



Central Connecticut State University

November 16 , 2015

Department of Physics and Engineering Physics
Central Connecticut State University

Br. 2

Mr. Michael Reichard
Health Physicist
Division of Nuclear Materials Safety
United States Nuclear Regulatory Commission
King of Prussia, PA 19406

REC RG 1 11 23 15 AM 07:04

Dear Mr. Reichard,

Central Connecticut State University is requesting termination of its license NRC No. 06-16975-01 Docket No. 030-12001 current Amendment No 9. The sealed sources are no longer needed in our program. The following radioactive sources are listed in the license:

- | | | |
|-----------|------------------|----------------------|
| A. Am-241 | A. Sealed Source | A. 10 microcuries |
| B. Cm-242 | B. Sealed Source | B. 0.005 microcuries |

On June 27, 2014 both sources were turned over to Radiation Safety Associates, Inc. at 19 Pendleton Drive, Hebron CT 06248 (NRC license No. 06-30007-01).

What I always thought was the Cm-242 source turned out to be a 2.066 μ Ci Ra-226 source. This was confirmed by gamma spectrum analysis performed by Radiation Safety Associates. We could not find any documentation for the Cm-242 source. I have been the RSO since 2011. The person who acquired the Am-241 and Cm-242 around 1981 was Dr. John Bulman who is now deceased. In the best case, Dr. Bulman never actually purchased or obtained the Cm-242 source. In the other case where he obtained the source, the Cm-242 by now would have decayed to something on the order of 10E-29nCi. Potential dose to an individual in proximity to this source would be essentially zero.

Documents attached to this letter include NRC Form 314, a list of radioactive samples transferred to Radiation Safety Associates from our facility, and a Radiological Decommissioning Report from Radiation Safety Associates, Inc.

Thank you very much for your assistance to this matter.

Sincerely,

Luisito Tongson
Luisito Tongson
RSO
(860) 832-2944

589440
NRCSS/RGNI MATERIALS-002



**CERTIFICATE OF DISPOSITION
OF MATERIALS**

Estimated burden per response to comply with this mandatory collection request: 30 minutes. This submittal is used by NRC as part of the basis for its determination that the facility is released for unrestricted use. Send comments regarding burden estimate to the FOIA, Privacy, and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0028), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE NAME AND ADDRESS

Central Connecticut State University
Physics and Engineering Physics Department
1615 Stanley St.
New Britain, CT 06050

LICENSE NUMBER 06-16975-01	DOCKET NUMBER 030-12001
LICENSE EXPIRATION DATE July 31, 2016	

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:
Radiation Safety Associates, 19 Pendleton Dr., Hebron, CT 06248
(NRC License No. 06-30007-01)
 - b. Disposal of radioactive materials:
 - 1. Directly by the licensee:
 - 2. By licensed disposal site:
 - 3. By waste contractor:
 - 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 Luisito Tongson	TITLE Professor of Physics and Engineering Physics	TELEPHONE (Include Area Code) 860 832-2944	E-MAIL ADDRESS tongson@ccsu.edu
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Mail all future correspondence regarding this license to:

Luisito Tongson c/o Central Connecticut State University

C. CERTIFYING OFFICIAL

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

PRINTED NAME AND TITLE Dr. Farik Malhas Dean, School of Engineering, Science, and Technology	SIGNATURE 	DATE 11/16/15
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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.

U.S. NUCLEAR REGULATORY COMMISSION

Duplicate

MATERIALS LICENSEE

Duplicate

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

<p>Licensee</p> <p>1. Central Connecticut State University Physics and Earth Sciences Department</p> <p>2. 1615 Stanley Street New Britain, Connecticut 06050</p>	<p>In accordance with the application dated February 25, 2014,</p> <p>3. License number 06-16975-01 is amended in its entirety to read as follows:</p> <p>4. Expiration date July 31, 2016</p> <p>5. Docket No. 030-12001 Reference No.</p>
<p>6. Byproduct, source, and/or special nuclear material</p> <p>A. Americium 241</p> <p>B. Curium 242</p>	<p>7. Chemical and/or physical form</p> <p>A. Sealed Source</p> <p>B. Sealed Source</p> <p>8. Maximum amount that licensee may possess at any one time under this license</p> <p>A. 10 microcuries</p> <p>B. 0.005 microcuries</p>
<p>9. Authorized use:</p> <p>A. through B. Storage only pending disposal</p>	

CONDITIONS

10. Licensed material may be stored only at the licensee's facilities located at Copernicus Hall at Central Connecticut State University, New Britain, Connecticut.
11. A. Licensed material shall be used by, or under the supervision of, Luisito Tongson, Ph.D.
- B. The Radiation Safety Officer for this license is Luisito Tongson, Ph.D.
12. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.
13. The licensee shall conduct a physical inventory every six months, or at other intervals approved by the U.S. Nuclear Regulatory Commission, to account for all sources and/or devices received and possessed under the license. Records of inventories shall be maintained for 5 years from the date of each inventory and shall include the radionuclides, quantities, manufacturer's name and model numbers, and the date of the inventory.

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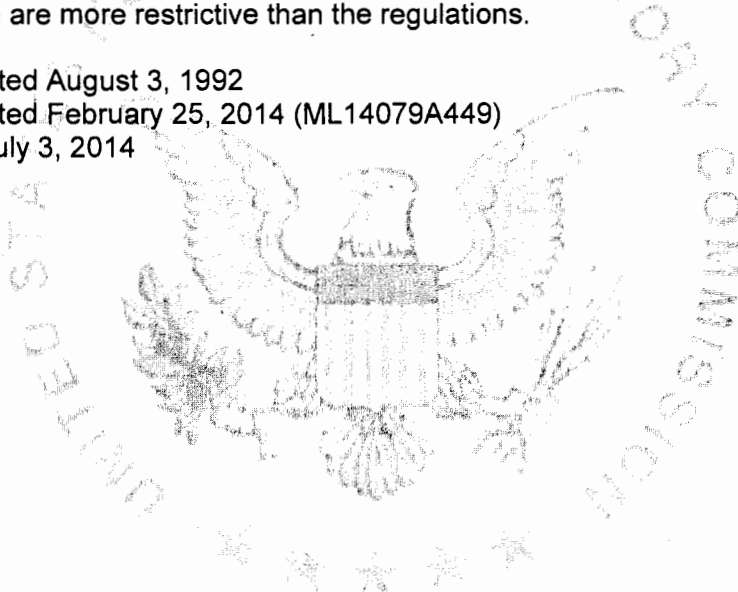
**MATERIALS LICENSE
SUPPLEMENTARY SHEET**

License Number
06-16975-01

Docket or Reference Number
030-12001

Amendment No. 09

- 14. The licensee is authorized to transport licensed material in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."
- 15. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.
 - A. Application dated August 3, 1992
 - B. Application dated February 25, 2014 (ML14079A449)
 - C. Letter dated July 3, 2014



For the U.S. Nuclear Regulatory Commission

Original signed by Elizabeth Ullrich

Date July 9, 2014

By _____

Elizabeth Ullrich
Commercial, Industrial, R&D and Academic Branch
Division of Nuclear Materials Safety
Region I
King of Prussia, Pennsylvania 19406

Duplicate

Duplicate

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RSA Laboratories, Inc.

Luisito Tongson, PhD
Physics/Earth Sciences Department
Copernicus Hall
Central Connecticut State University
1651 Stanley Street
New Britain, CT 06050

Dear Dr. Tongson:

This letter is in reference to the radioactive sources transferred to us from your facility during the decommissioning performed in August 2014.

The following 11 sources were transferred to us for disposal:


Object	Isotope	Activity
Check source	Ra-226	2.066 uCi
Lens assembly	Ra-226	5.69E-1 uCi
Instrument check source	Uranium	6.80E-2 uCi
CD 10 day water std	Uranium	5.84E-1 uCi
Cloud chamber source	Pb-210	4.52E-3 uCi
Check source	Tl-204	5.00E-2 uCi
Check Source	Tl-204	4.00E-2 uCi
Student kit sample	Thorium Nitrate	5.00E-2 uCi
Student kit sample	Uranyl Acetate	2.44E-1 uCi
Student kit sample	K-40	2.80E-4 uCi
Alpha source	Am-241	1.00E+1 uCi

All of these sources are currently in our possession, in storage, pending disposal. A comprehensive search of the lab and your office failed to locate a Cm-242 source.

The results of the survey performed for the decommissioning are contained in a decommissioning report which is being sent under separate cover.

If you have any questions, please don't hesitate to contact me.

Sincerely:


Jay R. Dockendorff
Health Physicist
Laboratory Supervisor

**RADIOLOGICAL
DECOMMISSIONING
REPORT
CENTRAL
CONNECTICUT
STATE UNIVERSITY**

June 9, 2014

K. Paul Steinmeyer

**Radiation Safety Associates, Inc.
19 Pendleton Drive
Hebron, CT 06248
(860) 228-0487**

1.0 INTRODUCTION

Central Connecticut State University (ECSU) is a Public University, part of the Connecticut State University system. It is located in New Britain Connecticut. As part of its Physics program ECSU was licensed to possess two sealed sources; a 10 μ Ci alpha emitting Am-241 sealed source and a 0.005 microcurie Cm-244 sealed source used for ongoing research and educational purposes. No other licensed materials or sealed sources were possessed. The purpose of this survey is to demonstrate that the site meets the criteria for unrestricted use and to terminate the Radioactive Materials License.

2.0 SITE DESCRIPTION

The CCSU building affected by this decommissioning survey is the Copernicus Science Building located on the CCSU Campus. Room 109, known as the accelerator room is where all radioactive materials were stored and used. At the time of the survey the licensed radioactive materials had been removed from the room and were in the possession of the RSO under lock and key along with a number of license-exempt materials.

During the time period that licensed sources have been present and used at CCSU, there has been no loss or release of radioactive material from any sealed source. The licensed sources did not require leak testing.

Because CCSU was licensed for only low activity sealed sources this Decommissioning is being carried out under the guidelines outlined in NUREG-1757, Vol. 2 Rev.2, *Decommissioning Process for Materials Licensees*, Chapter 8, Group 1 Decommissioning.

As a result of this, Room 109 can be released for unrestricted use. No radioactive materials are now used or possessed by this facility and the radioactive materials license can be terminated.

This survey is being conducted under the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidance for radiological surveys for demonstrating compliance with dose or risk-based regulations or standards.

3.0 SUMMARY OF INVESTIGATIONS

This radiological survey of the facility was performed on June 9, 2014. Based upon the history of radioactive materials use and information from the RSO, the only room affected was room 109 in the Copernicus Science Building. The area of the room is 522 ft² (48.5 m²). At the time of the survey all licensed radioactive materials had been removed and were in the possession of the RSO under lock and key. This area was presumptively designated MARSIMM Class 3 as the only sources used in this area were sealed sources.

This facility fits the criteria for decommissioning Group 1 (NUREG-1725 Vol 1 Rev 2) as only sealed sources were used and the source used did not require leak testing. There is no recorded instance of contamination of the site by loose radioactive material.

The survey consisted of a 100% scan of all floors in the affected area and random direct counts of floors, walls and furnishings for total contamination. For a Group 1 decommissioning the

requires wipe frequency is 1 wipe of 100 cm² per each 300ft². For completeness, a total of 17 wipes were taken at random locations of floors, walls and objects within the affected area.

Wipes were counted on a Protean IPC low background gas proportional counter.

In addition to surface scans, measurements for total contamination were made at random locations using the same instrument used for the floor scans. Measurements were made for lengths of time sufficient to achieve the required detection limit for the isotopes used in the facility.

Calibration certificates for the instruments used and calculations of MDA can be found in Attachment C to this report.

No single measurement for total or removable contamination exceeded the DCGL for the isotope of interest.

4.0 OBJECTIVES

The objective of this survey is to determine the level of contamination, if any, present in the manufacturing facility. The purpose is to provide information required to plan and execute a decontamination and decommissioning program sufficient to release the building for unrestricted use.

5.0 DERIVED CONCENTRATION GUIDELINE LEVELS (DCGLs)

Remediation goals for the final status survey will achieve the derived concentration guidelines (DCGLs) established for the area. The NRC has established a DCGL of 1.3E+02 dpm/100cm² total contamination for Am-241. This DCGL corresponds to an exposure of 25 mrem/y. The State of Connecticut imposes a more restrictive exposure limit of 19 mrem/y which would reduce the Am-241 DCGL to 9.0E+01 dpm/100cm².

6.0 DATA QUALITY OBJECTIVES

As part of the DQO process the objective of the survey and the null and alternate hypotheses should be clearly stated. In demonstrating that this objective is met, the null hypothesis, H₀, tested is that residual contamination exceeds the release criterion; the alternative hypothesis, H_a, is that residual contamination meets the release criterion.

Since the alpha emitting contaminants that are potentially present in the facility are not presumed present in background, the Sign test will be used if any statistical tests are required when analyzing the data

These data are summarized in the following table.

	STATE of CT DCGL (dpm/100 cm ²)	Site Specific (dpm/100 cm ²)	Δ (dpm/100 cm ²)	σ (dpm/100 cm ²)	Δ / σ
Am-241 Total	9E+1	9E+1	45	9.48	4.75
Am-241 Removable	9E+0	9E+0	4.5	3.00	1.5

Direct surveys and measurements were performed using the instruments listed in Attachment B. Using the background data from a similar floor area, the background and sample count times were established to make the MDA less than the DCGL for Americium-241.

Wipes were counted for alpha emitting isotopes on a Protean IPC 9025 Gas Propotional Counter

7.0 PROCEDURES - OVERVIEW

7.1 Class 3 Area

The affected area covered by this survey was designated as a MARSSIM Class 3 area. This is based upon the fact that *only* sealed sources were used in the facility and there was no history of contolled or uncontrolled release of radioactive materials.

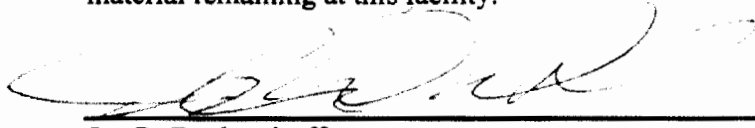
7.2 Reference Area

Background measurements were taken outside of the Class 3 areas on surfaces similar to those inside the survey units but which were not subject to exposure from licensed radioactive materials. The reference area floor had similar materials for floors.

8.0 CONCLUSIONS

Direct survey measurements from all areas sampled are indistinguishable from background. Wipe survey results demonstrated no sample that exceeded the Minimum Detectable Activity (MDA) for alpha emitting isotopes and are similarly indistinguishable from background.

Based upon the results of this final status survey, the average member of the critical group is unlikely to receive an annual dose of more than 19 mrem resulting from licensed radioactive material remaining at this facility.



Jay R. Dockendorff
Health Physicist

LIST OF ATTACHMENTS

- A. Instrumentation used during radiological surveys, and calibration certificates for these instruments
- B. MDA Calculations
- C. Maps of facility and Class 3 areas
- D. Survey results

ATTACHMENT A

Instrumentation

Table 1. Instrumentation for Radiological Surveys

Type of Measurement	Instrumentation		Bkgd. ^a	4π Eff. (%)	Detection Sensitivity
	Detector	Instrument			
Surface scans and activity: Alpha	Large area (584 cm ²) gas proportional, Floor monitor Ludlum, Model 43-37	Scaler/Count-rate meter ^b , Ludlum, Model 2224		4.6 (230Th)	169.63 dpm/detector area 29.05 dpm/100 cm ² (activity)
Surface scans and activity: Alpha	Large area (584 cm ²) gas proportional, Floor monitor Ludlum, Model 43-68	Scaler/Count-rate meter ^b , Ludlum, Model 2224		4.5 (230Th)	108.84 dpm/detector area 86.38 dpm/100 cm ² (activity)

^aNominal Values

^bMonitoring audible signal.

CERTIFICATE OF CALIBRATION (COUNT-RATE INSTRUMENT)



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

Customer and Contact: **Radiation Safety Associates, Inc. Attn: K. Paul Steinmeyer (860) 228-0487**
Customer Address: **P.O. Box 107, 19 Pendleton Drive, Hebron, CT 06248**
Inst. Mfr. & Model **Ludlum Model 2224** Inst. Type **Scaler/Ratemeter** Inst. s/n **119815**
Det. Mfr. & Model **Ludlum 43-37** Det. Type **Gas-Proportional** Det. s/n **160827**
Cal. Date **17 June 2013** Due Date **17 June 2014** Cal. Interval **1 year**

Environmental conditions: Temperature: 72°F Relative Humidity 52% Atmospheric Pressure 29.60 inches Hg

Pre-calibration Checks:

- Contamination survey
- Mechanical check
- Meter zero
- Geotropism check
- Battery check
- Audio check
- Reset check
- Fast response check
- Slow response check
- Window operation
- Plateau check
- Alarm set
- Det. volts 1580 Vdc
- Input sens. *See comments

- Pulse generator s/n 94926
- HV Readout (2 points) Ref./Inst. 900 V/ 900 V
- Oscilloscope s/n 171-04928
- Ref./Inst. 1700 V/ 1700 V
- Voltmeter s/n 574100X2

Comments: * Alpha threshold = 140 mV; Beta threshold = 3.6 mV; Beta window = 3.6 mV to 30 mV.
Local background ≈ 1 cpm alpha, 480 cpm beta. Th-230 efficiency measured on contact.

S/N of source used for precision check #6 Isotope **Cs-137** Dedicated Source? Yes No
Reading #1 **19,000 cpm** Reading #2 **19,000 cpm** Reading #3 **19,000 cpm** Mean **19,000 cpm**
Precision: ± < 10% ± 10-20% Out of tolerance

Range Multiplier	Reference Calibration Point	Instrument Indication
x 1000	400,000 cpm	400,000 cpm
x 1000	100,000 cpm	100,000 cpm
x 100	40,000 cpm	40,000 cpm
x 100	10,000 cpm	10,000 cpm
x 10	4000 cpm	4000 cpm
x 10	1000 cpm	1000 cpm
x 1	400 cpm	400 cpm
x 1	100 cpm	100 cpm
1 min. count	100,000 cpm	100,002 cpm

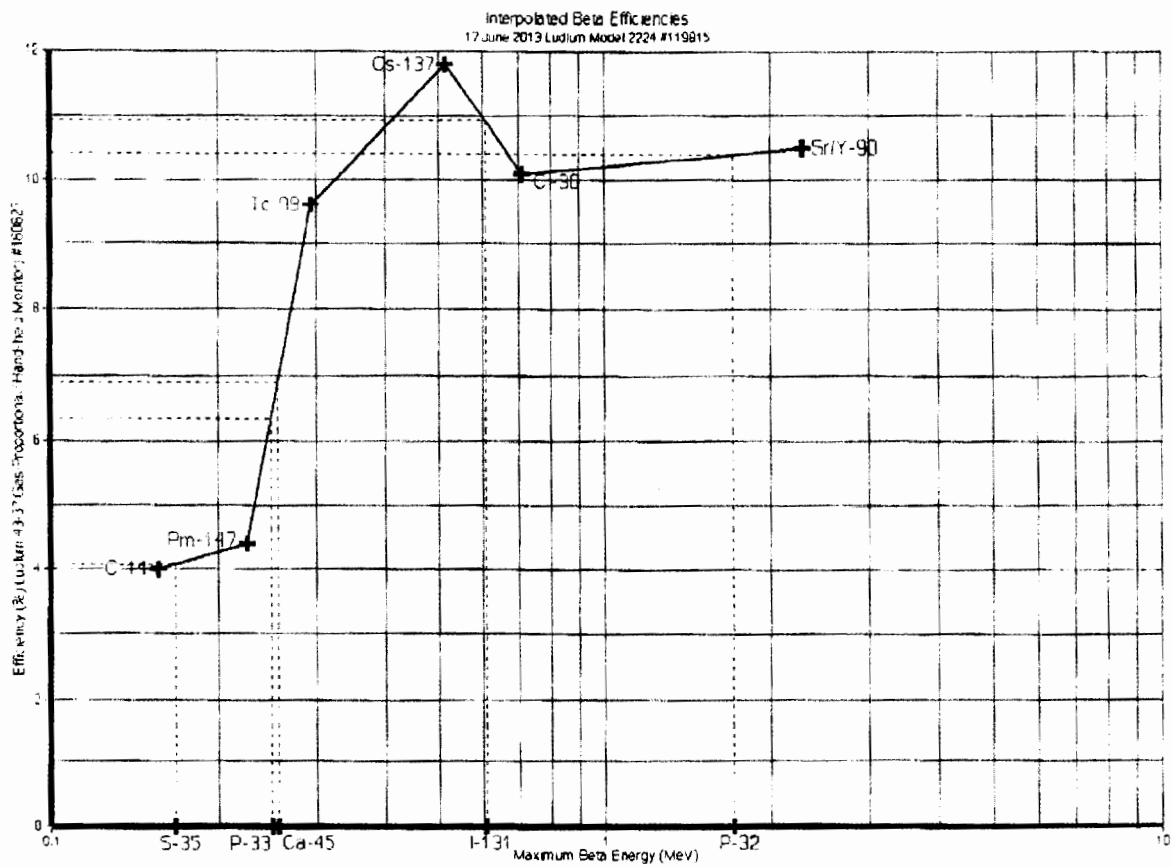
All ranges calibrated electronically.

Range Multiplier	Cal. Source Used (Isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	4σ Instrument Efficiency (%)
1 min. count	C-14 #4456	202,100	2 (a) 8,695 (B)	0.0% 4.0%
1 min. count	Pm-147 #1613-32	18,193	0 (a) 1,287 (B)	0.0% 4.0%
1 min. count	Tc-99 #D782	23,064	1 (a) 2,688 (B)	0.0% 9.6%
1 min. count	Cs-137 #2886	14,561	0 (a) 2,202 (B)	0.0% 11.8%
1 min. count	Cl-36 #D780	23,598	1 (a) 2,861 (B)	0.0% 10.1%
1 min. count	Sr/Y-90 #D711	36,051	2 (a) 4,265 (B)	0.0% 10.5%
1 min. count	Th-230 #91TH2200210	38,900	1,796 (a) 1,833 (B)	4.6% 2.2%

RSA Laboratories ID# 15583. Instrument indicates within ± 10% of calibration points unless otherwise indicated. Source-to-detector entry window distance for efficiency determinations is 1 cm unless otherwise specified. RSA Laboratories, Inc. certifies that the above instrument has been calibrated with standards traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio-type of calibration techniques.

Calibrated by: Kurt D. Newton

Date: 17 June 2013



RSA Laboratories ID# 15583.

Calibrated by: Kurt D. Newton

Date: 17 June 2013

CERTIFICATE OF CALIBRATION (COUNT-RATE INSTRUMENT)



RSA Laboratories, Inc.

19 Pendleton Drive, P.O. Box 61
Hebron, Connecticut 06248
(860) 228-0721 Fax (860) 228-4402

Customer and Contact: **Radiation Safety Associates, Inc. Attn: K. Paul Steinmeyer (860) 228-0487**

Customer Address: **P.O. Box 107, 19 Pendleton Drive, Hebron, CT 06248**

Inst. Mfr. & Model **Ludlum Model 2224**

Inst. Type **Scaler/Ratemeter**

Inst. s/n **119815**

Det. Mfr. & Model **Ludlum Model 43-68**

Det. Type **Gas Proportional**

Det. s/n **091223**

Cal. Date **17 June 2013**

Due Date **17 June 2014**

Cal. Interval **1 year**

Environmental conditions: Temperature: 72°F Relative Humidity 52% Atmospheric Pressure 29.60 inches Hg

Pre-calibration Checks:

- Contamination survey
- Mechanical check
- Meter zero
- Geotropism check
- Battery check
- Audio check
- Reset check
- Fast response check
- Slow response check
- Window operation
- Plateau check
- Alarm set
- Det. volts 1580 Vdc
- Input sens. *See comments

Pulse generator s/n 94926

Oscilloscope s/n 171-04928

Voltmeter s/n 57410002

HV Readout (2 points) Ref./Inst. 900 V/ 900 V Ref./Inst. 1700 V/ 1700 V

Comments: * Alpha threshold = 140 mV; Beta threshold = 3.6 mV; Beta window = 3.6 mV to 30 mV.

Local background ~ 1 cpm alpha, 298 cpm beta. Th-230 efficiency measured on contact.

S/N of source used for precision check #6

Isotope **Cs-137**

Dedicated Source? Yes No

Reading #1 **26,000 cpm**

Reading #2 **26,000 cpm**

Reading #3 **26,000 cpm**

Mean **26,000 cpm**

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

Range Multiplier	Reference Calibration Point	Instrument Indication
x 1000	400,000 cpm	400,000 cpm
x 1000	100,000 cpm	100,000 cpm
x 100	40,000 cpm	40,000 cpm
x 100	10,000 cpm	10,000 cpm
x 10	4000 cpm	4000 cpm
x 10	1000 cpm	1000 cpm
x 1	400 cpm	400 cpm
x 1	100 cpm	100 cpm
1 min count	100,000 cpm	100,002 cpm

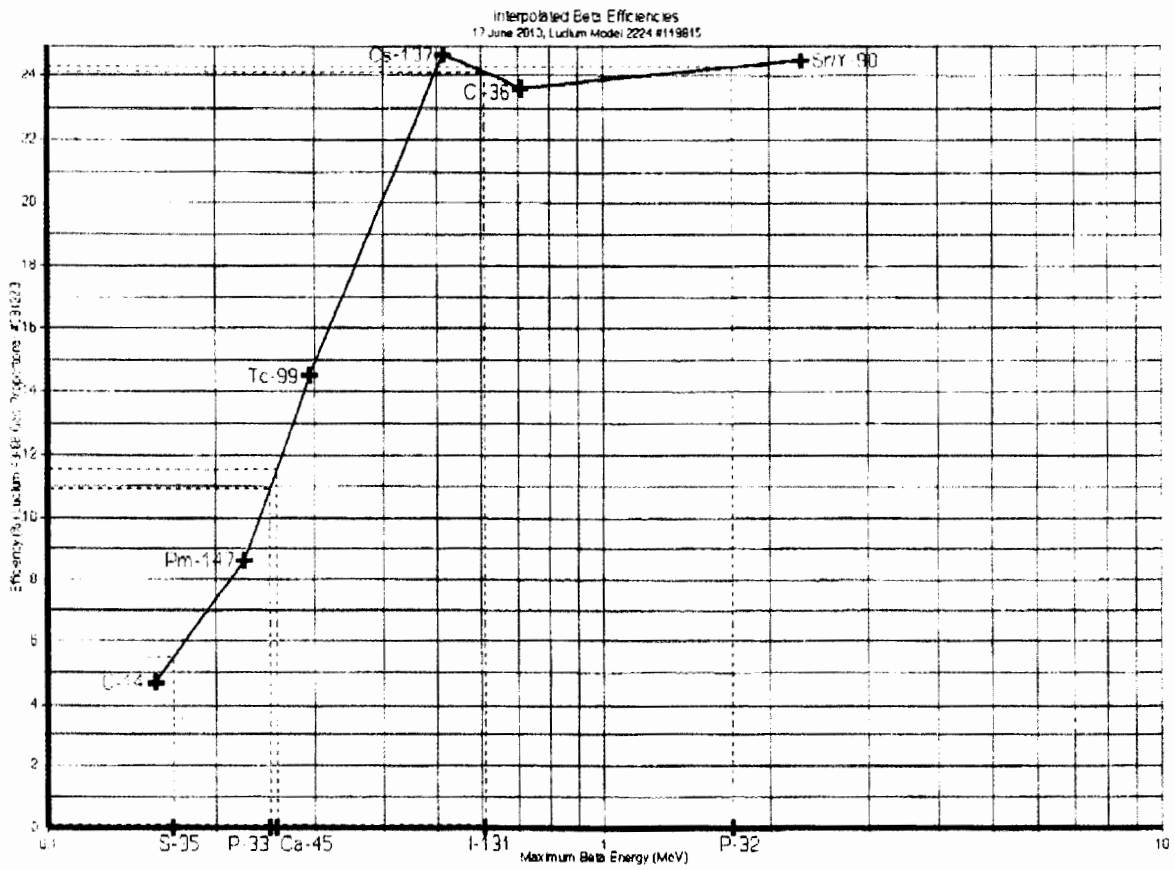
All ranges calibrated electronically.

Range Multiplier	Cal. Source Used (isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	4 π Instrument Efficiency (%)
1 min. count	C-14 #4486	292,100	0 (a) 9,860 (B)	0.0% 4.7%
1 min. count	Pm-147 #1613-32	18,193	0 (a) 1,856 (B)	0.0% 8.6%
1 min. count	Tc-99 #1702	23,064	0 (a) 3,641 (B)	0.0% 14.3%
1 min. count	Cs-137 #2886	14,561	1 (a) 3,890 (B)	0.0% 24.7%
1 min. count	Cl-36 #D700	23,598	1 (a) 5,875 (B)	0.0% 23.6%
1 min. count	Sr/Y-90 #D711	36,051	2 (a) 9,124 (B)	0.0% 24.5%
1 min. count	Th-230 #91T12200210	38,900	1,655 (a) 4,648 (B)	4.2% 11.2%

RSA Laboratories ID# 15583. Instrument indicates within ±10% of calibration points unless otherwise indicated. Source-to-detector entry window distance for efficiency determinations is 1 cm unless otherwise specified. RSA Laboratories, Inc. certifies that the above instrument has been calibrated with standards traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio-type of calibration techniques.

Calibrated by: **Kurt D. Newton**

Date: **17 June 2013**



RSA Laboratories ID# 15583.

Calibrated by: Kurt D. Newton

Date: 17 June 2013

CERTIFICATE OF CALIBRATION (COUNT-RATE INSTRUMENT)



RSA Laboratories, Inc.

19 Pendleton Drive, P.O. Box 61
Hebron, Connecticut 06248
(860) 228-0721 Fax (860) 228-4402

Customer and Contact: **Radiation Safety Associates, Inc. Attn: K. Paul Stelmeyer (860) 228-0487**
 Customer Address: **P.O. Box 107, 19 Pendleton Drive, Hebron, CT 06248**
 Inst. Mfr. & Model **Ludlum Model 2224** Inst. Type **Scaler/Ratemeter** Inst. s/n **119815**
 Det. Mfr. & Model **Ludlum Model 43-68** Det. Type **Gas Proportional** Det. s/n **091223**
 Cal. Date **17 June 2013** Due Date **17 June 2014** Cal. Interval **1 year**

Environmental conditions: Temperature: 72°F Relative Humidity 52% Atmospheric Pressure 29.60 inches Hg

Pre-calibration Checks:

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- Audio check
- Reset check
- Fast response check
- Slow response check
- Window operation
- Plateau check
- Alarm set
- Det. volts 1580 Vdc
- Input sens. *See comments

- Pulse generator s/n 94926
- HV Readout (2 points) Ref./Inst. 900 V/ 900 V
- Oscilloscope s/n 171-04928
- Ref./Inst. 1700 V/ 1700 V
- Voltmeter s/n 57410002

Comments: * Alpha threshold = 140 mV; Beta threshold = 3.6 mV; Beta window = 3.6 mV to 30 mV.
 Local background = 1 cpm alpha, 298 cpm beta. All efficiencies measured on contact.

S/N of source used for precision check #6 Isotope **Cs-137** Dedicated Source? Yes No
 Reading #1 33,000 cpm Reading #2 33,000 cpm Reading #3 33,000 cpm Mean 33,000 cpm
 Precision: ± < 10% ± 10-20% Out of tolerance

Range Multiplier	Reference Calibration Point	Instrument Indication
x 1000	400,000 cpm	400,000 cpm
x 1000	100,000 cpm	100,000 cpm
x 100	40,000 cpm	40,000 cpm
x 100	10,000 cpm	10,000 cpm
x 10	4000 cpm	4000 cpm
x 10	1000 cpm	1000 cpm
x 1	400 cpm	400 cpm
x 1	100 cpm	100 cpm
1 min count	100,000 cpm	100,002 cpm

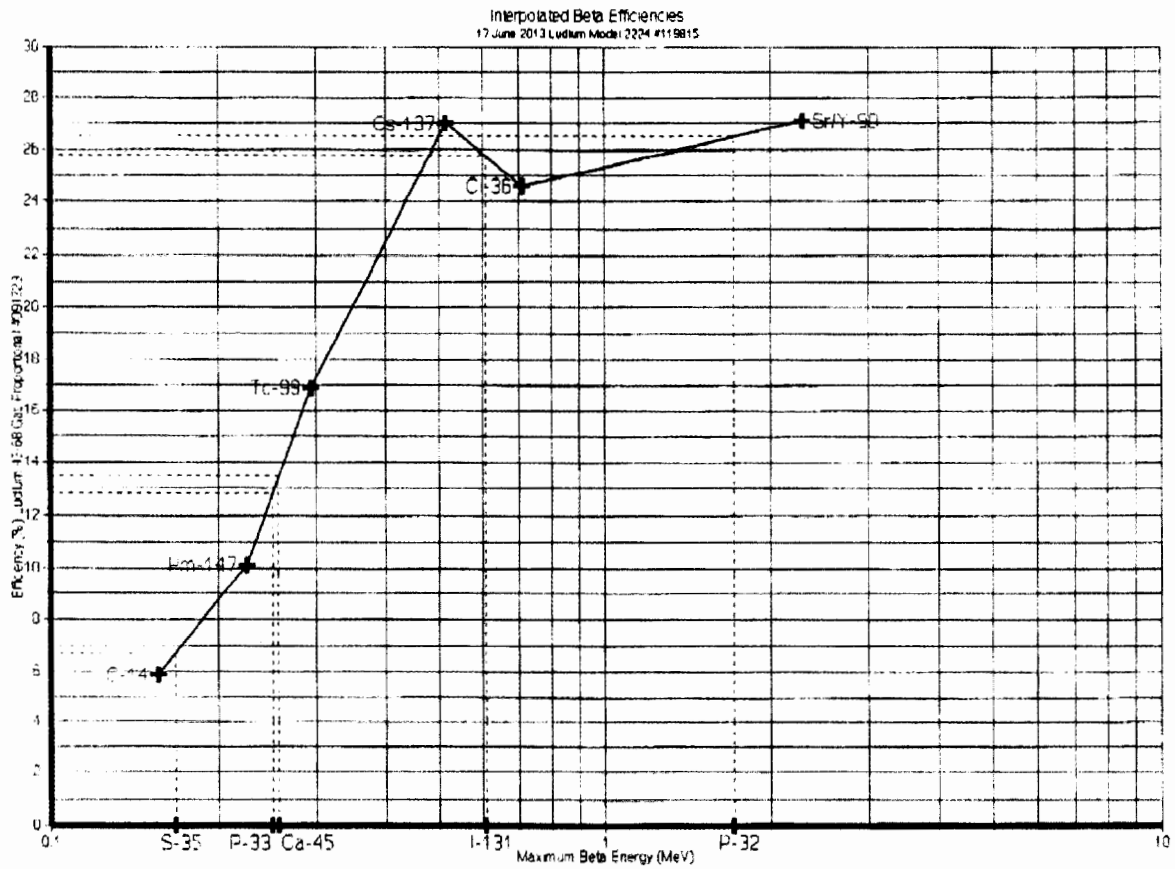
All ranges calibrated electronically.

Range Multiplier	Cal. Source Used (isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	4σ Instrument Efficiency (%)
1 min. count	C-14 #4436	202,100	1 (α) 12,198 (β)	0.0% 5.9%
1 min. count	Pm-147 #1613-32	18,193	0 (α) 2,143 (β)	0.0% 10.1%
1 min. count	Tc-99 #D702	23,064	1 (α) 4,198 (β)	0.0% 16.9%
1 min. count	Cs-137 #2886	14,561	1 (α) 4,228 (β)	0.0% 27.0%
1 min. count	Cl-36 #D700	23,598	2 (α) 6,100 (β)	0.0% 24.6%
1 min. count	Sr/Y-90 #D711	36,851	2 (α) 10,072 (β)	0.0% 27.1%
1 min. count	Th-230 #91TH2200210	38,900	1,766 (α) 4,670 (β)	4.5% 11.2%

RSA Laboratories ID# 15583. Instrument indicates within ±10% of calibration points unless otherwise indicated. Source-to-detector entry window distance for efficiency determinations is 1 cm unless otherwise specified. RSA Laboratories, Inc. certifies that the above instrument has been calibrated with standards traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio-type of calibration techniques.

Calibrated by: Kurt D. Newton

Date: 17 June 2013



RSA Laboratories ID# 15583.

Calibrated by: Kurt D. Newton

Date: 17 June 2013

ATTACHMENT B

MINIMUM DETECTABLE ACTIVITY

All values calculated to 95% CL via MARSSIM methods

For the Gas Proportional Counter 43-68 probe:

$$\frac{k_1^2 + 2 k_1 \sqrt{R_b t_s \left(1 + \frac{t_s}{t_b}\right)}}{(t_s) (E) \left(\frac{A}{100}\right) (C)}$$

where:

k_1 = one-sided confidence level factor for the chosen confidence level (95% = 1.645).
(The MARSSIM method sets the k_1^2 term = 3.)

R_b = background count rate in cpm

t_s = sample count time in minutes

t_b = background count time in minutes

E = detector efficiency in counts per disintegration

$\frac{A}{100}$ accounts for the detector area. (A = 126 cm².)

C = conversion factor from dpm to other desired activity unit, if applicable.
In this case, C = 1. MDA is in dpm/100 cm².

$$\frac{3 + 3.29 \sqrt{(1.966) (1) \left(1 + \frac{2}{30}\right)}}{(1) (0.045) \left(\frac{126}{100}\right) (1)} =$$

$$= \frac{12.34}{0.1134} = 108.84 \text{ dpm/100cm}^2 \text{ alpha}$$

For the Gas Proportional Counter 43-37 probe:

$$\frac{k_1^2 + 2 k_1 \sqrt{R_b t_s \left(1 + \frac{t_s}{t_b}\right)}}{(t_s) (E) \left(\frac{A}{100}\right) (C)}$$

where:

k_1 = one-sided confidence level factor for the chosen confidence level (95% = 1.645).
(The MARSSIM method sets the k_1^2 term = 3.)

R_b = background count rate in cpm

t_s = sample count time in minutes

t_b = background count time in minutes

E = detector efficiency in counts per disintegration

$\frac{A}{100}$ accounts for the detector area. (A = 584 cm².)

C = conversion factor from dpm to other desired activity unit, if applicable.
In this case, C = 1. MDA is in dpm/100 cm².

$$\frac{3 + 3.29 \sqrt{(2) (1) \left(1 + \frac{1}{5}\right)}}{(1) (0.046) \left(\frac{584}{100}\right) (1)}$$
$$= \frac{7.80}{0.2686} = 29.05 \text{ dpm/100cm}^2 \text{ alpha}$$

Direct Measurements (alpha)
Ludlum 2224 s/n 119815 w/43-37 s/n 160827

DETECTION LIMITS--SURFACE CONTAMINATION

INPUT DATA:

Background Count = 10 total counts
Background Counting Time = 5 minutes
Sample Counting Time = 1 minutes
Detector Efficiency = 4.6 %
Detector Area = 584 cm²

RESULTS:

Critical Level (Lc) = 2.54842 cpm above bkgd.
Detection Limit (Ld) = 7.80287 cpm above bkgd.
Minimum Detectable Activity (MDA) = 169.628 dpm/detector
Minimum Detectable Activity (MDA) = 29.0458 dpm/100 cm²
Minimum Detectable Activity (MDA) = 2.82713 Bq/detector
Minimum Detectable Activity (MDA) = 0.00484097 Bq/1 cm²

All values calculated to the 95% confidence level

Calculated by RadCalc version 1.1 on 7/28/2014 at 4:03:17 PM

Direct Measurements (alpha)
Ludlum 2224 s/n 119815 w/43-68 s/n 091223

DETECTION LIMITS--SURFACE CONTAMINATION

INPUT DATA:

Background Count = 59 total counts
Background Counting Time = 30 minutes
Sample Counting Time = 2 minutes
Detector Efficiency = 4.5 %
Detector Area = 126 cm²

RESULTS:

Critical Level (Lc) = 1.69895 cpm above bkgd.
Detection Limit (Ld) = 4.8979 cpm above bkgd.
Minimum Detectable Activity (MDA) = 108.842 dpm/detector
Minimum Detectable Activity (MDA) = 86.3827 dpm/100 cm²
Minimum Detectable Activity (MDA) = 1.81404 Bq/detector
Minimum Detectable Activity (MDA) = 0.0143971 Bq/1 cm²

All values calculated to 95% CL via MARSSIM methods

Calculated by RadCalc version 1.1 on 7/28/2014 at 4:01:11 PM

ATTACHMENT C

Survey Area Maps

RSA Laboratories

A Division of Radiation Safety Associates, Inc

19 Pendleton Drive

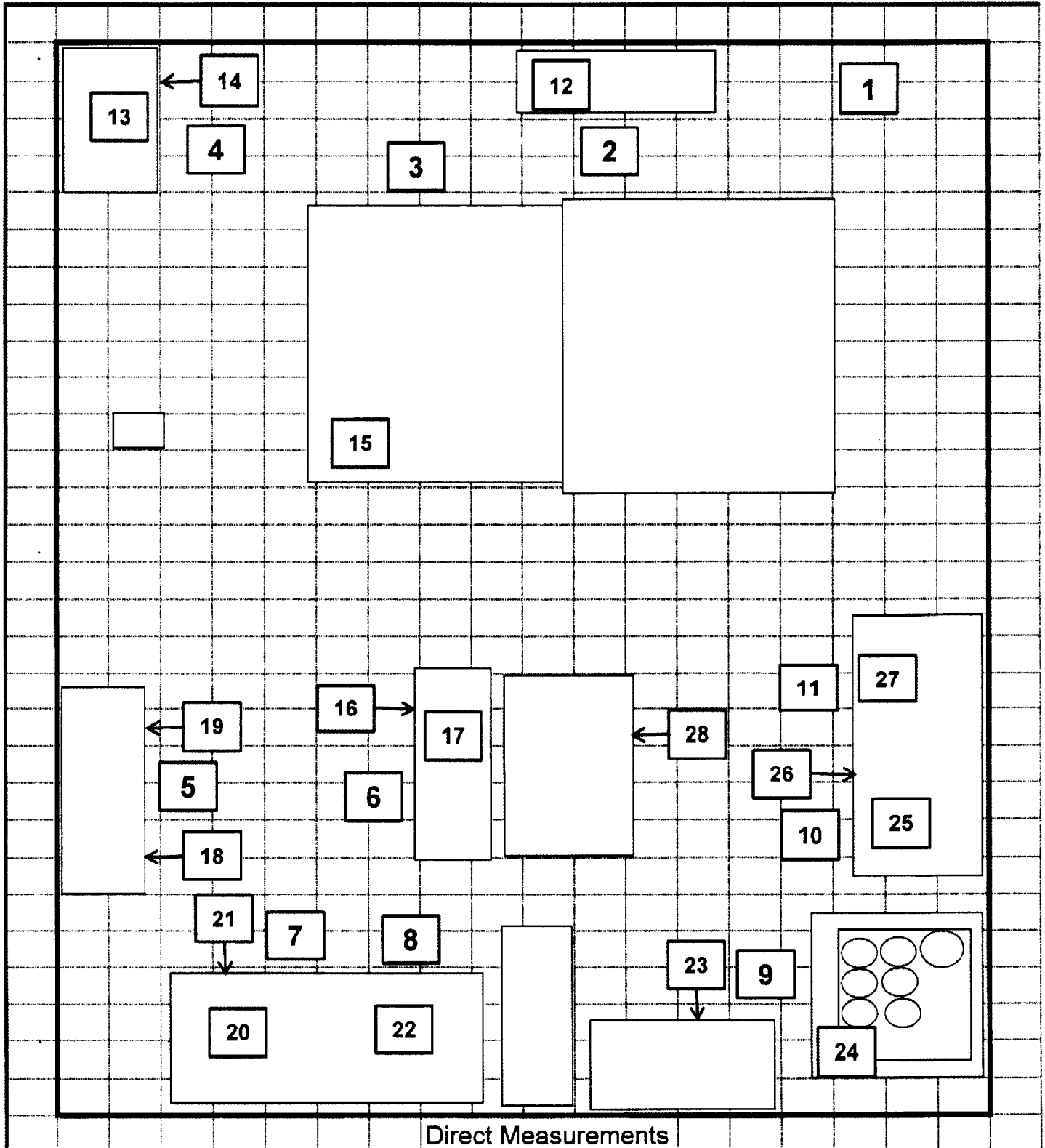
Hebron, CT 06248

(860) 228-0721

Location: Central Connecticut State University

Purpose: Decommissioning Survey

Date: 6/9/2014



RSA Laboratories

A Division of Radiation Safety Associates, Inc

19 Pendleton Drive

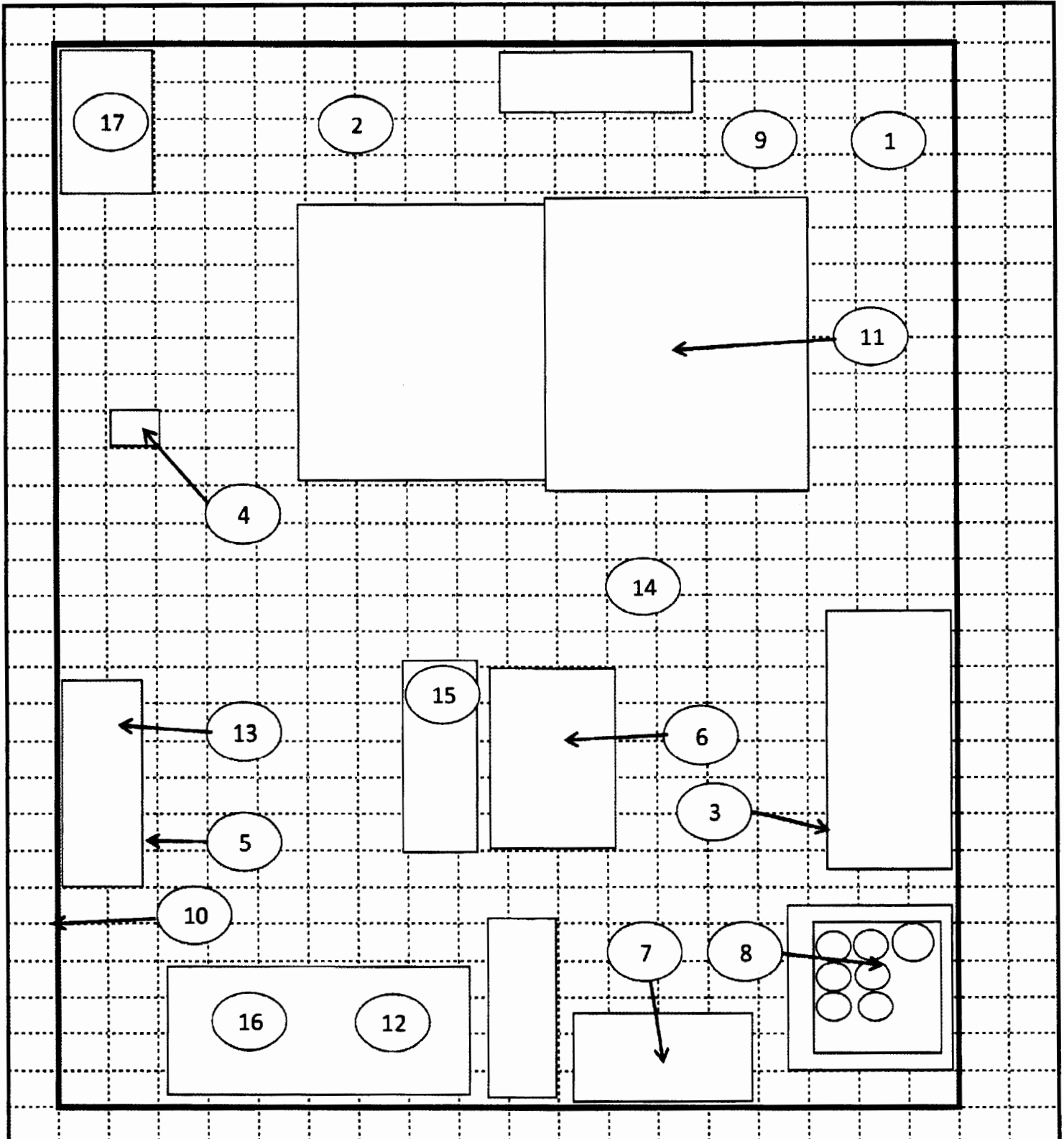
Hebron, CT 06248

(860) 228-0721

Location: Central Connecticut State University

Purpose: Decommissioning Survey Wipes

Date: 6/9/2014



ATTACHMENT D

Survey Results

**Central Connecticut State University-
Survey-Direct Measurements**

Date: 6/9/2014

Instrument: Ludlum 2224 s/n 119815 w/43-68 s/n 091223

MDA: 720 dpm/100 cm²

C-14 efficiency (%):

5.9

Background (5 min. count): 994

Beta cpm:

199

#	Location	Gross Beta cpm	Beta dpm
12	table	195	-54
13	countertop	189	-135
14	drawer-top-right	206	94
15	countertop	171	-377
16	drawer-top-left	219	269
17	countertop	190	-121
18	rad-drawer-top-left	200	13
19	shelf #2	187	-161
20	hood	202	40
21	cabinet-right	193	-81
22	counter	191	-108
23	drawer-top-left	203	54
24	pit ledge-center	238	525
25	counter	201	27
26	drawer-center-left	197	-27
27	sink ledge-center	240	552
28	cabinet-right	197	-27

Instrument: Ludlum 2224 s/n 119815 w/43-68 s/n 091223

MDA: 86.4 dpm/100 cm²

Th-230 (α) efficiency (%):

4.5

Background (30 min. count): 59

Alpha cpm:

2

#	Location	Gross Alpha (2 min. cnt)	Gross Alpha cpm	Alpha dpm
12	table	6	3	18
13	countertop	2	1	-18
14	drawer-top-right	5	2.5	9
15	countertop	4	2	0
16	drawer-top-left	6	3	18
17	countertop	3	1.5	-9
18	rad-drawer-top-left	2	1	-18
19	shelf #2	6	3	18
20	hood	4	2	0
21	cabinet-right	3	1.5	-9
22	counter	2	1	-18
23	drawer-top-left	3	1.5	-9
24	pit ledge-center	2	1	-18
25	counter	4	2	0
26	drawer-center-left	5	2.5	9

**Central Connecticut State University-
Survey-Direct Measurements**

Date: 6/9/2014

Instrument: Ludlum 2224 s/n 119815 w/43-37 s/n 160827

MDA: 279 dpm/100 cm²

C-14 efficiency (%):

4.0

Background (5 min. count): 1506

Beta cpm:

301

#	Location	Gross Beta cpm	Beta dpm
1	floor-entrance	332	133
2	floor-analyzer	313	51
3	floor-workbench	271	-128
4	floor-countertop	326	107
5	floor-counter	275	-111
6	floor-counter	296	-21
7	floor-hood	287	-60
8	floor-counter	313	51
9	floor-pit	310	39
10	floor-counter	289	-51
11	floor-sink	299	-9

Instrument: Ludlum 2224 s/n 119815 w/43-37 s/n 160827

MDA: 29 dpm/100 cm²

Th-230 (α) efficiency (%):

4.6

Background (5 min. count): 11

Alpha cpm:

2

#	Location	Gross Alpha cpm	Alpha dpm
1	floor-entrance	3	4
2	floor-analyzer	2	0
3	floor-workbench	4	7
4	floor-countertop	2	0
5	floor-counter	2	0
6	floor-counter	2	0
7	floor-hood	1	-4
8	floor-counter	0	-7
9	floor-pit	1	-4
10	floor-counter	3	4
11	floor-sink	2	0

Radiological Survey Logsheet

RSA Laboratories Inc.
21 Pendleton Drive, PO Box 61
Hebron, CT 06248

Job Location: Central Connecticut State University
Survey Purpose: Decommissioning Survey
Performed By: Jay R. Dockendorff Signature: _____

Page: 1
Date: 6/9/2014

Inst (1) (Model/SN)	Inst (2) (Model/SN)	Inst (3) Protean IPC 9025 (Model/SN) 236425
Det. (Model/SN)	Det. (Model/SN)	Det. Int Gas Proportional (Model/SN)
Eff.	Eff.	Eff. Alpha : 27.29% Beta : 40.80%
Type Rad.	Type Rad.	Type Rad. Alpha/Beta
Bkgd.	Bkgd.	Bkgd. Alpha cpm: 0.47 Beta cpm: 1.93
CalDue	CalDue	CalDue 28-Feb-15

Alpha LLD: **8.55 dpm/100 cm²**

All wipes 100 cm2

Instrument #3 used to analyze wipes

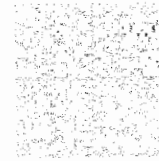
Beta LLD **13.57 dpm/100 cm²**

No.	Time	Location	A CPM	A DPM		
BG		Background	0.47		1.93	
1	"	Floor	-0.14	-0.23	6.07	6.70
2	"	Floor	-0.47	-0.78	1.07	1.18
3	"	Drawer (Civil Defense src loc.)	-0.47	-0.78	2.07	2.29
4	"	Civil Defense Box	-0.47	-0.78	0.07	0.08
5	"	Source drawer	0.20	0.32	1.07	1.18
6	"	Cabinet shelf	-0.47	-0.78	0.07	0.08
7	"	Cabinet Shelf	-0.47	-0.78	2.07	2.29
8	"	Source pit	-0.47	-0.78	2.07	2.29
9	"	Wall 0 - 1 meter	-0.14	-0.23	2.07	2.29
10	"	Wall 1 - 2 meter	-0.47	-0.78	1.07	1.18
11	"	Ion Implanter (inside shelf)	-0.47	-0.78	2.07	2.29
12	"	Countertop	-0.14	-0.23	3.07	3.39
13	"	Countertop	0.53	0.87	0.07	0.08
14	"	Floor	-0.47	-0.78	4.07	4.49
15	"	Rolling cart top	-0.47	-0.78	1.07	1.18
16	"	Hood countertop	-0.14	-0.23	6.07	6.70
17	"	Countertop	-0.47	-0.78	2.07	2.29

Dr. L. Tongson
Physics and Engineering Physics
CENTRAL CONNECTICUT STATE
1615 STANLEY STREET
NEW BRITAIN, CT 06050



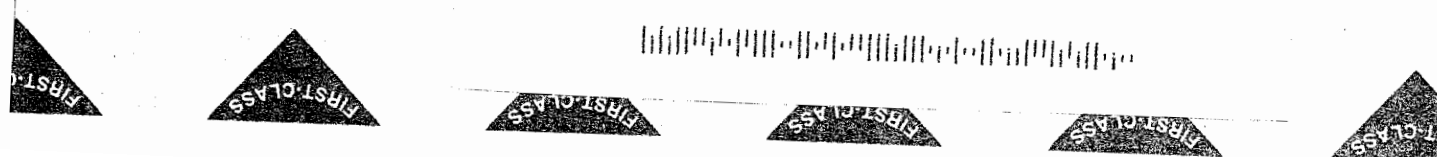
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Mr. Michael Reichard
Health Physicist
Division of Nuclear Materials Safety
United States Nuclear Regulatory Commission
King of Prussia, PA 19406



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Sincerely,
Licensing Assistance Team Leader