

Appendix C

X-Ray Diffraction User's Guide and Approval Form

X-RAY DIFFRACTION USER'S GUIDE

Central Michigan University

Michigan Occupational Safety and Health Administration (MIOSHA)

Use of X-ray equipment in Michigan is regulated by MIOSHA. MIOSHA has established regulations which must be followed by all individuals using energized (X-ray) equipment. These regulations are found in Michigan's *Ionizing Radiation Rules*. These regulations are available for review in the Radiation Safety Officer (RSO) office (Foust 108) or on the MIOSHA website.

Radiation Safety Officer (RSO)

The RSO is responsible for ensuring that radiation and radioactive material is used safely at CMU. The RSO performs a safety check of each diffraction unit annually. The RSO may be reached at 989-774-4189 during the day or via CMU Police (911) during off hours.

Unit Registration

All X-ray equipment must be registered with the RSO. The RSO will then register the unit with MIOSHA to obtain a unique identification number. This can be done by contacting the RSO and must be done when equipment is installed (989-774-4189).

Unit Relocation, Disposal or Transfer

The RSO must be notified prior to relocation, disposal or transfer of X-ray diffraction equipment. This includes moving equipment to a different room within the same building.

Worker Registration

All individuals using X-ray diffraction equipment must register with the RSO. This may be done by contacting the RSO (989-774-4189).

Training

1. Radiation Safety Training

All persons using the X-ray diffraction equipment must attend the radiation safety training specific to this type of equipment. This training is provided by the RSO and may be arranged by contacting the RSO office (989-774-4189).

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2. Operational Training

Additionally, all persons operating the equipment must receive the following information/instruction from the primary researcher:

- a. Significance of the various radiation warning and safety devices incorporated into the equipment, and the extra precautions necessary if the devices are absent or bypassed.
- b. Standard operating procedures that include the following:
 - i. Sample insertion and manipulation
 - ii. Equipment alignment
 - iii. Routine maintenance and data recording procedures

Radiation Survey

All X-ray diffraction equipment must be surveyed at the following times:

1. Upon installation;
2. Annually;
3. Whenever the following occurs:
 - a. When there is a change in the initial arrangement, number or type of local components in the analytical unit system.
 - b. Following maintenance requiring the disassembly or removal of a local component.
 - c. During the performance of maintenance and alignment procedures if the procedures require the presence of a primary X-ray beam when a local component in the system is disassembled or removed.
 - d. When a visual inspection of the local component in the system reveals an abnormal condition.
 - e. When the machine is operated in a manner other than the routine manner specified in the written operating manual.

Notify the RSO prior to maintenance and service on the equipment!

Safety Devices and Signs

1. On equipment with an open beam configuration manufactured and installed after December 19, 1987, each port on the radiation source housing must be equipped with a shutter that cannot be opened unless a collimator or coupling has been connected to the port.

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NOTE: An open beam configuration system is an analytical X-ray system in which the beam is not enclosed or shielded so any portion of an individual's body, including fingers, could accidentally be placed in the beam path during normal operation.

2. Unused ports on radiation housings shall be secured in the closed position in a manner which will prevent accidental opening.
3. An open-beam configuration unit must have a device which either prevents the entry of any portion of body into primary beam path or causes the beam to be terminated when a part of the body approaches the beam.
4. A warning label must be posted on the X-ray source housing which states, "Caution-High Intensity X-ray Beam", and another label which states, "Caution Radiation – This Equipment Produces Radiation When Energized", near any switch that energizes the X-ray tube.
5. An easily visible warning light which does the following:
 - a. Illuminates when the X-ray tube is energized and labeled with the words "X-Ray ON"
 - b. Illuminates in each port on radiation source housing when the shutter is open (this applies to open beam configurations).

Operating Requirements

Operating procedures must be written and available to the analytical X-ray equipment operators. Procedures must include instructions for the following:

1. Sample insertion and manipulation
2. Equipment alignment
3. Routine maintenance and data recording procedures

An individual may not operate analytical X-ray equipment in a manner other than that specified in the operating procedures unless that individual has obtained written approval from the RSO.

Overriding Safety Devices

An individual may not bypass or otherwise circumvent a safety device unless that person has received prior written approval from the RSO.

In order to receive written approval, the following will be needed:

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1. Whole body and extremity dosimeters.
2. Calibrated survey meter that measures mR/hr.
3. Controls and procedures to assure the safety of individuals during the override.
4. A readily discernible sign bearing the words, "SAFETY DEVICE NOT WORKING" to be placed on the source housing.

Personnel Exposure Monitoring

Exposure to scattered radiation from analytical X-ray equipment is extremely low. However, personnel dosimetry is required for individuals operating the XRD.

Personnel dosimetry is required for persons performing maintenance on X-ray diffraction units when a local component in the system is disassembled or removed, or when safety devices are disabled. Contact the RSO for dosimeters.

Emergency Procedures

If anyone thinks they may have been exposed to the X-ray beam, contact the RSO immediately (989-774-4189).

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X-Ray Diffraction
Primary Researcher's Approval Form

Topic	Date Covered	Supervisor's Initials
X-ray Diffraction Users' Guide <ul style="list-style-type: none"> • Employee has read and understands the content of the guide 		
Warning and Safety Devices <ul style="list-style-type: none"> • Employee has been informed of the significance of the various radiation warning and safety devices incorporated into the equipment. 		
Standard Operating Procedures <ul style="list-style-type: none"> • Sample insertion and manipulation • Equipment alignment • Routine maintenance and data recording procedures 		

Supervisor Name: _____

Supervisor Signature: _____

Date: _____

By signing this form, I acknowledge that I have been given a tour of the laboratory, I have reviewed the above items, and I have been given the opportunity to ask questions.

Worker Name: _____

Global ID#: _____

Worker Signature: _____

Date: _____

**FORWARD THE COMPLETED FORM TO JENNIFER WALTON,
FOUST HALL 108. IF YOU HAVE ANY QUESTIONS, PLEASE CALL
774-4189.**