9.4 DETAILED RESULTS FOR SURVEY UNIT 004

Room 2124A Floor (Class 1 Interior Area)

INDEX

SU-004 Survey Package Worksheet 1
SU-004 Survey Maps 4
SU-004 Alpha Fixed Point Survey Reports 5
SU-004 Alpha Scan Survey Reports 10
SU-004 Gamma Fixed Point Survey Reports 14
SU-004 Smear Survey Reports 22
SU-004 Instrument Efficiencies and MDC Worksheets 23
SU-004 COMPASS Survey Plan 24
SU-004 Survey Location Calculations 27

ENERGYSOLUTIONS

Survey Package Worksheet for NIST Boulder SU004

Package Identification No.: SU04F/SU04S	**Prepared by:** Paul C. Ely
Location: Room 2124A Floor (Class 1 Interior Area)	**Date Prepared:** 2/8/2009
Area Classification: Class 1	**Signature:** Paul Ely

Area Description

The survey area includes the floor only.

Historical Information

On June 9, 2008, researchers ruptured a glass vial of 0.25 grams of mixed plutonium isotopes in the form of $PuSO_4$-$4H_2O$ resulting in the contamination of laboratory rooms 2124, 2124A, 2120, 2120A and 2007 in Building 1 on the NIST campus in Boulder, Colorado. Room 2124 is the room where the glass vial ruptured and is the room that was the most contaminated. This room is a Class 1 area because it had activity in excess of the release limit of 696 dpm/100 cm^2 (44 cpm/100 cm^2). The isotopes of concern are Pu-238, Pu-239, Pu-240, Pu-241, Pu-242 and Am-241.

General Survey Instructions

1. Use gas proportional detector model numbers 43-68, or equivalent detector as approved by the ES PM for alpha surface activity surveys. The total instrument efficiency should use the following factors:
   - ε_i, 2π instrument efficiency from calibration papers. If a 4π efficiency is reported, calculate the 2π efficiency as follows using a 5% alpha Back Scatter factor (BS). $\varepsilon_i = (2 * \varepsilon_{4\pi}) \backslash (1 + BS)$
   - ε_s, the alpha surface efficiency is 25%.
   - ε_f, the fraction of radionuclides detected in the survey, 52% for the NIST-Boulder broken vial material.
   - ε_t, the total alpha efficiency $= \varepsilon_i * \varepsilon_s * \varepsilon_f$
2. Perform surface scans at a scan speed of 1 probe width per four seconds or less for the 43-68. Any locations that exceed 35 cpm alpha must be marked with a felt tip pen or equivalent and the extent of the elevated area recorded. Alternatively the 43-37 large area detector may be used for scanning at a scan speed of 1 probe width per four seconds or less and any locations that exceed 256 cpm alpha must be marked with a felt tip pen or equivalent and the extent of the elevated area recorded.
   - 100% scan of floor, for <u>alpha</u> contamination.
   - Log scan data.
3. Perform exposure rate measurement at 100-cm from the surface at each floor measurement location provided on survey map(s) (attached). If a reading exceeds 5 μR/hr above background, notify the ES Project Manager or his designee.
4. Perform direct <u>alpha</u> surface activity measurements at each measurement location provided on survey map(s).
5. Collect a removable surface activity sample over an area of 100 cm^2 in size at each measurement location provided on survey maps. Removable activity results are for information only and the same limits apply as for fixed contamination as a 10% smear activity removal factor is incorporated into the smear counting results. Notify the Project Manager if alpha smear results exceed 696 dpm/100 cm^2.

Special Instructions

- Source check instrumentation to Th-230 for alpha, and Cs-137 for gamma measurements.
- The static MDC for total alpha activity measurements shall be less than 345 dpm/100 cm^2.
- Perform a minimum of three one-minute field backgrounds using the plastic shield on the survey surface.
- Log scan measurement results for information only. The primary surface scanning methodology for the detection of elevated activity is the audible detection of count rate increases relative to background.
- Measurement and sampling locations are based on a random-start rectangular pattern. If any location is inaccessible, offset the measurement location to the nearest usable location and document the x and y coordinates for the location used.
- The attached map provides measurement and sampling locations.
- Notify the ES Project Manager of locations that exceed 44 cpm/100 cm^2 total alpha surface activity.
- Attach photographic records if available and provide descriptive comments for each image under Survey Comments.

Survey performance (Initial and date as each survey is complete)

Location Code					General Description	Beta Scan	Direct Beta	Direct Alpha	Alpha Scan	Direct Gamma	Smear Gross
L1	L2	L6	L7	L8							
NIST Boulder SU004 Class 1 Area											
Package ID	Surface or Structure	Material Code	Row	Column Number				@60 sec	100%	@100 cm	α
SU04F	FL01	B0002	A thru F	1 thru 3	Floor	N/A	N/A	18 SM. 3-12-09	N/A	18 SM 3-12-09	18 SM 3-12-09
SU04S	FL01	B0002	A thru F	1 thru 3	Floor	N/A	N/A	N/A	3-11-09 SM ~~3-12-09~~	N/A	N/A

Survey Comments

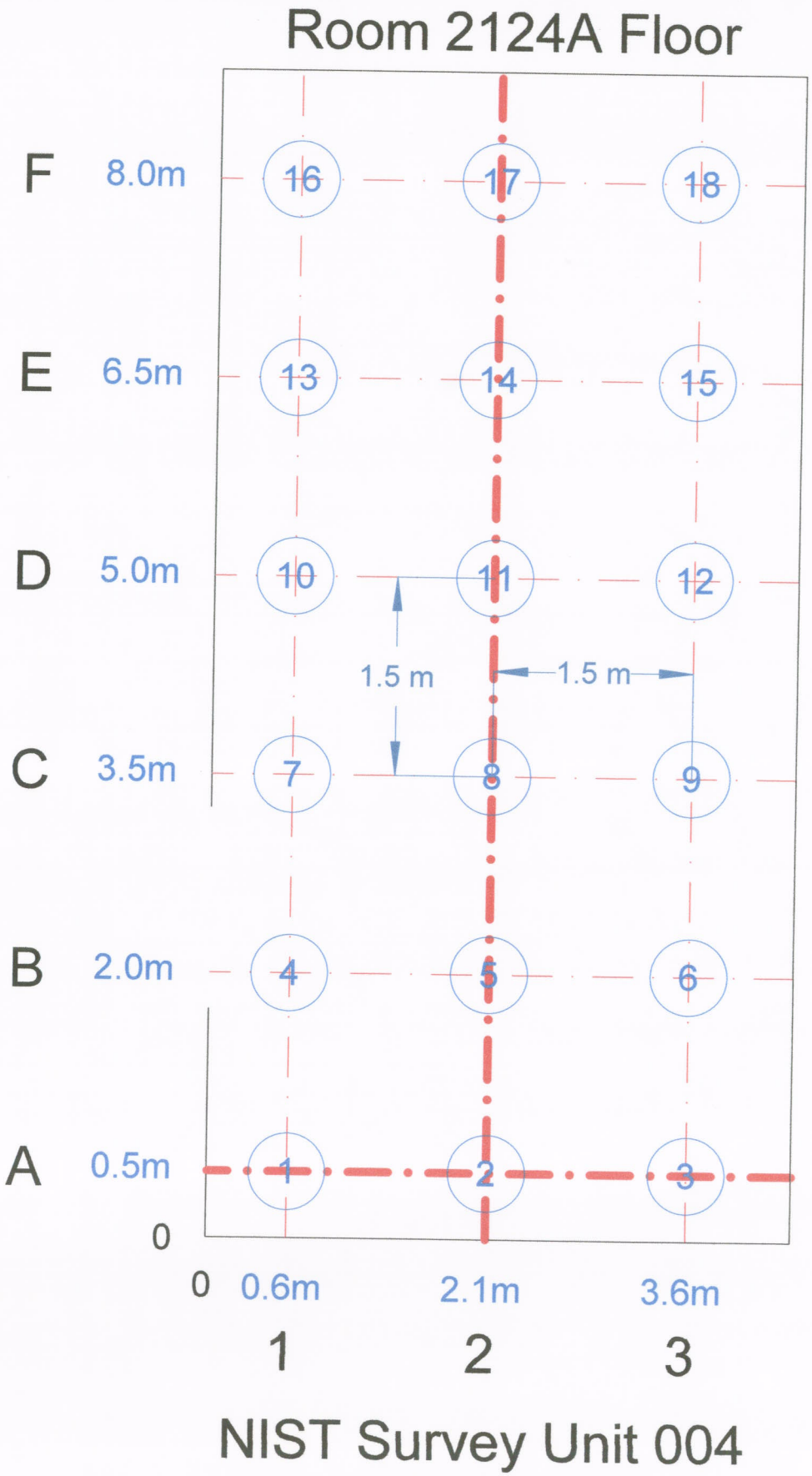
Smear results for floor in 2124A on NIST 09-0398 FSS Smear analysis
Static readings on download # 00000189 for gamma and download
#00000288 for alpha.
Scan results for floor in 2124A on # 00000284

Package Review

Surveyor(s) Signatures: Sharon McCheesney

Date Package Completed: 3-12-09

Package Reviewed by and Date (Signature): Paul Ely 3-19-09


Room 2124A Floor
F
8.0m
E
6.5m
D
5.0m
C
3.5m
B
2.0m
A
0.5m
0
16
17
18
13
14
15
10
11
12
7
8
9
4
5
6
1
2
3
1.5 m
1.5 m
0
0.6m
2.1m
3.6m
1
2
3
NIST Survey Unit 004

ATTACHMENT 14 - SURVEY DOWNLOAD DATA SHEET

Download Technician: Print Name: Sean McChesney **Signature:** Sean McChesney **Date:** 3/11/09

Download Station #: 12 Download File #: 288

Serial # Verification: Model 2350-1 ☐ Detector: ☐ Problems: (See Comments)

Survey Technician(s):

Print Name: Sharon McChesney **User ID** SXM1098 **Signature:** Sharon McChesney **Date:** 3-11-09

Print Name: _____ **User ID** _____ **Signature:** _____ **Date:** _____

Instrument Serial #(s): Model 2350-1: 117566

Survey Unit Description: SU04 and SU08 Rm 264A, Points on Ceiling Walls & Floor

(Example: Survey Package + description i.e. D16, Building 43, Area 09, Room 100, Floor - Grid Locations A1 through A7)

Instrument Calibration Due Date: 10-8-09 Detector Calibration Due Date: 8-8-09

Type Of Survey: ☒ Term Survey ☒ Characterization ☐ Information Only

Other (explain): ACE 3-20-09

Type of Measurement	Detector Serial Number	Detector Model Number	Detector Efficiency	Source Mean BKG Value	Pre & Post Use Info	
					Pre File#	Post File#
☐ Alpha α		43-37				
☐ Beta β		43-68B	ACE 3-18-09			
☒ Alpha α	092508	43-68A	.0411 ~~.0423~~		#	
☐ Gamma γ		44-2	N/A	N/A		
☐ Alpha α		43-93				

Local Area Background Measurements — MEAN Value in cpm ↓

β Beta	1	2	3	4	5	6	
α Alpha	1 7	2 ~~21~~ delete	3 ACE 3-17-09	4	5	6	ACE 3-17-09 ~~14~~ 7

COMMENTS: Deleted second background of 21 cpm because it was obviously too high and conservatively used the lower 7 cpm for background subtraction ACE 3-17-09

Duratek™

M2350-1 Download Alpha Report

Station 2 File : 00000288	Survey Description :Room 2124A Pointson F01, Walls and Ceiling + Post	
Survey Reason : ~~Characterization~~ FSS PCE 3-20-09		
User ID : SXM1098	Technician Name : Sharon McChesney	
Instrument Model : 2350-1	Instrument S/N : 117566	Instrument Cal. Due : 10/8/09
Detector Model : 43-68A	Detector S/N : 092508	Detector Cal. Due : 8/5/09
Measurement Type : Alpha	Detector Type : 01200 : 126 cm2 Gas Proportional Detector, Alpha Window	
Detector Area : 126	Efficiency : 0.0414	Survey Date : 3/11/09

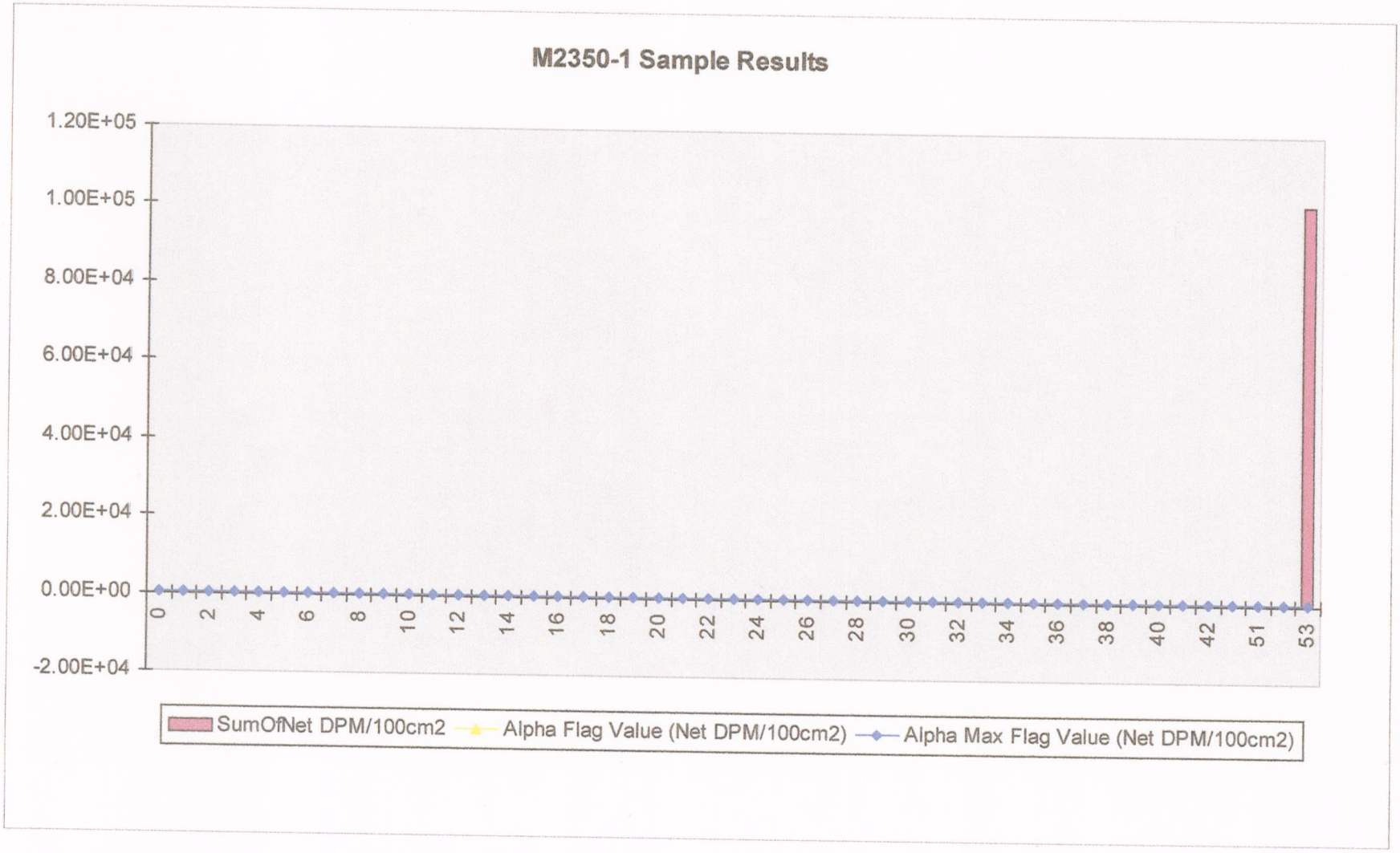
Print Name	Signature	Date
Sharon McChesney	Sharon McChesney	3/19/09

Comments:

Sign-Off

Print Name	Signature	Date
PAUL ELY	Paul Ely	3-20-09

Page 1 of 4


M2350-1 Sample Results
1.20E+05
1.00E+05
8.00E+04
6.00E+04
4.00E+04
2.00E+04
0.00E+00
-2.00E+04
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
51
53
SumOfNet DPM/100cm2
Alpha Flag Value (Net DPM/100cm2)
Alpha Max Flag Value (Net DPM/100cm2)

2 of 4

Duratek Alpha Survey Report

Download File Name: 00000288

Package ID(L1)	Surface (L2)	Sample #	Counts	Time (sec)	Count Type (L5)	Material Type (L6)	Grid ID(L7)	Location # (L8)	Bkgd	Net DPM/100cm2/Fixed DPM/Area/ Scans
SU08F	W01	0	7.0	60	FLDBK	B0005	B	1	7	0
SU08F	W01	1	5.0	60	FLDCT	B0005	A	1	7	-38
SU08F	W01	2	2.0	60	FLDCT	B0005	B	2	7	-96
SU08F	W01	3	11.0	60	FLDCT	B0005	B	3	7	77
SU08F	W02	4	7.0	60	FLDCT	B0005	A	4	7	0
SU08F	W02	5	12.0	60	FLDCT	B0005	A	5	7	96
SU08F	W02	6	9.0	60	FLDCT	B0005	B	6	7	38
SU08F	W02	7	9.0	60	FLDCT	B0005	B	7	7	38
SU08F	W03	8	9.0	60	FLDCT	B0005	A	8	7	38
SU08F	W03	9	5.0	60	FLDCT	B0005	A	9	7	-38
SU08F	W03	10	9.0	60	FLDCT	B0005	A	10	7	38
SU08F	W03	11	14.0	60	FLDCT	B0005	B	11	7	134
SU08F	W03	12	6.0	60	FLDCT	B0005	B	12	7	-19
SU08F	W03	13	10.0	60	FLDCT	B0005	B	13	7	58
SU08F	W04	14	4.0	60	FLDCT	B0005	A	14	7	-58
SU08F	W04	15	5.0	60	FLDCT	B0005	A	15	7	-38
SU08F	W04	16	4.0	60	FLDCT	B0005	B	16	7	-58
SU08F	W04	17	1.0	60	FLDCT	B0005	B	17	7	-115
SU08F	C01	18	9.0	60	FLDCT	B0010	A	18	7	38
SU08F	C01	19	6.0	60	FLDCT	B0010	A	19	7	-19
SU08F	C01	20	9.0	60	FLDCT	B0010	B	20	7	38
SU08F	C01	21	11.0	60	FLDCT	B0010	B	21	7	77
SU08F	C01	22	6.0	60	FLDCT	B0010	C	22	7	-19
SU08F	C01	23	5.0	60	FLDCT	B0010	C	23	7	-38
SU08F	C01	24	7.0	60	FLDCT	B0010	D	24	7	0
SU08F	C01	25	9.0	60	FLDCT	B0010	D	25	7	38
SU04F	FL01	26	18.0	60	FLDCT	B0002	A	1	7	211
SU04F	FL01	27	11.0	60	FLDCT	B0002	A	2	7	77
SU04F	FL01	28	18.0	60	FLDCT	B0002	A	3	7	211
SU04F	FL01	29	16.0	60	FLDCT	B0002	B	4	7	173
SU04F	FL01	30	13.0	60	FLDCT	B0002	B	5	7	115
SU04F	FL01	31	15.0	60	FLDCT	B0002	B	6	7	153
SU04F	FL01	32	18.0	60	FLDCT	B0002	C	7	7	211
SU04F	FL01	33	16.0	60	FLDCT	B0002	C	8	7	173
SU04F	FL01	34	11.0	60	FLDCT	B0002	C	9	7	77
SU04F	FL01	35	16.0	60	FLDCT	B0002	D	10	7	173
SU04F	FL01	36	14.0	60	FLDCT	B0002	D	11	7	134
SU04F	FL01	37	14.0	60	FLDCT	B0002	D	12	7	134

SU008
PCE 3-20-09

Alpha Flag -

Alpha Max Flag 350

Thursday, March 19, 2009

Page 3 *of* 4

Package ID(L1)	Surface (L2)	Sample #	Counts	Time (sec)	Count Type (L5)	Material Type (L6)	Grid ID(L7)	Location # (L8)	Bkgd	Net DPM/100cm2/Fixed DPM/Area/ Scans
SU04F	FL01	38	8.0	60	FLDCT	B0002	E	13	7	19
SU04F	FL01	39	8.0	60	FLDCT	B0002	E	14	7	19
SU04F	FL01	40	8.0	60	FLDCT	B0002	E	15	7	19
SU04F	FL01	41	14.0	60	FLDCT	B0002	F	16	7	134
SU04F	FL01	42	17.0	60	FLDCT	B0002	F	17	7	192
SU04F	FL01	43	13.0	60	FLDCT	B0002	F	18	7	115
SU04F	FL01	51	21.0	60	FLDBK	B0002	F	26	7	268
SU04F	FL01	52	54.0	600	PTABK	B0002	F	27	7	-31
SU04F	FL01	53	5,340.0	60	PTSC1	B0002	F	28	7	102,235

Alpha Flag - _____

Alpha Max Flag 350 [ ]

ATTACHMENT 14 - SURVEY DOWNLOAD DATA SHEET

Download Technician: **Print Name:** Sean McChesney **Signature:** [signature] **Date:** 3/11/09

Download Station #: #2 Download File #: 284

Serial # Verification: Model 2350-1 ☐ Detector: ☐ Problems: (See Comments)

Survey Technician(s):

Print Name: Sharon McChesney **User ID** SXM 1098 **Signature:** Sharon McChesney **Date:** 3-11-09

Print Name:_____ **User ID**_____ **Signature:**_____ **Date:** ----------

Instrument Serial #(s): Model 2350-1: 117566

Survey Unit Description: 5404 S Rm 2124A FLOOR A1 - F18

(Example: Survey Package + description i.e. D16, Building 43, Area 09, Room 100, Floor - Grid Locations A1 through A7)

Instrument Calibration Due Date: 10-8-09 Detector Calibration Due Date: 8-8-09

Type Of Survey: ☒ Term Survey ☒ Characterization ☐ Information Only

Other (explain): ACE 3-19-09

Type of Measurement	Detector Serial Number	Detector Model Number	Detector Efficiency	Source Mean BKG Value	Pre & Post Use Info	
					Pre File#	Post File#
☐ Alpha α		43-37				
☐ Beta β		43-68B	ACE 3-18-09			
☐ Alpha α	092508	43-68A	.0372 ~~.0390~~			
☐ Gamma γ		44-2	N/A	N/A		
☐ Alpha α		43-93				

Local Area Background Measurements MEAN Value in cpm ↓

β Beta	1	2	3	4	5	6	
α Alpha	1 3	2 19	3	4	5	6	1.1

COMMENTS:

Duratek™

M2350-1 Download ALPHA Report

Station 2 File : 00000284	Survey Description :SU04S Rm 2124A Floor A1-F18+Pre S/C	
Survey Reason : ~~Characterization~~ FSS PCE 3-19-09		
User ID : SXM1098	Technician Name : Sharon McChesney	
Instrument Model : 2350-1	Instrument S/N : 117566	Instrument Cal. Due : 10/8/09
Detector Model : 43-68A	Detector S/N : 092508	Detector Cal. Due : 8/8/09
Measurement Type : ALPHA	Detector Type : 01200 : 126 cm2 Gas Proportional Detector, Alpha Window	
Detector Area : 126	Efficiency : 0.0372	Survey Date : 3/11/09

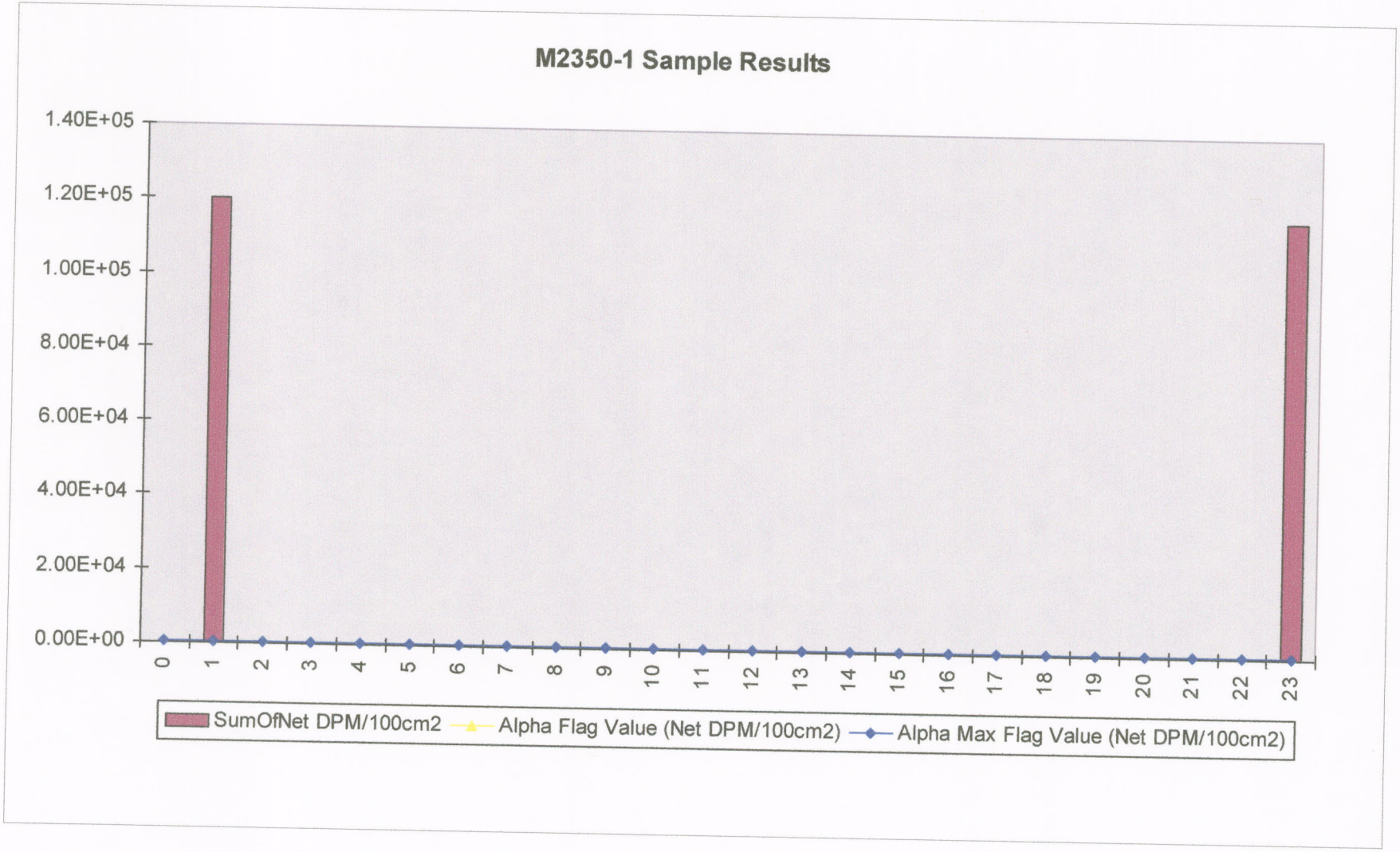
Print Name	Signature	Date
Sharon McChesney	Sharon McChesney	3/19/09

Comments:

Sign-Off

Print Name	Signature	Date
Paul Ely	Paul Ely	3-19-09

Page 1 *of* 3


M2350-1 Sample Results
1.40E+05
1.20E+05
1.00E+05
8.00E+04
6.00E+04
4.00E+04
2.00E+04
0.00E+00
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
SumOfNet DPM/100cm2
Alpha Flag Value (Net DPM/100cm2)
Alpha Max Flag Value (Net DPM/100cm2)

2 of 3

Duratek Alpha Survey Report

Download File Name: 00000284

Package ID(L1)	Surface (L2)	Sample #	Counts	Time (sec)	Count Type (L5)	Material Type (L6)	Grid ID(L7)	Location # (L8)	Bkgd	Net DPM/100cm2/Fixed DPM/Area/ Scans
ZZZZZ	ZZZZZ	0	27.0	600	PRABK	B9999	ZZZZZ	1	0	58
ZZZZZ	ZZZZZ	1	5,622.0	60	PRSC1	B9999	ZZZZZ	2	0	119,944
SU04S	FL01	2	4.0	60	FLDBK	B0002	A	1	1	64
SU04S	FL01	3	59.0	200	FLDSN	B0002	A	1	1	356
SU04S	FL01	4	48.0	200	FLDSN	B0002	A	2	1	286
SU04S	FL01	5	57.0	200	FLDSN	B0002	A	3	1	343
SU04S	FL01	6	59.0	225	FLDSN	B0002	B	4	1	314
SU04S	FL01	7	62.0	225	FLDSN	B0002	B	5	1	331
SU04S	FL01	8	61.0	225	FLDSN	B0002	B	6	1	326
SU04S	FL01	9	58.0	225	FLDSN	B0002	C	7	1	309
SU04S	FL01	10	68.0	225	FLDSN	B0002	C	8	1	366
SU04S	FL01	11	59.0	225	FLDSN	B0002	C	9	1	314
SU04S	FL01	12	56.0	225	FLDSN	B0002	D	10	1	297
SU04S	FL01	13	52.0	225	FLDSN	B0002	D	11	1	275
SU04S	FL01	14	62.0	225	FLDSN	B0002	D	12	1	331
SU04S	FL01	15	48.0	225	FLDSN	B0002	E	13	1	252
SU04S	FL01	16	37.0	225	FLDSN	B0002	E	14	1	189
SU04S	FL01	17	60.0	225	FLDSN	B0002	E	15	1	320
SU04S	FL01	18	37.0	225	FLDSN	B0002	F	16	1	189
SU04S	FL01	19	40.0	225	FLDSN	B0002	F	17	1	206
SU04S	FL01	20	46.0	225	FLDSN	B0002	F	18	1	240
SU04S	FL01	21	19.0	60	FLDBK	B0002	F	2	1	384
ZZZZZ	ZZZZZ	22	131.0	600	PTABK	B9999	ZZZZZ	1	0	279
ZZZZZ	ZZZZZ	23	5,500.0	60	PTSC1	B9999	ZZZZZ	1	0	117,341

Alpha Flag	-	
Alpha Max Flag	350	

Thursday, March 19, 2009

Page 3 *of* 3

ATTACHMENT 14 - SURVEY DOWNLOAD DATA SHEET

Download Technician: **Print Name:** Sean McChesney **Signature:** Sean McChesney **Date:** 3/12/09

Download Station #: 1 Download File #: 189
Serial # Verification: Model 2350-1 ☐ Detector: ☐ Problems: (See Comments)

Survey Technician(s):
Print Name: Sharon McChesney **User ID** SYM1098 **Signature:** Sharon McChesney **Date:** 3-12-09

Print Name:_____ **User ID**_____ **Signature:**_____ **Date:** ----------

Instrument Serial #(s): Model 2350-1: 126172

Survey Unit Description: 5404F Rm 2124A Points on Grids
(Example: Survey Package + description i.e. D16, Building 43, Area 09, Room 100, Floor - Grid Locations A1 through A7)

Instrument Calibration Due Date: 9-11-09 Detector Calibration Due Date: 9-29-09

Type Of Survey: ☒ Term Survey ☒ Characterization ☐ Information Only
Other (explain): AE 3-20-09

Type of Measurement	Detector Serial Number	Detector Model Number	Detector Efficiency	Source Mean BKG Value	Pre & Post Use Info	
					Pre File#	Post File#
☐ Alpha α		43-37				
☐ Beta β		43-68B				
☐ Alpha α		43-68A				
☐ Gamma γ	310	~~44-2~~ 44-10	N/A	N/A		
☐ Alpha α		43-93				

Local Area Background Measurements MEAN Value in cpm ↓

β Beta	1	2	3	4	5	6	
α Alpha	1	2	3	4	5	6	25799

COMMENTS:

Duratek™

M2350-1 Download Gamma Report

Station 3 File : 00000189	Survey Description :Room 2124A Pointa on Floor + Pre and Post R/C	
Survey Reason : ~~Characterization~~ FSS PCE 3-18-09		
User ID : SXM1098	Technician Name : Sharon McChesney	
Instrument Model : 2350-1	Instrument S/N : 126172	Instrument Cal. Due : 9/11/2009
Detector Model : LMI 44-10	Detector S/N : 310	Detector Cal. Due : 9/29/2009
Measurement Type : Gamma	Detector Type : 03300 : 2"X2" NaI(Tl)	
Cal. Constant : 5.98E+10		Survey Date : 3/11/2009

Print Name	Signature	Date
Sharon McChesney	Sharon McChesney	3-12-09

Comments:

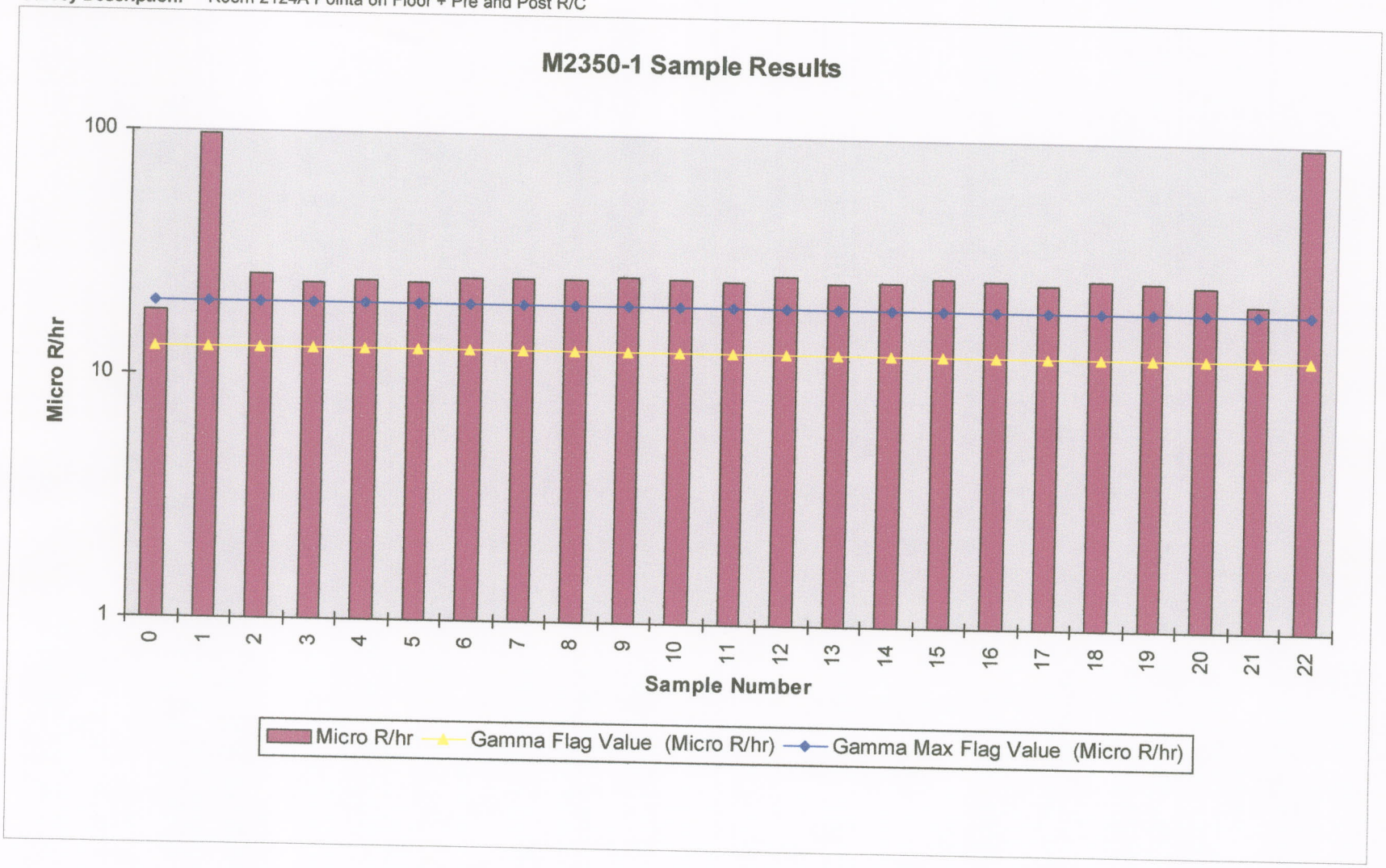
Sign-Off

Print Name	Signature	Date
Paul Ely	Paul Ely	3-18-09

Page 1 *of* 3

Download Name: 00000189

Survey Description: Room 2124A Pointa on Floor + Pre and Post R/C



Duratek Gamma Survey Report

Package ID(L1)	Surface (L2)	Sample #	Counts	Time (sec)	Count Type(L5)	Material Type(L6)	Grid ID(L7)	Location # (L8)	Bkgd (cpm)	µ R/hr:
ZZZZZ	ZZZZZ	0	181,978.0	600	PRGBK	B9999	ZZZZZ	0	0	1.83E+01
ZZZZZ	99608	1	97,390.0	60	PRG06	B9999	ZZZZZ	14594	0	9.77E+01
SU04F	FL01	2	25,638.0	60	FLDBK	B9999	A	1	25799	2.57E+01
SU04F	FL01	3	24,069.0	60	FLDCT	B9999	A	1	25799	2.41E+01
SU04F	FL01	4	24,837.0	60	FLDCT	B0002	A	2	25799	2.49E+01
SU04F	FL01	5	24,353.0	60	FLDCT	B0002	A	3	25799	2.44E+01
SU04F	FL01	6	25,527.0	60	FLDCT	B0002	B	4	25799	2.56E+01
SU04F	FL01	7	25,277.0	60	FLDCT	B0002	B	5	25799	2.54E+01
SU04F	FL01	8	25,275.0	60	FLDCT	B0002	B	6	25799	2.54E+01
SU04F	FL01	9	26,316.0	60	FLDCT	B0002	C	7	25799	2.64E+01
SU04F	FL01	10	25,797.0	60	FLDCT	B0002	C	8	25799	2.59E+01
SU04F	FL01	11	25,528.0	60	FLDCT	B0002	C	9	25799	2.56E+01
SU04F	FL01	12	26,975.0	60	FLDCT	B0002	D	10	25799	2.71E+01
SU04F	FL01	13	25,585.0	60	FLDCT	B0002	D	11	25799	2.57E+01
SU04F	FL01	14	25,933.0	60	FLDCT	B0002	D	12	25799	2.60E+01
SU04F	FL01	15	26,921.0	60	FLDCT	B0002	E	13	25799	2.70E+01
SU04F	FL01	16	26,477.0	60	FLDCT	B0002	E	14	25799	2.66E+01
SU04F	FL01	17	25,719.0	60	FLDCT	B0002	E	15	25799	2.58E+01
SU04F	FL01	18	27,121.0	60	FLDCT	B0002	F	16	25799	2.72E+01
SU04F	FL01	19	26,623.0	60	FLDCT	B0002	F	17	25799	2.67E+01
SU04F	FL01	20	25,960.0	60	FLDBK	B0002	F	2	25799	2.60E+01
ZZZZZ	ZZZZZ	21	216,592.0	600	PTGBK	B9999	ZZZZZ	1	0	2.17E+01
ZZZZZ	ZZZZZ	22	96,645.0	60	PTSC1	B9999	ZZZZZ	1	0	9.70E+01

Gamma Flag	13 -	
Gamma Max Flag	20	

Text67:
#Error

Thursday, March 12, 2009

Page 3 of 3

ATTACHMENT 14 - SURVEY DOWNLOAD DATA SHEET

Download Technician: Print Name: Sean McChesney **Signature:** Sean McChesney **Date:** 3/17/09

Download Station #: #3 Download File #: 12

Serial # Verification: Model 2350-1 ☐ Detector: ☐ Problems: (See Comments)

Survey Technician(s):

Print Name: Sharon McChesney **User ID** SXM1098 **Signature:** Sharon McChesney **Date:** 3-17-09

Print Name:_____ **User ID**_____ **Signature:**_____ **Date:** ----------

Instrument Serial #(s): Model 2350-1: 126172

Survey Unit Description: 5404F Rm 2124A Point #18 Floor

(Example: Survey Package + description i.e. D16, Building 43, Area 09, Room 100, Floor - Grid Locations A1 through A7)

Instrument Calibration Due Date: 9-11-09 Detector Calibration Due Date: 9-29-09

Type Of Survey: ☒ Term Survey ☒ Characterization ☐ Information Only

Other (explain): PCE 3-20-09

Type of Measurement	Detector Serial Number	Detector Model Number	Detector Efficiency	Source Mean BKG Value	Pre & Post Use Info	
					Pre File#	Post File#
☐ Alpha α		43-37				
☐ Beta β		43-68B				
☐ Alpha α		43-68A				
☒ Gamma γ	310	~~44-2~~ 44-10	N/A	N/A		
☐ Alpha α		43-93				

Local Area Background Measurements

MEAN Value in cpm ↓

β Beta	1	2	3	4	5	6	
α ~~Alpha~~ Gamma	1 24495	2	3	4	5	6	

COMMENTS: SNE 126172

Duratek™

M2350-1 Download Gamma Report

Station 3 File : 00000012	Survey Description :SU04F Rm 2124A point on Grid F18	
Survey Reason : ~~Characterization~~ FSS PE 3-18-09		
User ID : SXM1098	Technician Name : Sharon McChesney	
Instrument Model : 2350-1	Instrument S/N : 126172	Instrument Cal. Due : 9/11/2009
Detector Model : LMI 44-10	Detector S/N : 310	Detector Cal. Due : 9/29/2009
Measurement Type : Gamma	Detector Type : 03300 : 2"X2" NaI(Tl)	
Cal. Constant : 5.98E+10		Survey Date : 3/17/2009

Print Name	Signature	Date
Sharon McChesney	Sharon McChesney	3-17-09

Comments:

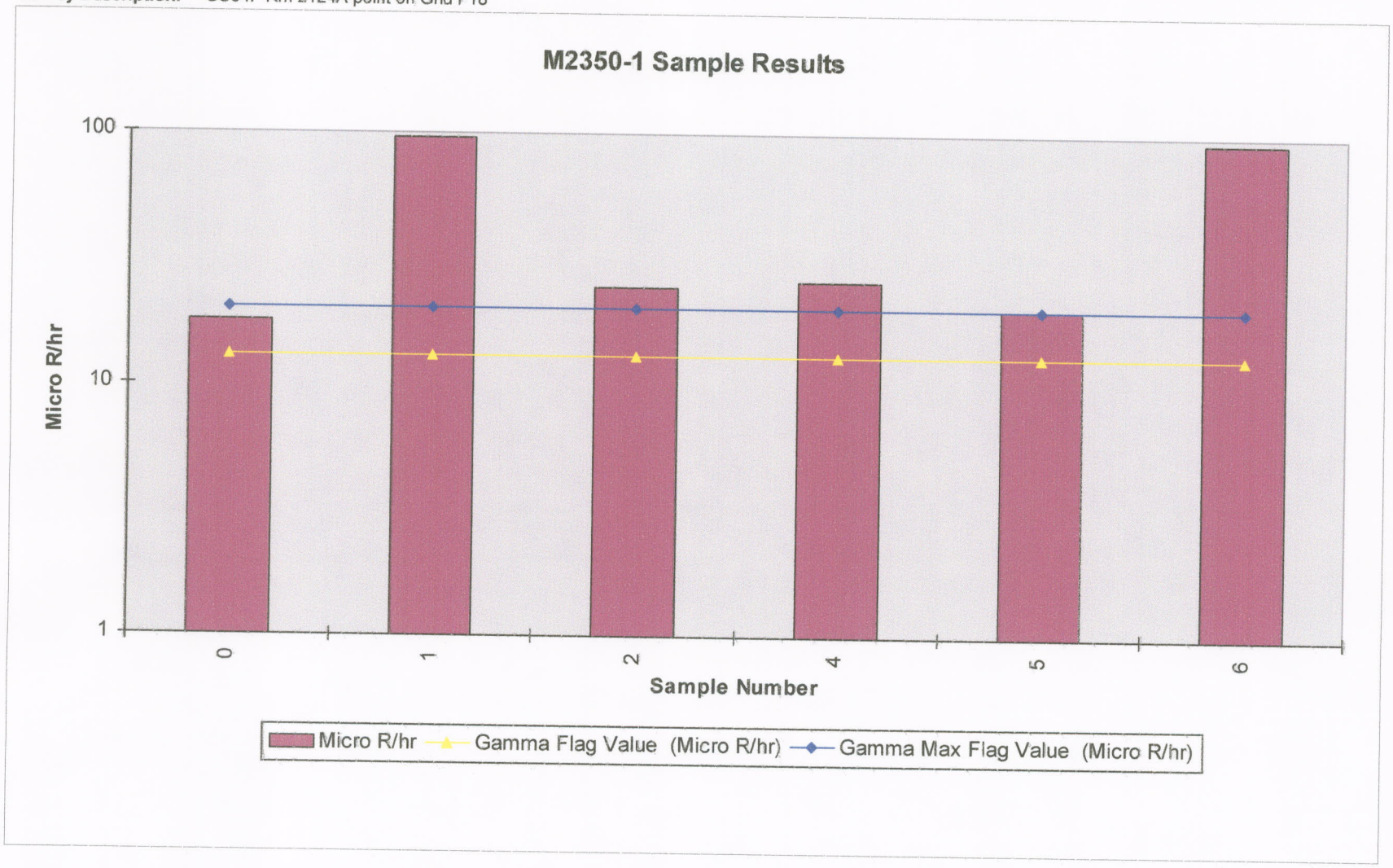
Sign-Off

Print Name	Signature	Date
Paul Ely	Paul Ely	3-18-09

Page 1 *of* 3

Download Name: 00000012

Survey Description: SU04F Rm 2124A point on Grid F18



Duratek Gamma Survey Report

Package ID(L1)	Surface (L2)	Sample #	Counts	Time (sec)	Count Type(L5)	Material Type(L6)	Grid ID(L7)	Location # (L8)	Bkgd (cpm)	µ R/hr:
ZZZZZ	ZZZZZ	0	178,179.0	600	PRGBK	B9999	ZZZZZ	1	0	1.79E+01
ZZZZZ	ZZZZZ	1	95,449.0	60	PRG06	B9999	ZZZZZ	1	0	9.58E+01
SU04F	FL01	2	24,495.0	60	FLDBK	B0002	ZZZZZ	1	24495	2.46E+01
SU04F	FL01	4	25,939.0	60	FLDCT	B0002	F	18	24495	2.60E+01
ZZZZZ	ZZZZZ	5	200,264.0	600	PTGBK	B9999	ZZZZZ	1	0	2.01E+01
ZZZZZ	ZZZZZ	6	94,504.0	60	PTG06	B9999	ZZZZZ	1	0	9.48E+01

Gamma Flag	13 -	
Gamma Max Flag	20	

Text67:
#Error

Tuesday, March 17, 2009

Page 3 of 3

Tennelec XLB Series 5 - NIST Boulder - FSS Smear Analysis

Report Revision: NIST-2 NIST09-0398

Date:	3/11/2009 4:16:27PM	**Alpha Activity Action Level (DPM):**	696.00
Counting Unit ID:	Tennelec 84920	**Beta Activity Action Level (DPM):**	10,000.00
Batch Name:	FSS Smears 3 min - 200903111616	**Certainty Level for MDA and Flags:**	95%
Batch Start Time:	Wed, March 11, 2009 04:16:27 PM	**High Voltage Setting:**	1380
Geometry:	1/8" Stainless Steel	**Count Minutes:**	3.00
Alpha Surface Eff. (including self Absorption) %:	0.25	**Total alpha Efficiency %:**	0.85
Beta Surface Eff. (including self Absorption) %:	0.25	**Total beta Efficiency %:**	0.93
Alpha Detection Factor:	0.52 **Beta Detection Factor:** 1.00	**Smear Removal Factor:**	0.10
Alpha BS:	0.05	**Background Subtract:**	Background Subtracted
Beta BS:	0.30	**Batch ID:**	

Alpha Eff. Std:	060101 Alpha Th-230		
4 π Alpha Eff. %:	34.29	±	0.30
2 π Alpha Eff. %:	65.32	±	0.58
Alpha BG CPM:	0.13	±	0.05
Beta Eff. Std:	079706 Beta Tc-99		
4 π Beta Eff. %:	24.19	±	0.32
2 π Beta Eff. %:	37.22	±	0.49
Beta BG CPM:	1.45	±	0.16

Cal Due: Aug 15 2009

Carrier	Sample ID	Alpha Activity DPM	Alpha Activity 2 Sigma	Alpha Activity Fla	Alpha Activity MDA	Beta Activity DPM	Beta Activity 2 Sigma	Beta Activity Fla	Beta Activity MDA	Count time (min)	Alpha CPM	Beta CPM	Count Start
46	1	62.81	111.60	<MDA	189.93	130.75	205.40	<MDA	348.80	3.00	0.67	2.67	3/11/2009 6:34:43PM
47	2	23.55	79.30	<MDA	189.93	238.21	240.03	<MDA	348.80	3.00	0.33	3.67	3/11/2009 6:37:56PM
48	3	23.55	79.30	<MDA	189.93	94.93	192.49	<MDA	348.80	3.00	0.33	2.33	3/11/2009 6:41:09PM
49	4	-15.70	11.11	<MDA	189.93	59.10	178.65	<MDA	348.80	3.00	0.00	2.00	3/11/2009 6:44:22PM
50	5	23.55	79.30	<MDA	189.93	-48.36	128.51	<MDA	348.80	3.00	0.33	1.00	3/11/2009 6:47:35PM
51	6	-15.70	11.11	<MDA	189.93	59.10	178.65	<MDA	348.80	3.00	0.00	2.00	3/11/2009 6:50:48PM
52	7	102.07	136.46	<MDA	189.93	94.93	192.49	<MDA	348.80	3.00	1.00	2.33	3/11/2009 6:54:00PM
53	8	62.81	111.60	<MDA	189.93	130.75	205.40	<MDA	348.80	3.00	0.67	2.67	3/11/2009 6:57:13PM
54	9	62.81	111.60	<MDA	189.93	130.75	205.40	<MDA	348.80	3.00	0.67	2.67	3/11/2009 7:00:26PM
55	10	62.81	111.60	<MDA	189.93	23.28	163.65	<MDA	348.80	3.00	0.67	1.67	3/11/2009 7:03:39PM
56	11	23.55	79.30	<MDA	189.93	-12.54	147.13	<MDA	348.80	3.00	0.33	1.33	3/11/2009 7:06:52PM
57	12	-15.70	11.11	<MDA	189.93	-12.54	147.13	<MDA	348.80	3.00	0.00	1.33	3/11/2009 7:10:05PM
58	13	-15.70	11.11	<MDA	189.93	59.10	178.65	<MDA	348.80	3.00	0.00	2.00	3/11/2009 7:13:18PM
59	14	-15.70	11.11	<MDA	189.93	59.10	178.65	<MDA	348.80	3.00	0.00	2.00	3/11/2009 7:16:31PM
60	15	62.81	111.60	<MDA	189.93	238.21	240.03	<MDA	348.80	3.00	0.67	3.67	3/11/2009 7:19:44PM
61	16	23.55	79.30	<MDA	189.93	23.28	163.65	<MDA	348.80	3.00	0.33	1.67	3/11/2009 7:22:57PM
62	17	23.55	79.30	<MDA	189.93	130.75	205.40	<MDA	348.80	3.00	0.33	2.67	3/11/2009 7:26:10PM
63	18	23.55	79.30	<MDA	189.93	274.03	250.52	<MDA	348.80	3.00	0.33	4.00	3/11/2009 7:29:22PM

QA Reviewer: RCEy **Date:** 3-16-09 **Technician:** RC. Ferri **Date:** 3-12-09 Floor

Static and Scan MDC Worksheet for 43-68 Gas Flow Proportional Detectors

Static MDC (43-68)

$$MDC_{alpha} = \frac{\frac{3}{t_s} + 3.29 * \sqrt{\left(\frac{R_b}{t_s} + \frac{R_b}{t_b}\right)}}{\varepsilon_i * \varepsilon_s * \frac{A}{100}}$$

CS-FO-PR-001 Rev. 1, Section 4.8.1.2

Inputs

INST#=	117566	Instrument Serial Number
DET#=	92508	Detector Serial Number
R_B =	1.6	Background Count Rate (cpm)
t_b =	10	Background Count Time (min)
t_s =	1	Sample Count Time (min)
A =	126	Area of Detector (cm^2)
$\varepsilon_{4\pi}$ =	0.167	Detector Efficiency (4π)
BS =	0.05	Backscatter
ε_i =	0.318	Detector Efficiency (2π)
ε_s =	0.25	Surface Efficiency
S_ε =	0.52	source efficiency (radionuclide detectability)

Outputs

ε_t =	0.0414	**Total Detection Efficiency**
MDC =	**141**	**dpm/100 cm^2**

Enter data

Formula, enter 2π efficiency data directly if available

Change if neccesary

Scan MDC (43-68)

$$MDC_{Scan} = \frac{d' * \sqrt{b_i} * \frac{60}{i}}{\sqrt{p} * \varepsilon_i * \varepsilon_s * \frac{A}{100}}$$

CS-FO-PR-001 Rev. 1, Section 4.8.3.3 to 4.8.3.5

Inputs

INST#=	117566	Instrument Serial Number
DET#=	92508	Detector Serial Number
d' =	1.38	Index of Sensitivity
p =	0.50	Surveyor Efficiency
Scan ε_i =	0.29	Scanning Instrument Efficiency (2π)
Scan ε_s =	0.25	Scanning Surface Efficiency
S_ε =	0.52	source efficiency (radionuclide detectability)
43-68		
Scan Speed =	2.2	(cm/sec)
R_B =	1.6	Background Count Rate (cpm)
b_i =	0.106667	Background counts per observation interval
Detector Width =	8.8	width of detector in direction of scan (cm)
A =	126	Area of Detector (cm^2)

Outputs

43-68		
ε_t =	0.0372	**Total Detection Efficiency**
i =	**4.00**	**Observation interval in seconds (detector width divided by the scan speed)**
Scan MDC =	**204**	**dpm/100 cm^2**

Reviewed by: Paul Ely

Date: 3-18-09

D:\Documents and Settings\pely\My Documents\d&d\NIST-Boulder\FSS\FSS MDC Worksheet.xls

BUILDING SURFACE SURVEY PLAN

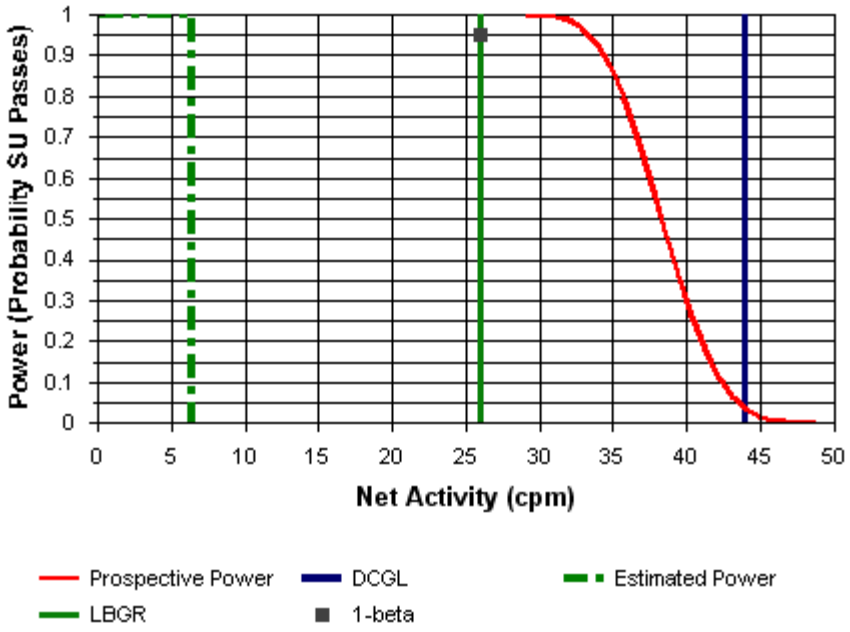
Survey Plan Summary

Site Name:	NIST Boulder Campus
Planner(s):	p ely
Survey Unit Name:	SU004 Room 2124A Floor
Comments:	N/A

Statistical Design Details

Area (m²):	37	Classification:	1
Selected Test:	Sign	Estimated Sigma (cpm/100 cm²):	9.2
DCGL (cpm/100 cm²):	44	Sample Size (N):	**15**
LBGR (cpm/100 cm²):	26	Estimated Conc. (cpm/100 cm²):	6.4
Alpha:	0.050	Estimated Power:	1.0
Beta:	0.050	Post-EMC Sample Size (N):	**15**

Prospective Power Curve



Gross Activity Efficiency Data

Instrument Description:	Ludlum 43-68 Gas Flow Proportional
Physical Detector Area (cm²):	126
DCGLw (dpm/100 cm²):	696
Total Efficiency:	0.05
DCGLw (cpm/100 cm²):	44

Contaminant	HTDC[a]	Energy[b]	Fract[c]	Inst. Eff.	Surf. Eff.	Total Eff.
Am-241	No	N/A	0.10	0.36	0.25	0.01
Pu-238	No	N/A	0.01	0.36	0.25	0.00
Pu-239	No	N/A	0.31	0.36	0.25	0.03
Pu-240	No	N/A	0.10	0.36	0.25	0.01
Pu-241	Yes	5.23	0.48	0.00	0.00	0.00

[a]Hard-to-detect contaminant [b]Average beta energy (keV) [N/A indicates alpha emission] [c]Activity fraction

Gross Activity Mean and Sigma Data

Count Time (min):	1
Sign Test Sigma (cpm/100 cm²):	9.2

Data/Material	Mean (cpm/100 cm²)	Std. Dev. (cpm/100 cm²)	MDC (dpm/100 cm²)
SU	6.4	9.2	234

Elevated Measurement Comparison (EMC) for Gross Activity

Scanning Instrumentation Description:	Ludlum 43-68 Gas Flow Proportional
Background (cpm/100 cm²):	2.0
Total Scanning Efficiency:	0.04
True Positive Proportion:	0.95
False Positive Proportion:	0.6
Index of Sensitivity (d'):	1.38
Observation Interval (sec):	1.0
Surveyor Efficiency:	0.50
Area Factor Table Interpolation Method:	Linear

Statistical Design		Hot Spot Design	
N:	15	Actual Scan MDC*:	534
Bounded Area (m²):	2.5	Area Factor:	N/A
Area Factor:	5.3	Bounded Area (m²):	N/A
DCGLw*:	358	Post-EMC N:	15
Scan MDC Required*:	1,894		

Contaminant	Energy[a]	Fract[b]	Inst. Eff.	Surf. Eff.	Total Eff.
Am-241	N/A	0.10	0.20	0.25	0.01
Pu-238	N/A	0.01	0.20	0.25	0.00
Pu-239	N/A	0.31	0.20	0.25	0.02
Pu-240	N/A	0.10	0.20	0.25	0.01

[a]Average beta energy (keV) [N/A indicates alpha emission] [b]Activity fraction

Contaminant	DCGLw*	Area Factor	Scan MDC Req'd*
Am-241	358	5.3	1,894
Pu-238	407	5.3	2,157

Pu-239	370	5.3	1,954
Pu-240	370	5.3	1,954

* dpm/100 cm²

Report Created 02/08/2009 0758 (*COMPASS v1.1.0*)

Survey Unit 004
Class 1
Floors in Room 2124A

X (Max):	**14.4**	feet	4.4	meters	Estimated dimension
Y (Max):	**29.0**	feet	8.8	meters	Estimated dimension
A (Area):	417	ft^2	39	m^2	Area of Survey area
Actual Survey Area:	417	ft^2			
Required Survey Points:	**15**	0%	Percent void area		
N (Points):	**16**	15	Estimated Minimum Points		

$$L = \left[\frac{A}{N} \right]^{1/2}$$

Spacing for a square grid

L= 1.6 meters (distance between measurement points)

X (Random):	1.4	random generated number
Y (Random):	2.8	random generated number
X (Origin):	2.1	initially generated random number
Y (Origin):	0.5	initially generated random number