

## OSU Analytical X-Ray Machines—Self-Audit Checklist

Building & Room \_\_\_\_\_ Principal Investigator \_\_\_\_\_ Date \_\_\_\_\_

Audit by \_\_\_\_\_

	Y	N	NA	COMMENTS
<b>A. General Requirements</b>				
1. Annual radiation safety survey and inspection performed for each machine.				
2. Written operating and alignment procedures available.				
3. Radiation Safety notified and inspection performed after acquisition, relocation, modification or repair of any machine				
4. Analytical x-ray equipment operated only when safety devices are functioning.				
5. Machine operating log maintained.				
6. Machine secured so that unauthorized users cannot energize the machine				
7. Machine "exempt" from registration?				
<b>B. Postings, Signs and Warning Lights</b>				
1. Clearly visible label with the words "Caution: This Equipment Produces X-Rays When Energized. To Be Operated Only By Authorized Personnel" attached near any switch that energizes the x-ray tube.				
2. A clearly visible label with the words "Caution: High Intensity X-Ray Beam" located in a conspicuous location near the x-ray tube housing.				
3. A clearly visible warning light with fail-safe characteristics, labeled with the words "X-Ray On", located near any switch that energizes the x-ray tube.				
4. A clearly visible warning light with fail-safe characteristics, located near the tube housing, indicating when the x-ray tube is producing x-rays or that shutter is open.				
5. OSHD Notice to Employees posted.				
6. OR State Registration Certificate posted near machine.				
7. "Caution: X-Ray" signs posted on doors entering the controlled area.				
8. Radiation Use Authorization posted.				

## Key to Analytical X-Ray Self-Audit Checklist

The possession and use of analytical x-ray machines is regulated by the Oregon Department of Health. The specific regulations pertaining to requirements for analytical x-ray machines are contained in OAR 333-108. References to EH&S in this document include the Radiation Safety discipline

### A. General Requirements

1. EH&S must be contacted to perform a radiation survey whenever a new machine is placed into service or whenever changes are made that could adversely affect radiation protection, including changes in machine location, shielding, experimental configuration, x-ray tube target, machine high voltage and current, etc.
2. Self-explanatory.
3. Self-explanatory
4. Self-explanatory.
5. Machine log available that contains sketch of work area, all maintenance activities, radiation surveys and safety related tests. Record of each exposure showing:
  1. Date of operation
  2. Exposure time
  3. Operator and any other person possible exposed
  4. Failures or improper functioning, determination of cause and corrective actions
6. No unauthorized users shall use the machine. Key must be secured against unauthorized access
7. When operating machines are unavailable for annual radiation safety survey and inspection the machine must be fitted with a plug lock until it can be surveyed and inspected. Machines that have been declared "inoperable" by radiation safety (meaning no power can be transmitted to the tube head) must be surveyed and inspected once they become operational. These machines are exempt from registration and fees.

### B. Postings, Signs and Warning Lights

1. Self-explanatory
2. Self-explanatory
3. Self-explanatory
4. Self-explanatory
5. "Notice to Employees" is posted in the laboratory. Copies are available from EH&S.
6. Each analytical x-ray machine must be registered with ORDHS. EH&S contacts the ORDHS and submits the registration form to initiate the registration process. Registration is good for two years. As part of the registration process, ORDHS assigns a unique registration number to the machine.
7. "Caution: X-Ray" signs are available from EH&S.
8. All x-ray machines must be operated under a Radiation Use Authorization issued by the OSU Radiation Safety Committee. A copy of the authorization must be posted in the same room as the x-ray machine.

	Y	N	NA	COMMENTS
<b>C. Additional Requirements for Open Beam Systems</b>				
1. A clearly visible warning light or indicator located near each x-ray tube shutter, indicating when the shutter is open.				
2. Suitable barrier or markings to delineate the boundary between the radiation area and the controlled area.				
3. A system barrier surrounding each radiation area and limiting the dose to individuals in the surrounding controlled area to less than 5 mrem in 1 hour or 100 mrem in 5 consecutive days.				
4. Beam shutter provided for each port of the x-ray tube housing.				
5. Guard or interlock capable of preventing entry of any part of the body into the primary beam.				
6. Each shutter interlocked to allow shutter opening only when the collimator or apparatus coupling is in place.				
7. Shutters on unused ports secured.				
<b>D. Additional Requirements for Enclosed Beam Systems</b>				
1. Interlocks to prevent x-ray exposure while enclosure is open.				
2. Chambers enclosing the x-ray tube housing, sample, detector and analyzing crystal to prevent entry of any part of the body during normal operation.				
3. Fail-safe interlock on sample chamber closure.				
4. Permit obtained from EH&S for any work performed with a safety interlock overridden. Written procedure for interlock override and proper posting procedure followed				
<b>E. Monitoring and Training Requirements</b>				
1. Finger and body radiation monitoring badges provided for each user				
2. Personnel monitoring results made available to machine users.				
3. All users have completed OSU Analytical X-ray Orientation and machine-specific training.				

## Key to Analytical X-Ray Self-Audit Checklist

### C. Additional Requirements for an Open Beam System

1. Self-explanatory
2. A barrier or other markings must be set up to show the boundary between a radiation area (any area in which a major portion of a worker's body could receive a dose in excess of 5 mrem in 1 hour or 100 mrem in any workweek) and the surrounding area.
3. Self-explanatory
4. Self-explanatory
5. Self-explanatory
6. Self-explanatory
7. Self-explanatory

### D. Additional Requirements for Enclosed Beam Systems

1. Safety interlocks must be provided so that the opening of any section of the enclosure during normal operation or routine alignment will either shut down the high voltage to prevent the generation of x-rays or will close the shutter to prevent the emergence of the primary beam.
2. Self-explanatory

3. Self-explanatory

4. Any operation of an enclosed beam system with a safety interlock overridden/defeated requires written permission from the Radiation Safety Officer. In addition, a written interlock override procedure must be maintained and proper posting procedure followed while interlock is in override position.

### E. Monitoring and Training Requirements

1. All persons who use an analytical x-ray machine must wear finger and body personnel monitoring badges.
2. Users must have access to their dosimetry records which are available from the person responsible for the machine or from EH&S.
3. All users must complete the OSU Analytical X-ray Orientation (provided by EH&S) and receive machine specific training by the Program Director or Lab Contact before working with analytical x-ray equipment.