Radiation Safety Associates, Inc.

19 Pendleton Drive, PO Box 107 • Hebron, CT 06248

July 9, 2013

Q-5
MS-16

Betsy Ullrich, MS, CHP
Senior Health Physicist, RI
U.S. Nuclear Regulatory Commission
2100 Renaissance Boulevard, Suite 100
King of Prussia, PA 19406

FAX: 610-337-5269

Re: License No. 06-30007-01
Docket No. 030-33025
Control No. 581256
RSA Laboratories 21 Pendleton Drive Decommissioning Report

Dear Ms. Ullrich:

Listed below are answers to your questions about the above referenced decommissioning report. We have repeated your questions below (in bold) with the responses supplied beneath.

1. **Sections 2.0 and 5.0 refer to routine surveys that detected no elevated levels of residual activity. However, the action level which would be considered elevated is not described, and the MDA or LLD of those surveys is not given. Because some of the radionuclides used at your facility have very small screening values for release for unrestricted use, the reference to routine surveys is not helpful without that information. No response to this item is needed, however, because of the information provided by the scoping surveys and the final status surveys.**

   No response required.

2. **Section 4.0 states that isotopes were used as liquid sources. Confirm if you also possessed and used other materials that would be dispersible, such as solid powders, which also should be considered.**

   Response: Except for the sealed sources described, only liquid sources were used. No solid powders or other dispersible forms of radioactive materials were used by the lab.

3. **The table in Section 4.0 states, for all of the alpha emitters except Ra226, that the DCGL values were obtained from a Federal Register Notice. Based on that notice, and the values listed, confirm that the reference should be NUREG/CR-5512, table 5.19, at the 95% value.**

   Response: With the exception of Ba-133 all DCGL Values listed below were obtained from NUREGF/CR-5512, table 5.19. The values presented in the table below represent slight changes from the values presented in the table on page 5 of the decommissioning

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report. They represent the DCGL Values from NUREG/CR-5512, table 5.19, at the 95% confidence level. Please note that based on the response to question 4 we will only be using the most restrictive alpha DCGL of 4.92 dpm/ 100cm^2 (Th-229) and the most restrictive beta DCGL of 7.78E+03 dpm/100 cm^2 (Sr-90) as release criteria for this survey. A Sum of the Fraction Calculation will be done along with this to demonstrate compliance.

ISOTOPE	TOTAL ACTIVITY (μCi) POSESSED	DCGL (dpm/100cm^2)
Beta, beta-gamma and electron capture decay isotopes		
H-3	1.61E-01	1.14E+08[1]
C-14	5.66E-02	3.40E+06[1]
P-32	5.06E+03	($t_{1/2}$ = 14.29 days)
Fe-55	7.45E-01	4.04E+06[1]
Sr-90	1.91E-01	7.78E+03[1]
Tc-99	5.90E+00	1.17E+06[1]
I-125	1.00E+03	($t_{1/2}$ = 59.4 days)
I-131	1.70E+00	($t_{1/2}$ = 8.02 days)
Ba-133	2.62E-01	1.3E+04[2]
Cs-137	4.54E-01	2.78E+04[1]
Alpha decay isotopes		
Ra-226+C	1.18E-01	2.85E+02[3]
Th-229	2.07E-03	4.92E+00[3]
Th-230+C	7.77E-02	2.93E+01[3]
U-232+C	1.06E-01	1.06E+01[3]
Pu-238	6.11E-03	2.72E+01[3]
Pu-240	2.40E-03	2.47E+01[3]
Am-243	5.14E-03	2.41E+01[3]

4. Section 6.0 describes the derivation of the gross alpha and gross beta DCGL used in the final Radiological Status Report. The gross alpha/beta equation from Abelquist's book is not used in the NRC guidance in NUREG-1757 consolidated Decommissioning Guidance at all. Abelquist (page 109) states that this calculation often is an academic exercise, and probably the unity rule should be used, based on actual measurements. In addition, the examples cited by Abelquist use the fractions from the relative amounts in the 'source term" (what is known to be in the residual contamination, based on scoping surveys) but your fractions appear to be based on the total amounts purchased or possessed, which may not be the same relative fractions as in any residual contamination. If you wish to use this calculation, explain why the fractions used are appropriate in this case. If you do not wish to use this calculation, you should propose an alternate method. This may require new

[1] NUREG/CR-5512, table 5.19.
[2] Obtained from *Radiological Survey Plan for Buildings and Consolidated Materials Within Area IV of the Santa Susana Field Laboratory. USDOE Sept 2011.* D&D Worker model.
[3] NUREG/CR-5512, table 5.19.

surveys, or revision of your final radiological survey report. The simplest/fastest method may be to choose the screening value for the most restrictive alpha radionuclide, and the screening value for the most restrictive beta/gamma radionuclide, and use the unity rule to show that the sum of the fractions for the two do (or do not) exceed unity when the residual contamination levels are compared to those screening values. (I understand that, because the screening value for thorium is so low, this may be a difficult test to pass.)

Response: The previously submitted calculation to determine the overall DCGL for this site was incorrect. We have decided to use the DCGLs for the most restrictive alpha emitter (Th-229 = 5.55E+00 dpm/100 cm^2) and the most restrictive beta/beta-gamma emitter (Sr-90 = 8.71E+03 dpm/100 cm^2).

5. **Section 7.0 includes a table that shows the calculation of the number of samples to be collected for four categories. Please note that a separate calculation is not required for removable contamination. The number of samples is calculated based on the DCGL for total residual contamination. The NRC assumptions in developing the screening values you have selected for your radionuclide-specific DCGLs is that not more than 10% of the total residual activity is removable, and the requirement is to demonstrate that the residual removable contamination does not exceed this assumption. In addition, the calculations determined that 11, 12, 9 and 9 samples would be required, respectively, and the results provided show samples collected at 32 locations. Please explain which locations were used to support the MARSSIM statistical survey results, and the reason for additional sampling locations.**

Response: The number of samples required for the MARSSIM Final Status Survey has been re-calculated based on the actual standard deviation for alpha and beta measurements obtained from the scoping survey. That calculation results in a sample number of 18 for alpha. An additional 20% (6 samples) are being taken, four of which are on the Class II walls of the Prep Room and Count Room.

	DCGL (dpm/100 cm^2)	State of CT DCGL (dpm/100 cm^2)	Δ (dpm/100 cm^2)	σ (dpm/100 cm^2)	Δ/σ	Number of samples required per survey unit using Sign Test
Total Alpha	5.55	4.2	2.75	1.86	1.16	18
Total Beta	8710	6620	4355	146.07	46.68	14

The sum of the fractions calculation is as follows:

$$\frac{A_M}{A_D} + \frac{B_M}{B_D} < 1$$

Where:

A_D = Th-229 DCGL
A_M = Highest Alpha Measurement
B_D = Sr-90 DCGL
B_M = Highest Beta Measurement

$$\frac{3.73}{4.92} + \frac{484}{7780} = 0.8203 < 1$$

Thus the survey unit passes.

6. Explain why Section 7.0 uses the standard assumptions for the value of the shift and the standard deviation, given that you performed scoping surveys which could provide actual data as the basis of these values.

Response: Calculation of the standard deviation from the scoping survey data for 21 Pendleton results in a standard deviation of 1.86 for alpha and 142.07 for beta. These values were used to calculate the number of samples required in the survey unit as per the sign test. The more restrictive value was 18 samples for alpha. To this was added 20% (6 samples) additional sampling points, including 4 wall locations in the prep room and storage room where the walls were classified as MARSSIM Class II up to a height of 2 meters from the floor.

7. Section 9.0 states that the total laboratory area is 118 square meters and is considered a single Class 2 area. However, the direct measurement and scan surveys were performed only of floor areas. Explain if the walls and ceilings were included in the Class 2 area, or should have been included in the Class 2 area. If the walls and ceilings were not part of the Class 2 area, explain their classification and provide any survey information, if applicable.

Response: We re-evaluated the distribution of Class 1, Class 2 and Class 3 areas in this facility and came up with the following breakdown:

1. The floors of all laboratory areas – Prep Room, Count Room, Office, Radioactive Materials Storage Room, Sample Receipt (Kitchen/Lunch Room), the open or Common Room and the Calibration Lab remain MARSSIM Class 2 areas.

2. All ceilings and walls over 2 meters above floor level are considered to be MARSSIM Class 3 areas because laboratory operations used no volatile or powdered forms of radioactive material.

3. The walls up to a height of 2 meters above the floor in the Radioactive Materials / Rad Waste Storage Room and the Chemistry Lab/Sample Prep Room have been classified as MARSSIM Class 2. Sampling points on the walls in these two rooms were added to the existing grid by extending the grid to and up the walls.

8. **There are 20 samples for alpha/beta direct measurements on pages C-4 and C-5. Confirm if these are the same 1-20 locations as on pages C-2 and C-3. Explain why there are no direct measurements for total residual radioactivity on the walls. Explain which of the 20 floor samples and the 21 wall samples are part of the MARSSIM random start statistical sample points, and which were additional locations you selected to survey. Section 9.3 refers to grid points and random locations, but I cannot tell which are which. What about scan survey results?**

Response: See the response to question 7. A new map of the MARSSIM sampling points and is attached (Attachment A). The additional wall sampling points are numbers 21 through 24 in the prep room and storage room. Direct measurement results are located on Attachment B (alpha) and C (beta) for all sample points. Wipe results are located on Attachments D (gas proportional analysis for gross alpha/beta) and E (liquid scintillation analysis).

9. Appendix C, page C-2, explain why the alpha LLD is different for samples 1-17 than it is for samples 18-32. Explain how the LLD was calculated for this analytical instrument, and for the LSC on page C-3.

An equation that should have been carried throughout the spread sheet was not. The corrected spreadsheet with the original MARSSIM 20 sampling points and the additional wall points is attached (attachment D). Please note that the LLD for the last 4 samples is different due to the different background count rates. The LLD values for the gas proportional alpha/beta and the liquid scintillation results have been re-calculated using the equation found in Attachment B page one of the Decommissioning report. The count rates and efficiencies used are as follows:

Alpha and beta background count time 600 minutes
Alpha and beta sample count times 19 minutes
Alpha efficiency 27.29 %
Beta efficiency 40.8%

Liquid scintillation background count time 10 minutes
Liquid scintillation sample count time 1 minute
Liquid scintillation H-3 and C-14 calibration curves: See Attachment F
H-3 LLD calculated at 19.59% efficiency, C-14 Calculated at 68.78% efficiency

10. Explain how the values for alpha dpm and beta dpm, on pages C-4 and C-5 respectively, were calculated. I cannot replicate these calculations.

Response: The calculations are as follows:

Alpha Results: $$\frac{\text{Alpha dpm}}{100\ \text{cm}^2} = \frac{\text{Net cpm alpha}}{\text{Alpha Eff} \times \left(^{584}/_{100}\right)}.$$

Note: the function 584/100 converts the activity per detector area (584 cm^2) to activity per 100 cm^2.

Beta Results: $$\frac{\text{Beta dpm}}{100\ \text{cm}^2} = \frac{\text{Net cpm Beta}}{\text{Beta Eff} \times \left(^{126}/_{100}\right)}.$$

Note: the function 126/100 converts the activity per detector area (126 cm^2) to activity per 100 cm^2. (In the original data set the conversion function used (erroneously) was 125/100.)

Note: The data sheets for direct measurements have been up-dated to reflect the fact that results are in terms of dpm/100cm^2. These sheets are attached to this document

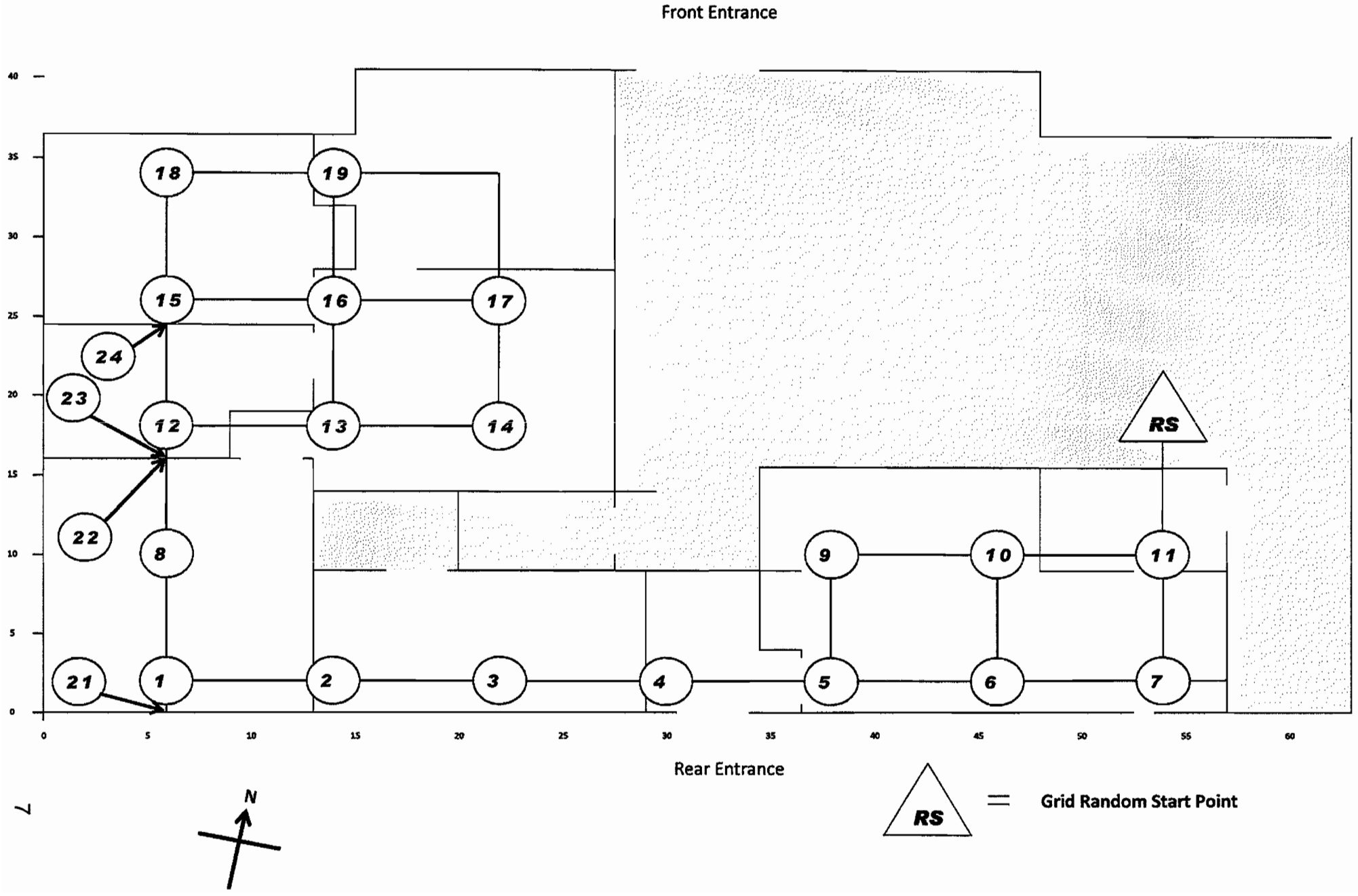
Sincerely,

K. Paul Steinmeyer
RSO, Senior Health Physicist
RSA Laboratories, Division of Radiation Safety Associates, Inc.

List of Attachments

Attachment A	Survey Map, 21 Pendleton Drive
Attachment B	Direct Survey results, Final Status Alpha
Attachment C	Direct Survey results, Final Status Beta
Attachment D	Wipe Survey results, Final Status Alpha/Beta
Attachment E	Wipe Survey results, Final Status Liquid Scintillation
Attachment F	LSC Calibration Curves, Dual Label, H-3, C-14

ATTACHMENT A
RSA LABORATORIES FINAL STATUS SURVEY 21 PENDLETON DRIVE



ATTACHMENT B

RSA Laboratories, 21 Pendleton Drive, Hebron, CT
Final Status Survey - Direct Measurements Results
Date: 5/25/13 & 5/28/13 & 7/8/13

Instrument: Eberline MS-2 s/n 794 w/43-37 s/n 160827
Detector area : 584 cm2

Alpha MDA: 4.50 dpm/100cm^2
Alpha Efficiency 17.90%
Background Alpha Floor (120 min count) 3948 counts = 32.9 cpm

FS Point #	LOCATION	gross counts (20 Min)	Gross Alpha cpm	Alpha bkg	Net Alpha cpm	Alpha dpm/100 cm^2
1	Prep Room Floor	612	30.6	32.9	-2.3	-2.20
2	Closet Floor	540	27	32.9	-5.9	-5.64
3	Sample Receipt Floor	702	35.1	32.9	2.2	2.10
4	Entrance Floor	672	33.6	32.9	0.7	0.67
5	Calibration Room Floor	566	28.3	32.9	-4.6	-4.40
6	Calibration Room Floor	648	32.4	32.9	-0.5	-0.48
7	Calibration Room Floor	624	31.2	32.9	-1.7	-1.63
8	Prep Room Floor	592	29.6	32.9	-3.3	-3.16
9	Calibration Room Floor	562	28.1	32.9	-4.8	-4.59
10	Calibration Room Floor	722	36.1	32.9	3.2	3.06
11	Calibration Room Floor	666	33.3	32.9	0.4	0.38
12	Storage Area Floor	644	32.2	32.9	-0.7	-0.67
13	Common Area Floor	578	28.9	32.9	-4	-3.83
14	Common Area Floor	672	33.6	32.9	0.7	0.67
15	Ofice Floor	524	26.2	32.9	-6.7	-6.41
16	Common Area Floor	594	29.7	32.9	-3.2	-3.06
17	Common Area Floor	716	35.8	32.9	2.9	2.77
18	Office Floor	608	30.4	32.9	-2.5	-2.39
19	Count Room Floor	538	26.9	32.9	-6	-5.74
20	Count Room Floor	736	36.8	32.9	3.9	3.73
21	Prep Room South Wall 6 Ft	542	27.1	32.9	-5.8	-5.55
22	Prep room North Wall 2Ft	718	35.9	32.9	3	2.87
23	Storage Room South Wall 2 Ft	606	30.3	32.9	-2.6	-2.49
24	Storage Room North Wall 6 Ft	600	30	32.9	-2.9	-2.77

ATTACHMENT C

RSA Laboratories, 21 Pendleton Drive, Hebron, CT
Final Status Survey - Direct Measurements Results
Date: 5/25/13 & 5/28/13 & 7/8/13

Instrument: Ludlum 2224 s/n 119815 w/43-68 s/n 094223
Detector area : 126 cm2

Beta MDA: 636 dpm/100 cm^2
Beta Efficiency 5.90%
Background Beta (5 min count) 1383 counts = 277 cpm

FS Point #	LOCATION	Beta gross counts (2 Min)	Gross Beta cpm	Beta bkg	Net Beta cpm	Beta dpm/100 cm^2
1	Prep Room Floor	556	278	277	1	13
2	Closet Floor	574	287	277	10	135
3	Sample Receipt Floor	536	268	277	-9	-121
4	Entrance Floor	506	253	277	-24	-323
5	Calibration Room Floor	564	282	277	5	67
6	Calibration Room Floor	560	280	277	3	40
7	Calibration Room Floor	526	263	277	-14	-188
8	Prep Room Floor	494	247	277	-30	-404
9	Calibration Room Floor	526	263	277	-14	-188
10	Calibration Room Floor	544	272	277	-5	-67
11	Calibration Room Floor	570	285	277	8	108
12	Storage Area Floor	550	275	277	-2	-27
13	Common Area Floor	530	265	277	-12	-161
14	Common Area Floor	626	313	277	36	484
15	Ofice Floor	530	265	277	-12	-161
16	Common Area Floor	556	278	277	1	13
17	Common Area Floor	620	310	277	33	444
18	Office Floor	528	264	277	-13	-175
19	Count Room Floor	548	274	277	-3	-40
20	Count Room Floor	558	279	277	2	27
21	Prep Room South Wall 6 Ft	536	268	277	-9	-121
22	Prep room North Wall 2Ft	566	283	277	6	81
23	Storage Room South Wall 2 Ft	558	279	277	2	27
24	Storage Room North Wall 6 Ft	556	278	277	1	13

RSA Laboratories Inc.
Radiochemistry Analysis Data Sheet

ATTACHMENT D

Report No. **33735RSA**

Customer: **RSA Laboratories**

Customer Samp No. **FS-01 - FS-24**

Location: **21 Pendleton Dr.**

RSA Lab Sample No. **33735**

Project: **21 Pendleton Dr. Decommissioning**

Date Collected: **N/A**

Samp. Description: **Final Status Wipes**

Date Counted: **5/24/2013 & 7/5/13**

Matrix: **Wipes**

RSA ID#	CUST. ID#		ALPHA CPM	ALPHA DPM	ALPHA LLD	BETA CPM	BETA DPM	BETA LLD
BACKGRND			0.06			0.98		
33735-1	F2-01	Prep Room Floor	0.05	0.06	0.42	0.58	0.47	0.76
33735-2	F2-02	Closet Floor	0.15	0.18	0.42	0.28	0.23	0.76
33735-3	F2-03	Sample Receipt Floor	-0.01	-0.01	0.42	-0.19	-0.16	0.76
33735-4	F2-04	Entrance Floor	-0.06	-0.07	0.42	-0.61	-0.50	0.76
33735-5	F2-05	Calibration Room Floor	-0.01	-0.01	0.42	-0.19	-0.16	0.76
33735-6	F2-06	Calibration Room Floor	0.10	0.12	0.42	0.14	0.12	0.76
33735-7	F2-07	Calibration Room Floor	-0.06	-0.07	0.42	-0.19	-0.16	0.76
33735-8	F2-08	Prep Room Floor	0.10	0.12	0.42	-0.12	-0.10	0.76
33735-9	F2-09	Calibration Room Floor	-0.01	-0.01	0.42	0.39	0.32	0.76
33735-10	F2-10	Calibration Room Floor	-0.01	-0.01	0.42	0.23	0.19	0.76
33735-11	F2-11	Calibration Room Floor	0.20	0.25	0.42	-0.42	-0.35	0.76
33735-12	F2-12	Storage Area Floor	-0.01	-0.01	0.42	0.54	0.44	0.76
33735-13	F2-13	Common Area Floor	0.05	0.06	0.42	-0.16	-0.13	0.76
33735-14	F2-14	Common Area Floor	0.10	0.12	0.42	0.35	0.29	0.76
33735-15	F2-15	Office Floor	0.10	0.12	0.42	-0.02	-0.01	0.76
33735-16	F2-16	Common Area Floor	0.15	0.18	0.42	0.07	0.06	0.76
33735-17	F2-17	Common Area Floor	-0.06	-0.07	0.42	0.07	0.06	0.76
33735-18	F2-18	Office Floor	-0.06	-0.07	0.42	0.02	0.01	0.76
33735-19	F2-19	Count Room Floor	-0.01	-0.01	0.42	-0.40	-0.33	0.76
33735-20	F2-20	Count Room Floor	0.10	0.12	0.42	-0.02	-0.01	0.76
33266-1	F2-21	Prep Room South Wall 6 Ft	-0.02	-0.03	0.44	0.15	0.12	0.78
33266-2	F2-22	Prep Room North Wall 2 Ft	-0.07	-0.09	0.44	0.20	0.16	0.78
33266-3	F2-23	Rad Room South Wall 6 Ft	0.03	0.04	0.44	0.24	0.20	0.78
33266-4	F2-24	Rad Room South Wall 2 Ft	-0.07	-0.09	0.44	0.04	0.03	0.78

RSA Laboratories

A Division of Radiation Safety Associates

Radiochemistry Analysis Data Sheet

ATTACHMENT E Page 1 of 1

Report No. **Report 1**

Customer: **RSA, Inc**

Customer Samp No. **N/A**

Location: **21 Pendleton Drive, Hebron, CT**

RSA Lab Sample No. **33775**

Project: **Final Status Wipes-LSC**

Date Collected: **6/19/2013**

Samp. Description: **Wipes**

Date Counted: **6/19/2013**

Matrix: **Wipes**

H-3 LLD dpm= 56.43

H-3 QC = 172150 dpm +/- 10%

C-14 LLD dpm= 26.96

C-14 QC = 134600 dpm +/- 10%

RSA ID#	CUST. ID#	Location	H-3 CPM	H-3 DPM	C-14 CPM	C-14 DPM	HE Beta CPM	
BG		BACKGROUND	9.20		22.80		11.30	
33775-1	FSW-1	Prep Room Floor	2.06	10	0.20	0.21	7.70	
33775-2	FSW-2	Closet Floor	0.91	4.40	0.00	0.00	4.70	
33775-3	FSW-3	Sample Receipt Floor	0.00	0.00	0.20	0.29	0.00	
33775-4	FSW-4	Entrance Floor	0.00	0.00	0.20	0.29	0.00	
33775-5	FSW-5	Calibration Room Floor	0.00	0.00	0.20	0.29	0.00	
33775-6	FSW-6	Calibration Room Floor	0.91	4.40	0.00	0.00	3.70	
33775-7	FSW-7	Calibration Room Floor	0.00	0.00	0.00	0.00	0.00	
33775-8	FSW-8	Prep Room Floor	7.77	37.37	0.00	0.00	0.00	
33775-9	FSW-9	Calibration Room Floor	0.91	4.41	0.00	0.00	0.00	
33775-10	FSW-10	Calibration Room Floor	0.00	0.00	0.00	0.00	0.70	
33775-11	FSW-11	Calibration Room Floor	0.00	0	0.00	0.00	0.00	
33775-12	FSW-12	Storage Area Floor	0.00	0.00	0.00	0.00	0.70	
33775-13	FSW-13	Common Area Floor	8.91	42.94	0.00	0.00	0.70	
33775-14	FSW-14	Common Area Floor	0.00	0.00	0.00	0.00	1.70	
33775-15	FSW-15	Office Floor	0.00	0.00	0.00	0.00	1.70	
33775-16	FSW-16	Common Area Floor	3.20	15.13	0.20	0.17	0.00	
33775-17	FSW-17	Common Area Floor	0.00	0.00	0.00	0.00	0.00	
33775-18	FSW-18	Office Floor	3.20	15.35	0.00	0.00	0.00	
33775-19	FSW-19	Count Room Floor	0.00	0.00	0.00	0.00	0.00	
33775-20	FSW-20	Count Room Floor	3.20	15.27	0.00	0.00	0.00	
33775-21	QC H-3	QC H-3	32517.60	184826.00	797.92	0.00	0.00	
33775-22	QC BL	QC Blank	0.00	0.00	0.00	0.00	0.00	
33775-23	FSW-21	Prep Room South Wall 6 Ft	0.00	0.00	0.00	0.00	0.00	
QC H-3	FSW-22	Prep Room North Wall 2 Ft	4.24	11.27	6.89	9.73	0.00	
33775-24	FSW-23	Storage Room South Wall 6 F	3.09	14.93	0.00	0.00	1.30	
33775-25	FSW-24	Storage Room North Wall 2 Ft	0.00	0.00	0.00	0.00	0.00	

ATTACHMENT F

LIQUID SCINTILLATION COUNTER DUAL LABEL CALIBRATION CURVES

Qip	H-3 Efficiency Channel 1	H-3 Efficiency Channel 2	Qip	C-14 Efficiency Channel 1	C-14 Efficiency Channel 2
728.5	28.78	0.64	715.9	18.04	73.83
581.6	24.78	0.58	615.4	18.45	73.36
491.4	22.04	0.53	517.2	18.92	71.99
400.7	19.59	0.57	400.8	19.60	68.78
318.0	15.36	0.46	306.3	20.22	65.13
241.5	11.18	0.34	248.2	21.04	62.01
163.6	6.54	0.21	176.3	22.00	53.36
110.2	3.29	0.13	106.3	23.07	37.14
69.0	1.37	0.05	71.6	21.44	23.96
45.4	0.50	0.03	47.1	16.52	10.12