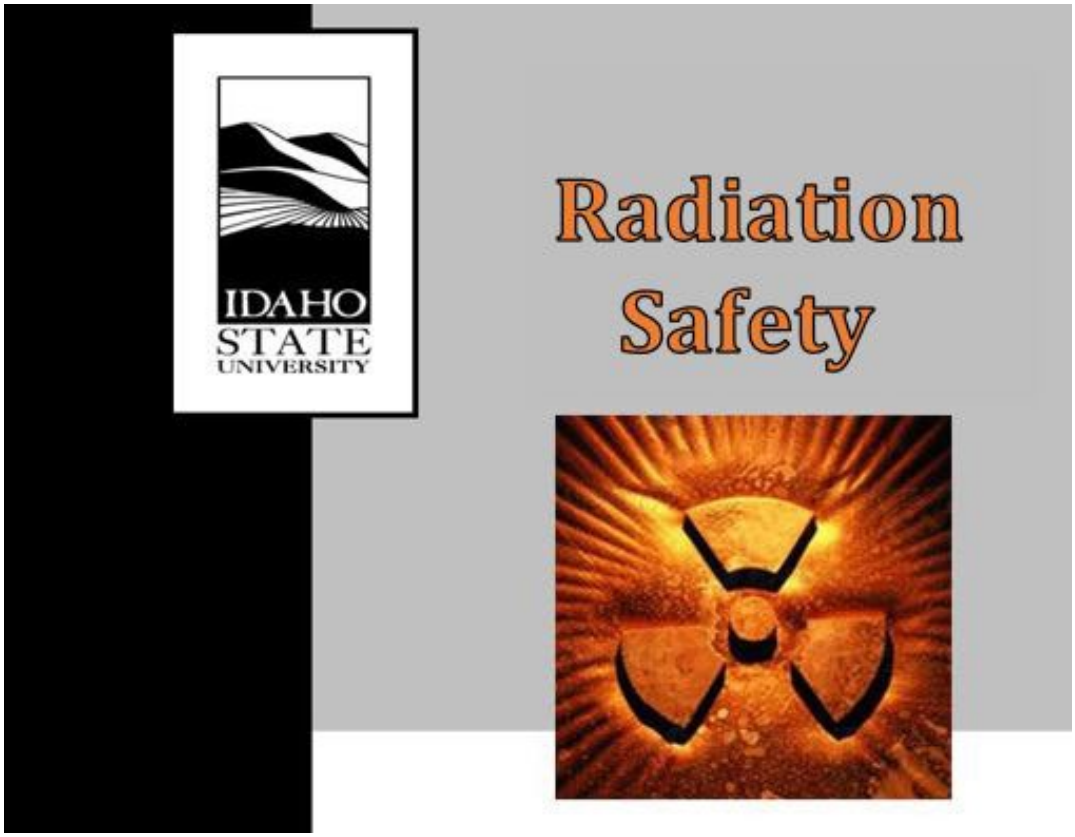


RADIATION PROCEDURES MANUAL

Procedure Cover Sheet

Procedure Title:	Radiological Surveys
Procedure Number:	RS-03 Rev.3
Effective Date:	7/29/2025

Approved By: Radiation Safety Committee Date: 7/29/2025

Revision History

Revision Number	Author Name	Date	Approved by/date
RS 3.0	Mason Jaussi & John Longley	09/16/20	RSO-09/16/20
RS 3.1	Brandon Jenkins	09/26/22	RSC-10/06/22
RS 3.2	Miranda Kriner	01/24/24	RSC-04/25/24
RS 3.3	Mason Jaussi	06/05/25	RSC-07/29/25

Table of Contents

1. INTRODUCTION

This procedure is designed after the requirements established in the ISU Radiation Safety Manual (RSM), Sections 11 and 12. While handling radioactive material, spills may occur, containers may leak, and physical contact with radionuclides may lead to the spread of radioactive material in unintended locations. Surveys for radioactive contamination help ensure that exposure to radioactive material remains ALARA. Dose rate surveys provide information about the radiation fields and associated dose rates in the work area. Conditions are subject to change and because of this, both contamination and radiation surveys are performed periodically. Surveys help reduce the spread of contamination and characterize exposure rates. When contamination is detected, it must be removed promptly to prevent its spread and the possible exposure of other individuals. The survey frequency is based on the source classification for a particular radiation use area, as shown in the RSM Section 12 – Table 8 and is specified in the Authorized User permit.

In addition to laboratory surveys, this procedure provides instructions for release surveys to demonstrate equipment and material may be released as non-radioactive and surveys for shipping containers to comply with transportation regulations.

2. PURPOSE

The purpose of this procedure is to provide clear instructions for performing and documenting the various radiological surveys conducted within the ISU Radiation Safety Program.

3. SCOPE

This procedure specifies instructions for radiological surveys performed in the ISU Radiation Safety Program as listed below:

- Confirmatory Surveys are performed by the Radiation Safety Department.
- User Survey of laboratory spaces.
- Release Surveys demonstrate equipment and material that have been used with dispersible radioactive materials or are potentially activated can be released as non-radioactive for repair or unrestricted use.
- Transportation Surveys for radioactive material packages prior to shipping.
- Trash Surveys are typically performed on laboratory trash in restricted areas to verify no radioactive material is present.
- Waste Surveys are performed on waste containers prior to being shipped.
- SCA Leak Test Surveys.

4. ROLES AND RESPONSIBILITIES

Radiation Safety Officer

- Maintain this procedure and applicable sections of the Radiation Safety Manual.

Authorized Users

- Ensure surveys are performed at the frequency specified in their permit.
- Review and approve Authorized User surveys for their laboratories.
- Maintain annual radiation safety training.

Radiation worker

- Properly perform surveys in accordance with this procedure.
- Maintain annual radiation safety training.

Radiation Safety Technician

- Perform confirmatory surveys, release surveys, transportation surveys, and SCA leak test surveys.
- Maintain annual radiation safety training.

5. ACRONYMS/DEFINITIONS

ALARA:	As Low As Reasonably Achievable
AU:	Authorized User
GM:	Geiger–Müller
ISU:	Idaho State University
LAW:	Large Area Wipe
PPE:	Personal Protective Equipment
RAM:	Radioactive Material
RS:	Radiation Safety
RSM:	Radiation Safety Manual
SCA:	Subcritical Assembly
WAL:	Waste Addition Log
Contamination:	Radioactive material in an unwanted location. Contamination can be both fixed and removable. Removable contamination is easily removed from the surface it is on while fixed contamination remains on its surface despite removal efforts.
External Exposure:	Penetrating dose from a radioactive source external to the body.
Internal Exposure:	Radioactive material deposited in the body through inhalation, ingestion, injection, or absorption.

Contamination Survey:	A survey designed to establish the level of radioactive material that may be on exposed surfaces. Swipes, Large Area Wipes (LAW's), and direct contact measurements are considered contamination surveys.
Radiation Survey:	Measuring the dose rate levels in various locations in a room or facility. This is performed with dose rate instruments to measure x-ray, beta, gamma and neutron fields. Typically done in general area and at 30 cm or 1 meter from a source.
Formal Map Survey:	Investigation of the area or item to identify possible contaminates and radiation levels. Legibly documented on a map.
Immediate Work-Area Survey:	A survey performed in the immediate work area to grossly identify that there is no significant contamination in the area.
Swipe/Smear:	Removable contamination survey method of swiping surface areas and counting it for gross alpha/beta analysis.
Direct Scan:	Contact reading of a suspected area of contamination with a survey meter (alpha/beta survey probe).
Large Area Wipe:	Removable contamination survey method of using a Masslinn mop or wipe to cover a large area and then perform a direct scan on the Masslinn.

6. REQUIRED MATERIAL(S)

- Applicable RPR 11 – Contamination and Radiation Survey Form
- PPE
- Dosimeter
- Appropriate Survey Instruments defined in Authorized User permit
- Swipes
- Masslinn, and Mop (if applicable)
- Pen

7. REQUIRED TRAINING(S)

- ISU Radiation Safety Training

8. PROCEDURE

Surveys should be clear and legible so that there is no question what is being written and it can be understood by anyone. The RPR-11 forms clearly identify the minimum survey requirements and proper way of recording survey results. A completed example form can be found in Appendix B. Once approved, the most recent survey should be posted in or near the laboratory space. Dose rate area postings should be updated to the appropriate signage, dependent on survey results.

8.1. Confirmatory Surveys

Confirmatory Surveys of permitted laboratory spaces are performed by the Radiation Safety Department. They are documented on the RPR-11a form.

8.1.1. Preliminary Steps

8.1.1.1. Obtain an RPR-11a form.

8.1.1.2. Identify the radionuclides that may be present in the survey. The radionuclides present are listed on the Authorized User's permit. Be aware of any neutron sources that are present in the laboratory. If multiple alpha and beta/gamma emitters are present, then write various on the RPR-11a form.

8.1.1.3. Gather the appropriate survey instrument(s) specified in the permit under the section for Radiation Safety Surveys.

8.1.1.4. Verify the instruments to be used have been daily checked. See the Instrument Performance Log on Google Sheets. If the instrument(s) have not been checked, complete a daily check by following RS-24, Instrument Response Checks procedure.

8.1.1.5. Record the make, model, serial number, calibration due date, and unit of measurement of each instrument on the RPR-11a form.

8.1.1.6. Take a background measurement with each handheld instrument and record the background range on the RPR-11a form. Background measurements should be representative of the area where the survey is being performed.

8.1.1.7. Gather the necessary survey materials. This includes PPE and swipes.

8.1.1.8. Draw a map of the location being surveyed. Maps should be up to date and to scale. Maps can be electronically drawn and printed on the back of the RPR-11a form or drawn by hand. Maps should include room numbers, all doorways, RAM storage cabinets, RAM use area, laboratory furnishings, and any other pertinent information about the area.

8.1.1.9. When applicable, contact the Authorized User to schedule an appropriate time to survey.

8.1.2. Survey

8.1.2.1. Measure the dose rate throughout the area. Take enough dose rate measurements to accurately represent the survey area. Focus on RAM use areas and RAM storage areas. Perform a dose rate measurement 30 cm from all RAM storage areas. When the user permit identifies neutron sources, the same principles apply for neutron dose rate measurements.

8.1.2.2. Record dose rate results on the RPR-11a map. If gamma and neutron dose rate measurements are performed, label them respectively with γ and n on the map. Avoid loitering near RAM storage areas. Record results in a low background area to maintain exposure ALARA.

8.1.2.3. Prepare and collect enough swipes to cover all potentially contaminated areas to accurately represent the area or item being surveyed. The following should be noted while taking swipes:

- Swipes should be collected in a 100 cm^2 area.
- Swipes should be taken at the entrance to the survey area, both inside and outside. Sink drains, sash/lip of Fume Hoods, rad trash lids, door handles, logbooks, tools used to process RAM, keyboards, etc.
- If direct scans are greater than background measurements it is a good practice to also swipe the area to classify the type of contamination: fixed or removable.
- Briefly frisk each swipe to verify that it is not highly contaminated. If highly contaminated, note count rate on the RPR-11a form but DO NOT analyze on laboratory equipment.
- Swipes are either counted on a proportional counter or liquid scintillation counter (see Authorized User permit). When results are completed, attach them to the survey map.
- When using the proportional counter, first verify that the daily check has been completed on the control chart. Record counting information in the proportional counter logbook.
- The liquid scintillation counter uses a standard rack with background H-3 and C-14 standards that is counted when a sample is started. Record counting details such as the number of vials, date counted, and carrier number(s) in the LSC logbook. A background vial should be used for each carrier.
- Attach swipe results to the RPR-11a form.

8.1.2.4. Direct scans should be performed in locations likely to find contamination (i.e., Fume Hoods, sinks, sample preparation areas, re-usable PPE etc.). Record all area direct scans on the RPR-11a form. Record maximum count rate observed. Scan speeds can be found in Appendix A. If no direct scans are performed due to

elevated radiation fields being present, add a comment to the top of the RPR-11a form stating "No direct scans performed due to elevated background."

8.1.2.5. When the survey has been completed, review that all information is complete and correct, sign it, and submit it to the Radiation Safety Department for review.

8.2. User Surveys

There are two types of User Surveys: Immediate Work Area and Formal Map User Surveys discussed in Section 8.3 and Section 8.4. Immediate Work Area Surveys are performed immediately after radiological work is completed and recorded in the AU's logbook. Formal Map Surveys are recorded on the RPR-11b form. See the Authorized User's permit for the frequency of Formal Map Surveys.

8.3. Immediate Work Area Post-Job Surveys

Immediate Work Area Surveys confirm there is no significant contamination from the day's operation. If contamination is detected above the limits of Table 7 in the RSM, decontamination shall be performed, and a Formal Map User Survey conducted.

8.3.1. Preliminary Steps

8.3.1.1. Be aware of which types of radionuclides are present based on the work performed.

8.3.1.2. Be prepared to conduct the survey by donning the proper PPE and obtaining the needed survey materials. (Lab coat, gloves, Masslinn, swipes, friskers etc.).

8.3.1.3. Verify the instruments to be used have been daily checked. See the Instrument Performance Log on google sheets. If the instrument(s) have not been checked, complete a daily check by following RS-24, Instrument Response Checks procedure.

8.3.2. Survey

8.3.2.1. Direct surveys and/or LAW surveys are used to assess the work area when detectable nuclides were used.

8.3.2.2. LAW areas where RAM may have spilled or been released. (Fume Hood sash/lid, floor near work area, etc.)

8.3.2.3. Direct scan each Masslinn in a low background area. Scan speeds can be found in Appendix A.

8.3.2.4. Frisk the work area. See Appendix A.

8.3.2.5. When non-detectable nuclides (low-energy beta emitters) or pure alpha-emitting radionuclides are used, perform a swipe survey.

8.3.2.6. Prepare and collect enough swipes to assess the immediate work area. The following should be noted while taking swipes:

- Swipes should be collected in a 100 cm^2 area.
- Briefly frisk Swipes to verify they are not highly contaminated. If the swipes are highly contaminated note count rate in the AU logbook but DO NOT analyze on laboratory equipment.
- Count the swipes on the appropriate survey equipment according to the Authorized User permit.

8.3.2.7. Record the results of the immediate work area survey in the laboratory logbook. The make, model, serial number, calibration due date, background measurement, and units of measurement of all instruments used in the survey should be included in the entry.

8.4. Formal Map User Surveys

8.4.1. Preliminary Steps

8.4.1.1. Obtain an RPR-11b form.

8.4.1.2. Identify the radionuclides that may be present in the survey. The radionuclides present are listed on the Authorized Users permit. Be aware of any neutron sources that are present in the laboratory. If multiple alpha and beta/gamma emitters are present, then write various on the RPR-11b form.

8.4.1.3. Gather the appropriate survey instrument(s) specified in the permit under the section for Radiation Safety Surveys.

8.4.1.4. Verify the instruments to be used have been daily checked. See the Instrument Performance Log on google sheets. If the instrument(s) have not been checked, complete a daily check by following RS-24, Instrument Response Checks procedure.

8.4.1.5. Record the make, model, serial number, calibration due date, and unit of measurement of each instrument on the RPR11b form.

8.4.1.6. Take a background measurement with each handheld instrument and record the background range on the RPR-11b form. Background measurements should be representative of the area where the survey is being performed.

8.4.1.7. Gather the necessary survey materials. This includes PPE, swipes, and Masslinn.

8.4.1.8. Draw an updated map of the location being surveyed. Maps should be up to date and to scale. Maps can be drawn by hand or electronically designed and printed on the back of the RPR-11b form. Maps should include room numbers, all doorways, RAM storage cabinets, RAM use areas, laboratory furnishings, and any other pertinent information about the area.

8.4.1.9. When applicable, contact the Authorized User to schedule an appropriate time to survey.

8.4.2. Survey

8.4.2.1. For areas with significant potential for removable contamination, take enough LAWs to cover the majority of the work area and record results on the RPR-11b form. The following should be noted while taking Large Area Wipes:

- A LAW is performed by using the Masslinn cloth and wiping the surface areas with a gloved hand or Masslinn mop.
- LAWs are direct scanned with a survey meter for removable contamination. Scan speeds can be found in Appendix A.
- It is acceptable to reuse the same Masslinn if the levels are found to be indistinguishable from background.

8.4.2.2. If contamination is found on the LAW, decontaminate the area using cleaning products. Dry the area or wait until dry and repeat LAW in the area. Repeat until the net count rate on the LAW is less than the action levels specified in Table 7, Section 11 of the RSM.

8.4.2.3. Measure the dose rate throughout the area. Take enough dose rate measurements to accurately represent the survey area. Focus on RAM use areas, high contact areas (i.e., sinks, door handles, etc.), and RAM storage areas. Perform a dose rate measurement 30 cm from all RAM storage areas. When the user permit identifies neutron sources, the same principles apply for neutron dose rate measurements.

8.4.2.4. Record dose rate results on the RPR-11b map. If gamma and neutron dose rate measurements are performed, label them respectively with γ and n on the map. Avoid loitering near RAM storage areas. Record results in a low background area to maintain exposure ALARA.

8.4.2.5. Prepare and collect enough swipes to cover all potentially contaminated areas as well as accurately represent the area or item being surveyed. The following should be noted while taking swipes:

- Swipes should be collected in a 100 cm^2 area.
- Swipes should be taken at the entrance to the survey area, both inside and outside. Sink drains, sash/lip of Fume Hoods, door handles, logbooks, tools

used to process RAM, keyboards, etc.

- If direct scans are greater than background measurements it is a good practice to also swipe the area to classify the type of contamination: fixed or removable.
- Briefly frisk each swipe to verify that it is not highly contaminated. If highly contaminated, note count rate on the RPR-11b form but DO NOT analyze on laboratory equipment.
- Swipes are either counted on a proportional counter or liquid scintillation counter (see Authorized User permit). When results are completed, attach them to the survey map.
- When using the proportional counter, first verify that the daily check has been completed on the control chart. Record counting information in the proportional counter logbook.
- The liquid scintillation counter uses a standard rack with background H-3 and C-14 standards that is counted when a sample is started. Record counting details such as the number of vials, date counted, and carrier number(s) in the LSC logbook. A background vial should be used for each carrier.
- Attach swipe results to the RPR-11b form.

8.4.2.6. Direct scans should be performed in locations likely to find contamination (i.e., Fume Hoods, sample preparation areas, etc.). Record all area Direct Scans on the RPR-11b form. Scan speeds can be found in Appendix A. If no direct scans are performed due to elevated radiation fields being present, add a comment to the top of the RPR-11b form stating “No direct scans performed due to elevated background.”

8.4.2.7. When finished with the survey, review that all information is complete and correct, sign it, and submit it to the Radiation Safety Department or Authorized User for review.

8.5. Release Surveys

Release Surveys are performed on items or equipment to be released for repair or unrestricted use that have been used with dispersible radioactive materials or may have been activated. Process knowledge can be used to determine whether a full release survey is appropriate. Items located in or near beamlines, where activation may occur, may be released following a survey using a GM probe and a NaI-based dose rate meter (or an equivalent device), provided the areas are free of removable contamination. Release Surveys are recorded on the RPR-11c form. Release Surveys are typically performed by Radiation Safety Technicians from the Radiation Safety Department. Please contact the Radiation Safety Department if something needs to be released.

8.5.1. Preliminary Steps

8.5.1.1. Obtain an RPR-11c form. Contact the Authorized User to determine if the item is potentially activated or to identify radionuclides that may be present. Identify if there are internal surfaces where RAM may be present in the comments section. Identify the action levels based on what radionuclides may be present (See Table 7 of the RSM). Record action levels for removable and average total contamination on the RPR-11c form.

8.5.1.2. Gather the appropriate survey instrument(s) for the release survey. Appropriate instruments may include a rate meter with GM probe or alpha/beta probe, and Model-19 NaI based dose rate meter (or equivalent) if the item is potentially activated.

8.5.1.3. Verify the instruments to be used have been daily checked. See the Instrument Performance Log on google sheets. If the instrument(s) have not been checked, complete a daily check by following RS-24, Instrument Response Checks procedure.

8.5.1.4. Record the make, model, serial number, calibration due date, and unit of measurement unit of each instrument on the RPR-11c form.

8.5.1.5. Take a background measurement with each handheld instrument and record the background range on the RPR-11c form. Background measurements should be representative of the area where the survey is being performed.

8.5.1.6. Gather the necessary survey materials. This includes PPE, swipes, and Masslinn.

8.5.1.7. Preferably, take photographs of the item. Add survey points to the photographs.

8.5.1.8. Alternatively, prepare a map of the item being surveyed. Maps should include all items surveyed for release. Maps should be legible and to scale. If this is not achievable, then a picture needs to be used instead. The item being surveyed for release should be stationed in a low background area in order to conduct the survey.

8.5.2. Survey

8.5.2.1. Scan 100% of the item with the contamination survey instrument. Complete questions regarding direct frisk. Scan speeds can be found in Appendix A. If positive results are found in the direct frisk, perform 30 second static counts at the location and record results on the RPR-11c form. Note all internal surfaces and areas in the comments where direct scans or swipes are not possible.

8.5.2.2. If potentially activated, survey the entire surface of the item with a Ludlum Model 19 µR meter (or equivalent). Survey 1 to 2 cm from the surface of the item. Use the same survey speed specified for frisking in Appendix A. Answer questions

regarding activation and μR survey on the RPR-11c form. If dose rates become too high for the Model 19, it is acceptable to then move to a Model 9 or equivalent to quantify the dose rates.

8.5.2.3. Take enough LAWs to cover all surfaces of the object and record results on the RPR-11c form. Follow the following list for LAWs:

- A LAW is performed by using the Masslinn cloth and wiping the surface areas with a gloved hand.
- LAWs are direct scanned with a survey meter for removable contamination. Scan speeds can be found in Appendix A.
- It is acceptable to reuse the same Masslinn if the levels are found to be indistinguishable from background.

8.5.2.4. If contamination is found from the LAW, decontaminate the item by using cleaning products. Dry the area or wait until dry and perform a second LAW on the item. Repeat until indistinguishable from background or less than action levels specified in Table 7, Section 11 of the RSM. Record results on the RPR-11c form.

8.5.2.5. Prepare and collect enough swipes to cover all openings as well as accurately represent the item being surveyed. The following should be noted while taking swipes:

- Swipes should be collected in a 100 cm^2 area for release items.
- If direct scans are greater than background measurements it is a good practice to also swipe the area to classify the type of contamination: fixed or removable.
- Briefly frisk each swipe to verify that it is not highly contaminated. If highly contaminated, note count rate on the RPR-11c form but DO NOT analyze on laboratory equipment.
- Swipes are either counted on a proportional counter or liquid scintillation counter, depending on isotopes that may be present. When results are completed, attach them to the survey map.
- When using the proportional counter, first verify that the daily check has been completed on the control chart. Record counting information in the proportional counter logbook.
- The liquid scintillation counter uses a standard rack that is counted when a sample is started. Record counting details such as the number of vials, date counted, and carrier number(s) in the LSC logbook. A background vial should be used for each carrier.

8.5.2.6. When the survey is complete, review that all information is complete and correct, sign it, and submit it to the Radiation Safety Department for review.

8.6. Transportation Surveys

Transportation surveys are performed in conjunction with RS-08, Transfer and Transport of Radioactive Material and are performed by the Radiation Safety Department technicians and staff.

8.6.1. Preliminary Steps

8.6.1.1. Obtain an RPR-11d form.

8.6.1.2. Gather required materials (Gamma dose rate meter, frisker, swipes, LAW, and neutron dose rate meter if neutron-emitting sources are present). A μR/hr dose rate meter should be used initially for all shipments, graduating to a mR/hr dose rate meter if the package dose rate requires a larger scale.

8.6.1.3. Verify the instruments to be used have been daily checked. See the Instrument Performance Log on google sheets. If the instrument(s) have not been checked, complete a daily check by following RS-24, Instrument Response Checks procedure.

8.6.1.4. Record the make, model, serial number, calibration due date, and unit of measurement for each instrument.

8.6.1.5. Perform surveys in a low background area.

8.6.1.6. Take a background measurement with each handheld instrument and record the background range on the RPR-11d form. Background measurements should be representative of the area where the survey is being performed.

8.6.1.7. Enter the shipment number, UN number, and label category.

8.6.2. Survey

8.6.2.1. Perform a dose rate survey on the shipment container. Find the highest on-contact reading and record it on the RPR-11d form. Measure 1-meter from the highest point and take a second reading. Record the 1-meter reading on the RPR-11d form. Measure neutron dose rates in the same manner when neutron-emitting material is present.

8.6.2.2. Record dose rate results on the RPR-11d map. If gamma and neutron dose rate measurements are performed, label them respectfully with γ and n on the map. Avoid loitering near RAM storage areas. Record results in a low background area to maintain exposure ALARA.

8.6.2.3. Collect 300 cm^2 swipes of the container and record the location on the RPR-11d form. Briefly frisk each swipe to verify that it is not highly contaminated. If highly contaminated, note the count rate on the RPR-11d form but DO NOT analyze on

the laboratory equipment. Dispose of the swipe in the radioactive waste bin and perform a decontamination of the container and re-swipe it.

8.6.2.4. When using the proportional counter, liquid scintillation counter, or alpha/beta scalar, first verify that all control measurements have been performed in accordance with the user procedure. Attach a printout of the swipe results to the form.

8.6.2.5. Take a LAW over the entire surface of the container and scan the LAW with a GM frisker for removable contamination. Record the result on the RPR-11d form.

8.6.2.6. When the survey is complete, review that all information is complete and correct, sign it, and submit it to the Radiation Safety Department for review.

8.7. Trash Survey

Trash Surveys are typically performed on trash bags collected from restricted or controlled areas near radioactive material use areas. Trash Surveys ensure no radioactive sources or material have been unintentionally placed in the non-rad trash. Trash Surveys are recorded on the RPR-11e form. Trash surveys may be performed by any Radiation Worker.

8.7.1. Preliminary Steps

8.7.1.1. Gather the appropriate survey instrument(s) for the release survey. Appropriate instruments may include a rate meter with GM probe or alpha/beta probe, and Model-19 NaI based dose rate meter (or equivalent).

8.7.1.2. Verify the instruments to be used have been daily checked. See the Instrument Performance Log on google sheets. If the instrument(s) have not been checked, complete a daily check by following RS-24, Instrument Response Checks procedure.

8.7.1.3. Record the make, model, serial number, calibration due date, and unit of measurement unit of each instrument on the RPR-11e form.

8.7.1.4. Take a background measurement with each handheld instrument and record the background range on the RPR-11e form. Background measurements should be representative of the area where the survey is being performed.

8.7.1.5. The trash being surveyed should be stationed in a low background area in order to conduct the survey.

8.7.1.6. Don the appropriate PPE for the survey.

8.7.2. Survey

8.7.2.1. Scan 100% of the trash with the contamination survey instrument. Complete questions regarding direct frisk. Scan speeds can be found in Appendix A. If

positive results are found in the direct frisk, perform 30 second static counts at the location and record results on the RPR-11e form.

8.7.2.2. Survey the entire surface of the trash with a Ludlum Model 19 µR meter (or equivalent). Survey 1 to 2 cm from the surface of the item. Use the same survey speed specified for frisking in Appendix A. Answer questions regarding activation and µR survey on the RPR-11e form.

8.7.2.3. Any measurements outside of the established background ranges need to be further evaluated by the Radiation Safety Department prior to putting it into the ordinary trash.

8.7.3. When the survey is complete, review that all information is complete and correct, sign it, and submit it to the Radiation Safety Department for review.

8.8. Waste Survey

Waste Surveys are performed on radioactive waste containers prior to shipment for disposal. Waste Surveys ensure that all containers destined for waste pick-up meet shipping requirements. Waste Surveys are recorded on the RPR-11f form. Waste Surveys are to be performed by Radiation Safety Technicians from the Radiation Safety Department. Please contact the Radiation Safety Department if any Radioactive waste container needs to be surveyed.

8.8.1. Preliminary Steps

8.8.1.1. Obtain an RPR-11f survey form.

8.8.1.2. Record the name, type, weight, and the fullness fraction of the container being surveyed on the RPR-11f form. Answer questions regarding the Waste Addition Logs on the RPR-11f form.

8.8.1.3. Identify the radionuclides that may be present in the survey. The radionuclides present should be posted on the drum with activities or logged in the Waste Addition Log. Be aware of any neutron sources that are present in the container. If multiple alpha and beta/gamma emitters are present, then write various on the RPR-11a form.

8.8.1.4. Gather required materials (Gamma dose rate meter, frisker, swipes, LAW, and neutron dose rate meter if neutron-emitting sources are present) A µR/hr dose rate meter should be used initially for all shipments, graduating to a mR/hr dose rate meter if the package dose rate requires a larger scale.

8.8.1.5. Verify the instruments to be used have been daily checked. See the Instrument Performance Log on google sheets. If the instrument(s) have not been checked,

complete a daily check by following RS-24, Instrument Response Checks procedure.

8.8.1.6. Record the make, model, serial number, calibration due date, and unit of measurement of each instrument.

8.8.1.7. Perform surveys in a low background area.

8.8.1.8. Take a background measurement with each handheld instrument and record the background range on the RPR-11d form. Background measurements should be representative of the area where the survey is being performed.

8.8.2. Survey

8.8.2.1. Perform a dose rate survey on the waste container. Find the highest on-contact reading and record on the front of the RPR-11f form. Measure 1 meter from the highest point and take a second reading. Record the 1-meter reading on the front of the RPR-11f form. Measure neutron dose rates in the same manner when neutron-emitting material is present.

8.8.2.2. Record dose rate results on the RPR-11f map. If gamma and neutron dose rate measurements are performed, label them respectively with γ and n on the map. Avoid loitering near RAM storage areas. Record results in a low background area to maintain exposure ALARA

8.8.2.3. Collect 300 cm^2 swipes of the container and record the location on the RPR-11d form. Briefly frisk each swipe to verify that it is not highly contaminated. If highly contaminated, note count rate on the RPR-11f form but DO NOT analyze on laboratory equipment.

8.8.2.4. When using the proportional counter, liquid scintillation counter, or alpha beta scalar, first verify that all control measurements have been performed in accordance with the user procedure. Attach a printout of the swipe results to the form.

8.8.2.5. Take a LAW over the surface of the entire container and scan with a GM frisker for removable contamination. Record the result on the RPR-11f form.

8.8.2.6. When the survey is complete, review that all information is complete and correct, sign it, and submit it to the Radiation Safety Department for review.

8.9. Ten Percent Survey of SCA Plates

The Sub-Critical Assembly (SCA) fuel plates are leak tested annually and after each experimental use. Ten percent of the SCA plates used in an experiment are selected and leak tested as specified below. During the September inventory, ten percent (15

plates) are surveyed as specified below. The ten percent survey is performed with the Reactor Supervisor or designated back-up and in accordance with the applicable requirements of the Subcritical Assembly Procedure.

8.9.1. Gather the required materials: Gloves, pen, SCA Leak Test Survey Form, GM frisker, swipes. For post SCA run surveys also gather 20 mL liquid scintillation vials (2) and a pipette.

8.9.2. Randomly select the 10% of the fuel plates used in the experiment or 15 plates if the performing the September inventory from the fuel locker and write the fuel plate number and corresponding swipe number on the SCA Leak Test Survey Form

8.9.3. Swipe the surface of each fuel plate, focusing on the edges, with the corresponding swipe number and collect the swipes in a bag.

8.9.4. Return the SCA plates to the fuel locker, ensure it is locked, and make an entry into the SCA laboratory notebook indicating the Ten Percent Survey was performed with a date and time.

8.9.5. If performing a post SCA run 10% Survey, use the pipette to collect a 5 mL water sample from the SCA tank and dispense it into one of the vials.

8.9.6. Use the pipette to collect a 5 mL background water sample and dispense it into the remaining vial.

8.9.7. Transfer the swipes and water samples to the Radiation Safety Department counting laboratories.

8.9.8. Count the swipes on the proportional counter.

8.9.9. Add 15 mL of scintillation cocktail to each of the water sample vials, shake them well to make sure solute and solvent are dissolved completely, and count them on the liquid scintillation counter.

8.9.10. Compile the SCA Leak Test Form, swipe results, water sample results and attach to Ten Percent Survey Report.

8.9.11. Update the applicable areas of the Ten Percent Survey Report and submit it to the RSO/ARSO for review.

9. LIST OF FORMS

RPR-11a – Laboratory Confirmatory Survey Form

RPR-11b – User Formal Map Survey Form

RPR-11c – Release Survey Form

RRP-11d – Transportation Survey Form

RRP-11e – Trash Survey Form

RRP-11f – Waste Survey Form

SCA Leak Test Survey Form

SCA Ten Percent Survey Report

10. REFERENCES

None.

11. CHANGE HISTORY

Revision 1 – Included formatting updates in accordance with RS-27, the addition of the Ten Percent Survey of SCA Plates section, and general clarification throughout the document.

Revision 2 – Added Sections 8.7 – Trash Surveys & 8.8 – Waste Survey, and minor additions & grammatical corrections to previous steps for consistency throughout sections.

Revision 3 – Updated Section 8.5 – Release Surveys to allow for the use of process knowledge to determine if a full release survey is appropriate for a given item and a process for releasing potentially activated items that are in areas free from removable contamination.

12. APPENDICES

APPENDIX A – Frisking Directions

APPENDIX B – Example Surveys and Results

APPENDIX A – Frisking Directions

- For survey meters it is important to strive to maintain a consistency of survey rate and distance.
- When surveying something, ¼ to ½" distance from the surface should be maintained so that the probe is not too far away from the surface to measure contamination but not too close to touch a potentially contaminated area and become contaminated.
    - Avoid using the probe to survey the bottom of something. When surveying feet or shoe covers, lift your leg up so that the probe is surveying vertically to prevent contaminating the probe.
- In general, the best way to determine how to survey something is by covering the width of the detector per second.
    - This is only about 1-2" per second for the 44-9 GM probe.
- The fast response should be used when looking for contamination, such as in a direct scan.
- The slow response should be when you want to quantify contamination.
- When scanning an area, use an "S" pattern making sure to stop when you audibly or visually see counts recording above background.

APPENDIX B – Example Surveys and Results

RPR-11a Confirmatory Survey Form

Building: LEL
Room: Rm 20 - Reactor Bay
Program: 72
Date: 12-7-2023
Radionuclides present: Various

Comments:

Performed by: Jordan Reed Signature: [signature]
Reviewed by: Miranda Kriner Signature: Miranda Kriner

Swipe	Location	Swipe	Location	Direct	Location	Results (cpm)
1	Door Handle	20	Keyboard	1	Door Handle	BKG
2	Floor	21	Window Seal	2	Floor	BKG
3	Cabinet Handle	22	Window Seal	3	Cabinet Handle	BKG
4	Floor			4	Floor	BKG
5	Floor			5	Top Surface	BKG
6	Top Surface			6	Hand Rail	BKG
7	Floor			7	Shielding	BKG
8	Floor			8	Window Sill	BKG
9	Hand Rail			9	Floor	BKG
10	Water Tank			10	Console	BKG
11	Shielding			11	Keyboard	BKG
12	Padlock			12	Window Seal	BKG
13	Bucket Lid			13	Window Seal	BKG
14	Floor					
15	Reactor Skirt					
16	Floor					
17	Floor					
18	Console					
19	Floor					

Instruments were Source Checked ☑ prior to survey

Instrument ✓	Instrument ✓	Instrument ✓
Make Ludlum	Make Ludlum	Make Ludlum
Model 9-4	Model 3	Model 12-4
Serial 291228	Serial 88242	Serial 349995
Cal due Apr2024	Cal due Dec2023	Cal due Dec2023
BKG Range <0.1	BKG Range 50-150	BKG Range <0.1
Unit mR/hr	Unit cpm	Unit mrem/hr

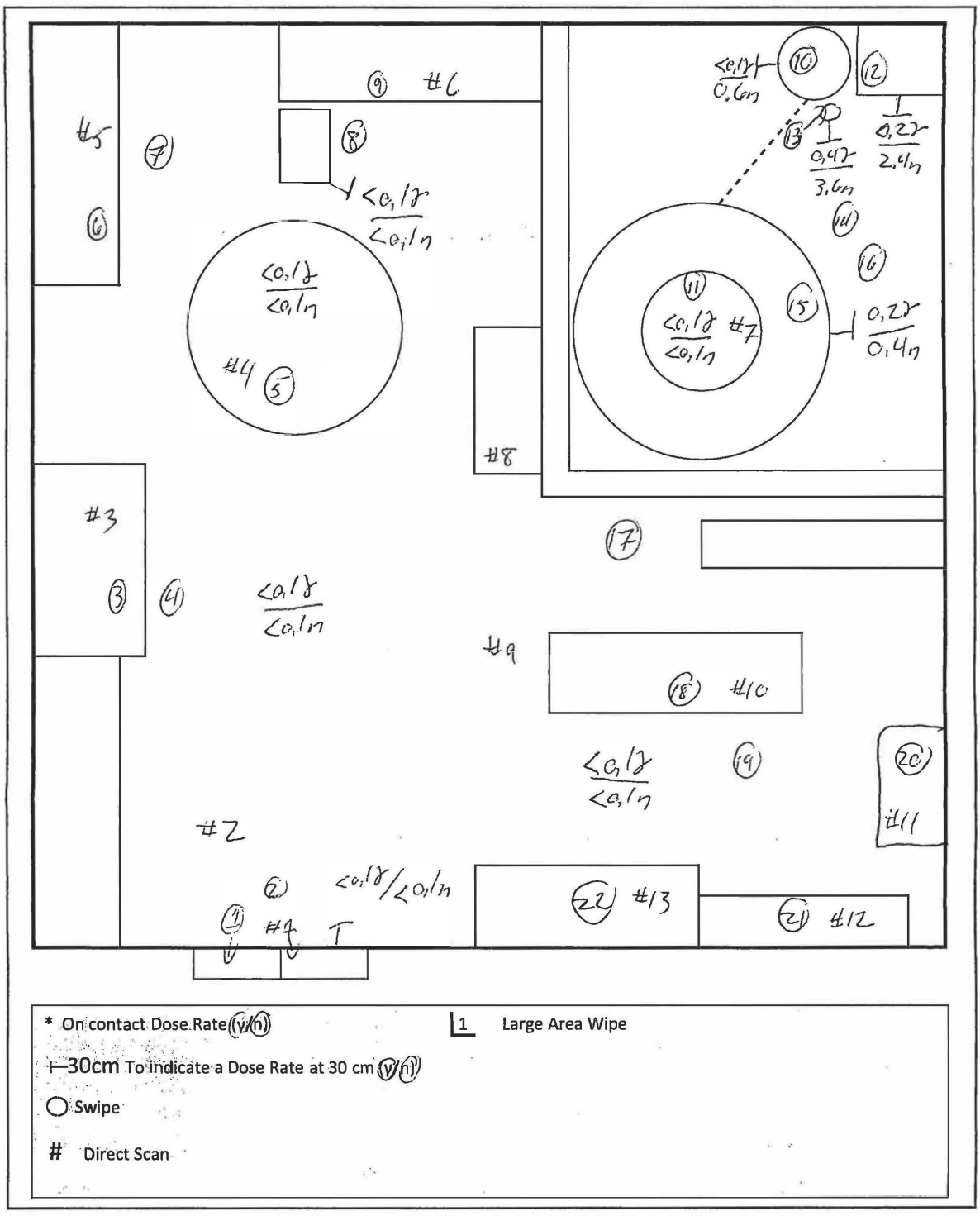
Action Levels:
α: 20 dpm/100cm²
β: 1000 dpm/100cm²

For Reviewer:

Are survey results[1] > Action Level Y (N) Are survey results[2] > MDA? Y (N)

[1] If swipes are > action level after 2nd analysis notify RSO or designee and decontaminate area.

RPR-11a Confirmatory Survey Form



[1] If swipes are > action level after 2nd analysis notify RSO or designee and decontaminate area.

Sample Report

Batch ID:	Smear - 202312071328	**Count Date:**	12/7/2023 1:28:57PM
Group:	B	**Count Minutes:**	4.00
Device:	S5XLB 10106542	**Count Mode:**	Simultaneous
Batch Key:	11956	**Operating Volts:**	1380
Selected Geometry	1/8" Stainless Steel		

Background (cpm)		Efficiency (%)		Spillover (%)	
Alpha Rate:	0.15 ± 0.09	**Alpha:**	35.85 ± 0.29	**Alpha to Beta:**	20.31
Beta Rate:	0.85 ± 0.21	**Beta:**	40.43 ± 0.35	**Beta to Alpha:**	0.04

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)
20231207132857-B11	Unknown	0.28	0.74	3.66	-0.92	1.02	5.49
20231207133508-B12	Unknown	0.28	0.74	3.66	0.32	1.34	5.49
20231207133918-B13	Unknown	-0.42	0.24	3.66	-0.17	1.19	5.44
20231207134328-B14	Unknown	-0.42	0.24	3.66	1.06	1.47	5.44
20231207134748-B15	Unknown	0.98	1.02	3.66	0.20	1.35	5.62
20231207135159-B16	Unknown	-0.42	0.24	3.66	-0.79	1.01	5.44
20231207135609-B17	Unknown	0.28	0.74	3.66	-1.53	0.81	5.49
20231207140019-B18	Unknown	-0.42	0.24	3.66	0.45	1.34	5.44
20231207140429-B19	Unknown	-0.42	0.24	3.67	1.68	1.60	5.44
20231207140839-B20	Unknown	-0.42	0.24	3.66	-0.79	1.01	5.44
20231207141300-B21	Unknown	-0.42	0.24	3.66	1.06	1.47	5.44
20231207141710-B22	Unknown	-0.42	0.24	3.66	-0.17	1.19	5.44
20231207142120-B23	Unknown	0.28	0.74	3.66	-0.30	1.19	5.49
20231207142530-B24	Unknown	-0.42	0.24	3.66	1.06	1.47	5.44
20231207142940-B25	Unknown	-0.42	0.24	3.66	-0.79	1.01	5.44
20231207143401-B26	Unknown	-0.42	0.24	3.66	-0.79	1.01	5.44
20231207143811-B27	Unknown	0.98	1.02	3.66	-1.66	0.82	5.62
20231207144221-B28	Unknown	-0.42	0.24	3.66	-0.17	1.19	5.44
20231207144631-B29	Unknown	-0.42	0.24	3.66	-0.17	1.19	5.44
20231207145042-B30	Unknown	-0.42	0.24	3.66	-0.79	1.01	5.44
20231207145452-B31	Unknown	-0.42	0.24	3.66	-0.79	1.01	5.44
20231207145912-B32	Unknown	-0.42	0.24	3.66	1.06	1.47	5.44

Reviewed by: Miranda Kriner 12/12/23

Print Date 12/7/2023
Print Time 3:03:28PM

RPR-11b User Formal Map Survey Form

Building: PS
Room: 102
Program: 1
Date: 11/2/23
Radionuclides present Nat U

Comments: TEM Grid Staining

Performed by: Miranda Kriner Signature: Mirandakriner
Reviewed by: Kishor Pandey Signature: Kishor Pandey

Swipe	Location	Swipe	Location	Direct	Location	Results
1	Work Area			1	Work Area	BKG
2	Fume Hood -Sash			2	Fume Hood -Sash	BKG
3	Fume Hood -Apron			3	Fume Hood -Apron	BKG
4	Uranly Acetate Bag					

Area	LAW #1	Decon#1	LAW #2	Decon #2	LAW #3	Decon #3	LAW #4	Decon #4	LAW #5
1	BKG								

Instrument
Make Ludlum
Model 3
Serial 284257
Cal due Jun '24
BKG Range 50 - 150
Unit cpm

Instrument
Make Ludlum
Model 9-4
Serial 278095
Cal due Jan '24
BKG Range <0.1
Unit mR/hr

Instrument
Make
Model
Serial
Cal due
BKG Range
Unit

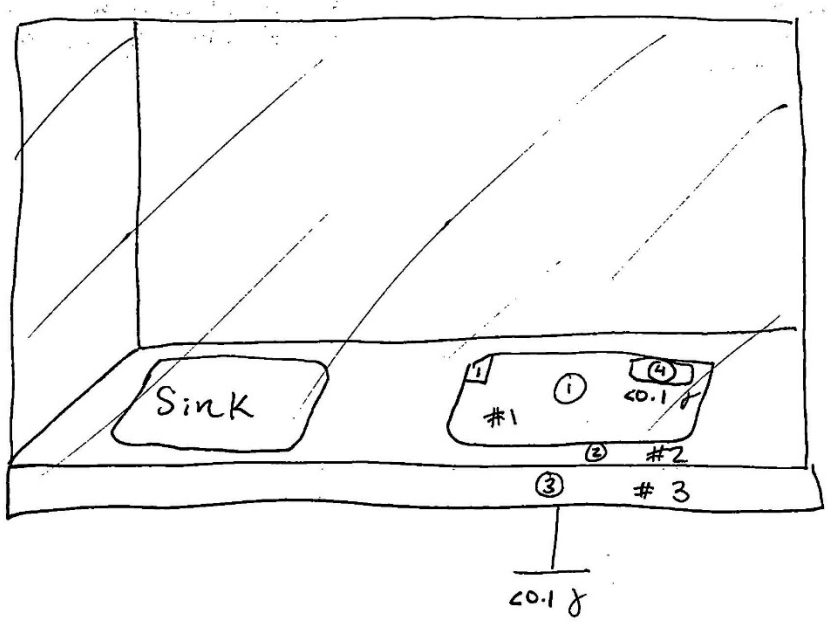
Radiation Levels > 5 mrem/hr @ 30 cm
(Y/N)_____ If Y, Radiation Area Posted
_____(Y/N)
Radiation Levels > 100 mrem/hr @ 30 cm
(Y/N)_____ If Y, Radiation Area Posted
_____(Y/N)

For Reviewer:
Instruments were Source Checked ☑ prior to survey
Are survey results[1] > Action Level Y (N) Are survey results[2] > MDA? (Y) N

Action Levels:
α: 20 dpm/100cm²
β: 1000 dpm/100cm²

[1] If swipes are > action level after 2nd analysis notify RSO or designee and decontaminate area.

RPR-11b User Formal Map Survey Form



* On contact Dose Rate (y/n)

⊢30cm To indicate a Dose Rate at 30 cm (y/n)

◯ Swipe

\# Direct Scan

1 Large Area Wipe

[1] If swipes are > action level after 2nd analysis notify Authorized User or designee and decontaminate area.

Ludlum 3030 SN: 210766
Date 11/2/2023
BKG Count time 10
Count time 1

Background		
	α	β
units	cts	cpm
	14	307
	1.4	30.7

	α	β
Detection Efficiency	0.37	0.18
Lc [cpm]	8.72	40.82
MDA [dpm]	5.39	46.29

Constants	
Lc	2.33
MDA 1	4.66
MDA 2	2.71

Target Number	Swipe Number	Measured Counts		Sample CPM		< Lc		DPM		< MDA	
		α	β	α	β	α	β	α	β	α	β
Work Area	1	4	31	2.6	0.3	yes	yes	6.95	1.65	no	yes
Fume Hood - Sash	2	2	36	0.6	5.3	yes	yes	1.60	29.08	yes	yes
Fume Hood - Apron	3	1	35	-0.4	4.3	yes	yes	-1.07	23.60	yes	yes
Uranyl Acetate Bag (outside)	4	2	26	0.6	-4.7	yes	yes	1.60	-25.79	yes	yes

RPR-11c Release Survey Form

Building: IAC
Room: Trimer
Program: 1
Date: 9/1/2023
Radionuclides present N/A

Comments: Bucket in trimer holding area containing items used in accelerator cave.

Performed by: Jordan Bost Signature: [signature]
Reviewed by: Miranda Kriner Signature: [signature]

Swipe	Location	Law	Location	Results (cpm)	Direct	Location	Results (cpm)
1	Bucket (Exterior)	1	Bucket (Exterior)	BKG	1	Bucket (Exterior)	BKG
2	Bucket (Interior)	2	Bucket (Interior)	BKG	2	Bucket (Interior)	BKG
3-4	Sand Bags	3-4	Sand Bags	BKG	3-4	Sand Bags	BKG
5-7	Padding	5-7	Padding	BKG	5-7	Padding	BKG

Internal Surfaces (Y)/N
Frisk performed over all surfaces (Y)/N
Frisk results within BKG range (Y)/N
Potentially Activated Y/(N)
µR Survey over all surfaces (Y)/N/NA
µR Survey within BKG range (Y)/N/NA
Photographs attached (Y)/N
Instruments were Source Checked ☑ prior to survey

Instrument ✓	Instrument ✓	Instrument
Make Ludlum	Make Ludlum	Make N/A
Model 19	Model 3	Model
Serial 253049	Serial 73017	Serial
Cal due Jun 2024	Cal due Mar 2024	Cal due
BKG Range 10-20	BKG Range 50-150	BKG Range
Unit µR	Unit cpm	Unit

Action Levels:
α: 20 dpm/100cm² Removable
β: 1000 dpm/100cm² Removable
α: 20 dpm/100cm² Average total
β: 1000 dpm/100cm² Average total

For Reviewer:
Are survey results > Action Level Y/(N) Are survey results > MDA? Y/(N)

Sample Report

Batch ID:	Smear - 202309011324	**Count Date:**	9/1/2023 1:24:36PM
Group:	D	**Count Minutes:**	4.00
Device:	S5XLB 10106542	**Count Mode:**	Simultaneous
Batch Key:	11609	**Operating Volts:**	1380
Selected Geometry	1/8" Stainless Steel		

Background (cpm)		Efficiency (%)		Spillover (%)	
Alpha Rate:	0.15 ± 0.09	**Alpha:**	35.85 ± 0.29	**Alpha to Beta:**	20.31
Beta Rate:	0.85 ± 0.21	**Beta:**	40.43 ± 0.35	**Beta to Alpha:**	0.04

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)
20230901132436-D67	Unknown	5.85	2.11	3.67	7.97	2.70	6.43
20230901133047-D68	Unknown	4.46	1.86	3.67	6.37	2.47	6.22
20230901133457-D69	Unknown	0.97	1.02	3.67	5.76	2.29	5.62
20230901133907-D70	Unknown	-0.42	0.24	3.66	-0.79	1.01	5.44
20230901134327-D71	Unknown	2.37	1.42	3.67	5.51	2.30	5.87
20230901134737-D72	Unknown	0.28	0.74	3.67	3.41	1.93	5.49
20230901135148-D73	Unknown	0.28	0.74	3.67	2.18	1.72	5.49

Reviewed by: Miranda Kriner 9/1/23

Print Date 9/1/2023
Print Time 1:56:04PM

RPR-11d Transportation Survey Form

Date: 1/11/2022 Time: 11:18 AM
Nuclide: Cu-67 Activity 430 mCi
LOT# 220111-01 HPA #220111000
220111000

Building: IAC
Room: count lab
Program: IDP-03
Date: 01-01-22
Radionuclides present Cu-67

Comments:

Performed by: Kishor Paudel Signature: Kishor Paudel
Reviewed by: Mason Jaussi Signature: Mason Jaussi

Swipe	Location	LAW	Location	Results (cpm)
1	Vial	1	Box	CBKG
2	Box			

Maximum Contact Dose Rate/unit γ 183 uR/hr n N/A
Maximum 1 M Dose Rate/unit γ 25.9 uR/hr n N/A
Instruments were Source Checked ☒ prior to survey
Shipment number: 22-02
UN: 2915
Label Category: White label I

Instrument	Instrument	Instrument
Make Ludlum	Make Ludlum	Make
Model 9DP	Model 3	Model
Serial 25003820	Serial 128861	Serial
Cal due Oct 22	Cal due Dec-22	Cal due
BKG 12.0	BKG 50-150	BKG
Unit uR/hr	Unit cpm	Unit

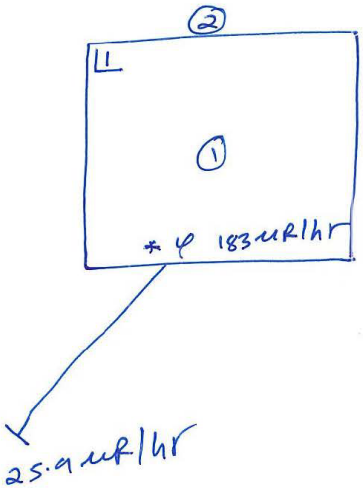
Action Levels:
α: 720 dpm/300cm²
β/γ: 7200 dpm/300cm²

RPR 14 has been completed and reviewed (Y)/ N
RPR-55 Checklist has been completed? (Y)/ N

For Reviewer:

Are survey results > Action Level Y/(N)
Are Results > MDA Y/(N)
RPR 14 has been completed and reviewed (Y)/N
RPR-55 Checklist has been completed (Y)/N

RPR-11d Transportation Survey Form



* On contact Dose Rate (γ/n)

⊢1m to indicate a Dose Rate at 1 m (γ/n)

○ Swipe

L1 Large Area Wipe

Ludlum 3030 SN: 210769
Date 1/11/2022

Count time 1

Background	α	β
units	cts	cpm
	0.7	0.7
	21.1	21.1

Detection Efficiency	α	β
Lc [cpm]	0.36	0.13
	1.95	10.70
MDA [dpm]	18.17	191.57

Constants	
Lc	2.33
MDA 1	4.66
MDA 2	2.71

Target Number	Swipe Number	Measured Counts		Sample CPM		< Lc		DPM		< MDA	
		α	β	α	β	α	β	α	β	α	β
22-02 vial	1	1	38	0.3	16.9	yes	no	0.82	134.25	yes	yes
22-02 box	2	0	28	-0.7	6.9	yes	yes	-1.92	54.81	yes	yes

RPR-11e Trash Survey Form

Building: IAC
Room: Count lab
Program: 1
Date: 10/30/23
Radionuclides present: N/A

Comments: Trash in count lab

Performed by: Paden Lambson Signature: Paden Lambson
Reviewed by: Miranda Kriner Signature: Miranda Kriner

Side: #1 *1

Top: #2 *2

Bottom: #3 *3

Direct Scan
* On contact Dose Rate (γ)

Frisk performed over all surfaces (Y)/N
Frisk results within BKG range (Y)/N
μR Survey performed over all surfaces (Y)/N/NA
μR Survey results within BKG range (Y)/N/NA

Instruments were Source Checked ☒ prior to survey

Instrument	Instrument	Instrument
Make Ludlum	Make Ludlum	Make
Model 3	Model 19	Model
Serial 73017	Serial 250437	Serial
Cal due Mar 2024	Cal due Aug 24	Cal due
BKG Range 50-150	BKG Range 15-20	BKG Range
Unit cpm	Unit μR/hr	Unit

Action Levels:
α: 20 dpm/100cm² Removable
β: 1000 dpm/100cm² Removable
α: 20 dpm/100cm² Average total
β: 1000 dpm/100cm² Average total

RPR-11f Waste Survey Form

Building: IAC
Room: Trimer
Program: 2
Date: 1/25/24
Radionuclides present: Various

Comments: WRH_16_June_2023 barrel in Trimer

Performed by: Paden Lambson Signature: Paden Lambson
Reviewed by: Kishor Pandey Signature: Kishor Pandey

Swipe	Location	LAW	Location	Results (cpm)
1	top	1	100%	bkg
2	side			
3	bottom			

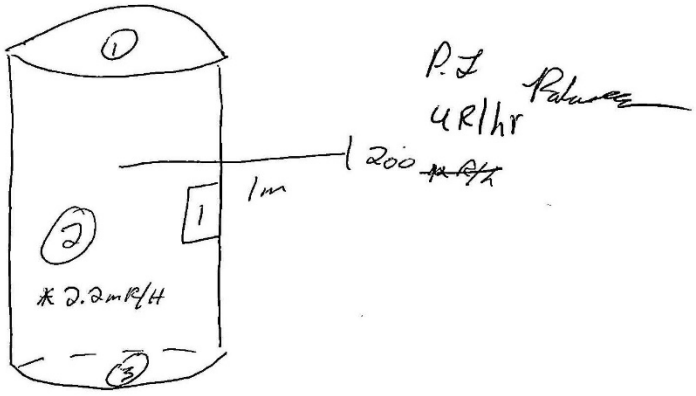
Maximum Contact Dose Rate/unit γ 2.2 mR/h n —
Maximum 1 M Dose Rate/unit γ 200 μR/h n —
Instruments were Source Checked ~~N~~ prior to survey
Container Name: WRH_16_June_23
Container Type: 55 gallon drum
Container Weight: 109.2 lbs Fullness Fraction: Full
Waste Addition Log Attached to Container (Y) N / N/A

Instrument	Instrument	Instrument
Make Ludlum	Make Ludlum	Make
Model 3	Model 19	Model
Serial 285967	Serial 240437	Serial
Cal due Oct 24	Cal due Aug 24	Cal due
BKG 50-100	BKG 6-10	BKG
Unit cpm	Unit mr/h	Unit

Action Levels:
α: 720 dpm/300cm²
β/γ: 7200 dpm/300cm²

For Reviewer:
Are survey results > Action Level Y/(N)
Are Results > MDA Y/(N)

RPR-11f Waste Survey Form



* On contact Dose Rate (γ/n)

1 Large Area Wipe

⊢1m to indicate a Dose Rate at 1 m (γ/n)

○ Swipe

		Background				α	β
Ludlum 3030	SN: 210766						
Date	1/25/2024	α	β	units	Detection Efficiency	0.36	0.21
Background Count time	10	17	328	cts	Lc [cpm]	4.80	21.10
Count time	2	1.7	32.8	cpm	* MDA [dpm]	13.17	77.34

Constants	
Lc	2.33
MDA 1	2.71
MDA 2	3.29

		Measured Counts		Sample CPM		< Lc		DPM		< MDA	
Target Number	Swipe Number	α	β	α	β	α	β	α	β	α	β
Top (WRH June)	1	3	58	-0.2	-3.8	yes	yes	-0.56	-18.43	yes	yes
Side	2	4	59	0.3	-3.3	yes	yes	0.84	-16.00	yes	yes
Botom	3	4	61	0.3	-2.3	yes	yes	0.84	-11.15	yes	yes

*The formula used in MDA calculation applies to an unpaired sample analysis, and was obtained from the NUREG 1400 - Equation 6.13.