UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EXPOSURE RESEARCH LABORATORY
Research Triangle Park, NC 27711

Office of
Research and Development

March 2, 2015

Br. 2

Docket No. 03008631
License No. 32-14048-04
Control No. 580712 586227
Mr. Dennis Lawyer
U.S. Nuclear Regulatory Commission, Region I
2100 Renaissance Boulevard, Suite 100
King of Prussia, PA 19406-2713

Request for License Amendment || Dated March 2, 2015.

Dear Mr. Lawyer:

The U. S. Environmental Protection Agency (EPA) has ceased activities associated with radioactive materials at the Reproductive Toxicology Facility (RTF) located at 2525 Highway NC 54, Durham, North Carolina and is requesting an amendment to License No. 32-14048-04 to remove this location of use. The EPA notified the U.S. Nuclear Regulatory Commission (NRC) by letter dated May 1, 2013 (ML13134A199) about the program change and planned cessation of activities at the RTF, a leased building location. The main purpose of the May 1, 2013 letter was to notify the NRC about the timeline for vacating the facility. The last day of the current lease is April 24, 2015. The NRC accepted this notification on July 22, 2013 (ML13207A088). The NRC also indicated that a simplified MARSSIM survey would be required to demonstrate that the facility meets the NRC release criteria.

The RTF is one building with biomedical research laboratories. EPA has reasonably expected the building to be suitable for unrestricted release in accordance with NRC requirements based on use history. The EPA subsequently determined the building to be in Decommissioning Group 2. [NUREG-1757, Vol1, Rev 3, p. 9-1] No persistent contamination of work areas, nor building surfaces nor surface soil contamination has ever occurred. EPA has determined radionuclides of potential concern include longer half-life Hydrogen-3 and Carbon-14.

In preparation for conducting the final status survey, the Radiation Safety Office first performed operational clearance and exit surveys of each radioactive material use laboratory in accordance

{Over Please...}

586227
NMSS/RGNI MATERIALS-002

with the site Radiation Safety Manual. No residual contamination was found. Next, AMEC Environment & Infrastructure, Inc. performed a scoping survey to make a better determination to support the design of a final status survey. Radiation scan surveys, direct static measurements and wipe samples were collected in representative areas of the RTF:

1. laboratory countertops and cabinets (71 samples)
2. chemical fume hoods (18 samples with 18 corresponding exhaust duct samples)
3. biological safety cabinet (16 samples)
4. sink traps (112 samples)
5. cold room [walk in refrigerated storage area] (4 samples)
6. rooftop filter and exhaust units (85 samples)
7. building vacuum system trap and strainer [consolidated system] (2 samples)
8. hazardous waste storage trailer. (4 samples)

For analysis, a combination of field screening and laboratory analysis was performed. The discussion of these eight representative areas surveyed appears in the larger Environmental Due Diligence Phase II Report. The results of the scoping survey by location are summarized in Figures 9C-9L (enclosure). All radiological results were less than the screening criteria of 5,000 dpm/100 cm^2 (total) and 1,000 dpm/100 cm^2 (removable) for beta radiation. Therefore, the final status survey design was for a Class 3 area because the impacted areas of the RTF are not expected to have measurable residual radioactivity above a small fraction of the release criterion and little or no potential for small areas of elevated activity.

In support of the submission of the NRC Form 314:

1. All activities authorized by License 32-14048-04 have ceased at the location specified in 10. A. – 2525 Highway NC54, Durham, North Carolina.
2. All radioactive materials procured and/or possessed by the licensee under License 32-14048-04 at the location specified in 10. A. – 2525 Highway NC54, Durham, North Carolina, have been transferred to the location specified in 10. D. – 109 T. W. Alexander Drive, Research Triangle Park, North Carolina.
3. All remaining radioactive waste associated with the location specified in 10. A. – 2525 Highway NC54, Durham, North Carolina has already been dispositioned.
4. A Final Status Survey Report is enclosed. This report provides the documentation of the radiation survey conducted by AMEC Environmental & Infrastructure, Inc. for the EPA. The survey confirms that any remaining residual radioactivity is within the limits of 10 CFR 20, Subpart E, and is as low as reasonably achievable (ALARA). This report is furnished in one binder.

Additionally, a single CD-ROM electronic copy of the entire hardcopy submittal is provided in Adobe Acrobat Reader Portable Document Format (Adobe PDF)

In summary, the RTF meets the NRC criteria for unrestricted use and EPA requests that the RTF be removed from the 32-14048-04 license as soon as possible, no later than April 24, 2015.

Thank you for your attention to this request. Please contact me if you need any additional information regarding this license amendment request at 919-541-4307.

Sincerely,

Todd W. Baker

Todd W. Baker, MSPH, CHP
Radiation Safety Officer

Enclosures: [1] NRC Form 314; dated March 2, 2015. 2 pages in length.
[2] Figure 9C through Figure 9L Sampling Results, Radiation 1st or 2nd Floor Laboratories; 10 pages in length.
[3] EPA RTF Radiological Summary (Scoping Survey) table; 8 pages in length.
[4] Final Status Survey Report, U. S. Environmental Protection Agency, Reproductive Toxicology Facility (RTF) dated February 10, 2015; 114 pages in length including Appendix.
[5] CD-ROM containing Adobe Acrobat Files of this submittal.

cc: Mr. Timothy H. Watkins, Senior Management Designee to the Radiation Safety Committee (w/o enclosures)
Dr. Michael F. Hughes, Chair, Radiation Safety Committee, (w/o enclosures)
Mr. Ritchie Buschow, Assistant Radiation Safety Officer, (w/o enclosures)
RTF Environmental Due Diligence Process Project File (w/o enclosures)
Material License File
Reading File (w/o enclosures)
RSO File (w/o enclosures)

NRC FORM 314
(02-2014)
10 CFR 30.36(j)(1); 40.42(j)(1); 70.38(j)(1); and 72.54(k)(5)(1)(1)

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF DISPOSITION OF MATERIALS

APPROVED BY OMB: NO. 3150-0028 EXPIRES: 02/28/2017

LICENSEE NAME AND ADDRESS	LICENSE NUMBER	DOCKET NUMBER
U.S. Environmental Protection Agency 109 T.W. Alexander Drive Research Triangle Park, (Durham) North Carolina 27709	32-14048-04	
	LICENSE EXPIRATION DATE: July 31, 2024	

A. LICENSE STATUS (Check the appropriate box)

☐ This license has expired. ☐ This license has not yet expired; please terminate it.

B. DISPOSAL OF RADIOACTIVE MATERIAL

(Check the appropriate boxes and complete as necessary. If additional space is needed, provide attachments)

The licensee, or any individual executing this certificate on behalf of the licensee, certifies that:

☐ 1. No radioactive materials have ever been procured or possessed by the licensee under this license.

☑ 2. All activities authorized by this license have ceased, and all radioactive materials procured and/or possessed by the licensee under this license number cited above have been disposed of in the following manner.

☑ a. Transfer of radioactive materials to the licensee listed below:

(Same License) authorized location 109 T. W. Alexander Drive, Research Triangle Park, North Carolina
[The Main Campus location.]

☑ b. Disposal of radioactive materials:

☑ 1. Directly by the licensee:

Discharge to Sanitary Sewer / Decay in storage / Licensed incineration

☐ 2. By licensed disposal site:

to

☑ 3. By waste contractor:

October 29, 2014 last shipment from 2525 Highway NC 54, Durham, NC by Chase Environmental Group, Inc., to Diversified Scientific Services, Inc., 657 Gallaher Road, Kingston, TN 37764.

☑ c. All radioactive materials have been removed such that any remaining residual radioactivity is within the limits of 10 CFR Part 20, Subpart E, and is ALARA.

C. SURVEYS PERFORMED AND REPORTED

☑ 1. A radiation survey was conducted by the licensee. The survey confirms:

☑ a. the absence of licensed radioactive materials

☑ b. that any remaining residual radioactivity is within the limits of 10 CFR 20, Subpart E, and is ALARA.

☑ 2. A copy of the radiation survey results:

☑ a. is attached; or ☐ b. is not attached (Provide explanation); or ☐ c. was forwarded to NRC on: _____ Date

☐ 3. A radiation survey is not required as only sealed sources were ever possessed under this license, and

☐ a. The results of the latest leak test are attached; and/or ☐ b. No leaking sources have ever been identified.

The person to be contacted regarding the information provided on this form:

NAME	TITLE	TELEPHONE *(Include Area Code)*	E-MAIL ADDRESS
Todd W. Baker	Health Physicist-Radiation Safety Officer	919-541-4307	baker.todd@epa.gov

Mail all future correspondence regarding this license to:
U.S. Environmental Protection Agency, 109 T.W. Alexander Dr., Radiation Safety Office, Mail Code D343-02, Research Triangle Park, North Carolina, 27711

C. CERTIFYING OFFICIAL

I CERTIFY UNDER PENALTY OF PERJURY THAT THE FOREGOING IS TRUE AND CORRECT

PRINTED NAME AND TITLE	SIGNATURE	DATE
Todd W. Baker, Radiation Safety Officer Acting Director, Safety Health and Environmental Mgmnt. Office	Todd W. Baker	03/02/2015

WARNING: FALSE STATEMENTS IN THIS CERTIFICATE MAY BE SUBJECT TO CIVIL AND/OR CRIMINAL PENALTIES. NRC REGULATIONS REQUIRE THAT SUBMISSIONS TO THE NRC BE COMPLETE AND ACCURATE IN ALL MATERIAL RESPECT. 18 U.S.C. SECTION 1001 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFICATE OF DISPOSITION OF MATERIALS

PLEASE READ THESE INSTRUCTIONS BEFORE COMPLETING NRC FORM 314.

Subpart E of 10 CFR Part 20 establishes the radiological criteria for license terminations/decommissioning of facilities licensed under 10 CFR Parts 30, 40, 50, 60, 61, 70, and 72, as well as other facilities subject to the Commission's jurisdiction under the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, as amended.

INSTRUCTIONS

Section B, Item 2.

Licensees should describe the specific radioactive material transfer actions. If radioactive wastes were generated in terminating this license, the licensee should describe the disposal actions taken, including the disposition of low-level radioactive waste, mixed waste, greater-than-Class-C waste, and sealed sources.

Section B, Item 2.a.

The information provided concerning the transfer of radioactive material to another licensee should specify the date of the transfer, the name of the licensee recipient, an individual contact name and telephone number for the licensee recipient, and the recipient's NRC or Agreement State license number.

Section B, Item 2.b.

For disposal of radioactive materials, licensees should describe the specific disposal method or procedure (e.g., decay-in-storage). For those cases when radioactive materials are disposed of by a licensed disposal site or by a waste contractor, the licensee should specify the name, address, and telephone number of the licensed disposal site operator or waste contractor.

Section B, Item 2.c.

"Residual radioactivity," as defined in 10 CFR 20.1003, means radioactivity in 'areas' (structures, materials, soils, etc.) remaining as a result of activities (licensed and unlicensed) under the licensee's control from sources used by the licensee, excluding background radiation. ALARA is defined in 10 CFR 20.1003.

FILE CERTIFICATES AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND CERTIFICATES TO:

LICENSING ASSISTANT SECTION
NUCLEAR MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
KING OF PRUSSIA, PA 19406-2713

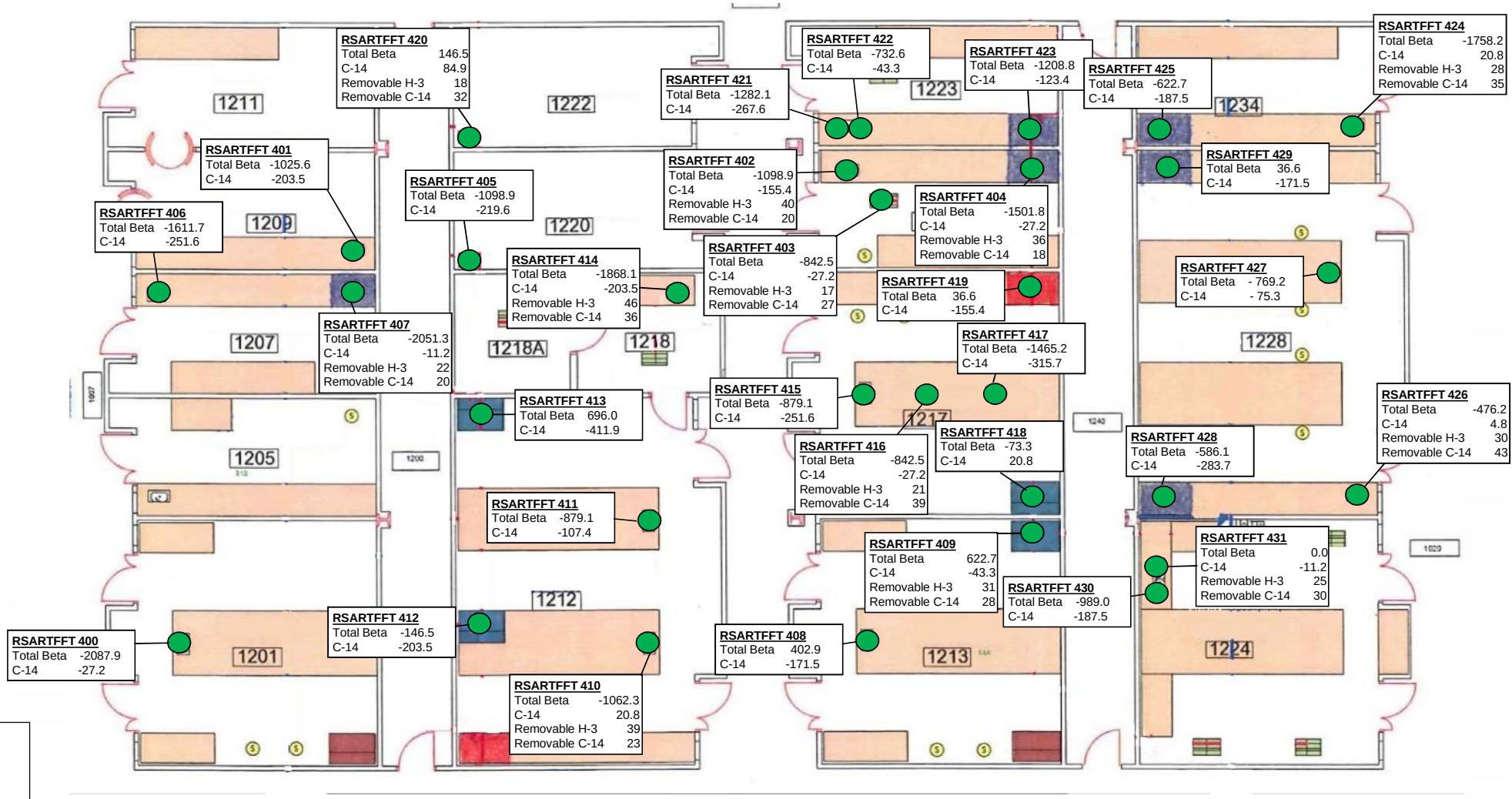
ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND CERTIFICATES TO:

MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

IF YOU ARE LOCATED IN:

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND CERTIFICATES TO:

MATERIAL RADIATION PROTECTION SECTION
U. S. NUCLEAR REGULATORY COMMISSION, REGION IV
1600 E. LAMAR BOULEVARD
ARLINGTON, TX 76011-4511



- Only Sample Locations that have reportable levels are annotated.
- Values in red exceed Tier II clearance levels and less than Tier II clearance criteria
- Units are listed as dpm/100 cm2

amec foster wheeler

AMEC Environment & Infrastructure, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, NC 27703
(919) 381-9900

CLIENT: ENVIRONMENTAL PROTECTION AGENCY

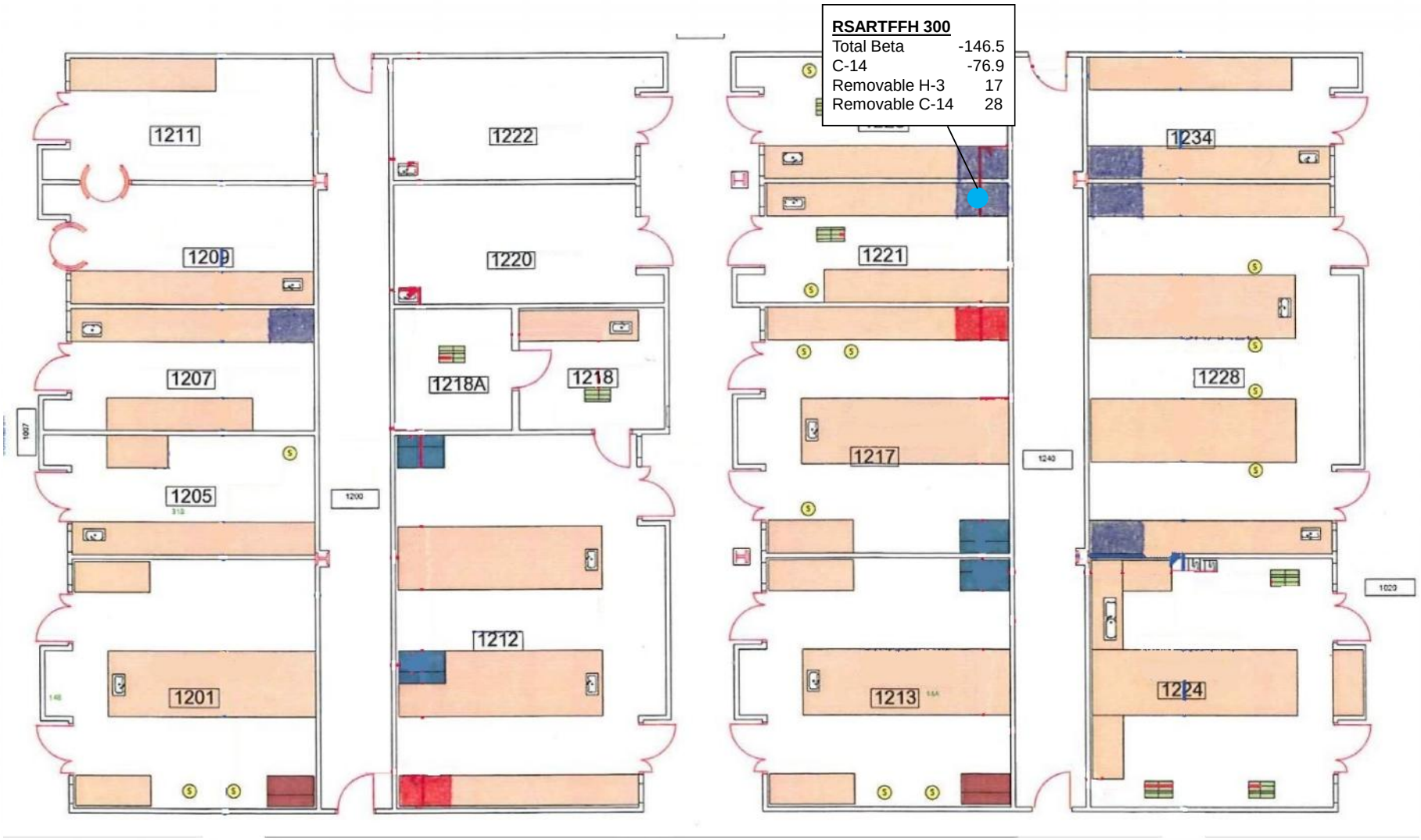
DATE: 12/04/14	**SCALE:** Not to scale	**PROJ.:** 321060245	
DR: R. Kirby	**CHK:** S.Johnson		

LOCATION: P:\Government\Federal\EPA\321060245 RTF Decommission\2.0 Deliverables\Phase II Report\Figures

TITLE: Sampling Results, Radiation, 1st Floor Laboratories

SITE: EPA RTF EDDP Phase II Confirmation Sampling
2525 Highway 54, Durham NC

Figure **9C**



Legend

- Sink traps
- Fume hoods
- Countertops

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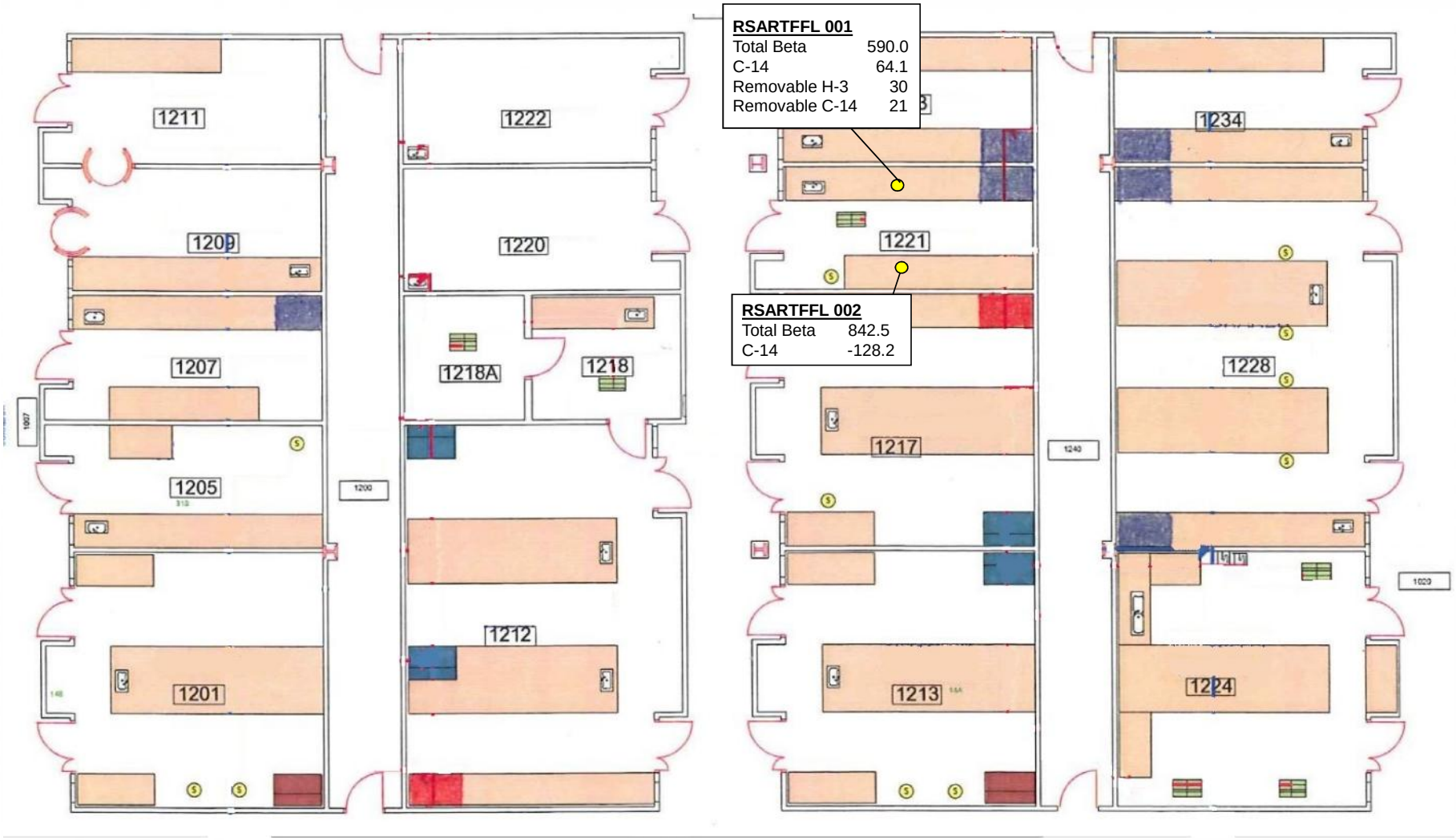
Figure **9D**



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TITLE: Sampling Results, Radiation, 1st Floor Laboratories

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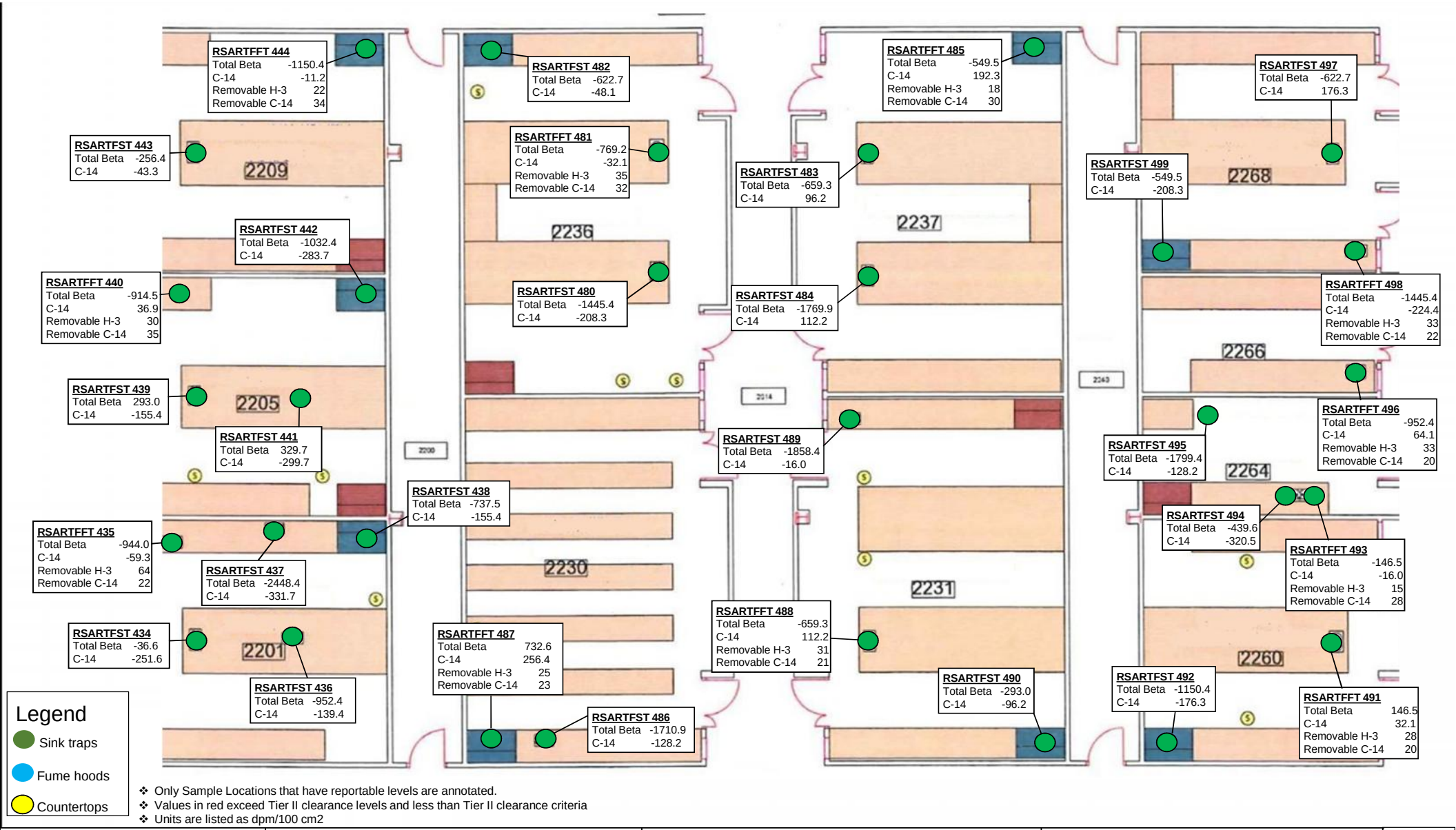
Figure **9E**



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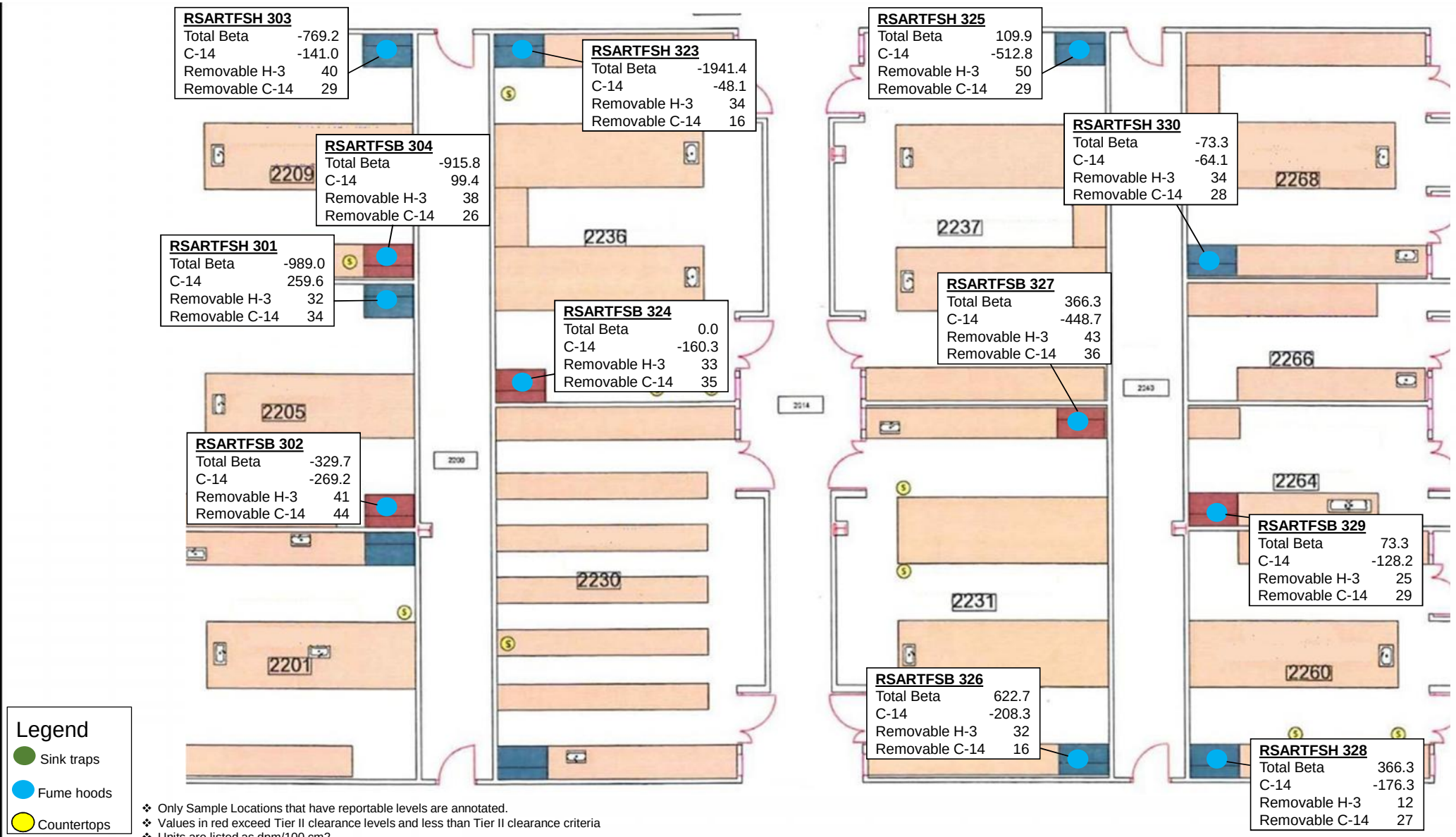
DR:	R. Kirby	**CHK:**	S.Johnson		

LOCATION: P:\Government\Federal\EPA\321060245 RTF Decommission\2.0 Deliverables\Phase II Report\Figures

TITLE: Sampling Results, Radiation, 2nd Floor Laboratories (A)

SITE: EPA RTF EDDP Phase II Confirmation Sampling
2525 Highway 54, Durham NC

Figure **9F**



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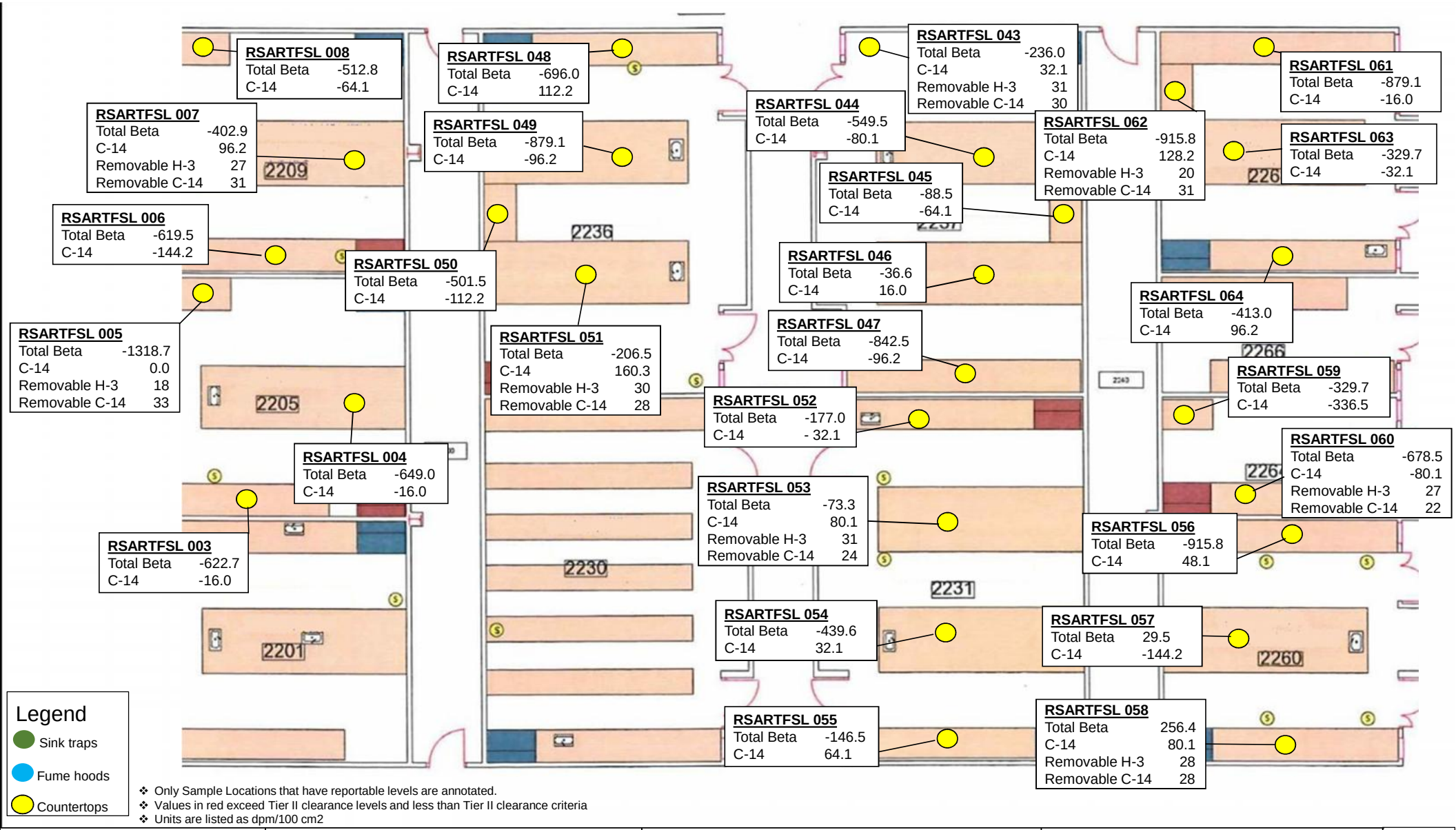
TITLE: Sampling Results, Radiation, 2nd Floor Laboratories (A)

SITE: EPA RTF EDDP Phase II Confirmation Sampling
2525 Highway 54, Durham NC

Figure **9G**



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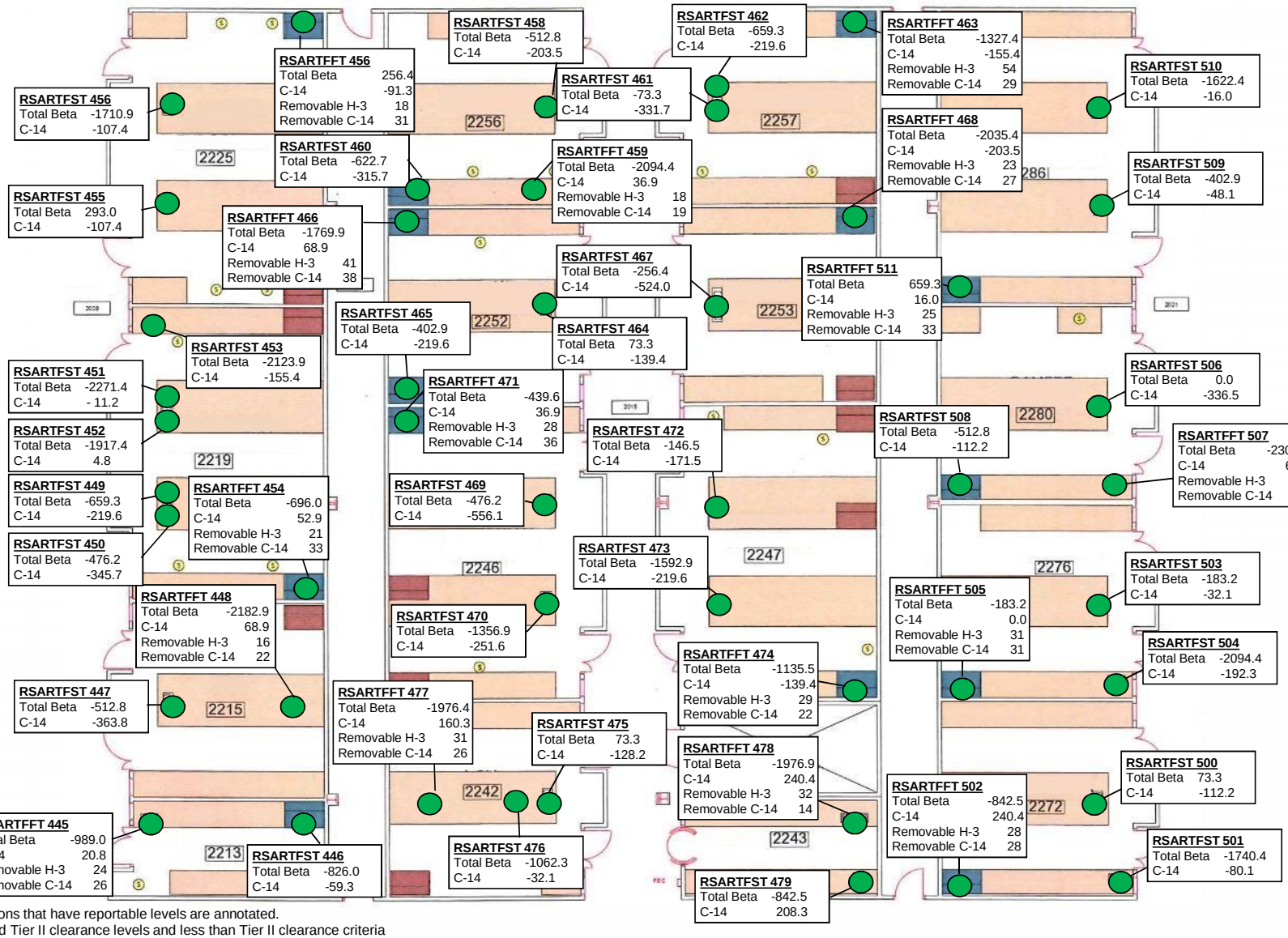
TITLE: Sampling Results, Radiation, 2nd Floor Laboratories (A)

SITE: EPA RTF EDDP Phase II Confirmation Sampling
2525 Highway 54, Durham NC

Figure **9H**



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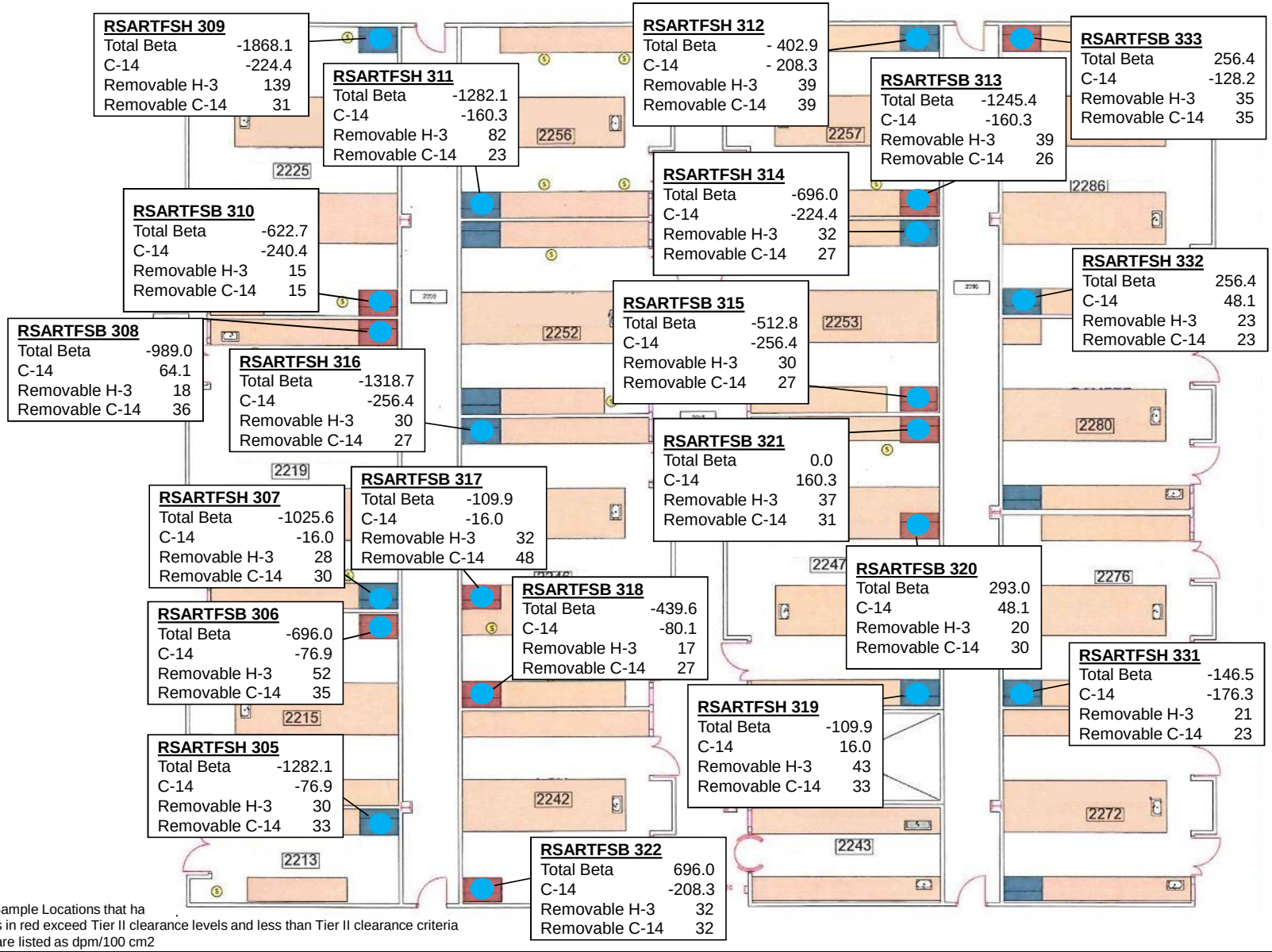
DR:	R. Kirby	**CHK:**	S.Johnson		

LOCATION: P:\Government\Federal\EPA\321060245 RTF Decommission\2.0 Deliverables\Phase II Report\Figures

TITLE: Sampling Results, Radiation, 2nd Floor Laboratories (B)

SITE: EPA RTF EDDP Phase II Confirmation Sampling
2525 Highway 54, Durham NC

Figure **9I**



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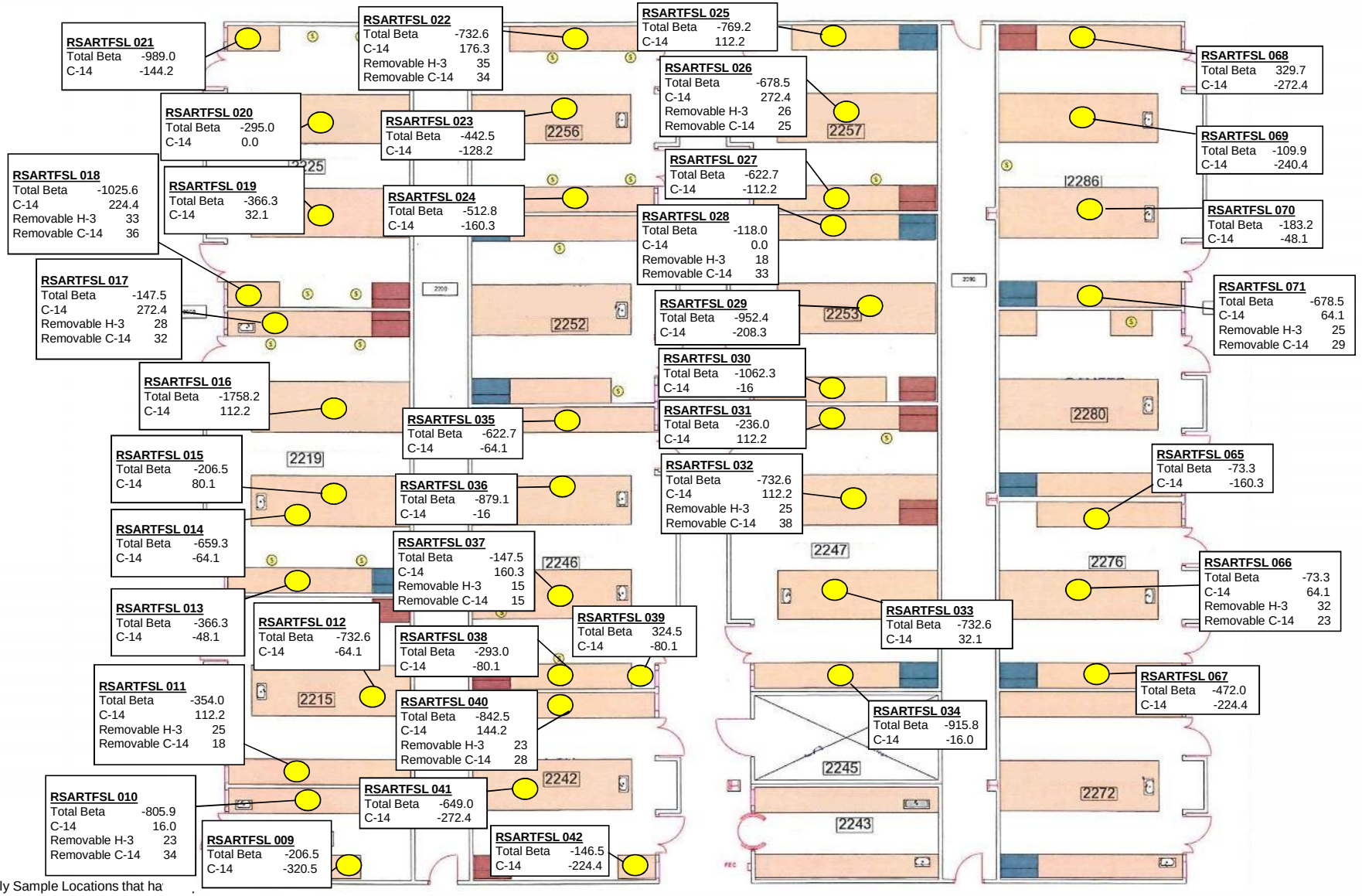
SITE: EPA RTF EDDP Phase II Confirmation Sampling
2525 Highway 54, Durham NC

Figure **9J**



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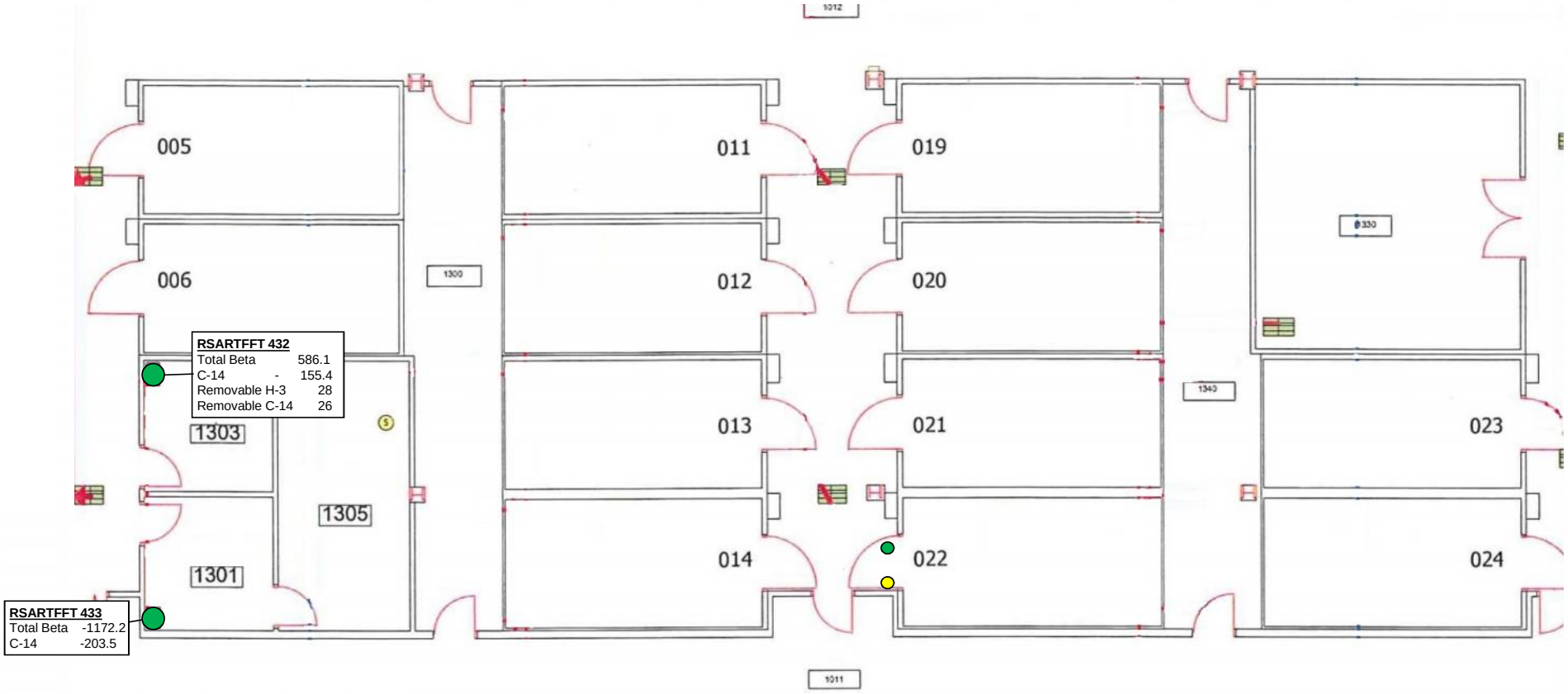
TITLE: Sampling Results, Radiation, 2nd Floor Laboratories (B)

SITE: EPA RTF EDDP Phase II Confirmation Sampling
2525 Highway 54, Durham NC

Figure **9K**



Legend

- Sink traps
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DR:	R. Kirby	**CHK:**	S.Johnson		

LOCATION: P:\Government\Federal\EPA\321060245 RTF Decommission\2.0 Deliverables\Phase II Report\Figures

TITLE: Sampling Results, Radiation, 1st Floor Animal Facilities

SITE: EPA RTF EDDP Phase II Confirmation Sampling
2525 Highway 54, Durham NC

Figure **9L**

EPA RTF Radiological Summary

		On-Site		LSC	
		Total Beta	Removable Beta	Removable H-3	Removable C-14
Description	Sample ID	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²
Filter / housing	RSAFRFRF 101	-439.6	-96.2		
Filter / housing	RSAFRFRF 102	2637.4	48.1		
Filter / housing	RSAFRFRF 103	2930.4	112.2		
Filter / housing	RSAFRFRF 104	-1758.2	-288.5		
Filter / housing	RSAFRFRF 105	-1391.9	-16.0		
Filter / housing	RSAFRFRF 106	146.5	192.3	38	21
Filter / housing	RSAFRFRF 107	-36.6	-192.3		
Filter / housing	RSAFRFRF 110	-439.6	-16.0		
Filter / housing	RSAFRFRF 111	-402.9	160.3	15	37
Filter / housing	RSAFRFRF 112	402.9	-272.4		
Filter / housing	RSAFRFRF 115	-842.5	-64.1		
Filter / housing	RSAFRFRF 116	-293.0	176.3	25	17
Filter / housing	RSAFRFRF 117	-1575.1	80.1		
Filter / housing	RSAFRFRF 118	-1501.8	0.0		
Filter / housing	RSAFRFRF 121	1465.2	-96.2		
Filter / housing	RSAFRFRF 123	3260.1	64.1		
Filter / housing	RSAFRFRR 108	-2527.5	-80.1		
Filter / housing	RSAFRFRR 109	-1428.6	-176.3		
Filter / housing	RSAFRFRR 113	-1135.5	64.1		
Filter / housing	RSAFRFRR 114	-1062.3	-128.2		
Filter / housing	RSAFRFRR 119	-2967.0	160.3	29	28
Filter / housing	RSAFRFRR 120	-3076.9	-144.2		
Filter / housing	RSAFRFRR 122	-329.7	112.2	16	31
Filter / housing	RSAFRFRR 124	-2087.9	-288.5		
Filter / housing	RSARTFRF 125	-3186.8	-80.1		
Filter / housing	RSARTFRF 126	-2564.1	16.0		
Filter / housing	RSARTFRF 127	-1794.9	-288.5		
Filter / housing	RSARTFRF 128	-1282.1	-112.2		
Filter / housing	RSARTFRF 129	-3296.7	-16.0		
Filter / housing	RSARTFRF 130	-4065.9	208.3	49	26
Filter / housing	RSARTFRF 131	-3076.9	0.0		
Filter / housing	RSARTFRF 132	-3370.0	-208.3		
Filter / housing	RSARTFRF 133	-3260.1	80.1	67	25
Filter / housing	RSARTFRF 134	-3113.6	-368.6		
Filter / housing	RSARTFRF 135	-3113.6	272.4	21	31
Filter / housing	RSARTFRF 136	-3150.2	-352.6		
Filter / housing	RSARTFRF 137	-3150.2	64.1		
Filter / housing	RSARTFRF 138	-2161.2	-16.0		
Filter / housing	RSARTFRF 139	-3003.7	-96.2		
Filter / housing	RSARTFRF 140	-1904.8	160.3		
Filter / housing	RSARTFRF 141	-1391.9	-112.2		
Filter / housing	RSARTFRF 142	-2197.8	96.2	38	31
Filter / housing	RSARTFRF 143	-3370.0	-112.2		
Filter / housing	RSARTFRF 144	-2893.8	16.0		
Filter / housing	RSARTFRF 145	-3626.4	-208.3		
Filter / housing	RSARTFRF 146	-2637.4	-112.2		
Filter / housing	RSARTFRF 147	-3333.3	-208.3		

EPA RTF Radiological Summary

		On-Site		LSC	
		Total Beta	Removable Beta	Removable H-3	Removable C-14
Description	Sample ID	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²
Filter / housing	RSARTFRF 148	-3223.4	-304.5		
Filter / housing	RSARTFRF 149	-3370.0	-64.1		
Filter / housing	RSARTFRF 150	-4945.1	-80.1		
Filter / housing	RSARTFRF 151	-1465.2	-304.5		
Filter / housing	RSARTFRF 152	-4725.3	-176.3		
Filter / housing	RSARTFRF 153	-4249.1	-352.6		
Filter / housing	RSARTFRF 154	1465.2	-64.1	27	51
Filter / housing	RSARTFRF 155	1648.4	-256.4		
Filter / housing	RSARTFRF 156	2234.4	-160.3		
Filter / housing	RSARTFRF 157	-2783.9	-208.3		
Filter / housing	RSARTFRF 158	-3223.4	-80.1		
Filter / housing	RSARTFRF 159	-2893.8	-224.4		
Filter / housing	RSARTFRF 160	-3772.9	-160.3		
Filter / housing	RSARTFRF 161	-3663.0	-80.1		
Filter / housing	RSARTFRF 162	3150.2	-173.1		
Filter / housing	RSARTFRF 163	1685.0	195.5		
Filter / housing	RSARTFRF 164	-3076.9	67.3		
Filter / housing	RSARTFRF 165	-1135.5	131.4		
Filter / housing	RSARTFRF 176	-4029.3	115.4		
Filter / housing	RSARTFRF 177	-2710.6	-76.9		
Filter / housing	RSARTFRR 166	-2197.8	227.6	45	30
Filter / housing	RSARTFRR 167	-1428.6	-189.1		
Filter / housing	RSARTFRR 168	-3113.6	19.2		
Filter / housing	RSARTFRR 169	-2161.2	163.5		
Filter / housing	RSARTFRR 170	-2674.0	-76.9		
Filter / housing	RSARTFRR 171	-3443.2	-189.1		
Filter / housing	RSARTFRR 172	-2490.8	307.7	27	26
Filter / housing	RSARTFRR 173	-3113.6	35.3		
Filter / housing	RSARTFRR 174	2674.0	19.2		
Filter / housing	RSARTFRR 175	1208.8	-92.9		
Filter / housing	RSARTFRR 178	-1575.1	147.4		
Filter / housing	RSARTFRR 179	-1721.6	323.7	36	20
Filter / housing	RSARTFRR 180	-2197.8	-12.8		
Filter / housing	RSARTFRR 181	-2344.3	163.5		
Filter / housing	RSARTFRR 182	-2674.0	99.4		
Filter / housing	RSARTFRR 183	-2014.7	195.5		
Filter / housing	RSARTFRR 184	-2527.5	-92.9		
Filter / housing	RSARTFRR 185	-1941.4	-44.9		
Cold room	RSARTFSC 376	-696.0	259.6	27	28
Cold room	RSARTFSC 377	-1831.5	195.5		
Cold room	RSARTFSC 378	-1868.1	195.5		
Cold room	RSARTFSC 379	-2087.9	195.5		
BSC	RSARTFSB 302	-329.7	-269.2	41	44
BSC	RSARTFSB 304	-915.8	99.4	38	26
BSC	RSARTFSB 306	-696.0	-76.9	52	35
BSC	RSARTFSB 308	-989.0	64.1	18	36
BSC	RSARTFSB 310	-622.7	-240.4	15	15

EPA RTF Radiological Summary

		On-Site		LSC	
		Total Beta	Removable Beta	Removable H-3	Removable C-14
Description	Sample ID	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²
BSC	RSARTFSB 313	-1245.4	-160.3	39	26
BSC	RSARTFSB 315	-512.8	-256.4	30	27
BSC	RSARTFSB 317	-109.9	-16.0	32	48
BSC	RSARTFSB 318	-439.6	-80.1	17	27
BSC	RSARTFSB 320	293.0	48.1	20	30
BSC	RSARTFSB 321	0.0	160.3	37	31
BSC	RSARTFSB 322	696.0	-208.3	32	32
BSC	RSARTFSB 324	0.0	-160.3	33	35
BSC	RSARTFSB 327	366.3	-448.7	43	36
BSC	RSARTFSB 329	73.3	-128.2	25	29
BSC	RSARTFSB 333	256.4	-128.2	35	35
Hoods	RSARTFFH 300	-146.5	-76.9	17	28
Hoods	RSARTFSH 301	-989.0	259.6	32	34
Hoods	RSARTFSH 303	-769.2	-141.0	40	29
Hoods	RSARTFSH 305	-1282.1	-76.9	30	33
Hoods	RSARTFSH 307	-1025.6	-16.0	28	30
Hoods	RSARTFSH 309	-1868.1	-224.4	139	31
Hoods	RSARTFSH 311	-1282.1	-160.3	82	23
Hoods	RSARTFSH 312	-402.9	-208.3	39	39
Hoods	RSARTFSH 314	-696.0	-224.4	32	27
Hoods	RSARTFSH 316	-1318.7	-256.4	30	27
Hoods	RSARTFSH 319	-109.9	16.0	43	33
Hoods	RSARTFSH 323	-1941.4	-48.1	34	16
Hoods	RSARTFSH 325	109.9	-512.8	50	29
Hoods	RSARTFSH 326	622.7	-208.3	32	16
Hoods	RSARTFSH 328	366.3	-176.3	12	27
Hoods	RSARTFSH 330	-73.3	-64.1	34	28
Hoods	RSARTFSH 331	-146.5	-176.3	21	23
Hoods	RSARTFSH 332	256.4	48.1	23	23
Hoods	RSARTFFH 900		-96.2	42	20
Hoods	RSARTFSH 901		240.4	55	17
Hoods	RSARTFSH 902		-96.2	61	19
Hoods	RSARTFSH 903		-496.8	64	32
Hoods	RSARTFSH 904		-224.4	79	32
Hoods	RSARTFSH 905		64.1	78	24
Hoods	RSARTFSH 906		32.1	85	19
Hoods	RSARTFSH 907		256.4	32	20
Hoods	RSARTFSH 908		112.2	71	19
Hoods	RSARTFSH 909		-32.1	168	30
Hoods	RSARTFSH 910		-48.1	72	20
Hoods	RSARTFSH 911		-144.2	50	20
Hoods	RSARTFSH 912		-160.3	11	18
Hoods	RSARTFSH 913		-80.1	169	26
Hoods	RSARTFSH 914		-96.2	34	17
Hoods	RSARTFSH 915		-96.2	97	23
Hoods	RSARTFSH 916		-224.4	54	17
Hoods	RSARTFSH 917		-144.2	40	23

EPA RTF Radiological Summary

		On-Site		LSC	
		Total Beta	Removable Beta	Removable H-3	Removable C-14
Description	Sample ID	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²
Countertop	RSARTFFL 001	590.0	64.1	30	21
Countertop	RSARTFFL 002	842.5	-128.2		
Countertop	RSARTFSL 003	-622.7	-16.0		
Countertop	RSARTFSL 004	-649.0	-16.0		
Countertop	RSARTFSL 005	-1318.7	0.0	18	33
Countertop	RSARTFSL 006	-619.5	-144.2		
Countertop	RSARTFSL 007	-402.9	96.2	27	31
Countertop	RSARTFSL 008	-512.8	-64.1		
Countertop	RSARTFSL 009	-206.5	-320.5		
Countertop	RSARTFSL 010	-805.9	16.0	23	34
Countertop	RSARTFSL 011	-354.0	112.2	25	18
Countertop	RSARTFSL 012	-732.6	-64.1		
Countertop	RSARTFSL 013	-366.3	-48.1		
Countertop	RSARTFSL 014	-659.3	-64.1		
Countertop	RSARTFSL 015	-206.5	80.1		
Countertop	RSARTFSL 016	-1758.2	112.2		
Countertop	RSARTFSL 017	-147.5	272.4	28	32
Countertop	RSARTFSL 018	-1025.6	224.4	33	36
Countertop	RSARTFSL 019	-366.3	32.1		
Countertop	RSARTFSL 020	-295.0	0.0		
Countertop	RSARTFSL 021	-989.0	-144.2		
Countertop	RSARTFSL 022	-732.6	176.3	35	34
Countertop	RSARTFSL 023	-442.5	-128.2		
Countertop	RSARTFSL 024	-512.8	-160.3		
Countertop	RSARTFSL 025	-769.2	112.2		
Countertop	RSARTFSL 026	-678.5	272.4	26	25
Countertop	RSARTFSL 027	-622.7	-112.2		
Countertop	RSARTFSL 028	-118.0	0.0	18	33
Countertop	RSARTFSL 029	-952.4	-208.3		
Countertop	RSARTFSL 030	-1062.3	-16.0		
Countertop	RSARTFSL 031	-236.0	112.2		
Countertop	RSARTFSL 032	-732.6	112.2	25	38
Countertop	RSARTFSL 033	-732.6	32.1		
Countertop	RSARTFSL 034	-915.8	-16.0		
Countertop	RSARTFSL 035	-622.7	-64.1		
Countertop	RSARTFSL 036	-879.1	-16.0		
Countertop	RSARTFSL 037	-147.5	160.3	15	15
Countertop	RSARTFSL 038	-293.0	-80.1		
Countertop	RSARTFSL 039	324.5	-80.1		
Countertop	RSARTFSL 040	-842.5	144.2	23	28
Countertop	RSARTFSL 041	-649.0	-272.4		
Countertop	RSARTFSL 042	-146.5	-224.4		
Countertop	RSARTFSL 043	-236.0	32.1	31	30
Countertop	RSARTFSL 044	-549.5	-80.1		
Countertop	RSARTFSL 045	-88.5	-64.1		
Countertop	RSARTFSL 046	-36.6	16.0		
Countertop	RSARTFSL 047	-842.5	-96.2		

EPA RTF Radiological Summary

		On-Site		LSC	
		Total Beta	Removable Beta	Removable H-3	Removable C-14
Description	Sample ID	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²
Countertop	RSARTFSL 048	-696.0	112.2		
Countertop	RSARTFSL 049	-879.1	-96.2		
Countertop	RSARTFSL 050	-501.5	-112.2		
Countertop	RSARTFSL 051	206.5	160.3	30	28
Countertop	RSARTFSL 052	-177.0	-32.1		
Countertop	RSARTFSL 053	-73.3	80.1	31	24
Countertop	RSARTFSL 054	-439.6	32.1		
Countertop	RSARTFSL 055	-146.5	64.1		
Countertop	RSARTFSL 056	-915.8	48.1		
Countertop	RSARTFSL 057	29.5	-144.2		
Countertop	RSARTFSL 058	256.4	80.1	28	28
Countertop	RSARTFSL 059	-329.7	-336.5		
Countertop	RSARTFSL 060	-678.5	-80.1	27	22
Countertop	RSARTFSL 061	-879.1	-16.0		
Countertop	RSARTFSL 062	-915.8	128.2	20	31
Countertop	RSARTFSL 063	-329.7	-32.1		
Countertop	RSARTFSL 064	-413.0	96.2		
Countertop	RSARTFSL 065	-73.3	-160.3		
Countertop	RSARTFSL 066	-73.3	64.1	32	23
Countertop	RSARTFSL 067	-472.0	-224.4		
Countertop	RSARTFSL 068	329.7	-272.4		
Countertop	RSARTFSL 069	-109.9	-240.4		
Countertop	RSARTFSL 070	-183.2	-48.1		
Countertop	RSARTFSL 071	-678.5	64.1	25	29
Traps	RSARTFFT 400	-2087.9	-27.2		
Traps	RSARTFFT 401	-1025.6	-203.5		
Traps	RSARTFFT 402	-1098.9	-155.4	40	20
Traps	RSARTFFT 403	-842.5	-27.2	17	27
Traps	RSARTFFT 404	-1501.8	-27.2	36	18
Traps	RSARTFFT 405	-1098.9	-219.6		
Traps	RSARTFFT 406	-1611.7	-251.6		
Traps	RSARTFFT 407	-2051.3	-11.2	22	20
Traps	RSARTFFT 408	402.9	-171.5		
Traps	RSARTFFT 409	622.7	-43.3	31	28
Traps	RSARTFFT 410	-1062.3	20.8	39	23
Traps	RSARTFFT 411	-879.1	-107.4		
Traps	RSARTFFT 412	-146.5	-203.5		
Traps	RSARTFFT 413	696.0	-411.9		
Traps	RSARTFFT 414	-1868.1	-203.5	46	36
Traps	RSARTFFT 415	-879.1	-251.6		
Traps	RSARTFFT 416	-842.5	-27.2	21	39
Traps	RSARTFFT 417	-1465.2	-315.7		
Traps	RSARTFFT 418	-73.3	20.8		
Traps	RSARTFFT 419	36.6	-155.4		
Traps	RSARTFFT 420	146.5	84.9	18	32
Traps	RSARTFFT 421	-1282.1	-267.6		
Traps	RSARTFFT 422	-732.6	-43.3		

EPA RTF Radiological Summary

		On-Site		LSC	
		Total Beta	Removable Beta	Removable H-3	Removable C-14
Description	Sample ID	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²
Traps	RSARTFFT 423	-1208.8	-123.4		
Traps	RSARTFFT 424	-1758.2	20.8	28	35
Traps	RSARTFFT 425	-622.7	-187.5		
Traps	RSARTFFT 426	-476.2	4.8	30	43
Traps	RSARTFFT 427	-769.2	-75.3		
Traps	RSARTFFT 428	-586.1	-283.7		
Traps	RSARTFFT 429	36.6	-171.5		
Traps	RSARTFFT 430	-989.0	-187.5		
Traps	RSARTFFT 431	0.0	-11.2	25	30
Traps	RSARTFFT 432	586.1	-155.4	28	26
Traps	RSARTFFT 433	-1172.2	-203.5		
Traps	RSARTFST 434	-36.6	-251.6		
Traps	RSARTFST 435	-944.0	-59.3	64	22
Traps	RSARTFST 436	-952.4	-139.4		
Traps	RSARTFST 437	-2448.4	-331.7		
Traps	RSARTFST 438	-737.5	-155.4		
Traps	RSARTFST 439	293.0	-155.4		
Traps	RSARTFST 440	-914.5	36.9	30	35
Traps	RSARTFST 441	329.7	-299.7		
Traps	RSARTFST 442	-1032.4	-283.7		
Traps	RSARTFST 443	-256.4	-43.3		
Traps	RSARTFST 444	-1150.4	-11.2	22	34
Traps	RSARTFST 445	-989.0	20.8	24	26
Traps	RSARTFST 446	-826.0	-59.3		
Traps	RSARTFST 447	-512.8	-363.8		
Traps	RSARTFST 448	-2182.9	68.9	16	22
Traps	RSARTFST 449	-659.3	-219.6		
Traps	RSARTFST 450	-476.2	-315.7		
Traps	RSARTFST 451	-2271.4	-11.2		
Traps	RSARTFST 452	-1917.4	4.8		
Traps	RSARTFST 453	-2123.9	-155.4		
Traps	RSARTFST 454	-696.0	52.9	21	33
Traps	RSARTFST 455	293.0	-107.4		
Traps	RSARTFST 456	-1710.9	-107.4		
Traps	RSARTFST 457	256.4	-91.3	18	31
Traps	RSARTFST 458	-512.8	-203.5		
Traps	RSARTFST 459	-2094.4	36.9	18	19
Traps	RSARTFST 460	-622.7	-315.7		
Traps	RSARTFST 461	-73.3	-331.7		
Traps	RSARTFST 462	-659.3	-219.6		
Traps	RSARTFST 463	-1327.4	-155.4	54	29
Traps	RSARTFST 464	73.3	-139.4		
Traps	RSARTFST 465	-402.9	-219.6		
Traps	RSARTFST 466	-1769.9	68.9	41	38
Traps	RSARTFST 467	-256.4	-524.0		
Traps	RSARTFST 468	-2035.4	-203.5	23	27
Traps	RSARTFST 469	-476.2	-556.1		

EPA RTF Radiological Summary

		On-Site		LSC	
		Total Beta	Removable Beta	Removable H-3	Removable C-14
Description	Sample ID	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²
Traps	RSARTFST 470	-1356.9	-251.6		
Traps	RSARTFST 471	-439.6	36.9	28	36
Traps	RSARTFST 472	-146.5	-171.5		
Traps	RSARTFST 473	-1592.9	-219.6		
Traps	RSARTFST 474	-1135.5	-139.4	29	22
Traps	RSARTFST 475	73.3	-128.2		
Traps	RSARTFST 476	-1062.3	-32.1		
Traps	RSARTFST 477	-1976.4	160.3	31	26
Traps	RSARTFST 478	-1946.9	240.4	32	14
Traps	RSARTFST 479	-842.5	208.3		
Traps	RSARTFST 480	-1445.4	-208.3		
Traps	RSARTFST 481	-769.2	-32.1	35	32
Traps	RSARTFST 482	-622.7	-48.1		
Traps	RSARTFST 483	-659.3	96.2		
Traps	RSARTFST 484	-1769.9	112.2		
Traps	RSARTFST 485	-549.5	192.3	18	30
Traps	RSARTFST 486	-1710.9	-128.2		
Traps	RSARTFST 487	732.6	256.4	25	23
Traps	RSARTFST 488	-659.3	112.2	31	21
Traps	RSARTFST 489	-1858.4	-16.0		
Traps	RSARTFST 490	-293.0	-96.2		
Traps	RSARTFST 491	146.5	32.1	28	20
Traps	RSARTFST 492	-1150.4	-176.3		
Traps	RSARTFST 493	-146.5	-16.0	15	28
Traps	RSARTFST 494	-439.6	-320.5		
Traps	RSARTFST 495	-1799.4	-128.2		
Traps	RSARTFST 496	-952.4	64.1	33	20
Traps	RSARTFST 497	-622.7	176.3		
Traps	RSARTFST 498	-1445.4	-224.4	33	22
Traps	RSARTFST 499	-549.5	-208.3		
Traps	RSARTFST 500	73.3	-112.2		
Traps	RSARTFST 501	-1740.4	-80.1		
Traps	RSARTFST 502	-842.5	240.4	28	28
Traps	RSARTFST 503	-183.2	-32.1		
Traps	RSARTFST 504	-2094.4	-192.3		
Traps	RSARTFST 505	-183.2	0.0	31	31
Traps	RSARTFST 506	0.0	-336.5		
Traps	RSARTFST 507	-2300.9	64.1	26	20
Traps	RSARTFST 508	-512.8	-112.2		
Traps	RSARTFST 509	-402.9	-48.1		
Traps	RSARTFST 510	-1622.4	-16.0		
Traps	RSARTFST 511	659.3	16.0	25	33
lead bricks	RSARTFSX 600	-549.5	68.9	59	28
lead bricks	RSARTFSX 601	-402.9	-219.6		
HazWaste Trailer	RSARTFFW 390	-219.8	38.5		
HazWaste Trailer	RSARTFFW 391	-1172.2	-201.9		
HazWaste Trailer	RSARTFFW 392	-1721.6	54.5	23	16

EPA RTF Radiological Summary

		On-Site		LSC	
		Total Beta	Removable Beta	Removable H-3	Removable C-14
Description	Sample ID	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²	DPM/ 100cm²
HazWaste Trailer	RSARTFFW 393	-2087.9	-121.8		
Vacuum strainer	RSARTFFY 610	-183.2	-208.3	25	17
Vacuum strainer	RSARTFFY 611	293.0	-192.3		

FINAL STATUS SURVEY REPORT
U.S. ENVIRONMENTAL PROTECTION AGENCY
REPRODUCTIVE TOXICOLOGY FACILITY (RTF)

REVISION 0

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ANSI	American National Standards Institute
cm^2	centimeters squared
cpm	counts per minute
DCGL	derived concentration guideline level
$DCGL_{EMC}$	derived concentration guideline level, elevated measurement comparison
$DCGL_W$	derived concentration guideline level, survey unit average (median) concentration corresponding to the permissible limit
dpm	disintegration per minute
DQA	Data Quality Analysis
DQI	Data Quality Indicator
EMC	elevated measurement comparison
EPA	Environmental Protection Agency
FSS	Final Status Survey
gcpm	gross counts per minute
GSA	US General Services Administration
keV	kilo-electron volts
LBGR	lower bound of the gray region
LCL_{95}	95% lower confidence level
LSC	liquid scintillation counting
m^2	meters squared
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	minimum detectable concentration
MDC_{SCAN}	minimum detectable concentration for scan surveys
MDCR	Minimum detectable count rate
ncpm	net counts per minute
NIST	National Institute of Standards and Technology
NORM	naturally occurring radioactive material
NRC	Nuclear Regulatory Commission
NUREG	U.S. NRC Nuclear Regulatory Commission Regulatory Report
QA/QC	Quality Assurance/Quality Control
RSA	Removable Surface Activity
RTF	Reproductive toxicology Facility
TSA	Total Surface Activity
UCL_{95}	95% upper confidence level
VSP	Visual Sample Plan

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EXECUTIVE SUMMARY

The RTF primarily consists of an 83,500 square-foot, 2-story building on a 5-acre parcel located at 2525 Highway 54, Durham, North Carolina. The property is EPA-occupied under a lease agreement between the property owner, Alexandria Real Estate Equities, and the US General Services Administration (GSA), on the EPA's behalf. The original lease was established in September 1993 for the yet-to-be constructed property, for occupancy between December 1994 and November 2014. The EPA has been the sole tenant since the RTF construction was completed in March 1995.

EPA seeks to free-release the RTF and supporting structures such that it will meet the criteria for unrestricted use and to remove the facility as an authorized location from the NRC radioactive materials license. This Final Status Survey (FSS) Report provides the design, field implementation and results of FSS conducted for the RTF.

The design and interpretation of the final radiological status survey of the building is based on the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (NRC, 2000) approach. Building surface derived concentration guideline levels (DCGLs) were established as part of the unrestricted release process. The total surface activity concentration DCGLs are 120,000,000 disintegrations per minute (dpm) per 100 square centimeters (cm^2) for tritium (H-3) and 3,700,000 dpm per 100 cm^2 for carbon 14 (C-14).

The null hypothesis for these surveys is that the residual radioactivity in the survey unit exceeds the established DCGLs. The survey data was compared to the DCGLs both statistically and with non-statistical comparisons. The radiological survey data demonstrate that the RTF is sufficiently below the DCGLs to confidently reject the null hypothesis. Concentrations of residual radioactivity were found to be very minimal and essentially indistinguishable from background. In the survey unit under consideration, the DCGL was met with greater than 95% confidence. For this FSS Report, the Sign Test is the statistical test for compliance evaluation since background is insignificant compared to the DCGLs. The Sign Test is a one-sample, non-parametric test that can be used to evaluate compliance with the DCGL.

Quality control (QC) measures were taken during the survey process to assess the accuracy and precision of the measured results. Review and analysis of the QC measures indicates that the data collected meet the data quality objectives and are acceptable for their intended use. In addition, no unexpected results or trends are evident in the data.

The final radiological status survey of the site concludes that all of the conditions and requirements for unrestricted radiological release have been met. This FSS Report submittal demonstrates that the RTF meets the criteria for unrestricted use, and therefore supports the decision to remove the facility as an authorized location from the NRC radioactive materials license.

1.0 INTRODUCTION

This radiological FSS report documents the radiological status of the RTF located at 2525 Highway 54, Durham, North Carolina. Radiological confirmatory and clearance surveys were conducted on the surfaces and systems associated with radioactive materials usage. Radiological surveys were conducted with a combination of portable instruments and laboratory analyses. Portable instruments used include scalers with alpha/beta scintillators and gamma scintillators, along with wipe sample counters (alpha/beta scintillator). The wipe samples were sent to an offsite laboratory for beta analysis by liquid scintillation counting with regions of interest for H-3 and C-14.

Radiological surveys were performed for all identified suspect areas within the RTF to address both total and removable residual contamination to release the facility in support of the overarching lease termination. The surveys were performed in accordance with methods approved using Derived Concentration Guideline Levels-wide area average using criteria established in U.S. NRC Nuclear Regulatory Commission Regulatory Report (NUREG) 1757, Vol 2 Rev 1 (NRC, 2006b) and the *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, (NRC, 2000). Given the nature of historical usage at the RTF, the existing radiological surveys/assessments, and experience with similar research laboratories, it was not expected that any significant residual radioactivity would be identified. With this basis, the U.S. NRC screening level derived concentration guideline levels (DCGLs) were selected and provided the most straight forward approach. The objective of EPA is to free-release the RTF such that it will meet the screening criteria for unrestricted use and to remove the facility as an authorized location from the active NRC radioactive materials license. This report documents the final radiological status of RTF and demonstrates that the criteria for unrestricted use have been met, and serves to support the decision to remove the facility as an authorized location from the NRC radioactive materials license.

1.1 Methodology and Guidance Used

The FSS report incorporates methods outlined in MARSSIM (NRC, 2000). The data evaluated in this report is presented in the context of the MARSSIM data quality assessment methods. Where appropriate, conventional guidance from the NRC, U.S. Environmental Protection Agency (EPA), and accepted practice and methods used in radiological site assessment and characterization are utilized. Principal guidance documents referenced include:

- NUREG-1575, “Multi-Agency Radiation Survey and Site Investigation Manual” (NRC, 2000);
- EPA Quality Assurance (QA)/G-4, “Guidance for the Data Quality Objectives Process” (EPA, 2000); and
- NUREG-1757 Vol. 2, “Consolidated NMSS Decommissioning Guidance, Characterization, Survey, and Determination of Radiological Criteria” (NRC, 2006b).

1.2 Sampling and Survey Report Road Map

Section 1 of this report provides a brief introduction and discusses the RTF site history and current site conditions including radionuclides of concern. Section 2 discusses survey unit designation, survey instrumentation and methods. FSS sampling results and data evaluations are presented in Section 3. Section 4 evaluates FSS data for compliance against the decision criteria. Section 5 includes quality control and data quality assessment evaluations and discussions. Section 6 summarizes the FSS and concludes the outcome of the FSS. Appendices are included for the survey unit to provide additional detail where appropriate.

1.3 General Site Description

The RTF consists of an 83,500 square-foot, 2-story building on a 5-acre parcel located at 2525 Highway 54, Durham, NC (Figure 1.1). The property is EPA-occupied under a lease agreement. The EPA has been the sole tenant since the RTF construction was completed in March 1995. Since EPA's occupancy in 1995, space within the RTF main building has been used for one of three general uses: office space, laboratory activities, and facility support. The laboratory spaces encompass approximately 56 percent of the building, including the following: 24 specialized laboratories; 25 controlled-environment animal housing rooms, equipment, and cage sanitization areas; and 9 specialized shared facilities including, but not limited to, a photograph development system and refrigerator cold rooms. The majority of the RTF building and utility systems are located at the western, interior end of the building in a large mechanical space with an elevated mezzanine. The property surrounding the RTF building is improved with paved access roadways, approximately 150 parking spaces, and landscaped areas. A loading dock, cooling tower, 10,000 gallon diesel aboveground storage tank, and an EPA-occupied hazardous waste storage shed are located at the northwest corner of the building. Figure 1.2 provides a facility layout of the 1st floor of the RTF facility. Figure 1.3 provides a facility layout of the 2nd floor of the RTF facility.

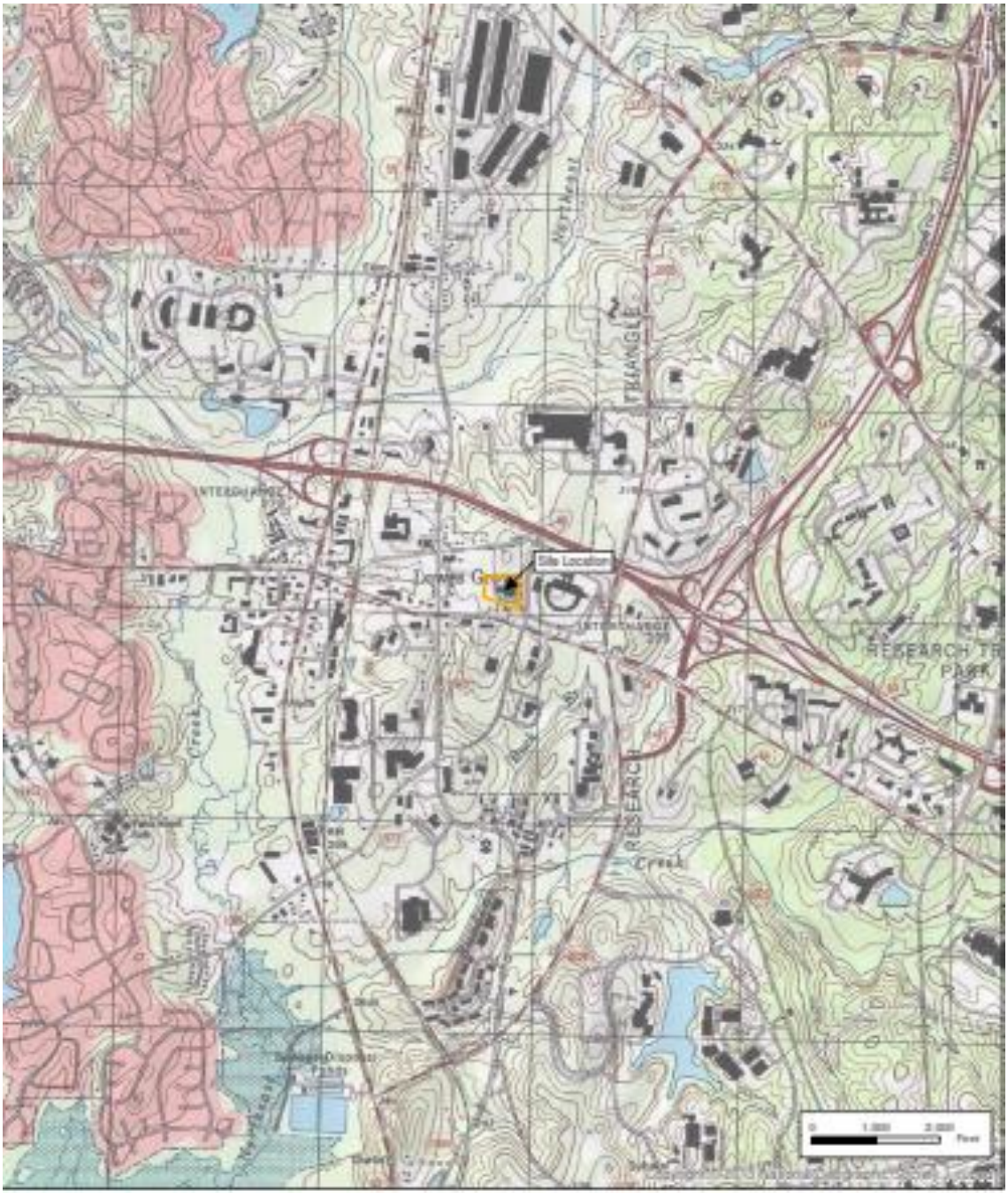

Figure 1.1 Site Location Map

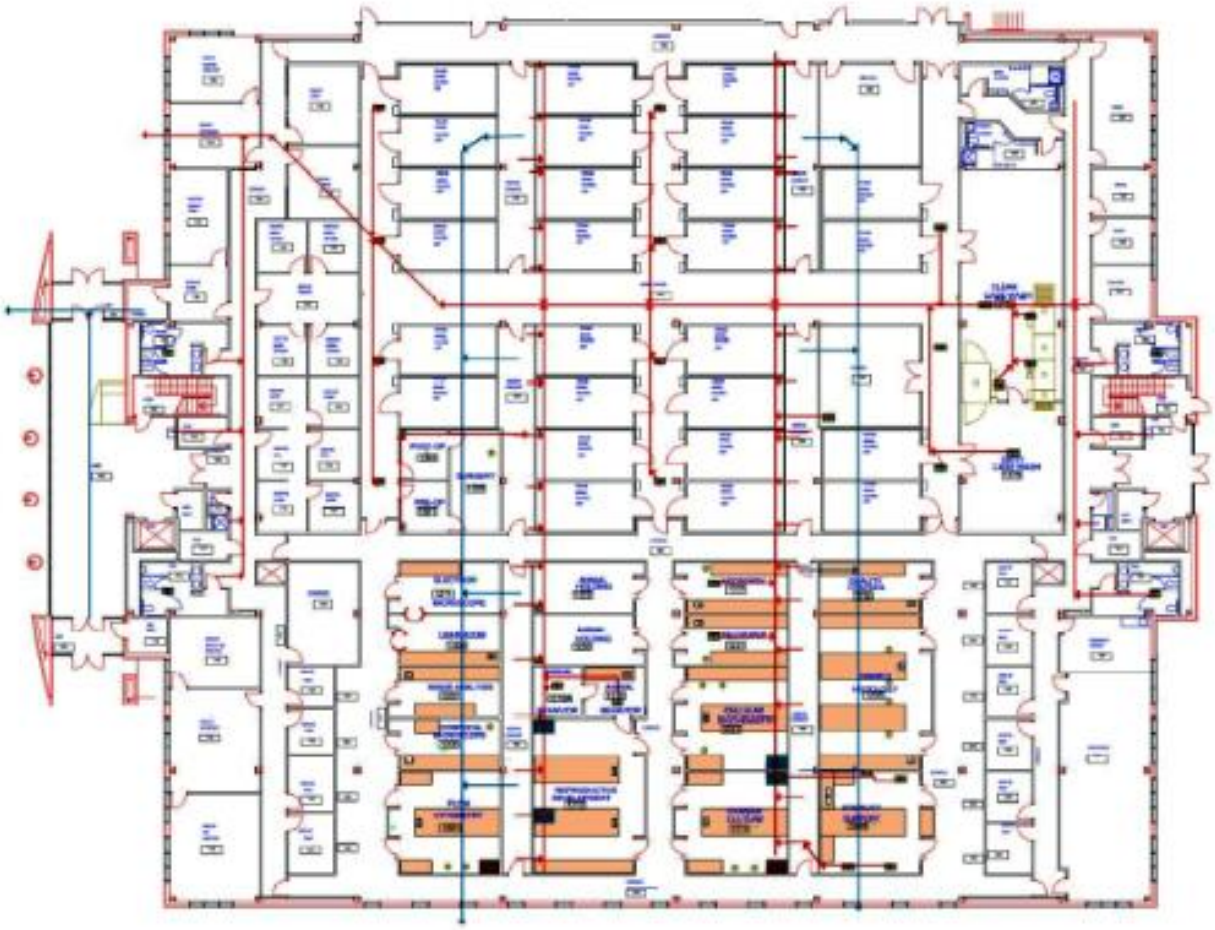

Figure 1.2 RTF First Floor Layout

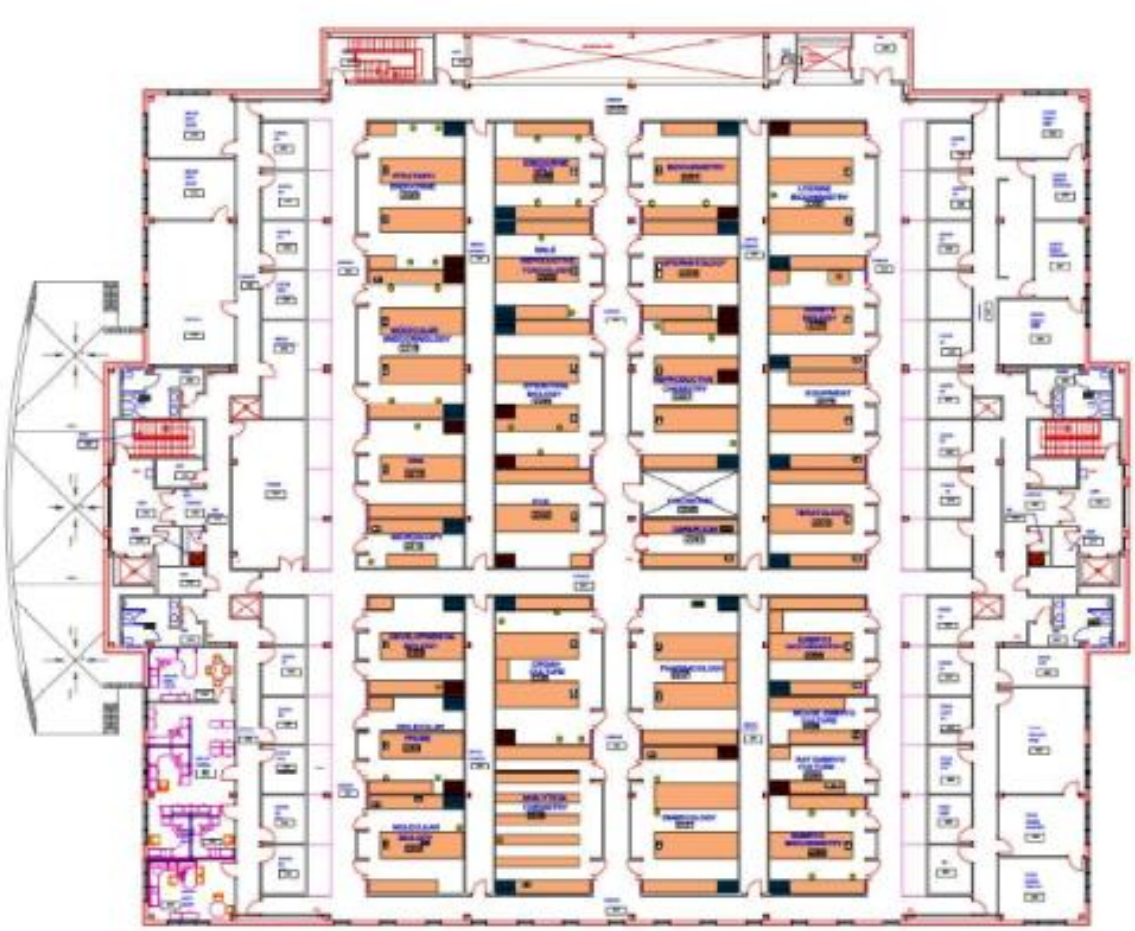

Figure 1.3 RTF Second Floor Layout

Review of historical information indicates that detailed final exit surveys were performed for 23 laboratory rooms of the RTF to obtain release from Radiation Safety Program requirements. No significant total or removable activity was identified during final exit surveys of the facility.

1.4 Current Site-Wide Conditions

Currently, the facility is in the process of being vacated by the tenant, EPA.

1.5 Residual Radioactivity Profile

Based on the review of historical records, process knowledge and the results of current radiological surveys, the residual radioactivity potential for site building structures can be isolated to a few credible source terms. Since a small variety of environmental samples, wastes, and sources have been handled in RTF, the following list of potential radionuclide contaminants were considered based on information contained in the EDDP Phase I Report Historical Site Assessment records search as shown in Table 1.1:

TABLE 1.1 RADIONUCLIDES OF POTENTIAL CONCERN FOR RTF

Nuclide	Name	Half-Life	Primary Emissions[1]	Comments
C-14	Carbon-14	5715 years	31 keV (beta)	Long half-life
H-3	Tritium	12 years	4 keV (beta)	Long half-life
I-125	Iodine-125	59.4 days	6 kev (beta) 27 keV (gamma)	Medium half-life
P-32	Phosphorous-32	14.3 days	470 keV (beta)	Short half-life
P-33	Phosphorous-33	25.3 days	44 keV (beta)	Short half-life
S-35	Sulphur-35	87.2 days	28 keV (beta)	Medium half-life

Notes: 1 - Beta energies level presented are averaged energy values.
keV = kilo-electron volts

However, with the exception of tritium (H-3) and carbon-14, the radionuclides listed above have medium to short half-lives, and significant levels are not expected to be present at the time of final survey.

Since the building will be released by the tenant (EPA) back to the owner for leasing to other tenants, and only low levels of sealed and unsealed sources were used in the facility, the RTF is considered a Group 2 facility, which does not require a formal decommissioning plan (NRC, 2006a). Therefore, the following screening levels [derived concentration guideline levels (DCGLs)] are appropriate to be considered for this scenario, as they are applicable to Decommissioning Groups 1-3 (NRC, 2006b). Table 1.2 is excerpted from Table H-1 of Volume 2 of NUREG 1757, *Characterization, Survey, and Determination of Radiological Criteria*.

TABLE 1.2 PRELIMINARY SURFACE DCGLS CONSIDERED FOR UNRESTRICTED RELEASE

Nuclide	Total (Fixed+Removable)
H-3	1.2E+08 dpm β/100 cm^2
C-14	3.7E+06 dpm β/100 cm^2

1.6 Decision Framework

The inputs providing the decision framework for measuring the residual radioactivity in each survey unit involve developing estimates of the central tendency (median) residual radioactivity concentration or surface activity, average residual radioactivity concentration or surface activity in locally elevated areas, and maximum residual radioactivity concentrations and surface activities. Direct measurements in the form of TSA (static) and RSA (smear) surface activity samples are the basis for the statistical tests and comparison to the decision rules.

1.7 Compliance Testing

The Sign Test was used to evaluate compliance with derived concentration guideline level, survey unit central tendency (median) concentration corresponding to the permissible limit ($DCGL_w$) for FSS. If the largest measurement of the sample population is below the $DCGL_w$, then the Sign Test will always show that the survey unit meets release criteria (NRC, 2000).

The Sign Test is a one-sample, non-parametric test that is used to evaluate compliance with the $DCGL_w$. The Sign Test is the recommended compliance evaluation procedure when the contaminant(s) under evaluation are not present at significant levels in background.

The combination of total and removable radiation survey data was used to demonstrate compliance with the release criterion. In addition to single-point comparisons of the measurement against the limit, the Sign Test was conducted. The decision to release a survey unit was based upon the outcome of the comparisons made in Table 1.3.

TABLE 1.3 SUMMARY OF DECISION RULES

Survey Result	Conclusion
All measurements less than $DCGL_w$	Survey unit meets release criteria
Average greater than $DCGL_W$	Survey unit does not meet release criteria
Any measurement greater than $DCGL_W$ and the average less than $DCGL_W$	Conduct Sign test and elevated measurement comparison

2.0 FIELD IMPLEMENTATION

This section of the report documents the FSS approach and process utilized for the RTF.

2.1 Mobilization

The survey team was briefed on the FSS package requirements associated with each individual survey unit which referenced the appropriate field sampling equipment and procedures to be used. A set of overview drawings of each survey unit for the building surfaces within the RTF was created. These drawings were then used in laying out the sampling and survey locations. Sample maps have been made as part of survey unit data in Appendix A.

Two types of radiation detection instruments were selected for this survey application. The first type of instrument employed is a portable alpha/beta surface monitor. The radiation detector was a solid state, dual-phosphor, scintillation detector designed to measure both the beta and alpha radiation emitted from a surface (direct measurement). The detector was coupled to a scaler/ratemeter to form a complete instrument/detector probe package. Direct readings were performed utilizing an Eberline Model E600 scaler/ratemeter with a Ludlum Model 43-89 dual-phosphor scintillation detector detector.

In addition to these field measurements, removable radioactivity samples (smears) were made in survey units. The instrument used was a sample counter for analyzing smear samples in the on-site counting laboratory. A Ludlum Model 2929 dual channel scalar with a Model 43-10-1 dual phosphor detector/sample tray system was utilized for counting smear samples collected during FSS on-site. The smear samples were then sent to a laboratory for liquid scintillation counting.

The instruments used in the surveys were calibrated, and frequently response checked and verified to be in working order and within established tolerance limits prior to use (American National Standards Institute [ANSI], 1997).

2.2 Survey Unit Designation

The survey unit represents the fundamental element for compliance demonstration during FSS results evaluation. There are numerous factors that influence the delineation of a survey unit and the design of the survey within the unit. Design of FSS Units was performed following the MARSSIM. One individual survey unit was identified and created based upon the potential likelihood of surfaces containing residual radioactivity. Each lab had a contamination clearance survey performed in 2014. No residual radioactivity readings above typical background levels were detected in surveyed areas. Therefore, the RTF was designated as a MARSSIM Class 3 survey unit classification for all impacted area surfaces.

Impacted areas of the RTF was designated as one FSS unit, generally following the contours of the building extents or particular floor and wing as applicable. The FSS unit covered the walls (up to 2 meters), floor, and installed equipment including fume hoods and countertops within each room. A summary of the FSS survey unit for the site is presented in Table 2.1.

TABLE 2.1 SUMMARY OF FSS UNITS

FSS Unit Number	MARSSIM Survey Unit Class	Area (m^2)	Description of Rooms Surveyed
RSARTFSS	3	<10,000	RTF impacted laboratory areas on 1st and 2nd floors

2.3 Survey Unit Sample Size Determination

The minimum sample size (N) and location of those samples for each survey unit was determined using the statistical sampling software, Visual Sample Plan (VSP) (Pacific Northwest National Laboratory [PNNL], 2014). VSP uses the statistical approach and algorithms referenced in MARSSIM to calculate the required minimum sample size for a given survey unit. In order to account and compensate for uncertainty in the computations of minimum sample size, as well as the possibility that some sample data may be lost or deemed unusable due to analytical and sampling error, minimum sample size computations were increased by twenty percent and rounded up to obtain sufficient data points to yield the desired power. VSP produced a sample distribution on scale drawings of the area(s) sampled within the survey unit.

Since Class 3 survey units are not expected to have measurable residual radioactivity above a small fraction of the DCGLs, the lower bound of the gray region (LBGR) was selected to be 10% of the DCGL. The standard deviation was also conservatively approximated high (30%) as a safety margin to reduce the chance of failing the decision criteria. The survey design parameters used to calculate the minimum required sample size for Class 3 Survey Units are shown in Table 2.2. This FSS report contains one Class 3 Survey Unit.

TABLE 2.2 CLASS 3 SURVEY UNIT SAMPLE SIZE

Parameter	C-14
α decision error	0.05
β decision error	0.05
$DCGL_w$ (dpm/100cm^2)	3.7E+06
LBGR (maximum estimated mean/median) (dpm/100cm^2)	3.7E+05
Standard Deviation (σ)(dpm/100cm^2)	1.1E+06
Relative Shift (Δ/σ)	3.0
Sample Size (N)	11
Additional 20%	3
FSS Sample Size	14

The table results above indicate that using the data from the calculation requires 14 samples (11+3), including the additional 20%. Therefore, it was used as the sample size for the building area Class 3 survey unit design.

The total number of samples planned and the number of samples obtained in the survey unit are presented in Table 2.3.

TABLE 2.3 NUMBER OF FSS SURFACE MEASUREMENTS OBTAINED PER SURVEY UNIT

Survey Unit ID	MARSSIM Survey Class	Number of Surface Measurements Planned	Number of Surface Measurements Obtained
RSARTFSS	3	14	14

2.4 Survey and Sample Locations

During FSS activities, the proposed location of each measurement was laid out using a simple random sample allocation protocol. The sampling design software *Visual Sample Plan, Version 7.0* (PNNL, 2014) was used to lay out the required number of measurements locations at random within the survey unit.

Drawings of the survey unit and actual sample locations, as determined in the field, are provided in Appendix A. After the measurement locations were allocated, an inspection of the survey unit was conducted to ensure that each sample location selected could be accessed and measured safely. Sample locations were next laid out on the building surfaces within the survey unit.

2.4.1 Building FSS Sample Locations

Surface measurements were collected for FSS evaluation for the areas included in this submittal report during September 2014. Figures of measurement locations for the survey unit are provided in Survey Unit Data Appendix A. Measurement locations were placed such that a sample would be representative of the sample media. Measurement density was defined by VSP using the assumptions stated earlier in this report.

2.5 Investigation Levels

Investigation levels (Table 2.4) for the direct measurement results were developed in accordance with the guidance found in MARSSIM. Any surface location measurement result greater than the investigation level was identified, marked, and further investigation performed to determine the extent of contamination at greater than the $DCGL_W$.

TABLE 2.4 FINAL STATUS SURVEY DIRECT MEASUREMENT INVESTIGATION LEVELS

Survey Unit Classification	Static Measurement Investigation Level	Static Net Investigation Level Eberline Model E600 with Ludlum Model 43-89 (most conservative)
Class 3	> 5,000 dpm/100 cm^2	>45 cpm

Investigation levels for the direct survey were derived using the most conservative assumption basis: the least sensitive instrument (lowest efficiency) of the inventory being used for the survey. It should be noted that two sets of instruments were used during performance of the field measurements. Therefore, using the most conservative investigation level (lowest instrument efficiency) ensures that an area with residual activity measured with a more efficient instrument would also warrant additional measurements to substantiate findings. For the purpose of this report, all reported counts per minute (cpm) or dpm values, unless otherwise specified, should be considered net values corrected for instrument background.

2.6 Direct Measurements and Scan Surveys

Direct measurements of the radiation emission from surfaces were made using static, 180-second counting intervals, over which the total counts were integrated. The direct measurements recorded were gross values. The data reduction process for the field measurement static (direct) data collected in this surface measurement sampling program involves corrections for the efficiency of the radiation detector to the subject radiation. However, it should be noted that for scanning surveys, raw field beta data were adjusted by the associated instrument backgrounds performed prior to the start of scanning in each room area, so that the net results could be directly compared to the surface DCGLs provided in Table 1.2.

2.6.1 Portable Instruments

The field measurement instrument used for direct static and scan measurements of surface-deposited residual radioactivity was the Eberline Model E600 scaler/ratemeter with a Ludlum Model 43-89 dual-phosphor scintillation detector.

2.6.2 Portable Instrument Calibration

MARSSIM guidance was considered in establishing efficiency factors (calibration constants) used to reduce the instrument count rate data to units comparable to those used in the surface standards along with guidance from other sources including NUREG-1507 (NRC,1997), NCRP Report 112 (NCRP, 1991), and ANSI N323A (ANSI, 1997).

As defined in MARSSIM and NUREG-1507, instrument efficiency is that derived by measuring the surface emission rate of a clean, calibrated and certified National Institute of Standards and Technology (NIST) traceable, reference source. The observed emission rate (counts per unit time) is compared to the certified emission rate (betas per unit time) to arrive at the instrument

efficiency. The source efficiency relates the amount of activity truly present on the surface being measured to the observable particle emission rate. As such, the source efficiency captures the effects of backscatter, and self-absorption inherent in the surface being measured.

In addressing the issues associated with the derivation of the appropriate total efficiency for the measurement, MARSSIM states (page 6-24) that the use of a total efficiency derived from measurements made on certified 4π activity traceable sources "…is not a problem, provided that the calibration source exhibits characteristics similar to the surface contamination (i.e., radiation energy, backscatter effects, source geometry, self-absorption)." Each of these four parameters was addressed as follows:

Radiation Energy. Radiation energy was addressed by selecting a calibration source that was manufactured using the same radionuclide (C-14), the beta emitter of predominant concern from historical use. C-14 was selected and used to establish the total efficiency.

Source Geometry. The source geometry of interest is the point source. Previous surveys have demonstrated that there is no large area residual radioactivity and a small diameter source will be representative in terms of actual potential residual radioactivity.

Backscatter and Self-Absorption. Backscatter and self-absorption are more difficult to control in the measurement process since they are impacted by field variables, beyond the control of the surveyor. The desire is to represent the total surface activity on a given surface as accurately as possible. To do this, consideration for the surface(s) to be measured and their effect on backscatter and self-absorption must be taken into account. For RTF surveys, this was recognized very early in the process and controlled. It was also recognized that the errors that can arise because of the characteristics of surface (often non-conservative errors) are due to distinct and measurable differences between the backscatter and self-absorption characteristics of the calibration source as compared to the surface of interest. As suggested in NRC, 1997 and NCRP, 1991, the efficiency calibration source closely approximates the backscatter and self-absorption characteristics of laboratory surfaces.

By adopting this efficiency calibration source, it can be said with reasonable confidence that the total efficiency (as measured by exposing the detector to the check source and comparing its response to the stated total 4π activity) is appropriate for making measurements on laboratory surfaces, having taken into account both source efficiency and instrument efficiency.

Background and response checks were performed at least twice a day when in use, as a preoperational check, and post use to ensure the instrument was operating properly during the survey period. Background results are discussed in this Section and response check results are discussed in Section 5. The calibration data sheets for the instruments are provided in Appendix A.

2.6.3 Measurement Detection Limitations

In order to calculate the statistically significant surface radioactivity, which could be distinguished from background (*a posteriori* minimum detectable concentration [MDC]), it was necessary to

convert the background measurement units from dpm/100 cm^2 to units of cpm. In this case, the more conservative metric, the geometric mean, was chosen to calculate the detection sensitivity achieved to prevent overstating the actual sensitivity achieved. The converted mean background count rates for the sampling period (cpm) along with other actual field measurement parameters are presented in Table 2.5. Using the actual instrument field measurement parameters, a calculation of the actual field measurement MDC achieved can be determined by solving Equation 2–1 as provided in Section 6.7.1 of MARSSIM (NRC, 2000).

$$MDC = \frac{3 + 4.65\sqrt{C_b}}{T_s \times \frac{A_p}{100cm^2} \times \in_T} \qquad \textit{(Equation 2–1)}$$

Where: MDC = the minimum surface radioactivity concentration above background radioactivity (in dpm/100 cm^2) that can be detected with 95% confidence.
C_b = the total number of background counts over the sample count period (Ts).
T_s = sample count time (in minutes).
A_P = probe size (in cm^2).
$\in_T$ = counting system efficiency in count/disintegration.

TABLE 2.5 STATIC SURFACE CONTAMINATION MEASUREMENT MDC PARAMETERS

Parameter		Eberline E600 with Ludlum 43-89	Eberline E600 with Ludlum 43-89
		3689 / 312071	1274 / 223946
		Beta	Beta
C_b	Background Counts	167	229
T_s	Sample count time (minutes)	3	3
A_P	Probe Size	100	100
$\in_T$	Instrument system efficiency in counts per disintegration	0.0091	0.0113
MDC	dpm/100 cm^2	2,311	2,164

Those locations with net residual surface radioactivity greater than the MDC are credited as having statistically distinguishable amounts of added radioactivity, while those less than the MDC are statistically indistinguishable from background values.

It is further important to note that the beta MDC (2,311 dpm/100 cm^2) presented above is less than half of the corresponding beta Regulatory Guide 1.86 screening level (5,000 dpm/100 cm^2).

MDC Scan Calculations

For any of the instrument systems, the detection sensitivity is affected not only by the factors influencing static measurements (as described above) but also by the detector's residence time over a given area and the uncertainty introduced by the human factors involved in moving the detector and interpreting the instrument response. The following formulation (NRC, 2000) is used to calculate the minimum detectable concentration, in dpm/100 cm^2, for each of the two scanning instrument systems used:

$$s_i = d' * \sqrt{b_i} \qquad \textit{(Equation 2–2)}$$

Where: s_i = the minimum detectable number of net source counts in the counting interval, *i* (probe residence time over a given source area).
d' = the index of sensitivity (the number of standard deviations between the means of background and radioactivity above background).
b_i = the number of background counts in the counting interval, *i*.

$$MDCR = s_i * (60 / i) \qquad \textit{(Equation 2–3)}$$

Where: *MDCR* = the minimum detectable count rate (above background) in cpm.
s_i = the minimum detectable number of net source counts in the counting interval, *i* (probe residence time over a given source area).
i = the length of the counting interval in seconds.

$$MDC_{SCAN} = \frac{MDCR}{\sqrt{\mathrm{p}} \times \frac{\mathrm{A_P}}{100\ \mathrm{cm}^2} \times \varepsilon_{\mathrm{T}}} \qquad \textit{(Equation 2–4)}$$

Where: MDC_{SCAN} = the minimum surface radioactivity concentration above background radioactivity (in dpm/100 cm^2) that can be reliably detected.
p = Surveyor efficiency.
A_P = Probe size (in cm^2).
ε_T = Counting system efficiency in counts/disintegration.

Some of these parameters were derived from guidance in MARSSIM. The index of sensitivity (d') was selected to allow for a 95% probability of accepting true positive responses and a 60% probability of returning false positive results. Surveyor efficiency (p) was determined to be 0.5 for portable (hand-held) instruments. The surveyor efficiency accounts for the uncertainty of the operator performing the non-static scanning procedure and the judgment involved in determining the presence of elevated counts during scanning.

Table 2.6 presents the observed site conditions and instrument specific parameters affecting the minimum detectable scanning concentration (MDC_{scan}) for the scanning surveys performed. Using these values, an *a posteriori* assessment of the building or material surface MDC_{scan} can be determined.

The *a posteriori* MDC_{scan} for beta radioactivity achieved under the conditions described and observed during surveys in the RTF (assuming a nominal scan speed of 2 inches per second) are listed at the bottom of Table 2.6. The *a posteriori* MDC_{scans} presented for both hand-held detector systems are well below the total surface residual radioactivity benchmark concentration of 3.7E+06 dpm/100cm^2 beta providing a solid basis for confidence that the scanning surveys employed are capable of detecting localized concentrations of significance.

TABLE 2.6 SURFACE SCANNING MEASUREMENT MDCSCAN PARAMETERS AND VALUES

Parameter		3689 / 312071 Eberline Model E600 Scaler/Ratemeter With Ludlum Model 43-89 Detector	1274 / 223946 Eberline Model E600 Scaler/Ratemeter With Ludlum Model 43-89 Detector
		Beta	Beta
C_b	Background Count Rate (cpm)	55.7	76.3
i	The residence time of the detector probe over a given surface area (the counting interval) in seconds.	1.4	1.4
d'	Index of sensitivity	1.38	1.38
p	Surveyor efficiency	0.5	0.5
A_P	Probe size (cm^2)	100	100
ε_T	Instrument system efficiency in counts/disintegration	0.0091	0.0113
MDCR	Minimum detectable count rate above background	96.6	113.0
MDC_{scan}	dpm/100 cm^2	10,612	10,003

2.6.4 Portable Instrument Background Measurements

Background measurements were made to assess the instrument background. Instrument background is defined as: "the response of the radiation-detecting instrument to sources of radiation in the environment such as cosmic radiation and to electronic noise in the instrumentation that may produce a measurable signal not due to radiation.

The assessment of an instrument's response to background radiation is important from two perspectives. First, it permits the assessment of the minimum sensitivity (detection limit) for the instrument and measurement process in the presence of background radiation. The *a posteriori* MDC is calculated from this actual background data. Second, by assessing the instrument's response to background radiation in terms of the units that field data will be collected, a correction can be applied to the field measurement data to permit determination of radioactivity present in excess of background.

Still, there was the need to measure and account for the instrument's response to other ubiquitous sources of background radiation (e.g., cosmic radiation) that could otherwise not be distinguished from the contaminant of concern. To correct the data for instrument sensitivity to background radiation, instrument background measurements were made. The variance in the recorded background data was small and within the range expected for beta-gamma background radiation (see Appendix A).

Time series plots of the background data sets, segregated according to the specific instrument/ detector probe with which the measurement was made, illustrate the lack of trend in the data over time and the overall stability of the instrument background count rate over the sampling period are provided in Appendix A. Coupled with the instrument response check measurements also performed over the entire sampling period, the stability in the measured beta background provides evidence of instrument stability. The time series plots of the background data set also reveal that the variability in the data set is small.

2.7 Removable Radioactivity Measurements

Technical smears were used to collect a sample of the removable radioactivity on building surfaces in the survey unit. The smear samples were collected by wiping the cloth filter over a 100 cm^2 area of the surface to be sampled using moderate pressure applied with two fingers. The smears were packaged to prevent sample contamination, labeled with a unique identification number linked to the location from which the smear sample was collected, and then measured for radioactivity on a Ludlum Model 2929 prior to shipment offsite for laboratory liquid scintillation counting (LSC) analysis.

To demonstrate compliance with the unrestricted release criterion for removable residual radioactivity, RSA measurements were taken after the direct static TSA measurements were collected. No attempt was made to adjust the RSA measurement data to account for smear collection efficiency.

2.7.1 Instrument

Smear samples were counted on a Ludlum Model 2929 sample counter. Background and response checks were performed at least once a day when in use.

2.7.2 Instrument Calibration

The Ludlum Model 2929 dual channel scaler with a Model 43-10-1 sample counting head equipped with a zinc sulfide (ZnS[Ag]) plastic scintillation detector was calibrated for beta. The beta channel was calibrated with a C-14 NIST traceable source. The calibration data sheets for the instrument are provided in Appendix A.

2.7.3 Measurement Detection Limitations

In order to calculate the statistically significant surface radioactivity, which could be distinguished from background (*a posteriori* MDC), Equation 2-1 was modified to remove the probe area term and account for different background and sample counting times as shown in Equation 2-6. The parameters for calculating the MDC are presented in Table 2.7.

$$MDC = \frac{3 + 3.29\sqrt{R_B T_{S+B}\left(1+\frac{TS+B}{TB}\right)}}{T_{S+B} \in_T} \qquad \textit{(Equation 2–6)}$$

Where: MDC = the minimum surface radioactivity concentration above background radioactivity (in dpm/100 cm^2) that can be detected with 95% confidence.
R_b = the background count rate (cpm).
T_B = background counting time (in minutes).
T_{S+B} = sample counting time (in minutes).
$\in_T$ = counting system efficiency in count/disintegration

TABLE 2.7 REMOVABLE CONTAMINATION MEASUREMENT MDC PARAMETERS

		Ludlum Model 2929
		50721
Parameter		Beta (C-14)
T_B	Background Count Time (min)	10
T_{S+B}	Sample Count Time (min)	3
R_b	Background Count Rate (cpm)	36
ε_T	Instrument system efficiency in counts/disintegration	0.0208
MDC	dpm/100 cm^2	832

It is further important to note that the net MDC value listed in the above table is lower than the removable radioactivity Regulatory Guide 1.86 screening level and significantly less than the unrestricted release criterion presented in Table 1.2.

2.7.4 Instrument Background Measurements

As smears were collected, they were analyzed by a Ludlum Model 2929 alpha/beta sample counter prior to shipment offsite for laboratory LSC analysis. Background measurements were taken as part of the response checks for the instrument periodically prior to use. Beta background measurements are provided in Appendix A.

3.0 FIELD SURVEY AND SURVEY RESULTS

Field survey sampling results are presented by survey unit with a data assessment and comparison to the release criterion. Where anomalies or notable results were identified, additional discussion and data are presented for the specific survey unit. QC data is presented separately in Section 5 of this report. Each survey unit is presented with a summary of the survey results, figures showing the layout of each survey unit and the selected sample locations, data assessment tables, and a preliminary comparison to the decision criteria. Data associated with the survey unit and its associated evaluations are provided in the Appendix A of this report.

3.1 Field Survey Results Overview

A total of 14 direct static surface measurements and an equal number of removable surface measurements from the wall, floor, and equipment surfaces from the survey unit were collected and analyzed as part of FSS areas for this report.

No investigations were performed because of elevated scan results. No investigations were performed as a result of elevated measurements.

3.2 Data Assessment

The preliminary data review assesses the FSS data utilizing various numerical and graphical techniques. This includes summary statistics, histograms, and probability plots. Each technique was run to provide insight that would identify patterns, relationships, or potential anomalies in the distribution of the data. A key test of the data set is for goodness-of-fit. Goodness-of-fit is important because it identifies the underlying distribution of the data set and provides a statistical basis for comparison of appropriate metrics calculated from the data. The Anderson-Darling (AD) Test was used to measure the relative goodness-of-fit of the observed data distribution to the normal and lognormal standard distributions. Distributions other than normal and lognormal were evaluated but were discounted for this data set on the grounds that:

- Based on knowledge of the expected distribution of radioactivity in the environment and in background, the data were expected to be approximately lognormally distributed; and
- The probability plot and histogram generated (for a host of possible distributions) gave no good evidence that other than normal or lognormal distributions might be present.

Posting plots provide a visual representation of the sampling locations and the activity concentrations at those locations. Posting plots are also used to reveal the heterogeneities in the data, especially possible patches of locally elevated residual radioactivity. The Posting Plots are provided in Appendix A.

Once the survey unit data was assessed and verified that it is acceptable for comparison to the release criteria, it was evaluated against the $DCGL_W$s.

This section of the report provides a summary of the FSS data and statistical data assessment. The data associated with each survey unit and its associated evaluations are provided in Appendix A of this report.

Survey Unit RSARTFSS

Survey Unit RSARTFSS covers the interior floors and wall (up to 2 meters) surfaces of the RTF and consists of less than 10,000 square meters (m^2) of floor surface area. Figures 3.1 and 3.2 presents an overview of the survey unit. Fourteen survey locations were randomly selected within the Class 3 survey unit to represent the distribution of residual radioactivity for the survey unit Data associated with this survey unit are provided in Appendix A.

Total Surface Activity Scanning Results

Approximately 10 percent of the wall, floor, counter and cabinet surfaces area for Survey Unit RSARTFSS was surveyed by hand-scanning with the Eberline Model E600 scaler/ratemeter with a Ludlum Model 43-89 dual-phosphor scintillation detector (for beta). Instrument readings ranging from 80 cpm to 360 cpm (gross) beta were recorded during the scan survey, with no detectable activity noted, with MDA_{SCAN} value of 10,612 dpm/100 cm^2 beta. No elevated readings were identified during the scan survey. Therefore, no additional direct static measurements to investigate anomalies were performed.

Total Surface Activity Results

Fourteen randomly-placed direct static surface activity measurements were obtained for FSS in Survey Unit RSARTFSS with the Eberline Model E600 scaler/ratemeter portable radiation survey Instrument coupled with the Ludlum Model 43-89 dual-phosphor scintillation detector. The analytical results show that the mean/median removable radioactivity is appreciably below the $DCGL_W$s. Data quality assessments indicated that the results meet the data quality requirements and are acceptable for use. Figures 3.1 and 3.2 present the FSS results for field beta total surface activity levels for Survey Unit RSARTFSS.

Removable Results

Fourteen randomly-placed removable surface activity measurements (at the direct static locations) were obtained for FSS in Survey Unit RSARTFSS and analyzed on Site with the Ludlum Model 2929 sample counter, then shipped to an approved offsite laboratory for LSC analysis for H-3 and C-14 analysis. The analytical results show that the mean/median removable radioactivity is appreciably below the $DCGL_w$. Data quality assessments indicated that the results meet the data quality requirements and are acceptable for use. Figures 3.1 and 3.2 present the FSS results for both H-3 and C-14 removable surface activity levels for Survey Unit RSARTFSS.

3.3 Survey Summary Results

This section provides a summary of the FSS results by survey unit and includes scan surveys, direct static measurements, and removable sample results.

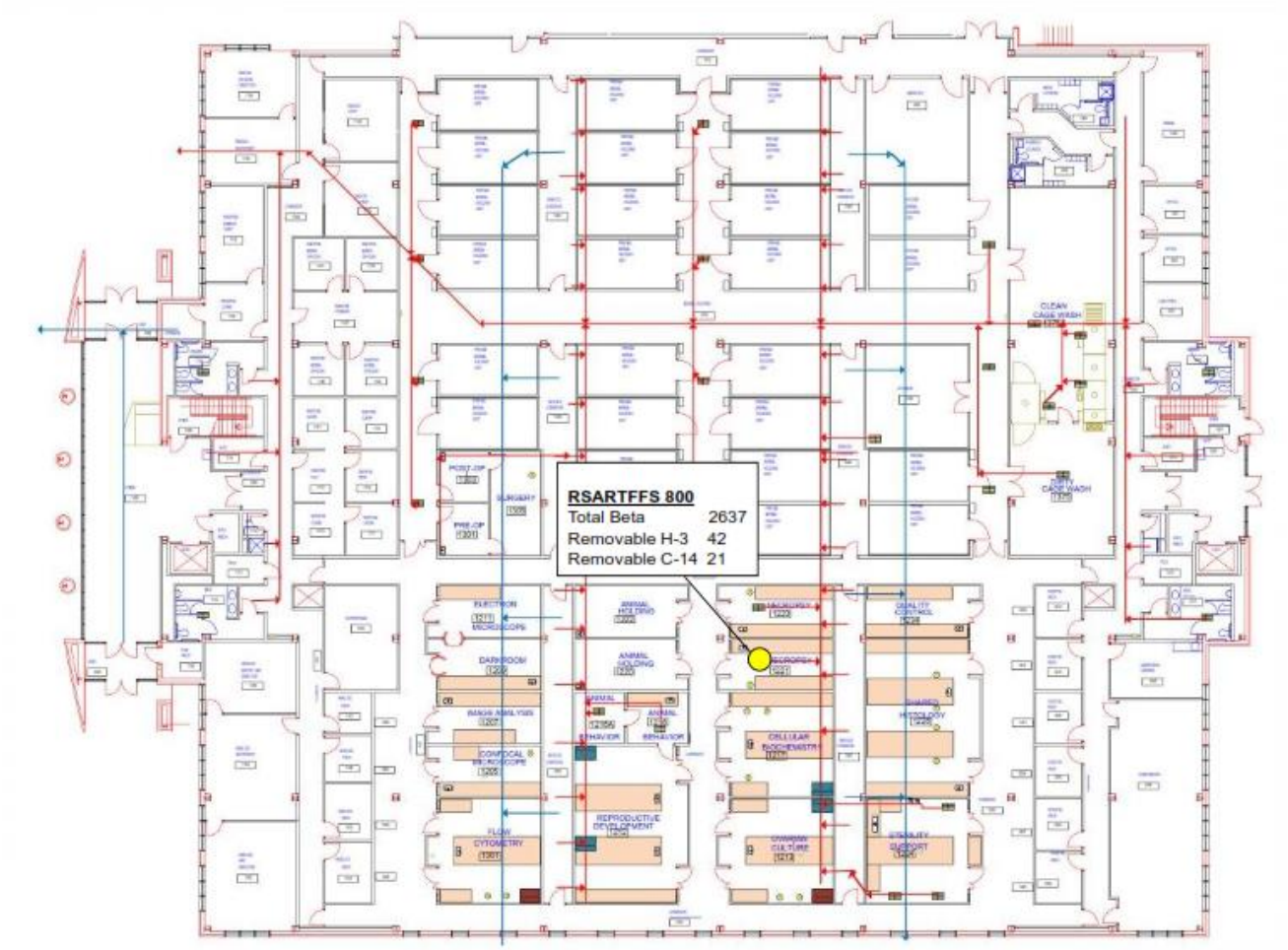

Figure 3.1 FSS Results First Floor (results in dpm/100 cm^2)

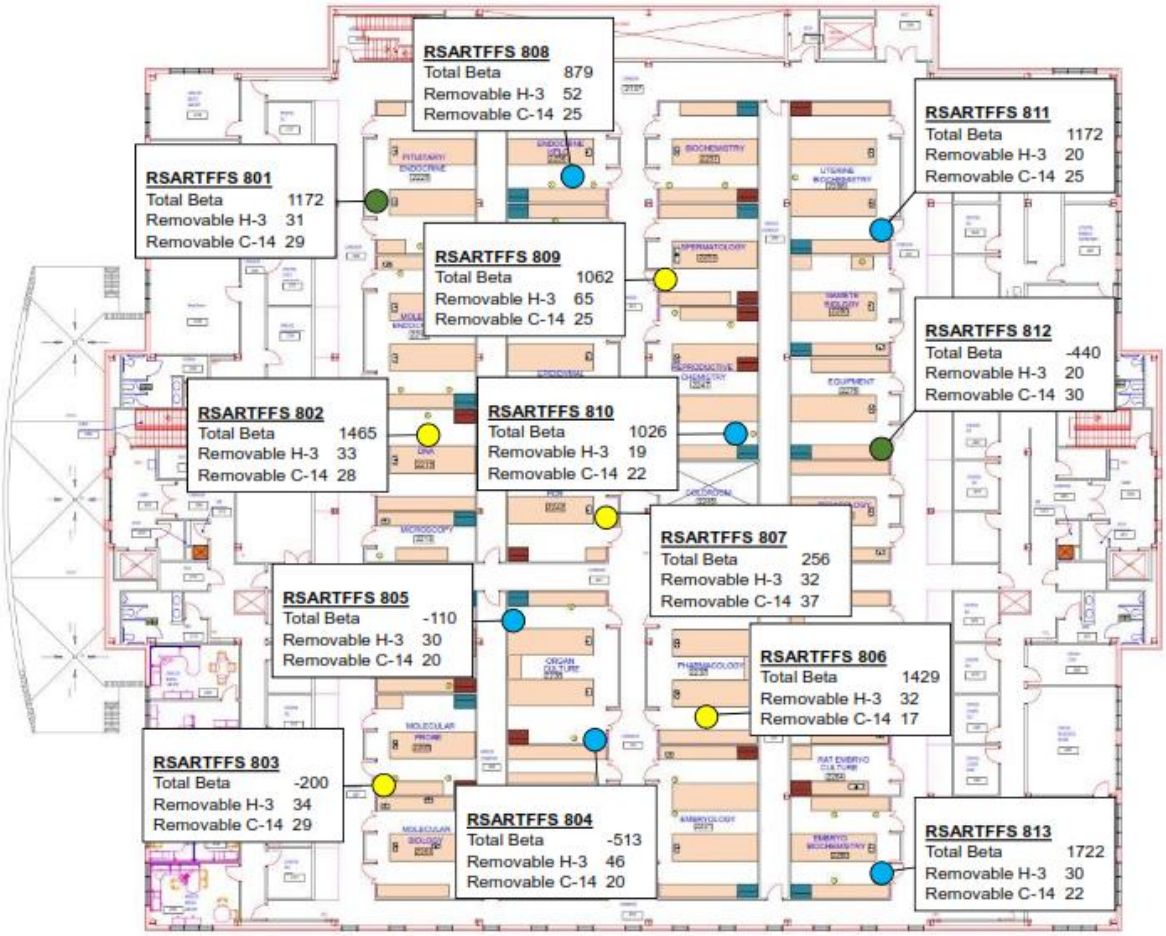

Figure 3.2 FSS Results Second Floor (results in dpm/100 cm^2)

3.3.1 Scan Survey

Table 3.1 presents the summary results of the scan surveys, the number of volumetric samples obtained as a result of elevated scan survey readings, and the highest measurements obtained during static counts performed in locations where a discernible increase in the count rate was identified. Scan survey areas are around the direct static measurement locations. While the scans ranged from background to levels expected from NORM levels expected in the matrix, none of the reported scan results (adjusted for instrument background) exceeded 1% of the beta investigation level which was calculated to be 80% of the $DCGL_w$ for Class 3 units. The survey unit surveyed was not identified as having residual surface radioactivity in excess of the total surface DCGL or had a significant potential for having residual surface radioactivity.

TABLE 3.1 SCAN SURVEY RESULTS SUMMARY

Survey Unit	Building Scan Results					
	Survey Unit Class	Percent of Survey Unit Surveyed (accessible surfaces)	Number of Elevated Locations Identified and Sampled	Recorded Background Reading (cpm)	Highest Scan Reading (gross cpm)	Highest Scan Reading (net cpm)
				β	β	β
RSARTFSS	3	~10	0	56	360	304

3.3.2 Total Surface Measurements

In addition to scan surveys, 3-minute direct static surface measurements were performed at FSS measurement locations using a beta scintillation detector. These 3-minute static measurements were used to verify that there were no areas of elevated residual radioactivity and to support the conclusion that residual radioactivity on building surfaces is less than the $DCGL_w$ for the survey units. Table 3.2 provides a summary of the beta direct static readings performed at each measurement location. A full descriptive statistics report (designated RSARTFFT_DIRECT) is provided in Appendix A.

TABLE 3.2 SUMMARY STATISTICS, DIRECT GROSS BETA STATIC MEASUREMENT DATA

Beta - β Statistic	Survey Unit
	RSARTFSS
Number of Measurements	14
Arithmetic Mean	824.2
Standard Deviation (sample)	914.9
Standard Error of the Mean	244.5
Coefficient of Variation	1.1
Geometric Mean	1,123
Maximum	2,637
Median	1,044
Minimum	-512.8
Range	3,150
UCL_{95} (median)	1,429
LCL_{95} (median)	-219.8

Note 1: Except for number of samples, standard error and the coefficient of variation (unitless) all statistics reported above are in units of dpm/100 cm^2.

3.3.3 Removable Surface Measurements

Summaries of the H-3 and C-14 removable results provided by the offsite laboratory from LSC analysis are presented in Table 3.3 and Table 3.4, respectively. Full descriptive statistics reports (designated RSARTFFT_REMH3 and RSARTFFT_REMC14) are provided in Appendix A.

TABLE 3.3 SUMMARY STATISTICS, TRITIUM REMOVABLE SURFACE ACTIVITY DATA

Tritium - H–3 Statistic	Survey Unit RSARTFSS
Number of Measurements	14
Arithmetic Mean	34.7
Standard Deviation (sample)	12.8
Standard Error of the Mean	3.4
Coefficient of Variation	0.4
Geometric Mean	32.7
Maximum	64.8
Median	32.2
Minimum	18.6
Range	46.2
UCL_{95} (median)	41.7
LCL_{95} (median)	20.4

Note 1: Except for number of samples, standard error and the coefficient of variation (unitless) all statistics reported above are in units of dpm/100 cm^2.

TABLE 3.4 SUMMARY STATISTICS, C-14 REMOVABLE SURFACE ACTIVITY DATA

carbon-14 - C–14 Statistic	Survey Unit RSARTFSS
Number of Measurements	14
Arithmetic Mean	24.9
Standard Deviation (sample)	5.3
Standard Error of the Mean	1.4
Coefficient of Variation	0.2
Geometric Mean	24.4
Maximum	37
Median	24.6
Minimum	16.7
Range	20.3
UCL_{95} (median)	28.9
LCL_{95} (median)	20.2

Note 1: Except for number of samples, standard error and the coefficient of variation (unitless) all statistics reported above are in units of dpm/100 cm^2.

4.0 ANALYSIS OF RESULTS FOR COMPLIANCE

As part of the data quality objective process, specified in MARSSIM (NRC 2000) and other environmental remediation and compliance guidance (EPA, 2000), the "*decision rule*" provides the objective basis for determining whether survey units meet the established criteria for release from radiological controls without restriction. The decision rules, identified below, specify conditions, based on final radiological status survey results, which must be met to enable release of the building from radiological controls.

4.1 Decision Rules

IF the evaluation of the FSS data from a single survey unit indicates that:

The mean/median surface activity concentration measurement result is less than the $DCGL_w$ (1.2E+08 dpm/100cm^2 H-3 and 3.7E+06 dpm/100cm^2 C-14); **AND**

The unity rule is met if both radionuclides are present in a location; **AND**

There are no areas having locally elevated concentrations of residual radioactivity on the building surfaces greater than the $DCGL_{EMC}$;

THEN conclude that the survey unit meets the criteria for release from radiological controls without restriction.

These decision rules ensure that residual radioactivity in this facility will not pose an unacceptable radiological risk under any reasonable future use or occupancy.

4.2 Field Survey Results Compared To $DCGL_s$

The compliance comparisons provide the risk managers and decision-makers with the quantitative information necessary to decide whether the site can be released from radiological controls without restriction. In addition to the 95% upper confidence limit (UCL_{95}) estimate of the median, several additional metrics (e.g. arithmetic mean, maximum, etc.) are provided to offer risk managers and decision-makers additional insight regarding the magnitude of compliance or non-compliance.

Compliance comparisons for the beta survey unit are presented in Table 4.1.

TABLE 4.1 COMPLIANCE COMPARISON OF BUILDING METRICS

Metric		RSARTFSS
Unity	Power of Sign Test	~1
Total Beta (dpm/100cm^2)	Median	1,044
	UCL_{95} of Median	1,429
	Arithmetic Mean	824.2
	Geometric Mean	1,124
	Maximum	2,637
Removable H-3 (dpm/100cm^2)	Median	32.2
	UCL_{95} of Median	41.7
	Arithmetic Mean	34.7
	Geometric Mean	32.7
	Maximum	64.8
Removable C-14 (dpm/100cm^2)	Median	24.6
	UCL_{95} of Median	28.9
	Arithmetic Mean	24.9
	Geometric Mean	24.4
	Maximum	37

4.3 Compliance Summary

The FSS demonstrates that the RTF meets all quantitative compliance decision rules to qualify for release from radiological controls, without restriction. This conclusion is summarized below.

DCGL Compliance

The central tendency (median) total surface residual radioactivity concentration on the building surfaces in each survey unit is below the $DCGL_w$ values of 1.2E+08 dpm/100cm^2 (H-3) and 3.7E+06 dpm/100cm^2 (C-14).

No single total surface activity measurement was identified as having beta total activity greater than 2,637 dpm/100cm^2, significantly below the $DCGL_w$ values of 1.2E+08 dpm/100cm^2 (H-3) and 3.7E+06 dpm/100cm^2 (C-14). Additionally, no single H-3 or C-14 removable surface activity measurement was identified as having beta activity greater than 65 dpm/100cm^2 and 37 dpm/100cm^2 respectively. No locally elevated concentrations of residual radioactivity were identified above the investigation levels.

5.0 QUALITY CONTROL AND DATA QUALITY ANALYSIS

An important aspect of any survey or sampling evolution is the effort made to assure the quality of data collected. It was critical to assure the quality of all of the data through quality checks and controls, calibrations, and training. The purpose of data quality assessment (DQA) is to evaluate the data collected from the field in light of its intended use in decision making. Decision makers should obtain an understanding of the verity of the data used in the FSS from reading this section.

Quality checks and controls were designed into the FSS to ensure adequate data quality. QC measurements were designed to provide a means of assessing the quality of the data set as a whole and demonstrate that measurement results had the required precision and were sufficiently free of errors to accurately represent the residual radiological conditions within the building of the various survey units within the potentially impacted areas. The DQA uses guidance from MARSSIM and professional judgment.

5.1 Quality Assurance

The goal of QA is to identify and implement sampling and analytical methodologies that limit the introduction of error into analytical data. During sampling and survey activities at the site, controls were implemented to ensure sufficient data of adequate quality and usability was collected for confirming that the project's release levels were met. These controls also ensured that data was verified authentic, was appropriately documented and is technically defensible. QA was achieved through one primary approach: QC measurements.

5.1.1 Quality Control Measurements

A significant portion of the data comes from in situ field measurements using conventional health physics techniques and practices and from wipe samples measured by scintillation counting (onsite) and LSC (laboratory). Both require additional steps in order to ensure accuracy of the sampling techniques and analysis methodologies.

5.1.2 Field Instrument Response Checks

The data set used to present the quality of direct static surface measurements is the response of the instruments (Eberline Model E600 scaler/ratemeter portable radiation survey Instrument coupled with the Ludlum Model 43-89 dual-phosphor scintillation detector) to a surface deposited activity source with a known amount of radioactivity. The source contains C-14 radioactivity.

Prior to initiating a survey each day, periodically, and at the end of a survey each day, the survey instrument in use was used to make a measurement on the known concentration source. Instrument response check data for each probe used during the final status survey is sorted and presented for individual probes. Response check data sheets are provided in Appendix A. A total of 28 response check measurements were made with the 2 combinations of instrument packages used during the survey period.

A control chart is provided for each of the individual probes to graphically portray the steadfastness of the instruments' responses to the source over the sampling period in Appendix A. One C-14 check source was used to perform response checks on the Eberline Model E600 scaler/ratemeter portable radiation survey Instrument coupled with the Ludlum Model 43-89 dual-phosphor scintillation detector, so there is one control chart for each system. Notable is the relatively tight band within which the response checks fall. No degradation of the instruments' response was observed over the entire sampling period.

5.1.3 Sample Counter

The quality of removable measurements can be measured by the response of the instruments (Ludlum Model 2929) to a source of known radioactivity. A C-14 source for the beta response checks was used. Prior to counting smears, a source of known concentration was counted on the instrument to create the instrument QC Check Limits. Response check data sheets are provided in Appendix A.

A control chart is provided to graphically portray the steadfastness of the instruments' responses to the source over the survey period in Appendix A. No degradation of the instruments' response was observed over the entire survey period.

5.2 Measurement Uncertainty and Data Quality Indicators

Measurement uncertainty in the techniques prescribed for the FSS arises from two principal sources: field sampling variation and instrument/ laboratory measurement variation. Of the two sources, field-sampling variation would be the greatest contributor to overall uncertainty because of the inherent logistics of sample collection activities. To minimize the uncertainty contributed by field-sampling variation, field survey and sampling operations were governed by procedures and protocols, and survey personnel were trained on survey instrumentation use and sample collection techniques and procedures. Additionally, individuals who were well versed in the overall survey approach and its data quality objectives provided guidance and gave direction when unclear situations arose. The measurement methods, on the other hand, employed standard instrument and laboratory procedures whose aspects and nuances were well understood. Procedures and their associated rigor also governed instrument calibrations, source checks, and operations at the site.

An important activity in determining the usability of the data obtained during the survey of the RTF and Supporting Structures is assessing the effectiveness of the sampling and survey program relative to the design objectives (NRC 2000, EPA 2000). Data Quality Indicators (DQIs) were used as a cornerstone for quality comparisons performed against sampling and surveying activities. Identified deficiencies or short-comings were corrected and redirected, increasing the overall data quality and usability. Project goals for measurement uncertainty were developed in line with DQIs and assessed during sampling and survey activities. Upon completion of FSS of the potentially impacted areas, FSS activities were evaluated against the project goals developed for the project. Table 5.1 presents the target DQIs and summarizes the post-sampling data quality assessment.

Inspection of Table 5.1 indicates that the DQIs were achieved, and thus, the data are regarded as having sufficient quality to be useable for the intended purpose of confidently demonstrating that:

- All total surface measurement results are less than the $DCGL_W$; **AND**
- There are no areas having locally elevated concentrations of residual radioactivity on building surfaces greater than the $DCGL_{EMC}$.

5.3 Overall Quality Assurance and Quality Control

Based on the forgoing analysis and observed practices in the field, the overall project QA/QC goals were obtained. There are no significant data problems or gaps, nor any procedural inadequacies that might compromise the findings of this survey report. The data collected in the FSS is regarded as high quality data and acceptable for its intended use.

TABLE 5.1 TARGET DATA QUALITY INDICATORS AND FINDINGS

DQI	Quality Objective	Significance	Action/Remark	Finding
Completeness	90% completeness	Less than complete data set could decrease confidence in supporting information.	A minimum 14 direct static surface radioactivity measurements were planned in the single Class 3 survey unit of the RTF and Supporting Structures. As a contingency, the minimum sample size specified was increased by 20% to accommodate the possibility that some data might be lost, unusable, or otherwise incomplete. A minimum of 14 direct static surface measurements were actually collected from and the Class 3 survey unit. Fourteen direct surface emission measurements (14 was the specified minimum) were obtained (100%).	DQI accepted.

DQI	Quality Objective	Significance	Action/Remark	Finding
Comparability	Affects ability to combine data sets produced using different sampling and/or analytical methods.	Data collected from randomly selected locations within a survey area are unbiased and comparable by design and can be combined. Combining of other data sets would be subject to appropriate two-sample statistical test methods designed to detect significant differences between samples or populations.	Sampling procedures and protocols were used throughout the FSS process for remaining impacted Site areas. No critical deviation from these procedures was encountered.	DQI accepted.
Representativeness	Non-representative-ness increases or decreases Type I error depending on the bias.	Sample allocation included a minimum number of unbiased, randomly distributed sample locations based on survey design.	Sample allocation for Survey Units was identified using the computer software program Visual Sample Plan. The survey was designed to produce a random sample allocation distribution within the Class 3 survey unit. The sample locations selected meet the intent of the survey design and are considered representative of conditions of the RTF and Supporting Structures.	DQI accepted.

DQI	Quality Objective	Significance	Action/Remark	Finding
Precision	Measurement variability, due to techniques and/or technology, may increase uncertainty.	Field sampling and instrument operation were governed by procedures, background measurements, and source response check measurements were used to gauge reproducibility.	All sampling and field measurement processes were controlled by approved written procedures. Field instrument response checks also demonstrate the precision of the field survey measurement. All procedures were implemented. Instruments were calibrated to industry standard specifications and yielded responses to NIST certified calibration sources within ±10% of the known amount of radioactivity. Field responses to a low-activity response check source were consistently within the acceptable range of ±20%. As represented above, precision was acceptable.	DQI accepted.
Accuracy	Sampling and data handling can introduce bias and affect Type I and Type II errors.	Sampling and measurements were governed by procedures. Instruments were calibrated with NIST traceable sources.	All sampling and field measurement processes were controlled by approved written procedures. Analytical measurements were controlled by approved procedures. Survey and sampling results were recorded in accordance with approved written procedures.	DQI accepted.

6.0 SUMMARY AND CONCLUSIONS

On the basis of the analysis presented in this report, FSS data demonstrates that the survey unit associated with the potentially impacted areas has met the decision criteria.

More specifically, the FSS of the RTF demonstrates that:

- No unexpected results or trends are evident in the data.
- The sampling and survey results demonstrate that residual radioactivity in the potentially impacted area is very minimal and for the most part, indistinguishable from background levels.
- The data quality is judged to be excellent for its intended purpose.
- The amount of data collected from each survey unit is adequate to provide the required statistical confidence needed to decide that the DCGLs are met.
- The retrospective power of the Sign Test, used to judge compliance, was consistently near 100% and always greater than 95%.

Thus, the null hypothesis-that residual radioactivity in the survey units exists in concentrations above the applicable DCGLs should be rejected for the survey unit in the RTF. The areas surveyed and sampled during FSS are acceptable for release from further radiological controls.

7.0 REFERENCES

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APPENDIX A

SURVEY UNIT RSARTFSS
RESULTS AND DATA EVALUATION

EPA RTF Final Status Surveys

Total Surface Activity

Sample ID	Date	Beta TSA dpm/100cm²	Uncertainty dpm/100cm²	MDC dpm/100cm²
RSARTFFS 800	09/24/14	2637.4	1446.6	2311.0
RSARTFSS 801	09/24/14	1172.2	1373.5	2311.0
RSARTFSS 802	09/24/14	1465.2	1388.4	2311.0
RSARTFSS 803	09/24/14	-219.8	1300.3	2311.0
RSARTFSS 804	09/24/14	-512.8	1284.3	2311.0
RSARTFSS 805	09/24/14	-109.9	1306.2	2311.0
RSARTFSS 806	09/24/14	1428.6	1386.6	2311.0
RSARTFSS 807	09/24/14	256.4	1325.8	2311.0
RSARTFSS 808	09/24/14	879.1	1358.4	2311.0
RSARTFSS 809	09/24/14	1062.3	1367.9	2311.0
RSARTFSS 810	09/24/14	1025.6	1366.0	2311.0
RSARTFSS 811	09/24/14	1172.2	1373.5	2311.0
RSARTFSS 812	09/24/14	-439.6	1288.3	2311.0
RSARTFSS 813	09/24/14	1721.6	1401.4	2311.0

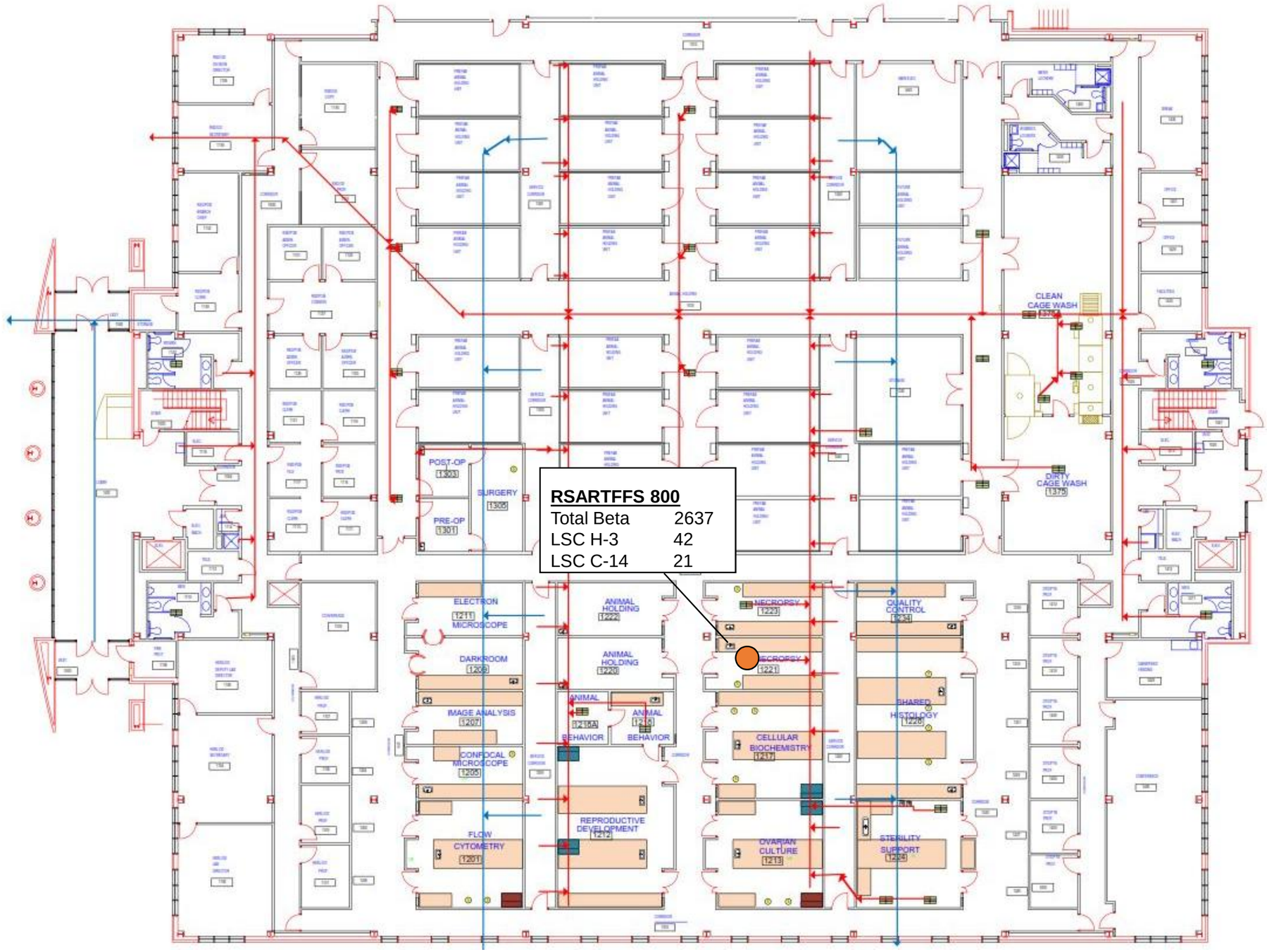
Uncertainty reported at 1.96 sigma.

EPA RTF Final Status Surveys

Removable Surface Activity

		Onsite Analysis			Laboratory LSC	
		Beta RSA	Uncertainty	MDC	H-3	C-14
Sample ID	Date	dpm/100cm²	dpm/100cm²	dpm/100cm²	dpm/100cm²	dpm/100cm²
RSARTFFS 800	09/24/14	-32.1	369.5	822.5	42	21
RSARTFSS 801	09/24/14	-208.3	354.5	822.5	31	29
RSARTFSS 802	09/24/14	-336.5	343.2	822.5	33	28
RSARTFSS 803	09/24/14	-64.1	366.8	822.5	34	29
RSARTFSS 804	09/24/14	-288.5	347.5	822.5	46	20
RSARTFSS 805	09/24/14	-64.1	366.8	822.5	30	20
RSARTFSS 806	09/24/14	-288.5	347.5	822.5	32	17
RSARTFSS 807	09/24/14	-208.3	354.5	822.5	32	37
RSARTFSS 808	09/24/14	48.1	376.1	822.5	52	25
RSARTFSS 809	09/24/14	-272.4	348.9	822.5	65	25
RSARTFSS 810	09/24/14	32.1	374.8	822.5	19	22
RSARTFSS 811	09/24/14	-80.1	365.5	822.5	20	25
RSARTFSS 812	09/24/14	-160.3	358.7	822.5	20	30
RSARTFSS 813	09/24/14	-288.5	347.5	822.5	30	22

Uncertainty reported at 1.96 sigma.



Legend

- Sink traps
- Fume hoods
- Countertops
- FSS

- Only Sample Locations that have reportable levels are annotated.
- Values in red exceed Tier II clearance levels and less than Tier II clearance criteria
- Units are listed as dpm/100 cm2

amec foster wheeler

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Durham, NC 27703
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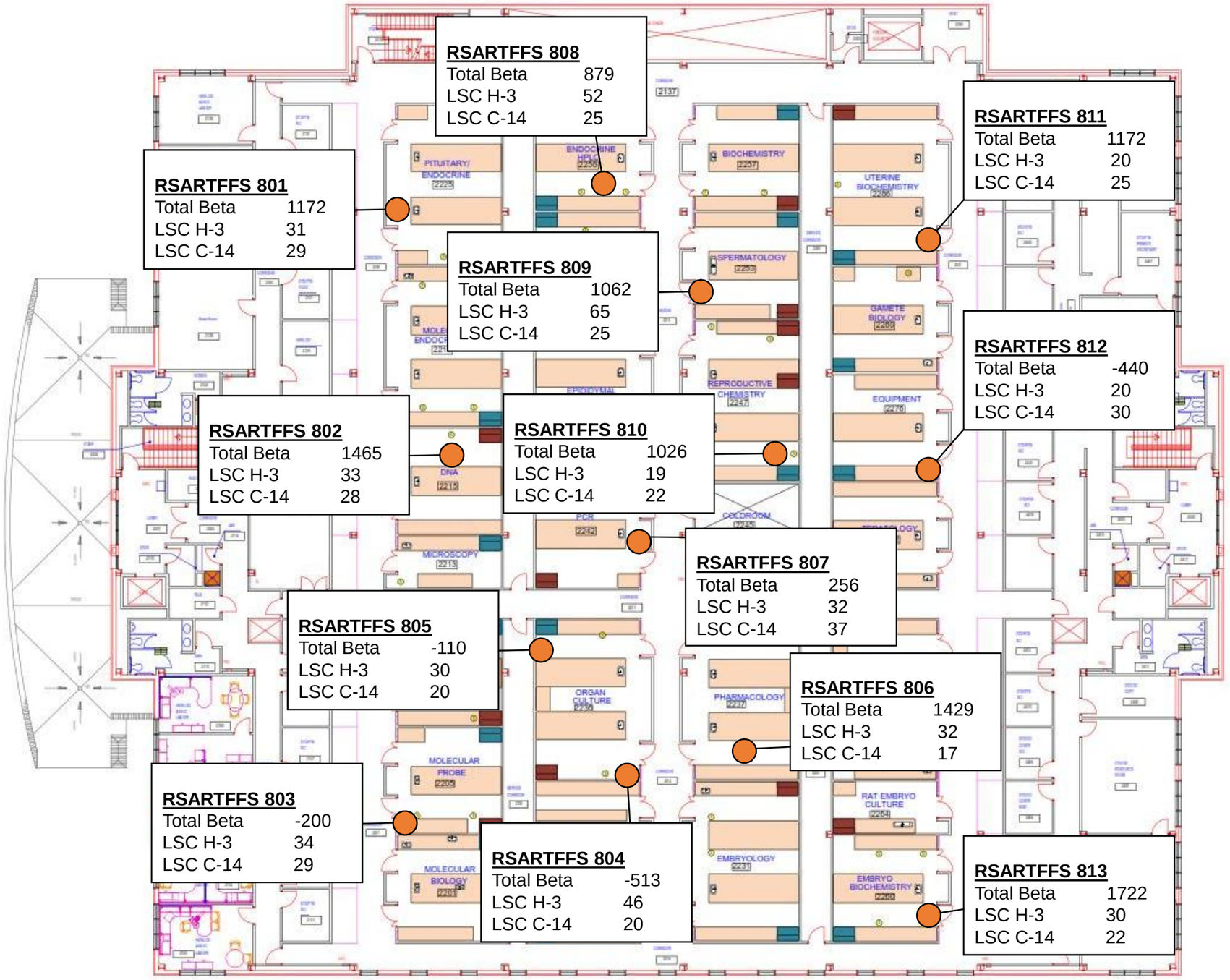
CLIENT: ENVIRONMENTAL PROTECTION AGENCY

TITLE: Sampling Results, FSS, 1st Floor

DATE:	12/04/14	**SCALE:** Not to scale	**PROJ.:**	321060245	
DR:	R. Kirby	**CHK:**	S.Johnson		
LOCATION:	P:\Government\Federal\EPA\321060245 RTF Decommission\2.0 Deliverables\Phase II Report\Figures				

SITE: EPA RTF EDDP Phase II Confirmation Sampling
2525 Highway 54, Durham NC

Figure **A**



RSARTFFS 808
Total Beta 879
LSC H-3 52
LSC C-14 25

RSARTFFS 801
Total Beta 1172
LSC H-3 31
LSC C-14 29

RSARTFFS 809
Total Beta 1062
LSC H-3 65
LSC C-14 25

RSARTFFS 811
Total Beta 1172
LSC H-3 20
LSC C-14 25

RSARTFFS 802
Total Beta 1465
LSC H-3 33
LSC C-14 28

RSARTFFS 810
Total Beta 1026
LSC H-3 19
LSC C-14 22

RSARTFFS 812
Total Beta -440
LSC H-3 20
LSC C-14 30

RSARTFFS 807
Total Beta 256
LSC H-3 32
LSC C-14 37

RSARTFFS 805
Total Beta -110
LSC H-3 30
LSC C-14 20

RSARTFFS 806
Total Beta 1429
LSC H-3 32
LSC C-14 17

RSARTFFS 803
Total Beta -200
LSC H-3 34
LSC C-14 29

RSARTFFS 804
Total Beta -513
LSC H-3 46
LSC C-14 20

RSARTFFS 813
Total Beta 1722
LSC H-3 30
LSC C-14 22

Legend
- Sink traps
- Fume hoods
- Countertops
- FSS

- Only Sample Locations that have reportable levels are annotated.
- Values in red exceed Tier II clearance levels and less than Tier II clearance criteria
- Units are listed as dpm/100 cm2

amec foster wheeler

AMEC Environment & Infrastructure, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, NC 27703
(919) 381-9900

CLIENT: ENVIRONMENTAL PROTECTION AGENCY

TITLE: Sampling Results, FSS, 2nd Floor

DATE:	12/04/14	**SCALE:** Not to scale	**PROJ.:**	321060245	
DR:	R. Kirby	**CHK:**	S.Johnson		
LOCATION:	P:\Government\Federal\EPA\321060245 RTF Decommission\2.0 Deliverables\Phase II Report\Figures				

SITE: EPA RTF EDDP Phase II
Confirmation Sampling
2525 Highway 54, Durham NC

Figure
B

SURVEY UNIT RSARTFSS

DESCRIPTIVE STATISTICS
AND COMPLIANCE TESTS

Descriptive Statistics Report

Summary Section of RSARTFFT_DIRECT

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
14	824.1786	914.8901	244.5147	-512.8	2637.4	3150.2

Counts Section of RSARTFFT_DIRECT

Rows	Sum of Frequencies	Missing Values	Distinct Values	Sum	Total Sum Squares	Adjusted Sum Squares
14	14	0	13	11538.5	2.03911E+07	1.088131E+07

Means Section of RSARTFFT_DIRECT

Parameter	Mean	Median	Geometric Mean	Harmonic Mean	Sum	Mode
Value	824.1786	1043.95	1123.596	-2037.587	11538.5	1172.2
Std Error	244.5147				3423.206	
95% LCL	295.9367	-219.8	728.7527	747.7133	4143.114	
95% UCL	1352.42	1428.6	1732.367	-431.227	18933.89	
T-Value	3.370671					
Prob Level	0.005017299					
Count	14		10	14		2

The geometric mean confidence interval assumes that the ln(y) are normally distributed.
The harmonic mean confidence interval assumes that the 1/y are normally distributed.

Variation Section of RSARTFFT_DIRECT

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	837024	914.8901	932.6369	244.5147	1575.125	3150.2
Std Error	256700.9	198.4008		53.02484		
95% LCL	439904.8	663.2532		177.2619		
95% UCL	2172461	1473.927		393.9235		

Skewness and Kurtosis Section of RSARTFFT_DIRECT

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.07614122	2.316761	0.0856001	-0.4184214	1.110063	0.669196
Std Error	0.3912855	0.4473365			0.3500241	

Trimmed Section of RSARTFFT_DIRECT

Parameter	5% Trimmed	10% Trimmed	15% Trimmed	25% Trimmed	35% Trimmed	45% Trimmed
Trim-Mean	797.7206	794.7411	817.0776	889.5928	1019.538	1043.95
Trim-Std Dev	794.3655	688.5137	607.9916	457.1396	181.5406	34.32971
Count	13	11	10	7	4	1

Mean-Deviation Section of RSARTFFT_DIRECT

Parameter	|X-Mean|	|X-Median|	(X-Mean)^2	(X-Mean)^3	(X-Mean)^4
Average	735.2275	698.6071	777236.6	5.217346E+07	1.399548E+12
Std Error	146.7439		238365.1	2.831116E+08	7.303234E+11

Descriptive Statistics Report

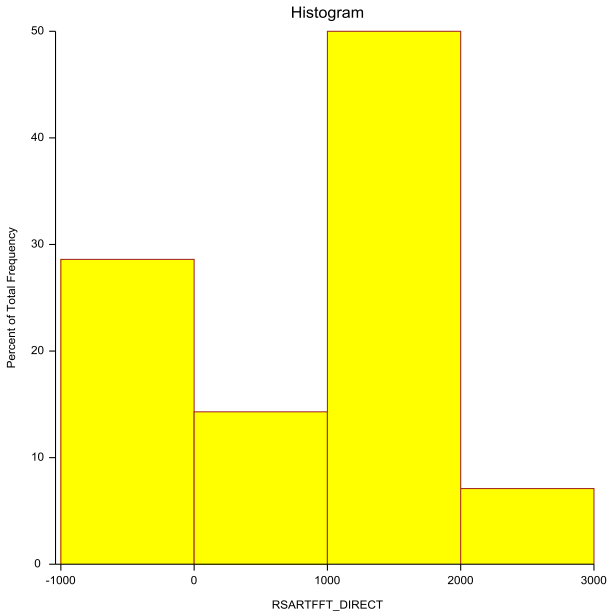
Quartile Section of RSARTFFT_DIRECT

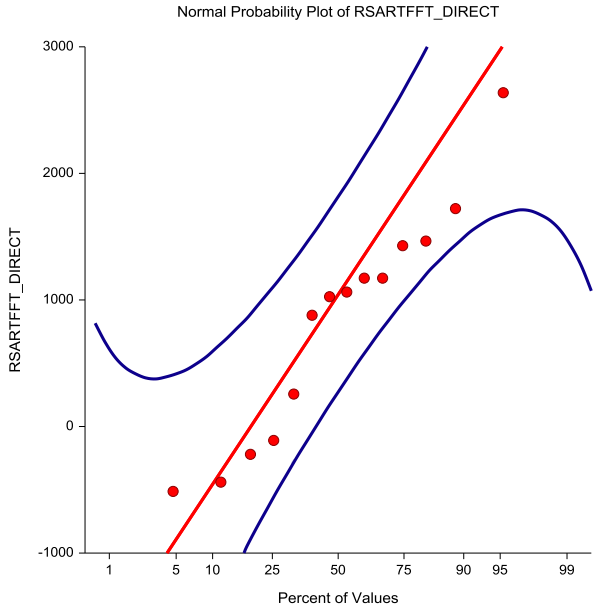
Parameter	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Value	-476.2	-137.375	1043.95	1437.75	2179.5
95% LCL		-512.8	-219.8	1025.6	
95% UCL		1062.3	1428.6	2637.4	

Normality Test Section of RSARTFFT_DIRECT

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9402528	0.4215727			Can't reject normality
Anderson-Darling	0.4280797	0.3113178			Can't reject normality
Martinez-Iglewicz	0.9750178		1.305415	1.57245	Can't reject normality
Kolmogorov-Smirnov	0.1320808		0.208	0.226	Can't reject normality
D'Agostino Skewness	0.1511859	0.879829	1.645	1.96	Can't reject normality
D'Agostino Kurtosis	-0.2060	0.836775	1.645	1.96	Can't reject normality
D'Agostino Omnibus	0.0653	0.967876	4.605	5.991	Can't reject normality

Plots Section of RSARTFFT_DIRECT





Descriptive Statistics Report

Percentile Section of RSARTFFT_DIRECT

Percentile	Value	95% LCL	95% UCL	Exact Conf. Level
99	2637.4			
95	2637.4			
90	2179.5			
85	1657.5			
80	1465.2	1025.6	2637.4	95.36224
75	1437.75	1025.6	2637.4	97.18725
70	1300.4	1025.6	2637.4	96.17493
65	1172.2	879.1	1721.6	95.51371
60	1172.2	256.4	1721.6	97.43929
55	1089.775	-109.9	1465.2	97.15633
50	1043.95	-219.8	1428.6	96.48438
45	988.975	-219.8	1428.6	97.15633
40	879.1	-439.6	1172.2	97.43929
35	412.075	-439.6	1172.2	95.51371
30	73.25	-512.8	1062.3	96.17493
25	-137.375	-512.8	1062.3	97.18725
20	-219.8	-512.8	1062.3	95.36224
15	-384.65			
10	-476.2			
5	-512.8			
1	-512.8			

Percentile Formula: Ave X(p[n+1])

Stem-Leaf Plot Section of RSARTFFT_DIRECT

Depth	Stem	Leaves
4	-0*	5421
5	0*	2
6	.	8
(6)	1*	001144
2	.	7
1	2*	
1	.	6

Unit = 100 Example: 1 |2 Represents 1200

Descriptive Statistics Report

Summary Section of RSARTFFT_REMH3

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
14	34.70714	12.84658	3.433392	18.6	64.8	46.2

Counts Section of RSARTFFT_REMH3

Rows	Sum of Frequencies	Missing Values	Distinct Values	Sum	Total Sum Squares	Adjusted Sum Squares
14	14	0	14	485.9	19009.65	2145.449

Means Section of RSARTFFT_REMH3

Parameter	Mean	Median	Geometric Mean	Harmonic Mean	Sum	Mode
Value	34.70714	32.15	32.67649	30.81058	485.9	
Std Error	3.433392				48.06749	
95% LCL	27.28975	20.4	26.55874	25.55992	382.0565	
95% UCL	42.12453	41.7	40.20344	38.7762	589.7435	
T-Value	10.1087					
Prob Level	1.586892E-07					
Count	14		14	14		0

The geometric mean confidence interval assumes that the ln(y) are normally distributed.
The harmonic mean confidence interval assumes that the 1/y are normally distributed.

Variation Section of RSARTFFT_REMH3

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	165.0346	12.84658	13.09577	3.433392	14.925	46.2
Std Error	67.12742	3.694856		0.9874917		
95% LCL	86.73527	9.313177		2.489051		
95% UCL	428.3402	20.69638		5.531341		

Skewness and Kurtosis Section of RSARTFFT_REMH3

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.8859842	3.316211	0.9960483	1.058039	0.3701422	0.2694957
Std Error	0.3983737	1.297452			0.06179909	

Trimmed Section of RSARTFFT_REMH3

Parameter	5% Trimmed	10% Trimmed	15% Trimmed	25% Trimmed	35% Trimmed	45% Trimmed
Trim-Mean	33.93016	33.37679	33.07551	32.59286	31.9381	32.15
Trim-Std Dev	10.67679	8.580095	6.711626	3.010389	1.003105	0.09354144
Count	13	11	10	7	4	1

Mean-Deviation Section of RSARTFFT_REMH3

Parameter	|X-Mean|	|X-Median|	(X-Mean)^2	(X-Mean)^3	(X-Mean)^4
Average	9.410204	8.664286	153.2464	1680.782	77879.4
Std Error	2.060528		62.3326	1061.097	43981.41

Descriptive Statistics Report

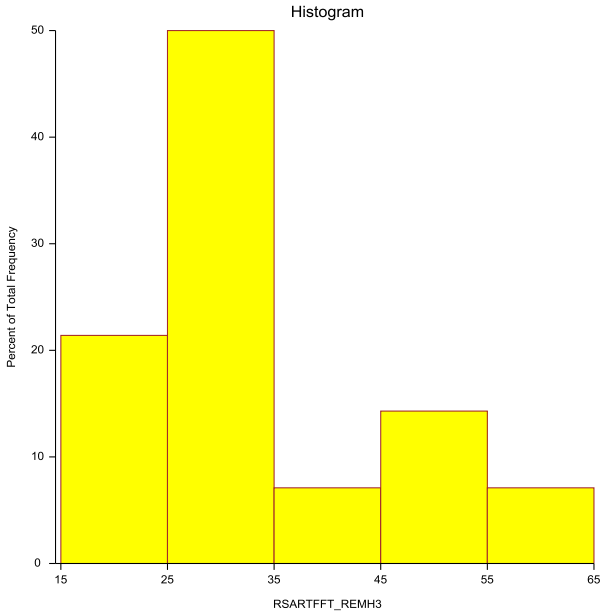
Quartile Section of RSARTFFT_REMH3

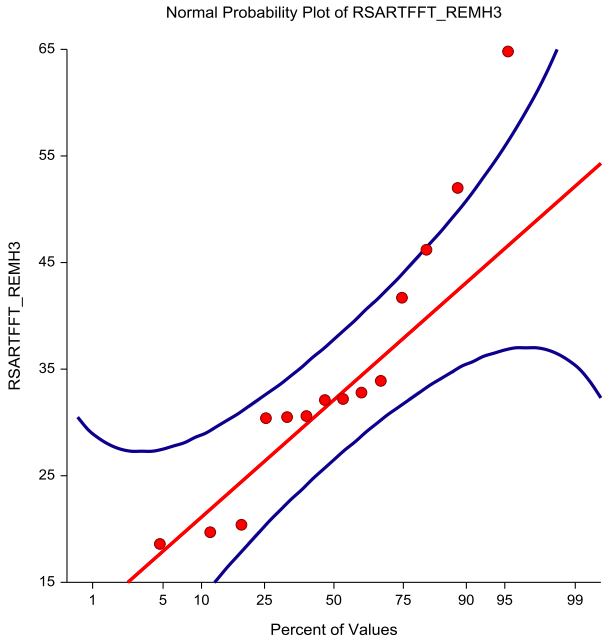
Parameter	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Value	19.15	27.9	32.15	42.825	58.4
95% LCL		18.6	20.4	32.1	
95% UCL		32.2	41.7	64.8	

Normality Test Section of RSARTFFT_REMH3

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.8998109	0.1120737			Can't reject normality
Anderson-Darling	0.6562294	0.08675183			Can't reject normality
Martinez-Iglewicz	1.282085		1.305415	1.57245	Can't reject normality
Kolmogorov-Smirnov	0.2393345		0.208	0.226	Reject normality
D'Agostino Skewness	1.675446	0.09384684	1.645	1.96	Can't reject normality
D'Agostino Kurtosis	1.0413	0.297729	1.645	1.96	Can't reject normality
D'Agostino Omnibus	3.8915	0.142883	4.605	5.991	Can't reject normality

Plots Section of RSARTFFT_REMH3





Descriptive Statistics Report

Percentile Section of RSARTFFT_REMH3

Percentile	Value	95% LCL	95% UCL	Exact Conf. Level
99	64.8			
95	64.8			
90	58.4			
85	50.55			
80	46.2	32.1	64.8	95.36224
75	42.825	32.1	64.8	97.18725
70	37.8	32.1	64.8	96.17493
65	33.625	30.6	52	95.51371
60	32.8	30.5	52	97.43929
55	32.35	30.4	46.2	97.15633
50	32.15	20.4	41.7	96.48438
45	31.725	20.4	41.7	97.15633
40	30.6	19.7	33.9	97.43929
35	30.525	19.7	32.8	95.51371
30	30.45	18.6	32.2	96.17493
25	27.9	18.6	32.2	97.18725
20	20.4	18.6	32.2	95.36224
15	19.875			
10	19.15			
5	18.6			
1	18.6			

Percentile Formula: Ave X(p[n+1])

Stem-Leaf Plot Section of RSARTFFT_REMH3

Depth	Stem	Leaves
2	1. |	89
3	2* |	0
3	. |	
(7)	3* |	0002223
4	. |	
4	4* |	1
3	. |	6
2	5* |	2
High	|	64

Unit = 1 Example: 1 |2 Represents 12

Descriptive Statistics Report

Summary Section of RSARTFFT_REMC14

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
14	24.92857	5.265187	1.407181	16.7	37	20.3

Counts Section of RSARTFFT_REMC14

Rows	Sum of Frequencies	Missing Values	Distinct Values	Sum	Total Sum Squares	Adjusted Sum Squares
14	14	0	14	349	9060.46	360.3886

Means Section of RSARTFFT_REMC14

Parameter	Mean	Median	Geometric Mean	Harmonic Mean	Sum	Mode
Value	24.92857	24.55	24.43211	23.9538	349	
Std Error	1.407181				19.70053	
95% LCL	21.88854	20.2	21.67485	21.41014	306.4396	
95% UCL	27.9686	28.9	27.54011	27.18336	391.5604	
T-Value	17.71526					
Prob Level	1.744942E-10					
Count	14		14	14		0

The geometric mean confidence interval assumes that the ln(y) are normally distributed.
The harmonic mean confidence interval assumes that the 1/y are normally distributed.

Variation Section of RSARTFFT_REMC14

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	27.7222	5.265187	5.36732	1.407181	8.275	20.3
Std Error	10.6848	1.434953		0.3835073		
95% LCL	14.56963	3.817018		1.020141		
95% UCL	71.95179	8.48244		2.267027		

Skewness and Kurtosis Section of RSARTFFT_REMC14

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.615151	3.079725	0.69157	0.7086838	0.211211	0.1640966
Std Error	0.4198741	0.749203			0.03727971	

Trimmed Section of RSARTFFT_REMC14

Parameter	5% Trimmed	10% Trimmed	15% Trimmed	25% Trimmed	35% Trimmed	45% Trimmed
Trim-Mean	24.71508	24.60179	24.58673	24.5	24.2119	24.55
Trim-Std Dev	4.259008	3.521836	3.260355	2.58457	1.535253	0.09354144
Count	13	11	10	7	4	1

Mean-Deviation Section of RSARTFFT_REMC14

Parameter	|X-Mean|	|X-Median|	(X-Mean)^2	(X-Mean)^3	(X-Mean)^4
Average	4.07551	4.028572	25.74204	80.34266	2040.788
Std Error	0.8445101		9.921603	75.16656	1263.757

Descriptive Statistics Report

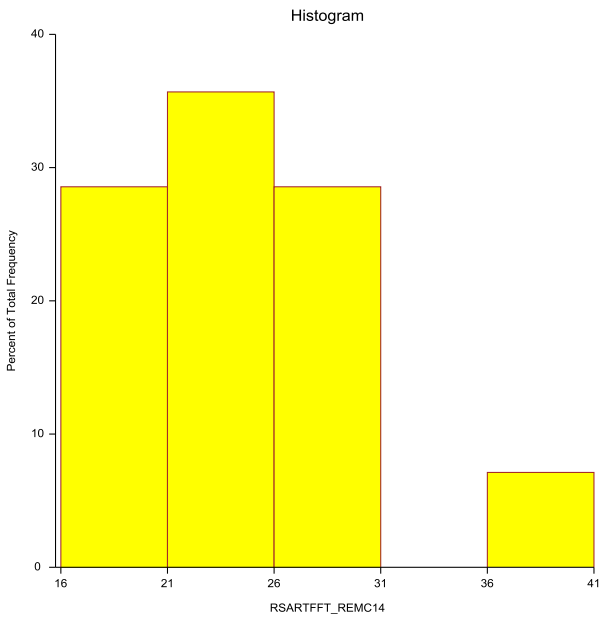
Quartile Section of RSARTFFT_REMC14

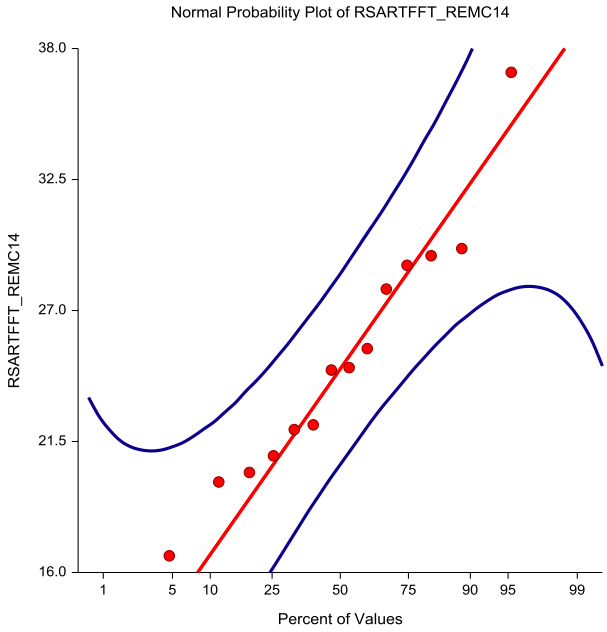
Parameter	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Value	18.25	20.725	24.55	29	33.3
95% LCL		16.7	20.2	24.5	
95% UCL		24.6	28.9	37	

Normality Test Section of RSARTFFT_REMC14

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9555287	0.6493075			Can't reject normality
Anderson-Darling	0.2947329	0.5979882			Can't reject normality
Martinez-Iglewicz	1.090783		1.305415	1.57245	Can't reject normality
Kolmogorov-Smirnov	0.1264221		0.208	0.226	Can't reject normality
D'Agostino Skewness	1.191758	0.2333561	1.645	1.96	Can't reject normality
D'Agostino Kurtosis	0.8039	0.421482	1.645	1.96	Can't reject normality
D'Agostino Omnibus	2.0665	0.355855	4.605	5.991	Can't reject normality

Plots Section of RSARTFFT_REMC14





Descriptive Statistics Report

Percentile Section of RSARTFFT_REMC14

Percentile	Value	95% LCL	95% UCL	Exact Conf. Level
99	37			
95	37			
90	33.3			
85	29.525			
80	29.3	24.5	37	95.36224
75	29	24.5	37	97.18725
70	28.4	24.5	37	96.17493
65	27.275	22.2	29.6	95.51371
60	25.4	22	29.6	97.43929
55	24.8	20.9	29.3	97.15633
50	24.55	20.2	28.9	96.48438
45	23.925	20.2	28.9	97.15633
40	22.2	19.8	27.9	97.43929
35	22.05	19.8	25.4	95.51371
30	21.45	16.7	24.6	96.17493
25	20.725	16.7	24.6	97.18725
20	20.2	16.7	24.6	95.36224
15	19.9			
10	18.25			
5	16.7			
1	16.7			

Percentile Formula: Ave X(p[n+1])

Stem-Leaf Plot Section of RSARTFFT_REMC14

Depth	Stem	Leaves
1	1S	6
2	.	9
4	2*	00
6	T	22
(3)	F	445
5	S	7
4	.	899
1	3*	
1	T	
1	F	
1	S	7

Unit = 1 Example: 1 |2 Represents 12

One-Sample Report

Descriptive Statistics

Variable	Count	Mean	Standard Deviation	Standard Error	Median
RSARTFFT_DIRECT	14	824.1786	914.8901	244.5147	1043.95

Two-Sided Confidence Interval of the Median

			95.0% C. I. of the Median	
Variable	Count	Median	Lower Limit	Upper Limit
RSARTFFT_DIRECT	14	1043.95	-219.8	1428.6

One-Sample T-Test

Variable: RSARTFFT_DIRECT

Alternative Hypothesis	Mean	Standard Error	T-Statistic	d.f.	Prob Level	Reject H0 at α = 0.050
μ ≠ 5000	824.1786	244.5147	-17.0780	13	0.00000	Yes
μ < 5000	824.1786	244.5147	-17.0780	13	0.00000	Yes
μ > 5000	824.1786	244.5147	-17.0780	13	1.00000	No

Power for the One-Sample T-Test

Variable: RSARTFFT_DIRECT

This section assumes the population mean and standard deviation are equal to the sample values.

Alternative Hypothesis	N	μ	σ	Power (α = 0.05)	Power (α = 0.01)
μ ≠ 5000	14	824.1786	914.8901	1.00000	1.00000
μ < 5000	14	824.1786	914.8901	1.00000	1.00000
μ > 5000	14	824.1786	914.8901	0.00000	0.00000

Quantile (Sign) Test

This Quantile test is equivalent to the Sign test if the Quantile Proportion is 0.5.

Variable: RSARTFFT_DIRECT

Null Quantile (Q0)	Quantile Proportion	Number Lower	Number Higher	H1: Q ≠ Q0 Prob Level	H1: Q < Q0 Prob Level	H1: Q > Q0 Prob Level
5000	0.5	14	0	0.000122	0.000061	1.000000

One-Sample Report

Wilcoxon Signed-Rank Test
Variable: RSARTFFT_DIRECT

Sum of Ranks (W)	Mean of W	Std Dev of W	Number of Zeros	Number Sets of Ties	Multiplicity Factor
0	52.5	15.92561	0	1	6

	Exact Probability*		Approximation Without Continuity Correction			Approximation With Continuity Correction		
Alternative Hypothesis	Prob Level	Reject H0 (α = 0.050)	Z-Value	Prob Level	Reject H0 (α = 0.050)	Z-Value	Prob Level	Reject H0 (α = 0.050)
Median ≠ 5000			3.2966	0.000979	Yes	3.2652	0.001094	Yes
Median < 5000			-3.2966	0.000489	Yes	-3.2652	0.000547	Yes
Median > 5000			-3.2966	0.999511	No	-3.3280	0.999563	No

*Exact probabilities are given only when there are no ties.

Tests of Assumptions
Variable: RSARTFFT_DIRECT

Assumption	Value	Prob Level	Decision (α = 0.050)
Skewness Normality	0.1512	0.879829	Cannot reject normality
Kurtosis Normality	-0.2060	0.836775	Cannot reject normality
Omnibus Normality	0.0653	0.967876	Cannot reject normality

One-Sample Report

Descriptive Statistics

Variable	Count	Mean	Standard Deviation	Standard Error	Median
RSARTFFT_H3	14	34.70714	12.84658	3.433392	32.15

Two-Sided Confidence Interval of the Median

			95.0% C. I. of the Median	
Variable	Count	Median	Lower Limit	Upper Limit
RSARTFFT_H3	14	32.15	20.4	41.7

One-Sample T-Test

Variable: RSARTFFT_REMH3

Alternative Hypothesis	Mean	Standard Error	T-Statistic	d.f.	Prob Level	Reject H0 at α = 0.050
μ ≠ 1000	34.70714	3.433392	-281.1484	13	0.00000	Yes
μ < 1000	34.70714	3.433392	-281.1484	13	0.00000	Yes
μ > 1000	34.70714	3.433392	-281.1484	13	1.00000	No

Power for the One-Sample T-Test

Variable: RSARTFFT_REMH3

This section assumes the population mean and standard deviation are equal to the sample values.

Alternative Hypothesis	N	μ	σ	Power (α = 0.05)	Power (α = 0.01)
μ ≠ 1000	14	34.70714	12.84658	1.00000	1.00000
μ < 1000	14	34.70714	12.84658	1.00000	1.00000
μ > 1000	14	34.70714	12.84658	0.00000	0.00000

Quantile (Sign) Test

This Quantile test is equivalent to the Sign test if the Quantile Proportion is 0.5.

Variable: RSARTFFT_REMH3

Null Quantile (Q0)	Quantile Proportion	Number Lower	Number Higher	H1: Q ≠ Q0 Prob Level	H1: Q < Q0 Prob Level	H1: Q > Q0 Prob Level
1000	0.5	14	0	0.000122	0.000061	1.000000

One-Sample Report

Wilcoxon Signed-Rank Test
Variable: RSARTFFT_REMH3

Sum of Ranks (W)	Mean of W	Std Dev of W	Number of Zeros	Number Sets of Ties	Multiplicity Factor
0	52.5	15.92953	0	0	0

	Exact Probability*		Approximation Without Continuity Correction			Approximation With Continuity Correction		
Alternative Hypothesis	Prob Level	Reject H0 (α = 0.050)	Z-Value	Prob Level	Reject H0 (α = 0.050)	Z-Value	Prob Level	Reject H0 (α = 0.050)
Median ≠ 1000	0.000122	Yes	3.2958	0.000982	Yes	3.2644	0.001097	Yes
Median < 1000	0.000061	Yes	-3.2958	0.000491	Yes	-3.2644	0.000549	Yes
Median > 1000	1.000000	No	-3.2958	0.999509	No	-3.3272	0.999561	No

*Exact probabilities are given only when there are no ties.

Tests of Assumptions
Variable: RSARTFFT_REMH3

Assumption	Value	Prob Level	Decision (α = 0.050)
Skewness Normality	1.6754	0.093847	Cannot reject normality
Kurtosis Normality	1.0413	0.297729	Cannot reject normality
Omnibus Normality	3.8915	0.142883	Cannot reject normality

One-Sample Report

Descriptive Statistics

Variable	Count	Standard Mean	Standard Deviation	Standard Error	Median
RSARTFFT_REMC14	14	24.92857	5.265187	1.407181	24.55

Two-Sided Confidence Interval of the Median

		95.0% C. I. of the Median		
Variable	Count	Lower Median	Upper Limit	Limit
RSARTFFT_REMC14	14	24.55	20.2	28.9

One-Sample T-Test

Variable: RSARTFFT_REMC14

Alternative Hypothesis	Mean	Standard Error	T-Statistic	d.f.	Prob Level	Reject H0 at α = 0.050
μ ≠ 1000	24.92857	1.407181	-692.9256	13	0.00000	Yes
μ < 1000	24.92857	1.407181	-692.9256	13	0.00000	Yes
μ > 1000	24.92857	1.407181	-692.9256	13	1.00000	No

Power for the One-Sample T-Test

Variable: RSARTFFT_REMC14

This section assumes the population mean and standard deviation are equal to the sample values.

Alternative Hypothesis	N	μ	σ	Power (α = 0.05)	Power (α = 0.01)
μ ≠ 1000	14	24.92857	5.265187	1.00000	1.00000
μ < 1000	14	24.92857	5.265187	1.00000	1.00000
μ > 1000	14	24.92857	5.265187	0.00000	0.00000

Quantile (Sign) Test

This Quantile test is equivalent to the Sign test if the Quantile Proportion is 0.5.

Variable: RSARTFFT_REMC14

Null Quantile (Q0)	Quantile Proportion	Number Lower	Number Higher	H1: Q ≠ Q0 Prob Level	H1: Q < Q0 Prob Level	H1: Q > Q0 Prob Level
1000	0.5	14	0	0.000122	0.000061	1.000000

One-Sample Report

Wilcoxon Signed-Rank Test
Variable: RSARTFFT_REMC14

Sum of Ranks (W)	Mean of W	Std Dev of W	Number of Zeros	Number Sets of Ties	Multiplicity Factor
0	52.5	15.92953	0	0	0

	Exact Probability*		Approximation Without Continuity Correction			Approximation With Continuity Correction		
Alternative Hypothesis	Prob Level	Reject H0 (α = 0.050)	Z-Value	Prob Level	Reject H0 (α = 0.050)	Z-Value	Prob Level	Reject H0 (α = 0.050)
Median ≠ 1000	0.000122	Yes	3.2958	0.000982	Yes	3.2644	0.001097	Yes
Median < 1000	0.000061	Yes	-3.2958	0.000491	Yes	-3.2644	0.000549	Yes
Median > 1000	1.000000	No	-3.2958	0.999509	No	-3.3272	0.999561	No

*Exact probabilities are given only when there are no ties.

Tests of Assumptions
Variable: RSARTFFT_REMC14

Assumption	Value	Prob Level	Decision (α = 0.050)
Skewness Normality	1.1918	0.233356	Cannot reject normality
Kurtosis Normality	0.8039	0.421482	Cannot reject normality
Omnibus Normality	2.0665	0.355855	Cannot reject normality

SURVEY UNIT RSARTFSS

FIELD DATA

AMEC RADIOLOGICAL SURVEY FORM

Survey Number: N/A Page 1 of 2

Location	EPA RTF	Requester	N/A	Date	9-24-14	Time	0800
Purpose	Phase 2					RWP #	N/A

Instrument and Probe Type and Serial Number		Surveyor(s) Printed Name	Surveyor(s) Signature
EGOO S/N 3689/43-89 S/N 312071	2929 S/N 50721/43-10 S/N 046118	Ronald Como	RCom
MODEL 3 S/N 250276 / SPA-8 S/N 1260952		JOE MEDELLIN	J. Medellin

#	ITEM DESCRIPTION/LOCATION	BETA-GAMMA ACTIVITY Counting Data Attached Yes No % Eff. 0.0019 /Radionuclide C14 3 min cpm	Bkg. 3 min cpm	dpm / 100 cm² (1)	T/R/F(2)	BETA-GAMMA ACTIVITY Counting Data Attached Yes No % Eff. 0.0208 /Radionuclide C14 3 min cpm	Bkg. 10 min cpm	dpm / 100 cm² (1)	T/R/F(2)	RADIATION SURVEY mrem/hr (3)	Distance
	RSARTF FS 800	239	167	2637.4	T	106	360	-32.1	R		
	RSARTF SS 801	199		1172.2	T	95		-208.3	R		
	802	207		1465.2	T	87		-336.5	R		
	803	161		-219.8	T	104		-64.1	R		
	804	153		-512.8	T	90		-288.5	R		
	805	164		-109.9	T	104		-64.1	R		
	806	206		1428.6	T	90		-288.5	R		
	807	174		236.4	T	95		-208.3	R		
	808	191		819.1	T	111		48.1	R		
	809	196		1062.3	T	91		-272.4	R		
	810	195		1025.6	T	110		32.1	R		
	811	199		1172.2	T	103		-80.1	R		
	812	155		-439.6	T	98		-160.3	R		
	813	214		1721.6	T	90		-288.5	R		

(1) If area other than 100 cm², record as dpm/probe, or dpm/LAW. (2) Total/Removable/Fixed. (3) Indicate type, if other than gamma (i.e., n or β).

Remarks:

Reviewed by: [signature] Date: 9/29/14

FRN-0007a

RADIOLOGICAL SURVEY MAP

Survey Number: N/A

PERFORMED BETA(β) SCAN AT SAMPLE LOCATIONS WITH EG&G
PERFORMED GAMMA(γ) SCAN AT SAMPLE LOCATIONS WITH MODEL 3

SAMPLE LOCATION #	β SCAN (cpm)	γ BKGD (cpm)	γ SCAN (cpm)
RSARTFFS 800	150-360	1200	1200-1300
RSARTFSS 801	100-280	1000	1100-1200
802	120-220	800	1000-1100
803	90-230	800	800-900
804	80-190	800	800-900
805	100-230	800	800-900
806	120-280	800	1000-1100
807	90-150	900	800-900
808	120-240	800	1000-1100
809	130-250	800	1000-1100
810	130-240	700	1100-1200
811	80-190	900	1100-1200
812	140-220	700	700-800
813	120-220	900	1400-1500

○ indicates smear location * indicates contact radiation reading △ indicates volumetric sample location LAW indicates large area wipe

All radiation readings are gamma in mrem/h unless noted.

SURVEY UNIT RSARTFSS

OFFSITE LABORATORY
LSC SAMPLE ANALYSIS
DATA REPORTS

ALS Environmental

Tritium, Carbon-14, and Technetium-99

Case Narrative

AMEC

ENVIRONMENTAL Phase II - 321060245

Work Order Number: 1409516

1. This report consists of the raw instrument data and supporting information for 14 swipe samples received by ALS on 9/23/2014.

2. These samples were prepared according to procedure SOP700R12.

3. The samples were analyzed for the presence of Tritium, Carbon-14, and Technetium-99. The analyses were completed on 9/26/2014.

4. Four calibration blanks (CB) and a Method Blank were run with this set of 14 samples. One Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD) for each analyte were analyzed for this set of 14 samples.

5. After the analysis, it was determined that several samples fell below the established quench range for analysis. This is believed to be a factor of the reduced count times and subsequent large uncertainty associated with this count time.

6. Per PM instructions, there will be no activity calculations reported. Only the instrument raw data will be given to the client. The sample specific efficiency was not calculated. The efficiency and background equations have been provided to the client so that they may calculate a more accurate efficiency for each sample. Also, the calibration range for the quench curve calibration has been provided. Any samples falling outside of this range may not conform to the given equations.

7. In order to determine an appropriate analysis window that would be applicable to the analysis of the three requested nuclides, an energy calibration was performed. Upon determination of the energy calibration, an analysis window was set up so that the approximate efficiency of Tritium, Carbon-14, and Technetium-99 were 20%, 25%, and 40%, respectively. These efficiencies are based on relatively low quench samples, and as such if the quench increases, these efficiencies will be reduced accordingly.

8. Tritium CB2, CB4, Carbon CB4 and Technetium CB2 had count rates that fell outside of the control limits for the geometry of interest. This is believed to be a factor of the reduced count times and subsequent large uncertainty associated with this count time. Data quality is not believed to be affected by these excursions.

9. The radiometric recovery for the H-3 laboratory control sample and the C-14 laboratory control sample duplicate fell outside of the acceptance limits. This is believed to be a factor of the reduced count time and the amount of activity added to the sample.

10. No further anomalous situations were encountered during the preparation or analysis of these samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

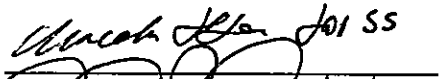
for Shiloh Summy — 9-30-14

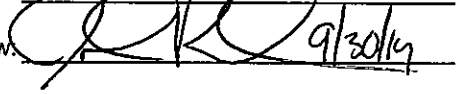
Shiloh Summy — Date
Radiochemistry Primary Data Reviewer

09/30/14

Radiochemistry Final Data Reviewer — Date

FieldID	LabID	Matrix	Date Collected	Sample	Rack-Pos	Time	H#	H-3 CPM	C-14 CPM	Tc-99 CPM	LumEx%	%Recovery
	CB1	**WIPE**		**CB1**	**13-1**	**2.00**	**137.7**	**4.00**	**7.50**	**8.00**	**0.91**	**na**
RSARTFFS 800	1409516-1	WIPE	9/24/2014	1409516-1	56-2	2.00	124.4	8.00	6.00	6.50	4.13	na
RSARTFSS 801	1409516-2	WIPE	9/24/2014	1409516-2	56-3	2.00	120.0	6.00	8.00	4.00	4.32	na
RSARTFSS 802	1409516-3	WIPE	9/24/2014	1409516-3	56-4	2.00	118.6	6.50	7.50	8.50	4.57	na
RSARTFSS 803	1409516-4	WIPE	9/24/2014	1409516-4	56-5	2.00	110.8	7.00	7.00	8.00	4.41	na
RSARTFSS 804	1409516-5	WIPE	9/24/2014	1409516-5	56-6	2.00	121.5	9.00	5.50	8.50	4.46	na
RSARTFSS 805	1409516-6	WIPE	9/24/2014	1409516-6	13-2	2.00	119.5	6.00	5.50	8.00	0.53	na
RSARTFSS 806	1409516-7	WIPE	9/24/2014	1409516-7	56-8	2.00	128.8	6.00	5.00	7.00	4.28	na
RSARTFSS 807	1409516-8	WIPE	9/24/2014	1409516-8	56-9	2.00	114.9	6.50	9.50	8.00	3.77	na
RSARTFSS 808	1409516-9	WIPE	9/24/2014	1409516-9	56-10	2.00	123.8	10.00	7.00	7.50	3.56	na
RSARTFSS 809	1409516-10	WIPE	9/24/2014	1409516-10	56-11	2.00	137.7	11.50	8.00	9.50	2.74	na
	CB2	**WIPE**		**CB2**	**13-3**	**2.00**	**132.6**	**7.50**	**9.50**	**5.50**	**0.89**	**na**
RSARTFSS 810	1409516-11	WIPE	9/24/2014	1409516-11	48-1	2.00	127.2	3.50	6.50	9.00	2.78	na
RSARTFSS 811	1409516-12	WIPE	9/24/2014	1409516-12	48-2	2.00	120.7	4.00	7.00	8.50	2.62	na
RSARTFSS 812	1409516-13	WIPE	9/24/2014	1409516-13	48-3	2.00	113.9	4.00	7.50	5.50	2.98	na
RSARTFSS 813	1409516-14	WIPE	9/24/2014	1409516-14	48-4	2.00	134.3	5.50	7.00	8.50	2.99	na
				CB3	**13-4**	**2.00**	**134.4**	**6.00**	**10.00**	**8.50**	**0.76**	**na**
				MB1	13-5	2.00	134.9	6.00	7.50	7.00	0.78	na
				LCS (H-3)	48-7	2.00	133.6	68.00	22.50	8.50	3.88	121.00%
				LCSD (H-3)	48-8	2.00	133.3	54.50	21.00	8.00	3.56	94.40%
				LCS (TC-99)	48-9	2.00	130.0	11.00	16.50	30.00	4.30	110.90%
				LCSD (TC-99)	48-10	2.00	137.9	8.50	15.50	31.50	4.58	113.80%
				LCS (C14)	13-6	2.00	135.8	8.50	18.50	18.00	0.59	110.90%
				LCSD (C14)	13-7	2.00	135.6	8.50	19.50	15.00	0.59	122.20%
				CB4	**13-8**	**2.00**	**119.1**	**7.50**	**6.50**	**9.00**	**0.91**	**na**

First Review: 

Second Review: 

ALS Environmental -- FC

Sample Number(s) Cross-Reference Table

OrderNum: 1409516
Client Name: AMEC
Client Project Name: Environmental Phase II
Client Project Number: 321060245
Client PO Number:

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
RSARTFFS 800	1409516-1		WIPE	24-Sep-14	10:30
RSARTFSS 801	1409516-2		WIPE	24-Sep-14	11:00
RSARTFSS 802	1409516-3		WIPE	24-Sep-14	12:45
RSARTFSS 803	1409516-4		WIPE	24-Sep-14	12:55
RSARTFSS 804	1409516-5		WIPE	24-Sep-14	13:00
RSARTFSS 805	1409516-6		WIPE	24-Sep-14	13:05
RSARTFSS 806	1409516-7		WIPE	24-Sep-14	13:10
RSARTFSS 807	1409516-8		WIPE	24-Sep-14	13:15
RSARTFSS 808	1409516-9		WIPE	24-Sep-14	13:20
RSARTFSS 809	1409516-10		WIPE	24-Sep-14	13:25
RSARTFSS 810	1409516-11		WIPE	24-Sep-14	13:35
RSARTFSS 811	1409516-12		WIPE	24-Sep-14	13:45
RSARTFSS 812	1409516-13		WIPE	24-Sep-14	13:50
RSARTFSS 813	1409516-14		WIPE	24-Sep-14	14:00

H-3, C-14, TC-99

USER ID: COMMENT:LS 6500

COUNT TIME : 2.00

DATA CALC :	CPM	H# :YES	SAMPLE REPEATS:	1	PRINTER	: STD
AUTO BLANK :	NO	IC# : NO	REPLICATES :	1	RS232	:EDIT
TWO PHASE :	NO	AQC : NO	CYCLE REPEATS :	1	DISK	:EDIT
SCINTILLATOR:	LIQUID	LUMEX: NO	LOW SAMPLE REJ:	0		

DATA BUFFER IS FULL. DATA WILL GO TO PRINTER ONLY.

LOW LEVEL : YES NEXT [illegible] CORRECTION DATE: none

CHAN: 50.0 - 250.0 %ERROR: [illegible] FACTOR: 1.000000 BKG. SUB: 0
CHAN: 251.0 - [illegible] %ERROR: [illegible] FACTOR: 1.000000 BKG. SUB: 0
CHAN: 401.0 - 550.0 %ERROR: 1.75 FACTOR: 1.000000 BKG. SUB: 0

SAM NO	POS	TIME MIN	H#	WIND1 CPM	WIND1 %ERROR	WIND2 CPM	WIND2 %ERROR	WIND3 CPM	WIND3 %ERROR	LUMEX %	ELAPSED TIME
~~1~~	~~56-1~~	~~2.00~~	~~123.8~~	~~11.00~~	~~42.64~~	~~7.00~~	~~53.45~~	~~9.50~~	[illegible]	~~[illegible]~~	[illegible]
2	56-2	2.00	124.4	8.00	50.00	6.00	57.74	6.50	55.47	4.13	5.39
3	56-3	2.00	120.0	6.00	57.74	8.00	50.00	4.00	70.71	4.32	8.07
4	56-4	2.00	118.6	6.50	55.47	7.50	51.64	8.50	48.51	4.57	10.73
5	56-5	2.00	110.3	7.00	53.45	7.00	53.45	8.00	50.00	4.41	13.41
6	56-6	2.00	121.5	9.00	47.14	5.50	60.30	8.50	48.51	4.46	16.12
~~7~~	~~56-7~~	~~2.00~~	~~110.6~~	~~6.50~~	[illegible]	~~9.50~~	[illegible]	~~7.00~~	[illegible]	[illegible]	[illegible]
8	56-8	2.00	128.8	6.00	57.74	5.00	63.25	7.00	53.45	4.28	21.51
9	56-9	2.00	114.9	6.50	55.47	9.50	45.88	8.00	50.00	[illegible]	[illegible]
10	56-10	2.00	123.8	10.00	44.72	7.00	[illegible]	7.50	51.64	3.56	26.90
[illegible]	[illegible]	[illegible]	[illegible]	11.50	41.70	8.00	50.00	9.50	45.88	2.74	[illegible]
~~12~~	~~56-12~~	[illegible]	[illegible]	~~10.50~~	~~43.64~~	~~9.50~~	~~45.88~~	~~8.00~~	~~50.00~~	~~11.49~~	~~32.29~~
13	48-1	2.00	127.2	3.50	[illegible]	6.50	55.47	9.00	47.14	2.78	35.11
14	48-2	2.00	120.7	4.00	70.71	7.00	53.45	8.50	48.51	[illegible]	[illegible]
15	48-3	2.00	113.9	4.00	70.71	7.50	51.64	5.50	[illegible]	2.98	40.51
16	48-4	2.00	134.3	5.50	60.30	7.00	53.45	8.50	48.51	2.99	43.22
[illegible]	[illegible]	[illegible]	[illegible]	~~10.00~~	~~44.72~~	~~9.00~~	~~47.14~~	~~6.50~~	[illegible]	[illegible]	~~45.93~~
~~18~~	~~48-6~~	~~2.00~~	~~131.4~~	~~9.50~~	~~45.88~~	~~9.00~~	~~47.14~~	~~12.50~~	~~40.00~~	~~6.34~~	~~48.62~~
[illegible]	[illegible]	[illegible]	[illegible]	68.00	[illegible]	22.50	29.81	8.50	48.51	3.88	51.34
20	48-8	2.00	133.3	54.50	19.16	21.00	30.86	8.00	50.00	[illegible]	[illegible]
21	48-9	2.00	130.0	11.00	[illegible]	16.50	[illegible]	30.00	25.82	4.30	56.75
22	48-10	2.00	137.9	8.50	48.51	15.50	35.92	31.50	[illegible]	[illegible]	[illegible]
~~23~~	~~48-11~~	~~2.00~~	~~132.0~~	~~14.00~~	~~37.80~~	~~14.50~~	~~37.14~~	~~26.50~~	[illegible]	~~8.03~~	~~62.19~~
~~24~~	~~48-12~~	~~2.00~~	~~133.4~~	~~11.00~~	~~42.64~~	~~14.50~~	~~37.14~~	~~20.00~~	~~31.62~~	~~5.82~~	~~64.91~~
[illegible]	[illegible]	[illegible]	[illegible]	~~13.00~~	~~39.22~~	~~5.00~~	~~63.25~~	~~8.00~~	~~50.00~~	~~8.55~~	~~67.72~~
26	16-2	2.00	107.8	3.50	75.59	6.50	55.47	7.00	53.45	2.51	70.41
27	16-3	2.00	116.6	6.50	55.47	9.00	[illegible]	9.00	47.14	2.47	73.13
28	16-4	2.00	120.0	8.00	50.00	12.00	40.82	9.50	45.88	[illegible]	[illegible]
29	16-5	2.00	126.2	7.50	51.64	8.50	[illegible]	9.50	[illegible]	2.71	78.54
30	16-6	2.00	108.6	8.00	50.00	6.00	57.74	7.00	53.45	2.88	81.25
[illegible]	[illegible]	[illegible]	[illegible]	6.00	57.74	8.50	48.51	8.00	50.00	[illegible]	83.96
32	16-8	2.00	116.1	10.50	[illegible]	9.00	47.14	7.00	53.45	2.13	86.65
33	[illegible]	[illegible]	[illegible]	5.50	[illegible]	8.00	50.00	6.50	55.47	3.23	89.35
34	16-10	2.00	116.7	3.50	75.59	9.50	45.88	7.00	53.45	2.50	92.07
~~35~~	~~16-11~~	~~2.00~~	~~239.2~~	~~46.50~~	[illegible]	~~9.50~~	[illegible]	~~10.50~~	[illegible]	~~35.11~~	~~94.81~~
~~36~~	~~16-12~~	~~2.00~~	~~131.2~~	~~8.50~~	~~48.51~~	~~7.00~~	~~53.45~~	~~9.50~~	~~45.88~~	[illegible]	~~97.48~~
37	28-1	2.00	119.1	3.00	81.65	4.00	70.71	8.50	48.51	[illegible]	100.30
~~38~~	~~28-2~~	~~2.00~~	~~225.4~~	~~10.50~~	~~43.64~~	~~13.50~~	[illegible]	~~11.50~~	~~41.70~~	~~10.31~~	~~102.99~~
[illegible]	[illegible]	[illegible]	[illegible]	7.50	51.64	11.50	41.70	11.00	42.64	2.61	105.69
40	28-4	2.00	113.3	8.00	50.00	6.50	55.47	6.50	55.47	2.37	108.40
41	28-5	2.00	[illegible]	6.50	[illegible]	7.00	[illegible]	6.00	57.74	2.35	111.07
42	28-6	2.00	116.3	6.00	57.74	7.00	53.45	5.50	60.30	2.49	113.79

B65_IL_092601 SS 9/27/14 JM 9/30/14

SM NO	POS	TIME MIN	HH	WIN01 CPM	WIN01 %ERROR	WIN02 CPM	WIN02 %ERROR	WIN03 CPM	WIN03 %ERROR	DEAD %	ELAPSED TIME
[illegible]	[illegible]	[illegible]	[illegible]	6.00	57.74	7.00	53.45	7.50	51.64	2.40	116.47
44	28-8	[illegible]	[illegible]	6.50	55.47	12.00	40.82	6.00	57.74	2.24	119.16
45	28-9	2.00	111.4	3.50	[illegible]	6.50	55.47	6.00	57.74	2.85	121.89
46	28-10	2.00	119.8	8.50	48.51	9.00	47.14	5.00	63.25	[illegible]	[illegible]
~~47~~	~~28-11~~	~~2.00~~	~~121.0~~	~~4.50~~	~~66.67~~	~~11.50~~	[illegible]	~~11.50~~	[illegible]	[illegible]	[illegible]
48	28-12	2.00	112.0	4.00	70.71	7.50	51.64	5.50	60.30	3.08	130.04
49	50-1	2.00	115.8	7.50	51.64	8.00	50.00	4.50	66.67	[illegible]	132.85
50	50-2	2.00	128.0	6.00	57.74	9.50	45.88	5.50	60.30	2.59	135.55
51	50-3	2.00	124.2	6.50	55.47	4.50	66.67	6.00	57.74	3.22	138.25
52	50-4	2.00	118.4	6.50	55.47	9.50	45.88	7.00	53.45	[illegible]	[illegible]
53	50-5	2.00	145.0	8.50	48.51	10.00	44.72	7.50	51.64	2.81	143.65
54	50-6	2.00	111.0	6.50	55.47	4.00	70.71	11.50	41.20	[illegible]	146.34
55	50-7	2.00	116.9	8.50	48.51	9.50	45.88	9.50	45.88	2.00	149.06
56	50-8	2.00	115.8	2.50	89.44	7.00	53.45	7.00	53.45	2.61	151.75
[illegible]	50-9	[illegible]	[illegible]	5.00	63.25	7.50	51.64	7.00	53.45	2.28	154.44
~~58~~	~~50-10~~	~~2.00~~	~~[illegible]~~	~~7.00~~	~~53.45~~	~~7.00~~	~~53.45~~	~~16.00~~	~~35.36~~	~~5.65~~	~~157.15~~
59	50-11	2.00	[illegible]	6.50	[illegible]	8.00	50.00	7.50	51.64	2.96	159.86
~~60~~	~~50-12~~	~~2.00~~	~~165.0~~	~~8.50~~	~~48.51~~	~~7.50~~	~~51.64~~	~~10.00~~	~~44.72~~	~~7.72~~	~~162.57~~
61	33-1	2.00	116.7	4.50	66.67	6.00	[illegible]	6.00	57.74	2.79	165.36
62	33-2	2.00	115.0	7.00	53.45	9.00	47.14	4.50	[illegible]	[illegible]	168.07
63	33-3	2.00	170.9	6.00	57.74	8.00	50.00	8.00	50.00	2.36	170.76
64	33-4	2.00	177.3	7.50	51.64	7.00	53.45	8.00	50.00	3.29	173.46
65	[illegible]	[illegible]	[illegible]	8.50	48.51	7.50	51.64	9.50	45.88	2.51	176.15
66	33-6	2.00	174.5	9.00	47.14	12.50	40.00	9.50	45.88	2.26	178.86
67	33-7	2.00	180.9	10.50	[illegible]	13.00	[illegible]	6.50	55.47	3.05	181.53
68	33-8	2.00	200.1	9.00	47.14	10.00	44.72	14.00	37.80	3.65	184.22
~~69~~	~~33-9~~	~~2.00~~	~~135.0~~	~~10.00~~	~~44.72~~	~~10.00~~	~~44.72~~	~~10.50~~	~~43.63~~	~~[illegible]~~	~~186.98~~
~~70~~	~~33-10~~	~~2.00~~	~~246.7~~	~~8.00~~	~~50.00~~	~~11.00~~	~~42.64~~	~~15.00~~	~~36.51~~	~~5.64~~	~~189.63~~
[illegible]	33-11	[illegible]	158.0	5.00	63.25	7.50	51.64	12.50	40.00	2.19	192.29
72	33-12	2.00	196.0	8.50	48.51	8.00	50.00	8.00	50.00	1.46	194.99
73	40-1	[illegible]	[illegible]	9.00	47.14	11.00	42.64	14.50	37.14	4.61	197.76
74	40-2	2.00	175.0	10.00	44.72	8.00	50.00	11.00	42.64	2.33	200.46
75	40-3	2.00	204.3	5.50	60.30	8.50	48.51	11.00	42.64	3.11	203.15
76	40-4	2.00	139.9	2.00	100.00	6.00	57.74	8.50	48.51	[illegible]	205.85
77	40-5	2.00	205.8	18.50	32.88	11.00	42.64	14.00	37.80	2.40	208.56
78	40-6	2.00	166.3	5.00	63.25	6.50	55.47	12.50	40.00	2.18	211.24
~~79~~	~~40-7~~	~~2.00~~	~~205.9~~	~~8.50~~	~~48.51~~	~~9.50~~	~~45.88~~	~~11.00~~	~~42.64~~	~~5.48~~	~~213.93~~
~~80~~	~~40-8~~	~~2.00~~	~~120.0~~	~~7.50~~	~~51.64~~	~~9.00~~	~~47.14~~	~~5.50~~	~~60.30~~	~~6.67~~	~~216.62~~
81	40-9	2.00	185.2	7.00	53.45	7.00	53.45	10.50	43.64	2.60	219.33
~~82~~	~~40-10~~	~~2.00~~	~~172.8~~	~~8.50~~	~~48.51~~	~~10.50~~	~~43.64~~	~~13.00~~	~~39.22~~	[illegible]	[illegible]
83	40-11	2.00	140.7	8.50	48.51	8.50	[illegible]	9.00	[illegible]	[illegible]	224.72
84	40-12	2.00	173.1	9.50	45.88	10.00	44.72	6.50	55.47	3.48	227.42
[illegible]	[illegible]	[illegible]	121.4	4.00	70.71	8.50	48.51	5.00	63.25	[illegible]	230.21
86	25-2	2.00	120.6	7.50	51.64	8.50	48.51	9.50	45.88	1.69	232.91
87	25-3	[illegible]	[illegible]	5.50	60.30	13.00	39.22	8.50	48.51	2.06	235.61
88	25-4	2.00	129.5	11.00	42.64	8.50	48.51	7.50	51.64	3.15	238.29
89	25-5	2.00	137.1	4.50	[illegible]	5.50	60.30	7.00	53.45	1.59	240.99
90	25-6	2.00	142.0	4.00	70.71	5.50	60.30	8.00	50.00	1.56	243.69
~~91~~	~~25-7~~	~~2.00~~	~~133.0~~	~~9.50~~	~~45.88~~	~~9.00~~	~~47.14~~	~~9.00~~	~~47.14~~	~~4.81~~	~~246.39~~

B65_11_092601
SS 9/27/14

JM 9/30/14

B65_11_092601.ASC

BSF Version	: 3
Instrument Type	: LS 6000
Data Capture Date	: 26 Sep 2014 14:47:44
User Filename	: C:\...\LS WINCONNECTION\DATA2\USER11\UN092601.BSF
User Number	: 11
User Id	: H-3,C-14,TC-99
User Comments	: LS 6500
Preset Count Time	: 2.00
Calculation Mode	: CPM
H# Selected	: YES
Sample Repeats	: 1
Printer Output Mode	: STD
Blank Count	: NO
IC# or SCR Selected	: NO
Replicates	: 1
RS232 Output Mode	: EDIT
Two-Phase Selected	: NO
AQC Choice	: NO
Cycle Repeats	: 1
Data Buffer Output Mode	: EDIT
Scintillator Choice	: LIQUID
Lumex Selected	: NO
Low Sample Reject Count	: 0
Low Level Selection	: YES
Half Life Correction Date	: none
Window Limits Window 1	: 50.00
Preset %Error Iso1	: 1.75
Norm Multiplier Iso1	: 1.00000
Background CPM 1	: 0.00
Window Limits Window 2	: 251.00
Preset %Error Iso2	: 1.75
Norm Multiplier Iso2	: 1.00000
Background CPM 2	: 0.00
Window Limits Window 3	: 401.00
Preset %Error Iso3	: 1.75
Norm Multiplier Iso3	: 1.00000
Background CPM 3	: 0.00

Sam	Rack	Time	H#	CPM Iso1	%Err1	CPM Iso2	%Err2	CPM Iso3	%Err3	LumEx	ElTime
1	56-1	2.00	123.8	11.00	42.64	7.00	53.45	9.50	45.88	13.41	2.64
2	56-2	2.00	124.4	8.00	50.00	6.00	57.74	6.50	55.47	4.13	5.39
3	56-3	2.00	120.0	6.00	57.74	8.00	50.00	4.00	70.71	4.32	8.07
4	56-4	2.00	118.6	6.50	55.47	7.50	51.64	8.50	48.51	4.57	10.73
5	56-5	2.00	110.8	7.00	53.45	7.00	53.45	8.00	50.00	4.41	13.41
6	56-6	2.00	121.5	9.00	47.14	5.50	60.30	8.50	48.51	4.46	16.12
7	56-7	2.00	110.6	6.50	55.47	9.50	45.88	7.00	53.45	5.01	18.81
8	56-8	2.00	128.8	6.00	57.74	5.00	63.25	7.00	53.45	4.28	21.51
9	56-9	2.00	114.9	6.50	55.47	9.50	45.88	8.00	50.00	3.77	24.20
10	56-10	2.00	123.8	10.00	44.72	7.00	53.45	7.50	51.64	3.56	26.90
11	56-11	2.00	137.7	11.50	41.70	8.00	50.00	9.50	45.88	2.74	29.60

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12	56-12	2.00	129.7	10.50	43.64	9.50	45.88	8.00	50.00	11.49	32.29
13	48-1	2.00	127.2	3.50	75.59	6.50	55.47	9.00	47.14	2.78	35.11
14	48-2	2.00	120.7	4.00	70.71	7.00	53.45	8.50	48.51	2.62	37.82
15	48-3	2.00	113.9	4.00	70.71	7.50	51.64	5.50	60.30	2.98	40.51
16	48-4	2.00	134.3	5.50	60.30	7.00	53.45	8.50	48.51	2.99	43.22
17	48-5	2.00	130.7	10.00	44.72	9.00	47.14	6.50	55.47	8.79	45.93
18	48-6	2.00	131.4	9.50	45.88	9.00	47.14	12.50	40.00	6.34	48.62
19	48-7	2.00	133.6	68.00	17.15	22.50	29.81	8.50	48.51	3.88	51.34
20	48-8	2.00	133.3	54.50	19.16	21.00	30.86	8.00	50.00	3.56	54.05
21	48-9	2.00	130.0	11.00	42.64	16.50	34.82	30.00	25.82	4.30	56.75
22	48-10	2.00	137.9	8.50	48.51	15.50	35.92	31.50	25.20	4.58	59.47
23	48-11	2.00	132.0	14.00	37.80	14.50	37.14	26.50	27.47	8.83	62.19
24	48-12	2.00	133.4	11.00	42.64	14.50	37.14	20.00	31.62	5.82	64.91
25	16-1	2.00	109.1	13.00	39.22	5.00	63.25	8.00	50.00	8.55	67.72
26	16-2	2.00	107.8	3.50	75.59	6.50	55.47	7.00	53.45	2.51	70.41
27	16-3	2.00	116.6	6.50	55.47	9.00	47.14	9.00	47.14	2.47	73.13
28	16-4	2.00	120.0	8.00	50.00	12.00	40.82	9.50	45.88	2.75	75.83
29	16-5	2.00	126.2	7.50	51.64	8.50	48.51	9.50	45.88	2.71	78.54
30	16-6	2.00	108.6	8.00	50.00	6.00	57.74	7.00	53.45	2.88	81.25
31	16-7	2.00	115.7	6.00	57.74	8.50	48.51	8.00	50.00	2.43	83.96
32	16-8	2.00	116.1	10.50	43.64	9.00	47.14	7.00	53.45	2.13	86.65
33	16-9	2.00	117.2	5.50	60.30	8.00	50.00	6.50	55.47	3.23	89.35
34	16-10	2.00	116.7	3.50	75.59	9.50	45.88	7.00	53.45	2.50	92.07
35	16-11	2.00	239.2	46.50	20.74	9.50	45.88	10.50	43.64	35.11	94.81
36	16-12	2.00	131.2	8.50	48.51	7.00	53.45	9.50	45.88	7.96	97.48
37	28-1	2.00	119.1	3.00	81.65	4.00	70.71	8.50	48.51	3.02	100.30
38	28-2	2.00	225.4	10.50	43.64	13.50	38.49	11.50	41.70	10.31	102.99
39	28-3	2.00	125.8	7.50	51.64	11.50	41.70	11.00	42.64	2.61	105.69
40	28-4	2.00	113.3	8.00	50.00	6.50	55.47	6.50	55.47	2.37	108.40
41	28-5	2.00	114.9	6.50	55.47	7.00	53.45	6.00	57.74	2.35	111.07
42	28-6	2.00	116.3	6.00	57.74	7.00	53.45	5.50	60.30	2.49	113.79
43	28-7	2.00	114.3	6.00	57.74	7.00	53.45	7.50	51.64		

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2.40	116.47								
44	28-8	2.00	112.7	6.50	55.47	12.00	40.82	6.00	57.74
2.24	119.16								
45	28-9	2.00	111.4	3.50	75.59	6.50	55.47	6.00	57.74
2.85	121.89								
46	28-10	2.00	119.8	8.50	48.51	9.00	47.14	5.00	63.25
2.36	124.61								
47	28-11	2.00	121.0	4.50	66.67	11.50	41.70	11.50	41.70
7.37	127.32								
48	28-12	2.00	112.0	4.00	70.71	7.50	51.64	5.50	60.30
3.08	130.04								
49	50-1	2.00	115.8	7.50	51.64	8.00	50.00	4.50	66.67
2.36	132.85								
50	50-2	2.00	128.0	6.00	57.74	9.50	45.88	5.50	60.30
2.59	135.55								
51	50-3	2.00	124.7	6.50	55.47	4.50	66.67	6.00	57.74
3.22	138.25								
52	50-4	2.00	118.4	6.50	55.47	9.50	45.88	7.00	53.45
2.19	140.97								
53	50-5	2.00	145.0	8.50	48.51	10.00	44.72	7.50	51.64
2.81	143.65								
54	50-6	2.00	111.0	6.50	55.47	4.00	70.71	11.50	41.70
2.76	146.34								
55	50-7	2.00	116.9	8.50	48.51	9.50	45.88	9.50	45.88
2.00	149.06								
56	50-8	2.00	115.8	2.50	89.44	7.00	53.45	7.00	53.45
2.61	151.75								
57	50-9	2.00	116.2	5.00	63.25	7.50	51.64	7.00	53.45
2.28	154.44								
58	50-10	2.00	133.1	7.00	53.45	7.00	53.45	16.00	35.36
5.65	157.15								
59	50-11	2.00	124.1	6.50	55.47	8.00	50.00	7.50	51.64
2.96	159.86								
60	50-12	2.00	165.0	8.50	48.51	7.50	51.64	10.00	44.72
7.72	162.57								
61	33-1	2.00	116.7	4.50	66.67	6.00	57.74	6.00	57.74
2.79	165.36								
62	33-2	2.00	115.0	7.00	53.45	9.00	47.14	4.50	66.67
2.41	168.07								
63	33-3	2.00	170.9	6.00	57.74	8.00	50.00	8.00	50.00
2.36	170.76								
64	33-4	2.00	177.3	7.50	51.64	7.00	53.45	8.00	50.00
3.29	173.46								
65	33-5	2.00	174.4	8.50	48.51	7.50	51.64	9.50	45.88
2.51	176.15								
66	33-6	2.00	174.5	9.00	47.14	12.50	40.00	9.50	45.88
2.26	178.86								
67	33-7	2.00	180.9	10.50	43.64	13.00	39.22	6.50	55.47
3.05	181.53								
68	33-8	2.00	200.1	9.00	47.14	10.00	44.72	14.00	37.80
3.65	184.22								
69	33-9	2.00	135.0	10.00	44.72	10.00	44.72	10.50	43.64
5.80	186.93								
70	33-10	2.00	246.7	8.00	50.00	11.00	42.64	15.00	36.51
5.64	189.61								
71	33-11	2.00	158.0	5.00	63.25	7.50	51.64	12.50	40.00
2.19	192.29								
72	33-12	2.00	196.0	8.50	48.51	8.00	50.00	8.00	50.00
1.46	194.99								
73	40-1	2.00	269.0	9.00	47.14	11.00	42.64	14.50	37.14
4.61	197.76								
74	40-2	2.00	175.0	10.00	44.72	8.00	50.00	11.00	42.64
2.33	200.46								

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TM 9/30/14

75	40-3	2.00	204.3	5.50	60.30	8.50	48.51	11.00	42.64	3.11	203.15
76	40-4	2.00	139.9	2.00	100.00	6.00	57.74	8.50	48.51	2.29	205.85
77	40-5	2.00	205.8	18.50	32.88	11.00	42.64	14.00	37.80	2.40	208.56
78	40-6	2.00	166.3	5.00	63.25	6.50	55.47	12.50	40.00	2.18	211.24
79	40-7	2.00	235.9	8.50	48.51	9.50	45.88	11.00	42.64	5.48	213.93
80	40-8	2.00	130.0	7.50	51.64	9.00	47.14	5.50	60.30	6.67	216.62
81	40-9	2.00	185.2	7.00	53.45	7.00	53.45	10.50	43.64	2.60	219.33
82	40-10	2.00	172.8	8.50	48.51	10.50	43.64	13.00	39.22	5.48	222.02
83	40-11	2.00	140.7	8.50	48.51	8.50	48.51	9.00	47.14	3.92	224.72
84	40-12	2.00	173.1	9.50	45.88	10.00	44.72	6.50	55.47	3.48	227.42
85	25-1	2.00	121.4	4.00	70.71	8.50	48.51	5.00	63.25	2.00	230.21
86	25-2	2.00	120.6	7.50	51.64	8.50	48.51	9.50	45.88	1.69	232.91
87	25-3	2.00	114.5	5.50	60.30	13.00	39.22	8.50	48.51	2.06	235.61
88	25-4	2.00	129.5	11.00	42.64	8.50	48.51	7.50	51.64	3.15	238.29
89	25-5	2.00	137.1	4.50	66.67	5.50	60.30	7.00	53.45	1.59	240.99
90	25-6	2.00	142.0	4.00	70.71	5.50	60.30	8.00	50.00	1.56	243.69
91	25-7	2.00	133.0	9.50	45.88	9.00	47.14	9.00	47.14	4.84	246.39

SS 9/27/14

9/30/14

ID:H-3,C-14,CO2 09 23 SEP 2014 13:30
USER:11 COMMENT:LS 6500
PRESET TIME : 2.00
DATA CALC : CPM H# :YES SAMPLE REPLATS: 1 PRINTER : STD
COUNT BLANK : NO [illegible] PREVIOUS : 1 RS232 :EDIT
TWO PHASE : NO AQC : NO CYCLE REPLATS : 1 DISK :EDIT
SCINTILLATOR: [illegible] NO SAMPLE REJ: 0
LOW LEVEL : YES HALF LIFE CORRECTION DATE: none

[illegible] 50.0 %ERROR: 1.75 FACTOR: 1.000000 BKG. SUB: 0
CHAN: 251.0 - 400.0 %ERROR: 1.75 FACTOR: 1.000000 BKG. SUB: 0
[illegible] 450.0 %ERROR: 1.75 FACTOR: 1.000000 BKG. SUB: 0

SAM NO	POS	TIME MIN	H#	WIND1 CPM	WIND1 %ERROR	WIND2 CPM	WIND2 %ERROR	WIND3 CPM	WIND3 %ERROR	LUMEX %	ELAPSED TIME
-1	13-1	2.00	137.7	4.00	70.71	7.50	51.64	8.00	50.00	0.91	2.60
	[illegible]	[illegible]	[illegible]	6.00	57.74	5.50	60.30	8.00	50.00	0.53	5.29
-3	13-3	2.00	132.6	7.50	51.64	9.50	45.88	5.50	60.30	0.89	7.98
-4	13-4	[illegible]	134.4	6.00	[illegible]	10.00	44.72	8.50	48.51	0.76	10.64
5	13-5	2.00	134.9	6.00	57.74	7.50	51.64	7.00	53.45	0.78	13.33
6	13-6	2.00	135.8	8.50	[illegible]	18.50	[illegible]	18.00	[illegible]	0.59	16.00
7	13-7	2.00	135.6	8.50	48.51	19.50	32.03	15.00	[illegible]	[illegible]	18.69
-8	13-8	2.00	119.1	7.50	51.64	6.50	55.47	9.00	[illegible]	0.91	21.38
9	13-9	2.00	235.3	11.50	[illegible]	13.00	[illegible]	15.50	[illegible]	7.88	24.07
10	13-10	[illegible]	132.6	6.00	57.74	11.50	41.70	7.50	51.64	0.74	[illegible]
11	13-11	[illegible]	[illegible]	7.50	51.64	9.50	45.88	10.50	43.64	1.88	29.43
12	13-12	2.00	131.4	5.50	60.30	6.00	57.74	6.00	57.74	0.82	32.11
13	10-1	[illegible]	137.3	5.50	60.30	6.00	57.74	8.00	50.00	1.10	[illegible]
14	10-2	2.00	172.8	3.00	81.65	[illegible]	[illegible]	6.50	[illegible]	1.19	37.58
15	10-3	2.00	138.5	4.50	66.67	9.50	45.88	7.50	51.64	0.98	40.28
16	10-4	[illegible]	249.5	6.00	57.74	7.50	51.64	10.00	[illegible]	0.84	42.96
17	10-5	2.00	230.2	8.50	48.51	9.50	45.88	11.00	42.64	1.18	45.64
[illegible]	[illegible]	[illegible]	[illegible]	5.50	60.30	9.00	47.14	7.50	51.64	1.61	48.34

B65_IL092801
SS
9/29/14 JPG 9/30/14

B65_11_092801.ASC

BSF Version	: 3
Instrument Type	: LS 6000
Data Capture Date	: 28 Sep 2014 13:27:00
User Filename	: C:\...\LS WINCONNECTION\DATA2\USER11\UN092801.BSF
User Number	: 11
User Id	: H-3,C-14,TC-99
User Comments	: LS 6500
Preset Count Time	: 2.00
Calculation Mode	: CPM
H# Selected	: YES
Sample Repeats	: 1
Printer Output Mode	: STD
Blank Count	: NO
IC# or SCR Selected	: NO
Replicates	: 1
RS232 Output Mode	: EDIT
Two-Phase Selected	: NO
AQC Choice	: NO
Cycle Repeats	: 1
Data Buffer Output Mode	: EDIT
Scintillator Choice	: LIQUID
Lumex Selected	: NO
Low Sample Reject Count	: 0
Low Level Selection	: YES
Half Life Correction Date	: none
Window Limits Window 1	: 50.00
Preset %Error Iso1	: 1.75
Norm Multiplier Iso1	: 1.00000
Background CPM 1	: 0.00
Window Limits Window 2	: 251.00
Preset %Error Iso2	: 1.75
Norm Multiplier Iso2	: 1.00000
Background CPM 2	: 0.00
Window Limits Window 3	: 401.00
Preset %Error Iso3	: 1.75
Norm Multiplier Iso3	: 1.00000
Background CPM 3	: 0.00

Sam	Rack	Time	H#	CPM Iso1	%Err1	CPM Iso2	%Err2	CPM Iso3	%Err3	LumEx	ElTime
1	13-1	2.00	137.7	4.00	70.71	7.50	51.64	8.00	50.00	0.91	2.60
2	13-2	2.00	119.5	6.00	57.74	5.50	60.30	8.00	50.00	0.53	5.29
3	13-3	2.00	132.6	7.50	51.64	9.50	45.88	5.50	60.30	0.89	7.98
4	13-4	2.00	134.4	6.00	57.74	10.00	44.72	8.50	48.51	0.76	10.64
5	13-5	2.00	134.9	6.00	57.74	7.50	51.64	7.00	53.45	0.78	13.33
6	13-6	2.00	135.8	8.50	48.51	18.50	32.88	18.00	33.33	0.59	16.00
7	13-7	2.00	135.6	8.50	48.51	19.50	32.03	15.00	36.51	0.59	18.69
8	13-8	2.00	119.1	7.50	51.64	6.50	55.47	9.00	47.14	0.91	21.38
9	13-9	2.00	235.3	11.50	41.70	13.00	39.22	15.50	35.92	7.88	24.07
10	13-10	2.00	132.6	6.00	57.74	11.50	41.70	7.50	51.64	0.74	26.74
11	13-11	2.00	225.4	7.50	51.64	9.50	45.88	10.50	43.64	1.88	29.43

SS 9/29/14 JP 9/30/14

12	13-12	2.00	131.4	5.50	60.30	6.00	57.74	6.00	57.74	0.82	32.11
13	10-1	2.00	137.3	5.50	60.30	6.00	57.74	8.00	50.00	1.10	34.91
14	10-2	2.00	172.8	3.00	81.65	9.00	47.14	6.50	55.47	1.19	37.58
15	10-3	2.00	138.5	4.50	66.67	9.50	45.88	7.50	51.64	0.98	40.28
16	10-4	2.00	249.5	6.00	57.74	7.50	51.64	10.00	44.72	0.84	42.96
17	10-5	2.00	230.2	8.50	48.51	9.50	45.88	11.00	42.64	1.18	45.64
18	10-6	2.00	175.7	5.50	60.30	9.00	47.14	7.50	51.64	1.61	48.34

Instrument ID: ***LS6500*** ***ALS***

Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
9/25/14	1409002-4	30	22 - 5	H_3 10mL	13	3H140922-1	SS	SS	NA
	-5		- 6						
	-6		- 7						
	-7		- 8						
	-8		- 9						
	-9		- 10						
	-10		- 11						
	-11		- 12						
	-12		16 - 1						
	3H140922-1CB2		- 2						
	1409002-13		- 3						
	-14		- 4						
	-15		- 5						
	-16		- 6						
	-17		- 7						
	-18		- 8						
	-19		- 9						
	-20		- 10						
	3H140922-1MB		- 11						
	-1LCS		- 12						
	-1LCSD		40 - 1						
	-1CB3		- 2						
9/26/14	Daily QC	10	1,3 - 1-3,1-2	—	13	—	SS	SS	NA
9/26/14	[14]	200	56 - 1	H_3 C14/C99	13	—	SS	SS	NA Lumex 75%
	140516-1		- 2						
	-2		- 3						
	-3		- 4						
	-4		- 5						
	-5		- 6						
	-6		- 7						

Analyst / Date GS 9/30/14

FORM 762r6.XLS (3/7/09)

Note: Each page is copied as completed and included with the workorder/run documentation; reviewed subsequently

Instrument ID: **LS6500** **ALS**

Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
9/22/14	1409516-7	2.00	56 - 8	H_2 CH$_4$ C$_2$H$_6$	11		SS	SS	MA Lumex 75d.
	-8		- 9						
	-9		- 10						
	-10		- 11						
	CB2		- 12						Lumex 75d
	1409516-11		48 - 1						
	-12		- 2						
	-13		- 3						
	-14		- 4						
	CB3		- 5						Lumex 75d.
	MB		- 6						
	LCS1		- 7						
	LCSD1		- 8						
	LCS2		- 9						
	LCSD2		- 10						
	LCS3		- 11						Lumex 75d.
	LCSD3		- 12						
	CB4		16 - 1						
	1409519-1		- 2						
	-2		- 3						
	-3		- 4						
	-4		- 5						
	-5		- 6						
	-6		- 7						
	-7		- 8						
	-8		- 9						
	-9		- 10						
	-10		- 11						Lumex 75d.
	CB5		- 12						
	1409519-11		28 - 1						

Analyst / Date SS 9/30/14

FORM 762r6.XLS (3/7/09)

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Instrument ID: **LS6500** **ALS**

Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
9/26/14	1409519-12	200	28 - 2	H, CH, IEH	11	—	SS	SS	NA Lumex 75°C
	-13		- 3						
	-14		- 4						
	-15		- 5						
	-16		- 6						
	-17		- 7						
	-18		- 8						
	-19		- 9						
	-20		- 10						
	CB6		- 11						Lumex 75°C
	1409519-21		- 12						
	-22		50 - 1						
	-23		- 2						
	-24		- 3						
	-25		- 4						
	-26		- 5						
	-27		- 6						
	-28		- 7						
	-29		- 8						
	-30		- 9						
	CB7		- 10						Lumex 75°C
	1409519-31		- 11						
	-32		- 12						Lumex 75°C
	-33		33 - 1						
	-34		- 2						
	-35		- 3						
	-36		- 4						
	-37		- 5						
	-38		- 6						
	-39		- 7						

Analyst / Date SS 9/30/14

FORM 762r6.XLS (3/7/09)

Note: Each page is copied as completed and included with the workorder/run documentation; reviewed subsequently

Instrument ID: **LS6500** **ALS**

Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
9/26/14	1409519-40	200	33 - 8	H_3,^{14}C,Gr^{99}	11	———	SS	SS	NA
	CB8		- 9						LUMEX 75%
	1409519-41		- 10						
	-42		- 11						
	-43		- 12						
	-44		40 - 1						
	-45		- 2						
	-46		- 3						
	-47		- 4						
	-48		- 5						
	-49		- 6						
	-50		- 7						LUMEX 75%
	CB1		- 8						
	1409519-51		- 9						
	-52		- 10						LUMEX 75%
	-53		- 11						
	-54		- 12						
	-55		25 - 1						
	-56		- 2						
	-57		- 3						
	-58		- 4						
	-59		- 5						
	-60		- 6						
	CB2		- 7						LUMEX 75%
9/26/14	Daily QC	10	43 - 1-3,1-2	—	43	———	SS	SS	NA
9/26/14	RN140926-1CB1	70	46 - 1	Rn222	11	RN140926-1	SS	SS	NA
	-1LCS	9.80	- 2						
	-1MB1	70	- 3						
	1409535-1		- 4						
	-1REP		- 5						

Analyst / Date SS 9/30/14

FORM 762r6.XLS (3/7/09)

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Instrument ID: ***LS6500*** ***ALS***

Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
9/28/14	1409036-4	30	21 - 3	TC99	2	TC140922-2	SS	SS	NA
	-9		- 4						
	1409061-4		- 5						
	1409062-4		- 6						
	-13		- 7						
	1409243-4	9.80	- 8						
	-9	27.25	- 9						
	-14	30	- 10						
	1409311-4		- 11						
	-6		- 12						
	-7		60 - 1						
	-10		- 2						
	-18		- 3						
	-22		- 4						
	-23	25.65	- 5						
	1409337-4	30	- 6						
	-9		- 7						
	-14		- 8						
	-19		- 9						
	TC140922-2 CS		- 10						
	TC140922-1CB3, -2CB3	60	26 - 1		8	TC140922-1, -2			
9/28/14	Daily QC	10	43 - L3, 1-2	—	1,3	—	SS	SS	NA
9/28/14	CB1	2.00	13 - 1	H, CH, TC99	11	—	SS	SS	NA
	1409516-6		- 2						
	CB2		- 3						
	CB3		- 4						
	MB		- 5						
	LCS 3		- 6						
	LCSD 3		- 7						
	CB4		- 8						

Analyst / Date SS 9/30/14

FORM 762r6.XLS (3/7/09)

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Instrument ID: **LS6500** **ALS**

Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
9/28/14	1409514-10	2.00	13 - 9	H_3,CM,TCM	11	—	SS	SS	NA
	CB5		- 10						
	1409519-12		- 11						
	CB6		- 12						
	CB7		10 - 1						
	1409519-32		- 2						
	CB8		- 3						
	1409519-41		- 4						
	-50		- 5						
	-52		- 6						
9/29/14	Daily QC	10	13 -1-3,1-2	—	1,3	—	SS	SS	NA
			-						
			-						
			-						
			-						
			-						
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			-						

Analyst / Date SS 9/30/14 SS 9/30/14

FORM 762r6.XLS (3/7/09)

Note: Each page is copied as completed and included with the workorder/run documentation; reviewed subsequently

FieldID	LabID	Standard Info.	Sample Date	Sample Time	Additional DI (mL)	Rack/Position	Nitromethane
	CB1		9/24/2014	1030		56-1	5
RSARTFFS 800	1409516-1		9/24/2014	1100		-2	
RSARTFFS 801	1409516-2		9/24/2014	1245		-3	
RSARTFFS 802	1409516-3		9/24/2014	1255		-4	
RSARTFFS 803	1409516-4		9/24/2014	1300		-5	
RSARTFFS 804	1409516-5		9/24/2014	1305		-6	
RSARTFFS 805	1409516-6		9/24/2014	1310		-7	
RSARTFFS 806	1409516-7		9/24/2014	1315		-8	
RSARTFFS 807	1409516-8		9/24/2014	1320		-9	
RSARTFFS 808	1409516-9		9/24/2014	1325		-10	
RSARTFFS 809	1409516-10		9/24/2014	1335		-11	
	CB2					-12	5
RSARTFFS 810	1409516-11		9/24/2014	1335		48-1	
RSARTFFS 811	1409516-12		9/24/2014	1345		-2	
RSARTFFS 812	1409516-13		9/24/2014	1350		-3	
RSARTFFS 813	1409516-14		9/24/2014	1400	+1.15	-4	
	CB3					-5	5
	MB					-6	
	LCS 1	S1				-7	
	LCSD 1	S1				-8	
	LCS 2	S2				-9	
	LCSD 2	S2				-10	
	LCS 3	S3				-11	
	LCSD3	S3				-12	
	~~CB6~~ CB4					16-1	5

13-1
13-2
13-3
13-4
13-5
13-6
13-7
13-8

~~B~~ 9/26/14

exp:

Standards Information

		Standard ID	Aliquot	Pipette	Reference Date	Activity (DPM)
S1	^{3}H	648.4095.58 7/23/15	0.1 mL	RS-013	9/3/1998	6936.91
S2	^{99}Tc	898.3610.39 7/13/15	0.1 mL	RS-013	6/29/2009	496.88
S3	^{14}C	617.4095.54 7/16/15	0.1 mL	RS-013	4/18/2002	283.94

UG-LLT Lot # 97-14192

Spiked By: _____ Date: 9/26/14

Witnessed By: _____ Date: 9/26/2014

Tritium Swipe (Glass Vial) Efficiency and Background Determination (LS6500)
11/12/2013

Standard : 699.3020.95
Ref. Date : 9/3/1998
Spike Act. : 160351.04 dpm/mL
Spike Vol. : 0.1 mL

Bkg. Coefficients	
Ax=	2.9159E-03
B=	5.0032E+00

Efficiency Coefficients	
Ax^2	8.4742E-07
Bx=	-1.2872E-03
C=	3.3865E-01

Non-Spiked/ Background

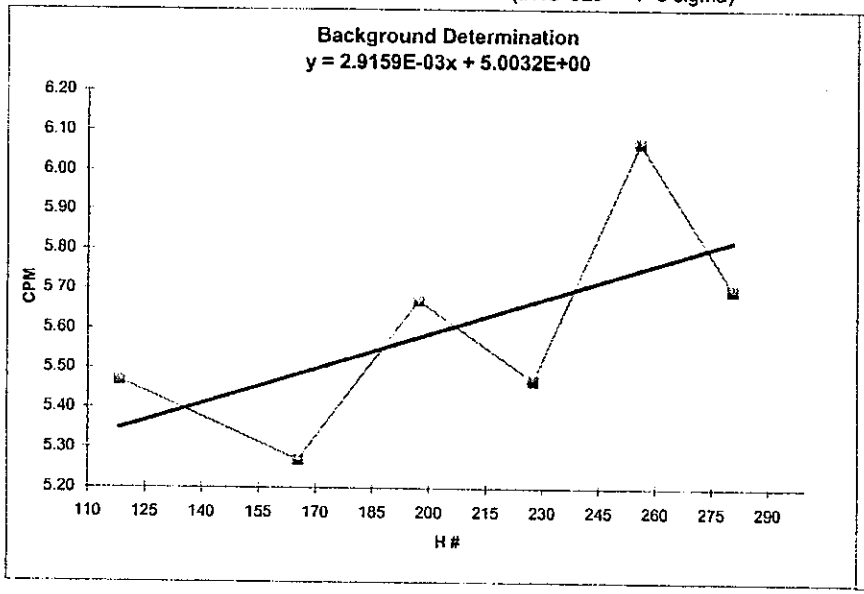
Sample ID	Ct. Dur.(m)	H #	CPM	Calc. Bkg.	Sigma Diff.
3H120813-1AMB	30.00	118.4	5.47	5.35	-0.57
3H120813-1BMB	30.00	165.4	5.27	5.49	1.03
3H120813-1CMB	30.00	197.2	5.67	5.58	-0.42
3H120813-1DMB	30.00	227.6	5.47	5.67	0.92
3H120813-1EMB	30.00	256.0	6.07	5.75	-1.42
3H120813-1FMB	30.00	280.6	5.70	5.82	0.56

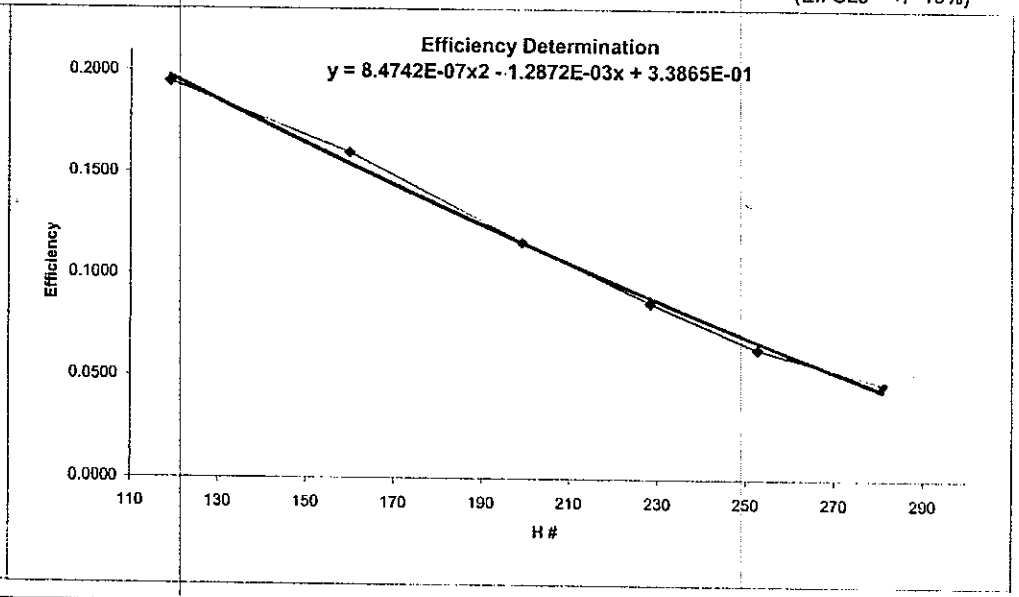
(BKG CLs = +/- 3 sigma)

Spiked / Efficiency

Sample ID	H #	CPM	Corr. Bkgd.	Corr. CPM	DPM	Efficiency	Calc. Eff.	% Diff.
1220006-1	119.0	1331.90	5.35	1326.55	6811.69	0.1947	0.1975	1.40%
1220006-2	159.9	1095.00	5.47	1089.53	6811.69	0.1600	0.1545	-3.41%
1220006-3	199.2	796.53	5.58	790.95	6811.69	0.1161	0.1159	-0.22%
1220006-4	228.4	593.30	5.67	587.63	6811.69	0.0863	0.0889	3.01%
1220006-5	252.7	440.70	5.74	434.96	6811.69	0.0639	0.0675	5.69%
1220006-6	281.0	326.70	5.82	320.88	6811.69	0.0471	0.0439	-6.89%

(Eff CLs = +/- 10%)





Quench Control Limits	
Lower	119.0
Upper	280.6

Analysis Window Settings
WIN 1 (50-250)
WIN 2 (251-400)
WIN 3 (401-550)

Nili Sandley
Instrument Technician

1/9/14
Date

Supervisory Review

1-9-14
Date

I:\Oprtns\RAD\INST\LSC\LS6500\CALIBRATIONS\QUENCH CURVES\2013\11.12.13_H3_swipes_QCurve(H3,C14,TC99)

Carbon-14 Swipe (Glass Vial) Efficiency and Background Determination (LS6500)
12/21/2013

Standard : 712.2613.23
Ref. Date : 7/22/2003
Spike Act. : 227723.94 dpm/mL
Spike Vol. : 0.1 mL

Non-Spiked/ Background

Bkg. Coefficients	
Ax=	1.5016E-02
B=	6.0333E+00

Sample ID	Ct. Dur.(m)	H #	CPM	Calc. Bkg.	Sigma Diff.
C120813-1AMB	30.00	113.7	7.53	7.74	0.84
C120813-1BMB	30.00	163.4	8.80	8.49	-1.16
C120813-1CMB	30.00	195.5	8.47	8.97	1.88
C120813-1DMB	30.00	226.0	9.93	9.43	-1.75
C120813-1EMB	30.00	247.5	10.27	9.75	-1.78
C120813-1FMB	30.00	274.6	9.53	10.16	2.22

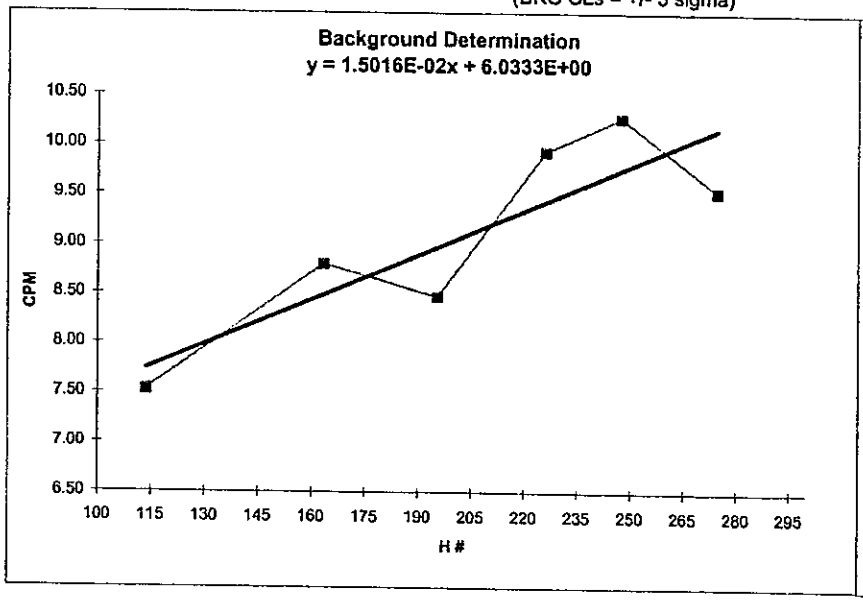
(BKG CLs = +/- 3 sigma)

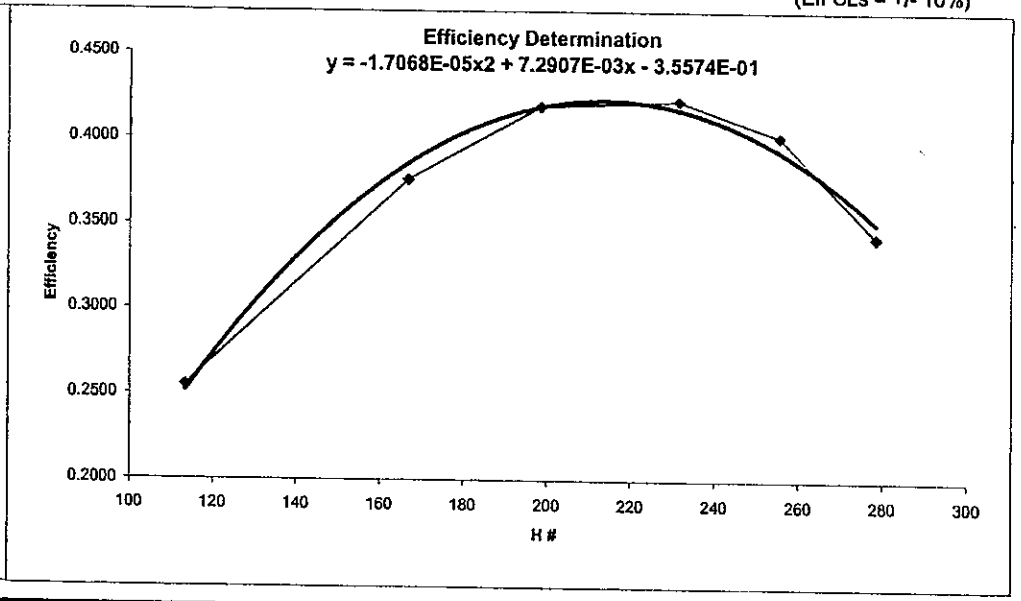
Spiked / Efficiency

Efficiency Coefficients	
Bx^2	-1.7068E-05
Cx=	7.2907E-03
D=	-3.5574E-01

Sample ID	H #	CPM	Corr. Bkgd.	Corr. CPM	DPM	Efficiency	Calc. Eff.	% Diff.
1220008-1	113.4	5814.36	7.74	5806.62	22743.71	0.2553	0.2515	-1.48%
1220008-2	166.7	8554.96	8.54	8546.42	22743.71	0.3758	0.3853	2.54%
1220008-3	198.4	9538.92	9.01	9529.91	22743.71	0.4190	0.4189	-0.03%
1220008-4	231.4	9617.21	9.51	9607.70	22743.71	0.4224	0.4174	-1.19%
1220008-5	255.4	9143.25	9.87	9133.38	22743.71	0.4016	0.3930	-2.14%
1220008-6	278.4	7814.07	10.21	7803.86	22743.71	0.3431	0.3511	2.33%

(Eff CLs = +/- 10%)





Quench Control Limits	
Lower	113.7
Upper	274.6

Analysis Window Settings
WIN 1 (50-250)
WIN 2 (251-400)
WIN 3 (401-550)

Instrument Technician

1/15/14
Date

Supervisory Review

1-14-14
Date

I:\Oprtns\RAD\INST\LSC\LS6500\CALIBRATIONS\QUENCH CURVES\2013\12.21.13_C14_swipes_QCurve(H3,C14,TC99)

Technetium-99 Swipe (Glass Vial) Efficiency and Background Determination (LS6500)
1/14/2014

Standard : 561.2613.88
Ref. Date : 9/1/1996
Spike Act. : 508.50 dpm/mL
Spike Vol. : 3.0 mL

Bkg. Coefficients	
Ax=	1.9639E-02
B=	4.7296E+00

Efficiency Coefficients	
Bx^2	-2.3819E-05
Cx=	8.0708E-03
D=	-2.4256E-01

Non-Spiked/ Background

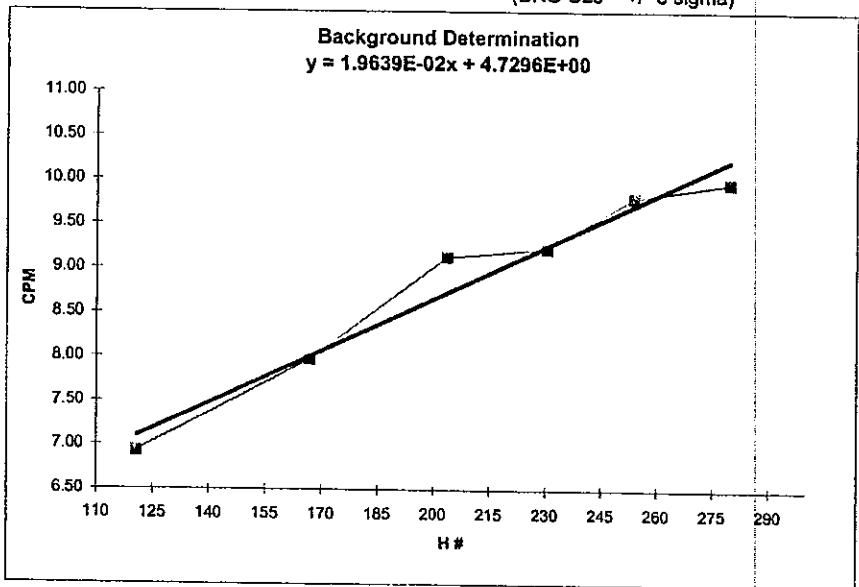
Sample ID	Ct. Dur.(m)	H #	CPM	Calc. Bkg.	Sigma Diff.
TA120423-1AMB	30.00	120.8	6.93	7.10	0.72
TA120423-1BMB	30.00	166.9	7.97	8.01	0.14
TA120423-1CMB	30.00	203.6	9.13	8.73	-1.46
TA120423-1EMB	30.00	230.5	9.23	9.26	0.10
TA120423-1FMB	30.00	253.8	9.80	9.71	-0.30
TA120423-1GMB	30.00	279.7	9.97	10.22	0.88

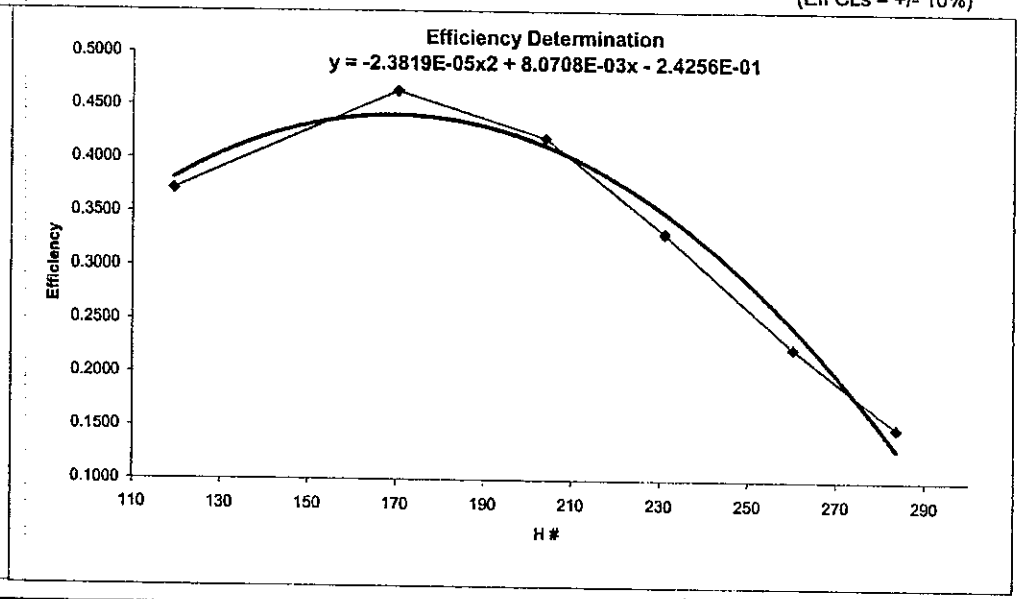
(BKG CLs = +/- 3 sigma)

Spiked / Efficiency

Sample ID	H #	CPM	Corr. Bkgd.	Corr. CPM	DPM	Efficiency	Calc. Eff.	% Diff.
1216014-1	119.4	573.53	7.07	566.46	1525.41	0.3713	0.3815	2.74%
1216014-2	170.4	715.83	8.08	707.75	1525.41	0.4640	0.4411	-4.93%
1216014-3	204.1	648.90	8.74	640.16	1525.41	0.4197	0.4125	-1.72%
1216014-4	231.2	514.10	9.27	504.83	1525.41	0.3309	0.3502	5.82%
1216014-5	260.3	351.37	9.84	341.53	1525.41	0.2239	0.2444	9.15%
1216014-6	283.7	239.00	10.30	228.70	1525.41	0.1499	0.1300	-13.27% *

(Eff CLs = +/- 10%)





Quench Control Limits	
Lower	120.8
Upper	279.7

Analysis Window Settings
WIN 1 (50-250)
WIN 2 (251-400)
WIN 3 (401-550)

*Excursion acceptable; calibration used for swipe screening. NEJ 1/15/14

Instrument Technician — 2/7/14 Date

Supervisory Review — 2-6-14 Date

I:\Oprtns\RAD\INST\LSC\LS6500\CALIBRATIONS\QUENCH CURVES\2014\1.14.14_Tc99_swipes_QCurve(H3,C14,TC99)

DAILY INSTRUMENT PERFORMANCE CHECKS - LS6500 (LL OFF, LUMEX OFF)

Daily IPCs consist of the following standards;

Efficiency Check -

Eckert&Ziegler Tritium Standard		**Eckert&Ziegler C-14 Standard**	
Lot H92218		Lot 92228	
101700.00	dpm	102420.00	dpm
3/4/2013	REF	3/4/2013	REF
3/4/2018	EXP	3/4/2018	EXP

Historical Control Limits	as of 03/25/13 JP	
	Decay Corrected Tritium	Carbon-14
UCL (3 sigma)	66070.55	81980.18
UWL (2 sigma)	64497.44	80028.27
Mean Value	62924.33	78076.36
LWL (2 sigma)	61351.22	76124.45
LCL (3 sigma)	59778.11	74172.54

Instrument re-calibrated for all tests starting 11/14/2012.

			Decay Corrected			
Obs	Date	H-3 CPM	H-CPM	PASS?	C-14 CPM	PASS?
507	9/26/2014	56258.30	61448.23	OK	78528.3	OK
508	9/26/2014	56257.70	61447.58	OK	78544.4	OK
509	9/27/2014	56332.30	61538.57	OK	78548.7	OK
510	9/28/2014	56328.80	61544.26	OK	78588.6	OK
511	9/29/2014	56410.10	61642.61	OK	78544.2	OK

DAILY CHECK LL ON ^{99}Tc SOURCE- LS6500

^{99}Tc standard		SPIKE	
836.3020.70		KNOWN ACTIVITY AS OF 2/26/07	
2/12/2014	REF	58000.38	dpm/g
2/12/2015	EXP	58000.38	dpm

Historical Control Limits 2/19/14 NES

	blank	Blank Quench #	spike
UCL (3 sigma)	21.1869	68.5218	12454.2597
UWL (2 sigma)	19.6736	66.7343	12164.6258
Mean Value	16.8150	59.5842	11585.3579
LWL (2 sigma)	13.8892	52.7320	11006.0900
LCL (3 sigma)	12.4263	50.4678	10716.4561

Obs #	Date	Blank C.R.	Pass ?	Quench #	Pass	Spiked C.R.	Pass ?
507	9/26/2014	15.6	OK	57	OK	11834.1	OK
508	9/26/2014	15	OK	57.4	OK	11735.5	OK
509	9/27/2014	17.5	OK	57.9	OK	11589.1	OK
510	9/28/2014	16	OK	57.1	OK	11717.2	OK
511	9/29/2014	13.2	LWL	57.8	OK	11815.4	OK

LS6500 Tritium Swipe in Glass Vial Background Determination

Interim control limits are established from the initial calibration for the geometry of interest. Limits are +/- 3 standard deviations from the initial unquenched calibration blank data. Once enough historical data is acquired, new historical limits are set as follows: Control limits for reagent blanks are established from 30 individual historical data points (10 batches). Limits are +/- 3 standard deviations from 30 individual historical data points. Individual reagent blanks and the average of reagent blanks from each batch are in control if the Count Rate (CPM) is within the established control limits.

CURRENTLY UNDER INTERIM LIMITS!

Updated on 11/14/13 NES

							Individual Reagent Blanks			Average of Reagent Blanks		
COUNT DATE	#	Sample ID	Count Duration (m)	Count Rate (CPM)	Total Cts.	Mean	LCL	UCL	Pass ?	LCL	UCL	Pass ?
9/26/2014	19	CB1	2	4	8.00		3.78	7.46	PASS			
9/26/2014	20	CB2	2	7.5	15.00		3.78	7.46	HIGH			
9/26/2014	21	CB3	2	6.00	12.00	5.83	3.78	7.46	PASS	3.78	7.46	PASS
9/26/2014	22	CB4	2	7.5	15.00		3.78	7.46	HIGH			
	23											
	24					7.50				3.78	7.46	HIGH

LS6500 Carbon-14 Swipe in Glass Vial Background Determination

Interim control limits are established from the initial calibration for the geometry of interest. Limits are +/- 3 standard deviations from the initial unquenched calibration blank data. Once enough historical data is acquired, new historical limits are set as follows: Control limits for reagent blanks are established from 30 individual historical data points (10 batches). Limits are +/- 3 standard deviations from 30 individual historical data points. Individual reagent blanks and the average of reagent blanks from each batch are in control if the Count Rate (CPM) is within the established control limits.

CURRENTLY UNDER INTERIM LIMITS!

			Updated on 1/14/14 NES				Individual Reagent Blanks			Average of Reagent Blanks		
COUNT DATE	#	Sample ID	Count Duration (m)	Count Rate (CPM)	Total Cts.	Mean	LCL	UCL	Pass ?	LCL	UCL	Pass ?
9/26/2014	16	CB1	2	7.5	15.00		6.66	11.30	PASS			
9/26/2014	17	CB2	2	9.5	19.00		6.66	11.30	PASS			
9/26/2014	18	CB3	2	10.00	20.00	9.00	6.66	11.30	PASS	6.66	11.30	PASS
9/26/2014	19	CB4	2	6.5	13.00		6.66	11.30	LOW			
	20											
	21					6.50				6.66	11.30	LOW

LS6500 Tc-99 Swipe in Glass Vial Background Determination

Interim control limits are established from the initial calibration for the geometry of interest. Limits are +/- 3 standard deviations from the initial unquenched calibration blank data. Once enough historical data is acquired, new historical limits are set as follows: Control limits for reagent blanks are established from 30 individual historical data points (10 batches). Limits are +/- 3 standard deviations from 30 individual historical data points. Individual reagent blanks and the average of reagent blanks from each batch are in control if the Count Rate (CPM) is within the established control limits.

CURRENTLY UNDER INTERIM LIMITS!

			Updated on 1/15/14 NES				Individual Reagent Blanks			Average of Reagent Blanks		
COUNT DATE	#	Sample ID	Count Duration (m)	Count Rate (CPM)	Total Cts.	Mean	LCL	UCL	Pass ?	LCL	UCL	Pass ?
9/26/2014	16	CB1	2	8	16.00		6.13	10.61	PASS			
9/26/2014	17	CB2	2	5.5	11.00		6.13	10.61	LOW			
9/26/2014	18	CB3	2	8.50	17.00	7.33	6.13	10.61	PASS	6.13	10.61	PASS
9/26/2014	19	CB4	2	9	18.00		6.13	10.61	PASS			
	20											
	21					9.00				6.13	10.61	PASS

SURVEY UNIT RSARTFSS

INSTRUMENT CALIBRATION
AND QA/QC DATA

PORTABLE INSTRUMENT RESPONSE CHECK SHEET

Page ___ of ___

Instrument: E-600 Serial No: 3689 Probe: 43-89 Serial No: 312071

Cal. Due Date: 12-02-2014 Response Check Location: Room 2138

βγ Channel

Source Isotope: C-14 Source ID: 4459 Source Jig ID: EPA

Source Reference Reading: 1176.2 Kcpm +20% 1771 Kcpm -20% 1181 Kcpm

Bkgd Reference Reading: 184.2 cpm +20% 221.04 cpm -20% 147.36 cpm

Response Checks

Date/Time	βγ Bkgd.	βγ Reading	Remarks	Initials
9-16-14 1000	204 cpm	1.414 Kcpm	Good	RC
9-16-14 1645	191 cpm	1.425 Kcpm	Good	RC
9-17-14 0725	164 cpm	1.494 Kcpm	Good	RC
9-17-14 1640	195 cpm	1,443 Kcpm	Good	RC
9-18-14 0730	183 cpm	1471 Kcpm	Good	RC
9-18-14 1700	175 cpm	1,390 Kcpm	Good	RC
9-19-14 0715	162 cpm	1,656 Kcpm	Good	RC
9-19-14 1610	204 cpm	1,467 Kcpm	Good	RC
9-22-14 0715	193, cpm	1,574 Kcpm	Good	RC
9-22-14 1615	209 cpm	1,515 Kcpm	Good	RC
9-23-14 0730	190 cpm	1,511 Kcpm	Good	RC
9-23-14 1625	168 cpm	1,506 Kcpm	Good	RC
9-24-14 0720	167 cpm	1,516 Kcpm	Good	RC
9-24-14 1820	185 cpm	1,466 Kcpm	Good	RC
9-25-14 0715	193 cpm	1,573 Kcpm	Good	RC

Review: [signature] Date: 9/29/14

FRN-0005

INSTRUMENT QC CHECK SHEET

Date: 9-6-14 Time: 1000

Instrument: E-600 Serial No: 3689

Probe: 43-89 Serial No: 312071

Cal. Performed Date: 12-02-2013 Cal. Due Date: 12-02-2014

Source Isotope: C-14 Source #: ____

QC Check Location: Room 2138

Jig Used: Yes No (circle one) Jig ID# ____

QC Counting Results	
Count No.	Count Result
1	1508
2	1446
3	1484
4	1460
5	1483
	Add results, list in Total
Total	7381
	Divide the total by 5
Source Reference Reading (Average)	1476.2

Range Calculation

Source Ref. Reading: 1476.2 X 20% = 295.24

Avg. + 20% = 1771.44

Avg. - 20% = 1180.96

Acceptable Range:

From 1181 Kcpm (Avg. - 20%) to 1771 Kcpm (Avg. + 20%)

Comments: BKg REF: 184.2 cpm x 20% = 36.84

AVG + 20% = 221.04 AVG - 20% = 147.36

From 147cpm TO 221 cpm

Performed By: JOSEPH E. MEDELLIN Date: 9.16.14

RSO Review: Date: 9/16/14

RSCS
Radiation Safety & Control Services

Calibration Certificate
ID Number: 31207179772-2

Customer: Joan Ervey
Radiation Safety & Control Services, Inc.
91 Portsmouth Avenue
Stratham, NH 03885

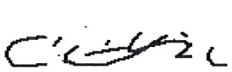
Instrument	Serial Number
Ludlum Model 43-89	312071

Probe Model & SN	Isotope	Efficiency	NIST Source ID	Geometry
Internal Probe	C-14	0.0091 C/D	C-14 (SN: 488-10-9)	On Contact
Internal Probe	Cs-137	0.2162 C/D	Cs-137(Beta) (SN: 98CS5004751)	@1cm
Internal Probe	Cs-137	0.2536 C/D	Cs-137(Beta) (SN: 98CS5004751)	On Contact
Internal Probe	Sr/Y-90	0.1989 C/D	Sr/Y-90 (SN: 63962 (Beta))	On Contact
Internal Probe	Tc-99	0.0793 C/D	Tc-99 (SN: 63963 (Beta))	@1cm
Internal Probe	Tc-99	0.0853 C/D	Tc-99 (SN: 63963 (Beta))	On Contact
Internal Probe	Co-60	0.0934 C/D	Tc-99 (SN: 63963 (Beta))	On Contact
Internal Probe	Th-230	0.0966 C/D	Th-230 (SN: S-963)	@1cm
Internal Probe	Th-230	0.2012 C/D	Th-230 (SN: S-963)	On Contact

Outer Physical Check: *Pass*
Tap Test: *Pass*

Electronics Checks	As Found	As Left
High Voltage	771 Volts	771 Volts

Comments: Calibrated with E-600 SN 3689 (Calibration Due Date = 12/02/2014) Added Cs-137 efficiencies 7/29/14 dsc. Added C-14, Sr-90 and Co-60 9/12/14 dsc.

Calibrated by:  QA Review: 

Date: 06/17/2014
Expires: 06/17/2015

Atmospheric Conditions - Temperature: 72° F Humidity: 29% Barometric Pressure:29.94 in/hg

This calibration was performed by RSCS using one or more of the following NIST Traceable radiation sources:
Tech Ops Model 773 Cs-137 Beam Calibrator (S/N S-1110), characterized using Exradin Model A6 (S/N 185) and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-008, with estimated uncertainty of 6.0%.
J.L. Shepherd and Associates Model 89 Cs-137 Box Calibrator (S/N 9141), characterized using Exradin, Model A6 (S/N 185), A3 (S/N 197), A12 (S/N XA091124), and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-001, with estimated uncertainty of 2.7%.
RSCS Neutron Calibrator, AmBe Source Model NUMEC-AM-31 (S/N Am-478), characterized using Far West Technologies Model FWAD-1 "HAWK" TEPC (S/N 021) in accordance with the methods specified in RSCS TSD 13-002, with estimated uncertainty of 9.4%
Calibrations performed in conformance to the following documents: ANSI N323A (1997); RSCS New Hampshire Radioactive Material License Number 381R. RSCS calibration services are performed in accordance with the RSCS Radiation Protection Program Manual and Standard Operating Procedures.
Calibration Laboratory is operated in accordance with ANSI/NCSL Z540-1-1994

RSCS
Radiation Safety & Control Services

Calibration Certificate
ID Number: 368974112-1

Customer: Joan Ervey
Radiation Safety & Control Services, Inc.
91 Portsmouth Avenue
Stratham, NH 03885

Instrument
Eberline Model E-600

Serial Number
3689

Precision Check				
Test 1	Test 2	Test 3	Mean	Results
7.98 Kcpm	7.98 Kcpm	8.01 Kcpm	7.99 Kcpm	Satisfactory

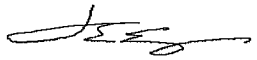
Accuracy Check			
Range	Target Value	As Found	As Left
100K	80 Kcpm	80.7 Kcpm #	80.47 Kcpm #
100K	20 Kcpm	19.85 Kcpm #	19.85 Kcpm #
10K	8 Kcpm	7.98 Kcpm #	7.98 Kcpm #
10K	2 Kcpm	1.996 Kcpm #	1.996 Kcpm #
1K	800 cpm	801 cpm #	801 cpm #
1K	200 cpm	201 cpm #	201 cpm #

Readings with * indicate ranges where As-Found readings are >20% of Target value. Readings with ** indicate As-left readings are >10.00% of Target value
Readings with # indicate ranges where pulser was used.

MTE Instrument Type	Model	CalDueDate
Pulser	Ludlum 500-4 SN: 98756	07/07/2015

Outer Physical Check: *Pass*
Tap Test: *Pass*

Electronics Checks	As Found	As Left
High Voltage	**898 Volts**	**898 Volts**

Calibrated by: 
QA Review: 

Calibration Date: 12/02/2013
Expires: 12/02/2014

Atmospheric Conditions - Temperature: 71°F Humidity: 19% Barometric Pressure: 29.90"hg

This calibration was performed by RSCS using one or more of the following NIST Traceable radiation sources:
Tech Ops Model 773 Cs-137 Beam Calibrator (S/N S-1110), characterized using Exradin Model A6 (S/N 185) and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-008, with estimated uncertainty of 6.0%.
J.L. Shepherd and Associates Model 89 Cs-137 Box Calibrator (S/N 9141), characterized using Exradin, Model A6 (S/N 185), A3 (S/N 197), A12 (S/N XA091124), and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-001, with estimated uncertainty of 2.7%.
RSCS Neutron Calibrator, AmBe Source Model NUMEC-AM-31 (S/N Am-478), characterized using Far West Technologies Model FWAD-1 "HAWK" TEPC (S/N 021) in accordance with the methods specified in RSCS TSD 13-002, with estimated uncertainty of 9.4%
Calibrations performed in conformance to the following documents: ANSI N323A (1997); RSCS New Hampshire Radioactive Material License Number 381R. RSCS calibration services are performed in accordance with the RSCS Radiation Protection Program Manual and Standard Operating Procedures.
Calibration Laboratory is operated in accordance with ANSI/NCSL Z540-1-1994

PORTABLE INSTRUMENT RESPONSE CHECK SHEET

Page ___ of ___

Instrument: E600 Serial No: 01274 Probe: 43-89 Serial No: 223946

Cal. Due Date: 12·6·14 Response Check Location: RM 2138

βγ Channel

Source Isotope: C14 Source ID: 4459 Source Jig ID: N/A

Source Reference Reading: 2.238 kcpm +20% 2.69 kcpm -20% 1.79 kcpm

Bkgd Reference Reading: 229.8 cpm +20% 276 cpm -20% 184 cpm

Response Checks

Date/Time	βγ Bkgd.	βγ Reading	Remarks	Initials
9-17-14 0815	229 cpm	2.16Kcpm	Good	RC
9-17-14 1650	221 cpm	2.14Kcpm	Good	RC
9-18-14 0730	210 cpm	2.11Kcpm	Good	RC
9-18-14 1710	209 cpm	2.19Kcpm	Good	RC
9-19-14 0730	219 cpm	2.16Kcpm	Good	RC
9-19-14 1615	195 cpm	2.16Kcpm	Good	RC
9-22-14 0725	202 cpm	2.17KCPM	Good	RC
9-22-14 1610	219 cpm	1.99Kcpm	Good	RC
9-23-14 0730	201 cpm	2.00Kcpm	Good	RC
9-23-14 1615	203 cpm	2.21Kcpm	Good	RC
9-24-14 0730	205 cpm	2.23Kcpm	Good	RC
9-24-14 1825	209 cpm	2.17Kcpm	Good	RC
9-25-14 0700	193 cpm	2.26KCPM	Good	RC

Review: [signature] Date: 9/29/14

FRN-0005

INSTRUMENT QC CHECK SHEET

Date: 9·17·14 Time: 0800

Instrument: E 600 Serial No: 01274

Probe: 43-89 Serial No: 223946

Cal. Performed Date: 12·6·13 Cal. Due Date: 12·6·14

Source Isotope: C.14 Source #: 4459

QC Check Location: _____

Jig Used: (Yes) No (circle one) Jig ID# N/A

QC Counting Results		
Count No.	C_{14} Count Result	
1	2.33 k	238
2	2.11 k	223
3	2.31 k	251
4	2.19 k	217
5	2.25 k	220
	Add results, list in Total	
Total	11.19 k	1149
	Divide the total by 5	
Source Reference Reading (Average)	2.238 k	229.8

Range Calculation

Source Ref. Reading: 2.238 X 20% = 0.4476

Avg. + 20% = 2.69 k

Avg. - 20% = 1.79 k

Acceptable Range:

From 1.79 kcpm (Avg. - 20%) to 2.69 kcpm (Avg. + 20%)

Comments:

BKGD REF: 229.8 X 20% = 45.96

AVG + 20% = 275.76 AVG - 20% = 183.84

From 184 cpm To 276 cpm

Performed By: JOSEPH E. MEDELLIN Date: 9·17·14

RSO Review: Ht Dry Date: 9/17/14

RSCS
Radiation Safety & Control Services

Calibration Certificate
ID Number: 22394679771-5

Customer: Joan Ervey
Radiation Safety & Control Services, Inc.
91 Portsmouth Avenue
Stratham, NH 03885

Instrument	Serial Number
Ludlum Model 43-89	223946

Probe Model & SN	Isotope	Efficiency	NIST Source ID	Geometry
Internal Probe	C-14	0.0113 C/D	C-14 (SN: 488-10-9)	On Contact
Internal Probe	Co-60	0.0072 C/D Gamma	Co-60 (SN: 394-H)	@1cm
Internal Probe	Cs-137	0.2267 C/D	Cs-137(Beta) (SN: 98CS5004751)	On Contact
Internal Probe	Sr/Y-90	0.1672 C/D	Sr/Y-90 (SN: 63962 (Beta))	@1cm
Internal Probe	Tc-99	0.0824 C/D	Tc-99 (SN: 63963 (Beta))	@1cm
Internal Probe	Co-60	0.0824 C/D Beta	Tc-99 (SN: 63963 (Beta))	@1cm
Internal Probe	Tc-99	0.0947 C/D	Tc-99 (SN: 63963 (Beta))	On Contact
Internal Probe	Th-230	0.0725 C/D	Th-230 (SN: S-963)	@1cm
Internal Probe	Th-230	0.1780 C/D	Th-230 (SN: S-963)	On Contact

Outer Physical Check: *Pass*
Tap Test: *Pass*

Electronics Checks	As Found	As Left
High Voltage	**674 Volts**	**674 Volts**

Comments: Calibrated with E-600 SN 003685 (Calibration Due Date = 3/26/2015). Efficiencies updated 9/2/2014 with background and check source readings verified.Check Source Acceptance Range (On Contact) with 0.25 µCi Cs-137 source (SN 154) = 2.0 to 3.0 kcpm on Alpha Plus Beta Channel. Added Cs-137 and C-14 efficiencies. dsc 9/12/14.

Calibrated by: _____ QA Review: _____

Date: 06/17/2014
Expires: 06/17/2015

Atmospheric Conditions - Temperature: 72° F Humidity: 29% Barometric Pressure:29.94 in/hg

This calibration was performed by RSCS using one or more of the following NIST Traceable radiation sources:
Tech Ops Model 773 Cs-137 Beam Calibrator (S/N S-1110), characterized using Exradin Model A6 (S/N 185) and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-008, with estimated uncertainty of 6.0%.
J.L. Shepherd and Associates Model 89 Cs-137 Box Calibrator (S/N 9141), characterized using Exradin, Model A6 (S/N 185), A3 (S/N 197), A12 (S/N XA091124), and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-001, with estimated uncertainty of 2.7%.
RSCS Neutron Calibrator, AmBe Source Model NUMEC-AM-31 (S/N Am-478), characterized using Far West Technologies Model FWAD-1 "HAWK" TEPC (S/N 021) in accordance with the methods specified in RSCS TSD 13-002, with estimated uncertainty of 9.4%
Calibrations performed in conformance to the following documents: ANSI N323A (1997); RSCS New Hampshire Radioactive Material License Number 381R. RSCS calibration services are performed in accordance with the RSCS Radiation Protection Program Manual and Standard Operating Procedures.
Calibration Laboratory is operated in accordance with ANSI/NCSL Z540-1-1994

RSCS
Radiation Safety & Control Services

Calibration Certificate
ID Number: 0127474265-0

Customer: Joan Ervey
Radiation Safety & Control Services, Inc.
91 Portsmouth Avenue
Stratham, NH 03885

Instrument
Eberline Model E-600

Serial Number
01274

Precision Check				
Test 1	Test 2	Test 3	Mean	Results
8.00 Kcpm	8.04 Kcpm	8.01 Kcpm	8.02 Kcpm	Satisfactory

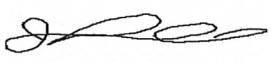
Accuracy Check			
Range	Target Value	As Found	As Left
100K	80 Kcpm	80.5 Kcpm #	80.5 Kcpm #
100K	20 Kcpm	20.0 Kcpm #	20.0 Kcpm #
10K	8 Kcpm	8.00 Kcpm #	8.00 Kcpm #
10K	2 Kcpm	1.997 Kcpm #	1.997 Kcpm #
1K	800 cpm	803 cpm #	803 cpm #
1K	200 cpm	197 cpm #	197 cpm #

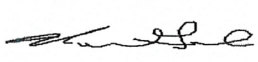
Readings with * indicate ranges where As-Found readings are >20% of Target value. Readings with ** indicate As-left readings are >10.00% of Target value
Readings with # indicate ranges where pulser was used.

MTE Instrument Type	Model	CalDueDate
Pulser	Eberline MP-2 SN: 886	10/29/2014

Outer Physical Check: *Pass*
Tap Test: *Pass*

Comments: High Voltage Adjustment: Set at 898 V - As-Found = 908, As-Left = 898

Calibrated by: 

QA Review: 

Calibration Date: 12/06/2013
Expires: 12/06/2014

Atmospheric Conditions - Temperature: 74°F Humidity: 18% Barometric Pressure: 29.83"hg

This calibration was performed by RSCS using one or more of the following NIST Traceable radiation sources (Cs-137 Beam Source SN S-1110, Cs-137 Box Calibrator SN 9141, AmBe NUMEC-AM-31 Neutron Calibrator), in conformance to the following standards: ANSI N323A (1997). RSCS New Hampshire Radioactive Material License Number: 381R. RSCS calibration services are performed in accordance with the RSCS Radiation Protection Program Manual and Standard Operating Procedure . This calibration certificate shall not be reproduced except in full without the express written consent of RSCS, Inc

Estimated uncertainty for measurements collected using the J.L. Shepherd and Associates Model 89 calibrator: 2.7%
Estimated uncertainty for measurements collected using the Tech Ops Model 773 calibrator: 6.0%
Estimated uncertianty for measurements collected using the AmBe Neutron souce calibrator: 9.4%

PORTABLE INSTRUMENT RESPONSE CHECK SHEET

Instrument: 2929 Serial No: 50121 Probe: 43-10 Serial No: 046118

Cal. Due Date: 9·10·15 Response Check Location: RM 2138

βγ Channel

Source Isotope: C_{14} Source ID: 4459 Source Jig ID: N/A

Source Reference Reading: 2510.6 +20% 3013 -20% 2008

Bkgd Reference Reading: 344.2 +20% 413 -20% 275

Response Checks

Date/Time	βγ Bkgd.	βγ Reading	Remarks	Initials
9·17·14 / 0730	369	2565	PASS PRE	
9·17·14 / 1720		2625	PASS POST	
9·18·14 / 0730	359	2526	PASS PRE	
9·18·14 / 1630	363	2572	PASS POST	
9·19·14 / 0730	340	2724	PASS PRE	
9·19·14 / 1645	355	2387	PASS POST	
9·22·14 / 0730	346	2601	PASS PRE	
9·22·14 / 1625	330	2613	PASS POST	RE
9·23·14 / 0730	326	2523	PASS PRE	
9·23·14 / 1645	332	2642	PASS POST	RE
9·24·14 / 0730	360	2554	PASS PRE	
9·24·14 / 1840	357	2677	PASS POST	RE
9·25·14 / 0730	352	2380	PASS PRE	

Review: [signature] Date: 9/29/14

INSTRUMENT QC CHECK SHEET

Date: 9·16·14 Time: 0900

Instrument: 2929 Serial No: 50721

Probe: 43-10 Serial No: 046118

Cal. Performed Date: 9·10·14 Cal. Due Date: 9·10·15

Source Isotope: C-14 Source #: 4459

QC Check Location:

Jig Used: (Yes) No (circle one) Jig ID# N/A

QC Counting Results		
Count No.	1 min C,14 Count Result	10 min BKGD
1	2529	325
2	2529	357
3	2474	366
4	2500	335
5	2521	338
	Add results, list in Total	
Total	12553	1721
	Divide the total by 5	
Source Reference Reading (Average)	2510.6	344.2

Range Calculation

Source Ref. Reading: 2510.6 X 20% = 502.12

Avg. + 20% = 3012.72

Avg. - 20% = 2008.48

Acceptable Range:

From 2008 (Avg. - 20%) to 3013 (Avg. + 20%)

Comments:

BKGD = 344.2 X 20% = 68.84

AVG + 20% = 413.04

AVG - 20% = 275.36

FROM 275 to 413

Performed By: JOSEPH E. MEDELLIN J.E. Medellin Date: 9·16·14

RSO Review: [signature] Date: 9/16/14

RSCS
Radiation Safety & Control Services

Calibration Certificate
ID Number: 5072181951-0

Customer: Heath Downey
AMEC - CO
2275 Logos Ct.
Suite A
Grand Junction, CO 81505

Instrument	Serial Number
Ludlum Model 2929	50721
Probe Model	**Serial Number**
Ludlum 43-10	046118

Precision Check

Test 1	Test 2	Test 3	Mean	Results
9.98 Kcpm	9.98 Kcpm	9.99 Kcpm	9.98 Kcpm	Satisfactory

Accuracy Check

Range	Target Value	As Found	As Left
X1000	400 Kcpm	399.288 Kcpm #	399.288 Kcpm #
X1000	100 Kcpm	99.71 Kcpm #	99.717 Kcpm #
X100	40 Kcpm	39.928 Kcpm #	39.928 Kcpm #
X100	10 Kcpm	9.980 Kcpm #	9.980 Kcpm #
X10	4 Kcpm	4.001 Kcpm #	4.001 Kcpm #
X10	1 Kcpm	0.999 Kcpm #	0.999 Kcpm #
X1	400 cpm	399 cpm #	399 cpm #
X1	100 cpm	100 cpm #	100 cpm #

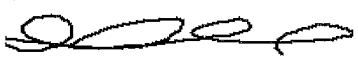
Readings with * indicate ranges where As-Found readings are >20% of Target value. Readings with ** indicate As-left readings are >10% of Target value
Readings with # indicate ranges were calibrated using a pulser

Probe Model & SN	Isotope	Efficiency	NIST Source ID	Geometry
43-10 046118	C-14	0.0208 C/D	C-14 (SN: 488-10-9)	In Holder
43-10 046118	Th-230	0.3546 C/D	Th-230 (SN: S-963)	In Holder

MTE Instrument Type	Model	CalDueDate
Pulser	Ludlum 500-4SN: 98756	07/07/2015

Outer Physical Check: *Pass*
Tap Test: *Pass*

Electronics Checks	As Found	As Left
High Voltage	924 Volts	924 Volts

Calibrated by: 
QA Review: 

Date: 09/10/2014
Expires: 09/10/2015

Atmospheric Conditions - Temperature: 73° F Humidity: 37% Barometric Pressure:30.08 In/hg
This calibration was performed by RSCS using one or more of the following NIST Traceable radiation sources:
Tech Ops Model 773 Cs-137 Beam Calibrator (S/N S-1110), characterized using Exradin Model A6 (S/N 185) and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-008, with estimated uncertainty of 6.0%.
J.L. Shepherd and Associates Model 89 Cs-137 Box Calibrator (S/N 9141), characterized using Exradin, Model A6 (S/N 185), A3 (S/N 197), A12 (S/N XA091124), and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-001, with estimated uncertainty of 2.7%.
RSCS Neutron Calibrator, AmBe Source Model NUMEC-AM-31 (S/N Am-478), characterized using Far West Technologies Model FWAD-1 "HAWK" TEPC (S/N 021) in accordance with the methods specified in RSCS TSD 13-002, with estimated uncertainty of 9.4%
Calibrations performed in conformance to the following documents: ANSI N323A (1997); RSCS New Hampshire Radioactive Material License Number 381R. RSCS calibration services are performed in accordance with the RSCS Radiation Protection Program Manual and Standard Operating Procedures.
Calibration Laboratory is operated in accordance with ANSI/NCSL Z540-1-1994

Radiation Safety and Control Services, Inc.
91 Portsmouth Ave. Stratham, NH 03885
1-800-525-8339 (603) 778-2871 Fax (603) 778-6879 www.radsafety.com

PORTABLE INSTRUMENT RESPONSE CHECK SHEET

Page ___ of ___

Instrument: MODEL 3 Serial No: 250276 Probe: 5PA-B Serial No: 726752

Cal. Due Date: 4.25.15 Response Check Location: _____

βγ Channel

Source Isotope: Am 241 Source ID: 5D-1 Source Jig ID: N/A

Source Reference Reading: 5.6 kcpm +20% 6.7 kcpm -20% 4.5 kcpm

Bkgd Reference Reading: 1.3 kcpm +20% 1.6 kcpm -20% 1 kcpm

Response Checks

Date/Time	βγ Bkgd.	βγ Reading	Remarks	Initials
9-18-14 0800	1.3 Kcpm	5Kcpm	PASS	RC
9.18.14 1700	1.2 kcpm	5 kcpm	PASS	
9.19.14 / 0715	1.2 kcpm	5 kcpm	PASS	
9-19-14 1625	1.2 Kcpm	5 Kcpm	PASS	RC
9-22-14 0705	1.2 Kcpm	5 Kcpm	PASS	RC
9-22-14 1620	1.2 Kcpm	5Kcpm	PASS	RC
9-23-14 0705	1.3 Kcpm	5 Kcpm	PASS	RC
9-23-14 1630	1.3 Kcpm	5Kcpm	PASS	RC
9-24-14 0715	1.3K cpm	5 Kcpm	PASS	RC
9-24-14 1845	1.3K cpm	5 Kcpm	PASS	RC
9-25-14 0720	1.2K cpm	5 Kcpm	PASS	RC

Review: _____ Date: 9/29/14

FRN-0005

INSTRUMENT QC CHECK SHEET

Date: 9·18·14 Time: 0730

Instrument: LUDLUM MODEL 3 Serial No: 250276

Probe: ~~MSA~~ SPA-3 Serial No: 726752

Cal. Performed Date: 4·25·14 Cal. Due Date: 4·25·15

Source Isotope: Am 241 Source #: SD-1

QC Check Location: _____

Jig Used: (Yes) No (circle one) Jig ID# N/A

QC Counting Results		
Count No.	Count Result Am 241	BkGD
1	5k	1.3k
2	6k	1.4k
3	5k	1.25k
4	6k	1.25k
5	6k	1.3k
	Add results, list in Total	
Total	28k	6.5k
	Divide the total by 5	
Source Reference Reading (Average)	5.6k	1.3k

Range Calculation

Source Ref. Reading: 5.6 kcpm X 20% = 1.12 kcpm

Avg. + 20% = 6.72 kcpm

Avg. - 20% = 4.48 kcpm

Acceptable Range:

From 4.5 kcpm (Avg. - 20%) to 6.7 kcpm (Avg. + 20%)

Comments:

BkGD REF: 1.3 kcpm X 20% = 0.26

AVG + 20% = 1.56 kcpm

AVG - 20% = 1.04 kcpm

FROM 1 kcpm TO 1.6 kcpm

Performed By: JOSEPH E. MEDELLIN J. E. Medellin Date: 9·18·14

RSO Review: Hut. Dry Date: 9/18/14

RSCS
Radiation Safety & Control Services

Calibration Certificate
ID Number: 25027678401-1

Customer: Joan Ervey
Radiation Safety & Control Services, Inc.
91 Portsmouth Avenue
Stratham, NH 03885

Instrument
Ludlum Model 3-002C

Serial Number
250276

Probe Model
Thermo Electron SPA-8

Serial Number
726752

Precision Check

Test 1	Test 2	Test 3	Mean	Results
1.00 Kcpm	1.00 Kcpm	1.00 Kcpm	1.00 Kcpm	Satisfactory

Accuracy Check

Range	Target Value	As Found	As Left
X100	400 Kcpm	400 Kcpm #	400 Kcpm #
X100	100 Kcpm	100 Kcpm #	100 Kcpm #
X10	40 Kcpm	40 Kcpm #	40 Kcpm #
X10	10 Kcpm	10 Kcpm #	10 Kcpm #
X1	4 Kcpm	4 Kcpm #	4 Kcpm #
X1	1 Kcpm	1 Kcpm #	1 Kcpm #
X.1	400 cpm	400 cpm #	400 cpm #
X.1	100 cpm	100 cpm #	100 cpm #

Readings with * indicate ranges where As-Found readings are >20% of Target value. Readings with ** indicate As-left readings are >10.00% of Target value
Readings with # indicate ranges where pulser was used.

Probe Model & SN	Isotope	Efficiency	NIST Source ID	Geometry
SPA-8 726752	Am-241	0.0151 C/D	Am-241 (SN: 33386-60 (Alpha))	@1cm
SPA-8 726752	Co-57	0.0506 C/D	Co-57 (SN: 129584)	@1cm
SPA-8 726752	Co-60	0.0288 C/D	Co-60 (SN: 394-H)	@1cm
SPA-8 726752	Cs-137	0.0200 C/D	Cs-137(Gamma) (SN: 14290)	@1cm
SPA-8 726752	I-125	0.0145 C/D	I-129 (SN: NES-186S)	@1cm

MTE Instrument Type	Model	CalDueDate
Pulser	Ludlum 500-4 SN: 98756	07/07/2015

Outer Physical Check: *Pass*
Internal Check: *Pass*
Geotropism Check: *Pass*
Mechanical Zero: *Pass*
Tap Test: *Pass*

Electronics Checks	As Found	As Left
High Voltage	**700 Volts**	**700 Volts**

Comments: Updated 9-16-2014 to add I-125 Efficiency

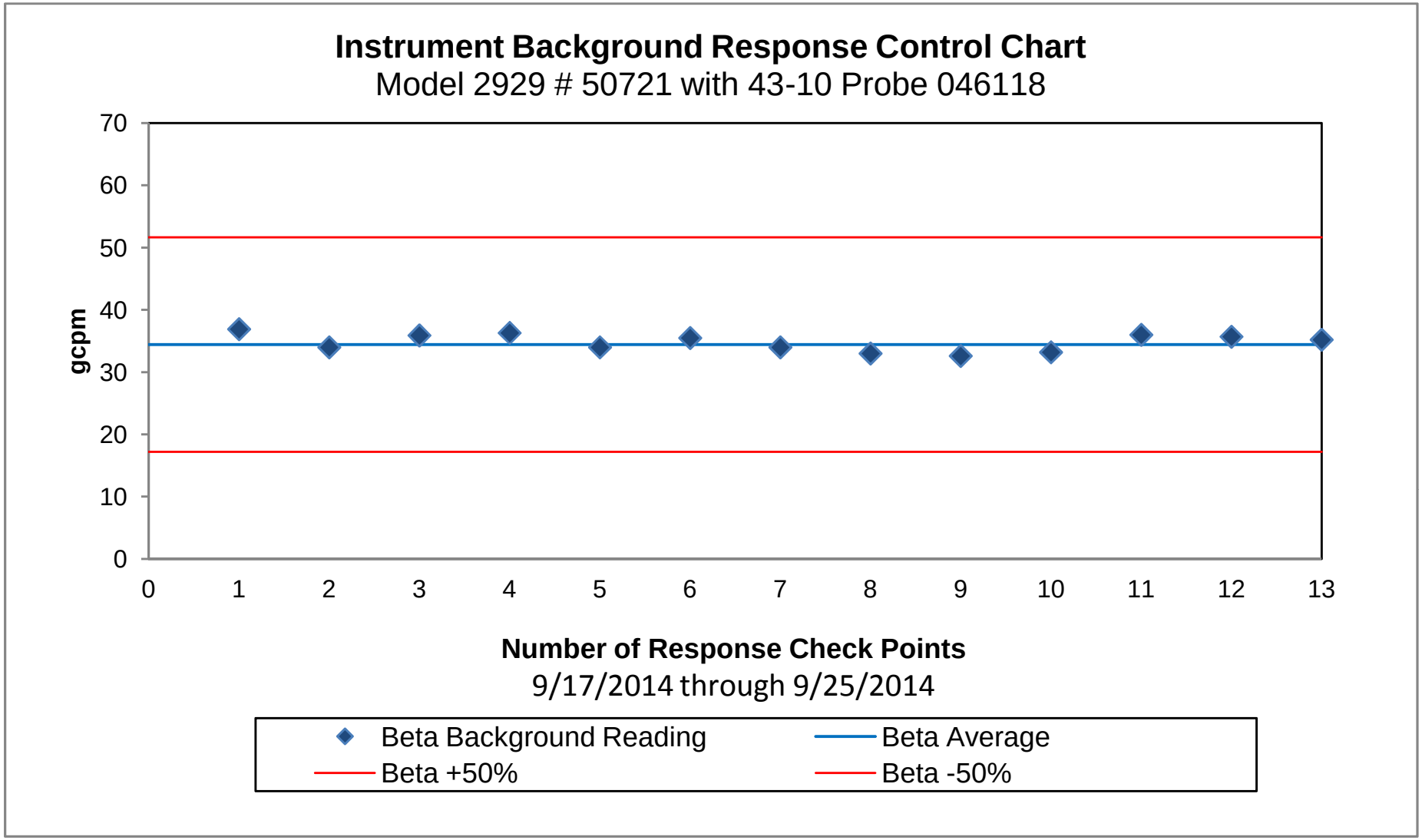
Calibrated by: 

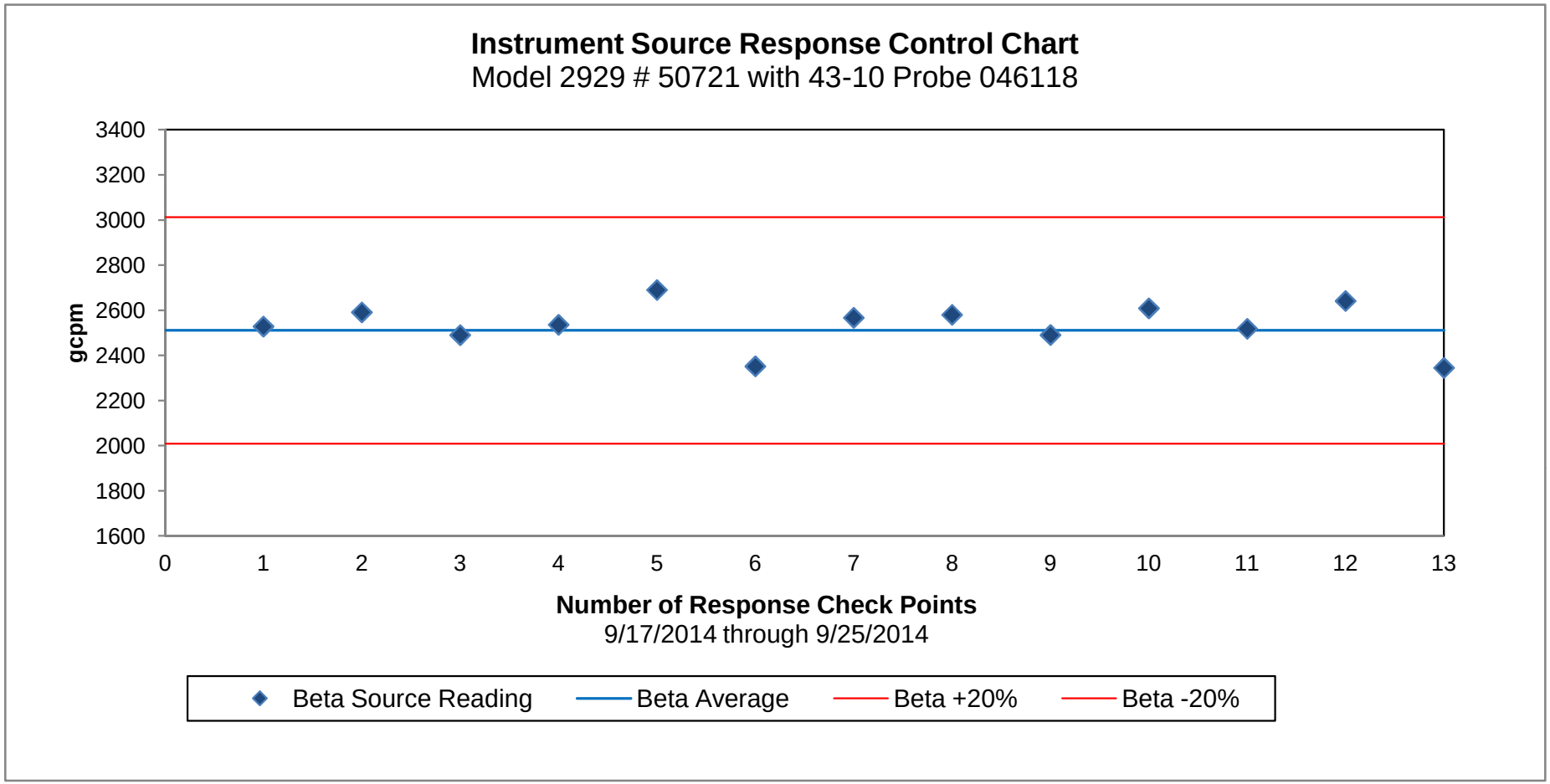
QA Review: 

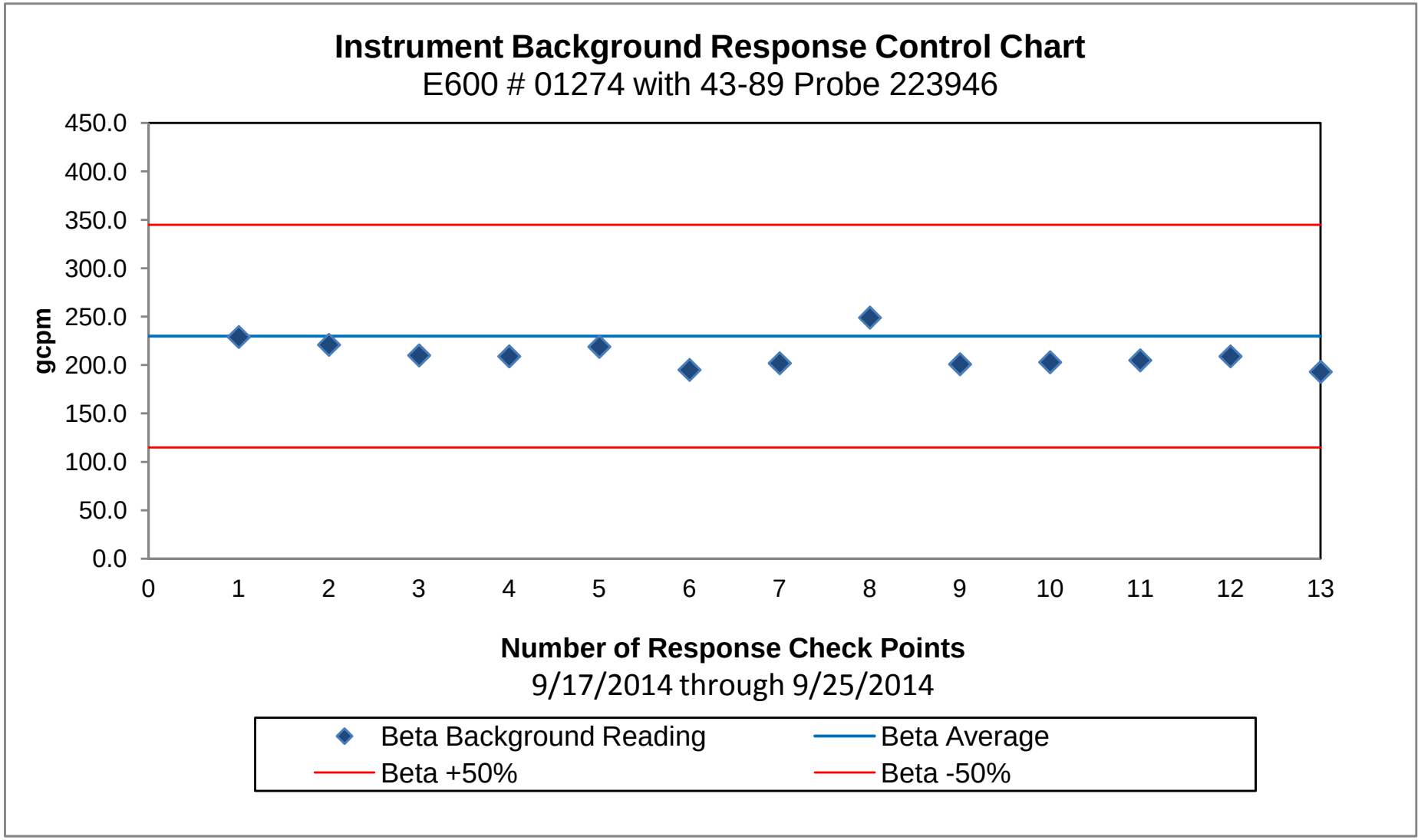
Calibration Date: 04/25/2014
Expires: 04/25/2015

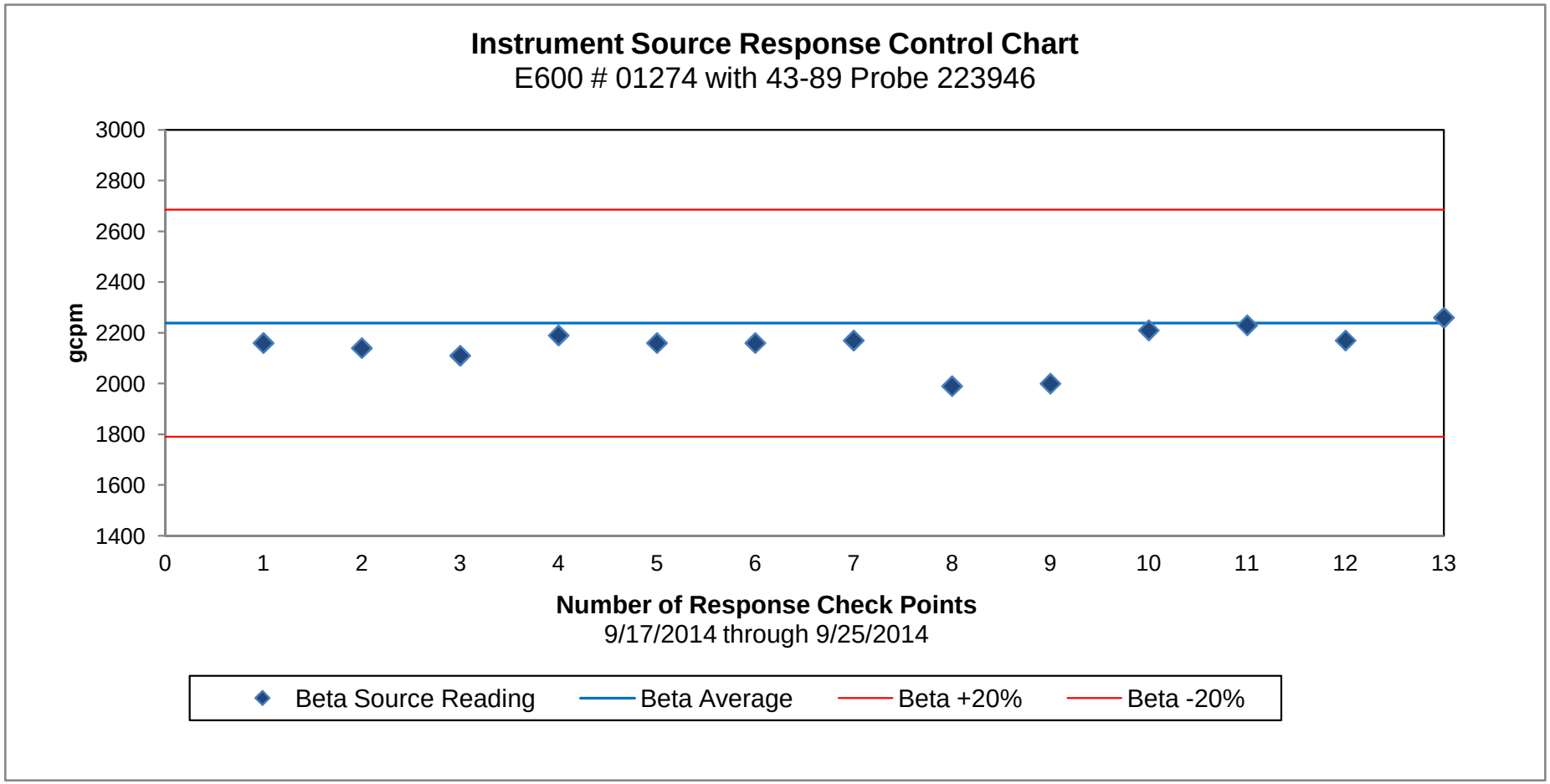
Atmospheric Conditions - Temperature: 72°F Humidity: 17% Barometric Pressure: 29.90"hg

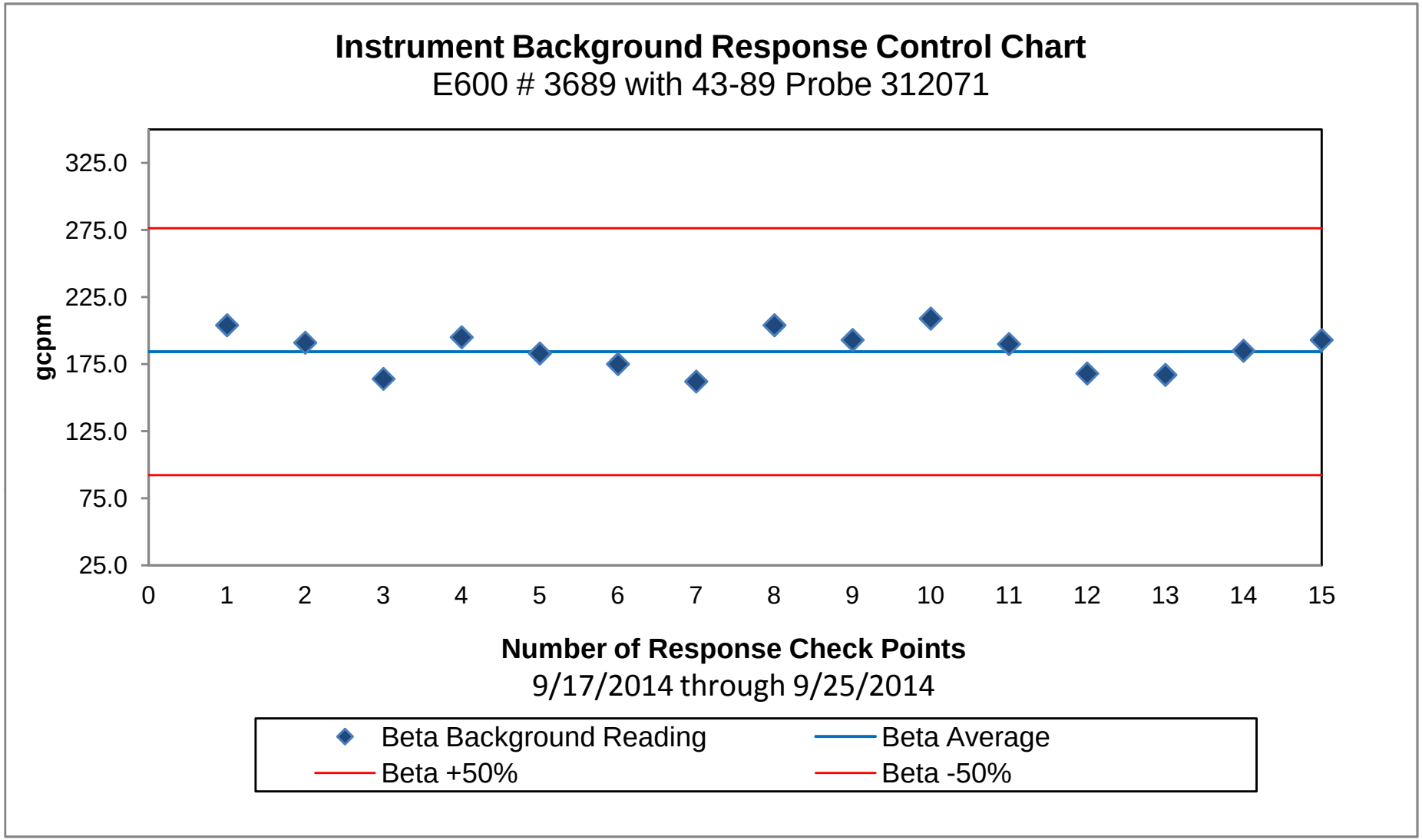
This calibration was performed by RSCS using one or more of the following NIST Traceable radiation sources:
Tech Ops Model 773 Cs-137 Beam Calibrator (S/N S-1110), characterized using Exradin Model A6 (S/N 185) and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-008, with estimated uncertainty of 6.0%.
J.L. Shepherd and Associates Model 89 Cs-137 Box Calibrator (S/N 9141), characterized using Exradin, Model A6 (S/N 185), A3 (S/N 197), A12 (S/N XA091124), and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-001, with estimated uncertainty of 2.7%.
RSCS Neutron Calibrator, AmBe Source Model NUMEC-AM-31 (S/N Am-478), characterized using Far West Technologies Model FWAD-1 "HAWK" TEPC (S/N 021) in accordance with the methods specified in RSCS TSD 13-002, with estimated uncertainty of 9.4%
Calibrations performed in conformance to the following documents: ANSI N323A (1997); RSCS New Hampshire Radioactive Material License Number 381R. RSCS calibration services are performed in accordance with the RSCS Radiation Protection Program Manual and Standard Operating Procedures.
Calibration Laboratory is operated in accordance with ANSI/NCSL Z540-1-1994

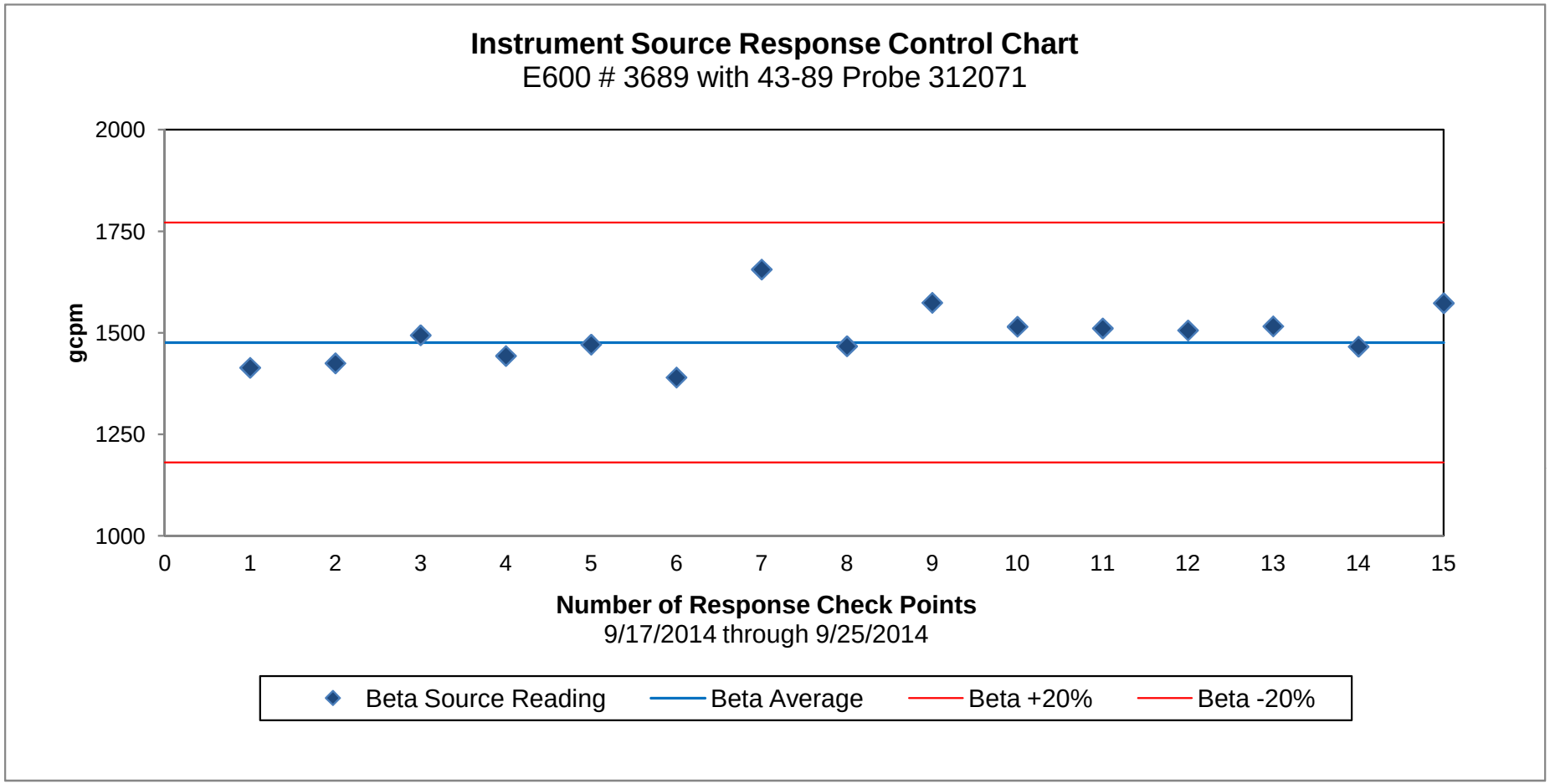

Instrument Background Response Control Chart
Model 2929 # 50721 with 43-10 Probe 046118
gcpm
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Number of Response Check Points
9/17/2014 through 9/25/2014
Beta Background Reading
Beta Average
Beta +50%
Beta -50%


Instrument Source Response Control Chart
Model 2929 # 50721 with 43-10 Probe 046118
gcpm
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Number of Response Check Points
9/17/2014 through 9/25/2014
Beta Source Reading
Beta Average
Beta +20%
Beta -20%


Instrument Background Response Control Chart
E600 # 01274 with 43-89 Probe 223946
gcpm
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Number of Response Check Points
9/17/2014 through 9/25/2014
Beta Background Reading
Beta Average
Beta +50%
Beta -50%


Instrument Source Response Control Chart
E600 # 01274 with 43-89 Probe 223946
gcpm
3000
2800
2600
2400
2200
2000
1800
1600
1400
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Number of Response Check Points
9/17/2014 through 9/25/2014
Beta Source Reading
Beta Average
Beta +20%
Beta -20%


Instrument Background Response Control Chart
E600 # 3689 with 43-89 Probe 312071
gcpm
325.0
275.0
225.0
175.0
125.0
75.0
25.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Number of Response Check Points
9/17/2014 through 9/25/2014
Beta Background Reading
Beta Average
Beta +50%
Beta -50%


Instrument Source Response Control Chart
E600 # 3689 with 43-89 Probe 312071
gcpm
2000
1750
1500
1250
1000
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Number of Response Check Points
9/17/2014 through 9/25/2014
Beta Source Reading
Beta Average
Beta +20%
Beta -20%

This is to acknowledge the receipt of your letter/application dated

03/02/2015, and to inform you that the initial processing which includes an administrative review has been performed.

32-14048-04 (amendment)

☒ There were no administrative omissions. Your application was assigned to a technical reviewer. Please note that the technical review may identify additional omissions or require additional information.

☐ Please provide to this office within 30 days of your receipt of this card

---

A copy of your action has been forwarded to our License Fee & Accounts Receivable Branch, who will contact you separately if there is a fee issue involved.

Your action has been assigned **Mail Control Number** 586227
When calling to inquire about this action, please refer to this control number.
You may call us on (610) 337-5398, or 337-5260.

NRC FORM 532 (RI)
(6-96)

Sincerely,
Licensing Assistance Team Leader.