

NUCLEAR AND CHEMICAL SCIENCE CORE FACILITY
RESEARCH INSTRUMENTATION STANDARD PROCEDURES

**RESEARCH INSTRUMENTATION STANDARD PROCEDURE-4 (RISP-4) FOR
RADIOACTIVE SAMPLES AND EXPERIMENTS USING
X-RAY ABSORPTION AND EMISSION AT NUCS DODGEN**

REVISION 0.1, 5/24/2022

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1 GENERAL

Standard Operating Procedure for the preparation, transportation and analysis of X-ray absorption/emission samples containing radioactive material in the Principal Investigator's Research Lab and Dodgen 114.

All researchers and Principal Investigators must comply with the Nuclear Science Center's (NSC) Accident Prevention Program and the Laboratory Safety Manual available on the Nuclear Science Center User Site or in the NUCS Dodgen Facility. Contact Nuclear & Chemical Science (NUCS) Core Facility staff for access to the NSC user site.

The following numbered items are basic requirements for the analysis of radioactive samples with the easyXAFS 300+.

- Dodgen 114 is a designated radioactive material lab. All users must survey their hands and feet with a Geiger meter, prior to leaving the room.
- Analysis of radioactive samples at the NUCS Core Facility must be approved by a student's Principal Investigator and the NUCS Core Facility staff prior to analyzing radioactive samples. To request approval, a student must fill out the radioactive sample analysis request form found on the NUCS Core Facility website: <https://nsc.wsu.edu/radioactive-sample-analysis/>
- PIs are responsible for radioactive material sample preparation and safety in their respective labs.
- PPE are the responsibility of the PI. Extra PPE will be made available in the NUCS Dodgen Facility work areas.
- Waste disposal is the responsibility of the PI unless otherwise indicated.

A copy of this procedure is available at the easyXAFS 300+ X-ray spectrometer.

2 SPILLS, CONTAMINATION, & EXPOSURE

2.1 Accidental Exposure

For any radioactive spills in the NUCS Dodgen Facility, immediate notification of the NUCS Dodgen Lab Supervisor or the NSC Emergency Line is required.

In all cases immediately contact WSU Radiation Safety Office at (509) 335-7183 and the Principal Investigator.

In case of **eye contact**, flush eyes with copious amounts of water at an emergency eyewash station for at least 15 minutes and seek medical attention.

In case of **skin contact**, flush skin with copious amounts of water for 15 minutes and seek medical attention. For exposure over a large portion of the body, remove clothing and shoes and rinse thoroughly in an emergency shower for at least 15 minutes. Seek medical attention.

In case of **inhalation**, move person to fresh air and immediately seek medical attention.

In case of **ingestion**, immediately seek medical attention and follow instructions on SDS. Do not induce vomiting.

2.2 Accidental Release

For any radioactive spills in the NUCS Dodgen Facility, the NUCS Core Facility Supervisor or the NSC Emergency Line must be immediately notified. A spill kit for radioactive samples is available in area designated for radioactive samples in the NUCS Dodgen 114.

Small Spill: If a small amount of a radioactive sample is spilled **within the RBA only** (it can be cleaned up in 10 minutes) and you have been appropriately trained to clean it up, you may do so. Trained personnel should wear at the minimum dual layer of latex gloves, chemical safety goggles, and a fully-buttoned lab coat.

Small spill outside of the RBA requires immediate contact of the Principal Investigator. Cordon off the area and follow all instructions from Radiation Safety Officer and the Principal Investigator. Do not leave the spill unattended.

Additional PPE such as respirators may be necessary depending upon material and concentration released. (Note: You must be medically cleared, fit tested and enrolled in WSU's respiratory protection program to wear a respirator). If it is necessary to use a respirator and personnel are not cleared to wear a respirator and not trained to appropriately clean up the spill, the employee should immediately evacuate, secure the area, and call 911 to contact EH&S and the Radiation Safety Office.

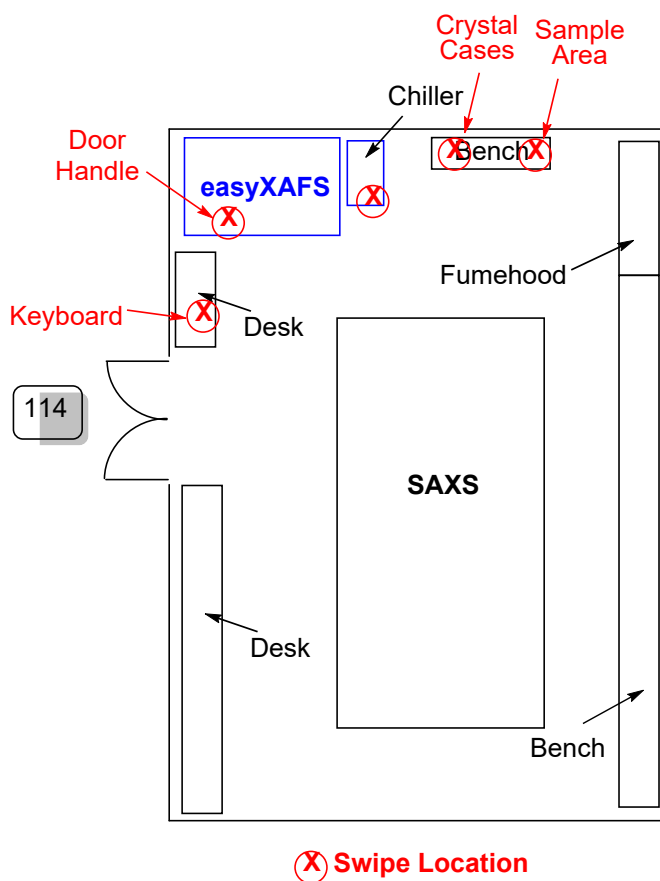
Absorb with an inert dry material, or if the released substance is a solid, use appropriate tools to collect it, and place in an appropriate waste disposal container (resealable bag, etc.) and dispose of as hazardous waste (see above WASTE DISPOSAL PROCEDURES).

As with all accidents, report any exposure as soon as possible to your Principal Investigator or Supervisor. Additional health and safety information can be obtained by referring to the SDS or by calling the EH&S Office (335-3041). All accidents shall be reported in accordance with WSU policies and procedures.

3 RECORDS

All swipe records shall be kept in accordance with Radiation Safety Office policies and procedures and shall be readily accessible for inspection by the NUCS Dodgen Facility Supervisor, the Nuclear Science Center (authorized user for the NUCS Core Facility) or the Radiation Safety Office.

Research groups undertaking the analysis of radioactive samples are required to undertake post use swipes of the locations indicated on the map below.



The Nuclear Science Center will undertake weekly swipes of the NUCS Dodgen Facility at the locations indicated in the areas designated on the map. The records will be kept according to the procedures of the Nuclear Science Center and are available for inspection when requested.

The swipes and surveys undertaken by the NSC are not substitutes to the swipes to be taken by the research groups that analyze radioactive samples.

4 SAMPLE PREPARATION

X-ray absorption/emission samples containing radioactive material must be prepared within an appropriate radiological control area (RCA) within the radiological buffer area (RBA) in the Principal Investigator's Research Lab.

4.1 Samples will be prepared differently if in solution or in solid phase.

4.1.1 Material suspended in solution will be loaded directly into a pre-made mylar bag (or other approved sample holder), approximately 1" × 1" inch, and heat sealed.

4.1.2 Dried powdered samples will be loaded between two layers of Kapton tape, or another approved sample holder.

4.1.3 Samples may additionally be placed in mylar bags or approved contained sample holders to account for air sensitivity and provide added containment. Such containment will be considered superfluous.

4.2 The outer layer of Kapton or mylar (or other containment as described in 4.1.3) will be swipe surveyed with a Geiger meter and an alpha meter or an alpha/beta counter or LSC to verify that the outside is free of removable contamination.

4.3 Sample will be placed in a secondary clean plastic bag marked with a radioactive label.

4.4 Radiological work specific PPE will then be removed following previously established procedures and now the sample may be removed to the RBA.

4.5 Sample identity will be recorded, researcher, analytical method, location of analysis, and check out time in the sample logbook stored in the RBA of the PI's Research Lab.

4.6 Prior to leaving the RBA of the PI's research Lab, sample will be placed in a plastic container for transport and tertiary containment.

5 NUCS DODGEN FACILITY AND SAMPLE ANALYSIS

Being that the easyXAFS 300+ X-ray spectrometer is located in a designated radioactive material laboratory, it is approved for the analysis of radioactive X-ray absorption/emission samples.

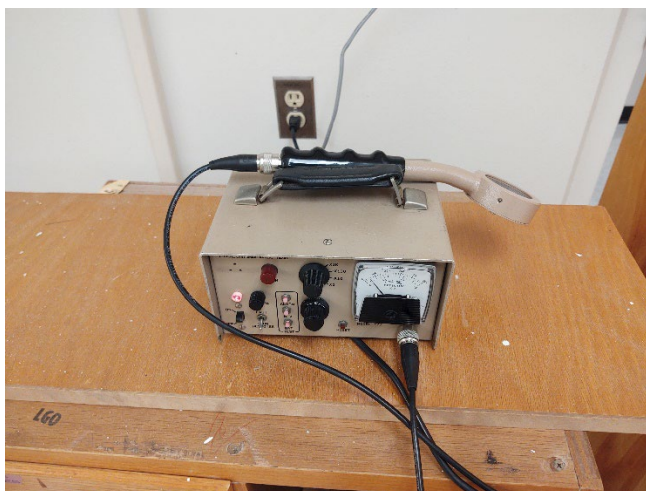
- 5.1 Sign up for instrument time on the easyXAFS 300+ X-ray spectrometer using the RADIOACTIVE SAMPLES option on iLab. This reservation must be made at least one hour in advance and the instrument time must run until the post use swipe/surveys have been completed and the area has been deemed usable for the next user.
- 5.2 At the instrument, cover the empty tray, located on the desk next to the easyXAFS X-ray spectrometer, with lab paper (provided) and adhere 1-2 of the radioactive materials stickers (provided) to the lab paper on the tray. If there are no lab paper or radioactive material stickers available next to the X-ray spectrometer please inform the staff of the NUCS Core Facility.



- 5.3 Place the container holding the radioactive sample in the designated tray located in the designated radioactive sample area.
- 5.4 Samples are to only be placed in the designated area (in the tray) for radioactive samples.
- 5.5 Since Dodgen 114 is a designated radioactive materials lab, no further signage is needed.
- 5.6 Record the X-ray diffraction absorption/emission data following standard practices.

6 POST MEASUREMENT

- 6.1 After the measurements are complete, return the X-ray absorption/emission sample to the plastic bag and the carrier.
- 6.2 Survey your hands and feet with the Geiger counter located near the door to Dodgen 114 prior to exiting the room.



- 6.3 Return the sample to the RBA in the Principal Investigator's Research Lab and log the sample as returned on the log sheet.
- 6.4 Don the appropriate radiological work PPE and return the X-ray absorption/emission sample to the appropriate RCA.
- 6.5 Swipe the sample for contamination with Kim wipe and count the Kim wipe with a Geiger meter and an alpha meter or an alpha/beta counter or LSC to verify that the outside is free of removable radioactive contamination.
- 6.6 If sample is powdered, first dispose of solids in radioactive solid waste, and then wash sample holder with appropriate solvents and dispose of in corresponding radioactive waste containers. If sample was drop cast, rinse with appropriate solvents and dispose of in corresponding radioactive waste containers.
- 6.7 If the sample(s) is/are free from contamination, then return to the Dodgen 114, deface the radioactive material stickers, dispose of the lab paper covering the radioactive material tray (leaving an empty tray) indicating the presence of radioactive material in the area has been removed and the area is clean for the next user.



- 6.8 If the sample(s) is/are found to be contaminated, contact the Principal Investigator, and the NUCS Core Facility Supervisor (NSC Emergency Line if after hours). In the rare event that the plastic bag, X-ray absorption/emission sample, and radioactive material is released outside of an RCA call the NSC Emergency Line immediately. Guard the spill and do not leave the area unless instructed otherwise.

7 TRAINING

Training is the responsibility of the PI. Training documentation will be provided to the NUCS Core Facility prior to experimentation with radioactive materials. The following PIs are trainers for WSU students performing radioactive X-ray absorption/emission experiments:

Xiaofeng Guo, Fulmer 630

Liane Moreau, Troy 224

Zach Heiden, NUCS Core Facility Research Scientist, 509-335-0936

Nuclear Science Center Emergency Line: 509-335-0004