A. Purpose

Radioactive contamination and/or elevated radiation dose levels represent the potential for unnecessary radiation exposure to laboratory workers, other employees or visitors.

All laboratories where radionuclides are used in unsealed form must be surveyed every month in which radioactive materials in unsealed form are used.

B. Applicability/scope

This protocol applies to campuses, facilities and areas under the jurisdiction of the Columbia University Radiation Safety Office. This includes the Morningside, Nevis Laboratories, Lamont-Doherty Earth Observatory, Barnard College, Manhattanville and Columbia University Medical Center (CUMC) campuses.

C. Definitions

CUMC – Medical Center Campus

MS – Morningside Campus, NEVIS, LDEO, Manhattanville, Barnard

RAM – radioactive materials

RSO – Radiation Safety Officer – This term includes the Chief RSO, RSO for Research Programs and the RSO for Clinical Programs.

PI – Principal Investigator – The individual who has a permit to order, use and store radioactive materials.

D. Procedures

1. General Procedures

Monthly surveys performed by the laboratory may be specific to laboratory in question as listed in the special conditions of the Authorized User’s permit (e.g., GM survey only when only P-32 is used). In addition to radioactive material work areas, the survey should include a sampling of areas throughout the laboratory or area where radioactive materials (RAM) are used or stored, including waste areas. Negative results should be clearly indicated.

These surveys must be documented by indicating the sample locations on an accurate map of the laboratory. Surveys need not be performed when radioactive materials in unsealed form have not been used in a calendar month. However, documentation should be provided stating that a survey was not required. Acceptable documentation includes written log book entries, completion of the “No Radioactive Materials Used Log” or written notation on the
Lab map “No RAM used this month.” Each such entry should be signed and dated by the person making the “no use” statement.

Surveys must be able to detect both fixed and removable contamination in excess of 200 DPM per 100 cm². The monthly survey records should be kept for 3 years. Labs are required to make these records available for review during the quarterly audits.

Table A below lists appropriate survey instruments for the most common radionuclides used.

2. Survey Methods

a. Wipe tests for removable contamination

This survey method is designed to detect removable contamination. It is the only method of detecting low levels of contamination with low-energy beta-emitting radionuclides such as H-3, C-14, S-35 or Fe-55.

A 10 x 10 cm area is wiped with a Q-tip or piece of filter paper. Location of each wipe should be carefully annotated on the lab map. The wipe is then counted in a liquid scintillation counter or gamma counter.

b. Fixed contamination survey method

Portable survey instruments such as Geiger-Mueller (GM) detectors are used to survey for contamination by high-energy beta-emitting radionuclides such as P-32 or P-33 or NaI(Tl) scintillation detectors for gamma-emitting radionuclides such as F-18, Cr-51, I-125, I-131 or Cs-137.

Check the background reading of the meter by placing it on the lowest scale and taking it outside the lab. Record this reading as background on the survey map. Spot check the radioactive material and laboratory work benches, fume hoods, freezers, equipment and the floor. Keep the probe 2 to 3 cm away from the surface. Record the readings on the survey map at the corresponding location. If it is above three times background contamination is present and these locations must be decontaminated.

c. Radiation field survey method

Laboratory areas where gamma-emitting radionuclides (F-18, Cr-51, I-125, I-131, etc.) are used or stored must be surveyed to prevent unnecessary exposure of person-nel or visitors. Ion chamber-type survey instruments are used to detect and quantify radiation emitted by these types of radionuclides.
Check the background reading of the meter by placing it on the lowest scale and taking it outside the lab. Record this reading as background on the survey map. Spot check the radioactive material and laboratory work benches, fume hoods, freezers, equipment, waste storage areas and the floor. Keep the probe 2 to 3 cm from the surface. Record the readings in mR or mrem/hr on the survey map at the corresponding location. Ambient radiation levels above 1 mR/hr or 1 mrem/hr should be addressed by adding appropriate shielding. Any area where radiation levels meet or exceed 5 mR/or or 5 mrem/hr at one foot from the source must be posted with a “CAUTION – RADIATION AREA” sign.

[Note: Do not use GM detectors for these surveys – they are not calibrated for accurate mR/hr readings]

3. Daily Experiment Survey

To prevent the spread of contamination, surveys should be performed before, during and after each use of RAM. The instrument(s) required for this survey depends on the isotope used. Please note that H-3, C-14, Fe-55 and S-35 contamination can only be detected through a wipe test. Please view Table A below for further details on how to select the appropriate survey instrument.

Survey the work area, equipment, shielding, hands, lab coat, clothing and shoes to ensure that radioactive material has not contaminated these locations. Decontaminate any area or article where contamination is found above background levels.
Table A. Guidance on Instruments Required for Laboratory Surveys

<table>
<thead>
<tr>
<th>Isotope</th>
<th>Half-Life</th>
<th>Type of Radiation</th>
<th>Type of Instrument or Probe for surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Am-241</td>
<td>432.7 years</td>
<td>alpha, gamma</td>
<td>Alpha scintillation; NaI(Tl) scintillation; and ion chamber</td>
</tr>
<tr>
<td>C-11</td>
<td>20.38 min</td>
<td>positron emission, twin 511 keV annihilation photons</td>
<td>NaI(Tl) scintillation; and ion chamber</td>
</tr>
<tr>
<td>C-14</td>
<td>5715 years</td>
<td>beta</td>
<td>Wipes; GM efficiency very low</td>
</tr>
<tr>
<td>Ca-45</td>
<td>167.2 days</td>
<td>beta</td>
<td>GM</td>
</tr>
<tr>
<td>Co-50</td>
<td>5.271 years</td>
<td>beta, gamma</td>
<td>NaI(Tl) scintillation; and ion chamber</td>
</tr>
<tr>
<td>Cr-51</td>
<td>27.7 days</td>
<td>gamma</td>
<td>NaI(Tl) scintillation; and ion chamber</td>
</tr>
<tr>
<td>Cs-137</td>
<td>30.07 years</td>
<td>beta, gamma</td>
<td>NaI(Tl) scintillation; and ion chamber</td>
</tr>
<tr>
<td>Fe-55</td>
<td>2.7 years</td>
<td>x-ray (low energy)</td>
<td>Wipes</td>
</tr>
<tr>
<td>Fe-59</td>
<td>44.51 days</td>
<td>beta, gamma</td>
<td>NaI(Tl) scintillation; and ion chamber</td>
</tr>
<tr>
<td>Ga-67</td>
<td>3.261 days</td>
<td>gamma</td>
<td>NaI(Tl) scintillation; and ion chamber</td>
</tr>
<tr>
<td>H-3</td>
<td>12.32 years</td>
<td>beta</td>
<td>Wipes</td>
</tr>
<tr>
<td>I-125</td>
<td>59.4 days</td>
<td>gamma</td>
<td>NaI(Tl) scintillation; and ion chamber</td>
</tr>
<tr>
<td>I-131</td>
<td>8.02 days</td>
<td>beta, gamma</td>
<td>NaI(Tl) scintillation or GM; and ion chamber</td>
</tr>
<tr>
<td>N-13</td>
<td>10 minutes</td>
<td>positron emission, twin 511 keV annihilation photons</td>
<td>NaI(Tl) scintillation; and ion chamber</td>
</tr>
<tr>
<td>Na-22</td>
<td>2.6 years</td>
<td>positron emission, twin 511 keV annihilation photons</td>
<td>NaI(Tl) scintillation or GM; ion chamber</td>
</tr>
<tr>
<td>Ni-63</td>
<td>101 years</td>
<td>beta</td>
<td>Wipes</td>
</tr>
<tr>
<td>P-32</td>
<td>14.28 days</td>
<td>beta</td>
<td>GM and Ion Chamber</td>
</tr>
<tr>
<td>P-33</td>
<td>25.3 days</td>
<td>beta</td>
<td>GM</td>
</tr>
</tbody>
</table>
E. Responsibilities

Lab worker – perform surveys as directed by PI; take immediate action when contamination or other unsafe conditions are found.

PI – ensure that surveys are performed and properly documented; ensure immediate action is taken to remove contamination or remediate other unsafe conditions.

Radiation Safety Office – conduct quarterly inspections to audit compliance.

F. Emergency contact

Public Safety: MS: 854-2797 or MC: 305-8100

Radiation Safety Program: MC: 305-0303 MS: 854-4443

Workforce Health and Safety (MC Only): 305-7580

G. Medical Surveillance

N/A
H. Recordkeeping

All survey records must be kept for 3 years.

I. Appendices

N/A

J. Forms

N/A

K. References

N/A

L. Acknowledgements (optional)

N/A