	1 <sup>st</sup> Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
	Total Counts	Minute				
1217	142	142	-126	-126	701	1245
1218	200	200	1092	1092	768	1245
1219	152	152	84	84	713	1245
1220	150	150	42	42	710	1245
1221	142	142	-126	-126	701	1245
1222	158	158	210	210	720	1245
1223	150	150	42	42	710	1245
1224	124	124	-504	-504	679	1245
1225	152	152	84	84	713	1245
1226	142	142	-126	-126	701	1245

Individual Completing Form: *Robert J. Hancey*  
 Reviewed By: *Robert J. Hancey*

Date: 11/7/98  
 Date: 11/7/98

# Calculation Sheet

SURVEY TYPE:	<u>2</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>DECON Room- Hood and Ventilation System</u>		2 for direct beta/gamma
Date	<u>10/16/97</u>		3 for removable alpha
Meter	<u>L2221</u>		4 for removable beta/gamma
Serial #	<u>68537</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>66762</u>		
MDA	<u>1245</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm <sup>2</sup> )		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>672</u>
$n_s$ =	<u>10</u>
$x_{avg}$ =	<u>67</u>
Maximum value in population =	<u>1092</u> (dpm/100 cm <sup>2</sup> )

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>67</u>
$n_s$ =	<u>10</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>1510690</u>
$s_x$ =	<u>410</u>

## Calculation Sheet

Survey Unit: DECON Room- Hood and Ventilation System  
Survey Type: 2

This sheet uses the following equation to determine the 95%

Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 67

$t_{1-\alpha, df}$  = 1.833

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

$s_x$  = 410

$n_s$  = 10

$\mu_{\alpha}$  = 304

Individual Completing Form: *Pat W*

Date: 1/7/98

Reviewed by: *Robert M. Barry*

Date: 1/17/98

# Removable Alpha Data Sheet

Survey No. 3

Georgia Tech Characterization Survey

Notes

Project Title

DECON Room-Hood and Ventilation System

1) Place total counts directly from meter. Activity counts will correct for background.

Survey Unit

Location

2) Information for instrument and background taken directly from the VIDA spreadsheet.

Date

10/17/97

Instrument

Model LB 5100 W

Serial # 13795

Efficiency 28.35%

Probe

N/A

Serial # N/A

MDA 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1217	3	13
1218	3	13
1219	0	13
1220	0	13
1221	3	13
1222	0	13
1223	0	13
1224	3	13
1225	0	13
1226	0	13

Individual Completing Form:

Reviewed By:

*John H. Hwang*

Date:

Date:

11/7/98  
11/7/98

# Removable Beta-Gamma Data Sheet

Survey Type: 1  
Project Name: Georgia Tech Characterization Survey  
Survey Unit Location: DECON Room- Hood and Ventilation System  
Date: 10/17/97

Notes

1. Place total counts directly from meter. Activity column will correct for background.
2. Information for instrument and background taken directly from the MDA spreadsheet.

Instrument:  
Model: LB 5100 W  
Probe: N/A

Serial #: 13795  
Serial #: N/A  
Efficiency: 43.45%  
MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1217	10	17
1218	1	17
1219	3	17
1220	0	17
1221	7	17
1222	1	17
1223	12	17
1224	3	17
1225	0	17
1226	1	17

Individual Completing Form:

Reviewed By:

Date:

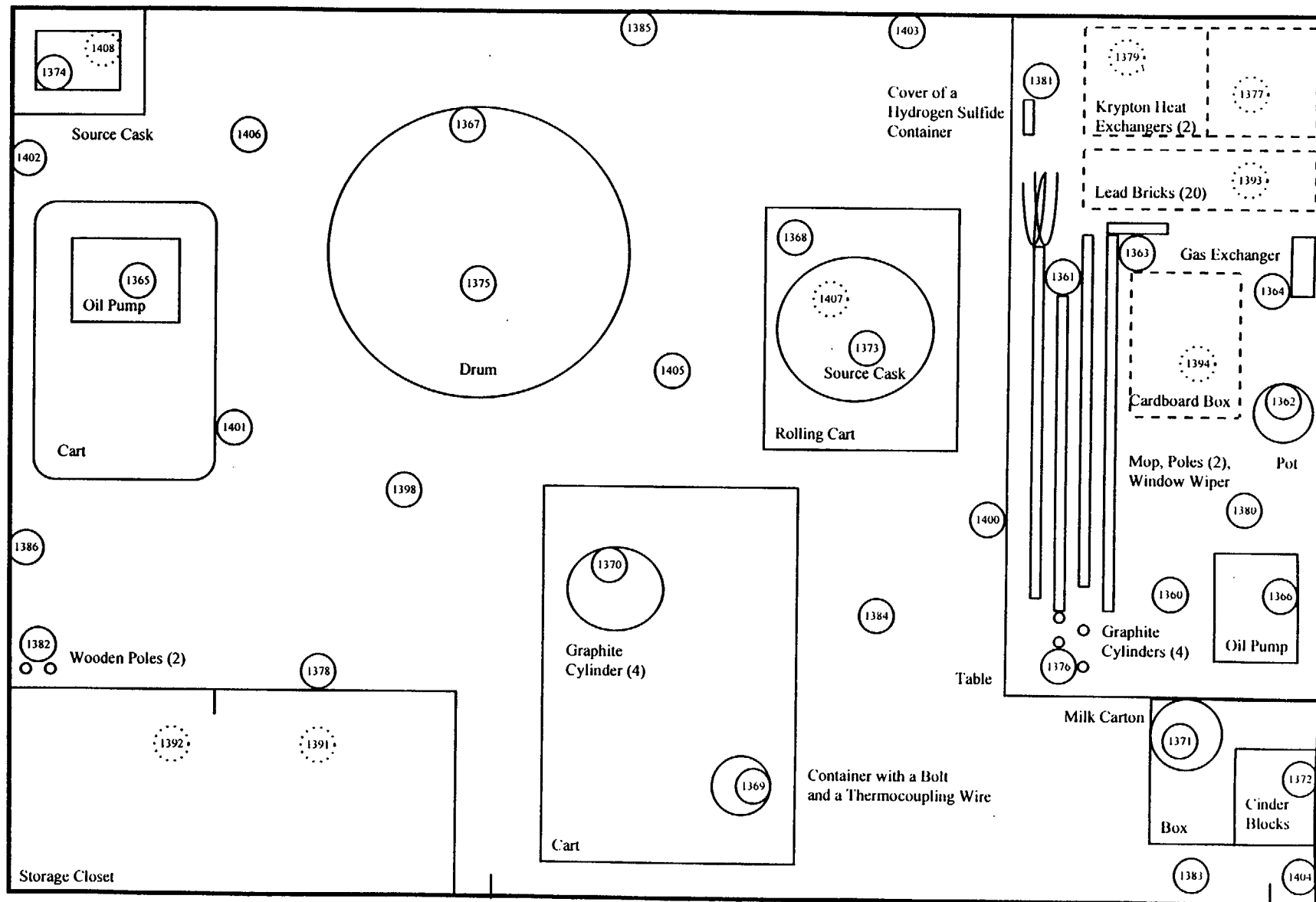
Date:



# DECON Room- Walk-in Hood

Elevation View  
Not Drawn To Scale

D-66



○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_c/T_s)}{e(a/100)} \cdot 2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Decon Room- Walk in Hood

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 48409  
PROBE #: 43-65  
SERIAL #: 62385  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/21/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 123

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 68537  
PROBE #: 44-9  
SERIAL #: 66762  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 148  
Date background was taken = 10/21/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 148  
e = Probe Efficiency = 31.75%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1245

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/21/97  
Time background was taken = 11:04  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/21/97  
Time background was taken = 11:04  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

## Direct Alpha Data Sheet

Survey Type  
Project Site  
Survey Unit/Location,  
Date

Georgia Tech Characterization Survey

Decon Room - Walk in Hood

10/21/97

Notes

1. Place total counts directly from meter. Activity column will correct for background.
2. Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
Model L2220  
Probe 43-65

Serial #: 48409  
Serial #: 62385

Efficiency: 18.00%  
MDA 123

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
1360	2	2	-28	49	123
1361	4	4	-9	55	123
1362	1	1	-38	45	123
1363	4	4	-9	55	123
1364	3	3	-19	52	123
1365	2	2	-28	49	123
1366	0	0	-47	41	123
1367	4	4	-9	55	123
1368	2	2	-28	49	123
1369	4	4	-9	55	123
1370	4	4	-9	55	123
1371	3	3	-19	52	123
1372	3	3	-19	52	123
1373	5	5	0	58	123
1374	4	4	-9	55	123
1375	2	2	-28	49	123
1376	2	2	-28	49	123
1377	2	2	-28	49	123
1378	0	0	-47	41	123
1379	1	1	-38	45	123
1380	2	2	-28	49	123
1381	2	2	-28	49	123
1382	1	1	-38	45	123
1383	0	0	-47	41	123
1384	2	2	-28	49	123
1385	2	2	-28	49	123
1386	0	0	-47	41	123
1391	1	1	-38	45	123
1392	0	0	-47	41	123
1393	2	2	-28	49	123
1394	3	3	-19	52	123
1400	2	2	-28	49	123
1401	1	1	-38	45	123
1402	2	2	-28	49	123
1403	2	2	-28	49	123
1404	1	1	-38	45	123
1405	0	0	-47	41	123
1406	1	1	-38	45	123
1407	0	0	-47	41	123
1408	0	0	-47	41	123

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Decon Room- Walk in Hood

Date 10/23/97

Meter L2220

Serial # 48409

Probe 43-65

Serial # 62385

MDA 123

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\Sigma(x_i) = \underline{\underline{-1164}}$$

$$n_s = \underline{\underline{40}}$$

$$x_{avg} = \underline{\underline{-29}}$$

$$\text{Maximum value in population} = \underline{\underline{0}} \text{ (dpm/100 cm2)}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$x_{avg} = \underline{\underline{-29}}$$

$$n_s = \underline{\underline{40}}$$

$$\Sigma(x_{avg} - x_i)^2 = \underline{\underline{6814}}$$

$$s_x = \underline{\underline{13}}$$

## Calculation Sheet

Survey Unit: Decon Room- Walk in Hood  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$	=	<u>-29</u>	
$t_{1-\alpha, df}$	=	<u>1.697</u>	*Note: for values of $t_{1-\alpha, df}$ not on the table, the nearest greater value is used
$s_x$	=	<u>13</u>	
$n_s$	=	<u>40</u>	
$\mu_{\alpha}$	=	<u>-25</u>	

Individual Completing Form:

Pete Fry

Date: 2/23/97

Reviewed by:

Edward M. Young

Date: 4/17/98

## Direct Beta-Gamma Data Sheet

Survey Type 2  
 Project Title Decon Room Characterization Survey  
 Survey Unit Location Decon Room - Walk in Hood  
 Date 10/21/97

## Notes

- \* Place total counts directly from meter. Activity column will correct for background.  
 \*2: Information for instrument and background taken directly from the MDA spreadsheet.

Instrument \_\_\_\_\_  
 Model L2220 Serial # 68537  
 Probe 44-9 Serial # 66752

Efficiency 31.15%  
 MDA 1245

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
1360	3800	3800	76682	2586	1245
1361	4296	4296	87097	2744	1245
1362	3896	3896	78698	2617	1245
1363	4720	4720	96000	2871	1245
1364	21740	21740	453375	6089	1245
1365	378	378	4829	944	1245
1366	252	252	2184	823	1245
1367	11858	11858	245879	4509	1245
1368	421	421	5732	982	1245
1369	36900	36900	771696	7921	1245
1370	25832	25832	539297	6633	1245
1371	722	722	12052	1214	1245
1372	874	874	15244	1316	1245
1373	488	488	7139	1038	1245
1374	1740	1740	33428	1798	1245
1375	406	406	5417	969	1245
1376	308	308	3360	879	1245
1377	183150	183150	3842562	17620	1245
1378	510	510	7601	1056	1245
1379	187372	187372	3931213	17822	1245
1380	2478	2478	48924	2109	1245
1381	5400	5400	110278	3065	1245
1382	345	345	4136	914	1245
1383	520	520	7811	1064	1245
1384	430	430	5921	989	1245
1385	1520	1520	28808	1681	1245
1386	340	340	4031	909	1245
1391	510	510	7601	1056	1245
1392	507	507	7538	1053	1245
1393	2800	2800	55685	2235	1245
1394	175	175	567	740	1245
1400	4044	4044	81806	2665	1245
1401	7210	7210	148283	3530	1245
1402	425	425	5816	985	1245
1403	1427	1427	26856	1633	1245
1404	320	320	3612	890	1245
1405	242	242	1974	813	1245
1406	327	327	3759	897	1245
1407	475	475	6866	1027	1245
1408	810	810	13900	1274	1245

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Decon Room- Walk in Hood

Date 10/23/97

Meter L2220

Serial # 68537

Probe 44-9

Serial # 66762

MDA 1245

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  10793657

$n_s =$  40

$x_{avg} =$  269841

Maximum value in population = 3931213 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

- $s_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg} =$  269841

$n_s =$  40

$\Sigma(x_{avg} - x_i)^2 =$  28538521129639

$s_x =$  855428

## Calculation Sheet

Survey Unit: Decon Room- Walk in Hood  
 Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>269841</u>	
$t_{1-\alpha, df}$ =	<u>1.697</u>	*Note: for values of $t_{1-\alpha, df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>855428</u>	
$n_s$ =	<u>40</u>	
$\mu_{\alpha}$ =	<u>499369</u>	

Individual Completing Form:

Pat J. J.

Date: 12/23/97

Reviewed by:

Herbert M. Young

Date: 1/17/98



## Removable Alpha Data Sheet

Survey Type: 3 Notes: (1) Place total counts directly from meter. Activity column will correct for background.  
 Project Title: Georgia Tech Characterization Survey (2) Information for instrument and background taken directly from the MDA spreadsheet.  
 Survey Unit Location: Decon Room- Walk in Hood  
 Date: 10.21.97

Instrument: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1360	3	13
1361	3	13
1362	0	13
1363	0	13
1364	0	13
1365	0	13
1366	3	13
1367	0	13
1368	0	13
1369	0	13
1370	0	13
1371	0	13
1372	3	13
1373	7	13
1374	0	13
1375	0	13
1376	0	13
1377	0	13
1378	0	13
1379	0	13
1380	0	13
1381	0	13
1382	3	13
1383	3	13
1384	0	13
1385	0	13
1386	0	13
1391	0	13
1392	3	13
1393	0	13
1394	0	13
1400	3	13
1401	0	13
1402	0	13
1403	0	13
1404	0	13
1405	0	13
1406	0	13
1407	0	13
1408	3	13

Individual Completing Form:

Reviewed By:

Date:

Date:

## Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit - Location: Decon Room - Walk in Hood  
 Date: 10/21/97

Notes

1) Place total counts directly from meter. Activity column will correct for background.  
 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: \_\_\_\_\_ Serial #: 13795 Efficiency: 43.45%  
 Model: LB 5100 W Serial #: N/A MDA: 17  
 Probe: N/A

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1360	7	17
1361	1	17
1362	14	17
1363	1	17
1364	1	17
1365	10	17
1366	3	17
1367	0	17
1368	5	17
1369	5	17
1370	16	17
1371	0	17
1372	19	17
1373	28	17
1374	1	17
1375	12	17
1376	10	17
1377	0	17
1378	0	17
1379	0	17
1380	12	17
1381	5	17
1382	1	17
1383	3	17
1384	0	17
1385	3	17
1386	1	17
1391	1	17
1392	3	17
1393	1	17
1394	3	17
1400	46	17
1401	7	17
1402	19	17
1403	3	17
1404	12	17
1405	10	17
1406	3	17
1407	3	17
1408	23	17

Individual Completing Form:

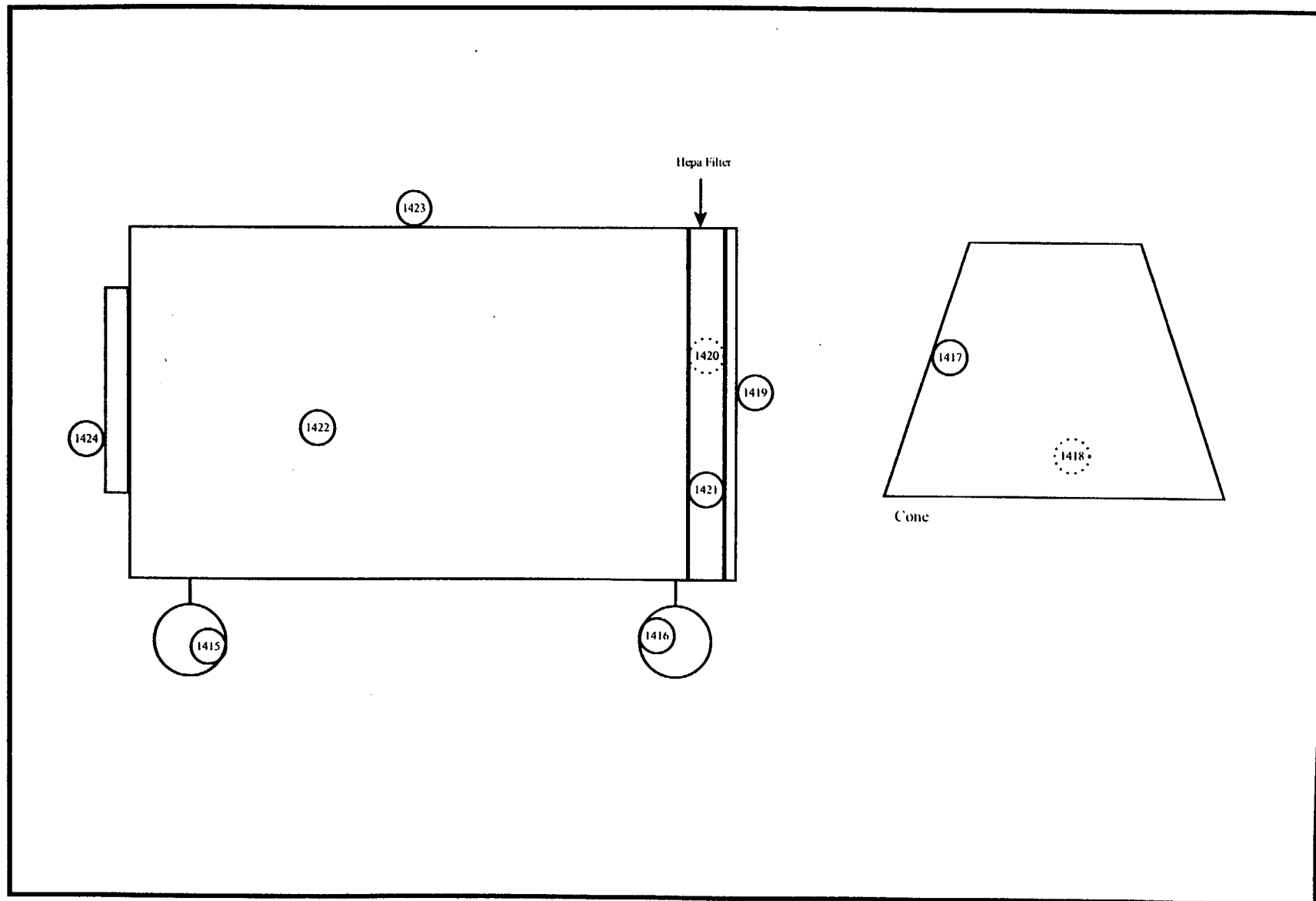
Reviewed By:

Date: 12/23/97Date: 1/17/98

# HEPA Ventilation Unit

Elevation View  
Not Drawn To Scale

D-76



○ Survey Location

⊘ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_s)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Hepa Ventilation Unit

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/22/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/22/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 12/30/97

Date: 1/16/98

# Removable Alpha Data Sheet

Survey Type: 3 Georgia Tech Characterization Survey  
 Project Title: Asaia Ventilation Unit  
 Survey Unit Location: 10-22-97  
 Date: \_\_\_\_\_

Notes:  
 (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: Model: LB 5100 W Serial #: 13795  
 Probe: N/A Serial #: N/A

Efficiency: 28.35%  
 MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1415	0	13
1416	3	13
1417	0	13
1418	7	13
1419	0	13
1420	0	13
1421	3	13
1422	10	13
1423	0	13
1424	3	13

Individual Completing Form: 1778  
 Reviewed By: Grant M. Murray

Date: 12/30/97  
 Date: 1/17/98

## Removable Beta-Gamma Data Sheet

Survey Type: 4 Notes: (1) Place total counts directly from meter. Activity column will correct for background.  
Project Title: Georgia Tech Characterization Survey (2) Information for instrument and background taken directly from the MDA spreadsheet.  
Survey Unit (Location): Hepa Ventilation Unit  
Date: 10/22/97

Instrument: \_\_\_\_\_  
Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1415	1	17
1416	72	17
1417	95	17
1418	74	17
1419	14	17
1420	21	17
1421	14	17
1422	92	17
1423	26	17
1424	51	17

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

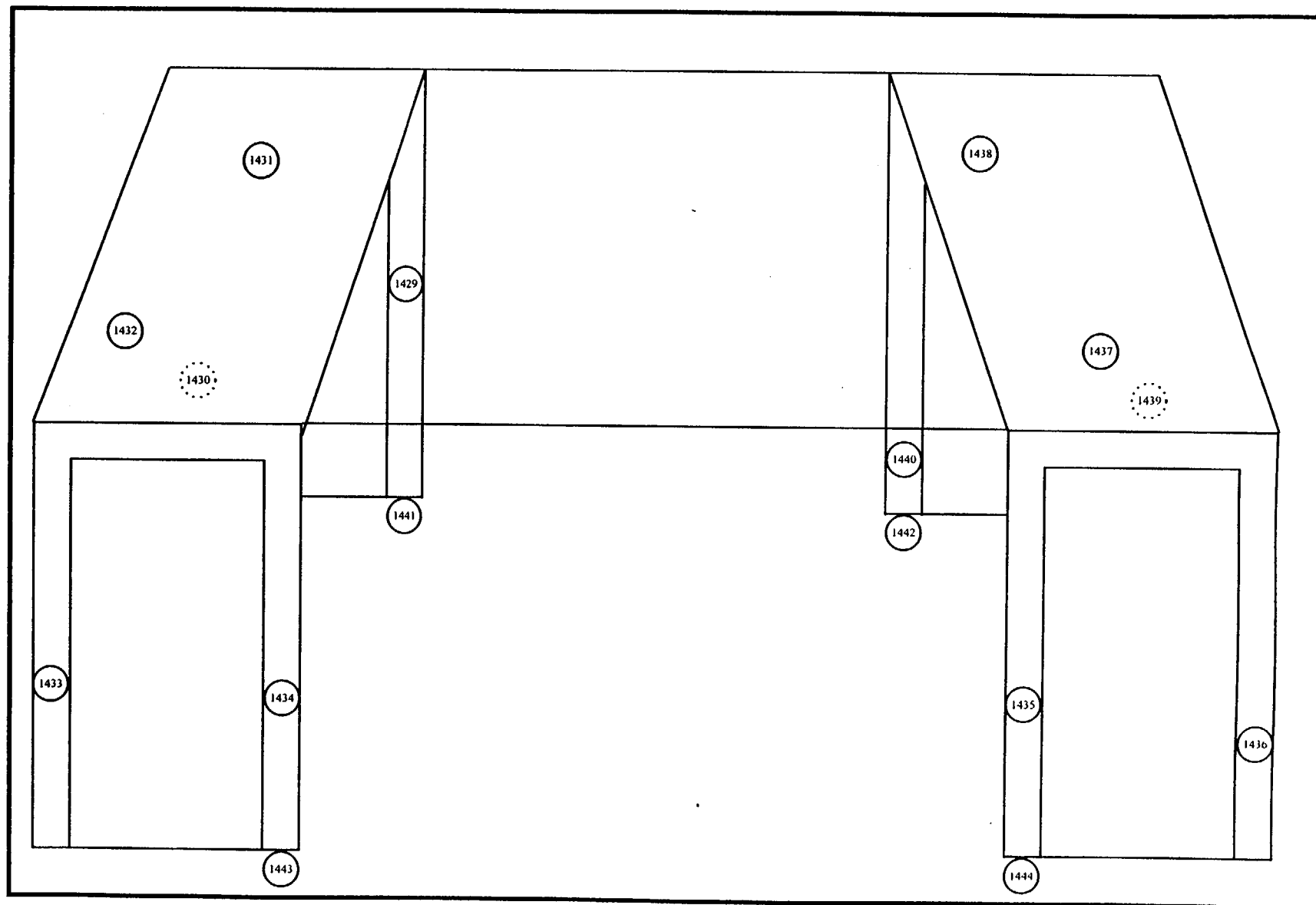
Date: \_\_\_\_\_

Date: \_\_\_\_\_

# Scaffolding Equipment

Three-Dimensional  
Not Drawn To Scale

D-80



○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_b/T_s)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Scaffolding Equipment

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/22/97  
Time background was taken = 15:21  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/22/97  
Time background was taken = 15:21  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: Peter Long

Reviewed By: Gerard M. Toney

Date: 12/23/97

Date: 1/16/98



# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Scaffolding Equipment  
 Date: 10/22/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1429	0	13
1430	0	13
1431	0	13
1432	0	13
1433	0	13
1434	7	13
1435	0	13
1436	0	13
1437	0	13
1438	3	13
1439	0	13
1440	3	13
1441	0	13
1442	0	13
1443	0	13
1444	0	13

Individual Completing Form:

Reviewed By:

Date:

Date:

Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Scaffolding Equipment  
 Date: 10/22/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1429	7	17
1430	42	17
1431	12	17
1432	5	17
1433	1	17
1434	1	17
1435	16	17
1436	10	17
1437	10	17
1438	16	17
1439	16	17
1440	14	17
1441	12	17
1442	7	17
1443	3	17
1444	5	17

Individual Completing Form:

Reviewed By:

*[Signature]*  
*[Signature]*

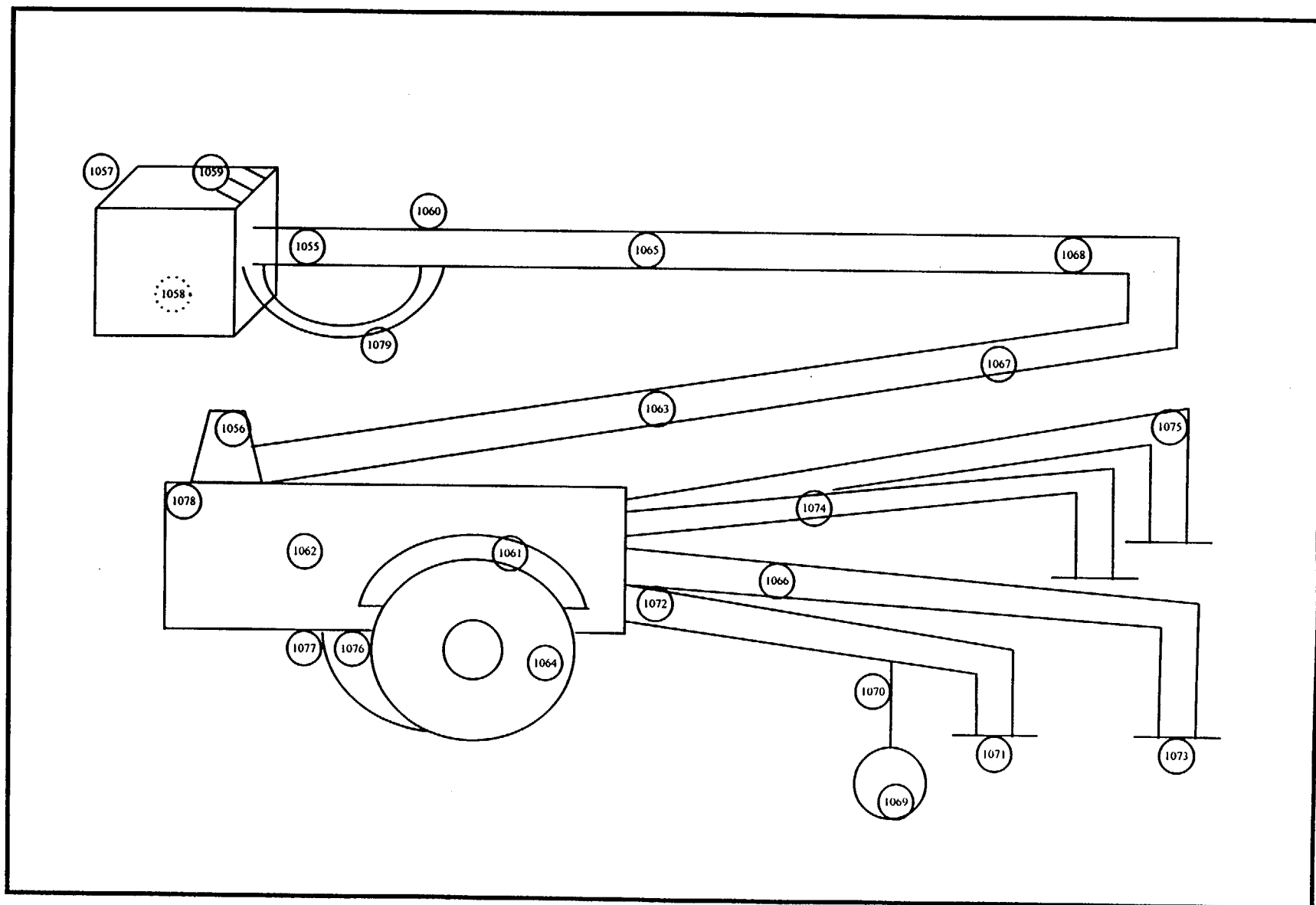
Date:

Date:

12/23/97  
1/16/98

# Manlift

Elevation View  
Not Drawn To Scale



○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)^{1/2}}{e(a/100)}$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Manlift

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/16/97  
Time background was taken = 13:42  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/16/97  
Time background was taken = 13:42  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Removable Alpha Data Sheet

Survey Type: 3 Notes:  
Project Title: Georgia Tech Characterization Survey  
Survey Unit Location: Main  
Date: 10/16/97

(1) Place total counts directly from meter. Activity column will correct for background.  
(2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument:  
Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1055	0	13
1056	0	13
1057	0	13
1058	0	13
1059	0	13
1060	0	13
1061	0	13
1062	0	13
1063	0	13
1064	0	13
1065	0	13
1066	0	13
1067	3	13
1068	0	13
1069	0	13
1070	0	13
1071	7	13
1072	0	13
1073	0	13
1074	0	13
1075	0	13
1076	3	13
1077	0	13
1078	0	13
1079	0	13

Individual Completing Form: Patty JV

Reviewed By: Sharon M. Young

Date: 1/5/99

Date: 1/17/99

## Removable Beta-Gamma Data Sheet

Survey Type: 4 Notes: (1) Place total counts directly from meter. Activity column will correct for background  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Manlift (2) Information for instrument and background taken directly from the MDA spreadsheet  
 Date: 10/18/97

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1055	1	17
1056	1	17
1057	0	17
1058	3	17
1059	7	17
1060	3	17
1061	1	17
1062	0	17
1063	5	17
1064	0	17
1065	1	17
1066	1	17
1067	3	17
1068	0	17
1069	0	17
1070	1	17
1071	7	17
1072	5	17
1073	3	17
1074	5	17
1075	0	17
1076	1	17
1077	5	17
1078	1	17
1079	1	17

Individual Completing Form:

Reviewed By:

Date:

Date:

## Clean-Up Survey

The following is a list of smears taken at the completion of the project :

Smears	Location
1148-1195	Floor of First Floor
1196-1199	Walls of First Floor
1521-1540	Walls and Floor of Second Floor
1558-1578	Floor by Plug Storage Area
1593-1597	Floor of DECON Room (by Hood)
1601-1618	Circular Saw

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_s)^{1/2}}{e (a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Clean-Up Survey

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/23/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/23/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 12/29/97

Date: 1/16/98



## Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit Location: Clean-Up Survey  
 Date: 10/23/97

Notes

1. Place total counts directly from meter. Activity column will correct for background.  
 2. Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W  
 Model: N/A  
 Probe: N/A  
 Serial #: 13795  
 Serial #: N/A  
 Efficiency: 28.35%  
 MDA: 13

NT= None Taken

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1148	3	13
1149	3	13
1150	0	13
1151	0	13
1152	0	13
1153	3	13
1154	0	13
1155	3	13
1156	3	13
1157	3	13
1158	0	13
1159	0	13
1160	0	13
1161	0	13
1162	0	13
1163	0	13
1164	0	13
1165	0	13
1166	0	13
1167	0	13
1168	0	13
1169	0	13
1170	0	13
1171	0	13
1172	3	13
1173	0	13
1174	0	13
1175	0	13
1176	0	13
1177	3	13
1178	0	13
1179	0	13
1180	0	13
1181	0	13
1182	3	13
1183	0	13
1184	0	13
1185	0	13
1186	3	13
1187	0	13
1188	0	13
1189	0	13
1190	0	13
1191	3	13
1192	10	13
1193	0	13
1194	0	13
1195	3	13
1196	0	13
1197	0	13
1198	0	13
1199	0	13
1521	0	13
1522	0	13
1523	0	13
1524	0	13
1525	0	13
1526	0	13
1527	0	13
1528	0	13
1529	0	13
1530	0	13
1531	0	13
1532	0	13
1533	0	13
1534	0	13
1535	3	13
1536	0	13
1537	0	13
1538	0	13
1539	0	13
1540	0	13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1558	3	13
1559	0	13
1560	3	13
1561	0	13
1562	0	13
1563	3	13
1564	NT	13
1565	0	13
1566	0	13
1567	3	13
1568	0	13
1569	0	13
1570	0	13
1571	3	13
1572	0	13
1573	3	13
1574	0	13
1575	0	13
1576	0	13
1577	3	13
1578	0	13
1593	0	13
1594	0	13
1595	3	13
1596	0	13
1597	0	13
1601	0	13
1602	0	13
1603	0	13
1604	0	13
1605	0	13
1606	0	13
1607	0	13
1608	0	13
1609	0	13
1610	0	13
1611	0	13
1612	0	13
1613	0	13
1614	0	13
1615	0	13
1616	0	13
1617	0	13
1618	0	13

Individual Completing Form:

Reviewed By:

Date:

Date:

## Removable Beta-Gamma Data Sheet

Survey Type:

4

Project Title:

Georgia Tech Characterization Survey

Notes:

Survey Unit (Location):

Clean-Up Survey

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Date:

10/23/97

Instrument:

Model: LB 5100 W

Serial #: 13795

Efficiency: 43.45%

Probe: N/A

Serial #: N/A

MDA: 17

NT= None Taken

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1148	1	17
1149	10	17
1150	10	17
1151	1	17
1152	3	17
1153	111	17
1154	19	17
1155	5	17
1156	3	17
1157	7	17
1158	19	17
1159	0	17
1160	7	17
1161	10	17
1162	3	17
1163	10	17
1164	1	17
1165	5	17
1166	3	17
1167	3	17
1168	1	17
1169	0	17
1170	0	17
1171	3	17
1172	3	17
1173	0	17
1174	5	17
1175	5	17
1176	0	17
1177	0	17
1178	1	17
1179	3	17
1180	3	17
1181	0	17
1182	14	17
1183	1	17
1184	7	17
1185	7	17
1186	7	17
1187	7	17
1188	5	17
1189	3	17
1190	7	17
1191	3	17
1192	69	17
1193	7	17
1194	30	17
1195	12	17
1196	7	17
1197	10	17
1198	14	17
1199	7	17
1521	23	17
1522	1	17
1523	5	17
1524	7	17
1525	5	17
1526	1	17
1527	1	17
1528	5	17
1529	0	17
1530	1	17
1531	3	17
1532	3	17
1533	0	17
1534	3	17
1535	1	17
1536	1	17
1537	21	17
1538	0	17
1539	0	17
1540	1	17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1558	33	17
1559	7	17
1560	1	17
1561	5	17
1562	1	17
1563	3	17
1564	NT	17
1565	7	17
1566	1	17
1567	5	17
1568	16	17
1569	14	17
1570	3	17
1571	5	17
1572	19	17
1573	21	17
1574	12	17
1575	12	17
1576	0	17
1577	21	17
1578	3	17
1593	0	17
1594	0	17
1595	10	17
1596	7	17
1597	7	17
1601	23	17
1602	90	17
1603	14	17
1604	39	17
1605	48	17
1606	33	17
1607	26	17
1608	111	17
1609	10	17
1610	12	17
1611	30	17
1612	16	17
1613	35	17
1614	5	17
1615	7	17
1616	21	17
1617	10	17
1618	3	17

Individual Completing Form:

Reviewed By:

*Patr JV*  
*David Thum*

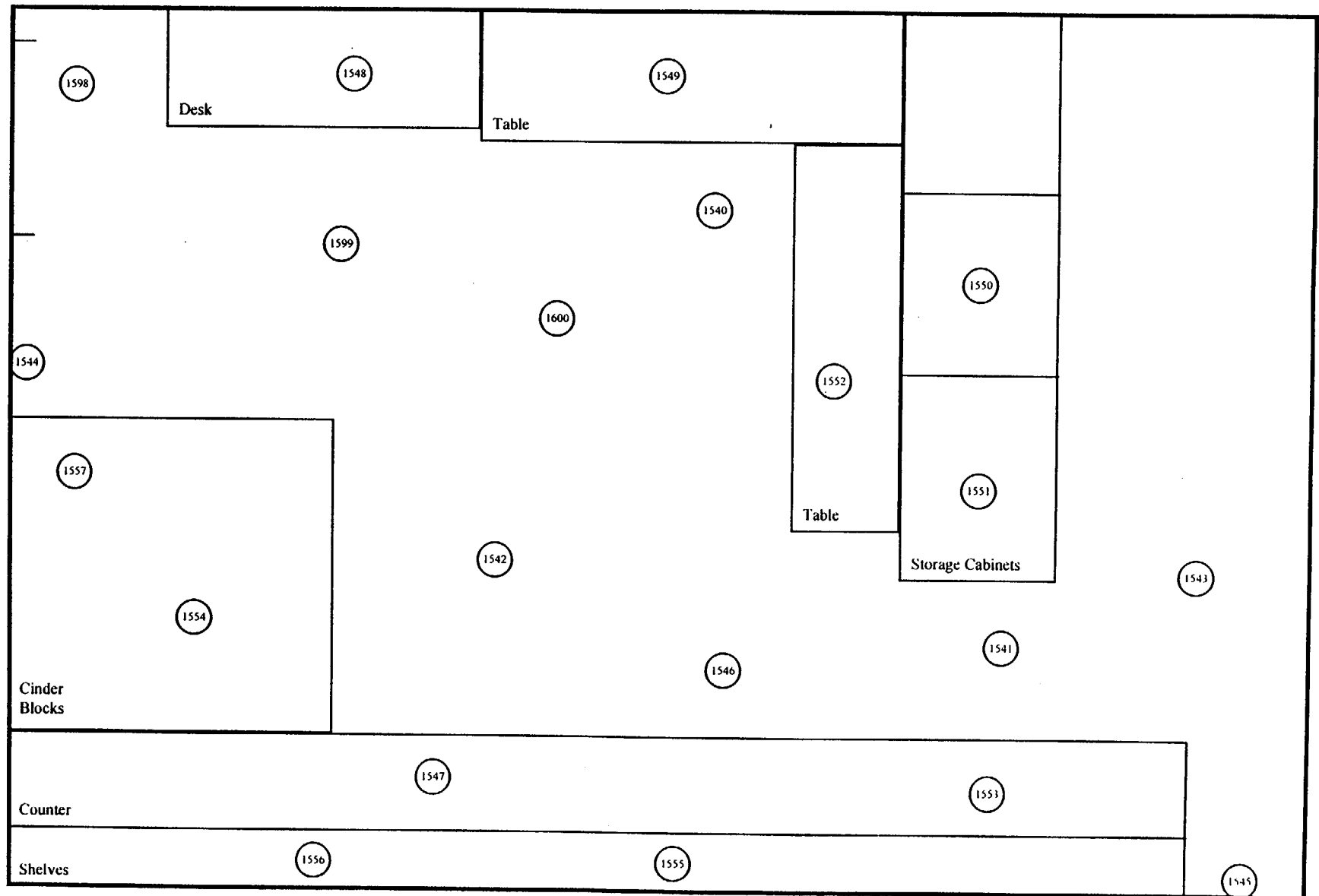
Date:

12/29/97  
 1/19/98

# NES Field Office- After Project Completion

Top View  
Not Drawn To Scale

D-92



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_b/T_s)^{1/2}}{e (a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): NES Field Office-After Project Completion

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 3  
Date background was taken = 10/23/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 3  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 95

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 92  
Date background was taken = 10/23/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 92  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1443

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/23/97  
Time background was taken = 14:38  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/23/97  
Time background was taken = 14:38  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date: 1/5/98

Date: 1/17/98

# Direct Alpha Data Sheet

Survey Date: Georgia Tech Characterization Survey  
 Project Site: NES Field Office-After Project Completion  
 Survey Unit Location: 102337

Notes:  
 1. Place total counts directly from meter. Add 100,000 counts for background.  
 2. Information for instrument and background given directly from the VDA spreadsheet.

Instrument: Model 12220  
 Probe 1365  
 Serial # 50061  
 Serial # 03291

Efficiency: 0.007  
 MDA: 95

NT = None Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
1540	0	0	-26	30	95
1541	1	1	-18	35	95
1542	0	0	-26	30	95
1543	1	1	-18	35	95
1544	0	0	-26	30	95
1545	1	1	-18	35	95
1546	0	0	-26	30	95
1547	0	0	-26	30	95
1548	0	0	-26	30	95
1549	1	1	-18	35	95
1550	0	0	-26	30	95
1551	0	0	-26	30	95
1552	0	0	-26	30	95
1553	0	0	-26	30	95
1554	0	0	-26	30	95
1555	1	1	-18	35	95
1556	0	0	-26	30	95
1557	0	0	-26	30	95
1598	NT	NT			
1599	NT	NT			
1600	NT	NT			

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: <u>1</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>NES Field Office-After Project Completion</u>		2 for direct beta/gamma
Date	<u>10/23/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>95</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\sum(x_i) =$	<u>-428</u>
$n_s =$	<u>18</u>
$x_{avg} =$	<u>-24</u>
Maximum value in population =	<u>-18</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg} =$	<u>-24</u>
$n_s =$	<u>18</u>
$\sum(x_{avg} - x_i)^2 =$	<u>1960</u>
$s_x =$	<u>11</u>

## Calculation Sheet

Survey Unit: NES Field Office-After Project Completion  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$ =	<u>-24</u>	
$t_{1-\alpha, \text{df}}$ =	<u>1.740</u>	*Note: for values of $t_{1-\alpha, \text{df}}$ not on the table, the nearest greater value is used
$s_x$ =	<u>11</u>	
$n_s$ =	<u>18</u>	
$\mu_{\alpha}$ =	<u>-20</u>	

Individual Completing Form:

Patricia J. J.

Date:

1/5/98

Reviewed by:

Gerard M. Toumey

Date:

1/12/98

## Direct Beta-Gamma Data Sheet

Survey Type 2  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit Location NES Field Office After Project Completion  
 Date 10/23/97

## Notes

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model 12220 Serial # 52823  
 Probe 44-9 Serial # 11150

Efficiency 21.37%  
 MDA 1443

NT = None Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)		MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	(dpm/100 cm <sup>2</sup> )	
1540	62	62	-914	741		1443
1541	67	67	-752	753		1443
1542	83	83	-274	790		1443
1543	54	54	-1158	722		1443
1544	62	62	-914	741		1443
1545	72	72	-610	765		1443
1546	80	80	-366	784		1443
1547	70	70	-671	760		1443
1548	80	80	-366	784		1443
1549	76	76	-488	774		1443
1550	82	82	-305	788		1443
1551	81	81	-335	786		1443
1552	80	80	-366	784		1443
1553	74	74	-549	770		1443
1554	68	68	-732	756		1443
1555	56	56	-1097	727		1443
1556	49	49	-1311	709		1443
1557	87	87	-152	799		1443
1598	NT					
1599	NT					
1600	NT					

Individual Completing Form:

Reviewed By:

Date:

Date:



# Calculation Sheet

SURVEY TYPE: <u>2</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>NES Field Office-After Project Completion</u>		2 for direct beta/gamma
Date	<u>10/23/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>52823</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>11150</u>		
MDA	<u>1443</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$$\Sigma(x_i) = \underline{\underline{-11370}}$$

$$n_s = \underline{\underline{18}}$$

$$x_{avg} = \underline{\underline{-632}}$$

$$\text{Maximum value in population} = \underline{\underline{-152}} \text{ (dpm/100 cm2)}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$$x_{avg} = \underline{\underline{-632}}$$

$$n_s = \underline{\underline{18}}$$

$$\Sigma(x_{avg} - x_i)^2 = \underline{\underline{3133762}}$$

$$s_x = \underline{\underline{429}}$$

## Calculation Sheet

Survey Unit: NES Field Office-After Project Completion  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$ =	<u>-632</u>	
$t_{1-\alpha, \text{df}}$ =	<u>1.740</u>	*Note: for values of $t_{1-\alpha, \text{df}}$ not on the table, the nearest greater value is used
$s_x$ =	<u>429</u>	
$n_s$ =	<u>18</u>	
$\mu_{\alpha}$ =	<u>-456</u>	

Individual Completing Form:

Pate Jr

Date:

1/5/98

Reviewed by:

Gerard W. Torrey

Date:

1/17/98

## Removable Alpha Data Sheet

Survey Type: 3 Notes: (1) Place total counts directly from meter. Activity column will correct for background.  
 Project Title: Georgia Tech Characterization Survey (2) Information for instrument and background taken directly from the MDA spreadsheet.  
 Survey Unit (Location): NES Field Office After Project Completion  
 Date: 10/23/97

Instrument: \_\_\_\_\_  
 Model: LS 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1540	0	13
1541	0	13
1542	0	13
1543	0	13
1544	0	13
1545	0	13
1546	0	13
1547	3	13
1548	0	13
1549	0	13
1550	0	13
1551	0	13
1552	0	13
1553	0	13
1554	0	13
1555	0	13
1556	0	13
1557	0	13
1598	0	13
1599	0	13
1600	0	13

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: 1/5/98Date: 1/16/98

## Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit Location: NES Field Office-After Project Completion  
 Date: 10/23/97

Notes

1. Place total counts directly from meter. Activity column will correct for background.  
 2. Information for instrument and background taken directly from the MDA spreadsheet.

Instrument:  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1540	1	17
1541	1	17
1542	19	17
1543	5	17
1544	5	17
1545	5	17
1546	12	17
1547	10	17
1548	0	17
1549	14	17
1550	7	17
1551	1	17
1552	3	17
1553	5	17
1554	5	17
1555	5	17
1556	7	17
1557	1	17
1598	14	17
1599	23	17
1600	5	17

Individual Completing Form:

Reviewed By:

Date:

Date:

## Ground Floor Survey Data Summary

Survey Location	No. of Survey Points	Range of Activity (dpm/100 cm <sup>2</sup> )							
		Direct				Removable			
		Alpha	MDA	Beta-Gamma	MDA	Alpha	MDA	Beta-Gamma	MDA
Center Columns	14	-88 to 110	289	-2713 to 3048	1860	0	13	0 to 44	17
North Wall of Reactor	20	-110 to 110	289	-2713 to 16522	1860	0 to 3	13	0 to 10	17
West Wall of Containment	7	-88 to 88	289	-3018 to 1799	1860	0 to 3	13	0 to 37	17
Northwest Wall of Containment	12	-110 to 22	289	-3018 to 5335	1860	0	13	0 to 23	17
Northwest Corner of Containment	10	-110 to 44	289	-2957 to 5792	1860	0	13	0 to 5	17
West Corner of Containment	7	-110 to 88	289	-1311 to 21795	1860	0 to 3	13	0 to 5	17
North Wall of Containment	12	-110 to 44	289	-2286 to 1616	1860	0	13	0 to 12	17
East Wall of Containment	6	-26 to 9	116	-3048 to -549	1854	0	13	0 to 7	17
Southeast Wall of Containment	14	-44 to 62	116	-3109 to 2195	1854	0	13	0 to 5	17
Southeast Corner of Containment	11	-26 to 441	116	-2622 to 14815	1854	0 to 3	13	0 to 12	17
Pump Room	22	-44 to 62	116	-2865 to 10242	1854	0 to 3	13	0 to 12	17
Pump Room, Ceiling	17	-44 to 9	116	-1036 to 10547	1854	0	13	0 to 10	17
East Wall, Outside of Experimental Rooms	10	-44 to 247	116	-2500 to 2408	1854	0 to 3	13	0 to 12	17
Experimental Room No. 1	41	-44 to 220	116	-2926 to 5670	1854	0 to 3	13	0 to 12	17
Experimental Room No. 2	26	-44 to 18	116	-2865 to 1402	1854	0	13	0 to 7	17
Experimental Room No. 2, Ceiling	15	-35 to 26	116	-2743 to -396	1854	0 to 3	13	0 to 5	17
Rabbit System (to include unrestricted areas)	13	-44 to 123	116	-2184 to 4283	1261	0 to 3	13	0 to 122	17
Process Equipment Room	27	-47 to 66	123	-1176 to 40399	1261	0 to 32	13	0 to 502	17
Process Equipment Room, Ceiling	8	-47 to -9	123	-1302 to 6677	1261	0 to 7	13	0 to 3	17
Outer Wall of Process Equipment Room	15	-47 to 28	123	-2439 to 8048	1854	0 to 3	13	0 to 12	17
Reactor Faces-Process Equipment Room	10	-47 to 28	123	-504 to 2520	1261	0	13	0 to 10	17
Elevator Shaft	5	None Taken	-	None Taken	-	0 to 17	13	0 to 175	17
Hydraulic Sump	4	None Taken	-	None Taken	-	0 to 7	13	0 to 173	17
Miscellaneous Areas	22	None Taken	-	None Taken	-	0 to 14	13	0 to 191	17

E-1

Shading represent areas where activities are above acceptable limits in

U.S. Nuclear Regulatory Guide 1.86, "Termination for Operating License for Nuclear Reactors," June 1974.

## Survey Locations with Elevated Activity- Ground Floor

Removable Alpha activity action level (DPM): 20/100 cm<sup>2</sup>

Removable Beta activity action level (DPM): 1000/100 cm<sup>2</sup>

Direct Alpha activity action level (DPM): 100 /100 cm<sup>2</sup>

Direct Beta activity action level (DPM): 5000/100 cm<sup>2</sup>

Survey Number	Removable Alpha Activity dpm/100 cm <sup>2</sup>	Removable Beta/Gamma Activity dpm/100 cm <sup>2</sup>	Direct Alpha Activity dpm/100 cm <sup>2</sup>	Direct Beta/Gamma Activity dpm/100 cm <sup>2</sup>	Location
557	0	0	110	5914	Ground Floor- North Wall of Reactor
559	0	0	22	4329	Ground Floor- North Wall of Reactor
560	0	1	0	4268	Ground Floor- North Wall of Reactor
561	0	7	-66	11797	Ground Floor- North Wall of Reactor
562	0	0	0	1341	Ground Floor- North Wall of Reactor
563	0	10	-88	16552	Ground Floor- North Wall of Reactor
568	0	0	-66	4420	Ground Floor- North Wall of Reactor
569	0	3	-22	9114	Ground Floor- North Wall of Reactor
570	0	3	-22	5792	Ground Floor- Northwest Corner of Containment
577	0	0	110	-884	Ground Floor- North Wall of Reactor
590	0	-44	110	-2103	Ground Floor- Center Columns
593	0	5	-22	21795	Ground Floor- West Corner of Containment
617	0	3	-9	6036	Ground Floor- Pump Room
620	0	0	-26	7743	Ground Floor- Pump Room
621	0	0	-44	7133	Ground Floor- Pump Room
622	0	1	18	7682	Ground Floor- Pump Room
623	0	1	18	10242	Ground Floor- Pump Room
642	0	1	9	14815	Ground Floor- Southwest Corner of Containment
678	0	0	247	-2195	Ground Floor- West Wall, Outside Exper. Rooms
719	0	0	220	-945	Ground Floor- Experimental Room No. 1
745	0	1	-26	7072	Ground Floor- Pump Room, Ceiling
747	0	0	-35	10547	Ground Floor- Pump Room, Ceiling

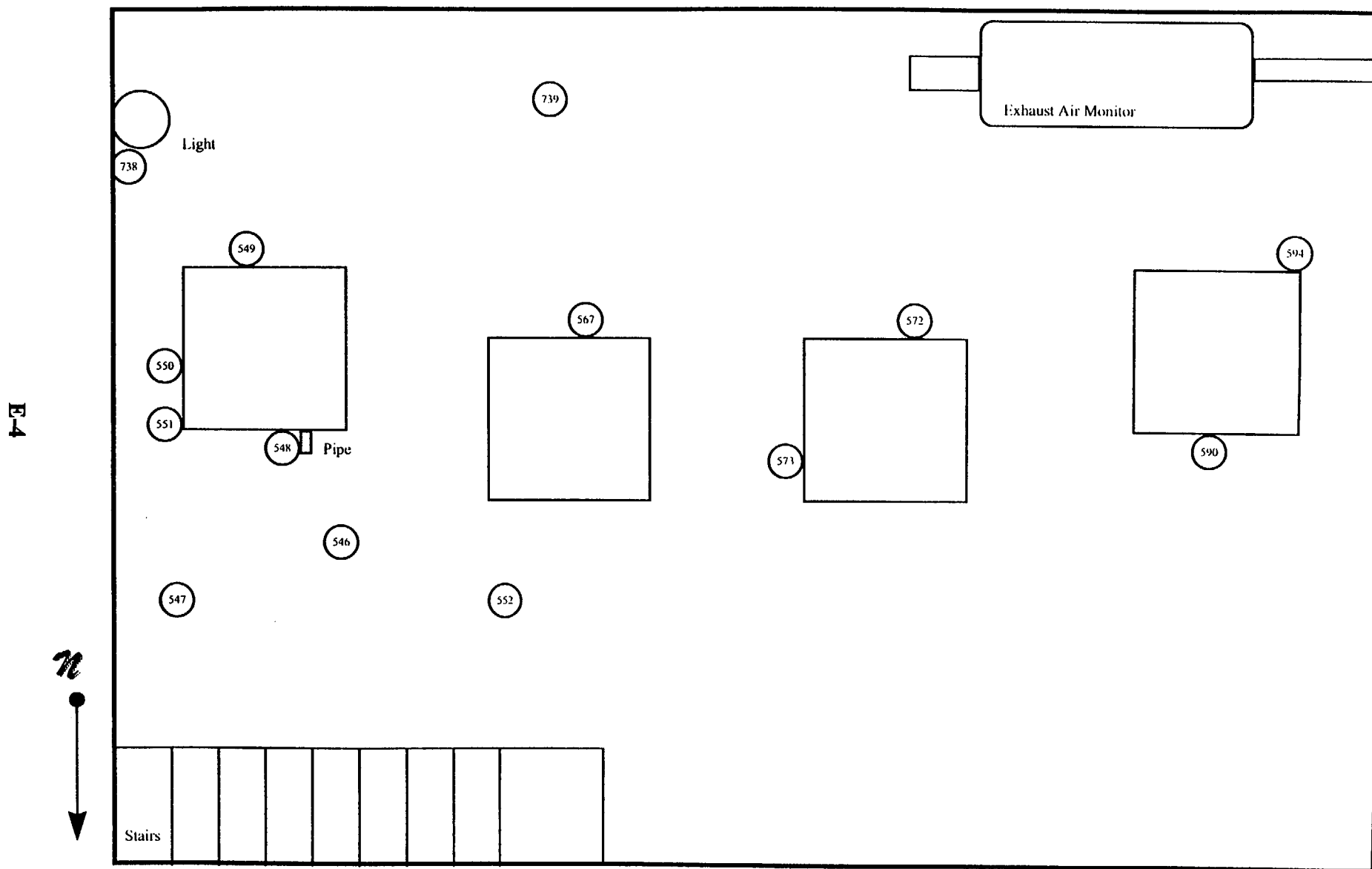
Removable Alpha activity action level (DPM): 20/100 cm<sup>2</sup>  
Removable Beta activity action level (DPM): 1000/100 cm<sup>2</sup>

Direct Alpha activity action level (DPM): 100 /100 cm<sup>2</sup>  
Direct Beta activity action level (DPM): 5000/100 cm<sup>2</sup>

	Removable	Removable	Direct	Direct	
Survey	Alpha Activity	Beta/Gamma Activity	Alpha Activity	Beta/Gamma Activity	Location
Number	dpm/100 cm <sup>2</sup>	dpm/100 cm <sup>2</sup>	dpm/100 cm <sup>2</sup>	dpm/100 cm <sup>2</sup>	
749	0	5	-18	7011	Ground Floor- Pump Room, Ceiling
751	0	0	-44	8901	Ground Floor- Pump Room, Ceiling
755	0	1	-26	6584	Ground Floor- Pump Room, Ceiling
757	0	1	-9	7255	Ground Floor- Pump Room, Ceiling
759	0	10	-44	6828	Ground Floor- Pump Room, Ceiling
760	0	3	-66	5335	Ground Floor- Northeast Wall of Containment
782	0	1	-44	5670	Ground Floor- Experimental Room No. 1
830	0	3	-9	5548	Outer Wall of Process Equipment Room
837	0	1	28	6584	Outer Wall of Process Equipment Room
838	0	3	-9	5487	Outer Wall of Process Equipment Room
839	0	7	-9	8048	Outer Wall of Process Equipment Room
840	0	3	-28	7438	Outer Wall of Process Equipment Room
841	0	1	-19	7377	Outer Wall of Process Equipment Room
858	0	0	28	40399	Process Equipment Room
859	3	5	66	22215	Process Equipment Room
860	3	21	28	5753	Process Equipment Room
861	0	0	-47	16210	Process Equipment Room
862	0	0	-9	8693	Process Equipment Room
875	0	1	-9	6509	Process Equipment Room- Ceiling
876	7	1	-47	6677	Process Equipment Room- Ceiling
1115	28	468	None Taken	None Taken	Process Equipment Room-Back Side of Tank He-1
1117	28	503	None Taken	None Taken	Process Equipment Room-Top of Tank He-1
1118	32	332	None Taken	None Taken	Process Equipment Room

# Ground Floor- Center Columns

Top View  
Not Drawn To Scale



○ Survey Location

○ Survey Locations  
Behind Figure



# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_s)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- Center Columns

SURVEY TYPE: 1 (direct alpha)  
METER: L2221  
SERIAL #: 50062  
PROBE #: AC-3  
SERIAL #: 408951  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 7.70%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 289

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 157  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 157  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1860

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 12/30/97

Date: 1/13/98

# Direct Alpha Data Sheet

Survey Type: \_\_\_\_\_  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor - Center Columns  
 Date: 10/9/97

## Notes

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: \_\_\_\_\_  
 Model: L2221 Serial #: 50062  
 Probe: AC-3 Serial #: 408951

Efficiency: 7.70%  
 MDA: 289

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
546	1	1	-88	106	289
547	7	7	44	149	289
548	6	6	22	143	289
549	4	4	-22	129	289
550	4	4	-22	129	289
551	4	4	-22	129	289
552	5	5	0	136	289
567	2	2	-66	114	289
572	4	4	-22	129	289
573	5	5	0	136	289
590	10	10	110	167	289
594	5	5	0	136	289
738	2	2	-66	114	289
739	3	3	-44	122	289

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: 12/30/98  
 Date: 1/16/98

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Ground Floor- Center Columns

Date 10/9/97

Meter L2221

Serial # 50062

Probe AC-3

Serial # 408951

MDA 289

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -176  
 $n_s =$  14  
 $x_{avg} =$  -13  
 Maximum value in population = 110 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -13  
 $n_s =$  14  
 $\Sigma(x_{avg} - x_i)^2 =$  32638  
 $s_x =$  50

## Calculation Sheet

Survey Unit: Ground Floor- Center Columns  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-13</u>	
$t_{1-\alpha, df}$ =	<u>1.771</u>	*Note: for values of $t_{1-\alpha, df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>50</u>	
$n_s$ =	<u>14</u>	
$\mu_{\alpha}$ =	<u>11</u>	

Individual Completing Form:

Dave L...

Date: 12/30/97

Reviewed by:

Gerard M. Journey

Date: 1/16/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Center Columns  
 Date: 10/9/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model: L2220 Serial #: 52823  
 Probe: 44-9 Serial #: 11150

Efficiency: 21.87%  
 MDA: 1880

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
546	253	253	2926	1210	1880
547	257	257	3048	1216	1880
548	250	250	2835	1205	1880
549	90	90	-2042	939	1880
550	256	256	3018	1214	1880
551	195	195	1158	1121	1880
552	200	200	1311	1129	1880
567	194	194	1128	1119	1880
572	226	226	2103	1169	1880
573	166	166	274	1074	1880
590	88	88	-2103	935	1880
594	74	74	-2530	908	1880
738	72	72	-2591	904	1880
739	68	68	-2713	896	1880

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 12/30/97

Date: 1/13/98

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- Center Columns

Date 10/9/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1860

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  5822  
 $n_s =$  14  
 $x_{avg} =$  416  
 Maximum value in population = 3048 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  416  
 $n_s =$  14  
 $\Sigma(x_{avg} - x_i)^2 =$  70472886  
 $s_x =$  2328

## Calculation Sheet

Survey Unit: Ground Floor- Center Columns  
 Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 416  
 $t_{1-\alpha, df}$  = 1.771  
 $s_x$  = 2328  
 $n_s$  = 14  
 $\mu_{\alpha}$  = 1518

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Rate*

Date: 12/30/97

Reviewed by: *Gerard M. Tourney*

Date: 1/13/98

# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Center Columns  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
546	0	13
547	0	13
548	0	13
549	0	13
550	0	13
551	0	13
552	0	13
567	0	13
572	0	13
573	0	13
590	0	13
594	0	13
738	0	13
739	0	13

Individual Completing Form:

Reviewed By:

*Pat L...*  
*Bernard M. Bouney*

Date:

Date:

*12/30/97*  
*1/13/98*



# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor, Center Columns  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: \_\_\_\_\_  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
546	1	17
547	1	17
548	1	17
549	1	17
550	0	17
551	0	17
552	5	17
567	3	17
572	0	17
573	1	17
590	44	17
594	5	17
738	0	17
739	1	17

Individual Completing Form: \_\_\_\_\_

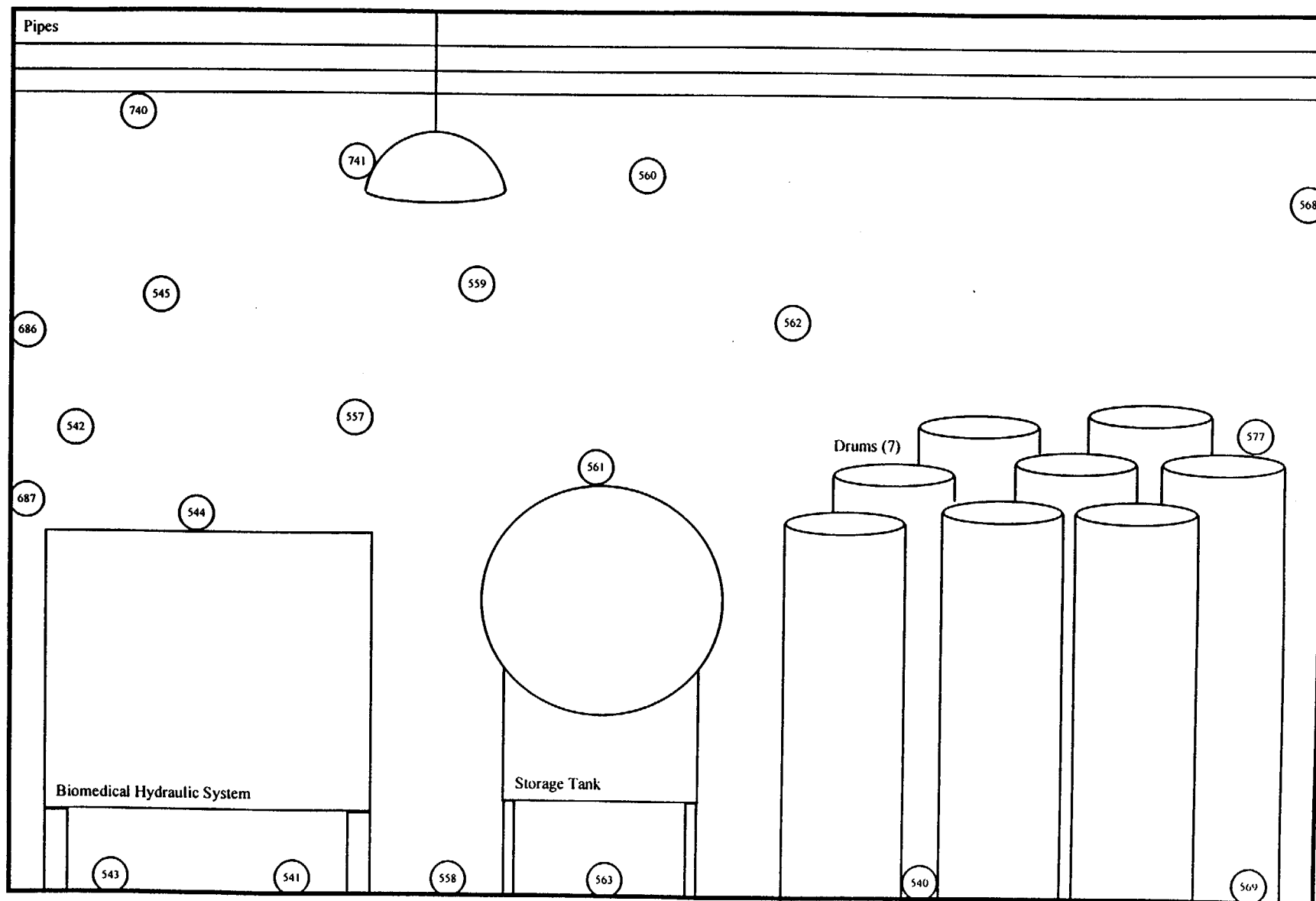
Reviewed By: \_\_\_\_\_

Date: 12/30/97

Date: 1/13/98

# Ground Floor- North Wall of Reactor

Elevation View  
Not Drawn To Scale



○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- North Wall of Reactor

SURVEY TYPE: 1 (direct alpha)  
METER: L2221  
SERIAL #: 50062  
PROBE #: AC-3  
SERIAL #: 408951  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 7.70%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 289

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 157  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 157  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1860

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: *[Signature]*

Reviewed By: *[Signature]*

Date: 12/22/97

Date: 1/13/98

## Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor, North Wall of Reactor  
 Date: 10/9/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model: L2221 Serial #: 50062 Efficiency: 7.70%  
 Probe: AC-3 Serial #: 408951 MDA: 289

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
540	0	0	-110	96	289
541	3	3	-44	122	289
542	4	4	-22	129	289
543	2	2	-66	114	289
544	1	1	-88	106	289
545	4	4	-22	129	289
557	4	4	-22	129	289
558	1	1	-88	106	289
559	6	6	22	143	289
560	5	5	0	138	289
561	2	2	-66	114	289
562	5	5	0	138	289
563	1	1	-88	106	289
568	2	2	-66	114	289
569	4	4	-22	129	289
577	10	10	110	167	289
686	2	2	-66	114	289
687	2	2	-66	114	289
740	0	0	-110	96	289
741	2	2	-66	114	289

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Ground Floor- North Wall of Reactor

Date 10/9/97

Meter L2221

Serial # 50062

Probe AC-3

Serial # 408951

MDA 289

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -880  
 $n_s =$  20  
 $x_{avg} =$  -44  
 Maximum value in population = 110 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -44  
 $n_s =$  20  
 $\Sigma(x_{avg} - x_i)^2 =$  51304  
 $s_x =$  52

## Calculation Sheet

Survey Unit: Ground Floor- North Wall of Reactor  
 Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = -44  
 $t_{1-\alpha, df}$  = 1.729  
 $s_x$  = 52  
 $n_s$  = 20  
 $\mu_{\alpha}$  = -24

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

Rate ppp

Date: 12/22/97

Reviewed by:

Richard M. Toney

Date: 1/13/98

## Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- North Wall of Reactor  
 Date: 10/9/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument:  
 Model: L2220  
 Probe: 44-9

Serial #: 52823  
 Serial #: 11150

Efficiency: 21.87%  
 MDA: 1860

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
540	151	151	-183	1049	1860
541	208	208	1555	1141	1860
542	86	86	-2164	931	1860
543	229	229	2195	1174	1860
544	158	158	30	1060	1860
545	83	83	-2256	926	1860
557	351	351	5914	1347	1860
558	250	250	2835	1205	1860
559	299	299	4329	1276	1860
560	297	297	4268	1273	1860
561	544	544	11797	1582	1860
562	201	201	1341	1130	1860
563	700	700	16552	1749	1860
568	302	302	4420	1280	1860
569	456	456	9114	1479	1860
577	128	128	-884	1009	1860
686	270	270	3445	1235	1860
687	124	124	-1006	1002	1860
740	100	100	-1738	958	1860
741	68	68	-2713	896	1860

Individual Completing Form:

Reviewed By:

*Pat H*  
*Bernard M. Tourney*

Date:

Date:

*12/22/97*  
*1/13/98*

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- North Wall of Reactor

Date 10/9/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1860

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  56851  
 $n_s =$  20  
 $x_{avg} =$  2843  
 Maximum value in population = 16552 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  2843  
 $n_s =$  20  
 $\Sigma(x_{avg} - x_i)^2 =$  476989871  
 $s_x =$  5010



## Calculation Sheet

Survey Unit: Ground Floor- North Wall of Reactor  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 2843  
 $t_{1-\alpha, df}$  = 1.729  
 $s_x$  = 5010  
 $n_s$  = 20  
 $\mu_{\alpha}$  = 4780

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

Ruth J. J.

Date: 12/22/97

Reviewed by:

Gerard W. Tormey

Date: 1/13/98

# Removable Alpha Data Sheet

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor, North West of Reactor  
 Date: 10/10/97

Instrument: Model: LB 5100 W  
 Probe: N/A  
 Serial #: 13795  
 Serial #: N/A

Efficiency: 28.35%  
 MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
540	0	13
541	0	13
542	0	13
543	0	13
544	0	13
545	0	13
557	0	13
558	0	13
559	0	13
560	0	13
561	0	13
562	0	13
563	0	13
568	0	13
569	0	13
577	0	13
686	0	13
687	3	13
740	0	13
741	0	13

Individual Completing Form: [Signature]  
 Reviewed By: [Signature]

Date: 12/22/97  
 Date: 1/13/98

# Removable Beta-Gamma Data Sheet

Survey Type 4  
Project Title Georgia Tech Characterization Survey  
Survey Unit (Location) Ground Floor- North Wall of Reactor  
Date 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
Model: LB 5100 W      Serial #: 13795      Efficiency: 43.45%  
Probe: N/A      Serial #: N/A      MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
540	5	17
541	10	17
542	5	17
543	0	17
544	7	17
545	1	17
557	0	17
558	7	17
559	0	17
560	1	17
561	7	17
562	0	17
563	10	17
568	0	17
569	3	17
577	0	17
686	1	17
687	3	17
740	5	17
741	3	17

Individual Completing Form:

Reviewed By:

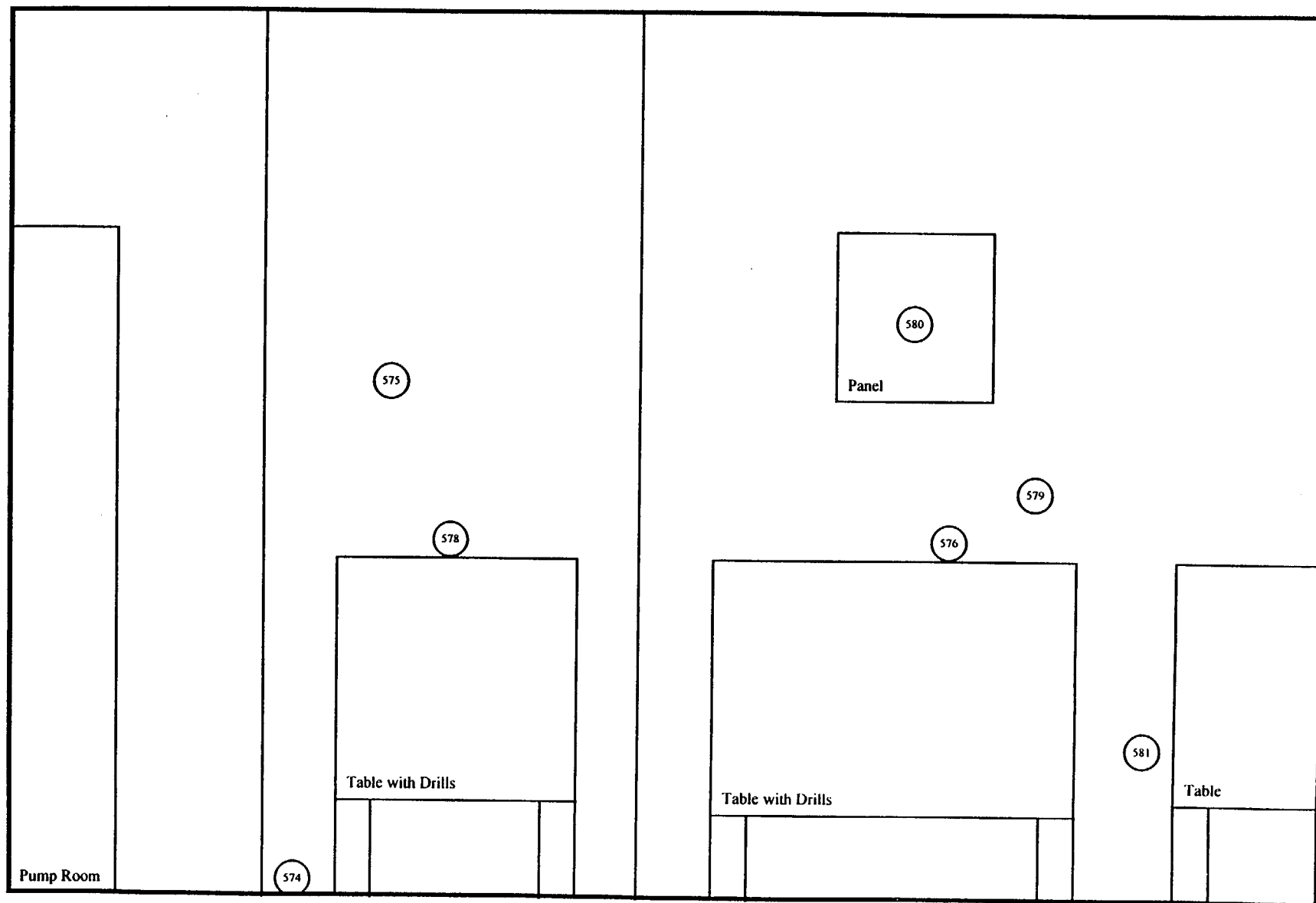
Date:

Date:

# Ground Floor- West Wall of Containment

Elevation View  
Not Drawn To Scale

E-24



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- West Wall of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2221  
SERIAL #: 50062  
PROBE #: AC-3  
SERIAL #: 408951  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 7.70%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 289

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 157  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 157  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1860

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 9:49  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 9:49  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: Pat Lym

Reviewed By: Ronald M. Lounney

Date: 1/4/98

Date: 1/13/98

# Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- West Wall of Containment  
 Date: 10/9/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: L2221  
 Probe: AC-3

Serial #: 50062  
 Serial #: 408951

Efficiency: 7.70%  
 MDA: 289

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
574	5	5	0	136	289
575	9	9	88	161	289
576	1	1	-88	106	289
578	2	2	-66	114	289
579	2	2	-66	114	289
580	2	2	-66	114	289
581	2	2	-66	114	289

Individual Completing Form:

*Pat Lye*

Date:

*1/4/98*

Reviewed By:

*[Signature]*

Date:

*1/31/98*

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Ground Floor- West Wall of Containment

Date 10/9/97

Meter L2221

Serial # 50062

Probe AC-3

Serial # 408951

MDA 289

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -264

$n_s =$  7

$x_{avg} =$  -38

Maximum value in population = 88 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

- $s_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg} =$  -38

$n_s =$  7

$\Sigma(x_{avg} - x_i)^2 =$  22956

$s_x =$  62

## Calculation Sheet

Survey Unit: Ground Floor- West Wall of Containment  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = -38  
 $t_{1-\alpha, df}$  = 1.943  
 $s_x$  = 62  
 $n_s$  = 7  
 $\mu_{\alpha}$  = 7

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Pat Fyfe*

Date: 1/4/98

Reviewed by: *[Signature]*

Date: 1/8/98



# Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- West Wall of Containment  
 Date: 10/9/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: L2220  
 Probe: 44-9

Serial #: 52823  
 Serial #: 11150

Efficiency: 21.87%  
 MDA: 1860

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	
				(dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
574	214	214	1738	1151	1860
575	208	208	1555	1141	1860
576	58	58	-3018	876	1860
578	70	70	-2652	900	1860
579	216	216	1799	1154	1860
580	130	130	-823	1012	1860
581	166	166	274	1074	1860

Individual Completing Form: *Pat*

Reviewed By: *[Signature]*

Date: 1/4/98  
 Date: 1/8/98

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- West Wall of Containment

Date 10/9/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1860

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm<sup>2</sup>)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -1127

$n_s =$  7

$x_{avg} =$  -161

Maximum value in population = 1799 (dpm/100 cm<sup>2</sup>)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

- $s_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg} =$  -161

$n_s =$  7

$\Sigma(x_{avg} - x_i)^2 =$  25387456

$s_x =$  2057

## Calculation Sheet

Survey Unit: Ground Floor- West Wall of Containment  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

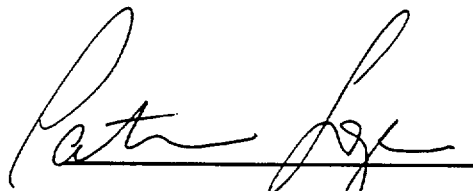
$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$	=	<u>-161</u>	
$t_{1-\alpha, df}$	=	<u>1.943</u>	*Note: for values of $t_{1-\alpha, df}$ not on the table, the nearest greater value is used
$s_x$	=	<u>2057</u>	
$n_s$	=	<u>7</u>	
$\mu_{\alpha}$	=	<u>1350</u>	

Individual Completing Form:



Date:

1/4/98

Reviewed by:



Date:

1/5/98

# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor, West Wall of Containment  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument:

Model: LB 5100 W

Probe: N/A

Serial #: 13795

Serial #: N/A

Efficiency: 28.35%

MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
574	0	13
575	3	13
576	0	13
578	0	13
579	0	13
580	0	13
581	0	13

Individual Completing Form: *[Signature]*

Reviewed By: *[Signature]*

Date: 1/4/98

Date: 1/9/98

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor - West Hall of Containment  
 Date: 10/10/97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: Model: LB 5100 W  
 Probe: N/A  
 Serial #: 13795  
 Serial #: N/A  
 Efficiency: 43.45%  
 MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
574	0	17
575	5	17
576	5	17
578	37	17
579	3	17
580	0	17
581	7	17

Individual Completing Form: Patricia T. T.

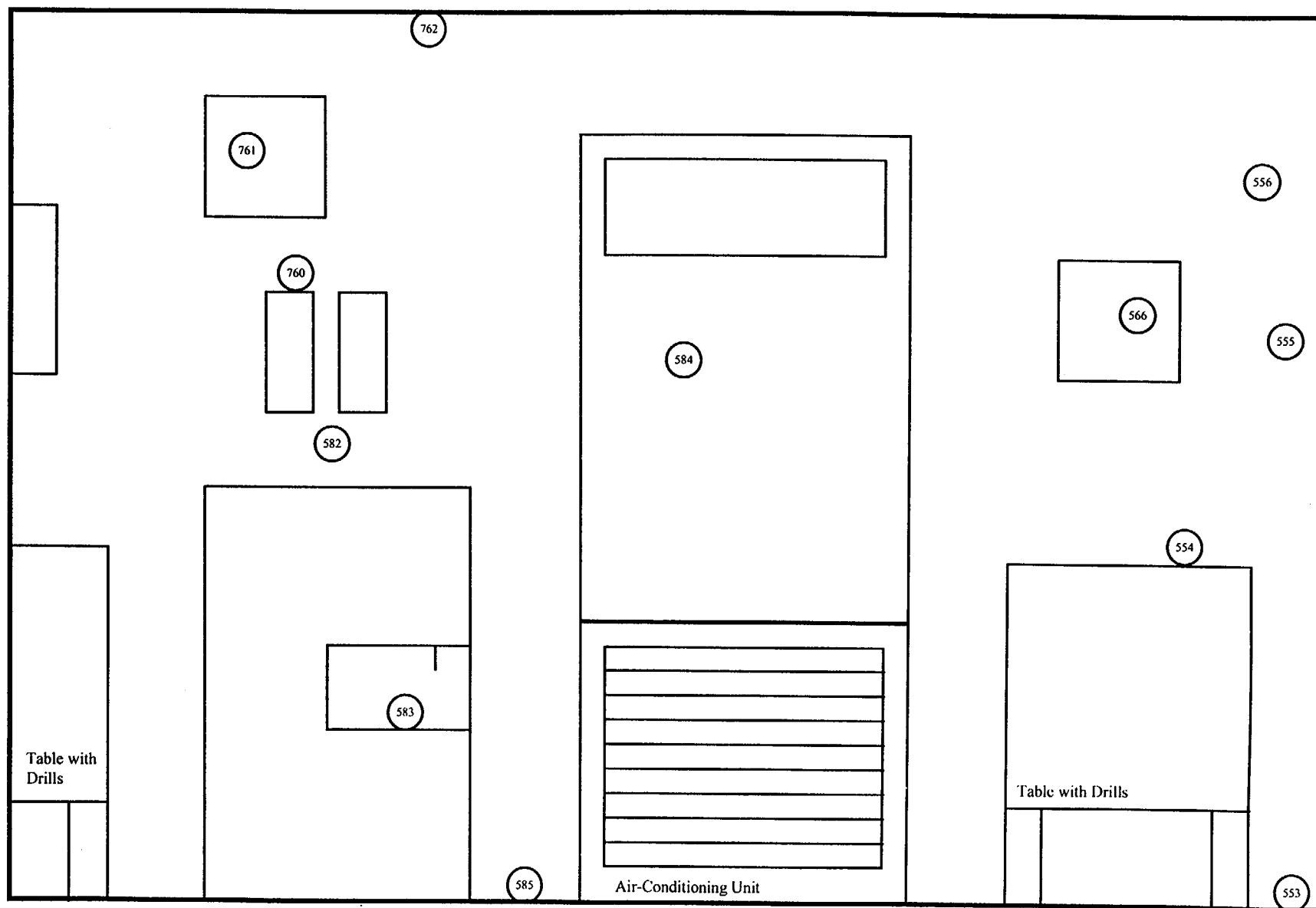
Reviewed By: David M. Carney

Date: 1/5/98

Date: 1/3/98

# Ground Floor- Northwest Wall of Containment

Elevation View  
Not Drawn To Scale



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_s)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- Northwest Wall of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2221  
SERIAL #: 50062  
PROBE #: AC-3  
SERIAL #: 408951  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 7.70%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 289

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 157  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 157  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1860

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 9:49  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 9:49  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: Pat J. V.

Reviewed By: Donald J. H.

Date: 4/8/98

Date: 4/8/98

# Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Northwest Wall of Containment  
 Date: 10/9/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: L2221 Serial #: 50062 Efficiency: 7.70%  
 Probe: AC-3 Serial #: 408951 MDA: 289

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)		MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	(dpm/100 cm <sup>2</sup> )	
553	2	2	-66	114	289	
554	2	2	-66	114	289	
555	3	3	-44	122	289	
556	3	3	-44	122	289	
566	2	2	-66	114	289	
582	2	2	-66	114	289	
583	3	3	-44	122	289	
584	6	6	22	143	289	
585	3	3	-44	122	289	
760	2	2	-66	114	289	
761	0	0	-110	96	289	
762	1	1	-88	106	289	

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_



# Calculation Sheet

SURVEY TYPE: <u>1</u>		Input one of the following
Survey Unit	<u>Ground Floor- Northwest Wall of Containment</u>	1 for direct alpha
Date	<u>10/9/97</u>	2 for direct beta/gamma
Meter	<u>L2221</u>	3 for removable alpha
Serial #	<u>50062</u>	4 for removable beta/gamma
Probe	<u>AC-3</u>	5 for exposure data at 1 cm
Serial #	<u>408951</u>	6 for exposure data at 1 meter
MDA	<u>289</u>	
Survey Type	<u>Direct Alpha</u>	
Guideline Value	<u>100</u> (dpm/100 cm2)	

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$	<u>-682</u>
$n_s =$	<u>12</u>
$x_{avg} =$	<u>-57</u>
Maximum value in population =	<u>22</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

- $s_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg} =$	<u>-57</u>
$n_s =$	<u>12</u>
$\Sigma(x_{avg} - x_i)^2 =$	<u>11092</u>
$s_x =$	<u>32</u>

## Calculation Sheet

Survey Unit: Ground Floor- Northwest Wall of Containment

Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha,df} [s_x/(n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha,df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-57</u>	
$t_{1-\alpha,df}$ =	<u>1.796</u>	*Note: for values of $t_{1-\alpha,df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>32</u>	
$n_s$ =	<u>12</u>	
$\mu_{\alpha}$ =	<u>-41</u>	

Individual Completing Form:

Pat L

Date: 4/8/98

Reviewed by:

D. S. L.

Date: 4/8/98

Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Northwest Wall of Containment  
 Date: 10/9/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: L2220 Serial #: 52823  
 Probe: 44-9 Serial #: 11150

Efficiency: 21.87%  
 MDA: 1860

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
553	227	227	2134	1171	1860
554	71	71	-2622	902	1860
555	110	110	-1433	976	1860
556	104	104	-1616	965	1860
566	160	160	91	1064	1860
582	184	184	823	1103	1860
583	128	128	-884	1009	1860
584	58	58	-3018	876	1860
585	116	116	-1250	987	1860
760	332	332	5335	1321	1860
761	64	64	-2835	888	1860
762	124	124	-1006	1002	1860

Individual Completing Form:

Reviewed By:

*Pat H*  
*Paul H*

Date:

Date:

4/8/98  
4/9/98

# Calculation Sheet

SURVEY TYPE: <u>2</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- Northwest Wall of Containment</u>		2 for direct beta/gamma
Date	<u>10/9/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>52823</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>11150</u>		
MDA	<u>1860</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-6281</u>
$n_s$ =	<u>12</u>
$x_{avg}$ =	<u>-523</u>
Maximum value in population =	<u>5335</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-523</u>
$n_s$ =	<u>12</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>62455583</u>
$s_x$ =	<u>2383</u>

## Calculation Sheet

Survey Unit: Ground Floor- Northwest Wall of Containment  
 Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha,df} [s_x/(n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha,df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-523</u>	
$t_{1-\alpha,df}$ =	<u>1.796</u>	*Note: for values of $t_{1-\alpha,df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>2383</u>	
$n_s$ =	<u>12</u>	
$\mu_{\alpha}$ =	<u>712</u>	

Individual Completing Form: Pat H

Date: 4/8/98

Reviewed by: D. J. Smith

Date: 4/9/99

# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Northwest Wall of Containment  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
553	0	13
554	0	13
555	0	13
556	0	13
566	0	13
582	0	13
583	0	13
584	0	13
585	0	13
760	0	13
761	0	13
762	0	13

Individual Completing Form:

Reviewed By:

Date:

Date:

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Northwest Wall of Containment  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
553	3	17
554	23	17
555	1	17
556	1	17
566	3	17
582	3	17
583	7	17
584	1	17
585	0	17
760	3	17
761	3	17
762	0	17

Individual Completing Form:

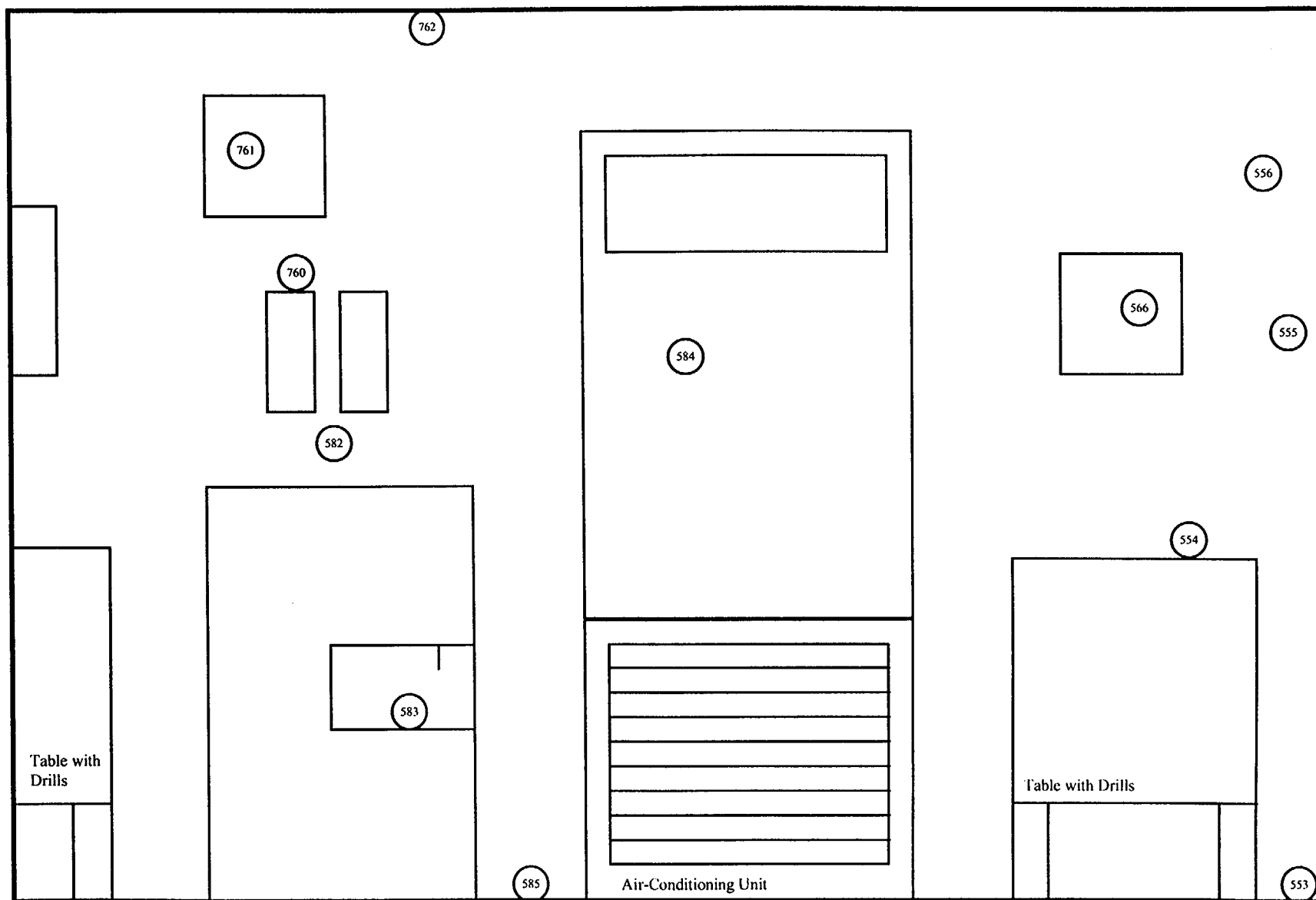
Reviewed By:

Date:

Date:

# Ground Floor- Northwest Wall of Containment

Elevation View  
Not Drawn To Scale



E-44

○ Survey Location

⊙ Survey Locations  
Behind Figure



# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_b/T_s)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- Northwest Corner of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2221  
SERIAL #: 50062  
PROBE #: AC-3  
SERIAL #: 408951  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 7.70%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 289

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 157  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 157  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1860

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 9:49  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 9:49  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 1/6/98

Date: 1/5/98

# Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor - Northwest Corner of Containment  
 Date: 10/9/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument: 1221  
 Model: AC-3

Serial #: 50062  
 Serial #: 408951

Efficiency: 7.70%  
 MDA: 289

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
570	4	4	-22	129	289
571	0	0	-110	96	289
586	2	2	-66	114	289
587	1	1	-68	106	289
588	1	1	-68	106	289
589	7	7	-44	149	289
591	0	0	-110	96	289
595	3	3	-44	122	289
596	2	2	-66	114	289
598	7	7	-44	149	289

Individual Completing Form:

Reviewed By:

*Lot*  
*lyr*

Date:

*11/10/99*

Date:

*11/10/99*

# Calculation Sheet

SURVEY TYPE:	<u>1</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- Northwest Corner of Containment</u>		2 for direct beta/gamma
Date	<u>10/9/97</u>		3 for removable alpha
Meter	<u>L2221</u>		4 for removable beta/gamma
Serial #	<u>50062</u>		5 for exposure data at 1 cm
Probe	<u>AC-3</u>		6 for exposure data at 1 meter
Serial #	<u>408951</u>		
MDA	<u>289</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-506</u>
$n_s$ =	<u>10</u>
$x_{avg}$ =	<u>-51</u>
Maximum value in population =	<u>44</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-51</u>
$n_s$ =	<u>10</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>29090</u>
$s_x$ =	<u>57</u>

## Calculation Sheet

Survey Unit: Ground Floor- Northwest Corner of Containment  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-51</u>	
$t_{1-\alpha, df}$ =	<u>1.833</u>	*Note: for values of $t_{1-\alpha, df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>57</u>	
$n_s$ =	<u>10</u>	
$\mu_{\alpha}$ =	<u>-18</u>	

Individual Completing Form: *Patricia L. Fyfe*

Date: 1/6/98

Reviewed by: *[Signature]*

Date: 8/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Northwest Corner of Containment  
 Date: 10/9/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument

Model: L2220

Serial #: 52823

Efficiency: 21.87%

Probe: 44-9

Serial #: 11150

MDA: 1860

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty	MDA (dpm/100 cm <sup>2</sup> )
				(95% Confidence Level)	
570	347	347	5792	1341	1860
571	141	141	-488	1031	1860
586	74	74	-2530	908	1860
587	102	102	-1077	962	1860
588	240	240	2530	1190	1860
589	122	122	-1067	998	1860
591	145	145	-386	1038	1860
595	60	60	-2957	880	1860
596	68	68	-2713	896	1860
598	117	117	-1219	989	1860

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: <u>2</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- Northwest Corner of Containment</u>		2 for direct beta/gamma
Date	<u>10/9/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>52823</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>11150</u>		
MDA	<u>1860</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-4695</u>
$n_s$ =	<u>10</u>
$x_{avg}$ =	<u>-470</u>
Maximum value in population =	<u>5792</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-470</u>
$n_s$ =	<u>10</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>66057861</u>
$s_x$ =	<u>2709</u>

## Calculation Sheet

Survey Unit: Ground Floor- Northwest Corner of Containment  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$	=	<u>-470</u>
$t_{1-\alpha, df}$	=	<u>1.833</u>
$s_x$	=	<u>2709</u>
$n_s$	=	<u>10</u>
$\mu_{\alpha}$	=	<u>1100</u>

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

*Pat Lyr*

Date: 1/6/98

Reviewed by:

*[Signature]*

Date: 1/8/98

# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Northwest Corner of Containment  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
570	0	13
571	0	13
586	0	13
587	0	13
588	0	13
589	0	13
591	0	13
595	0	13
596	0	13
598	0	13

Individual Completing Form:

Reviewed By:

Date:

Date:



# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor- Northwest Corner of Containment  
Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
570	3	17
571	0	17
586	0	17
587	5	17
588	0	17
589	1	17
591	0	17
595	3	17
596	1	17
598	1	17

Individual Completing Form: *Steve Lyy*

Reviewed By: *[Signature]*

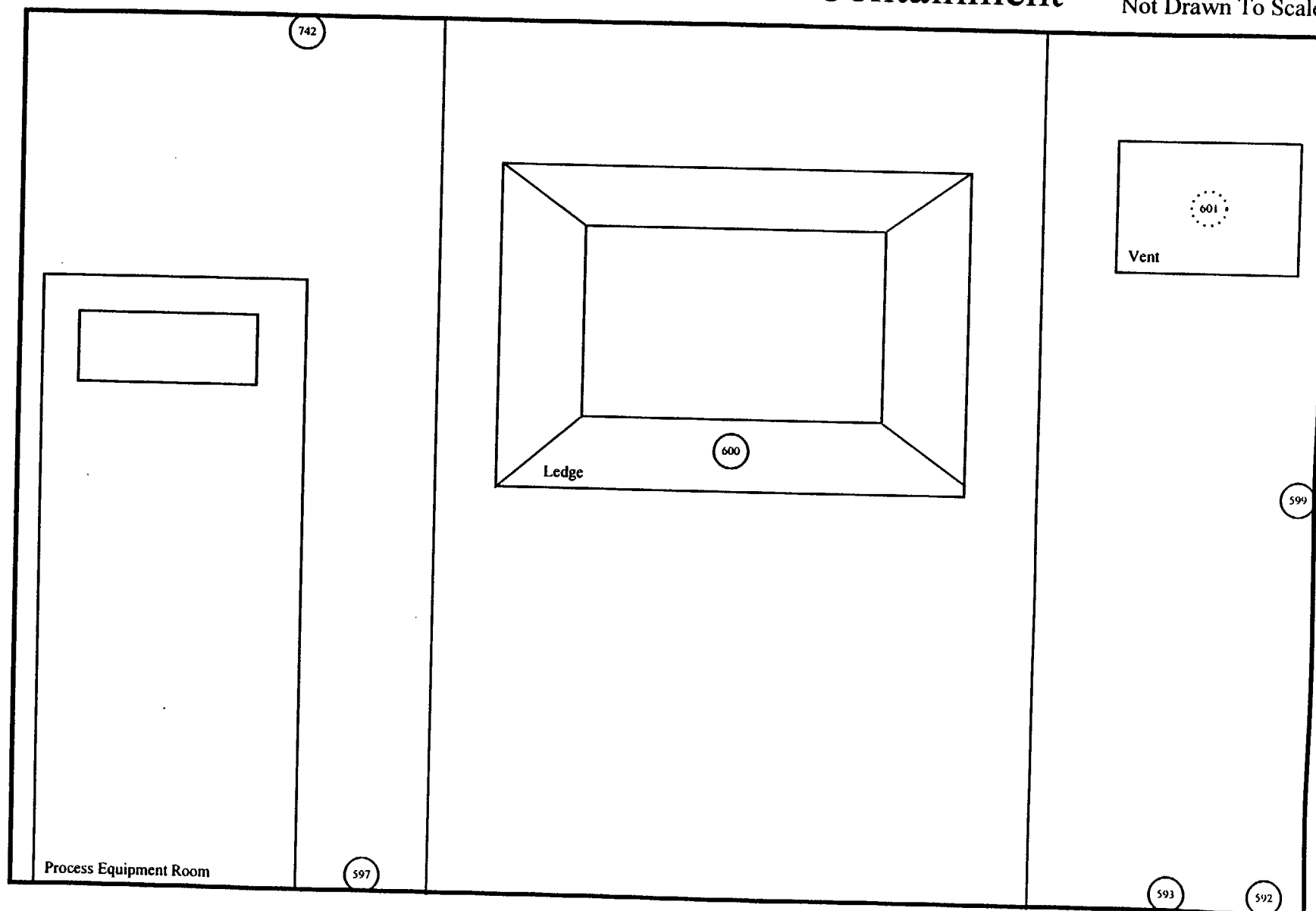
Date: 1/6/98

Date: 1/5/98

# Ground Floor Floor- West Corner of Containment

Elevation View  
Not Drawn To Scale

E-54



○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_s)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- West Corner of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2221  
SERIAL #: 50062  
PROBE #: AC-3  
SERIAL #: 408951  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 7.70%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 289

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 157  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 157  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1860

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 9:50  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 9:50  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 1/6/98

Date: 1/5/98

Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- West Corner of Containment  
 Date: 10/9/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: L2221 Serial #: 50062  
 Probe: AC-3 Serial #: 408951

Efficiency: 7.70%  
 MDA: 289

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
592	5	5	0	136	289
593	4	4	-22	129	289
597	0	0	-110	96	289
599	0	0	-110	96	289
600	0	0	-110	96	289
601	9	9	88	161	289
742	0	0	-110	96	289

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Ground Floor- West Corner of Containment

Date 10/9/97

Meter L2221

Serial # 50062

Probe AC-3

Serial # 408951

MDA 289

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -374  
 $n_s =$  7  
 $x_{avg} =$  -53  
 Maximum value in population = 88 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -53  
 $n_s =$  7  
 $\Sigma(x_{avg} - x_i)^2 =$  36647  
 $s_x =$  78

## Calculation Sheet

Survey Unit: Ground Floor- West Corner of Containment  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = -53  
 $t_{1-\alpha, df}$  = 1.943  
 $s_x$  = 78  
 $n_s$  = 7  
 $\mu_{\alpha}$  = 4

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: 

Date: 1/6/98

Reviewed by: 

Date: 1/5/98

## Direct Beta-Gamma Data Sheet

Survey Type 2  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit (Location) Ground Floor- West Corner of Containment  
 Date 10.9.97

## Notes

- 1) Place total counts directly from meter. Activity column will correct for background.  
 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model 2220  
 Probe 44-9

Serial # 52823  
 Serial # 11150

Efficiency 21.87%  
 MDA 1860

NT=None Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
592	194	194	1128	1119	1860
593	872	872	21795	1917	1860
597	238	238	2469	1187	1860
599	162	162	152	1067	1860
600	234	234	2347	1181	1860
601	114	114	-1311	984	1860
742	NT				

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- West Corner of Containment

Date 10/9/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1860

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  26580  
 $n_s =$  6  
 $x_{avg} =$  4430  
 Maximum value in population = 21795 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  4430  
 $n_s =$  6  
 $\Sigma(x_{avg} - x_i)^2 =$  391516104  
 $s_x =$  8849



## Calculation Sheet

Survey Unit: Ground Floor- West Corner of Containment  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha,df} [s_x/(n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha,df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 4430  
 $t_{1-\alpha,df}$  = 2.015  
 $s_x$  = 8849  
 $n_s$  = 6  
 $\mu_{\alpha}$  = 11709

\*Note: for values of  $t_{1-\alpha,df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Date*

Date: 1/6/98

Reviewed by: *Gerard M. Toumey*

Date: 1/13/98

# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor - West Corner of Containment  
 Date: 10/10/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

## Instrument

Model: LB 5100 W

Serial #: 13795

Efficiency: 28.35%

Probe: N/A

Serial #: N/A

MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
592	3	13
593	0	13
597	0	13
599	0	13
600	0	13
601	0	13
742	0	13

Individual Completing Form: *Pat Fyr*

Reviewed By: *[Signature]*

Date: 1/6/98

Date: 1/8/98

## Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor- West Corner of Containment  
Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
(2) Information for instrument and background taken directly from the MDA spreadsheet

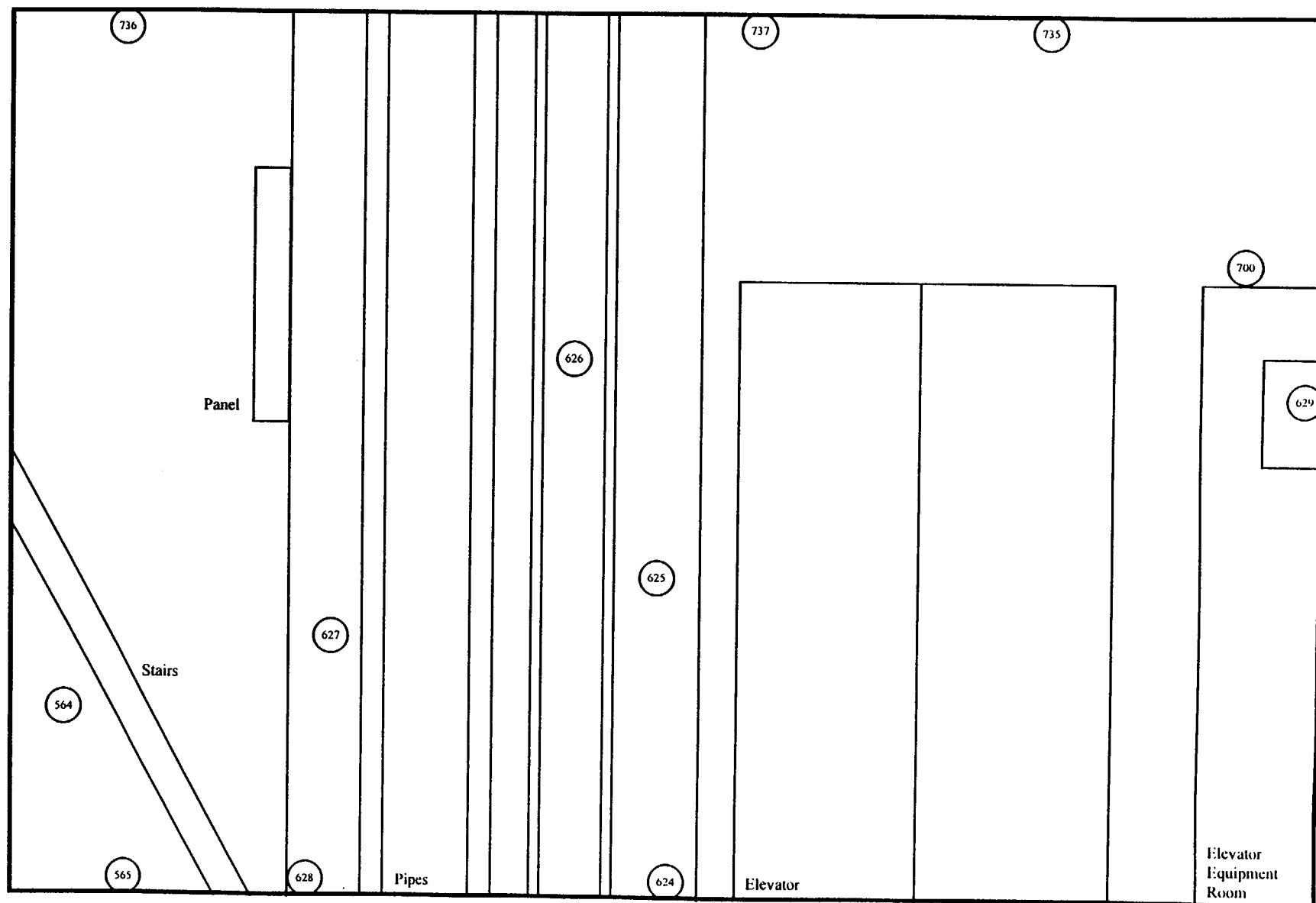
Instrument  
Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
592	0	17
593	5	17
597	1	17
599	1	17
600	3	17
601	0	17
742	3	17

Individual Completing Form: *[Signature]*Reviewed By: *[Signature]*Date: 1/6/98Date: 1/13/98

# Ground Floor- North Wall of Containment

Elevation View  
Not Drawn To Scale



E-64

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)}{e(a/100)}^{1/2}$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- North Wall of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2221  
SERIAL #: 50062  
PROBE #: AC-3  
SERIAL #: 408951  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 7.70%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 289

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 157  
Date background was taken = 10/9/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 157  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1860

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 10:26  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 10:26  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: [Signature]  
Reviewed By: [Signature]

Date: 12/23/97  
Date: 1/5/98

Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- North Wall of Containment  
 Date: 10/9/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: \_\_\_\_\_  
 Model: L2221 Serial #: 50062 Efficiency: 7.70%  
 Probe: AC-3 Serial #: 408951 MDA: 289

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
564	4	4	-22	129	289
565	5	5	0	136	289
624	6	6	22	143	289
625	4	4	-22	129	289
626	5	5	0	136	289
627	4	4	-22	129	289
628	2	2	-66	114	289
629	7	7	44	149	289
700	2	2	-66	114	289
735	3	3	-44	122	289
736	2	2	-66	114	289
737	0	0	-110	96	289

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Ground Floor- North Wall of Containment

Date 10/9/97

Meter L2221

Serial # 50062

Probe AC-3

Serial # 408951

MDA 289

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -352  
 $n_s =$  12  
 $x_{avg} =$  -29  
 Maximum value in population = 44 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -29  
 $n_s =$  12  
 $\Sigma(x_{avg} - x_i)^2 =$  20652  
 $s_x =$  43

## Calculation Sheet

Survey Unit: Ground Floor- North Wall of Containment  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-29</u>
$t_{1-\alpha, df}$ =	<u>1.796</u>
$s_x$ =	<u>43</u>
$n_s$ =	<u>12</u>
$\mu_{\alpha}$ =	<u>-7</u>

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

*Pat Lipp*

Date: 12/23/97

Reviewed by:

*[Signature]*

Date: 1/8/98



## Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit Location: Ground Floor North Wall of Containment  
 Date: 10.9.97

## Notes

- 1) Place total counts directly from meter. Activity column will correct for background.  
 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument:  
 Model: L2220  
 Probe: 44-9

Serial #: 52823  
 Serial #: 11150

Efficiency: 21.87%  
 MDA: 1860

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
564	207	207	1524	1140	1860
565	199	199	1280	1127	1860
624	210	210	1616	1145	1860
625	96	96	-1859	950	1860
626	150	150	-213	1047	1860
627	82	82	-2286	924	1860
628	192	192	1067	1116	1860
629	96	96	-1859	950	1860
700	88	88	-2103	935	1860
735	102	102	-1677	962	1860
736	100	100	-1738	958	1860
737	110	110	-1433	976	1860

Individual Completing Form:

Reviewed By:

*Pat Foy*  
*Bernard M. Tourney*

Date:

Date:

*1/6/98*  
*1/13/98*

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- North Wall of Containment

Date 10/9/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1860

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm<sup>2</sup>)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -7681  
 $n_s =$  12  
 $x_{avg} =$  -640  
 Maximum value in population = 1616 (dpm/100 cm<sup>2</sup>)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$S_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -640  
 $n_s =$  12  
 $\Sigma(x_{avg} - x_i)^2 =$  27286439  
 $S_x =$  1575

## Calculation Sheet

Survey Unit: Ground Floor- North Wall of Containment  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = -640

$t_{1-\alpha, df}$  = 1.796

$s_x$  = 1575

$n_s$  = 12

$\mu_{\alpha}$  = 177

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Dave Lipp*

Date: 1/6/98

Reviewed by: *Gerard M. Tormey*

Date: 1/13/98

Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor North Wall of Containment  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
564	0	13
565	0	13
624	0	13
625	0	13
626	0	13
627	0	13
628	0	13
629	0	13
700	0	13
735	0	13
736	0	13
737	0	13

Individual Completing Form:

Reviewed By:

Date:

Date:

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- North Wall of Containment  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
564	7	17
565	0	17
624	0	17
625	3	17
626	0	17
627	1	17
628	1	17
629	12	17
700	5	17
735	1	17
736	0	17
737	0	17

Individual Completing Form: Pat Perry

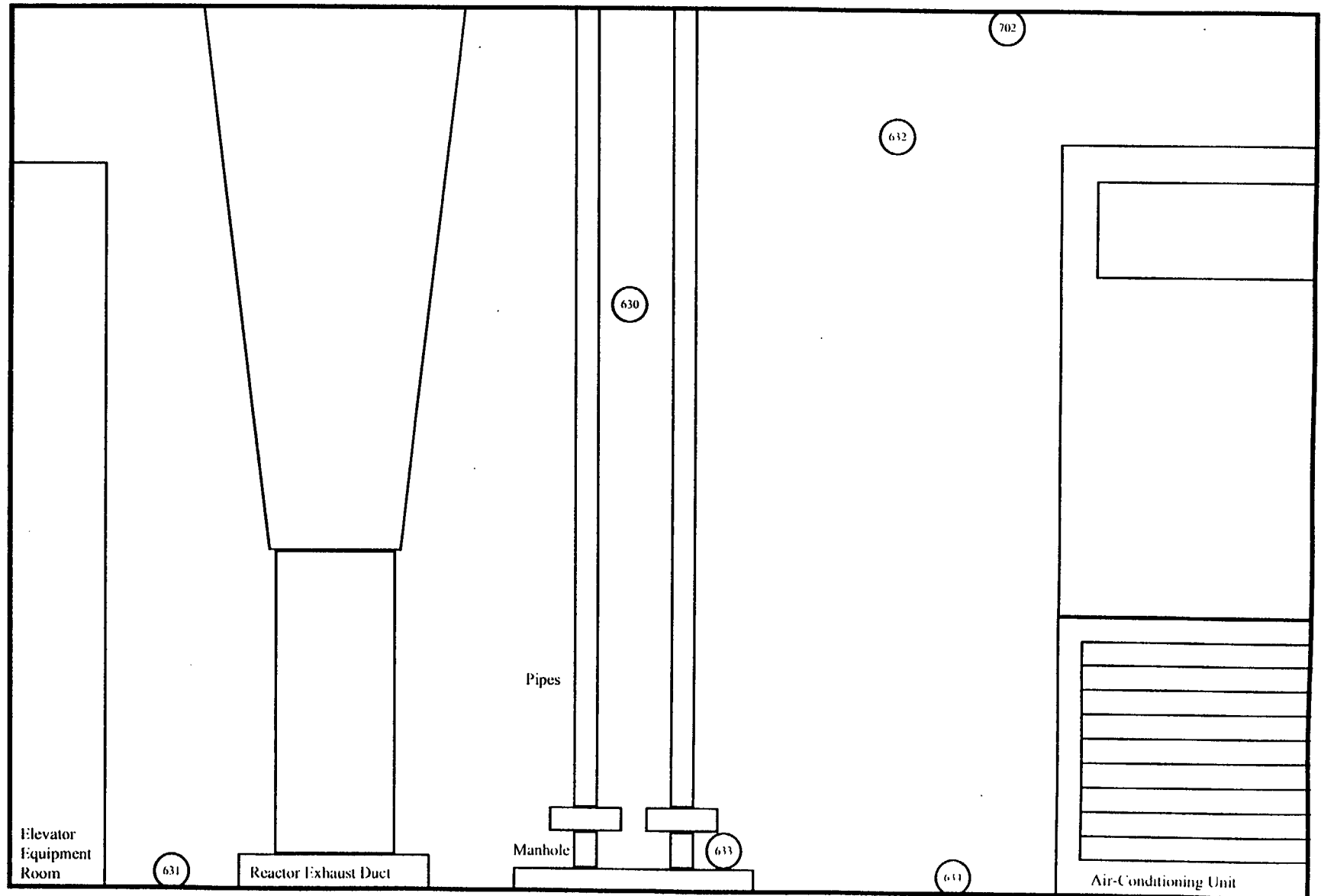
Reviewed By: [Signature]

Date: 1/8/98

Date: 1/8/98

# Ground Floor- East Wall of Containment

Elevation View  
Not Drawn To Scale



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_b/T_s)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- East Wall of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 156  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 156  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1854

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 12:31  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 12:31  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Title: Georgia Tech Characterization Survey  
 Project Title: Ground Floor- East Wall of Containment  
 Survey Unit Location: 10-10-97  
 Date: 10-10-97

## Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: Model: L2220 Serial #: 50061  
 Probe: 43-65 Serial #: 63291

Efficiency: 18.00%  
 MDA: 1:6

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
630	3	3	-18	49	116
631	4	4	-9	52	116
632	4	4	-9	52	116
633	6	6	9	57	116
634	2	2	-26	46	116
702	3	3	-18	49	116

Individual Completing Form:

Reviewed By:

*Pat Fyfe*  
*Gerard M. Journey*

Date:

Date:

*1/5/98*

*1/13/98*



# Calculation Sheet

SURVEY TYPE: <u>1</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- East Wall of Containment</u>		2 for direct beta/gamma
Date	<u>10/10/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>116</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-71</u>
$n_s$ =	<u>6</u>
$x_{avg}$ =	<u>-12</u>
Maximum value in population =	<u>9</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-12</u>
$n_s$ =	<u>6</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>727</u>
$s_x$ =	<u>12</u>

## Calculation Sheet

Survey Unit: Ground Floor- East Wall of Containment  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$ =	<u>-12</u>	
$t_{1-\alpha, \text{df}}$ =	<u>2.015</u>	*Note: for values of $t_{1-\alpha, \text{df}}$ not on the table, the nearest greater value is used
$s_x$ =	<u>12</u>	
$n_s$ =	<u>6</u>	
$\mu_{\alpha}$ =	<u>-2</u>	

Individual Completing Form: *[Signature]*

Date: 1/5/98

Reviewed by: *[Signature]*

Date: 1/12/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor East Wall of Containment  
 Date: 10/10/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: L2220  
 Model: 44.9  
 Probe: 10/10/97

Serial #: 52823  
 Serial #: 11150

Efficiency: 21.87%  
 MDA: 1854

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
630	60	60	-2928	878	1854
631	132	132	-732	1014	1854
632	84	84	-27195	928	1854
633	138	138	-549	1024	1854
634	92	92	-1951	941	1854
702	56	56	-3048	870	1854

Individual Completing Form:

Reviewed By:

*[Signature]*

Date:

11/5/98

Date:

11/5/98

# Calculation Sheet

SURVEY TYPE: <u>2</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- East Wall of Containment</u>		2 for direct beta/gamma
Date	<u>10/10/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>52823</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>11150</u>		
MDA	<u>1854</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm <sup>2</sup> )		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-11401</u>
$n_s$ =	<u>6</u>
$x_{avg}$ =	<u>-1900</u>
Maximum value in population =	<u>-549</u> (dpm/100 cm <sup>2</sup> )

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-1900</u>
$n_s$ =	<u>6</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>5849631</u>
$s_x$ =	<u>1063</u>

## Calculation Sheet

Survey Unit: Ground Floor- East Wall of Containment  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg} =$  -1900

$t_{1-\alpha, df} =$  2.015

$s_x =$  1063

$n_s =$  6

$\mu_{\alpha} =$  -1026

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

Patricia Ryp

Date: 1/5/98

Reviewed by:

[Signature]

Date: 1/5/98

# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor, East Wall of Containment  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
630	0	13
631	0	13
632	0	13
633	0	13
634	0	13
702	0	13

Individual Completing Form:

Reviewed By:

Date:

Date:

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor- East Wall of Containment  
Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
630	7	17
631	3	17
632	5	17
633	0	17
634	1	17
702	5	17

Individual Completing Form:

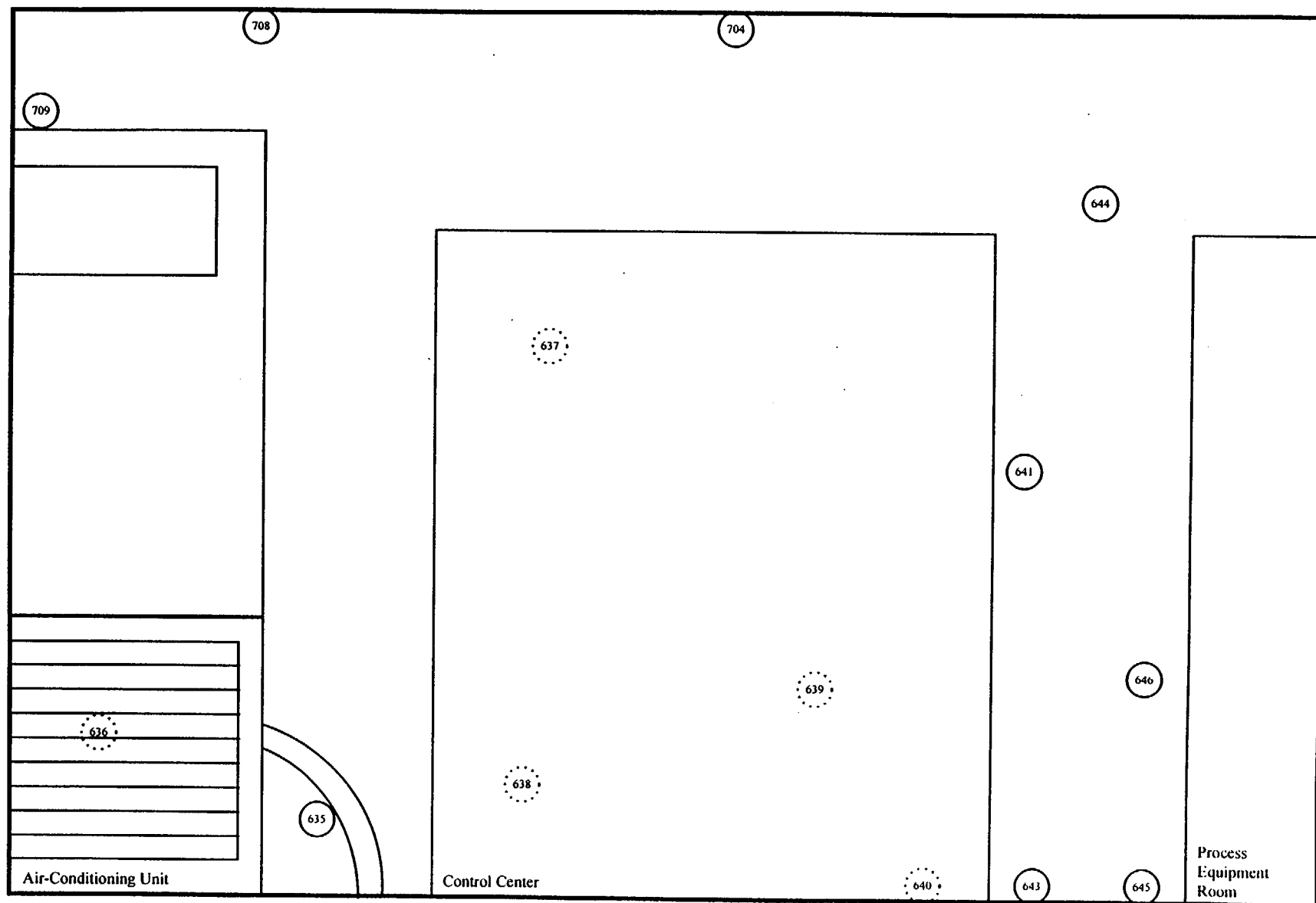
Reviewed By:

Date:

Date:

# Ground Floor- Southeast Wall of Containment

Elevation View  
Not Drawn To Scale



○ Survey Location

○ Survey Locations  
Behind Figure



# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_w/T_s)}{e(a/100)} \cdot 2$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- Southeast Wall of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 156  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 156  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1854

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 12:31  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 12:31  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor Southeast Wall of Containment  
 Date: 10/10/97

Notes:  
 1) Place total counts directly from meter. Activity column will correct for background.  
 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: L2220 Serial #: 50061  
 Model: 43-65 Serial #: 63291  
 Efficiency: 18.00%  
 MDA: 116

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
635	5	5	0	55	116
636	7	7	18	60	116
637	8	8	26	62	116
638	3	3	-18	49	116
639	3	3	-18	49	116
640	2	2	-26	46	116
641	5	5	0	55	116
643	2	2	-26	46	116
644	12	12	62	71	116
645	5	5	0	55	116
646	7	7	18	60	116
704	1	1	-35	42	116
708	0	0	-44	39	116
709	1	1	-35	42	116

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: <u>1</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- Southeast Wall of Containment</u>		2 for direct beta/gamma
Date	<u>10/10/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>116</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$	<u>-78</u>
$n_s =$	<u>14</u>
$x_{avg} =$	<u>-6</u>
Maximum value in population =	<u>62</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$x_{avg} =$	<u>-6</u>
$n_s =$	<u>14</u>
$\Sigma(x_{avg} - x_i)^2 =$	<u>11122</u>
$s_x =$	<u>29</u>

## Calculation Sheet

Survey Unit: Ground Floor- Southeast Wall of Containment  
 Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

- $\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level
- $x_{avg}$  = calculated mean for a survey unit
- $t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)
- $s_x$  = standard deviation of measurements in a survey unit
- $n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-6</u>	
$t_{1-\alpha, df}$ =	<u>1.771</u>	*Note: for values of $t_{1-\alpha, df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>29</u>	
$n_s$ =	<u>14</u>	
$\mu_{\alpha}$ =	<u>8</u>	

Individual Completing Form:

*Pat J. J.*

Date:

1/5/93

Reviewed by:

*Gerard M. Torrey*

Date:

1/13/93

# Direct Beta-Gamma Data Sheet

Survey Type  
Project Title  
Survey Unit (Location)  
Date

2  
Georgia Tech Characterization Survey  
Ground Floor Southeast Wall of Containment  
10/10/97

Notes

(1) Place total counts directly from meter. Activity column will correct for background  
(2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument

Model: L2220

Probe: 44-9

Serial #: 52823

Serial #: 11150

Efficiency: 21.87%

MDA: 1854

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
635	54	54	-3109	866	1854
636	88	88	-2073	933	1854
637	126	126	-914	1003	1854
638	70	70	-2622	898	1854
639	132	132	-732	1014	1854
640	110	110	-1402	974	1854
641	102	102	-1646	960	1854
643	76	76	-2439	910	1854
644	114	114	-1280	982	1854
645	228	228	2195	1171	1854
646	202	202	1402	1130	1854
704	102	102	-1646	960	1854
708	88	88	-2073	933	1854
709	104	104	-1585	963	1854

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- Southeast Wall of Containment

Date 10/10/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1854

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm<sup>2</sup>)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$$\Sigma(x_i) = \underline{\underline{-17924}}$$

$$n_s = \underline{\underline{14}}$$

$$x_{avg} = \underline{\underline{-1280}}$$

$$\text{Maximum value in population} = \underline{\underline{2195}} \text{ (dpm/100 cm}^2\text{)}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$$x_{avg} = \underline{\underline{-1280}}$$

$$n_s = \underline{\underline{14}}$$

$$\Sigma(x_{avg} - x_i)^2 = \underline{\underline{27826014}}$$

$$s_x = \underline{\underline{1463}}$$

## Calculation Sheet

Survey Unit: Ground Floor- Southeast Wall of Containment  
 Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = -1280  
 $t_{1-\alpha, df}$  = 1.771  
 $s_x$  = 1463  
 $n_s$  = 14  
 $\mu_{\alpha}$  = -588

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

Date HVR

Date: 1/5/98

Reviewed by:

Gerard M. Toumey

Date: 1/13/98

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor Southeast Wall of Containment  
 Date: 10/10/97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
635	1	17
636	1	17
637	0	17
638	1	17
639	1	17
640	1	17
641	1	17
643	0	17
644	0	17
645	3	17
646	0	17
704	0	17
708	5	17
709	0	17

Individual Completing Form: [Signature]

Reviewed By: [Signature]

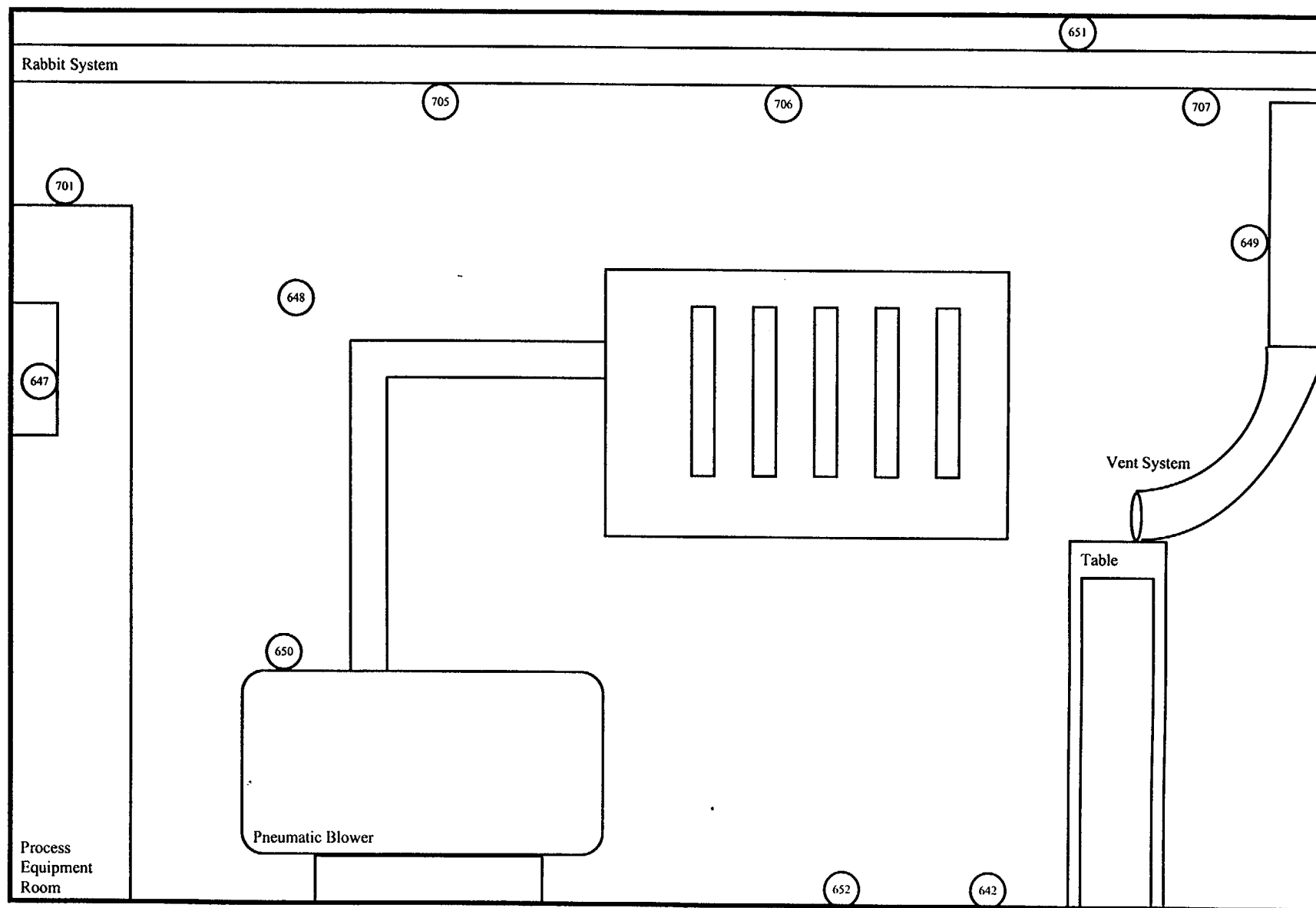
Date: 1/15/98

Date: 1/13/98



# Ground Floor- Southeast Corner of Containment

Elevation View  
Not Drawn To Scale



○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)}{e(a/100)}^{1/2}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- Southeast Corner of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 156  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 156  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1854

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 10:26  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 10:26  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: Pat P

Reviewed By: David M. Lounney

Date: 4/8/98

Date: 4/8/98

# Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Southeast Corner of Containment  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument

Model: L2220

Probe: 43-65

Serial #: 50061

Serial #: 63291

Efficiency: 18.00%

MDA: 116

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty	MDA
				(95% Confidence Level) (dpm/100 cm <sup>2</sup> )	
642	6	6	9	57	116
647	55	55	441	134	116
648	3	3	-18	49	116
649	15	15	88	77	116
650	41	41	317	117	116
651	21	21	141	88	116
652	3	3	-18	49	116
701	2	2	-26	46	116
705	6	6	9	57	116
706	4	4	-9	52	116
707	3	3	-18	49	116

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: <u>1</u>		Input one of the following
Survey Unit	<u>Ground Floor- Southeast Corner of Containment</u>	1 for direct alpha
Date	<u>10/10/97</u>	2 for direct beta/gamma
Meter	<u>L2220</u>	3 for removable alpha
Serial #	<u>50061</u>	4 for removable beta/gamma
Probe	<u>43-65</u>	5 for exposure data at 1 cm
Serial #	<u>63291</u>	6 for exposure data at 1 meter
MDA	<u>116</u>	
Survey Type	<u>Direct Alpha</u>	
Guideline Value	<u>100</u> (dpm/100 cm2)	

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>916</u>
$n_s$ =	<u>11</u>
$x_{avg}$ =	<u>83</u>
Maximum value in population =	<u>441</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>83</u>
$n_s$ =	<u>11</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>248209</u>
$s_x$ =	<u>158</u>

## Calculation Sheet

Survey Unit: Ground Floor- Southeast Corner of Containment  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$ =	<u>83</u>	
$t_{1-\alpha, \text{df}}$ =	<u>1.812</u>	*Note: for values of $t_{1-\alpha, \text{df}}$ not on the table, the nearest greater value is used
$s_x$ =	<u>158</u>	
$n_s$ =	<u>11</u>	
$\mu_{\alpha}$ =	<u>169</u>	

Individual Completing Form: *Patricia J. P.*

Date: 4/8/98

Reviewed by: *Bernard M. Toumey*

Date: 4/8/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Southeast Corner of Containment  
 Date: 10/10/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

## Instrument

Model: L2220  
 Probe: 44-9

Serial #: 52823  
 Serial #: 11150

Efficiency: 21.87%  
 MDA: 1854

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
642	642	642	14815	1688	1854
647	148	148	-244	1042	1854
648	128	128	-854	1007	1854
649	70	70	-2622	898	1854
650	180	180	732	1095	1854
651	88	88	-2073	933	1854
652	92	92	-1951	941	1854
701	74	74	-2500	906	1854
705	110	110	-1402	974	1854
706	96	96	-1829	948	1854
707	84	84	-2195	926	1854

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: <u>2</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- Southeast Corner of Containment</u>		2 for direct beta/gamma
Date	<u>10/10/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>52823</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>11150</u>		
MDA	<u>1854</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\sum(x_i)$ =	<u>-123</u>
$n_s$ =	<u>11</u>
$x_{avg}$ =	<u>-11</u>
Maximum value in population =	<u>14815</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-11</u>
$n_s$ =	<u>11</u>
$\sum(x_{avg} - x_i)^2$ =	<u>252165010</u>
$s_x$ =	<u>5022</u>

## Calculation Sheet

Survey Unit: Ground Floor- Southeast Corner of Containment

Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha,df} [s_x/(n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha,df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg} =$  -11

$t_{1-\alpha,df} =$  1.812

$s_x =$  5022

$n_s =$  11

$\mu_{\alpha} =$  2732

\*Note: for values of  $t_{1-\alpha,df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Patricia L. [Signature]*

Date: 4/8/98

Reviewed by: *Edward M. [Signature]*

Date: 4/8/98



# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Southeast Corner of Containment  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

## Instrument

Model: LB 5100 W

Serial #: 13795

Efficiency: 28.35%

Probe: N/A

Serial #: N/A

MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
642	0	13
647	0	13
648	0	13
649	0	13
650	0	13
651	0	13
652	0	13
701	0	13
705	0	13
706	0	13
707	3	13

Individual Completing Form:

Reviewed By:

Date:

Date:

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Southeast Corner of Containment  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

## Instrument

Model: LB 5100 W

Serial #: 13795

Efficiency: 43.45%

Probe: N/A

Serial #: N/A

MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
642	1	17
647	12	17
648	1	17
649	10	17
650	3	17
651	0	17
652	1	17
701	0	17
705	1	17
706	0	17
707	10	17

Individual Completing Form:

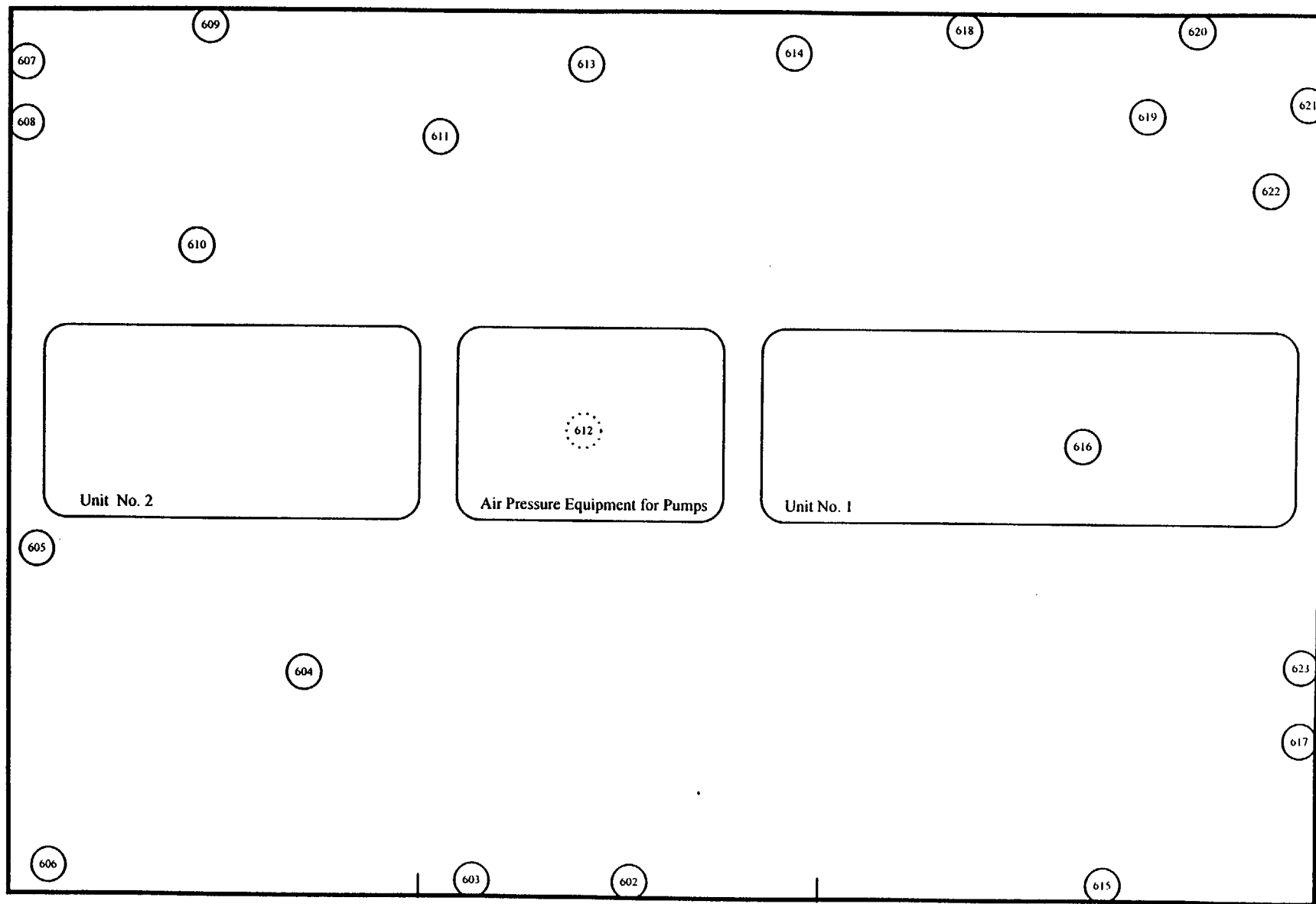
Reviewed By:

Date:

Date:

# Ground Floor- Pump Room

Top View  
Not Drawn To Scale



E-104

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)}{e(a/100)}^{1/2}$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- Pump Room

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 156  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 156  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1854

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 15:03  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 15:03  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

## Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit/Location: Ground Floor- Pump Room  
 Date: 10/10/97

## Notes

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument:  
 Model: L2220 Serial #: 50061  
 Probe: 43-65 Serial #: 63291

Efficiency: 18.00%  
 MDA: 116

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
602	4	4	-9	52	116
603	4	4	-9	52	116
604	7	7	18	60	116
605	7	7	18	60	116
606	4	4	-9	52	116
607	5	5	0	55	116
608	7	7	18	60	116
609	7	7	18	60	116
610	10	10	44	67	116
611	4	4	-9	52	116
612	4	4	-9	52	116
613	0	0	-44	39	116
614	0	0	-44	39	116
615	12	12	62	71	116
616	2	2	-26	46	116
617	4	4	-9	52	116
618	1	1	-35	42	116
619	2	2	-26	46	116
620	2	2	-26	46	116
621	0	0	-44	39	116
622	7	7	18	60	116
623	7	7	18	60	116

Individual Completing Form:

Reviewed By:

Date: 12/23/97Date: 1/13/98

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Ground Floor- Pump Room

Date 10/10/97

Meter L2220

Serial # 50061

Probe 43-65

Serial # 63291

MDA 116

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$$\Sigma(x_i) = \underline{\underline{-85}}$$

$$n_s = \underline{\underline{22}}$$

$$x_{avg} = \underline{\underline{-4}}$$

$$\text{Maximum value in population} = \underline{\underline{62}} \text{ (dpm/100 cm2)}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$$x_{avg} = \underline{\underline{-4}}$$

$$n_s = \underline{\underline{22}}$$

$$\Sigma(x_{avg} - x_i)^2 = \underline{\underline{16943}}$$

$$s_x = \underline{\underline{28}}$$

## Calculation Sheet

Survey Unit: Ground Floor- Pump Room  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha,df} [s_x/(n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha,df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = -4  
 $t_{1-\alpha,df}$  = 1.721  
 $s_x$  = 28  
 $n_s$  = 22  
 $\mu_{\alpha}$  = 6

\*Note: for values of  $t_{1-\alpha,df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Rate Lopez*

Date: 12/23/97

Reviewed by: *Gerard M. Courtney*

Date: 1/13/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor Pump Room  
 Date: 10/10/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: L2220  
 Probe: 44-9

Serial #: 52823  
 Serial #: 11150

Efficiency: 21.87%  
 MDA: 1854

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
602	96	96	-1829	948	1854
603	118	118	-1158	989	1854
604	196	196	1219	1121	1854
605	188	188	975	1108	1854
606	138	138	-549	1024	1854
607	62	62	-2865	882	1854
608	172	172	488	1082	1854
609	118	118	-1158	989	1854
610	134	134	-871	1017	1854
611	100	100	-1707	956	1854
612	102	102	-1646	960	1854
613	182	182	793	1098	1854
614	218	218	1890	1155	1854
615	182	182	793	1098	1854
616	208	208	1585	1140	1854
617	354	354	6036	1349	1854
618	216	216	1829	1152	1854
619	224	224	2073	1165	1854
620	410	410	7743	1421	1854
621	390	390	7133	1396	1854
622	408	408	7682	1419	1854
623	492	492	10242	1521	1854

Individual Completing Form:

Reviewed By:

Date:

Date:



# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- Pump Room

Date 10/10/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1854

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  38898  
 $n_s =$  22  
 $x_{avg} =$  1768  
 Maximum value in population = 10242 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  1768  
 $n_s =$  22  
 $\Sigma(x_{avg} - x_i)^2 =$  280673046  
 $s_x =$  3656

## Calculation Sheet

Survey Unit: Ground Floor- Pump Room  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg} =$  1768

$t_{1-\alpha, df} =$  1.721

$s_x =$  3656

$n_s =$  22

$\mu_{\alpha} =$  3109

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

Rate Lopez

Date: 12/23/97

Reviewed by:

[Signature]

Date: 1/8/98

# Removable Alpha Data Sheet

Survey Type 3  
Project Title Georgia Tech Characterization Survey  
Survey Unit (Location) Ground Floor Pump Room  
Date 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
(2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
Model LB 5100 W Serial #: 13795 Efficiency 28.35%  
Probe N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
602	0	13
603	0	13
604	0	13
605	0	13
606	0	13
607	0	13
608	0	13
609	0	13
610	0	13
611	0	13
612	0	13
613	0	13
614	0	13
615	0	13
616	0	13
617	3	13
618	0	13
619	0	13
620	0	13
621	0	13
622	0	13
623	0	13

Individual Completing Form:

Reviewed By:

Date:

Date:

*Pat [Signature]*  
*Reinal M. Touney*

*1/13/98*

*1/13/93*

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor Pump Room  
Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
(2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
602	0	17
603	1	17
604	3	17
605	1	17
606	5	17
607	0	17
608	5	17
609	0	17
610	1	17
611	7	17
612	12	17
613	5	17
614	3	17
615	0	17
616	0	17
617	3	17
618	3	17
619	5	17
620	0	17
621	0	17
622	1	17
623	1	17

Individual Completing Form:

Reviewed By:

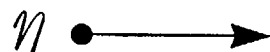
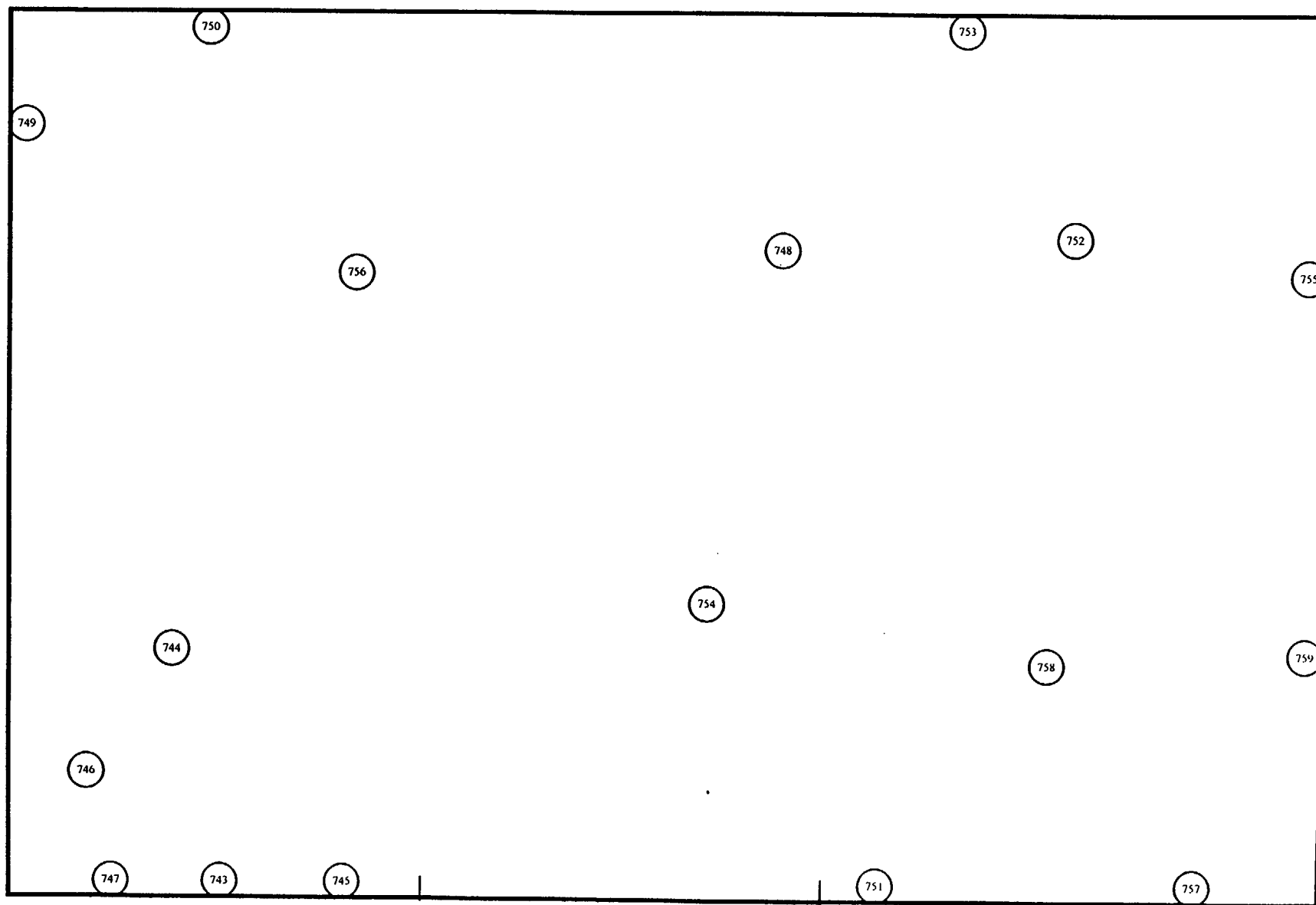
Date:

Date:

# Ground Floor- Pump Room

Ceiling  
Not Drawn To Scale

E-114



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)}{e(a/100)}$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- Pump Room, Ceiling

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63  
  
MDA (dpm/100 cm<sup>2</sup>) = 116

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 156  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 156  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15  
  
MDA (dpm/100 cm<sup>2</sup>) = 1854

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 15:03  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100  
  
MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 15:03  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100  
  
MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: State FRT

Reviewed By: Richard M. Torrey

Date: 12/30/97

Date: 1/13/98

# Direct Alpha Data Sheet

Survey Type: 1  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor Pump Room Ceiling  
Date: 10/10/97

## Notes

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument:  
Model: L2220      Serial #: 50061  
Probe: 43-65      Serial #: 63291

Efficiency: 8.00%  
MDA: 1.6

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
743	2	2	-26	46	116
744	2	2	-26	46	116
745	2	2	-26	46	116
746	3	3	-18	49	116
747	1	1	-35	42	116
748	0	0	-44	39	116
749	3	3	-18	49	116
750	2	2	-26	46	116
751	0	0	-44	39	116
752	2	2	-26	46	116
753	3	3	-18	49	116
754	4	4	-9	52	116
755	2	2	-26	46	116
756	2	2	-26	46	116
757	4	4	-9	52	116
758	6	6	9	57	116
759	0	0	-44	39	116

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Ground Floor- Pump Room, Ceiling

Date 10/10/97

Meter L2220

Serial # 50061

Probe 43-65

Serial # 63291

MDA 116

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -412  
 $n_s =$  17  
 $x_{avg} =$  -24  
 Maximum value in population = 9 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -24  
 $n_s =$  17  
 $\Sigma(x_{avg} - x_i)^2 =$  2996  
 $s_x =$  14



## Calculation Sheet

Survey Unit: Ground Floor- Pump Room, Ceiling  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for  $n-1$  degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-24</u>
$t_{1-\alpha, df}$ =	<u>1.746</u>
$s_x$ =	<u>14</u>
$n_s$ =	<u>17</u>
$\mu_{\alpha}$ =	<u>-18</u>

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

Pat FVR

Date:

12/30/97

Reviewed by:

General M. Tormey

Date:

1/13/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit/Location: Ground Floor Pump Room Ceiling  
 Date: 10.10.97

## Notes

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: \_\_\_\_\_  
 Model: L2220 Serial #: 52823  
 Probe: 44-9 Serial #: 11150

Efficiency: 21.87%  
 MDA: 1854

NT = None Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
743	NT				
744	318	318	4938	1301	1854
745	388	388	7072	1394	1854
746	319	319	4969	1302	1854
747	502	502	10547	1533	1854
748	194	194	1158	1118	1854
749	386	386	7011	1391	1854
750	122	122	-1036	996	1854
751	448	448	8901	1468	1854
752	318	318	4938	1301	1854
753	286	286	3963	1256	1854
754	206	206	1524	1137	1854
755	372	372	6584	1373	1854
756	126	126	-914	1003	1854
757	394	394	7255	1401	1854
758	316	316	4877	1298	1854
759	380	380	6828	1383	1854

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- Pump Room, Ceiling

Date 10/10/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1854

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm<sup>2</sup>)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  78615  
 $n_s =$  16  
 $x_{avg} =$  4913  
 Maximum value in population = 10547 (dpm/100 cm<sup>2</sup>)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  4913  
 $n_s =$  16  
 $\Sigma(x_{avg} - x_i)^2 =$  188629042  
 $s_x =$  3546

## Calculation Sheet

Survey Unit: Ground Floor- Pump Room, Ceiling  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 4913  
 $t_{1-\alpha, df}$  = 1.753  
 $s_x$  = 3546  
 $n_s$  = 16  
 $\mu_{\alpha}$  = 6467

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Dave P. J. R.*

Date: 12/30/97

Reviewed by: *Gerard M. Torrey*

Date: 1/13/98

# Removable Alpha Data Sheet

Survey Type: 3  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor Pump Room Ceiling  
Date: 10/10/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
(2) Information for instrument and background taken directly from the MOA spreadsheet.

Instrument: Model: LB 5100 W      Serial #: 13795      Efficiency: 28.35%  
Probe: N/A      Serial #: N/A      MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
743	0	13
744	0	13
745	0	13
746	0	13
747	0	13
748	0	13
749	0	13
750	0	13
751	0	13
752	0	13
753	0	13
754	0	13
755	0	13
756	0	13
757	0	13
758	0	13
759	0	13

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 12/30/97

Date: 12/30

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Pump Room- Ceiling  
 Date: 10/10/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument: Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
743	0	17
744	1	17
745	1	17
746	1	17
747	0	17
748	3	17
749	5	17
750	1	17
751	0	17
752	1	17
753	0	17
754	3	17
755	1	17
756	1	17
757	1	17
758	0	17
759	10	17

Individual Completing Form:

Reviewed By:

Date:

Date:

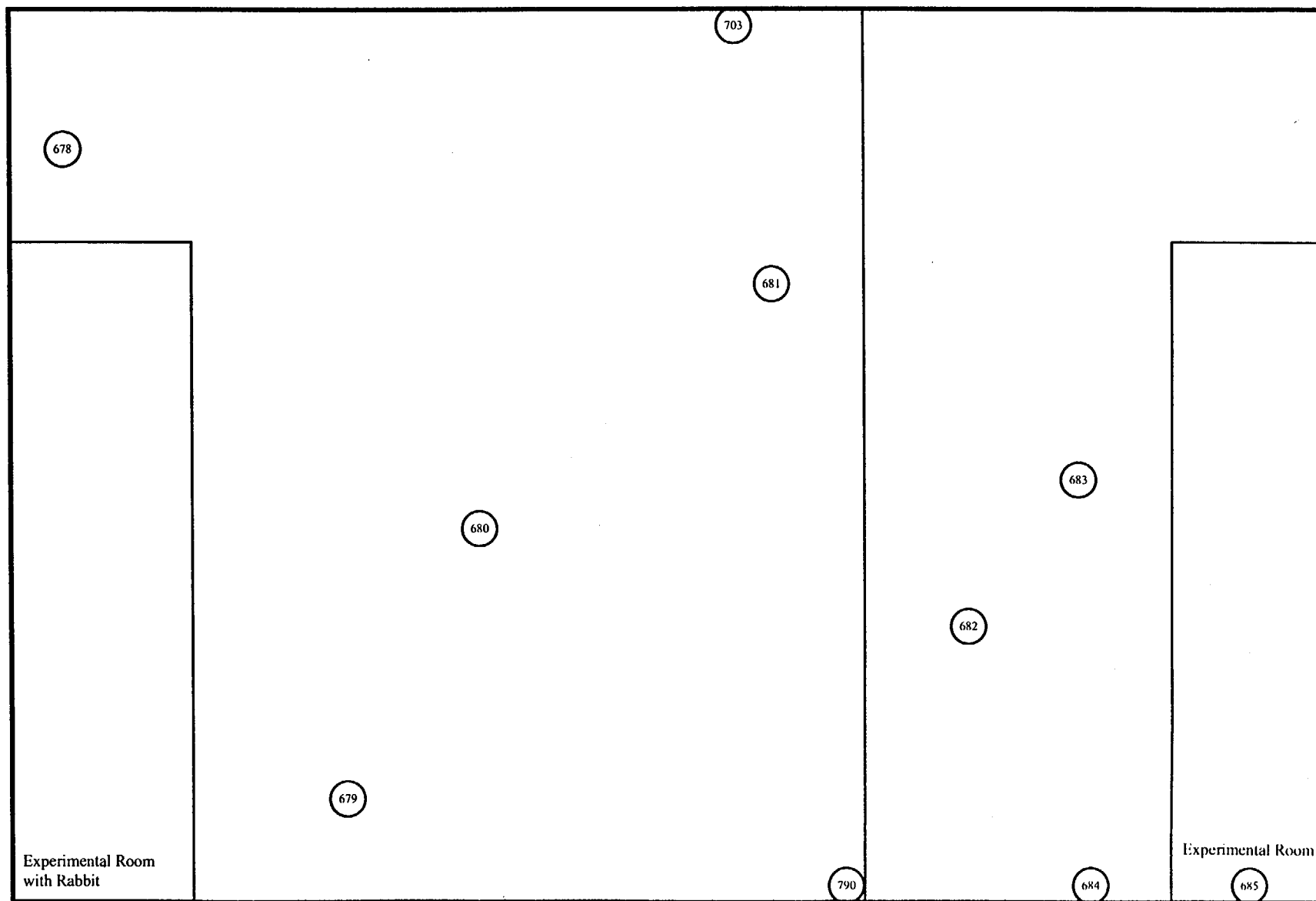
Patryk  
[Signature]

12/30/97  
1/8/98

# Ground Floor- East Wall, Outside Experimental Rooms

Elevation View  
Not Drawn To Scale

E-123



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_b/T_s)^{1/2}}{e(a/100)}$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- East Wall, Outside Experimental Rooms

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 156  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 156  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1854

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 10:26  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 10:26  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:



# Direct Alpha Data Sheet

Survey Type: 1 Notes: (1) Place total counts directly from meter. Activity column will correct for background  
 Project Title: Georgia Tech Characterization Survey (2) Information for instrument and background taken directly from the MDA spreadsheet  
 Survey Unit (Location): Ground Floor- East Wall, Outside Experimental Rooms  
 Date: 10/10/97

Instrument  
 Model: L2220 Serial #: 50061 Efficiency: 18.00%  
 Probe: 43-65 Serial #: 63291 MDA: 116

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
678	33	33	247	107	116
679	1	1	-35	42	116
680	0	0	-44	39	116
681	1	1	-35	42	116
682	5	5	0	55	116
683	4	4	-9	52	116
684	1	1	-35	42	116
685	1	1	-35	42	116
703	4	4	-9	52	116
790	1	1	-35	42	116

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: 4/9/98

Date: 4/9/99

# Calculation Sheet

SURVEY TYPE: <u>1</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- East Wall, Outside Experimental Rooms</u>		2 for direct beta/gamma
Date	<u>10/10/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>116</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\begin{aligned} \Sigma(x_i) &= \underline{10} \\ n_s &= \underline{10} \\ x_{avg} &= \underline{1} \\ \text{Maximum value in population} &= \underline{247} \text{ (dpm/100 cm2)} \end{aligned}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\begin{aligned} x_{avg} &= \underline{1} \\ n_s &= \underline{10} \\ \Sigma(x_{avg} - x_i)^2 &= \underline{69222} \\ s_x &= \underline{88} \end{aligned}$$

## Calculation Sheet

Survey Unit: Ground Floor- East Wall, Outside Experimental Rooms  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for  $n-1$  degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$ =	<u>1</u>
$t_{1-\alpha, \text{df}}$ =	<u>1.833</u>
$s_x$ =	<u>88</u>
$n_s$ =	<u>10</u>
$\mu_{\alpha}$ =	<u>52</u>

\*Note: for values of  $t_{1-\alpha, \text{df}}$  not on the table, the nearest greater value is used

Individual Completing Form:

Pat F  
David G

Date: 4/9/98

Reviewed by:

Date: 4/9/99

# Direct Beta-Gamma Data Sheet

Survey Type: 2 Notes: (1) Place total counts directly from meter. Activity column will correct for background  
 Project Title: Georgia Tech Characterization Survey (2) Information for instrument and background taken directly from the MDA spreadsheet  
 Survey Unit (Location): Ground Floor- East Wall, Outside Experimental Rooms  
 Date: 10/10/97

Instrument  
 Model: L2220 Serial #: 52823 Efficiency: 21.87%  
 Probe: 44-9 Serial #: 11150 MDA: 1854

Survey	Gross	Gross	Activity	Uncertainty	MDA
Point	Total	Counts Per	(dpm/100 cm <sup>2</sup> )	(95% Confidence Level)	(dpm/100 cm <sup>2</sup> )
	Counts	Minute			
678	84	84	-2195	926	1854
679	76	76	-2439	910	1854
680	100	100	-1707	956	1854
681	74	74	-2500	906	1854
682	132	132	-732	1014	1854
683	112	112	-1341	978	1854
684	120	120	-1097	993	1854
685	183	183	823	1100	1854
703	84	84	-2195	926	1854
790	235	235	2408	1181	1854

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: <u>2</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- East Wall, Outside Experimental Rooms</u>		2 for direct beta/gamma
Date	<u>10/10/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>52823</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>11150</u>		
MDA	<u>1854</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-10975</u>
$n_s$ =	<u>10</u>
$x_{avg}$ =	<u>-1098</u>
Maximum value in population =	<u>2408</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-1098</u>
$n_s$ =	<u>10</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>22716867</u>
$s_x$ =	<u>1589</u>

## Calculation Sheet

Survey Unit: Ground Floor- East Wall, Outside Experimental Rooms  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for  $n-1$  degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$	=	<u>-1098</u>
$t_{1-\alpha, \text{df}}$	=	<u>1.833</u>
$s_x$	=	<u>1589</u>
$n_s$	=	<u>10</u>
$\mu_{\alpha}$	=	<u>-177</u>

\*Note: for values of  $t_{1-\alpha, \text{df}}$  not on the table, the nearest greater value is used

Individual Completing Form: Pat Fry

Date: 4/9/98

Reviewed by: Donald S. Smith

Date: 4/9/98

# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor, East Wall, Outside Experimental Rooms  
 Date: 10/10/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
678	0	13
679	0	13
680	0	13
681	3	13
682	3	13
683	0	13
684	0	13
685	0	13
703	0	13
790	0	13

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 4/9/98

Date: 4/19/99

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- East Wall, Outside Experimental Rooms  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
678	0	17
679	12	17
680	0	17
681	1	17
682	5	17
683	1	17
684	5	17
685	3	17
703	3	17
790	3	17

Individual Completing Form:

Reviewed By:

Date:

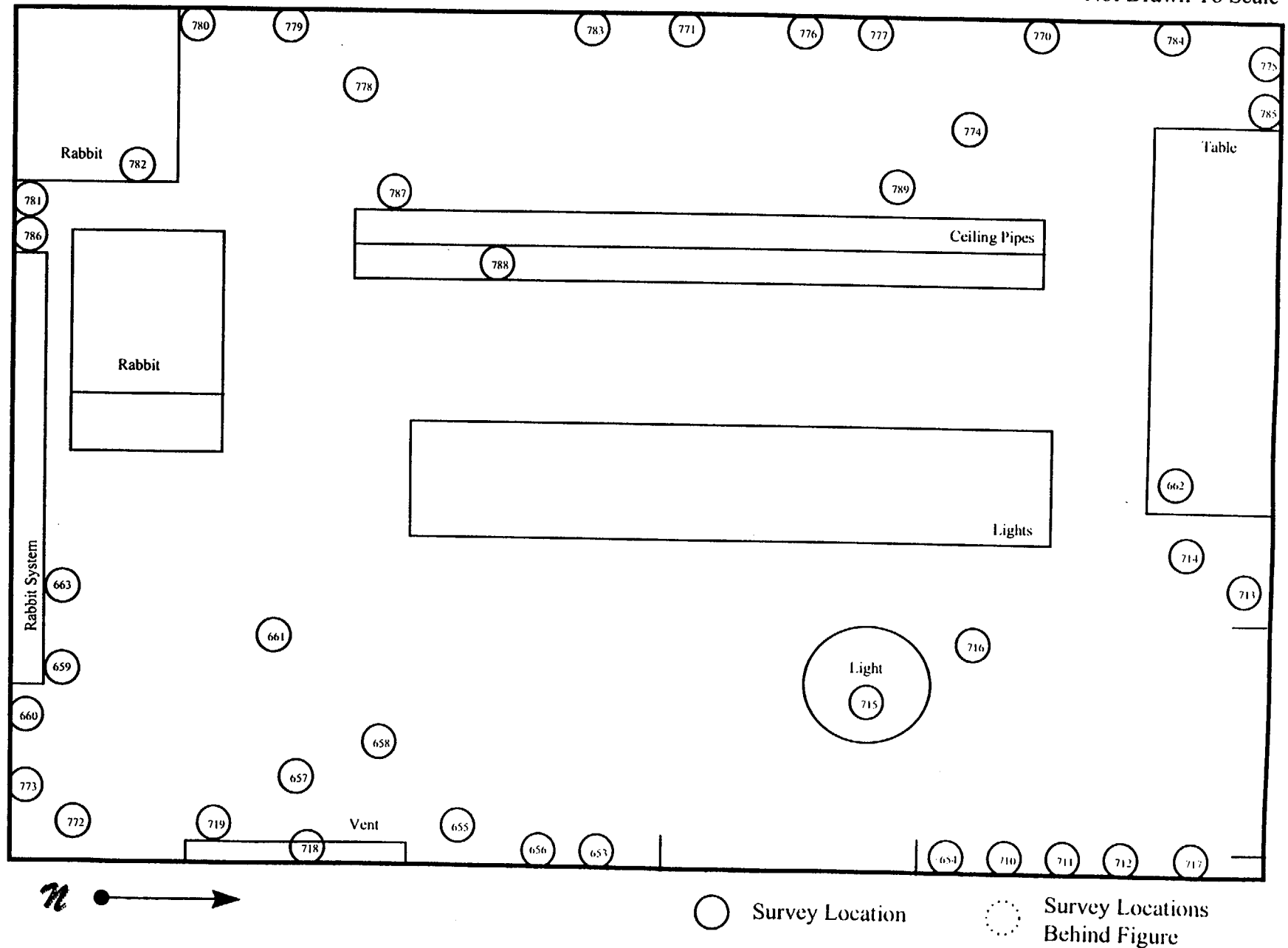
Date:



# Ground Floor- Experimental Room No. 1

Top View  
Not Drawn To Scale

E-133



# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)}{e(a/100)} \cdot 2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- Experimental Room No. 1

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 156  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 156  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1854

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 10:26  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 10:26  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Type: \_\_\_\_\_  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor- Experimental Room No. 1  
Date: 10.10.97

## Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: \_\_\_\_\_  
Model: L2220  
Probe: 43-65

Serail #: 50061  
Serail #: 63291

Efficiency: 18.00%  
MDA: 116

NT= None Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
653	4	4	-9	52	116
654	4	4	-9	52	116
655	4	4	-9	52	116
656	3	3	-18	49	116
657	16	16	97	79	116
658	15	15	88	77	116
659	2	2	-26	46	116
660	7	7	18	60	116
661	3	3	-18	49	116
662	3	3	-18	49	116
663	4	4	-9	52	116
710	1	1	-35	42	116
711	2	2	-26	46	116
712	2	2	-26	46	116
713	5	5	0	55	116
714	4	4	-9	52	116
715	NT				
716	8	8	26	62	116
717	9	9	35	65	116
718	NT				
719	30	30	220	102	116
770	2	2	-26	46	116
771	3	3	-18	49	116
772	4	4	-9	52	116
773	6	6	9	57	116
774	0	0	-44	39	116
775	0	0	-44	39	116
776	1	1	-35	42	116
777	0	0	-44	39	116
778	0	0	-44	39	116
779	10	10	44	67	116
780	0	0	-44	39	116
781	1	1	-35	42	116
782	0	0	-44	39	116
783	6	6	9	57	116
784	2	2	-26	46	116
785	2	2	-26	46	116
786	0	0	-44	39	116
787	0	0	-44	39	116
788	2	2	-26	46	116
789	1	1	-35	42	116

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Ground Floor- Experimental Room No. 1

Date 10/10/97

Meter L2220

Serial # 50061

Probe 43-65

Serial # 63291

MDA 116

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -254  
 $n_s =$  39  
 $x_{avg} =$  -7  
 Maximum value in population = 220 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -7  
 $n_s =$  39  
 $\Sigma(x_{avg} - x_i)^2 =$  95231  
 $s_x =$  50

## Calculation Sheet

Survey Unit: Ground Floor- Experimental Room No. 1  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$	=	<u>-7</u>	
$t_{1-\alpha, \text{df}}$	=	<u>1.697</u>	*Note: for values of $t_{1-\alpha, \text{df}}$ not on the table, the nearest greater value is used
$s_x$	=	<u>50</u>	
$n_s$	=	<u>39</u>	
$\mu_{\alpha}$	=	<u>7</u>	

Individual Completing Form:

*Patricia J. [Signature]*

Date: 12/30/97

Reviewed by:

*Richard M. Toumey*

Date: 1/13/98

# Direct Beta-Gamma Data Sheet

Survey Title: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor- Experimental Room No. 1  
 Date: 10/10/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: Model: L2220  
 Probe: 44-9

Serial #: 52823  
 Serial #: 11150

Efficiency: 21.87%  
 MDA: 1854

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
653	88	88	-2073	933	1854
654	70	70	-2622	898	1854
655	74	74	-2500	906	1854
656	100	100	-1707	956	1854
657	70	70	-2622	898	1854
658	90	90	-2012	937	1854
659	140	140	-488	1028	1854
660	128	128	-854	1007	1854
661	130	130	-793	1010	1854
662	160	160	122	1062	1854
663	164	164	244	1069	1854
710	92	92	-1951	941	1854
711	79	79	-2347	916	1854
712	66	66	-2743	890	1854
713	60	60	-2926	878	1854
714	88	88	-2073	933	1854
715	120	120	-1097	993	1854
716	106	106	-1524	967	1854
717	110	110	-1402	974	1854
718	130	130	-793	1010	1854
719	125	125	-945	1002	1854
770	150	150	-183	1045	1854
771	109	109	-1433	973	1854
772	92	92	-1951	941	1854
773	112	112	-1341	978	1854
774	172	172	488	1082	1854
775	168	168	366	1075	1854
776	266	266	3353	1227	1854
777	270	270	3475	1233	1854
778	84	84	-2195	926	1854
779	204	204	1463	1134	1854
780	304	304	4512	1281	1854
781	286	286	3963	1256	1854
782	342	342	5670	1333	1854
783	234	234	2378	1180	1854
784	208	208	1585	1140	1854
785	160	160	122	1062	1854
786	222	222	2012	1162	1854
787	236	236	2439	1183	1854
788	190	190	1036	1111	1854
789	252	252	2926	1207	1854

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- Experimental Room No. 1

Date 10/10/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1854

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -4421  
 $n_s =$  41  
 $x_{avg} =$  -108  
 Maximum value in population = 5670 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -108  
 $n_s =$  41  
 $\Sigma(x_{avg} - x_i)^2 =$  203530665  
 $s_x =$  2256

## Calculation Sheet

Survey Unit: Ground Floor- Experimental Room No. 1  
 Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-108</u>
$t_{1-\alpha, df}$ =	<u>1.684</u>
$s_x$ =	<u>2256</u>
$n_s$ =	<u>41</u>
$\mu_{\alpha}$ =	<u>485</u>

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

Pate J. J.

Date:

12/19/97

Reviewed by:

Gerard M. Brown

Date:

1/16/98



# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor, Experimental Room No. 1  
 Date: 10/10/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
653	0	13
654	0	13
655	3	13
656	0	13
657	0	13
658	0	13
659	0	13
660	0	13
661	0	13
662	0	13
663	0	13
710	0	13
711	0	13
712	0	13
713	0	13
714	0	13
715	0	13
716	0	13
717	0	13
718	0	13
719	0	13
770	0	13
771	0	13
772	0	13
773	0	13
774	0	13
775	0	13
776	0	13
777	0	13
778	0	13
779	0	13
780	0	13
781	0	13
782	0	13
783	0	13
784	3	13
785	0	13
786	0	13
787	0	13
788	0	13
789	0	13

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 12/19/97

Date: 5/1/98

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor- Experimental Room No. 1  
Date: 10/10/97

## Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
653	0	17
654	5	17
655	1	17
656	1	17
657	3	17
658	0	17
659	5	17
660	3	17
661	3	17
662	5	17
663	0	17
710	10	17
711	0	17
712	0	17
713	3	17
714	5	17
715	0	17
716	5	17
717	3	17
718	1	17
719	0	17
770	3	17
771	0	17
772	1	17
773	3	17
774	0	17
775	7	17
776	10	17
777	0	17
778	0	17
779	0	17
780	12	17
781	7	17
782	1	17
783	5	17
784	5	17
785	1	17
786	1	17
787	3	17
788	3	17
789	3	17

Individual Completing Form: Steve FVF

Reviewed By: Gerard M. Lounney

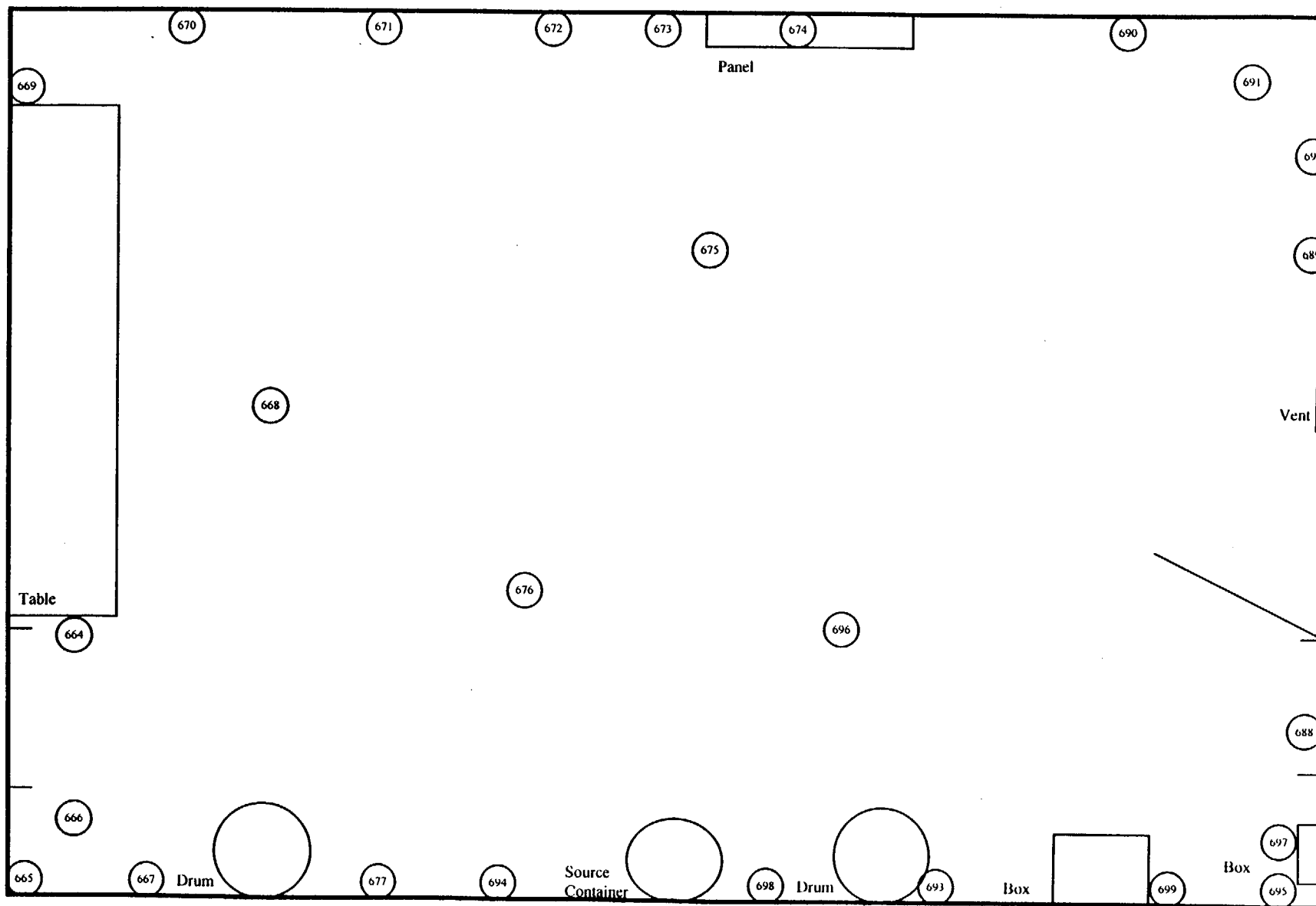
Date: 12/19/97

Date: 1/13/98

# Ground Floor- Experimental Room No. 2

Top View  
Not Drawn To Scale

E-143



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_b/T_s)}{e(a/100)} \cdot 2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor- Experimental Room No. 2

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 156  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 156  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1854

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/11/97  
Time background was taken = 14:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/11/97  
Time background was taken = 14:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: *[Signature]*

Reviewed By: *[Signature]*

Date: 12/31/97

Date: 1/14/98

# Direct Alpha Data Sheet

Survey Type: 1  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor- Experimental Room No. 2  
Date: 10-19-97

## Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: L2220 Serial #: 50061  
Probe: 43-65 Serial #: 63291

Efficiency: 18.00%  
MDA: 116

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
664	5	5	0	55	116
665	2	2	-26	46	116
666	4	4	-9	52	116
667	2	2	-26	46	116
668	2	2	-26	46	116
669	7	7	18	60	116
670	5	5	0	55	116
671	2	2	-26	46	116
672	0	0	-44	39	116
673	2	2	-26	46	116
674	2	2	-26	46	116
675	3	3	-18	49	116
676	3	3	-18	49	116
677	3	3	-18	49	116
688	2	2	-26	46	116
689	7	7	18	60	116
690	2	2	-26	46	116
691	3	3	-18	49	116
692	2	2	-26	46	116
693	2	2	-26	46	116
694	3	3	-18	49	116
695	1	1	-35	42	116
696	3	3	-18	49	116
697	2	2	-26	46	116
698	3	3	-18	49	116
699	2	2	-26	46	116

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit Ground Floor- Experimental Room No. 2

Date 10/10/97

Meter L2220

Serial # 50061

Probe 43-65

Serial # 63291

MDA 116

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -490

$n_s =$  26

$x_{avg} =$  -19

Maximum value in population = 18 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

- $s_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg} =$  -19

$n_s =$  26

$\Sigma(x_{avg} - x_i)^2 =$  5036

$s_x =$  14

## Calculation Sheet

Survey Unit: Ground Floor- Experimental Room No. 2  
 Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha,df} [s_x/(n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha,df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-19</u>	
$t_{1-\alpha,df}$ =	<u>1.708</u>	*Note: for values of $t_{1-\alpha,df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>14</u>	
$n_s$ =	<u>26</u>	
$\mu_{\alpha}$ =	<u>-14</u>	

Individual Completing Form:

Pat FVR

Date: 12/31/97

Reviewed by:

Gerard M. Toumey

Date: 1/14/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor- Experimental Room No. 2  
Date: 10/10/97

## Notes

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument:  
Model: 12220  
Probe: 44-9

Seral # 52823  
Seral # 11150

Efficiency: 21.87%  
MDA: 1854

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
664	75	75	-2469	908	1854
665	77	77	-2408	912	1854
666	76	76	-2439	910	1854
667	78	78	-2378	914	1854
668	109	109	-1433	973	1854
669	88	88	-2073	933	1854
670	86	86	-2134	929	1854
671	86	86	-2134	929	1854
672	114	114	-1280	982	1854
673	92	92	-1951	941	1854
674	80	80	-2317	918	1854
675	104	104	-1585	963	1854
676	74	74	-2500	906	1854
677	80	80	-2317	918	1854
688	130	130	-793	1010	1854
689	202	202	1402	1130	1854
690	100	100	-1707	956	1854
691	98	98	-1768	952	1854
692	88	88	-2073	933	1854
693	99	99	-1738	954	1854
694	82	82	-2256	922	1854
695	84	84	-2195	926	1854
696	92	92	-1951	941	1854
697	124	124	-975	1000	1854
698	92	92	-1951	941	1854
699	62	62	-2865	882	1854

Individual Completing Form:

Reviewed By:

Date:

Date:



# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- Experimental Room No. 2

Date 10/10/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1854

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -48288  
 $n_s =$  26  
 $x_{avg} =$  -1857  
 Maximum value in population = 1402 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -1857  
 $n_s =$  26  
 $\Sigma(x_{avg} - x_i)^2 =$  16850118  
 $s_x =$  821

## Calculation Sheet

Survey Unit: Ground Floor- Experimental Room No. 2  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg} =$  -1857  
 $t_{1-\alpha, df} =$  1.708  
 $s_x =$  821  
 $n_s =$  26  
 $\mu_{\alpha} =$  -1582

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *[Signature]*

Date: 12/31/97

Reviewed by: *[Signature]*

Date: 1/14/98

## Removable Alpha Data Sheet

Survey Type 3  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit (Location) Ground Floor, Experimental Room No. 2  
 Date 10/11/97

Notes

- 1) Place total counts directly from meter. Activity column will correct for background.  
 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model LB 5100 W Serial #: 13795 Efficiency 28.35%  
 Probe N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
664	0	13
665	0	13
666	0	13
667	0	13
668	0	13
669	0	13
670	0	13
671	0	13
672	0	13
673	0	13
674	0	13
675	0	13
676	0	13
677	0	13
688	0	13
689	0	13
690	0	13
691	0	13
692	0	13
693	0	13
694	0	13
695	0	13
696	0	13
697	0	13
698	0	13
699	0	13

Individual Completing Form:

Reviewed By:

Date:

Date:

## Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit Location: Ground Floor Experimental Room No. 2  
 Date: 10/11/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
664	0	17
665	3	17
666	3	17
667	3	17
668	7	17
669	3	17
670	0	17
671	5	17
672	7	17
673	1	17
674	7	17
675	3	17
676	0	17
677	5	17
688	1	17
689	7	17
690	0	17
691	1	17
692	3	17
693	3	17
694	3	17
695	3	17
696	0	17
697	1	17
698	0	17
699	0	17

Individual Completing Form:

Reviewed By:

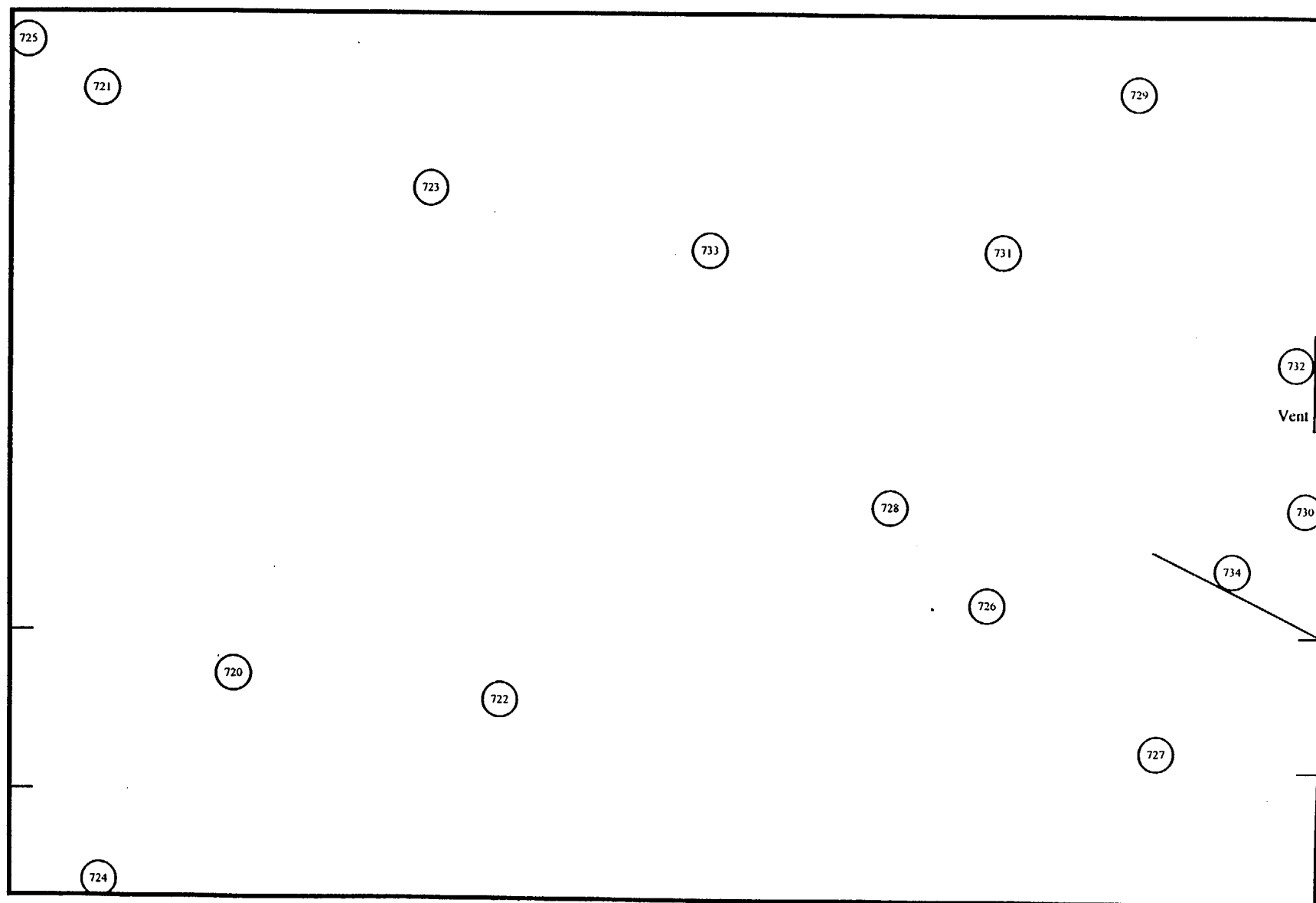
Date:

Date:

# Ground Floor- Experimental Room No. 2

Ceiling  
Not Drawn To Scale

E-153



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)}{e(a/100)} \cdot 2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE:  
SURVEY UNIT (Location):

Georgia Tech Characterization Survey  
Ground Floor- Experimental Room No. 2, Ceiling

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63  
MDA (dpm/100 cm<sup>2</sup>) = 116

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 156  
Date background was taken = 10/10/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 156  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15  
MDA (dpm/100 cm<sup>2</sup>) = 1854

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 14:26  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100  
MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 14:26  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100  
MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

## Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor, Experimental Room No. 2, Ceiling  
 Date: 10/10/97

## Notes

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: L2220  
 Model: 43-65  
 Probe: 43-65

Serial #: 50061  
 Serial #: 63291

Efficiency: 18.00%  
 MDA: 116

NT= None Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)		MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	(dpm/100 cm <sup>2</sup> )	
720	7	7	18	60	116	116
721	7	7	18	60	116	116
722	1	1	-35	42	116	116
723	1	1	-35	42	116	116
724	3	3	-18	49	116	116
725	5	5	0	55	116	116
726	2	2	-26	46	116	116
727	2	2	-26	46	116	116
728	NT					
729	3	3	-18	49	116	116
730	1	1	-35	42	116	116
731	2	2	-26	46	116	116
732	2	2	-26	46	116	116
733	5	5	0	55	116	116
734	8	8	26	62	116	116

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE:	<u>1</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- Experimental Room No. 2, Ceiling</u>		2 for direct beta/gamma
Date	<u>10/10/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>116</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-183</u>
$n_s$ =	<u>14</u>
$x_{avg}$ =	<u>-13</u>
Maximum value in population =	<u>26</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-13</u>
$n_s$ =	<u>14</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>5959</u>
$s_x$ =	<u>21</u>



## Calculation Sheet

Survey Unit: Ground Floor- Experimental Room No. 2, Ceiling  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$  = -13  
 $t_{1-\alpha, \text{df}}$  = 1.771  
 $s_x$  = 21  
 $n_s$  = 14  
 $\mu_{\alpha}$  = -3

\*Note: for values of  $t_{1-\alpha, \text{df}}$  not on the table, the nearest greater value is used

Individual Completing Form:

Dan FVR

Date: 12/30/97

Reviewed by:

Gerard M. Torney

Date: 1/14/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor- Experimental Room No. 2, Ceiling  
Date: 10/10/97  
Instrument: \_\_\_\_\_  
Model: L2220  
Probe: 44-9  
Serial #: 52823  
Serial #: 11150  
Notes: (1) Place total counts directly from meter. Activity column will correct for background.  
(2) Information for instrument and background taken directly from the MCA spreadsheet.  
Efficiency: 21.87%  
MDA: 1854

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
720	90	90	-2012	937	1854
721	97	97	-1799	950	1854
722	66	66	-2743	890	1854
723	88	88	-2073	933	1854
724	88	88	-2073	933	1854
725	102	102	-1646	960	1854
726	110	110	-1402	974	1854
727	86	86	-2134	929	1854
728	128	128	-854	1007	1854
729	89	89	-2042	935	1854
730	107	107	-1494	969	1854
731	143	143	-396	1033	1854
732	99	99	-1738	954	1854
733	112	112	-1341	978	1854
734	140	140	-488	1028	1854

Individual Completing Form:

Reviewed By:

*Scott Fox*  
*Edward M. Toomey*

Date:

Date:

12/30/97  
1/14/98

# Calculation Sheet

SURVEY TYPE: <u>2</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- Experimental Room No. 2, Ceiling</u>		2 for direct beta/gamma
Date	<u>10/10/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>52823</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>11150</u>		
MDA	<u>1854</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\sum(x_i) =$	<u>-24235</u>
$n_s =$	<u>15</u>
$x_{avg} =$	<u>-1616</u>
Maximum value in population =	<u>-396</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{\sum(x_{avg} - x_i)^2^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$	<u>-1616</u>
$n_s =$	<u>15</u>
$\sum(x_{avg} - x_i)^2 =$	<u>5821449</u>
$s_x =$	<u>645</u>

## Calculation Sheet

Survey Unit: Ground Floor- Experimental Room No. 2, Ceiling  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$ =	<u>-1616</u>	
$t_{1-\alpha, \text{df}}$ =	<u>1.761</u>	*Note: for values of $t_{1-\alpha, \text{df}}$ not on the table, the nearest greater value is used
$s_x$ =	<u>645</u>	
$n_s$ =	<u>15</u>	
$\mu_{\alpha}$ =	<u>-1323</u>	

Individual Completing Form:

*Steve Perry*

Date:

12/30/97

Reviewed by:

*Bernard M. Tourney*

Date:

1/14/98

# Removable Alpha Data Sheet

Survey Type: 3  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor, Experimental Room No. 2, Ceiling  
Date: 10/10/97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background.  
(2) Information for instrument and background taken directly from the MDA spreadsheet.

## Instrument

Model: LB 5100 W

Serial #: 13795

Efficiency: 28.35%

Probe: N/A

Serial #: N/A

MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
720	0	13
721	3	13
722	0	13
723	0	13
724	0	13
725	0	13
726	0	13
727	0	13
728	0	13
729	0	13
730	0	13
731	0	13
732	0	13
733	0	13
734	0	13

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 12/30/97

Date: 1/14/98

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor, Experimental Room No. 2, Ceiling  
Date: 10/13/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
720	3	17
721	3	17
722	0	17
723	5	17
724	3	17
725	5	17
726	3	17
727	3	17
728	1	17
729	0	17
730	1	17
731	0	17
732	3	17
733	5	17
734	3	17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Rabbit System

100% Scan was performed and smears were taken at the joints.  
The following is a list of these smears and their locations:

Smear	Location
811	Room 149
812	Room 149
813	Room 149
814	Room 149
815	Room 149
816	Experimental Room in Ground Floor
817	Rabbit Case in Experimental Room
818	Inside Top
819	Power Unit
820	Northwest Corner of Ground Floor
821	Right Corner of Area Left of Elevator
822	Left Corner of Area Left of Elevator
823	Room 123 in Ground Floor

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_p/T_s)}{e(a/100)}^2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Rabbit System

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/15/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2221  
SERIAL #: 68537  
PROBE #: 44-9  
SERIAL #: 66762  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 152  
Date background was taken = 10/15/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 152  
e = Probe Efficiency = 31.75%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1261

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/14/97  
Time background was taken = 14:16  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/14/97  
Time background was taken = 14:16  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: [Signature]

Reviewed By: [Signature]

Date: 12/30/97

Date: 1/16/98



Survey Type: \_\_\_\_\_  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Rabbit System  
Date: 10/15/97

(1) Place total counts directly from meter. Activity column will correct for background.  
(2) Information for instrument and background taken directly from the MDA spreadsheet.

Model: L2220  
Probe: 43-65

Senal #: 50061  
Senal #: 63291

Efficiency: 18.00%  
MDA: 116

Survey	Gross Total	Gross Counts Per	Uncertainty (95% Confidence Level)		
			Activity		MDA
<u>Point</u>	<u>Counts</u>	<u>Minute</u>	<u>(dpm/100 cm<sup>2</sup>)</u>	<u>(dpm/100 cm<sup>2</sup>)</u>	<u>(dpm/100 cm<sup>2</sup>)</u>
811	0	0	-44	39	116
812	1	1	-35	42	116
813	3	3	-18	49	116
814	1	1	-35	42	116
815	0	0	-44	39	116
816	2	2	-26	46	116
817	1	1	-35	42	116
818	19	19	123	85	116
819	2	2	-26	46	116
820	1	1	-35	42	116
821	2	2	-26	46	116
822	0	0	-44	39	116
823	2	2	-26	46	116

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE:	<u>1</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>Rabbit System</u>		2 for direct beta/gamma
Date	<u>10/15/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>116</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm <sup>2</sup> )		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-271</u>
$n_s$ =	<u>13</u>
$x_{avg}$ =	<u>-21</u>
Maximum value in population =	<u>123</u> (dpm/100 cm <sup>2</sup> )

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-21</u>
$n_s$ =	<u>13</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>23216</u>
$s_x$ =	<u>44</u>

## Calculation Sheet

Survey Unit: Rabbit System

Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg} =$  -21

$t_{1-\alpha, df} =$  1.782

$s_x =$  44

$n_s =$  13

$\mu_{\alpha} =$  1

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Patricia J. [Signature]*

Date: 12/30/97

Reviewed by: *Richard M. [Signature]*

Date: 1/16/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
Project Title: Georgia Tech Characterization Survey  
Survey Unit Location: Rabbit System  
Date: 10/15/97

## Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: Model: 2221  
Probe: 44-9

Serial #: 68537  
Serial #: 66762

Efficiency: 31.75%  
MDA: 1261

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
811	48	48	-2184	582	1261
812	94	94	-1218	645	1261
813	114	114	-798	671	1261
814	110	110	-882	666	1261
815	88	88	-1344	638	1261
816	286	286	2814	861	1261
817	216	216	1344	789	1261
818	192	192	840	763	1261
819	196	196	924	768	1261
820	356	356	4283	928	1261
821	72	72	-1680	616	1261
822	216	216	1344	789	1261
823	90	90	-1302	640	1261

Individual Completing Form: Dan L...

Reviewed By: Richard M. Young

Date: 12/30/97

Date: 1/14/98

# Calculation Sheet

SURVEY TYPE:	<u>2</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>Rabbit System</u>		2 for direct beta/gamma
Date	<u>10/15/97</u>		3 for removable alpha
Meter	<u>L2221</u>		4 for removable beta/gamma
Serial #	<u>68537</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>66762</u>		
MDA	<u>1261</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\begin{aligned}
 \Sigma(x_i) &= \underline{2141} \\
 n_s &= \underline{13} \\
 x_{avg} &= \underline{165} \\
 \text{Maximum value in population} &= \underline{4283} \text{ (dpm/100 cm2)}
 \end{aligned}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\begin{aligned}
 x_{avg} &= \underline{165} \\
 n_s &= \underline{13} \\
 \Sigma(x_{avg} - x_i)^2 &= \underline{45074176} \\
 s_x &= \underline{1938}
 \end{aligned}$$

## Calculation Sheet

Survey Unit: Rabbit System

Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 165

$t_{1-\alpha, df}$  = 1.782

$s_x$  = 1938

$n_s$  = 13

$\mu_{\alpha}$  = 1123

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Pat Perry*

Date: 12/30/97

Reviewed by: *Gerard M. Journey*

Date: 1/14/98

Removable Alpha Data Sheet

Survey Type: 3 Notes: (1) Place total counts directly from meter. Activity column will correct for background.  
 Project Title: Georgia Tech Characterization Survey (2) Information for instrument and background taken directly from the MDA spreadsheet.  
 Survey Unit: Location: Rabbit System  
 Date: 10/14/97

Instrument: \_\_\_\_\_  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
811	0	13
812	0	13
813	3	13
814	0	13
815	0	13
816	0	13
817	0	13
818	3	13
819	3	13
820	0	13
821	3	13
822	0	13
823	0	13

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

# Removable Beta-Gamma Data Sheet

Survey Type: 4 Notes: Georgia Tech Characterization Survey  
 Project Title: Geotach Tech Characterization Survey  
 Survey Unit Location: Rabbit System  
 Date: 01/14/97

(1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
811	0	17
812	3	17
813	122	17
814	3	17
815	0	17
816	1	17
817	5	17
818	19	17
819	10	17
820	5	17
821	3	17
822	10	17
823	1	17

Individual Completing Form: Steve Perry  
 Reviewed By: Kenneth M. Tamm

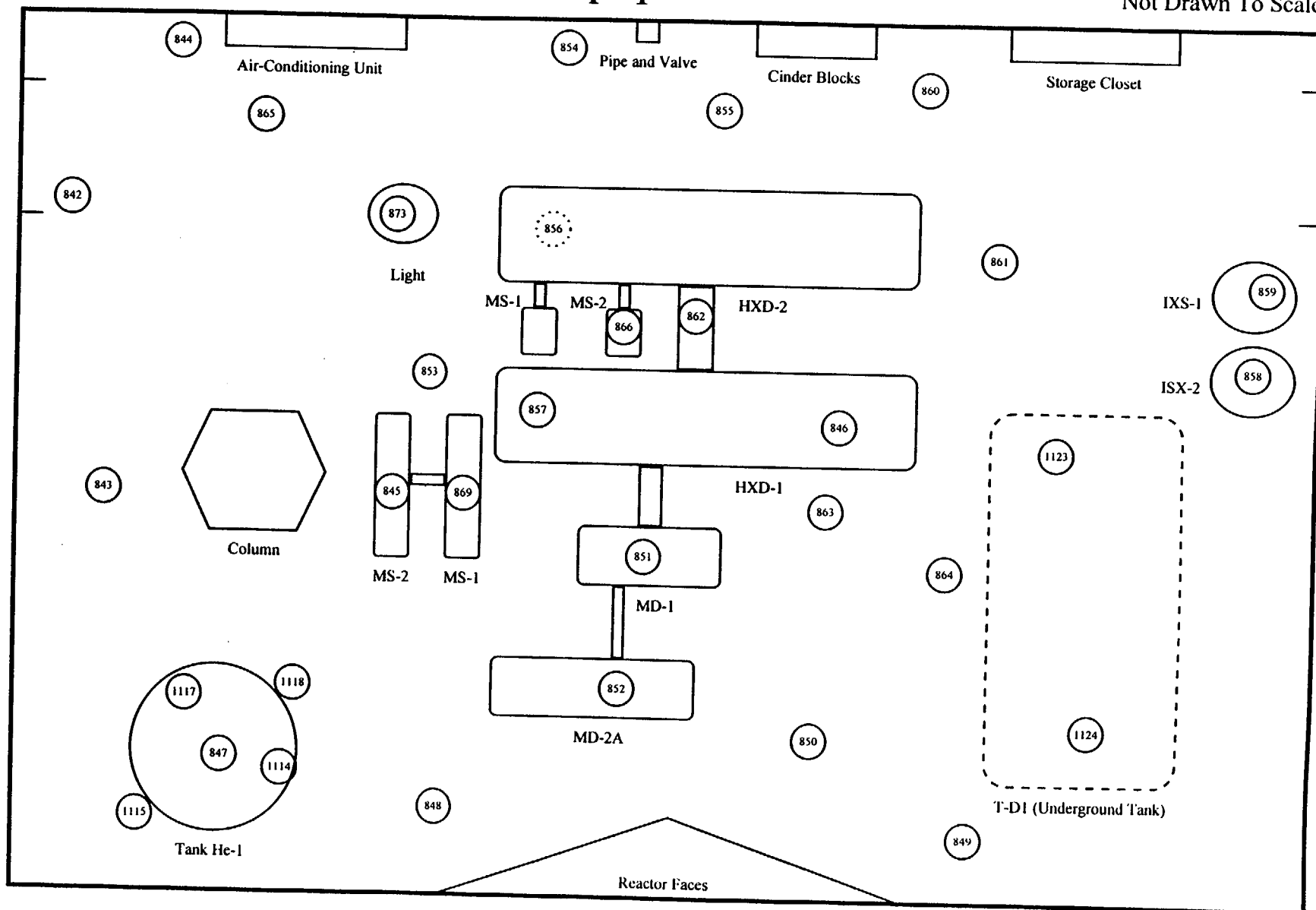
Date: 12/30/97  
 Date: 1/14/98



# Ground Floor- Process Equipment Room

Top View  
Not Drawn To Scale

E-173



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)}{e(a/100)}^2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together.

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor-Process Equipment Room

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 48409  
PROBE #: 43-65  
SERIAL #: 62385  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/15/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 59  
MDA (dpm/100 cm<sup>2</sup>) = 123

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2221  
SERIAL #: 68537  
PROBE #: 44-9  
SERIAL #: 66762  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 152  
Date background was taken = 10/15/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 152  
e = Probe Efficiency = 31.75%  
a = Probe Area (cm) = 15  
MDA (dpm/100 cm<sup>2</sup>) = 1261

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/15/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100  
MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/15/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100  
MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

## Direct Alpha Data Sheet

Survey Type: \_\_\_\_\_  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor-Process Equipment Room  
 Date: 10/15/97

## Notes

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: \_\_\_\_\_  
 Model: L2220 Serial #: 48409  
 Probe: 43-65 Serial #: 62385

Efficiency: 18.00%  
 MDA: 123

NT= None Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
842	4	4	-9	55	123
843	2	2	-28	49	123
844	4	4	-9	55	123
845	0	0	-47	41	123
846	2	2	-28	49	123
847	2	2	-28	49	123
848	8	8	28	67	123
849	4	4	-9	55	123
850	6	6	9	61	123
851	6	6	9	61	123
852	0	0	-47	41	123
853	0	0	-47	41	123
854	0	0	-47	41	123
855	0	0	-47	41	123
856	4	4	-9	55	123
857	8	8	28	67	123
858	8	8	28	67	123
859	12	12	66	76	123
860	8	8	28	67	123
861	0	0	-47	41	123
862	4	4	-9	55	123
863	2	2	-28	49	123
864	4	4	-9	55	123
865	2	2	-28	49	123
866	2	2	-28	49	123
869	0	0	-47	41	123
873	0	0	-47	41	123
1114	NT				
1115	NT				
1117	NT				
1118	NT				
1123	NT				
1124	NT				

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE:	<u>1</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor-Process Equipment Room</u>		2 for direct beta/gamma
Date	<u>10/15/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>48409</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>62385</u>		
MDA	<u>123</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm <sup>2</sup> )		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\sum(x_i)$ =	<u>-402</u>
$n_s$ =	<u>27</u>
$x_{avg}$ =	<u>-15</u>
Maximum value in population =	<u>66</u> (dpm/100 cm <sup>2</sup> )

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

- $s_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-15</u>
$n_s$ =	<u>27</u>
$\sum(x_{avg} - x_i)^2$ =	<u>24531</u>
$s_x$ =	<u>31</u>

## Calculation Sheet

Survey Unit: Ground Floor-Process Equipment Room

Survey Type: 1

This sheet uses the following equation to determine the 95%

Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$ =	<u>-15</u>	
$t_{1-\alpha, \text{df}}$ =	<u>1.706</u>	*Note: for values of $t_{1-\alpha, \text{df}}$ not on the table, the nearest greater value is used
$s_x$ =	<u>31</u>	
$n_s$ =	<u>27</u>	
$\mu_{\alpha}$ =	<u>-5</u>	

Individual Completing Form:

Dan J. J. J.

Date: 1/5/98

Reviewed by:

Berard M. Tormey

Date: 1/14/98

## Direct Beta-Gamma Data Sheet

Survey Type 2  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit (Location) Ground Floor-Process Equipment Room  
 Date 10.15.97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model: L2221  
 Probe: 44-9

Serial #: 68537  
 Serial #: 66762

Efficiency 31.75%  
 MDA 1261

NT = None Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
942	138	138	-294	701	1261
943	108	108	-924	664	1261
844	134	134	-378	696	1261
845	146	146	-126	710	1261
846	148	148	-84	713	1261
847	116	116	-756	674	1261
848	96	96	-1176	648	1261
849	178	178	546	748	1261
850	108	108	-924	664	1261
851	374	374	4661	944	1261
852	152	152	0	718	1261
853	144	144	-168	708	1261
854	146	146	-126	710	1261
855	376	376	4703	946	1261
856	256	256	2184	831	1261
857	356	356	4283	928	1261
858	2076	2076	40399	1943	1261
859	1210	1210	22215	1519	1261
860	426	426	5753	989	1261
861	924	924	16210	1350	1261
862	566	566	8693	1103	1261
863	156	156	84	722	1261
864	308	308	3276	883	1261
865	114	114	-798	671	1261
866	146	146	-126	710	1261
869	106	106	-966	661	1261
873	114	114	-798	671	1261
1114	NT				
1115	NT				
1117	NT				
1118	NT				
1123	NT				
1124	NT				

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE:	<u>2</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor-Process Equipment Room</u>		2 for direct beta/gamma
Date	<u>10/15/97</u>		3 for removable alpha
Meter	<u>L2221</u>		4 for removable beta/gamma
Serial #	<u>68537</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>66762</u>		
MDA	<u>1261</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm <sup>2</sup> )		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\begin{aligned} \Sigma(x_i) &= \underline{105363} \\ n_s &= \underline{27} \\ x_{avg} &= \underline{3902} \\ \text{Maximum value in population} &= \underline{40399} \text{ (dpm/100 cm}^2\text{)} \end{aligned}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\begin{aligned} x_{avg} &= \underline{3902} \\ n_s &= \underline{27} \\ \Sigma(x_{avg} - x_i)^2 &= \underline{2170028719} \\ s_x &= \underline{9136} \end{aligned}$$

## Calculation Sheet

Survey Unit: Ground Floor-Process Equipment Room  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$	=	<u>3902</u>	
$t_{1-\alpha, \text{df}}$	=	<u>1.706</u>	*Note: for values of $t_{1-\alpha, \text{df}}$ not on the table, the nearest greater value is used
$s_x$	=	<u>9136</u>	
$n_s$	=	<u>27</u>	
$\mu_{\alpha}$	=	<u>6901</u>	

Individual Completing Form:

Rate FVR

Date: 1/15/98

Reviewed by:

Gerard M. Touny

Date: 1/14/98



# Removable Alpha Data Sheet

Survey Type 3 Notes  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit Location Ground Exposed Equipment Room  
 Date 10.15.97

1. Place total counts directly from meter. Activity column will contain 100% of background.
2. Information for instrument and background taken directly from the NCA spreadsheet.

Instrument Model LB-5100 W Serial # 13795 Efficiency 29.35%  
 Probe N/A Serial # N/A MDA 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
842	0	13
843	0	13
844	0	13
845	0	13
846	0	13
847	0	13
848	3	13
849	7	13
850	0	13
851	0	13
852	7	13
853	0	13
854	0	13
855	0	13
856	0	13
857	0	13
858	0	13
859	3	13
860	3	13
861	0	13
862	0	13
863	0	13
864	3	13
865	3	13
866	0	13
869	0	13
873	0	13
1114	7	13
1115	28	13
1117	28	13
1118	32	13
1123	0	13
1124	3	13

Individual Completing Form:

Reviewed By:

*Patricia M. Foddy*  
*Patricia M. Foddy*

Date:

Date:

1/5/98  
1/14/98

# Removable Beta-Gamma Data Sheet

Survey Type \_\_\_\_\_  
 Project Title \_\_\_\_\_  
 Survey Unit (Location) \_\_\_\_\_  
 Date \_\_\_\_\_

1 \_\_\_\_\_  
 Georgia Tech Characterization Survey  
 Ground Floor Process Equipment Room  
 10/15/97

Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the VCA Worksheet.

Instrument \_\_\_\_\_  
 Model LB 5100 W  
 Probe N/A

Serial # 13795  
 Serial # N/A

Efficiency 43.45%  
 MDA 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
342	1	17
343	3	17
344	10	17
345	7	17
346	1	17
347	3	17
348	0	17
349	3	17
350	1	17
351	1	17
352	3	17
353	3	17
354	7	17
355	5	17
356	16	17
357	1	17
358	0	17
359	5	17
360	21	17
361	0	17
362	0	17
363	7	17
364	5	17
365	0	17
366	7	17
369	10	17
373	5	17
1114	150	17
1115	468	17
1117	502	17
1118	332	17
1123	0	17
1124	5	17

Individual Completing Form:

Reviewed By:

*Patricia*  
*Gerard Myrany*

Date:

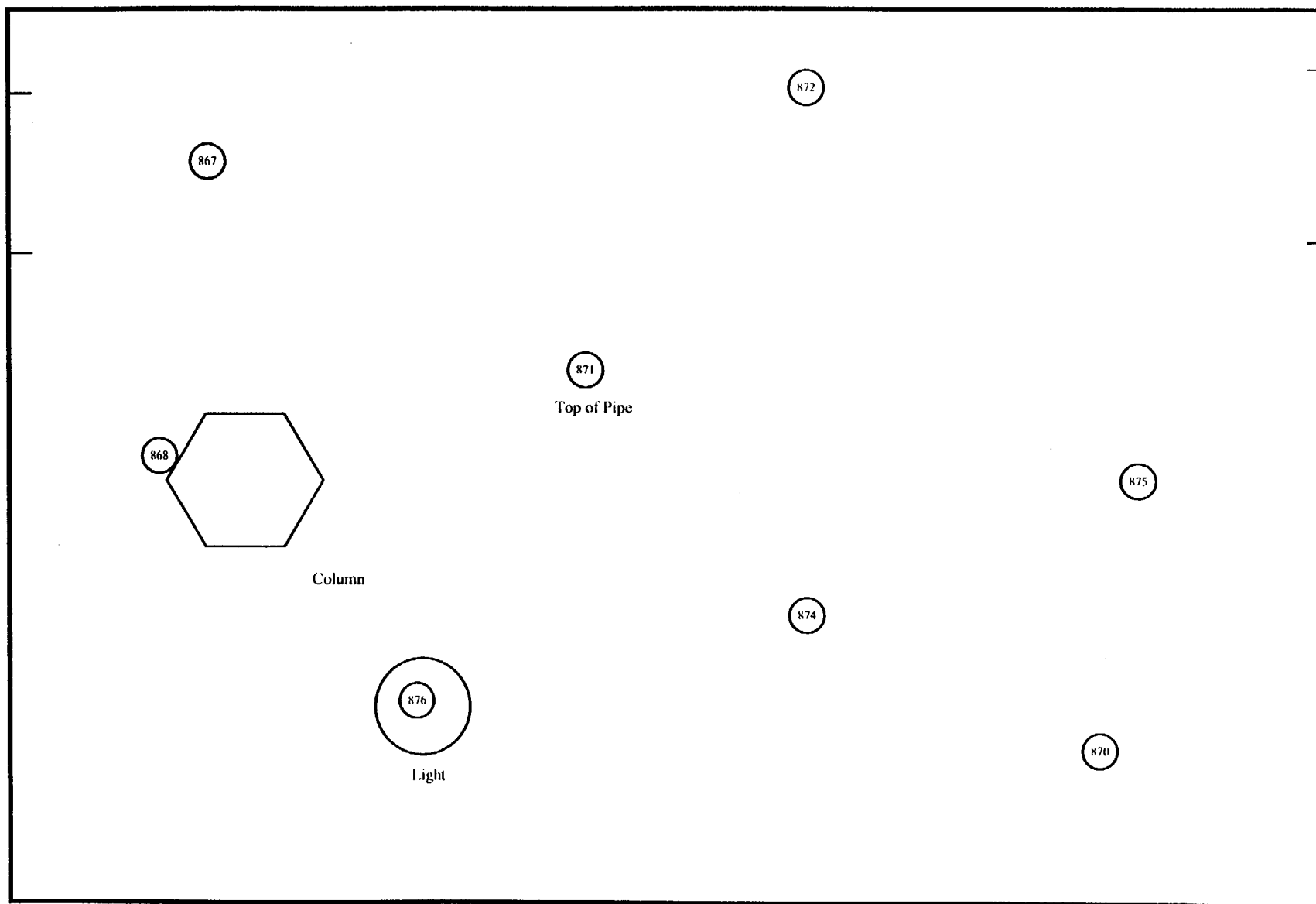
Date:

1/5/98  
 1/14/98

# Ground Floor- Process Equipment Room

Ceiling  
Not Drawn To Scale

E-183



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_b/T_s)^2}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor-Process Equipment Room, Ceiling

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 48409  
PROBE #: 43-65  
SERIAL #: 62385  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/15/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 123

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2221  
SERIAL #: 68537  
PROBE #: 44-9  
SERIAL #: 66762  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 152  
Date background was taken = 10/15/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 152  
e = Probe Efficiency = 31.75%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1261

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/16/97  
Time background was taken = 16:49  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/16/97  
Time background was taken = 16:49  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor-Process Equipment Room, Ceiling  
 Date: 10/15/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: L2220  
 Probe: 43-85

Serial #: 48409  
 Serial #: 62385

Efficiency: 18.00%  
 MDA: 123

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
867	2	2	-28	49	123
868	2	2	-28	49	123
870	0	0	-47	41	123
871	0	0	-47	41	123
872	2	2	-28	49	123
874	0	0	-47	41	123
875	4	4	-9	55	123
876	0	0	-47	41	123

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE:	<u>1</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor-Process Equipment Room, Ceiling</u>		2 for direct beta/gamma
Date	<u>10/15/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>48409</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>62385</u>		
MDA	<u>123</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-281</u>
$n_s$ =	<u>8</u>
$x_{avg}$ =	<u>-35</u>
Maximum value in population =	<u>-9</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

- $s_x$  = standard deviation
- $x_{avg}$  = calculated mean for a survey unit
- $n_s$  = number of measurements within a survey unit
- $x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-35</u>
$n_s$ =	<u>8</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>1399</u>
$s_x$ =	<u>14</u>

## Calculation Sheet

Survey Unit: Ground Floor-Process Equipment Room, Ceiling  
 Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-35</u>	
$t_{1-\alpha, df}$ =	<u>1.895</u>	*Note: for values of $t_{1-\alpha, df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>14</u>	
$n_s$ =	<u>8</u>	
$\mu_{\alpha}$ =	<u>-26</u>	

Individual Completing Form:

Patricia Lopez

Date: 12/29/97

Reviewed by:

Bernard M. Tormey

Date: 1/14/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
Project Title: Georgia Tech Characterization Survey  
Survey Unit - Location: Ground Floor-Process Equipment Room Ceiling  
Date: 10.15.97

Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument

Model: L2221

Probe: 44-9

Serial #: 68537

Serial #: 66762

Efficiency: 31.75%

MDA: 1261

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
867	120	120	-672	679	1261
868	110	110	-882	666	1261
870	90	90	-1302	640	1261
871	102	102	-1050	656	1261
872	120	120	-672	679	1261
874	176	176	504	745	1261
875	462	462	6509	1020	1261
876	470	470	6677	1026	1261

Individual Completing Form:

Reviewed By:

Date:

Date:



# Calculation Sheet

SURVEY TYPE:	<u>2</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor-Process Equipment Room, Ceiling</u>		2 for direct beta/gamma
Date	<u>10/15/97</u>		3 for removable alpha
Meter	<u>L2221</u>		4 for removable beta/gamma
Serial #	<u>68537</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>66762</u>		
MDA	<u>1261</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\begin{aligned}
 \Sigma(x_i) &= \underline{\underline{9112}} \\
 n_s &= \underline{\underline{8}} \\
 x_{avg} &= \underline{\underline{1139}} \\
 \text{Maximum value in population} &= \underline{\underline{6677}} \text{ (dpm/100 cm2)}
 \end{aligned}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$$\begin{aligned}
 x_{avg} &= \underline{\underline{1139}} \\
 n_s &= \underline{\underline{8}} \\
 \Sigma(x_{avg} - x_i)^2 &= \underline{\underline{81303654}} \\
 s_x &= \underline{\underline{3408}}
 \end{aligned}$$

## Calculation Sheet

Survey Unit: Ground Floor-Process Equipment Room, Ceiling  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for  $n-1$  degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$ =	<u>1139</u>
$t_{1-\alpha, \text{df}}$ =	<u>1.895</u>
$s_x$ =	<u>3408</u>
$n_s$ =	<u>8</u>
$\mu_{\alpha}$ =	<u>3422</u>

\*Note: for values of  $t_{1-\alpha, \text{df}}$  not on the table, the nearest greater value is used

Individual Completing Form: *Dan Fpy*

Date: 1/14/98

Reviewed by: *Sean M. Torney*

Date: 1/14/98

# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor-Process Equipment Room, Ceiling  
 Date: 10/16/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
867	0	13
868	0	13
870	0	13
871	0	13
872	3	13
874	0	13
875	0	13
878	7	13

Individual Completing Form:

Reviewed By:

Date:

Date:

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor-Process Equipment Room, Ceiling  
 Date: 10/16/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument:  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
867	1	17
868	0	17
870	0	17
871	1	17
872	3	17
874	0	17
875	1	17
876	1	17

Individual Completing Form:

Reviewed By:

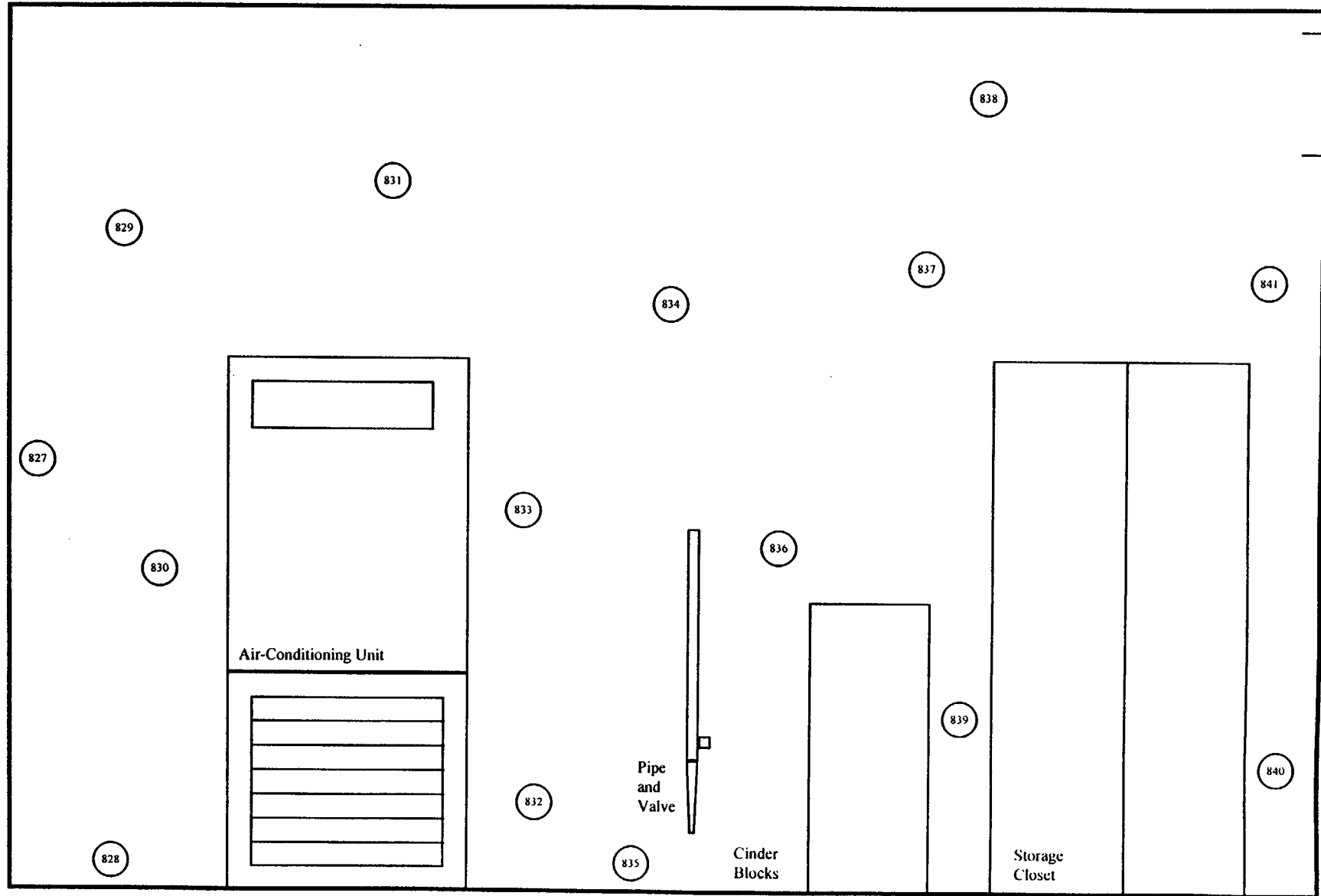
Date:

Date:

# Ground Floor- Outer Wall of Process Equipment Room

Elevation View  
Not Drawn To Scale

E-193



○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_p/T_s)}{e(a/100)}^{1/2}$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

**PROJECT TITLE:** Georgia Tech Characterization Survey  
**SURVEY UNIT (Location):** Ground Floor- Outer Wall of Process Equipment Room

**SURVEY TYPE:** 1 (direct alpha)  
**METER:** L2221  
**SERIAL #:** 48409  
**PROBE #:** 43-65  
**SERIAL #:** 62385  
**GUIDELINE VALUE:** 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/14/97  
Time background was taken = 7:45  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 123

**SURVEY TYPE:** 2 (direct beta/gamma)  
**METER:** L2220  
**SERIAL #:** 52823  
**PROBE #:** 44-9  
**SERIAL #:** 11150  
**GUIDELINE VALUE:** 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 156  
Date background was taken = 10/14/97  
Time background was taken = 7:45  
Rb = Background rate (cpm) = 156  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1854

**SURVEY TYPE:** 3 (removable alpha)  
**METER:** LB 5100 W  
**SERIAL #:** 13795  
**PROBE #:** N/A  
**SERIAL #:** N/A  
**GUIDELINE VALUE:** 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/10/97  
Time background was taken = 10:26  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

**SURVEY TYPE:** 4 (removable beta/gamma)  
**METER:** LB 5100 W  
**SERIAL #:** 13795  
**PROBE #:** N/A  
**SERIAL #:** N/A  
**GUIDELINE VALUE:** 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/10/97  
Time background was taken = 10:26  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Type

Project Title

Survey Unit Location

Date

Georgia Tech Characterization Survey

Ground Floor- Outer Wall of Process Equipment Room

10/14/97

Notes

- 1) Place total counts directly from meter. Activity column will correct for background.
- 2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument

Model: 2221

Probe: 43-65

Serial #: 48409

Serial #: 62385

Efficiency: 18.00%

MDA: 123

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
827	0	0	-47	41	123
828	0	0	-47	41	123
829	0	0	-47	41	123
830	4	4	-9	55	123
831	0	0	-47	41	123
832	2	2	-28	49	123
833	4	4	-9	55	123
834	0	0	-47	41	123
835	6	6	9	61	123
836	2	2	-28	49	123
837	8	8	28	67	123
838	4	4	-9	55	123
839	4	4	-9	55	123
840	2	2	-28	49	123
841	3	3	-19	52	123

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: <u>1</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor- Outer Wall of Process Equipment Room</u>		2 for direct beta/gamma
Date	<u>10/14/97</u>		3 for removable alpha
Meter	<u>L2221</u>		4 for removable beta/gamma
Serial #	<u>48409</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>62385</u>		
MDA	<u>123</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\sum(x_i)$ =	<u>-337</u>
$n_s$ =	<u>15</u>
$x_{avg}$ =	<u>-22</u>
Maximum value in population =	<u>28</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-22</u>
$n_s$ =	<u>15</u>
$\sum(x_{avg} - x_i)^2$ =	<u>7379</u>
$s_x$ =	<u>23</u>



## Calculation Sheet

Survey Unit: Ground Floor- Outer Wall of Process Equipment Room

Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg} =$  -22

$t_{1-\alpha, df} =$  1.761

$s_x =$  23

$n_s =$  15

$\mu_{\alpha} =$  -12

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *[Signature]*

Date: 12/30/97

Reviewed by: *[Signature]*

Date: 1/14/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2

Project Title: Georgia Tech Characterization Survey

Survey Unit (Location): Ground Floor- Outer Wall of Process Equipment Room

Date: 10/14/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
(2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument

Model: L2220

Probe: 44-9

Serial #: 52823

Serial #: 11150

Efficiency: 21.87%

MDA: 1854

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
827	80	80	-2317	918	1854
828	104	104	-1585	963	1854
829	78	78	-2439	910	1854
830	338	338	5548	1328	1854
831	108	108	-1483	971	1854
832	134	134	-671	1017	1854
833	78	78	-2378	914	1854
834	180	180	732	1095	1854
835	124	124	-975	1000	1854
836	200	200	1341	1127	1854
837	372	372	6584	1373	1854
838	336	336	5487	1325	1854
839	420	420	8048	1434	1854
840	400	400	7438	1409	1854
841	398	398	7377	1406	1854

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit Ground Floor- Outer Wall of Process Equipment Room

Date 10/14/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 1854

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  30727  
 $n_s =$  15  
 $x_{avg} =$  2048  
 Maximum value in population = 8048 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  2048  
 $n_s =$  15  
 $\Sigma(x_{avg} - x_i)^2 =$  241167233  
 $s_x =$  4150

## Calculation Sheet

Survey Unit: Ground Floor- Outer Wall of Process Equipment Room  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 2048

$t_{1-\alpha, df}$  = 1.761

$s_x$  = 4150

$n_s$  = 15

$\mu_{\alpha}$  = 3935

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: Pat Lopez

Date: 12/30/97

Reviewed by: Lon Beck

Date: 1/8/98

# Removable Alpha Data Sheet

Survey Type: 3 Notes: (1) Place total counts directly from meter. Activity column will correct for background  
 Project Title: Georgia Tech Characterization Survey (2) Information for instrument and background taken directly from the MDA spreadsheet  
 Survey Unit (Location): Ground Floor- Outer Wall of Process Equipment Room  
 Date: 10/10/97

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
827	3	13
828	3	13
829	3	13
830	0	13
831	0	13
832	0	13
833	0	13
834	0	13
835	0	13
836	0	13
837	0	13
838	0	13
839	0	13
840	0	13
841	0	13

Individual Completing Form:

Reviewed By:

Date:

Date:

# Removable Beta-Gamma Data Sheet

Survey Type: 4 Notes: \_\_\_\_\_  
Project Title: Georgia Tech Characterization Survey (1) Place total counts directly from meter. Activity column will correct for background  
Survey Unit (Location): Ground Floor- Outer Wall of Process Equipment Room (2) Information for instrument and background taken directly from the MDA spreadsheet  
Date: 10/10/97

Instrument \_\_\_\_\_  
Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
827	12	17
828	0	17
829	1	17
830	3	17
831	0	17
832	0	17
833	0	17
834	3	17
835	3	17
836	1	17
837	1	17
838	3	17
839	7	17
840	3	17
841	1	17

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

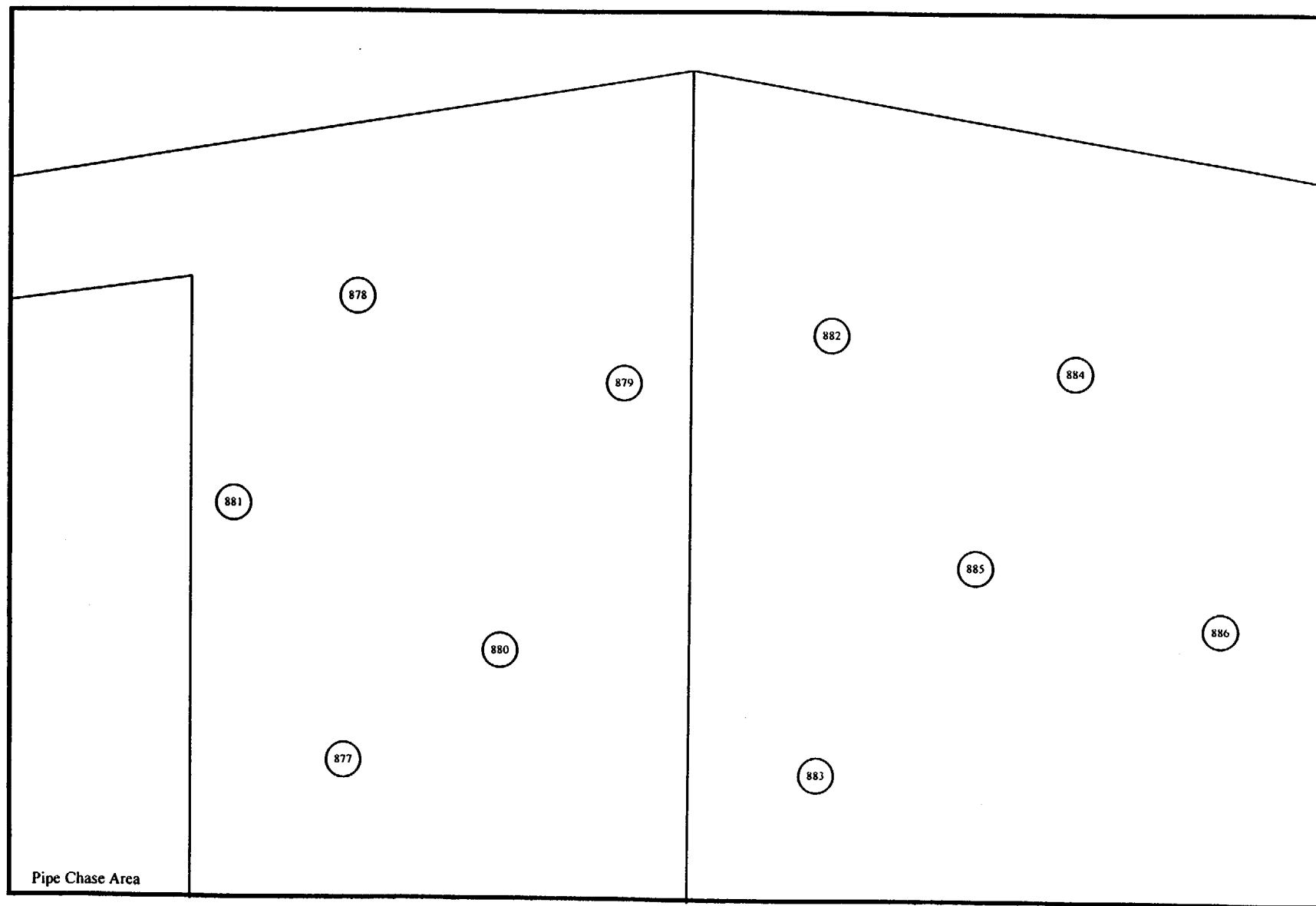
Date: 12/30/97

Date: 1/8/98

# Ground Floor- Reactor Faces in Process Equipment Room

Elevation View  
Not Drawn To Scale

E-203



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_p/T_s)}{e(a/100)} \cdot 2$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor-Reactor Faces in Process Equipment Room

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 48409  
PROBE #: 43-65  
SERIAL #: 62385  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/15/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 59

MDA (dpm/100 cm<sup>2</sup>) = 123

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2221  
SERIAL #: 68537  
PROBE #: 44-9  
SERIAL #: 66762  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 152  
Date background was taken = 10/15/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 152  
e = Probe Efficiency = 31.75%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 1261

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/16/97  
Time background was taken = 16:49  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/16/97  
Time background was taken = 16:49  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: *[Signature]*

Reviewed By: *Gerard M. Lounney*

Date: 1/5/98

Date: 1/16/98



# Direct Alpha Data Sheet

Survey Type: Georgia Tech Characterization Survey Notes: (1) Place total counts directly from meter. Activity column will correct for background.  
Project Title: Ground Floor-Reactor Faces in Process Equipment Room (2) Information for instrument and background taken directly from the MDA spreadsheet.  
Survey Unit (Location): 10-15/97  
Date: 10-15/97

Instrument: L2220 Serial #: 48409 Efficiency: 18.00%  
Model: 43-65 Serial #: 62385 MDA: 123  
Probe: 43-65

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
877	8	8	28	67	123
878	2	2	-28	49	123
879	0	0	-47	41	123
880	2	2	-28	49	123
881	0	0	-47	41	123
882	0	0	-47	41	123
883	2	2	-28	49	123
884	0	0	-47	41	123
885	0	0	-47	41	123
886	0	0	-47	41	123

Individual Completing Form: Pat J

Reviewed By: David H. Boney

Date: 1/15/98

Date: 1/16/98

# Calculation Sheet

SURVEY TYPE:	<u>1</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor-Reactor Faces in Process Equipment Room</u>		2 for direct beta/gamma
Date	<u>10/15/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>48409</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>62385</u>		
MDA	<u>123</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm <sup>2</sup> )		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-338</u>
$n_s$ =	<u>10</u>
$x_{avg}$ =	<u>-34</u>
Maximum value in population =	<u>28</u> (dpm/100 cm <sup>2</sup> )

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-34</u>
$n_s$ =	<u>10</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>4966</u>
$s_x$ =	<u>23</u>

## Calculation Sheet

Survey Unit: Ground Floor-Reactor Faces in Process Equipment Room

Survey Type: 1

This sheet uses the following equation to determine the 95%

Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}} =$  -34

$t_{1-\alpha, \text{df}} =$  1.833

$s_x =$  23

$n_s =$  10

$\mu_{\alpha} =$  -20

\*Note: for values of  $t_{1-\alpha, \text{df}}$  not on the table, the nearest greater value is used

Individual Completing Form: *Pat Lrr*

Date: 1/5/98

Reviewed by: *Gerard M. Soumy*

Date: 1/14/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2 Notes: (1) Place total counts directly from meter. Activity column will correct for background.  
 Project Title: Georgia Tech Characterization Survey (2) Information for instrument and background taken directly from the MDA spreadsheet  
 Survey Unit (Location): Ground Floor-Reactor Faces in Process Equipment Room  
 Date: 10/15/97

Instrument: \_\_\_\_\_  
 Model: L2221 Serial #: 68537 Efficiency: 31.75%  
 Probe: 44-9 Serial #: 66762 MDA: 1261

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
877	262	262	2310	837	1261
878	272	272	2520	847	1261
879	248	248	2016	823	1261
880	148	148	-84	713	1261
881	216	216	1344	789	1261
882	140	140	-252	703	1261
883	128	128	-504	689	1261
884	130	130	-462	691	1261
885	138	138	-294	701	1261
886	145	145	-147	709	1261

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

# Calculation Sheet

SURVEY TYPE: <u>2</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>Ground Floor-Reactor Faces in Process Equipment Room</u>		2 for direct beta/gamma
Date	<u>10/15/97</u>		3 for removable alpha
Meter	<u>L2221</u>		4 for removable beta/gamma
Serial #	<u>68537</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>66762</u>		
MDA	<u>1261</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>6447</u>
$n_s$ =	<u>10</u>
$x_{avg}$ =	<u>645</u>
Maximum value in population =	<u>2520</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$S_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>645</u>
$n_s$ =	<u>10</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>14046777</u>
$S_x$ =	<u>1249</u>

## Calculation Sheet

Survey Unit: Ground Floor-Reactor Faces in Process Equipment Room  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for  $n-1$  degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$  = 645  
 $t_{1-\alpha, \text{df}}$  = 1.833  
 $s_x$  = 1249  
 $n_s$  = 10  
 $\mu_{\alpha}$  = 1369

\*Note: for values of  $t_{1-\alpha, \text{df}}$  not on the table, the nearest greater value is used

Individual Completing Form: *Dave J. J.*

Date: 1/5/98

Reviewed by: *Gerard M. Tournay*

Date: 1/14/93

# Removable Alpha Data Sheet

Survey Type: 3  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor-Reactor Faces in Process Equipment Room  
Date: 10/16/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument

Model: LB 5100 W

Serial #: 13795

Efficiency: 28.35%

Probe: N/A

Serial #: N/A

MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
877	0	13
878	0	13
879	0	13
880	0	13
881	0	13
882	0	13
883	0	13
884	0	13
885	0	13
886	0	13

Individual Completing Form: Pat Lox

Reviewed By: Bernard M. Loomis

Date: 1/5/98

Date: 1/14/98

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Ground Floor-Reactor Faces in Process Equipment Room  
 Date: 10/16/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument

Model: LB 5100 W

Serial #: 13795

Efficiency: 43.45%

Probe: N/A

Serial #: N/A

MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
877	0	17
878	1	17
879	7	17
880	0	17
881	5	17
882	3	17
883	10	17
884	1	17
885	5	17
886	0	17

Individual Completing Form: *[Signature]*

Reviewed By: *Herard M Young*

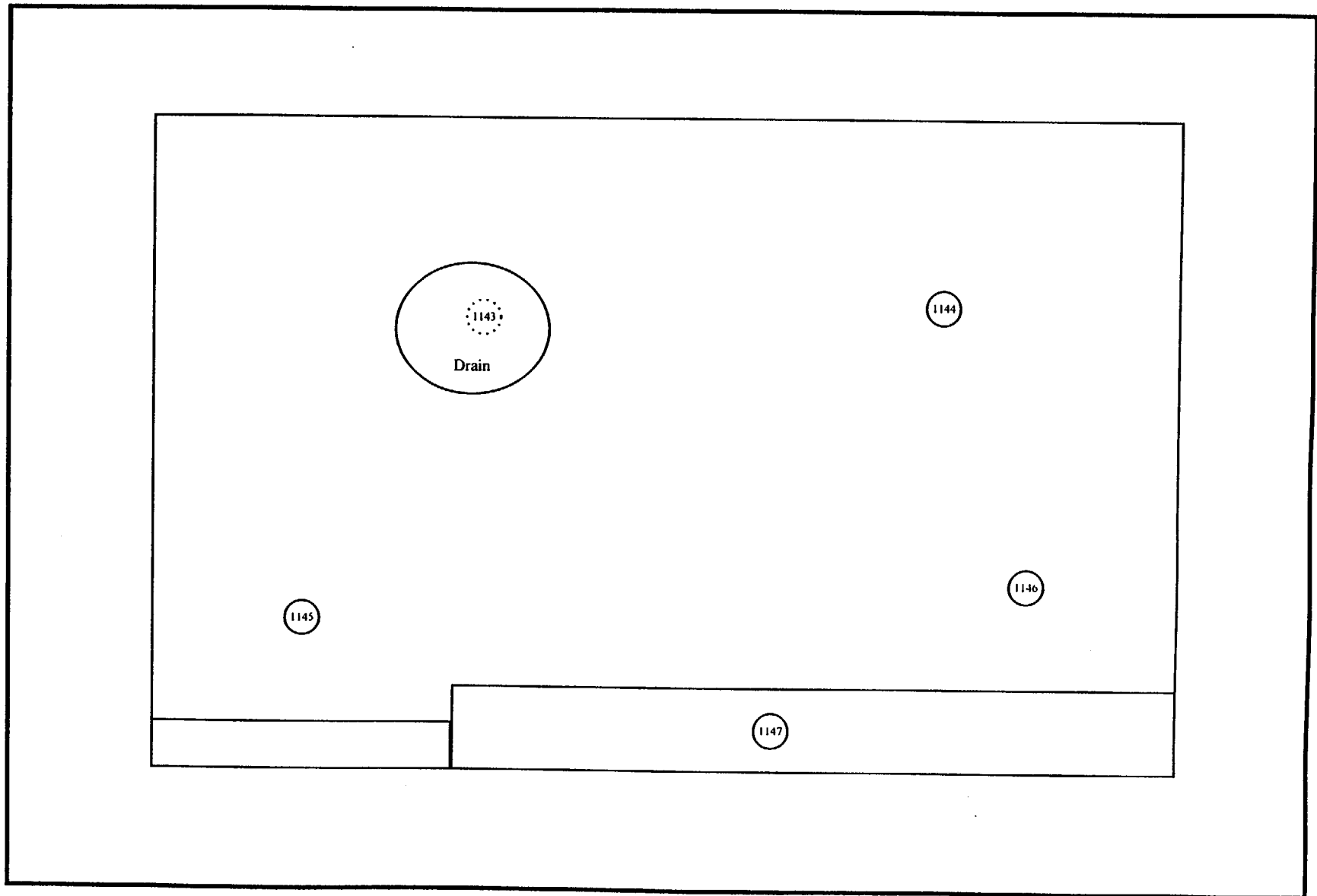
Date: 11/5/98

Date: 1/14/98



# Elevator Shaft- Bottom

Top View  
Not Drawn To Scale



E-213

○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_p/T_s)}{e(a/100)}^{1/2}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Elevator Shaft - Bottom

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/22/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/22/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: Date JVR

Reviewed By: Gerard M. Toring

Date: 12/30/97

Date: 1/14/98

# Removable Alpha Data Sheet

Survey Type 3  
 Project Title Georgia Tech Characterization Survey  
 Survey Unit Location: Elevator Shaft - Bottom  
 Date 10/22/97

Notes

1. Place total counts directly from meter. Activity column will correct for background.
2. Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model LB 5100 W Serial # 13795 Efficiency 28.35%  
 Probe N/A Serial # N/A MDA 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1143	17	13
1144	0	13
1145	0	13
1146	3	13
1147	0	13

Individual Completing Form:

Reviewed By:

Pat TTR  
Barthymy

Date:

12/30/97  
 Date: 1/14/98

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Elevator Shaft - Bottom  
Date: 10/22/97

Notes:  
(1) Place total counts directly from meter. Activity column will correct for background  
(2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1143	175	17
1144	0	17
1145	7	17
1146	1	17
1147	12	17

Individual Completing Form:

Reviewed By:

Date:

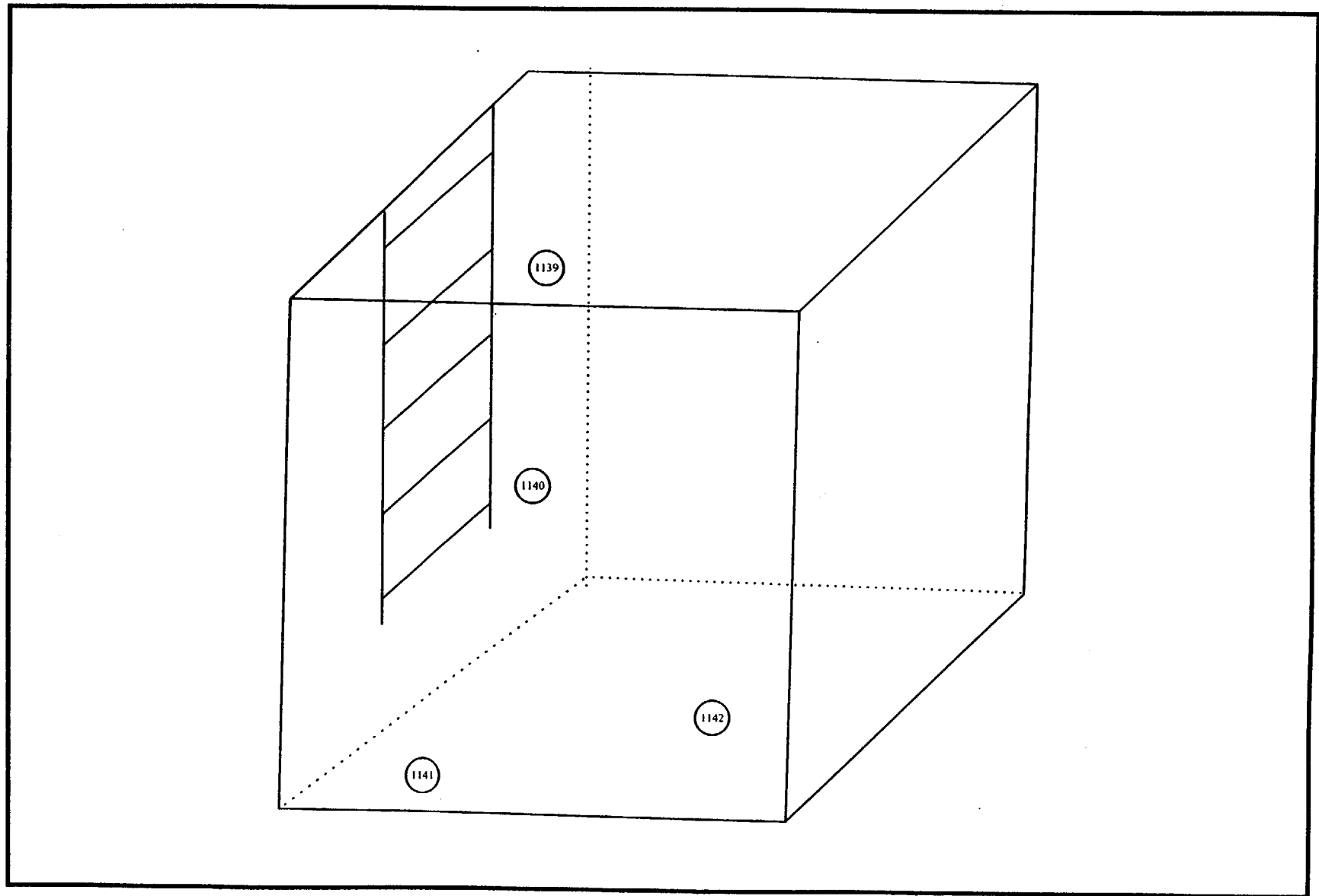
Date:

*Pat Lyy*  
*[Signature]*

12/30/97  
1/9/98

# Ground Floor- Hydraulic Sump

Three-Dimensional View  
Not Drawn To Scale



○ Survey Location

⋯ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_b/T_s)}{e(a/100)} \cdot 2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Ground Floor - Hydraulic Sump

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/22/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/22/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Removable Alpha Data Sheet

Survey Type: 3  
Project Title: Georgia Tech Characterization Survey  
Survey Unit / Location: Ground Floor - Hydraulic Sump  
Date: 10/22/97

Notes

(1) Place total counts directly from meter. Activity column will correct for background.  
(2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W      Serial #: 13795      Efficiency: 28.35%  
Probe: N/A      Serial #: N/A      MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1139	0	13
1140	7	13
1141	0	13
1142	6	13

Individual Completing Form:

Reviewed By:

*John F. T.*  
*General M. T. T.*

Date:

Date:

12/19/97  
1/14/98

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Ground Floor - Hydraulic Sump  
Date: 10/22/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1139	0	17
1140	16	17
1141	21	17
1142	173	17

Individual Completing Form:

Reviewed By:

Date:

Date:



## Miscellaneous Areas

The following is a list of smears in miscellaneous areas:

Smear	Location	Smear	Location
1109	Ladder in Hold-up duct	1126	Inside GR-2-AC Filter Bank
1110	Shutter in Hold-up duct	1127	Inside GR-3-Ac Filter Bank
1111	Tunnel Wall of Hold-up duct	1128	Inside SA-1 Hold-up duct
1112	Tunnel Wall of Hold-up duct	1129	Inside Reactor Exhaust Duct
1113	Floor of Hold-up Duct	1130	GR-2-AC Coils
1116	Floor Cover of Hold-up duct	1131	Tritium of GR-3-Ac coils
1119	Bismuth Shield Area Floor	1132	GR-3-AC coils
1120	Floor of Bismuth Shield Area	1133	Inside AC duct over Control Room
1121	Corner of Bismuth Shield Leak Area	1134	AC Coils over Control Room
1122	Sump in Bismuth Shield Leak Area	1136	Tritium of GR-3-AC
1125	Inside GR-1-AC Filter Bank	1137	Tritium of GR-2-AC

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)}{e(a/100)}^2$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): Miscellaneous Areas

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/22/97  
Time background was taken = 15:16  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/22/97  
Time background was taken = 15:16  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: *Date JTF*

Reviewed By: *David M. Young*

Date: *12/19/97*

Date: *1/14/98*

# Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): Miscellaneous Areas  
 Date: 10/22/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1109	0	13
1110	14	13
1111	0	13
1112	0	13
1113	0	13
1116	0	13
1119	3	13
1120	0	13
1121	10	13
1122	0	13
1125	0	13
1126	0	13
1127	3	13
1128	0	13
1129	0	13
1130	0	13
1131	0	13
1132	0	13
1133	7	13
1134	7	13
1136	0	13
1137	7	13

Individual Completing Form: Rate Lynn

Reviewed By: [Signature]

Date: 12/19/97

Date: 1/9/98

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): Miscellaneous Areas  
Date: 10/22/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument

Model: LB 5100 W

Probe: N/A

Serial #: 13795

Serial #: N/A

Efficiency: 43.45%

MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
1109	30	17
1110	152	17
1111	30	17
1112	46	17
1113	23	17
1116	69	17
1119	67	17
1120	173	17
1121	191	17
1122	99	17
1125	1	17
1126	0	17
1127	1	17
1128	0	17
1129	5	17
1130	3	17
1131	12	17
1132	5	17
1133	16	17
1134	7	17
1136	1	17
1137	3	17

Individual Completing Form: Rate Lopez

Reviewed By: [Signature]

Date: 12/19/97

Date: 1/9/98

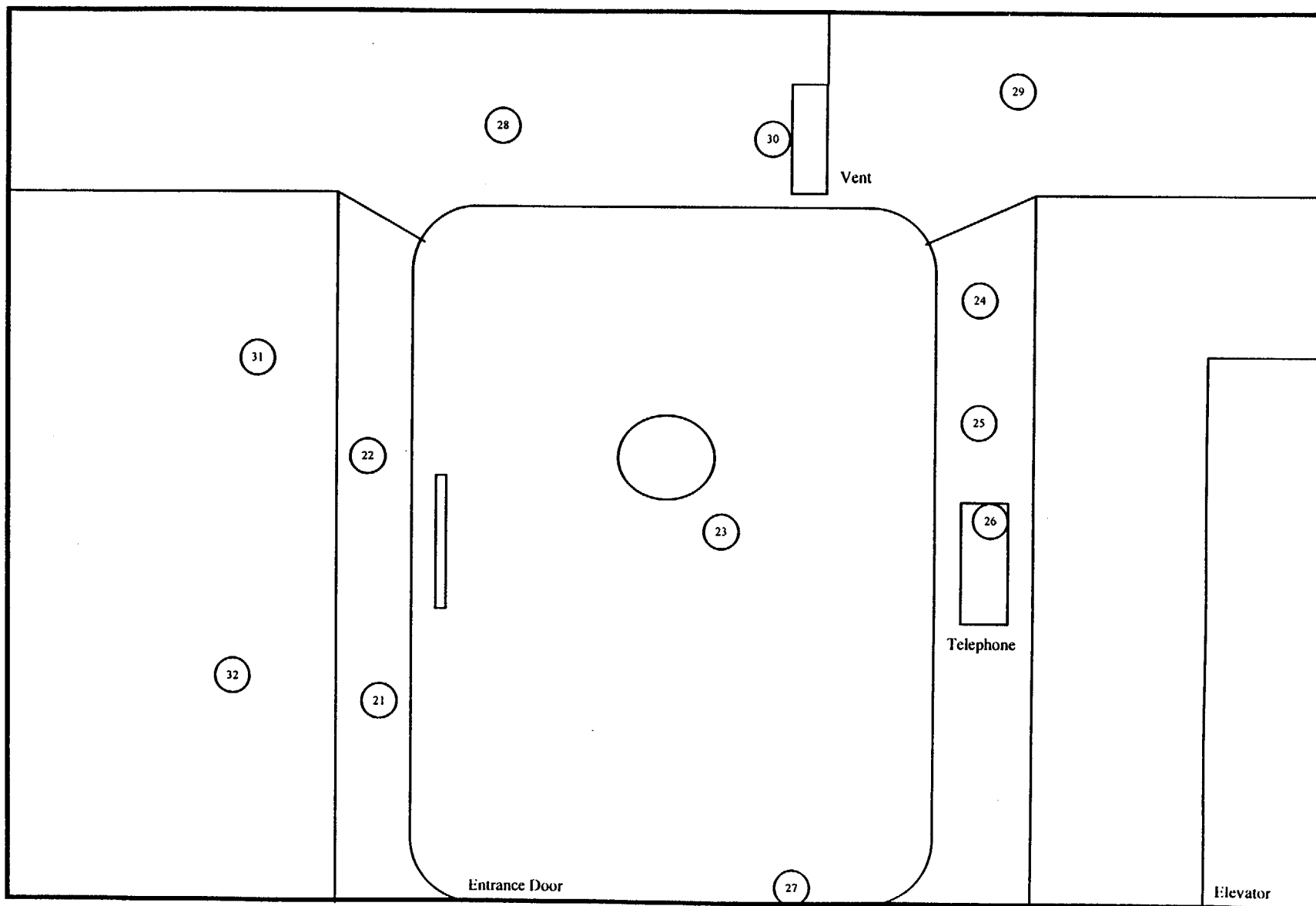
## First Floor Survey Data Summary

Survey Location	No. of Survey Points	Range of Activity (dpm/100 cm <sup>2</sup> )							
		Direct				Removable			
		Alpha	MDA	Beta-Gamma	MDA	Alpha	MDA	Beta-Gamma	MDA
Entrance Door to Containment	12	-44 to 106	116	-2662 to 9907	2234	0 to 23	13	0 to 26	17
Northwest Wall of Containment	23	-44 to 9	116	-3384 to 7468	2234	0 to 3	13	0 to 7	17
West Wall of Containment	15	-44 to 44	116	-3353 to 8657	2234	0 to 3	13	0 to 14	17
Emergency Air Lock	26	-44 to 53	116	-4329 to 16308	2234	0 to 3	13	0 to 33	17
Southeast Wall of Containment	15	-44 to 35	116	-3414 to 1421978	2234	0 to 24	13	0 to 260	17
South Wall of Containment	16	-88 to 176	289	1341 to 25545	2243	0 to 113	13	0 to 1724	17
East Wall of Containment	27	-110 to 154	289	-3597 to 610486	2243	0 to 3	13	0 to 636	17
East Wall of Containment-B	16	-35 to 132	116	-5335 to 27435	2243	0 to 3	13	0 to 21	17
North Wall of Containment	12	-88 to 132	289	-4816 to 8352	2243	0 to 3	13	0 to 12	17
North Wall of Reactor	16	-66 to 352	289	-4024 to 154976	2243	0 to 3	13	0 to 97	17
Southeast Wall of Reactor	14	-88 to 616	289	-1402 to 32160	2234	0 to 3	13	0 to 21	17
South Wall of Reactor	13	-44 to 26	116	-3048 to 129858	2243	0 to 7	13	0 to 537	17
Southwest Wall of Reactor	14	-110 to 66	289	-4877 to -152	2243	0 to 3	13	0 to 14	17
East Wall of Reactor	4	-110 to 66	289	-4268 to -152	2243	0	13	0 to 5	17
Biomedical Irradiation Facility	38	-110 to 44	289	-5639 to 7468	2243	0 to 3	13	0 to 10	17
Biomedical Irradiation Facility, Ceiling	11	-88 to 110	289	-5030 to 21917	2243	0 to 3	13	0 to 26	17
Stairs from First Floor to Ground Floor	7	-44 to -18	116	-488 to 7926	1854	0 to 3	13	0 to 14	17
Irradiation Tunnels	10	-47 to -28	123	-1463 to 12986	2234	0 to 3	13	0 to 141	17
Irradiation Tunnels-B	11	-47 to 28	123	2743 to 10364	2234	0 to 3	13	0 to 63	17
Plug Storage Area	89	None Taken	-	None Taken	-	0 to 1707	13	0 to 87610	17
Equipment in Front of Plug Storage Area	42	None Taken	-	None Taken	-	0 to 14	13	0 to 309	17
Overhead Cranes	14	-44 to -26	116	-5213 to 1738		0 to 3	13	0 to 10	17

Shading represent areas where activities are above acceptable limits in  
U.S. Nuclear Regulatory Guide 1.86, "Termination for Operating License for Nuclear Reactors," June 1974.

# First Floor- Entrance Door to Containment

Elevation View  
Not Drawn To Scale



○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)}{e(a/100)}^{1/2}$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): First Floor- Entrance Door to Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/8/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63  
MDA (dpm/100 cm<sup>2</sup>) = 116

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 230  
Date background was taken = 10/8/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 230  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15  
MDA (dpm/100 cm<sup>2</sup>) = 2234

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/8/97  
Time background was taken = 19:49  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100  
MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/8/97  
Time background was taken = 19:49  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100  
MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Type: 1 Georgia Tech Characterization Survey Notes: (1) Place total counts directly from meter. Activity column will correct for background  
 Project Title: First Floor Entrance Door to Containment (2) Information for instrument and background taken directly from the MDA spreadsheet  
 Survey Unit (Location): 10/9/97  
 Date: \_\_\_\_\_

Instrument: Model: L2220 Serial #: 50061 Efficiency: 18.00%  
Probe: 43-85 Serial #: 53291 MDA: 118

Survey Point	Gross Total Counts		Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
	Counts	Minute				
21	17	17	108		81	116
22	11	11	53		69	116
23	0	0	-44		39	116
24	3	3	-18		49	116
25	11	11	53		69	116
26	4	4	-9		52	116
27	2	2	-28		46	116
28	2	2	-28		46	116
29	4	4	-9		52	116
30	3	3	-18		49	116
31	1	1	-35		42	116
32	2	2	-28		46	116

Individual Completing Form: *[Signature]*  
 Reviewed By: *[Signature]*

Date: 12/30/97  
 Date: 1/9/98



# Calculation Sheet

SURVEY TYPE:	<u>1</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>First Floor- Entrance Door to Containment</u>		2 for direct beta/gamma
Date	<u>10/8/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>116</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\sum(x_i)$ =	<u>1</u>
$n_s$ =	<u>12</u>
$x_{avg}$ =	<u>0</u>
Maximum value in population =	<u>106</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>0</u>
$n_s$ =	<u>12</u>
$\sum(x_{avg} - x_i)^2$ =	<u>22853</u>
$s_x$ =	<u>46</u>

# Calculation Sheet

Survey Unit: First Floor- Entrance Door to Containment  
 Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

- $\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level
- $x_{avg}$  = calculated mean for a survey unit
- $t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)
- $s_x$  = standard deviation of measurements in a survey unit
- $n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 0  
 $t_{1-\alpha, df}$  = 1.796  
 $s_x$  = 46  
 $n_s$  = 12  
 $\mu_{\alpha}$  = 24

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

Pat Fry

Date: 12/30/97

Reviewed by:

[Signature]

Date: 1/9/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2 Notes: (1) Place total counts directly from meter. Activity column will correct for background.  
 Project Title: Georgia Tech Characterization Survey (2) Information for instrument and background taken directly from the MDA spreadsheet.  
 Survey Unit (Location): First Floor Entrance Door to Containment  
 Date: 10/8/97

Instrument: \_\_\_\_\_  
 Model: L2220 Serial #: 52823 Efficiency: 21.87%  
 Probe: 44-9 Serial #: 11150 MDA: 2234

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
21	260	260	914	1323	2234
22	189	189	-1250	1223	2234
23	208	208	-671	1250	2234
24	345	345	3506	1433	2234
25	341	341	3384	1428	2234
26	496	496	8109	1610	2234
27	555	555	9907	1674	2234
28	144	144	-2622	1155	2234
29	217	217	-396	1263	2234
30	183	183	-1433	1214	2234
31	177	177	-1616	1205	2234
32	223	223	-213	1272	2234

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: 12/30/97

Date: 1/16/98

# Calculation Sheet

SURVEY TYPE: <u>2</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>First Floor- Entrance Door to Containment</u>		2 for direct beta/gamma
Date	<u>10/8/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>52823</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>11150</u>		
MDA	<u>2234</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm <sup>2</sup> )		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$\bar{x}_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

$\bar{x}_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\sum(x_i)$ =	<u>17619</u>
$n_s$ =	<u>12</u>
$\bar{x}_{avg}$ =	<u>1468</u>
Maximum value in population =	<u>9907</u> (dpm/100 cm <sup>2</sup> )

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $\bar{x}_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\bar{x}_{avg}$ =	<u>1468</u>
$n_s$ =	<u>12</u>
$\sum(x_{avg} - x_i)^2$ =	<u>176369077</u>
$s_x$ =	<u>4004</u>

## Calculation Sheet

Survey Unit: First Floor- Entrance Door to Containment

Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 1468

$t_{1-\alpha, df}$  = 1.796

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

$s_x$  = 4004

$n_s$  = 12

$\mu_{\alpha}$  = 3544

Individual Completing Form: *Pat J.W.*

Date: 12/30/97

Reviewed by: *Kenneth M. Gurney*

Date: 1/16/98

# Removable Alpha Data Sheet

Survey Type: 3 Notes: Georgia Tech Characterization Survey  
 Project Title: First Floor- Entrance Door to Containment  
 Survey Unit (Location): 10/8/97  
 Date: \_\_\_\_\_

(1) Place total counts directly from meter. Activity column will correct for background  
 (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument: Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
21	0	13
22	0	13
23	0	13
24	0	13
25	0	13
26	3	13
27	0	13
28	0	13
29	0	13
30	7	13
31	23	13
32	0	13

Individual Completing Form: Lat M 877  
 Reviewed By: [Signature]

Date: 12/30/97  
 Date: 1/8/98

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): First Floor Entrance Door to Containment  
Date: 10/8/97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W  
Model: LB 5100 W  
Probe: N/A  
Serial #: 13795  
Serial #: N/A  
Efficiency: 43.45%  
MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
21	12	17
22	5	17
23	7	17
24	7	17
25	0	17
26	0	17
27	1	17
28	0	17
29	1	17
30	26	17
31	5	17
32	0	17

Individual Completing Form:

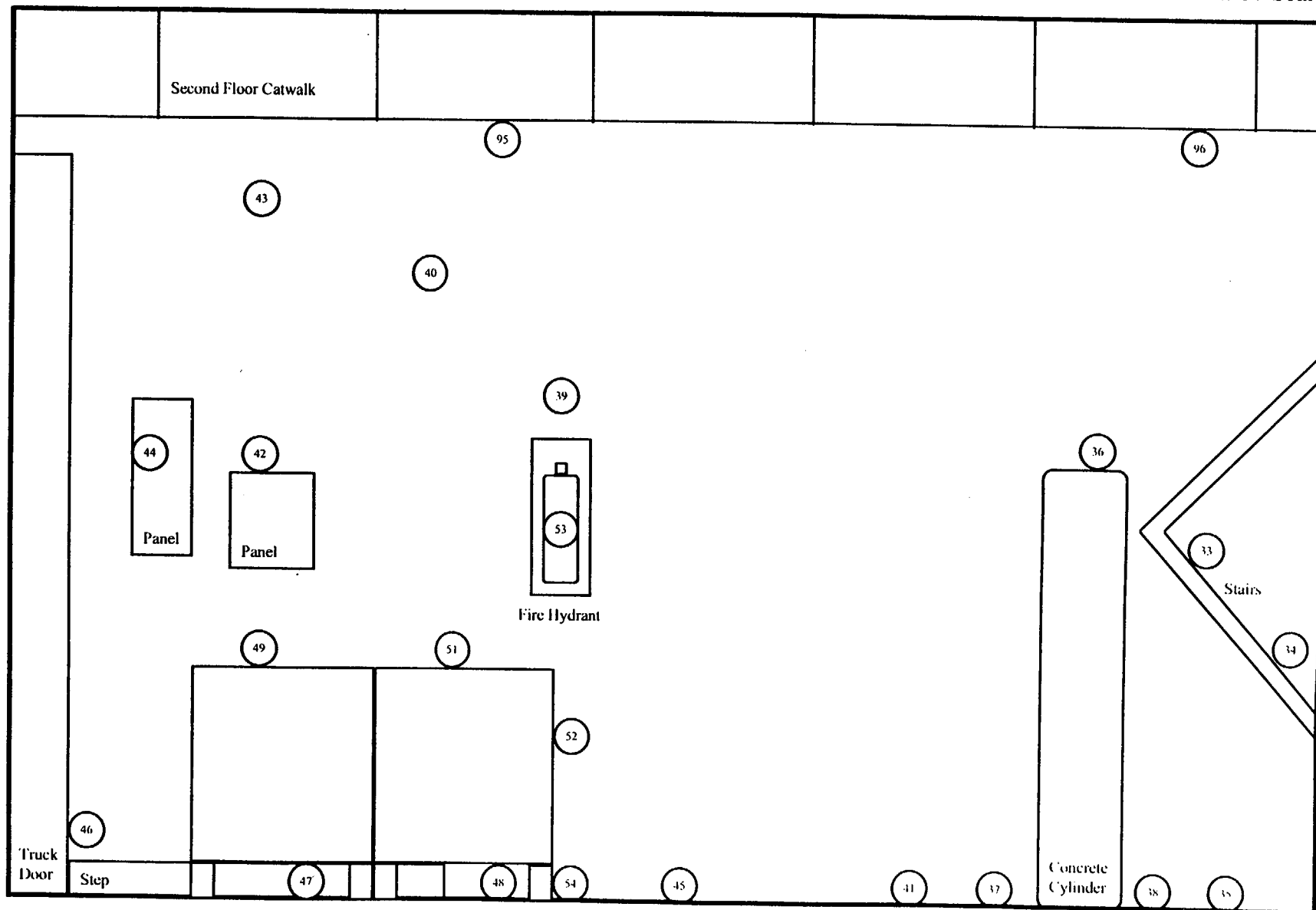
Reviewed By:

Date:

Date:

# First Floor- Northwest Wall of Containment

Elevation View  
Not Drawn To Scale



○ Survey Location

○ Survey Locations  
Behind Figure



# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_b/T_s)^{1/2}}{e (a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): First Floor- Northwest Wall of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/8/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 230  
Date background was taken = 10/8/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 230  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 2234

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/9/97  
Time background was taken = 19:49  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/9/97  
Time background was taken = 19:49  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form: Pat Lorr

Reviewed By: Gerard M. Lounney

Date: 12/28/97

Date: 1/14/98

# Direct Alpha Data Sheet

Survey Type:                       
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit/Location: First Floor Northwest Wall of Containment  
 Date: 10.8.97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background
- (2) Information for instrument and background taken directly from the MDA spreadsheet

Instrument:                      Serial #: 50061  
 Model: L2220 Serial #: 83291  
 Probe: 43-65 Efficiency: 18.00%  
 MDA: 116

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
33	3	3	-18	49	116
34	5	5	0	55	116
35	5	5	0	55	116
36	0	0	-44	39	116
37	1	1	-35	42	116
38	3	3	-18	49	116
39	1	1	-35	42	116
40	1	1	-35	42	116
41	4	4	-9	52	116
42	0	0	-44	39	116
43	0	0	-44	39	116
44	2	2	-26	46	116
45	6	6	9	57	116
46	0	0	-44	39	116
47	2	2	-26	46	116
48	3	3	-18	49	116
49	6	6	9	57	116
51	1	1	-35	42	116
52	0	0	-44	39	116
53	1	1	-35	42	116
54	0	0	-44	39	116
95	0	0	-44	39	116
96	0	0	-44	39	116

Individual Completing Form

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE:	<u>1</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>First Floor- Northwest Wall of Containment</u>		2 for direct beta/gamma
Date	<u>10/8/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>116</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-624</u>
$n_s$ =	<u>23</u>
$x_{avg}$ =	<u>-27</u>
Maximum value in population =	<u>9</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-27</u>
$n_s$ =	<u>23</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>7251</u>
$s_x$ =	<u>18</u>

## Calculation Sheet

Survey Unit: First Floor- Northwest Wall of Containment  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = -27  
 $t_{1-\alpha, df}$  = 1.717  
 $s_x$  = 18  
 $n_s$  = 23  
 $\mu_{\alpha}$  = -21

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Ruth F. [Signature]*

Date: 12/28/97

Reviewed by: *Gerard M. [Signature]*

Date: 1/14/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): First Floor Northwest Wall of Containment  
 Date: 10/8/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: L2220 Serial #: 52823  
 Probe: 44-9 Serial #: 11150

Efficiency: 21.87%  
 MDA: 2234

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
33	160	160	-2134	1180	2234
34	192	192	-1158	1227	2234
35	220	220	-305	1267	2234
36	178	178	-1585	1207	2234
37	183	183	-1433	1214	2234
38	223	223	-213	1272	2234
39	190	190	-1219	1224	2234
40	182	182	-1463	1213	2234
41	134	134	-2926	1140	2234
42	244	244	427	1301	2234
43	275	275	1372	1343	2234
44	160	160	-2134	1180	2234
45	169	169	-1859	1193	2234
46	125	125	-3201	1126	2234
47	174	174	-1707	1201	2234
48	135	135	-2896	1141	2234
49	119	119	-3384	1116	2234
51	190	190	-1219	1224	2234
52	197	197	-1006	1235	2234
53	162	162	-2073	1183	2234
54	191	191	-1189	1226	2234
95	456	456	6889	1565	2234
96	475	475	7468	1586	2234

Individual Completing Form:

Reviewed By:

*Pat L...*  
*Gerard M. Tommy*

Date:

Date:

12/28/97  
1/14/98

# Calculation Sheet

SURVEY TYPE:	<u>2</u>	Input one of the following	1 for direct alpha
Survey Unit	<u>First Floor- Northwest Wall of Containment</u>		2 for direct beta/gamma
Date	<u>10/8/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>52823</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>11150</u>		
MDA	<u>2234</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm <sup>2</sup> )		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-16948</u>
$n_s$ =	<u>23</u>
$x_{avg}$ =	<u>-737</u>
Maximum value in population =	<u>7468</u> (dpm/100 cm <sup>2</sup> )

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-737</u>
$n_s$ =	<u>23</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>164809833</u>
$s_x$ =	<u>2737</u>

## Calculation Sheet

Survey Unit: First Floor- Northwest Wall of Containment

Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = -737

$t_{1-\alpha, df}$  = 1.717

$s_x$  = 2737

$n_s$  = 23

$\mu_{\alpha}$  = 243

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: Pete J. J. J.

Date: 12/28/97

Reviewed by: Gerard M. Young

Date: 1/14/98

Removable Alpha Data Sheet

Survey Type: 3  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): First Floor- Northwest Wall of Containment  
 Date: 10/9/97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
 Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
33	0	13
34	3	13
35	0	13
36	0	13
37	0	13
38	0	13
39	0	13
40	0	13
41	3	13
42	0	13
43	0	13
44	0	13
45	0	13
46	0	13
47	0	13
48	0	13
49	0	13
51	0	13
52	0	13
53	3	13
54	0	13
95	0	13
96	3	13

Individual Completing Form:

Reviewed By:

Date:

Date:



# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): First Floor- Northwest Wall of Containment  
Date: 10.9.97

Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
Model: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
33	0	17
34	1	17
35	1	17
36	5	17
37	1	17
38	0	17
39	0	17
40	3	17
41	0	17
42	0	17
43	0	17
44	0	17
45	1	17
46	1	17
47	0	17
48	7	17
49	0	17
51	5	17
52	1	17
53	1	17
54	3	17
95	1	17
96	5	17

Individual Completing Form:

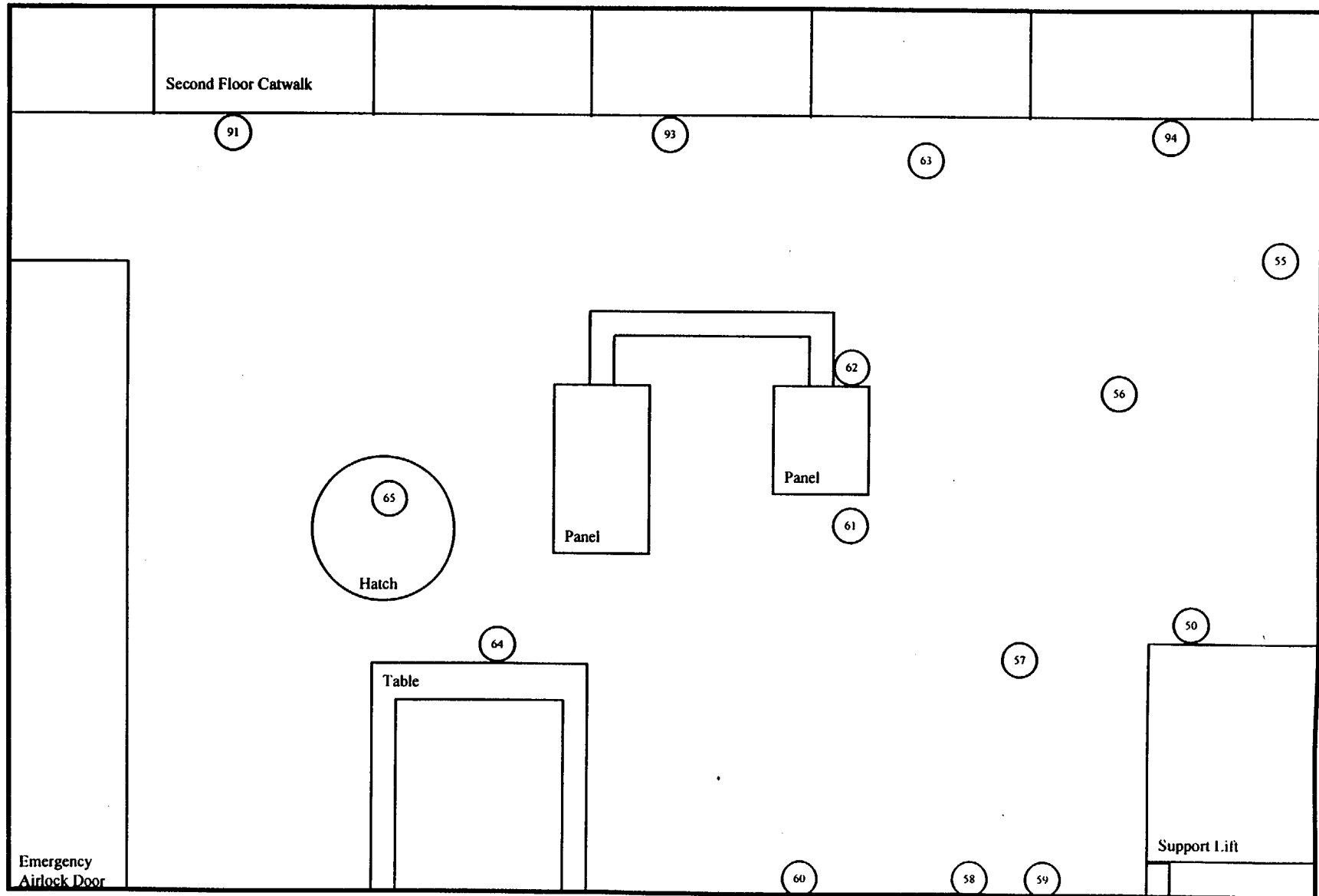
Reviewed By:

Date:

Date:

# First Floor- West Wall of Containment

Elevation View  
Not Drawn To Scale



F-22

○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_s)}{e(a/100)} \cdot 2$$

## Notes:

Enter all time in minutes  
Enter all dates as m/d/y  
Enter efficiency in decimal form (i.e., 28.3% = 0.283)  
Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): First Floor- West Wall of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/8/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63  
MDA (dpm/100 cm<sup>2</sup>) = 116

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 230  
Date background was taken = 10/8/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 230  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15  
MDA (dpm/100 cm<sup>2</sup>) = 2234

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/9/97  
Time background was taken = 19:49  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100  
MDA (dpm/100 cm<sup>2</sup>) = 13

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/9/97  
Time background was taken = 19:49  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100  
MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Type: 1  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): First Floor West Wall of Containment  
 Date: 10/8/97

## Notes:

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: L2220      Serial #: 50061      Efficiency: 18.00%  
 Probe: 43-65      Serial #: 63291      MDA: 116

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
50	4	4	-9	52	116
55	2	2	-26	46	116
56	4	4	-9	52	116
57	5	5	0	55	116
58	5	5	0	55	116
59	0	0	-44	39	116
60	2	2	-26	46	116
61	4	4	-9	52	116
62	2	2	-26	46	116
63	2	2	-26	46	116
64	7	7	18	60	116
65	3	3	-18	49	116
91	10	10	44	67	116
93	3	3	-18	49	116
94	6	6	9	57	116

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: <u>1</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>First Floor- West Wall of Containment</u>		2 for direct beta/gamma
Date	<u>10/8/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>116</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\sum(x_i)$ =	<u>-140</u>
$n_s$ =	<u>15</u>
$x_{avg}$ =	<u>-9</u>
Maximum value in population =	<u>44</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$S_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-9</u>
$n_s$ =	<u>15</u>
$\sum(x_{avg} - x_i)^2$ =	<u>6567</u>
$S_x$ =	<u>22</u>

## Calculation Sheet

Survey Unit: First Floor- West Wall of Containment  
 Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-9</u>	
$t_{1-\alpha, df}$ =	<u>1.761</u>	*Note: for values of $t_{1-\alpha, df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>22</u>	
$n_s$ =	<u>15</u>	
$\mu_{\alpha}$ =	<u>1</u>	

Individual Completing Form:

*Patricia L. V. R.*

Date: 12/19/97

Reviewed by:

*Gerard M. Toumey*

Date: 4/14/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
Project Title: Georgia Tech Characterization Survey  
Survey Unit Location: First Floor, West Wall of Containment  
Date: 10/8/97

## Notes

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument:  
Model: L2220  
Probe: 44-9

Seral #: 52823  
Seral #: 11150

Efficiency: 21.87%  
MDA: 2234

NT= None Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
50	174	174	-1707	1201	2234
55	236	236	183	1290	2234
56	149	149	-2469	1163	2234
57	172	172	-1768	1198	2234
58	260	260	914	1323	2234
59	NT				
60	214	214	-488	1259	2234
61	185	185	-1372	1217	2234
62	248	248	549	1306	2234
63	355	355	3810	1445	2234
64	175	175	-1677	1202	2234
65	223	223	-213	1272	2234
91	514	514	8657	1630	2234
93	420	420	5792	1523	2234
94	120	120	-3353	1118	2234

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: <u>2</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>First Floor- West Wall of Containment</u>		2 for direct beta/gamma
Date	<u>10/8/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>52823</u>		5 for exposure data at 1 cm
Probe	<u>44-9</u>		6 for exposure data at 1 meter
Serial #	<u>11150</u>		
MDA	<u>2234</u>		
Survey Type	<u>Direct Beta/Gamma</u>		
Guideline Value	<u>5000</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>6858</u>
$n_s$ =	<u>14</u>
$x_{avg}$ =	<u>490</u>
Maximum value in population =	<u>8657</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>490</u>
$n_s$ =	<u>14</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>149414428</u>
$s_x$ =	<u>3390</u>



## Calculation Sheet

Survey Unit: First Floor- West Wall of Containment  
 Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 490  
 $t_{1-\alpha, df}$  = 1.771  
 $s_x$  = 3390  
 $n_s$  = 14  
 $\mu_{\alpha}$  = 2095

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form:

Pat Lrv

Date: 12/19/97

Reviewed by:

Gerard M. Tomy

Date: 1/14/98

# Removable Alpha Data Sheet

Survey Type 3  
Project Title Georgia Tech Characterization Survey  
Survey Unit (Location) First Floor- West Wall of Containment  
Date 10/9/97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background.  
(2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument  
Model: LB 5100 W Serial #: 13795 Efficiency: 28.35%  
Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
50	0	13
55	0	13
56	0	13
57	0	13
58	0	13
59	0	13
60	0	13
61	3	13
62	0	13
63	0	13
64	0	13
65	0	13
91	0	13
93	0	13
94	0	13

Individual Completing Form:

Reviewed By:

*Pat FTT*  
*Edward M. Torrey*

Date:

Date:

*12/19/97*  
*1/14/98*

Removable Beta-Gamma Data Sheet

Survey Type: 4  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): First Floor- West Wall of Containment  
 Date: 10/9/97

Notes

- 1; Place total counts directly from meter. Activity column will correct for background  
 2; Information for instrument and background taken directly from the MDA spreadsheet

Instrument  
 Model: LB 5100 W Serial #: 13795 Efficiency: 43.45%  
 Probe: N/A Serial #: N/A MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
50	12	17
55	5	17
56	5	17
57	0	17
58	0	17
59	7	17
60	12	17
61	0	17
62	14	17
63	0	17
64	0	17
65	0	17
91	0	17
93	0	17
94	14	17

Individual Completing Form:

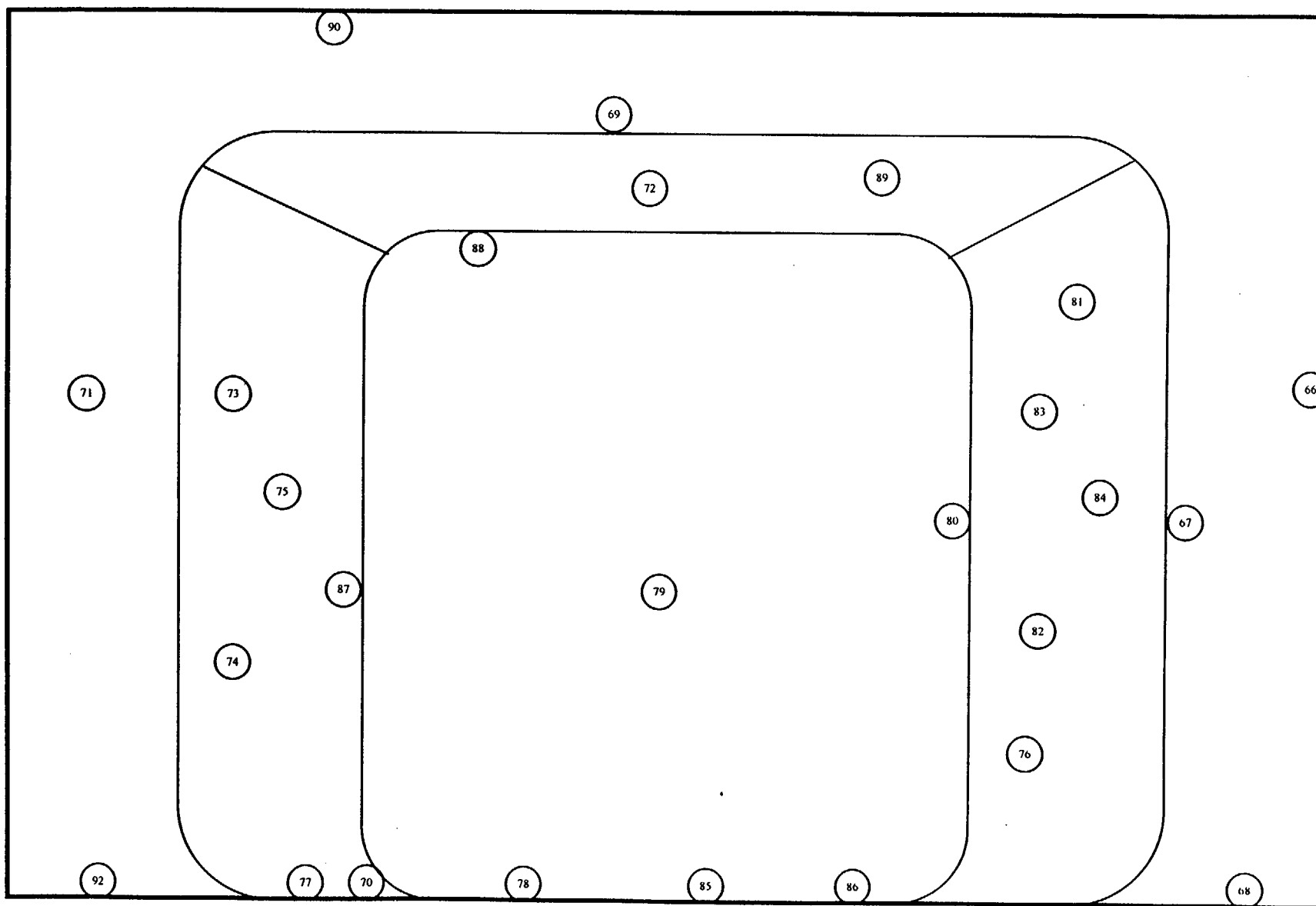
Reviewed By:

Date:

Date:

# First Floor- Emergency Air Lock

Elevation View  
Not Drawn To Scale



○ Survey Location

○ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_b + R_p/T_p)}{e(a/100)} \cdot 2$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE: Georgia Tech Characterization Survey  
SURVEY UNIT (Location): First Floor- Emergency Air Lock

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/8/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63

MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 230  
Date background was taken = 10/8/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 230  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15

MDA (dpm/100 cm<sup>2</sup>) = 2234

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/8/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/8/97  
Time background was taken = 8:00  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100

MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

# Direct Alpha Data Sheet

Survey Type: \_\_\_\_\_  
 Project Title: Georgia Tech Characterization Survey  
 Survey Unit (Location): First Floor Emergency Air Lock  
 Date: 10.8.97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background.  
 (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: \_\_\_\_\_  
 Model: L2220  
 Probe: 43-65  
 Serial #: 50061  
 Serial #: 63291  
 Efficiency: 18.00%  
 MDA: 116

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
66	2	2	-26	46	116
67	1	1	-35	42	116
68	2	2	-26	46	116
69	0	0	-44	39	116
70	3	3	-18	49	116
71	6	6	9	57	116
72	1	1	-35	42	116
73	3	3	-18	49	116
74	2	2	-26	46	116
75	1	1	-35	42	116
76	2	2	-26	46	116
77	0	0	-44	39	116
78	0	0	-44	39	116
79	1	1	-35	42	116
80	0	0	-44	39	116
81	1	1	-35	42	116
82	4	4	-9	52	116
83	1	1	-35	42	116
84	1	1	-35	42	116
85	2	2	-26	46	116
86	4	4	-9	52	116
87	1	1	-35	42	116
88	2	2	-26	46	116
89	0	0	-44	39	116
90	11	11	53	69	116
92	4	4	-9	52	116

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 1

Survey Unit First Floor- Emergency Air Lock

Date 10/8/97

Meter L2220

Serial # 50061

Probe 43-65

Serial # 63291

MDA 116

Survey Type Direct Alpha

Guideline Value 100 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \sum(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\sum(x_i) =$  -657  
 $n_s =$  26  
 $x_{avg} =$  -25  
 Maximum value in population = 53 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\sum(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -25  
 $n_s =$  26  
 $\sum(x_{avg} - x_i)^2 =$  10717  
 $s_x =$  21

## Calculation Sheet

Survey Unit: First Floor- Emergency Air Lock  
Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$ =	<u>-25</u>	
$t_{1-\alpha, df}$ =	<u>1.708</u>	*Note: for values of $t_{1-\alpha, df}$ not on the table, the nearest greater value is used
$s_x$ =	<u>21</u>	
$n_s$ =	<u>26</u>	
$\mu_{\alpha}$ =	<u>-18</u>	

Individual Completing Form:

Nath fpr

Date: 12/29/97

Reviewed by:

Gerard M. Toumey

Date: 1/14/98



# Direct Beta-Gamma Data Sheet

Survey Type: 2 Notes: (1) Place total counts directly from meter. Activity column will correct for background.  
 Project Title: Georgia Tech Characterization Survey (2) Information for instrument and background taken directly from the MDA spreadsheet.  
 Survey Unit (Location): First Floor - Emergency Air Lock  
 Date: 10.8.97

Instrument: \_\_\_\_\_  
 Model: L2220 Serial #: 52823 Efficiency: 21.87%  
 Probe: 44-9 Serial #: 11150 MDA: 2234

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
66	148	148	-2500	1162	2234
67	230	230	0	1281	2234
68	298	298	2073	1373	2234
69	100	100	-3963	1085	2234
70	111	111	-3627	1103	2234
71	114	114	-3536	1108	2234
72	119	119	-3384	1116	2234
73	129	129	-3079	1132	2234
74	146	146	-2561	1159	2234
75	100	100	-3963	1085	2234
76	258	258	854	1320	2234
77	118	118	-3414	1115	2234
78	192	192	-1158	1227	2234
79	112	112	-3597	1105	2234
80	113	113	-3567	1107	2234
81	132	132	-2987	1137	2234
82	101	101	-3932	1087	2234
83	121	121	-3323	1119	2234
84	138	138	-2804	1146	2234
85	114	114	-3536	1108	2234
86	109	109	-3688	1100	2234
87	146	146	-2561	1159	2234
88	88	88	-4329	1065	2234
89	157	157	-2225	1175	2234
90	698	698	14266	1820	2234
92	765	765	16308	1885	2234

Individual Completing Form: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: 12/22/97

Date: 1/14/98

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit First Floor- Emergency Air Lock

Date 10/8/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 2234

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$\Sigma(x_i) =$  -34233  
 $n_s =$  26  
 $x_{avg} =$  -1317  
 Maximum value in population = 16308 (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation  
 $x_{avg}$  = calculated mean for a survey unit  
 $n_s$  = number of measurements within a survey unit  
 $x_i$  = systematic and random measurements at point (i)  
 (i varies from 1 to  $n_s$ )

$x_{avg} =$  -1317  
 $n_s =$  26  
 $\Sigma(x_{avg} - x_i)^2 =$  658532861  
 $s_x =$  5132

## Calculation Sheet

Survey Unit: First Floor- Emergency Air Lock  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{\text{avg}} + t_{1-\alpha, \text{df}} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{\text{avg}}$  = calculated mean for a survey unit

$t_{1-\alpha, \text{df}}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{\text{avg}}$  and  $s_x$

$x_{\text{avg}}$	=	<u>-1317</u>
$t_{1-\alpha, \text{df}}$	=	<u>1.708</u>
$s_x$	=	<u>5132</u>
$n_s$	=	<u>26</u>
$\mu_{\alpha}$	=	<u>402</u>

\*Note: for values of  $t_{1-\alpha, \text{df}}$  not on the table, the nearest greater value is used

Individual Completing Form:

Pate JTV

Date: 12/22/97

Reviewed by:

Gerard M. Torrey

Date: 1/14/98

# Removable Alpha Data Sheet

Survey Type 3  
Project Title Georgia Tech Characterization Survey  
Survey Unit (Location) First Floor Emergency Air Lock  
Date 10/8/97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument LB 5100 W Serial #: 13795 Efficiency: 28.35%  
Probe: N/A Serial #: N/A MDA: 13

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
66	0	13
67	0	13
68	0	13
69	3	13
70	0	13
71	0	13
72	0	13
73	0	13
74	0	13
75	0	13
76	0	13
77	0	13
78	0	13
79	0	13
80	0	13
81	0	13
82	0	13
83	0	13
84	0	13
85	0	13
86	0	13
87	0	13
88	0	13
89	0	13
90	0	13
92	0	13

Individual Completing Form:

Reviewed By:

*[Signature]*  
*[Signature]*

Date:

Date:

*12/22/97*  
*1/14/98*

# Removable Beta-Gamma Data Sheet

Survey Type: 4  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): First Floor Emergency Air Lock  
Date: 10.8.97

Notes

1. Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W  
Model: LB 5100 W  
Probe: N/A  
Serial #: 13795  
Serial #: N/A  
Efficiency: 43.45%  
MDA: 17

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
66	0	17
67	33	17
68	5	17
69	5	17
70	7	17
71	3	17
72	0	17
73	0	17
74	7	17
75	3	17
76	5	17
77	3	17
78	10	17
79	5	17
80	7	17
81	5	17
82	0	17
83	1	17
84	7	17
85	12	17
86	0	17
87	0	17
88	12	17
89	1	17
90	0	17
92	0	17

Individual Completing Form:

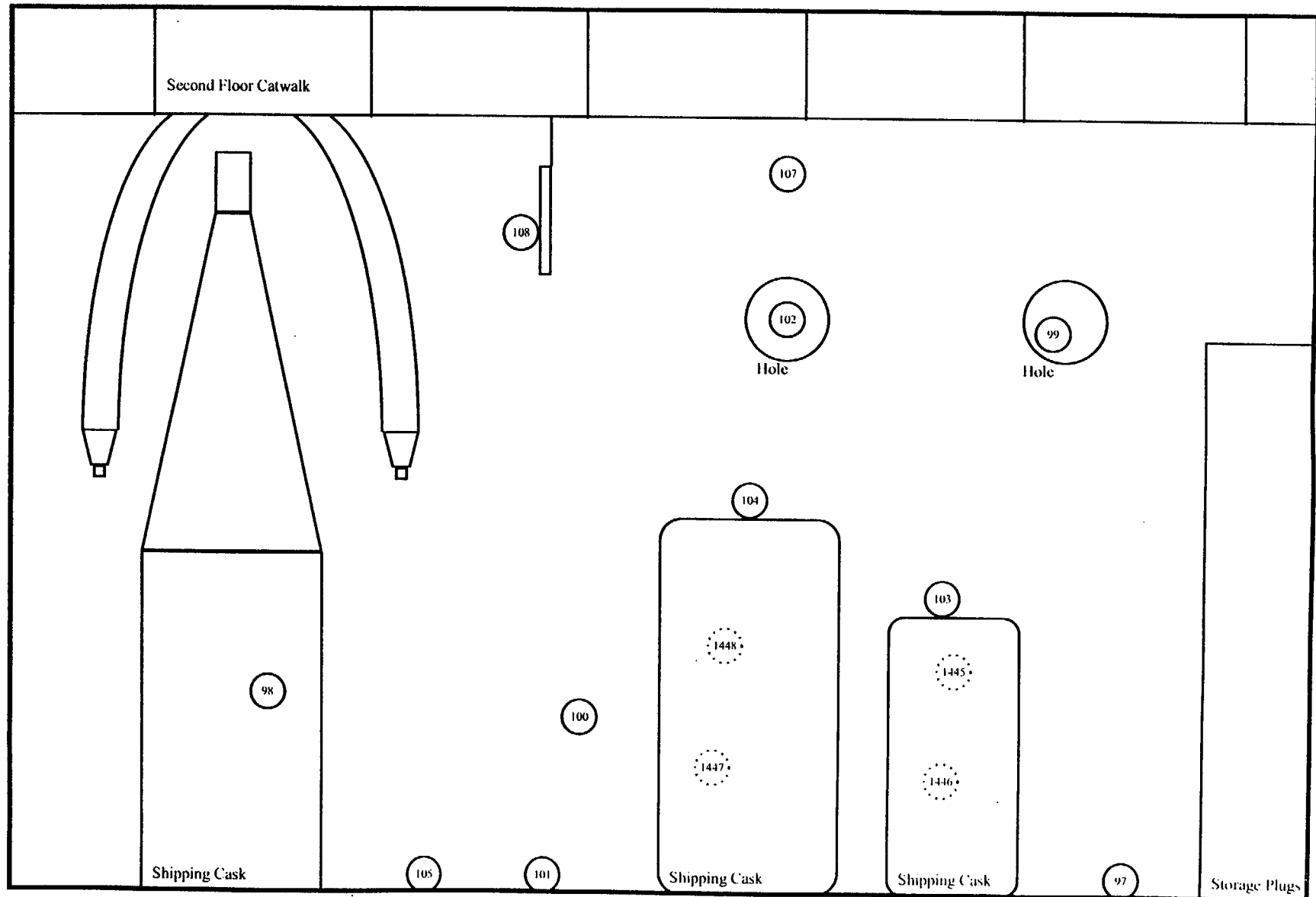
Reviewed By:

Date:

Date:

# First Floor- Southeast Wall of Containment

Elevation View  
Not Drawn To Scale



○ Survey Location

⊙ Survey Locations  
Behind Figure

# MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATION SHEET

This sheet uses the following equation to determine the MDA for each instrument per survey unit (NUREG/CR-5849):

$$MDA = \frac{2.71/T_s + 3.29(R_b/T_s + R_p/T_s)^{1/2}}{e(a/100)}$$

## Notes:

- Enter all time in minutes
- Enter all dates as m/d/y
- Enter efficiency in decimal form (i.e., 28.3% = 0.283)
- Enter probe area as 100 if not applicable (i.e., Ludlum 2929, etc.)

Survey type (by number) refers to direct or removable alpha or beta/gamma surveys. This is used to tie the various sheets together:

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma

PROJECT TITLE:  
SURVEY UNIT (Location):

Georgia Tech Characterization Survey  
First Floor- Southeast Wall of Containment

SURVEY TYPE: 1 (direct alpha)  
METER: L2220  
SERIAL #: 50061  
PROBE #: 43-65  
SERIAL #: 63291  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 5  
Date background was taken = 10/8/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 5  
e = Probe Efficiency = 18.00%  
a = Probe Area (cm) = 63  
MDA (dpm/100 cm<sup>2</sup>) = 116

SURVEY TYPE: 2 (direct beta/gamma)  
METER: L2220  
SERIAL #: 52823  
PROBE #: 44-9  
SERIAL #: 11150  
GUIDELINE VALUE: 5000 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 1  
Background counts in Tb = 230  
Date background was taken = 10/8/97  
Time background was taken = 7:30  
Rb = Background rate (cpm) = 230  
e = Probe Efficiency = 21.87%  
a = Probe Area (cm) = 15  
MDA (dpm/100 cm<sup>2</sup>) = 2234

SURVEY TYPE: 3 (removable alpha)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 20 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 0.7  
Date background was taken = 10/8/97  
Time background was taken = 19:49  
Rb = Background rate (cpm) = 0.07  
e = Probe Efficiency = 28.35%  
a = Probe Area (cm) = 100  
MDA (dpm/100 cm<sup>2</sup>) = 13

SURVEY TYPE: 4 (removable beta/gamma)  
METER: LB 5100 W  
SERIAL #: 13795  
PROBE #: N/A  
SERIAL #: N/A  
GUIDELINE VALUE: 100 (dpm/100 cm<sup>2</sup>)

Ts = Sample Time (min) = 1  
Tb = Background Time (min) = 10  
Background counts in Tb = 18.3  
Date background was taken = 10/8/97  
Time background was taken = 19:49  
Rb = Background rate (cpm) = 2  
e = Probe Efficiency = 43.45%  
a = Probe Area (cm) = 100  
MDA (dpm/100 cm<sup>2</sup>) = 17

Individual Completing Form:

Reviewed By:

Date:

Date:

Direct Alpha Data Sheet

Survey Type  
Project Title  
Survey Unit (Location)  
Date

Georgia Tech Characterization Survey  
First Floor Southeast Wall of Containment  
12/8/97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background.  
(2) Information for instrument and background taken directly from the MOA spreadsheet.

Instrument

Model: L2220  
Probe: 43-65

Serial #: 50061  
Serial #: 63291

Efficiency: 18.00%  
MDA: 116

NT=Not Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level)	MDA (dpm/100 cm <sup>2</sup> )
				(dpm/100 cm <sup>2</sup> )	
97	1	1	-35	42	116
98	0	0	-44	39	116
99	0	0	-44	39	116
100	6	6	9	57	116
101	4	4	-9	52	116
102	4	4	-9	52	116
103	5	5	0	55	116
104	9	9	35	65	116
105	3	3	-18	49	116
107	4	4	-9	52	116
108	4	4	-9	52	116
1445	NT				
1446	NT				
1447	NT				
1448	NT				

Individual Completing Form:

Reviewed By:

Date:

Date:



# Calculation Sheet

SURVEY TYPE: <u>1</u>		Input one of the following	1 for direct alpha
Survey Unit	<u>First Floor- Southeast Wall of Containment</u>		2 for direct beta/gamma
Date	<u>10/8/97</u>		3 for removable alpha
Meter	<u>L2220</u>		4 for removable beta/gamma
Serial #	<u>50061</u>		5 for exposure data at 1 cm
Probe	<u>43-65</u>		6 for exposure data at 1 meter
Serial #	<u>63291</u>		
MDA	<u>116</u>		
Survey Type	<u>Direct Alpha</u>		
Guideline Value	<u>100</u> (dpm/100 cm2)		

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$\Sigma(x_i)$ =	<u>-133</u>
$n_s$ =	<u>11</u>
$x_{avg}$ =	<u>-12</u>
Maximum value in population =	<u>35</u> (dpm/100 cm2)

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$s_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)  
(i varies from 1 to  $n_s$ )

$x_{avg}$ =	<u>-12</u>
$n_s$ =	<u>11</u>
$\Sigma(x_{avg} - x_i)^2$ =	<u>5443</u>
$s_x$ =	<u>23</u>

## Calculation Sheet

Survey Unit: First Floor- Southeast Wall of Containment  
 Survey Type: 1

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = -12  
 $t_{1-\alpha, df}$  = 1.812  
 $s_x$  = 23  
 $n_s$  = 11  
 $\mu_{\alpha}$  = 1

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Pat Lyrr*

Date: 12/22/97

Reviewed by: *Gerard M. Tourney*

Date: 1/14/98

# Direct Beta-Gamma Data Sheet

Survey Type: 2  
Project Title: Georgia Tech Characterization Survey  
Survey Unit (Location): First Floor Southeast Wall of Containment  
Date: 10.8.97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: L2220  
Model: 44-9  
Serial #: 52823  
Serial #: 11150  
Efficiency: 21.87%  
MDA: 2234

NT = Not Taken

Survey Point	Gross Total Counts	Gross Counts Per Minute	Activity (dpm/100 cm <sup>2</sup> )	Uncertainty (95% Confidence Level) (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
97	756	756	16034	1876	2234
98	118	118	-3414	1115	2234
99	197	197	-1006	1235	2234
100	1492	1492	38470	2479	2234
101	1570	1570	40847	2535	2234
102	569	569	10334	1689	2234
103	46878	46878	1421978	12968	2234
104	7501	7501	221643	5253	2234
105	872	872	19570	1983	2234
107	386	386	4755	1483	2234
108	405	405	5335	1506	2234
1445	NT				
1446	NT				
1447	NT				
1448	NT				

Individual Completing Form:

Reviewed By:

Date:

Date:

# Calculation Sheet

SURVEY TYPE: 2

Survey Unit First Floor- Southeast Wall of Containment

Date 10/8/97

Meter L2220

Serial # 52823

Probe 44-9

Serial # 11150

MDA 2234

Survey Type Direct Beta/Gamma

Guideline Value 5000 (dpm/100 cm2)

Input one of the following

- 1 for direct alpha
- 2 for direct beta/gamma
- 3 for removable alpha
- 4 for removable beta/gamma
- 5 for exposure data at 1 cm
- 6 for exposure data at 1 meter

## Average Measurement Level

This sheet uses the following equation to determine the Average Measurement Level for each instrument per survey unit. (NUREG/CR-5849)

$$x_{avg} = 1/n_s \cdot \Sigma(x_i)$$

Where

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$$\Sigma(x_i) = \underline{1774546}$$

$$n_s = \underline{11}$$

$$x_{avg} = \underline{161322}$$

$$\text{Maximum value in population} = \underline{1421978} \text{ (dpm/100 cm}^2\text{)}$$

## Standard Deviation

This sheet uses the following equation to determine the Standard Deviation. (NUREG/CR-5849)

$$S_x = \frac{(\Sigma(x_{avg} - x_i)^2)^{1/2}}{(n_s - 1)^{1/2}}$$

Where

$S_x$  = standard deviation

$x_{avg}$  = calculated mean for a survey unit

$n_s$  = number of measurements within a survey unit

$x_i$  = systematic and random measurements at point (i)

(i varies from 1 to  $n_s$ )

$$x_{avg} = \underline{161322}$$

$$n_s = \underline{11}$$

$$\Sigma(x_{avg} - x_i)^2 = \underline{1788832120436}$$

$$S_x = \underline{422946}$$

## Calculation Sheet

Survey Unit: First Floor- Southeast Wall of Containment  
Survey Type: 2

This sheet uses the following equation to determine the 95% Confidence Level. (NUREG/CR-5849)

$$\mu_{\alpha} = x_{avg} + t_{1-\alpha, df} [s_x / (n_s)^{1/2}]$$

Where

$\mu_{\alpha}$  = value compared to guideline value to determine 95% Confidence Level

$x_{avg}$  = calculated mean for a survey unit

$t_{1-\alpha, df}$  = 95% confidence level for n-1 degrees of freedom (see table B-1 of NUREG-5849)

$s_x$  = standard deviation of measurements in a survey unit

$n_s$  = number of measurements within a survey unit used to determine  $x_{avg}$  and  $s_x$

$x_{avg}$  = 161322  
 $t_{1-\alpha, df}$  = 1.812  
 $s_x$  = 422946  
 $n_s$  = 11  
 $\mu_{\alpha}$  = 392394

\*Note: for values of  $t_{1-\alpha, df}$  not on the table, the nearest greater value is used

Individual Completing Form: *Pat J*

Date: 12/22/97

Reviewed by: *Ernest M. Towner*

Date: 4/16/98

# Removable Alpha Data Sheet

Survey Type: 3  
Project Title: Georgia Tech Characterization Survey  
Survey Unit / Location: First Floor, Southeast Wall of Confinement  
Date: 10/8/97

Notes

- (1) Place total counts directly from meter. Activity column will correct for background.
- (2) Information for instrument and background taken directly from the MDA spreadsheet.

Instrument: LB 5100 W  
Model: N/A  
Probe: N/A  
Serial #: 13795  
Serial #: N/A  
Efficiency: 28.35%  
MDA: 13

NT= None Taken

Survey Point	Activity (dpm/100 cm <sup>2</sup> )	MDA (dpm/100 cm <sup>2</sup> )
97	0	13
98	0	13
99	0	13
100	0	13
101	0	13
102	0	13
103	0	13
104	0	13
105	3	13
107	0	13
108	0	13
1445	3	13
1446	3	13
1447	17	13
1448	24	13

Individual Completing Form:

Reviewed By:

Date:

Date: