Western Michigan University
Radiation Safety

Radiological Controls Program

Purpose

To provide guidance and instructions for maintaining exposure of the general public, students, staff, and faculty at Western Michigan University (WMU) ALARA while meeting the requirements of all Federal, State, and local rules and regulations governing the use of radioactive material and radiation producing machines.

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I. Responsibilities

A. Executive Manager **[License / NUREG 1556 Vol.11]**

1. Support the RSO and AUs in complying with the requirements of this program.

B. Radiation Safety Officer (RSO) **[License / NUREG 1556 Vol.11]**

1. Conduct job/protocol reviews for ALARA.
2. Investigate unplanned exposure levels greater than prescribed levels.
3. Perform surveys, such as investigational and initial run for radiation producing machines.
4. Perform and provide guidance for special decontamination evolutions.
5. Perform the Free Release surveys.
6. Provide the guidance and conditions for items that are Conditionally Released.
7. Provide storage for the documentation required by this program.

C. Authorized Users (AUs) / Radiation Workers (RWs)

1. Review jobs and protocols to ensure resultant exposure will NOT exceed action levels and for ALARA considerations.
2. Maintain the required room postings.
3. Perform or verify the completion of required surveys.
4. Ensure all equipment, waste bags, bottles, and containers are marked.
5. Practice proper radiological and contamination control to maintain exposure ALARA.
6. Provide the level of supervision necessary to maintain proper radiological and contamination controls.
7. Perform normal decontamination tasks.
8. Maintain the records and documentation required by this program.
9. Abide by the terms established for the Conditional Release of an item.

II. Definitions

Anti-Cs	An abbreviation for anti-contamination clothing. Anti-Cs are the items worn by personnel using unsealed radioactive material to prevent them from getting radioactive material on their person.
ccpm	An acronym for corrected counts per minute. It is derived by subtracting the background reading from the sample or survey reading when determining loose or fixed contamination levels.
Conditional Release	The release of radioactive material for use outside a restricted area under strict controls and conditions.
Contact Readings	Dose rate readings taken within 1/4 -1/2 inch from the surface of an object.
Contamination	The disposition of radioactive material in an undesired area, particularly where its presence may be harmful.
Contamination, Fixed	Contamination that is trapped in the pores or in some way bonded to the surface of a material and cannot be easily removed.

Contamination, Loose	Contamination that can be easily removed from the surface of a material.
Control Levels	Designated criteria which govern the depth of control and oversight required during the use of radioactive material.
Declared pregnant women	A woman that has voluntarily informed the licensee, in writing, of her pregnancy and estimated date of conception.
Decontamination	The transfer of contamination from one medium to another for the purpose of reducing or eliminating contamination from the original medium.
Decontamination, Special	Aggressive decontamination methods that may cause damage to the item in which the contamination is present, e.g., high-pressure washing, grinding the surface, etc.
Engineering Controls	The installed equipment such as glove bags, fume hoods, other ventilators, etc. used to control the concentration of radioactive material in the air to reduce the dose and exposure.
Extremities	The parts of the arms from the elbow to the fingertips and the legs from the knees to the toes.
Free Release	The change in status of an area or equipment from restricted to unrestricted after verification that the radiation and contamination levels comply with the stringent criteria for uncontrolled areas.
Frequencies	Time requirements for complying with the rules and regulations governing the use of radioactive material.
Daily	The 24-hour period that starts at 12:00 AM and concludes at 11:59 PM.
Weekly	A seven day period, running Monday through Sunday.
Biweekly or Semi-monthly	A fourteen day period, running Monday through the second Sunday, including a grace period of +/- 2 working days.
Monthly	A 30 day period that includes a grace period of +/- 5 working days.
Quarterly	A period in time not less than 12 consecutive weeks and not more than 14. The 1st calendar quarter of each year shall begin in January.
Semi-annual	A six month period, that includes a grace period of +/- 30 calendar days.
Annual	The period of time that is bounded by the beginning and ending of the year, i.e. January 1st through December 31st.
Biannual	The period of time that is bounded by the beginning of one year and ending of the next year, i.e. January 1, 1999 through December 31, 2000.
Grace Period	The additional time allowed to fulfill routine commitment requirements due to special circumstances. Entry into a grace period does not adjust the tasks next scheduled due date.
Marking	A warning placed conspicuously on items to make individuals aware of potential radiation exposures and to minimize exposures.
Posting	A warning sign placed conspicuously to make individuals aware of potential radiation exposures and to minimize exposures.

Pre-operational checks	A series of instrument checks that verify that the instrument can reproduce accurate results from use to use.
Radiation	Excess energy emitted by an atom in form of electromagnetic waves or particles.
Radiation Symbols	Alpha = α Beta = β Gamma = γ Neutron = η
Radioactive / Licensed Material (RAM)	Source material, special nuclear material, or by-product material received, possessed, used, transferred, or disposed of under a license issued by the NRC.
Restricted Area	An area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials.
Shielding	An engineering control used to reduce the exposure to individuals working around or with licensed material or waste.
Survey	An evaluation of the radiological conditions and potential hazards incident to the use, transfer, release, disposal, or presence of radioactive material or other sources of radiation.
Whole Body	For the purposes of external exposure determinations, include the head, trunk, gonads, legs above the knees, and arms above the elbows.

III. Requirements for Radiation Control

A. As Low As Reasonably Achievable (ALARA) **[10CFR20.1101]**

1. Table of Dose Limits **[10CFR20.1201, 1207, 1208, 1301, and 1502 / R333.5057, 5058, 5059, and 5060]**

	Federal and State Adult	Federal and Sate Minor (≤ 18 yrs)	Declared Pregnant Woman	Public	WMU Level 1 **[License]**	WMU Level 2 **[License]**
Whole Body	5 REM/yr	0.5 REM/yr	0.5 REM/ gestation	0.1 REM/yr	0.1 REM/qtr	0.2 REM/qtr
Lens of the Eye	15 REM/yr	1.5 REM/yr	15 REM/yr	N/A	0.5 REM/qtr	1 REM/qtr
Skin & Extremities	50 REM/yr	5 REM/yr	50 REM/yr	N/A	1 REM/qtr	2 REM/qtr

2. To keep radiation exposure ALARA, the following actions will be taken

a. Work that is expected to result in exposure to an individual greater than Level 1:

1. Reviewed by the RSO and AU for ALARA considerations.

2. Document the review and any adaptations as a result of the review.

3. Consider an increase in surveillance of the job by the AU or RSO.

b. Unplanned exposure to an individual exceeding Level 1 limits:

1. Will be investigated by the RSO to determine the cause AND why the exposure was not reviewed and planned.

2. The RSO and AU will develop and implement a plan to prevent recurrence.

c. Unplanned exposure to an individual exceeding Level 2 limits.

1. The RSO will restrict the individual from further exposure until the investigation is completed.

2. Will be investigated by the RSO to determine the cause AND why the exposure was not reviewed and planned.

3. The RSO and AU will develop and implement a plan to prevent recurrence.

d. All AUs and RWs should routinely evaluate their practices and protocols for ALARA considerations. Suggestions, ideas, or implemented changes that result or may result in the reduction of exposure should be discussed with the RSO for presentation to other users.

B. Postings

1. Standard Requirements **[10CFR19.11 / 10CFR20.1901, 1902, and 1903 / R333.5061]**

a. All signs shall

1. Use the colors magenta on a yellow background or black on a yellow background.

2. Display the three-bladed radiation symbol (Trefoil).

3. Display the word 'Caution', unless directed by the RSO to display ‘Danger’.

4. Additional information, as appropriate, can be placed on or near the required signs to make people aware of the potential radiation exposures.

b. Every entrance to a room in which NRC licensed material is used or stored shall be conspicuously posted with the appropriate radiological area sign, i.e. Restricted Area, Radioactive Material, Radiation Area, etc and

NOTE: A letter stating where these documents can be obtained is an acceptable means of fulfilling this requirement. **[10CFR19.11]**

1. Notice to Employees.

2. Sign proclaiming ‘No Eating, Drinking, or Smoking”

3. Any Notice of Violation and our response involving radiological working conditions, proposed penalties, or orders.

4. A copy of our license, conditions and amendments to it.

d. Every entrance to a room in which a State of Michigan registered machine or material is used shall be conspicuously posted **[R333.5061]** as:

1. A Radiation Area, when dose rates are $\geq$ 2 mR/hr, 30 cm from the machine operating at or below its maximum

2. X-Ray Hazard, if the machine produces X-Rays beams outside of its housing.

3. State of Michigan Notice to Employees

4. Ionizing Radiation Rules.

5. Certificate of Registration, conditions and amendments to it.

2. Radiological Posting Levels **[10CFR20.1003, 1301, and 1902 / RG 8.21 / R333.5060 and 5061]**

Restricted Area	**≥ 0.2 mR/hr**
Radioactive Materials Area	Area containing licensed material.
Radiation Area	**2 mR/hr to 90 mR/hr**
High Radiation Area	**≥ 90 mR/hr**
X-Ray Hazard Area	Area with X-Ray beams not contained in the machines housing.
Controlled Surface Contamination Area	**1000 to 100,000 dpm/100 cm^2** β-γ **and/or ≥ 20 dpm/100 cm^2** α
High Controlled Surface Contamination Area	**> 100,000 dpm/100 cm^2**

3. Lab Type Criteria based upon radioisotope toxicity **[License]**

Radioisotope Toxicity	Unsealed Quantity Per Use		
	Type C	Type B	Type A
Very High	< 1 μCi	1 μCi	> 1 μCi
High	< 10 μCi	10 μCi	> 10 μCi
Moderate	< 200 μCi	200 μCi to 100 mCi	> 100 mCi
Low	< 2 mCi	2 mCi to 1 Ci	> 1 Ci

4. Standards for radioisotope toxicity **[License]**

Very High	Po-210 Pb-210	Ra-226 Ra-228	Th-227 Cf-249	Pa-231	U-233	Pu-238	Am-243	Cm-244
High	I-125 I-131	Co-56 Co-60	Zr-95 Cl-36	Sb-125 Ir-192	Ce-144 Na-22	Hf-181	Bi-207	Ac-228
Moderate	C-14 Au-198	P-32 S-35	Sc-48 V-48	Zn-65 Zn-69m	Sr-91 Y-90	Ru-103 Te-125m	La-140 Cr-51	Na-24 W-187
Low	H-3 Kr-85	Co-58 Os-232	Ge-71 Tc-99m	Rb-87	Nb-97	Rh-103	X e-131m	Cs-125

C. Surveys **[10CFR20.1501 / RG 8.21 / R333.5061 and 5063]**

1. Survey results are used to determine or verify the controls being used will provide adequate safety for the public, staff, students, and facility.

2. General requirements

a. The RWs working with RAM will conduct required surveys.

b. The AU is responsible for ensuring routine surveys are performed and documented.

c. Surveys should be sufficient enough to determine the magnitude and extent of the radiation levels.

d. Surveys should be sufficient enough to determine the magnitude and extent of the concentrations or quantities of radioactive material (contamination) levels.

e. Surveys should be sufficient enough to determine the potential radiological hazards.

3. Surveys, in addition those required below, may be requested by the RSO at any time.

4. Type C labs (lowest level)

a. Radiation Surveys

1. Routine – Monthly, while material is being used in the area

2. Routine – Quarterly when material is NOT being used and the area remains a posted Restricted Area

3. Post use of material.

b. Contamination - Area

1. Routine – Monthly, while material is being used in the area

2. Routine – Quarterly when material is NOT being used and the area remains a posted Restricted Area

3. Post decontamination evolutions.

4. Post use of material.

c. Contamination – Personnel

1. During use of material - Frequent enough to control/prevent the spread of contamination.

2. Post decontamination.

3. Post use of material.

d. Airborne – Not required due to not using volatile material.

5. Type B labs (increased level)

a. Radiation Surveys

1. Routine – Weekly, while material is being used in the area

2. Routine – Quarterly when material is NOT being used and the area remains a posted Restricted Area

3. While material is out of its shield

4. After changes to the distribution of the material that may alter the exposure levels.

5. Post use of material.

b. Contamination - Area

1. Routine – Weekly, while material is being used in the area

2. Routine – Quarterly when material is NOT being used and the area remains a posted Restricted Area

3. Post decontamination.

4. Post use of material.

c. Contamination – Personnel

1. During use of material - Frequent enough to control/prevent the spread of contamination.

2. Post decontamination evolutions.

3. Post use of material.

d. Airborne – Not required due to not using volatile material.

6. Type A labs (maximum level) – The RSO will establish the necessary conditions for these labs should we ever need to create one.

7. Radiation Producing Machine Room

a. Radiation Surveys **[R333.5061 and 5063]**

1. Periodically to ensure ALARA and proper operation of the machine.

2. Prior to performing maintenance.

3. Initial use of the machine: post maintenance, installation, or reinstallation.

4. After changes in location or layout of the machine or operator's station.

8. Receipt of radioactive material surveyed as per the Source Inventory and Control Program procedure. **[10CFR33.14 / NUREG 1556 Vol 11]**

NOTE:	Material markings may be altered by other means deemed suitable by the RSO on a case by case basis.

D. Material Marking **[10CFR20.1904 / R333.5038]**

1. Large lab equipment (i.e. centrifuge) marked conspicuously with a sticker, label, or tape bearing the Radiation Trefoil symbol and the words “Radioactive” or “Radioactive Material.”

2. Small lab equipment (i.e. tweezers) marked with tape bearing the Radiation Trefoil symbol and the words “Radioactive” or “Radioactive Material.”

3. Waste Containers marked:

a. With a sticker, label, tape, or tag bearing the Radiation Trefoil symbol and the words “Radioactive” or “Radioactive Material.”

b. Include the isotope being disposed.

c. Translucent containers may use a marked waste bag.

4. Waste Bags marked:

a. With a sticker, label, tape, tag, or commercial printing bearing the Radiation Trefoil symbol and the words “Radioactive”, “Radioactive Material”, or "Radioactive Waste."

b. Bags in storage shall include the isotope, survey information, date, and lab where waste was generated.

5. Radiation Producing Machines

a. The State of Michigan registration tag must be attached to the machine’s control panel.

b. A warning label and the words “Caution Radiation – This machine produces X-Radiation when energized” or Caution X-Ray Hazard”, must be displayed unless the room has been posted.

c. For XRDs a RED warning light indicating “X-Ray On” must be displayed when the machine is operating.

E. Radiation Control Good Work Practices

1. Utilize the ALARA theory and practice of time, distance, and shielding to the maximum extent possible.

2. Maximize shielding whenever possible.

a. Use the shielded shipping container for storage.

b. Use high-density plastic or Lucite for shielding β–emitting isotopes.

c. Use lead bricks, plates, panels, or other suitable means for shielding γ–emitting isotopes.

d. Use waste containers that are made of or shielded by the above mentioned material.

3. Maximize the distance from the source.

a. Use remote handling tools when possible.

b. Work with material at an arm's length when possible.

c. Relocate or locate the operating station as far as possible from the radiation producing machine.

4. Minimize the time using radioactive material.

a. Set up and conduct dry runs for special or infrequently performed tasks.

b. Periodically review protocols for timesaving opportunities.

NOTE: Specific animal controls will be determined and described in the use application by the applicant, RSO, and Animal Care Specialist for every use.

F. General Radiation Controls for Use of Radioactive Material in Animals

1. Animals that have been administered radioactive material SHALL NOT be used for human consumption. **[NUREG 1556 Vol 7]**

2. The animals are to be housed in designated radiation safety rooms.

3. Keep contaminated or radioactive animals, animal parts, carcasses, waste, and bedding material apart from non-radioactive or non-contaminated animals, animal parts, waste, and bedding material.

4. Procedures are to be performed on the animals in rooms designated for working on or with the animals.

5. Cages containing animals that have been administered radioactive material must be marked.

a. Cages marked conspicuously with a sticker, label, or tape bearing the Radiation Trefoil symbol and the words “Radioactive” or “Radioactive Material.”

b. Additional information to be include on the cage:

1. Radionuclide administered,

2. Date radionuclide was administered,

3. Quantity administered, in millicurie (mCi).

6. The survey frequency and type will be determined by the RSO prior to approving the use application.

7. Sacrificed animals and other wastes must be placed in properly marked containers used specifically for animal waste.

a. A means of preserving these wastes until disposal will be provided.

b. Keep carcasses and tissues separate from other wastes.

IV. Requirements for Contamination Control [10CFR20.1406 / NUREG 1556 Vol 7]

A. Contamination controls are used to prevent the spread of contamination, thus maintaining exposure ALARA and minimizing radioactive waste production or damaging equipment.

B. Good Work Practices

1. Survey or remove gloves prior to touching uncontaminated items.
2. Do NOT wear gloves away from the area in which radioactive material is being used.
3. Do not eat, drink, smoke, or apply cosmetics in any Radiation Safety Room or Restricted Area.
4. Cover areas with a plastic sheet if the surface may not be conducive to effective decontamination.
5. Wear appropriate anti-contamination clothing (anti-Cs).
   a. Items considered anti-Cs: Lab coats, coveralls, gloves, face shield, goggles, shoe covers, and hair covers.
   b. Long sleeve gloves may be used in lieu of a lab coat under the direction of the RSO to protect an individual's arm.
6. Immediately wipe all liquid droplets.
7. Increase personal vigilance of lab techniques to correct potential cross contamination practices and to avoid spills, splashes, or sprays.
8. Avoid touching your face, body, or other items that are not and should not be contaminated.
9. Use equipment for its intended use only.
10. Frequently monitor your hands and work area.
11. Store coats and personal belongings in designated areas to avoid contaminating them.
12. Concentrate on the work at hand when using radioactive material.
13. Set up and conduct dry runs for special or infrequently performed tasks.
14. Cover work areas in a disposable absorbent material when handling liquids.
15. Select non-porous smooth surfaces for work areas to allow effective decontamination.
16. Dispose of radioactive waste in designated containers.
17. Store radioactive material in clearly marked containers.
18. Use trays to contain spills when working with liquids.

C. Decontamination

1. RWs and AUs should perform normal decontamination, i.e. wipe downs of work areas after an experiment.
   a. Normal decontamination methods for an area or equipment.
      1. Soap (degreaser, detergent) and water.
      2. Detergent and a scrub brush.
      3. Cover the affected area and allow it to decay.
         a. Note area on the survey map and room log.
         b. Monitor the area as directed by the RSO for contamination and radiation levels.

b. Normal decontamination methods for a person.
1. Mild soap and lukewarm (98°) water.
2. Mild soap, lukewarm (98°) water, and a soft bristle scrub brush.

2. Request decontamination assistance from the RSO.
3. Assist the RSO in special decontamination efforts.

NOTE: Special Decontamination methods **ONLY** to be performed under the guidance of the RSO.

a. Special decontamination methods for an area or equipment, such as:
1. Abrasive practices, such as grinding or sanding
2. High pressure washing
3. Chemical agents

b. Special decontamination methods for a person, such as:
1. Paste made from corn starch
2. Mild soap, lukewarm (98°) water, and a medium bristle scrub brush.
3. Shower
4. Sweating by covering the affected area
5. Shaving the affected area

NOTE:	Release of material that has been marked as radioactive to an unrestricted status shall be done only under the auspice of the RSO.

NOTE:	Areas/rooms will **NOT** be Conditionally Released.

D. Free Release and Conditional Release of Equipment or Areas

1. Limits – Free or Unrestricted Use **[10CFR20.1402 / 10CFR30.36]**

Fixed contamination	Not distinguishable from background within efficiency of the detector (< 100 ccpm – $\beta\gamma$)
Loose Beta-Gamma ($\beta\gamma$) contamination	Not distinguishable from background within efficiency of the detector (< 1000 dpm/100 cm^2 or item)
Loose alpha (α) contamination if suspected of being exposed to alpha	Not distinguishable from background within efficiency of the detector (< 20 dpm/100 cm^2 or item)

2. Limits on Accessible Surfaces – Conditional or Restricted Use **[10CFR20.1403]**

Fixed contamination	< 0.2 mR/hr at 30 cm
Loose $\beta\gamma$ contamination	< 1000 dpm/100 cm^2 or item
Loose α contamination if suspected of being exposed to alpha	< 20 dpm/100 cm^2 or item

V. Final Conditions

A. The radiation controls and practices are in place and implemented.

B. The contamination controls and practices are in place and implemented.

C. Surveys are being performed as required.

D. Items are controlled while in a Conditional Release status.

E. Records are being maintained in accordance with the Administrative Controls Program.

Appendix A
Conducting Radiation Surveys

I. The following steps are performed by all users:

A. Determine the areas to be surveyed.

B. Review the previous survey, if applicable.

C. Obtain the appropriate meter and perform the pre-operational checks in accordance with the instrumentation procedures.

D. Set the meter to the highest scale that corresponds to the expected dose rate and turn on the audible response, if the meter has one.

E. Survey the area

1. General Area Radiation Survey

a. Hold the probe about waist high and > 30 cm from an object.

b. Slowly move about the area.

c. Listen to the audible response of the meter or watch the meter reading if it does not have an audible response.

d. If the frequency of the audible response quickens or the meter readings rises appreciably.

1. Stop.

2. Monitor the meter reading until it stabilizes for 15 seconds.

e. Continue the process until a representative survey of the condition of the area has been obtained.

f. Record the General Area readings in mR/hr.

NOTE: All contact readings should have a reading taken 30 cm from the object to evaluate the impact on the general area.

2. Contact Radiation Survey

a. Hold the probe ¼ - ½ inch from the surface.

b. Move the probe slowly (1-2 inches per second) over the area being surveyed.

c. Listen to the audible response of the meter and watch the meter reading.

d. If the frequency of the audible response quickens or the meter readings rises appreciably.

1. Stop.

2. Monitor the meter reading until it stabilizes for 15 seconds.

e. Continue the process until a representative survey has been obtained.

f. Record the contact and 30 cm readings in mR/hr.

F. Determine the required posting.
   1. Review the results of the survey.
   2. Compare the results of the survey with the definitions and previous surveys.
   3. Inform the RSO and AU of the need to change postings.
   4. Obtain the appropriate posting material.
   5. Post the area.
      a. Sign bearing the appropriate wording and symbols, or
      b. Tape bearing appropriate wording and symbols, or
      c. Yellow and magenta rope or ribbon with a sign, or
      d. Other means approved by the RSO.

G. Submit the completed survey to the RSO for review and filing.

Appendix B
Conducting Fixed Contamination Surveys, Direct Frisks

I. The following steps are performed by all users:

A. Determine the areas to be surveyed.

B. Review the previous survey, if applicable.

C. Obtain the appropriate meter, Ludlum Model 3 or 14C.
1. Perform the pre-operational checks in accordance with the instrumentation procedures.

D. Set the meter to the x 0.1 scale for readings in cpm and turn on the audible response, if the meter has one.

E. Survey the area
1. Determine the background levels, must be less than 200 cpm
2. Hold the probe ¼ - ½ inch from the surface.
3. Move the probe slowly (1-2 inches per second) over the surface.
4. Listen to the audible response of the meter
5. If the frequency of the audible response quickens or the meter readings rises appreciably.
   a. Stop.
   b. Monitor the meter reading until it stabilizes for 15 seconds.
6. Continue the process until a representative survey of the condition of the area has been obtained.
7. Record the Fixed Contamination readings in corrected counts per minute (ccpm).
   ccpm = obtained reading (cpm) – background reading (cpm)

F. Determine the required posting.
1. Review the results of the survey.
2. Compare the results of the survey with the definitions and previous surveys.
3. Inform the RSO and AU of the need to change postings.
4. Obtain the appropriate posting material.
5. Post the area.
   a. Sign bearing the appropriate wording and symbols, or
   b. Tape bearing appropriate wording and symbols, or
   c. Yellow and magenta rope or ribbon with a sign, or
   d. Other means approved by the RSO.

G. Submit the completed survey to the RSO for review and filing.

Appendix C
Conducting Loose Contamination Surveys, Wipes

I. The following steps are performed by all users:

A. Determine the areas to be surveyed.

B. Review the previous survey, if applicable.

C. Obtain the appropriate equipment; i.e. wipes, swabs, vials, liquid scintillation fluid, meter, gloves, etc..

1. Perform the pre-operational checks in accordance with the instrumentation procedures
   a. Portable instrument, Ludlum Model 3 or 14C
   b. Liquid Scintillation Counter

D. Survey the area

1. Rub a dry wipe or wet swab across the surface of the area / item.
   a. Wipe an area of 100 cm^2 .
   b. Estimate of the size for wipe areas < 100 cm^2 .
2. Record the location on the survey map, if necessary by a circled number.
3. Count the sample
   a. Dry samples
      1. Set the meter to the x 0.1 scale for readings in cpm and turn on the audible response.

NOTE: If the background level is > 200 cpm, relocate to an area of lower background

NOTE: If the activity requires use of a scale > x 0.1, record the reading in mR/hr/100 cm^2. Background, if it was < 200 cpm, will be negligible.

      2. Determine the background levels in cpm.
      3. Place the wipe ¼ - ½ inch from the probe face.
      4. Note the meter reading after it has stabilized for 15 seconds.
      5. Determine the activity of the wipe in dpm.
         dpm = (observed reading (cpm) – background reading (cpm)) x 5
      6. Record the activity in dpm of the wipe.
   b. Wet samples.
      1. Place the sample in the scintillation vial.
      2. Add enough scintillation fluid to fill the sample vial three quarters full.
      3. Cap the vial.
      4. Count the prepared samples in the Liquid Scintillation Counter.
      5. Record the activity in dpm of the wipe.

E. Clean the counting area

1. Discard samples, < 1000 dpm/100 cm^2 in the normal trash.
2. Discard samples, > 1000 dpm/100 cm^2 as radioactive trash.

F. Determine the required posting.
   1. Review the results of the survey.
   2. Compare the results of the survey with the definitions and previous surveys.
   3. Inform the RSO and AU of the need to change postings.
   4. Obtain the appropriate posting material.
   5. Post the area.
      a. Sign bearing the appropriate wording and symbols, or
      b. Tape bearing appropriate wording and symbols, or
      c. Yellow and magenta rope or ribbon with a sign, or
      d. Other means approved by the RSO.

G. Submit the completed survey to the RSO for review and filing.

Appendix D
Free and Conditional Release

I. Conditional Releases

NOTE: Conditional Release of materials that have been marked as radioactive will be evaluated and approved by the RSO ONLY.

A. The following steps are to be performed by the individual requesting the conditional release of an item:

1. Evaluate the item and its operation to ensure that its operation will not allow the release of material that may be on an inaccessible surface to an unrestricted area or untrained individual.
2. Survey the accessible surfaces of the item.
    a. Proceed with request if levels are within limits.
    b. Decontaminate the item using minor methods until levels are within limits.
        1. Repeat the survey and decontamination efforts as necessary.
        2. Contact the RSO for assistance if minor decontamination methods fail to remove the loose surface contamination.
3. Fill out the Conditional Release Request Form.
4. Record the accessible surface survey results on the Conditional Release Form.
5. Submit the Conditional Release Request Form to the RSO.

B. The following steps are to be performed by the RSO:

1. Review the Conditional Release Request Form.
2. Survey the accessible surfaces of the item.
3. Document the Conditions in which the item can be used, stored, and handled while under the conditional release in an unrestricted area.
4. Log the conditional release.
5. Provide the requestor with a copy of the conditions in which the item can be used outside a restricted area.

C. The following steps are to be performed by the individual requesting the conditional release of an item:

1. Control the item in accordance with the conditions of the release.
2. Return the item to its normal restricted area storage or use area.
3. Notify the RSO the item has been returned to its restricted area.

D. The following steps are to be performed by the RSO:

1. Survey the external surfaces of the item.
    a. If survey results are within the limits, proceed to I.D.2.
    b. If the survey results in levels > limits:
        1. Contact the user.

2. Survey the unrestricted work area, the transfer path, and personnel involved in the incident.
3. Decontaminate as necessary.
4. Investigate the incident, as per the Quality Control Program.

2. Record the results of the survey.
3. Log the return of the item.

II. Free Releases

NOTE: Free Release of materials and areas that have been marked as radioactive will be evaluated and approved by the RSO ONLY.

A. The following steps are to be performed by the RSO:
1. Evaluate the item for inaccessible surfaces.
   a. Flush if possible; collect and count run off.
2. Survey the item/area.
   a. Within limits, proceed with request.
   b. Outside the limits,
      1. The item cannot be Free Released.
      2. Evaluate for conditional release or special decontamination methods.
      3. Store for Decay
         a. Exposed to short half-life isotopes (≤ 120 day T ½).
         b. Stored for ten (10) half-lives.
3. Record the survey results.
4. Remove all radioactive material markings.
5. File the documents.

Appendix E
Conducting Non-Gaseous Sealed Beta-Gamma Emitting Source Leak Tests

NOTE: Leak tests being sent to a licensed vendor will be performed in accordance with vendor instructions.

I. The following steps are to be performed by the RSO:

A. Determine how the source is to be surveyed.

B. Obtain the appropriate equipment; i.e. swabs, vials, liquid scintillation fluid, meter, gloves, etc.

C. Prepare the Liquid Scintillation Counter for leak test determination.

D. Review the previous survey, if applicable.

E. Survey the source
1. Rub a wet swab across the surface of the source.
2. Prepare and count the sample in accordance with the instrument's operating procedure.

NOTE: If the activity is found to be > 0.005 microcuries the RSO must notify the NRC within 30 days.

3. Calculate the activity.
4. Record the results of the leak test.

F. Clean the counting area.
1. Discard samples with an activity of < 1000 dpm as normal trash.
2. Discard samples with an activity of > 1000 dpm as radioactive trash.

G. File the completed leak test.