

Counting Statistics for Portable and Laboratory Instruments

Minimum Detectable Activity (MDA)

MDA is the minimum detectable (*quantifiable*) activity in dpm at a specified confidence level. Additional conversion factors (C) may be applied to convert dpm to any other activity units that may be desired (e.g., μCi , kBq, etc.). MDA depends on the counting device, counting times (controllable by procedure) and background counting rate. It is not specific to an individual sample. The MDA of a detection system can be prospectively established in the sample collection and counting procedure by specifying sample and background counting times, and by specifying some maximum acceptable background counting rate. Detector efficiency is established during calibration.

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

Where:

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

A = area wiped

C = conversion factor from dpm to other desired activity unit, if applicable

k_1 = the one-sided confidence factor = 1.645 at 95% confidence

In nuclear counting programs, MDA is usually calculated at the 95% confidence level ($k_1 = 1.645$).

MARSSIM sets the first term of the numerator equal to 3 instead of 2.71.

$$\text{MDA}_{95\%} = \frac{3 + 3.29 \sqrt{R_b t_s \left(1 + \frac{t_s}{t_b}\right)}}{(t_s)(E)(C)}$$

Where:

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

C = conversion factor from dpm to other desired activity unit, if applicable. For these calculations, C = 1.

LLD for Wipe Samples—Liquid Scintillation Analysis

When assaying samples, including wipe samples, the more correct term to use is lower limit of detection (LLD) because sample parameters (e.g., area wiped in this case), in addition to detector and procedural variables, are now part of the equation. For wipe samples, the equation is modified as follows:

$$LLD_{95\%} = \frac{3 + 2k_1 \sqrt{R_b t_s \left(1 + \frac{t_s}{t_b}\right)}}{(t_s)(E) \left(\frac{A}{100}\right)(C)}$$

This extra term in the denominator accounts for the actual area wiped. A sample area of 100 cm² (~4"×4" or 10 cm×10 cm) was used for these samples.

$$k_1 = 1.645 \text{ at CL}=95\%$$

$$R_b = 50 \text{ cpm}$$

$$t_s = 1 \text{ minutes}$$

$$t_b = 1 \text{ minutes}$$

$$E = 75\% \text{ (worst case)}$$

$$A_{\text{Wiped}} = 100 \text{ cm}^2$$

$$C = 1 \text{ (i.e., no unit conversion factor used)}$$

$$\frac{3 + 3.29 \sqrt{50 * 1 \left(1 + \frac{1}{1}\right)}}{(1)(0.75) \left(\frac{100}{100}\right)(1)} = \frac{35.9}{0.75} = 47.9 \text{ dpm}/100 \text{ cm}^2$$

An LLD of 47.9 dpm/100cm² shows that the DCGL concentration of total contamination can easily be seen with 95% certainty.

LLD for Direct Static Surface Measurements (Ludlum Model 43-68 + Model 2224-1)

Performing direct contamination measurements is the same as counting wipe samples, except the sample is the floor or component being measured. Detector area (A) now comes into play, instead of the area wiped. The area of the Ludlum Model 43-68 is 126 cm². The LLD will be in terms of dpm/100 cm².

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

Given:

$$k_1 = 1.645 \text{ at CL}=95\%$$

$$R_b = 546 \text{ cpm}$$

$$t_s = 2 \text{ minutes}$$

$$t_b = 5 \text{ minutes}$$

$$E = 7.2\%$$

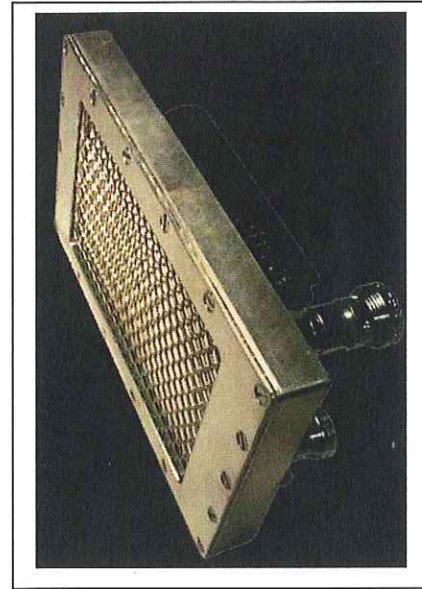
$$A_{\text{Active}} = 126 \text{ cm}^2$$

$$C = 1 \text{ (i.e., no unit conversion factor used)}$$

At 95% confidence this becomes

$$LLD_{95\%} = \frac{3 + 3.29 \sqrt{546 * 2 \left(1 + \frac{2}{5}\right)}}{(2)(0.072) \left(\frac{126}{100}\right) (1)} = \frac{131.64}{0.18} = 726 \text{ dpm}/100 \text{ cm}^2$$

An LLD of 726dpm/100cm² shows that we can detect concentrations of total contamination that are far less than even the DCGL for removable contamination, with 95% certainty.



LLD for Direct Static Surface Measurements (Ludlum Model 43-37 + Model 2224-1)

Performing direct contamination measurements is the same as counting wipe samples, except the sample is the floor or component being measured. Detector area (A) now comes into play, instead of the area wiped. The area of the Ludlum Model 43-37 is 584 cm². The LLD will be in terms of dpm/100 cm².

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

Given:

$$k_1 = 1.645 \text{ at CL}=95\%$$

$$R_b = 521 \text{ cpm}$$

$$t_s = 2 \text{ minutes}$$

$$t_b = 5 \text{ minutes}$$

$$E = 4.7\%$$

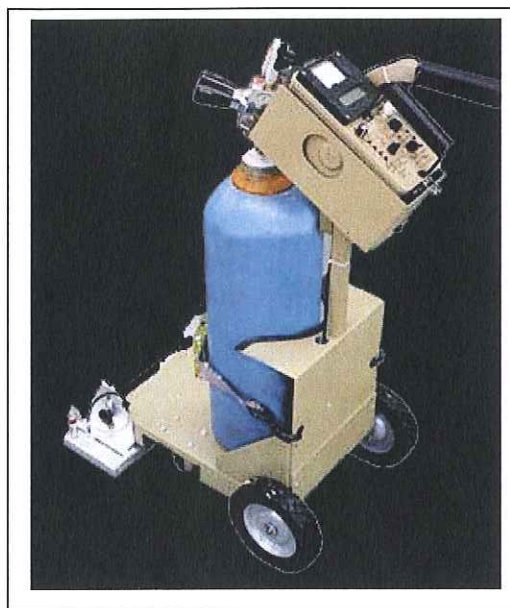
$$A_{\text{active}} = 584 \text{ cm}^2$$

$$C = 1 \text{ (i.e., no unit conversion factor used)}$$

At 95% confidence this becomes

$$LLD_{95\%} = \frac{3 + 3.29 \sqrt{490 \times 2 \left(1 + \frac{2}{5}\right)}}{(2)(0.047) \left(\frac{584}{100}\right) (1)} = \frac{124.9}{0.55} = 227 \text{ dpm}/100 \text{ cm}^2$$

An LLD of 227 dpm/100 cm² shows that concentrations of total contamination can be detected that are far less than even the DCGL for removable contamination with 95% certainty.



SCANNING MDA FOR COUNT-RATE METERS¹

At the 95% confidence level, the equation for MDA using a count rate meter is

$$MDA_{95\%} = \frac{4.65 \sqrt{\frac{R_b}{2\tau}}}{(E) \left(\frac{A}{100} \right)}$$

where:

MDA = dpm/100 cm²

R_b = background count rate (cpm)

τ = detector time constant (min)^{*}

(from mfr's tech manual; = 4 sec fast, 22 sec slow)

NOTE: time constant ≠ response time.

E = detector efficiency in counts per disintegration

A = active detector area in cm²

The detection sensitivity of scanning is dependent on a number of other factors, such as detector scan rate, size of contaminated area, amount of activity present and surface-to-detector distance. A rough estimate of the MDA for a scan survey can be calculated by substituting the audibly discernable increase in count rate for the numerator in the above equation. Therefore,

$$MDA = \frac{D_i \times R_b}{E \times \frac{A}{100}}$$

where:

D_i = Audibly discernable increase in instrument counting rate (multiples of R_b)

E.g., 2 = able to discern 2× background from R_b; 3 = able to discern 3× background from R_b.

R_b = Background counting rate (cpm)

E = Instrument counting efficiency (counts per disintegration)

A = Active detector area in cm²

An experienced surveyor may be able to discern an increase of 25% to 50% at background counting rates of several hundred cpm or more. At low background counting rates an increase of two or three times background might be required before an identifiable audible difference can be discerned. The health physicists who performed the scanning surveys at Chemtura are able to discern (conservatively) **twice** background at a minimum.

Standard practice for Radiation Safety Associates, Inc. personnel is to scan at a rate no faster than 1 detector width per second, and maintain a surface-to detector distance of 1 cm.

¹ From Oak Ridge Associated Universities text book (<http://www.ora.u.org/ptp/5849/5849-5.pdf>) "Scanning."

Scan Survey Sensitivity—Ludlum 43-37 Floor Monitor

The health physicists who performed the scanning surveys at Chemtura are able to discern (conservatively) **twice** background at a minimum. Therefore the scanning MDA at the 95% confidence level for the Ludlum 43-37 floor monitor is:

$$MDA = \frac{2 \times R_b}{E \times \frac{A}{100}}$$

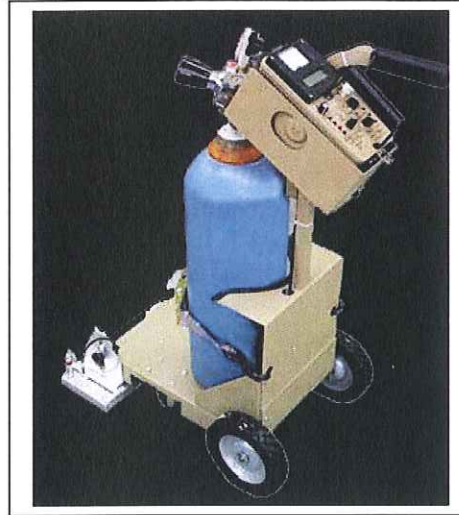
Where:

$$R_b = 490 \text{ cpm}$$

$$E = 4.7\%$$

$$A = 584 \text{ cm}^2$$

$$MDA = \frac{2 \times 490 \text{ cpm}}{0.047 \times \frac{584}{100}} = \frac{980}{0.27} = 3,630 \text{ dpm}/100 \text{ cm}^2$$

**Scan Survey Sensitivity—Ludlum 43-68 Hand-Held Detector**

The health physicists who performed the scanning surveys at Chemtura are able to discern (conservatively) **twice** background at a minimum. Therefore the scanning MDA at the 95% confidence level for the Ludlum 43-68 hand-held monitor is:

$$MDA = \frac{2 \times R_b}{E \times \frac{A}{100}}$$

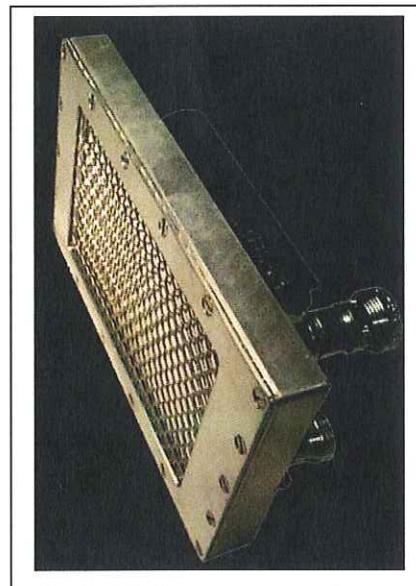
Where:

$$R_b = 546 \text{ cpm}$$

$$E = 7.2\%$$

$$A = 126 \text{ cm}^2$$

$$MDA = \frac{2 \times 546 \text{ cpm}}{0.072 \times \frac{126}{100}} = \frac{1092}{0.091} = 12,000 \text{ dpm}/100 \text{ cm}^2$$



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 2224-1 Inst. Type Scaler/Ratemeter
 Det. Mfr. & Model Ludlum Model 43-68 Det. Type Gas Proportional
 Cal. Date 29 December 2010 Due Date 29 December 2011
 Inst. s/n 129459
 Det. s/n 111315
 Cal. Interval 1 year

Environmental conditions: Temperature: 72°F Relative Humidity 34% Atmospheric Pressure 29.65 inches Hg

Pre-calibration Checks:

- Contamination survey Battery check Slow response check Det. volts 1550 Vdc
- Mechanical check Audio check Window operation
- Meter zero Reset check Plateau check
- Geotropism check Fast response check Alarm set 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 ≈ 2 cpm alpha, 614 cpm beta.

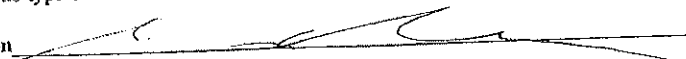
S/N of source used for precision check #6 Isotope Cs-137 Dedicated Source? Yes No
 Reading #1 23,000 cpm Reading #2 23,000 cpm Reading #3 23,000 cpm Mean 23,000 cpm
 Precision: ± < 10% ± 10-20% Out of tolerance

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	100,001 cpm	100,001 cpm

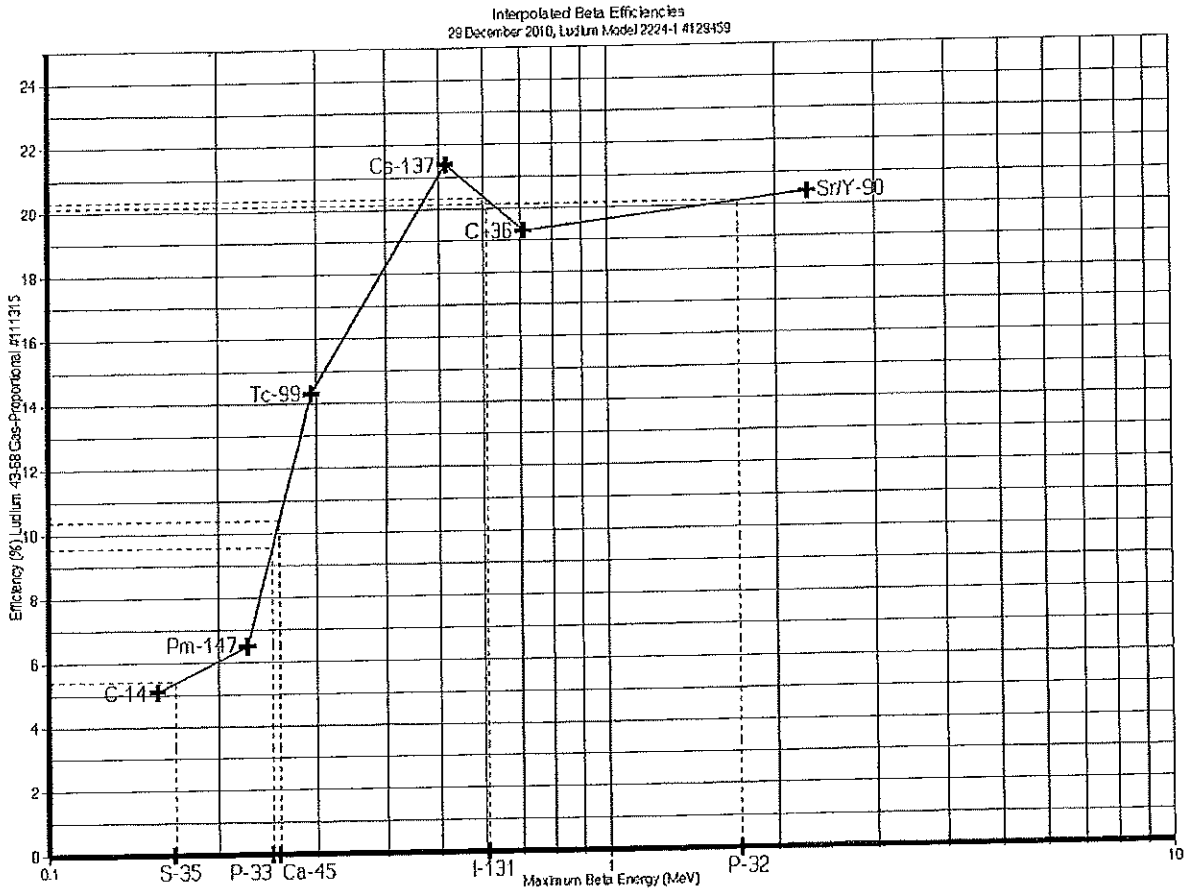
All ranges calibrated electronically.

Range Multiplier	Cal. Source Used (isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	4x Instrument Efficiency (%)
1 min. count	C-14 #4456	202,100	1 (α) 10,838 (β)	0.0% 5.1%
1 min. count	Pm-147 #5381	1,653	1 (α) 721 (β)	0.0% 6.5%
1 min. count	Tc-99 #D702	23,064	3 (α) 3,917 (β)	0.0% 14.3%
1 min. count	Cs-137 #2886	15,425	3 (α) 3,921 (β)	0.0% 21.4%
1 min. count	Cl-36 #D700	23,598	1 (α) 5,162 (β)	0.0% 19.3%
1 min. count	Sr/Y-90 #D711	38,312	2 (α) 8,431 (β)	0.0% 20.4%
1 min. count	Th-230 #91TH2200210	38,900	310 (α) 1,593 (β)	0.8% 2.5%

RSA Laboratories ID# 13901. 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: 29 December 2010

Calibration Certificates Attachment AA



RSA Laboratories ID# 13901.

Calibrated by: Kurt D. Newton

Date: 29 December 2010

**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 2224-1 Inst. Type Scaler/Ratemeter Inst. s/n 129459
Det. Mfr. & Model Ludlum Model 43-68 Det. Type Gas Proportional Det. s/n 111315
Cal. Date 29 December 2010 Due Date 29 December 2011 Cal. Interval 1 year

Environmental conditions: Temperature: 72°F Relative Humidity 34% Atmospheric Pressure 29.65 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 1550 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 = 2 cpm alpha, 614 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 28,000 cpm Reading #2 28,000 cpm Reading #3 28,000 cpm Mean 28,000 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	100,001 cpm

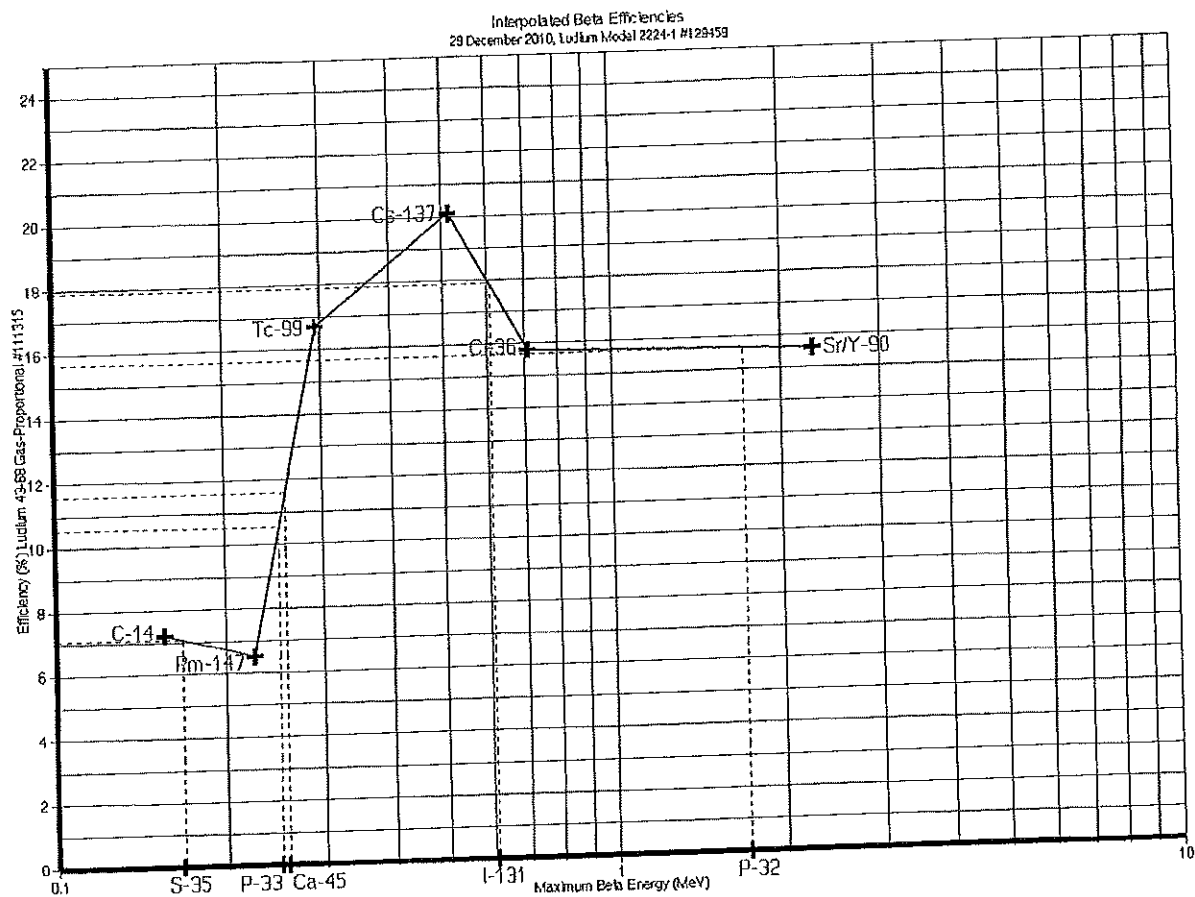
All ranges calibrated electronically.

Range Multiplier	Cal. Source Used (isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	4x Instrument Efficiency (%)
1 min. count	C-14 #4456	202,100	0 (α) 15,158 (β)	0.0% 7.2%
1 min. count	Pm-147 #5381	1,653	1 (α) 720 (β)	0.0% 6.5%
1 min. count	Tc-99 #D702	23,064	0 (α) 4,467 (β)	0.0% 16.7%
1 min. count	Cs-137 #2886	15,425	0 (α) 3,714 (β)	0.0% 20.1%
1 min. count	Ci-36 #D700	23,598	2 (α) 4,342 (β)	0.0% 15.8%
1 min. count	Sc/Y-90 #D711	38,312	0 (α) 6,603 (β)	0.0% 15.6%
1 min. count	Th-230 #91TH2200210	38,900	3,895 (α) 2,186 (β)	8.4% 4.0%

RSA Laboratories ID# 13901. 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: 29 December 2010

Calibration Certificates Attachment AA



RSA Laboratories ID# 13901.

Calibrated by: Kurt D. Newton

Date: 29 December 2010

Calibration Certificates Attachment AA
**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 30 December 2010 Due Date 30 December 2011 Cal. Interval 1 year

Environmental conditions: Temperature: 70°F Relative Humidity 36% Atmospheric Pressure 29.85 inches Hg

Pre-calibration Checks:

- Contamination survey
- Battery check
- Slow response check
- Mechanical check
- Audio check
- Window operation
- Meter zero
- Reset check
- Plateau check
- Det. volts 1580 Vdc
- Geotropism check
- Fast response check
- Alarm set
- 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, 617 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 20,000 cpm Reading #2 20,000 cpm Reading #3 20,000 cpm Mean 20,000 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	99,999 cpm	99,999 cpm

All ranges calibrated electronically.

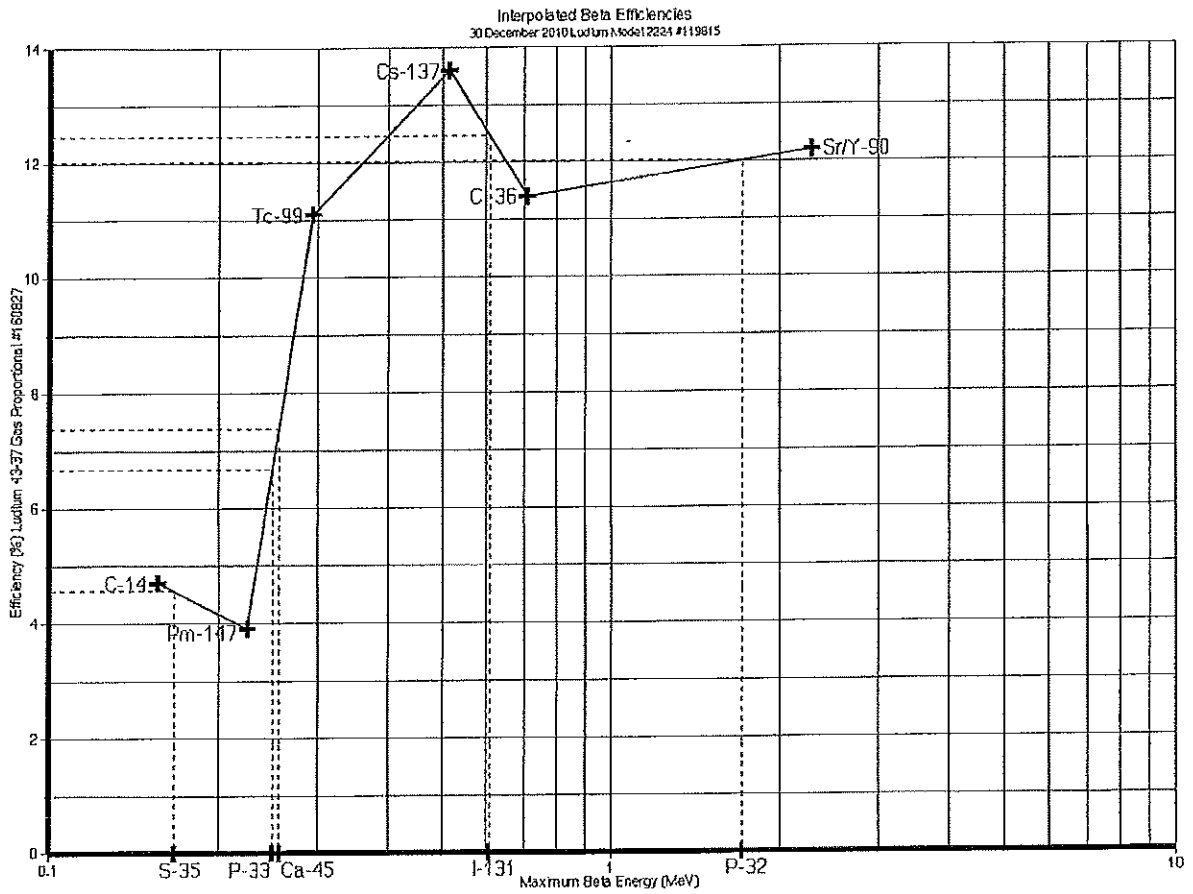
Range Multiplier	Cal. Source Used (Isotope and S/N)	Source Activity (dpm)	Instrument Reading (cpm)	4x Instrument Efficiency (%)
1 min. count	C-14 #4456	202,100	0 (a) 10,135 (b)	0.0% 4.7%
1 min. count	Pm-147 #5381	1,653	0 (a) 682 (b)	0.0% 3.9%
1 min. count	Tc-99 #D702	23,064	2 (a) 2,179 (b)	0.0% 11.1%
1 min. count	Cs-137 #2886	15,425	2 (a) 2,708 (b)	0.0% 13.6%
1 min. count	Cl-36 #D700	23,598	3 (a) 3,311 (b)	0.0% 11.4%
1 min. count	Sr/Y-90 #D711	38,312	1 (a) 5,301 (b)	0.0% 12.2%
1 min. count	Th-230 #91TH2200210	38,900	1,895 (a) 1,954 (b)	4.9% 3.4%

RSA Laboratories ID# 13902. 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: 30 December 2010

Calibration Certificates Attachment AA



RSA Laboratories ID# 13902.

Calibrated by: Kurt D. Newton  Date: 30 December 2010

To: Licensed Project Designers, Licensed Asbestos Abatement Contractors and Connecticut Approved Asbestos Training Providers

From: Ronald Skomro, Supervising Environmental Sanitarian Asbestos Program

Date: April 7, 2003

Subject: Regulatory Interpretation Regarding Intact Removal of Non-Friable Asbestos-Containing Materials

A request for regulatory interpretation was made by a licensed asbestos consultant to the Department of Public Health (DPH) concerning the applicability of the DPH regulations to activities involving intact non-friable asbestos-containing materials within a facility. This memorandum addresses the DPH response to the scenarios presented. The following is a list of those activities detailed by the consultant:

- Removal of transite panels by unbolting or unscrewing and removing the panels intact;
- Removal of transite lab-type desk tops by either unbolting or unscrewing and removing the desk top intact, or complete component removal of the entire desk;
- Removal of flexible duct connectors by either unbolting or unscrewing and removing the connector intact, or complete component removal of the entire connector and small portions of the surrounding ductwork;
- Removal of countertops, backsplashes, etc., with linoleum, panel glue, or similar materials by completely removing the entire unit intact;
- Removal of sinks with pan sealant by removing the sink intact;
- Removal of window sashes with window glazing (interior or exterior) by removing the window stops and removing the entire window sash unit intact;
- Picking up loose floor tiles that have become completely disassociated with the floor and are either whole or are slightly broken but are still not considered to be Regulated Asbestos-Containing Material (RACM);
- Picking up loose miscellaneous non-friable items such as rolls of linoleum, loose gaskets, loose shingles, etc.;
- Removal of fire doors containing insulation from their hinges intact for complete component disposal;
- Attaching framing, brackets, etc., to structures by using power actuated tools to shoot/screw/bolt fasteners through the framing, brackets, etc., and through category I non-friable ACM (e.g., floor tile or mastic, cove base, waterproofing tar-like coating, asphalt roofing, gasketing, etc.). (The use of drills or similar tools to drill pilot holes or holes through the materials is not allowed.)

(860) 509-7367 / Fax (860) 509-7378

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DEH Circular Letter # 2003-10 Page 2

It is the interpretation of the DPH that the activities that are detailed above do not constitute asbestos abatement as defined by Section 19a-332 of the Connecticut General Statutes. Given this interpretation, such activities are not subject to DPH regulation. This interpretation is provided based upon the following understandings:

1. The asbestos-containing material is undamaged and non-friable and remains undamaged and non-friable during the removal or collection of the material. In the case of floor tile characterized as "slightly broken", a case-by-case assessment should be made to determine whether the removal of the tile constitutes asbestos abatement. The DPH shall be contacted directly when such activities are contemplated.
2. The asbestos-containing material is removed intact and without breakage or other disturbance of the material. The material is removed without the creation of a visible residue.
3. The asbestos-containing material is not subject to sanding, cutting, grinding, or abrading during the removal or collection process.
4. The asbestos-containing material does not become a RACM as defined by the asbestos National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61, Subpart M).

It should be noted that asbestos-containing waste generated as a result of these activities must be disposed of as asbestos waste at an authorized waste disposal facility. Questions regarding the disposal of asbestos-containing material within the State of Connecticut should be directed to the Connecticut Department of Environmental Protections at (860) 424-3366.

This interpretation does not relieve the owner of the facility in which these activities are performed, or the operator of these activities from complying with the provisions of all other applicable federal, state, or local regulations.

Miscellaneous Objects Scoping Survey

Contents

NOTE

In addition to a number of objects identified for survey in various labs¹ by Chemtura, other objects were found in the laboratory wing that also needed survey to establish whether or not they could be released. This attachment contains survey results for the objects in the latter category.

Page

2-4 Wipe test data

¹ Room 1205 (Attachment E), Room 1206 (Attachment F), Room 1207 (Attachment G), Room 1208 (Attachment H), Room 1210 (Attachment J), Room 1215 (Attachment K), Room 1216 (Attachment L), Room 1218 (Attachment N), Room 1219 (Attachment O), Room 1220 (Attachment P) and Room 1221 (Attachment Q).

RSA Laboratories
A Division of Radiation Safety Associates
Radiochemistry Analysis Data Sheet

Page 1 of 2

Report No. N/A

Customer: Chemtura

Customer Samp No. N/A

Location: Misc Object Wipes

RSA Lab Sample No. N/A

Project: Lab Decommissioning

Date Collected: 2/28/2011

Samp. Description: Survey Wip

Date Counted: 2/28/2011

Matrix: Wipes

C-14 LLD dpm= 40.47

RSA ID#	CUST. ID#	Location	C-14 CPM	dpm/100 cm sq
	BG	BACKGROUND	35.30	
1		Room 1205 Desk 325	19.30	21.70
2		Room 1205 Weigh Table 326	27.40	30.70
3		Room 1205 Desk 327	26.10	29.30
4		Room 1206 Bookcase 328	29.40	34.30
5		Room 1206 Padded Chair 329	23.50	26.50
6		Room 1206 Metal Chair 330	18.30	20.60
7		Room 1206 Stool 331	27.10	30.60
8		Room 1207 Weigh Table 332	34.10	38.30
9		Room 1207 Padded Chair 333	210.30	236.60
10		Room 1207 Stool 334	62.00	69.80
11		Room 1207 Shelves (Metal) 335	78.60	93.20
12		Room 1208 Bookcase 336	6.30	7.10
13		Room 1208 Metal Table 337	25.90	29.60
14		Room 1208 Chair 942	21.80	24.40
15		Room 1208 Chair 943	20.80	23.30
16		Room 1208 Chair 944	19.10	21.30
17		Room 1208 Chair 945	28.30	31.70
18		Room 1208 Cork Boards 946	26.80	30.10
19		Room 1208 Desk 947	20.00	22.40
20		Room 1208 Chair 948	11.60	19.90
21		Room 1208 Chair 949	25.90	29.10
22		Room 1208 Chair 950	27.10	30.70
23		Room 1208 Desk 951	26.20	29.40
C-14		QC C-14	118475.90	134448.40
24		Room 1210 Chair/Stool 952	42.80	48.10
25		Room 1210 Chair/Stool 953	24.30	27.40
26		Room 1210 Dewar 954	18.80	21.40
27		Room 1215 Stool 955	58.10	65.30
28		Room 1215 Desk 956	24.70	27.60
29		Room 1215 Chair 957	32.40	36.30
30		Room 1215 Chair 958	32.00	35.80
31		Room 1215 Chair 959	22.10	24.70
32		Room 1215 Chair 960	23.80	26.60
33		Room 1215 Haz. Waste Can 961	15.90	17.80
34		Room 1216 Desk 962	27.80	31.20

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RSA ID#	CUST. ID#	LOCATION			C-14 CPM	dpm/100 cm sq
35		Room 1216 Chair 963			18.40	20.60
36		Room 1216 Chair 964			25.00	27.90
37		Room 1216 Desk 965			26.70	29.90
38		Room 1217 Desk 966			22.50	25.30
39		Room 1217 Chair 967			2.80	3.20
40		Room 1217 Chair 968			17.60	19.70
41		Room 1217 Desk 969			16.10	18.20
42		Room 1219 Table Marked Rad 970			17.30	20.10
43		Room 1219 UPS 971			35.60	40.20
44		Room 1219 UPS 972			21.00	23.70
45		Room 1219 Plastic Tray 973			6.90	7.70
46		Room 1219 Chair 974			22.10	24.70
BL		QC Blank			9.90	10.70
47		Room 1219 Chair 975			8.00	9.00
48		Room 1219 Table 976			24.60	27.60
49		Room 1219 Table 977			5.00	5.70
50		Room 1219 Chair 978			30.30	33.80
51		Room 1219 Chair 979			25.10	28.00
52		Room 1219 Chair 980			11.50	12.90
53		Room 1222 Object 1002 Water Bath			13.20	14.30
54		Room 1222 Object 1003 Pump			6.70	7.40
55		Room 1222 Object 1004 Hot Plate			27.00	29.30
56		Room 1222 Object 1005 Transformer			12.10	13.10
57		Room 1222 Object 1006 Balance			19.20	20.90
58		Room 1222 Object 1007 Pump			29.50	32.10
59		Room 1206 Object 1008 Corner Desk Left			10.50	11.40
60		Room 1206 Object 1008 Middle			9.50	10.30
61		Room 1206 Object 1008 Right			18.10	20.20
62		Room 1206 Object 1009 Desk			11.90	13.00
63		Room 1220 Object 1010 Cabinet			0.00	0.00
64		Room 1220 Object 1011 Cabinet			14.10	15.40
65		Room 1219 Object 1012 H ² Generator			18.30	19.90
66		Room 1219 Object 1013 Liquid Nitrogen Tank			0.00	0.00
67		Room 1206 Object 1014 Tray			150.90	167.30
68		Room 1206 Object 1014 White Container			18.60	20.30
69		Room 1206 Object 1014 Red Container			23.70	25.90
70		Room 1206 Object 1014 Tray			17.40	18.90
71		Room 1207 Object 1016 Tray			27.00	29.70
72		Room 1207 Object 1016 White Container			15.30	16.70
73		Room 1207 Object 1016 Red Container			25.80	28.10
74		Room 1207 Object 1016 Flucked Container			12.70	13.90
C-14		QC C-14			125148.10	13571.00
BL		QC Blank			21.70	23.60

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Report No. **N/A**Customer: **Chemtura**Customer Samp No. **N/A**Location: **Floor Mats**RSA Lab Sample No. **N/A**Project: **Lab Decommissioning**Date Collected: **3/8/2011**Samp. Description: **Survey Wip**Date Counted: **3/8/2011**Matrix: **Wipes****C-14 LLD dpm= 39.35**

RSA ID#	CUST. ID#	Location	C-14 CPM	dpm/100 cm sq
	BG	BACKGROUND	33.20	
1		Room 1201 402	13.60	15.00
2		Room 1201 403	11.80	13.00
3		Room 1201 404	18.70	20.70
4		Room 1201 405	16.90	18.70
5		Room 1201 406	11.30	12.50
6		Room 1201 407	6.60	7.40
7		Room 1201 408	2.50	2.80
8		Room 1201 409	25.40	28.30
9		Room 1205 410	17.80	19.70
10		Room 1205 411	22.30	24.50
11		Room 1209 412	14.70	16.20
12		Room 1210 413	14.40	15.80
13		Room 1210 414	15.70	17.30
14		Room 1210 415	16.30	18.00
15		Room 1215 416	24.30	26.80
16		Room 1215 417	19.10	21.10
17		Room 1215 418	19.30	21.20
18		Room 1215 419	12.80	14.10
19		Room 1215 420	17.60	19.40
20		Room 1216 421	18.60	20.50
21		Room 1217 422	0.00	0.00
22		Room 1217 423	13.80	15.20
23		Room 1221 424	24.70	27.20
C-14		QC C-14	115236.90	134890.40
24		Room 1221 425	10.20	11.30
25		Room 1221 426	13.60	14.90
26		Room 1221 427	2.80	3.00
27		Room 1221 428	14.00	15.40
BL		QC Blank	0.20	0.20