

**ROUTINE SURVEYS FOR
OPEN SOURCE RADIOACTIVE MATERIAL LABS**

1.0 **PURPOSE**

To specify methods for conducting and documenting routine surveys in open source radioactive material labs at the Georgia Institute of Technology (Georgia Tech).

Routine contamination surveys are an essential part of contamination control to prevent the spread of contamination to personnel, equipment, and work areas. Surveys can also confirm that radioactive material is being stored and shielded in a safe manner.

2.0 **SCOPE**

The methods specified in this procedure are applicable to routine surveys in open source radioactive material (RAM) labs. An open source is defined as RAM that is dispensed from its original container as a liquid, solid, or gas. Spill response as outlined in Procedure 9303 is not in the scope of this procedure.

3.0 **RESPONSIBILITIES**

3.1 The Authorized User (AU) shall be responsible for the routine monitoring of each of his/her labs for removable contamination and ensuring documentation of the monitoring is available for review.

3.2 The Radiation Worker that measures contamination in excess of the Action Levels specified in Appendix A shall address the contamination accordingly. Regardless of contamination levels detected, ORS may be contacted for guidance and/or assistance.

4.0 **REFERENCES**

4.1 State of Georgia, Rules and Regulations for Radioactive Material, Chapter 391-3-17

4.2 Procedure 9303, Guidelines For Handling Radioactive Spills

4.3 Procedure 9310, Posting And Labeling For Radioactive Materials And Radiation Machines

5.0 **EQUIPMENT/MATERIALS**

5.1 Smear filter paper

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- 5.2 Liquid scintillation counter (or other appropriate fixed instrumentation) and counting supplies
- 5.3 Handheld survey meter (when applicable, see 6.2.1.2 for restrictions)
- 5.4 RS-160, Routine Contamination Survey Form or equivalent (Appendix B)
- 6.0 **PROCEDURAL STEPS**
- 6.1 **General Area Survey**
 - 6.1.1 Identify survey locations and mark them on a lab survey map for reference during the survey. Examples include:
 - 6.1.1.1 Work area (bench surface, drawers, cabinets, and floor near RAM use)
 - 6.1.1.2 Fume hood (work surface, sash, sash handle, apron)
 - 6.1.1.3 Entrance to work area (floor, door handle)
 - 6.1.1.4 Lab sink (basin, drain, faucet handles)
 - 6.1.1.5 Equipment used (pipetters, centrifuges)
 - 6.1.1.6 Areas likely to have contamination
 - 6.1.1.7 Random locations in the lab
 - 6.1.2 **Handheld Survey Meter Use**
 - 6.1.2.1 Do pre-survey operational checks on the survey meter:
 - 6.1.2.1.1 Check battery.
 - 6.1.2.1.2 Check condition of the meter.
 - 6.1.2.1.3 Ensure meter has been calibrated within the last year.
 - 6.1.2.2 Note the handheld survey meter's background measurement.
 - 6.1.2.3 Turn on the survey meter's audio function.
 - 6.1.2.4 Make sure nearby sources of radiation, such as stock vials or waste, are shielded.
 - 6.1.2.5 Conduct the survey.

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- 6.1.2.5.1 Survey areas of concern approximately ½” from the surface, taking care not to touch the surface with the meter probe.
- 6.1.2.5.2 Move the probe at a pace of approximately 1-2 inches per second.
- 6.1.2.5.3 For assessing external radiation levels, take measurements at the closest location to the RAM where a person could stand or sit.
- 6.1.3 Fixed Instrument Use
 - 6.1.3.1 Confirm that a daily operational check has been performed on the instrument and that the background measurement is known for the day or determine background at the time of the survey.
 - 6.1.3.2 Confirm that the counting efficiency has been determined for the radioisotope(s) that has been used in the lab.
 - 6.1.3.3 Collect samples.
 - 6.1.3.3.1 Each smear should cover a minimum of 100 cm² of the area surveyed. An S-shaped smear pattern 25 cm long using a smear ~4 cm wide will approximate 100 cm².
 - 6.1.3.3.2 Use moderate pressure when smearing surface.
 - 6.1.3.3.3 Keep smears separated from each other as much as possible.
 - 6.1.3.4 Prepare the survey samples for counting and run them in the fixed instrument.
- 6.2 **Survey Frequency, Details, and Documentation**
 - 6.2.1 Daily Surveys
 - 6.2.1.1 A daily survey shall be performed at the end of each day that RAM has been used.
 - 6.2.1.2 Handheld survey meters may be used for high-energy beta emitters (e.g., ³²P, ⁹⁰Sr, etc.), alphas, and gamma emitters (e.g., ¹²⁵I). A liquid scintillation counter or other appropriate fixed instrument must be used in all other cases.
 - 6.2.1.3 Survey the areas identified in 6.1 for contamination.
 - 6.2.1.4 Use survey meters, when appropriate, to verify that stock vials, radioactive waste, and other RAM in use all are adequately shielded, taking measurements at the closest location to the RAM where a person could stand or sit.

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6.2.1.4.1 If any of these locations are above 3 times background, employ more shielding or move the source further away.

6.2.1.5 Action Levels for daily surveys are found in Appendix A, Table 1.

6.2.1.6 This survey is only required to be documented if contamination is detected, unless the contaminated item is disposed into a RAM waste container. If documentation is required:

6.2.1.6.1 Perform and document the survey as if it were a weekly survey, including using a fixed instrument and RS-160, and

6.2.1.6.2 Decontaminate according to 6.2.3 below and resurvey as if it were a weekly survey.

6.2.2 Weekly Surveys

6.2.2.1 A weekly documented contamination survey shall be performed each week that RAM has been used.

6.2.2.2 Wipe tests for weekly surveys shall be conducted with a liquid scintillation counter or other appropriate fixed instrument (e.g., low-background alpha/beta counting systems) for all isotopes.

NOTE: Handheld survey meters may not be used for documented weekly wipe tests.

6.2.2.3 Follow 6.2.1.4 to assess radiation levels from sources of RAM.

6.2.2.4 Contamination Action Levels for weekly surveys are found in Appendix A, Table 2.

6.2.3 Decontamination

6.2.3.1 If an Action Level is exceeded, notify the AU and decontaminate the affected area.

6.2.3.2 Notify ORS if any contamination is above 10 times the Action Level.

6.2.3.3 Repeat the survey/decontamination process until contamination is below the Action Level.

6.2.3.4 If contamination is discovered on the floor, expand the areas surveyed to ensure that contamination has not spread to other parts of the lab.

6.2.3.5 If the contamination cannot be cleaned to below the Action Level, contact ORS.

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- 6.2.3.5.1 It is understood that some equipment, such as pipettors, beakers or centrifuges, may become routinely contaminated. Decontamination should be attempted on these items; however, should minor contamination still exist, then these items must be labeled per Procedure 9310 and be kept in a clearly labeled RAM work area. No single item may contain contamination that is more than 2 times the Action Level applicable for the area.
- 6.2.3.5.2 The RSO may consider ALARA principles in order to allow specific individual items to have contamination in excess of the Action Level.
- 6.2.4 Documentation
- 6.2.4.1 Complete the RS-160 Routine Contamination Survey Data Form or equivalent, which includes the following items:
- 6.2.4.1.1 Building and room, AU name, and date performed
- 6.2.4.1.2 Instrument manufacturer, model, serial number, background cpm, and detection efficiency
- 6.2.4.1.3 Map of room with locations marked
- 6.2.4.1.4 Map location number and description of location (floor, bench, pipettor, etc.)
- 6.2.4.1.5 Survey results in gross cpm, net cpm (survey results minus background), and net dpm (net cpm divided by efficiency)
- 6.2.4.1.6 If applicable, an indication that all external radiation levels are less than 3x background (see 6.2.1.4).
- 6.2.4.1.7 Signature of the individual who performed the survey and date performed
- 6.2.5 Quarterly Surveys
- 6.2.5.1 The ORS conducts quarterly contamination surveys at open source labs. The AU will be contacted if contamination above the Action Level is detected.
- 7.0 **RECORDS**
- 7.1 Survey records shall be maintained in the AU's Radiation Safety Lab Notebook or other location determined by the AU.
- 7.2 Survey records shall be readily accessible to ORS and Georgia Department of Natural Resources inspectors.
- 7.3 All survey records shall be maintained for 5 years except where there is contamination above the Action Levels specified in Appendix A.

Minor Change
Number:
By:
Date: / /

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7.3.1 If contamination above these levels exists, survey records shall be maintained until the lab has been decommissioned.

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APPENDIX A
ROUTINE CONTAMINATION SURVEY ACTION LEVELS FOR
COMMON RADIOISOTOPES

TABLE 1
ACTION LEVELS FOR DAILY SURVEYS

Decontamination is required if any area exceeds the following values:

Isotope	Instrument	Unrestricted Areas² *Net Values	Restricted Areas¹ *Net Values
³ H, ¹⁴ C, ³⁵ S, ⁶³ Ni	Liquid Scintillation Counter	100 dpm/ 100 cm ²	200 dpm/ 100 cm ²
¹²⁵ I	Hand-Held Low Energy Gamma Probe	100 <i>cpm</i>	200 <i>cpm</i>
³² P	Hand-Held GM Pancake Probe	100 <i>cpm</i>	200 <i>cpm</i>
Alpha Emitters	Liquid Scintillation Counter	20 dpm/ 100 cm ²	20 dpm/ 100 cm ²
	Low Background Proportional Counter	20 dpm/ 100 cm ²	20 dpm/ 100 cm ²
Beta/Gamma/Positron Emitters with Half-Life ≤ 48 hours	Hand-Held GM Pancake Probe or NaI Probe	200 <i>cpm</i> / 100cm ²	2,000 <i>cpm</i> / 100cm ²
High Energy Beta (> 250 keV)	Hand-Held GM Pancake Probe	100 <i>cpm</i>	200 <i>cpm</i>
Low Energy Beta (<250 keV)	Liquid Scintillation Counter	100 dpm/ 100 cm ²	200 dpm/ 100 cm ²
Low Energy Gamma Emitters (≤ 60 keV)	Hand-Held Low Energy Gamma Probe	100 <i>cpm</i>	200 <i>cpm</i>
High Energy Gamma Emitters (>60 keV)	Hand-Held NaI Probe	100 <i>cpm</i>	200 <i>cpm</i>

¹ Restricted areas are defined as rooms that are secured to control for radiation exposure, or where access is restricted by the Authorized User.

² “Neighborhood” labs are considered unrestricted areas.

* Net *cpm* = measured *cpm* - background *cpm*

* Net *dpm* = net *cpm*/efficiency

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**TABLE 2
ACTION LEVELS FOR DOCUMENTED WEEKLY SURVEYS**

Decontamination is required if any area exceeds the following values.

	Unrestricted Areas (net dpm/100 cm ²)	Restricted Areas (net dpm/100 cm ²)
Alpha Emitters	20	20
Beta or Gamma Emitters (Half-life > 48 hours)	100	200
All Beta or Gamma Emitters (Half-life ≤ 48 hours)	200	2,000

APPENDIX B
FORMS

- RS-160 – Routine Contamination Survey Form
 - Use this form for surveys conducted using a liquid scintillation counter (LSC) or other fixed instrument such as a gamma counter or low-background alpha/beta analyzer.

Download the Excel file containing this blank form at
<http://www.ehs.gatech.edu/radiation/ram/forms>