DEPARTMENT OF CORRECTIONS

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| **Policy Number:** | **105.122** |
| **Title:** | **Cabinet X-Ray Radiation Safety Program** |
| **Effective Date:** | **10/15/19** |

**PURPOSE:** To define the elements of the radiation safety program and required components necessary to provide a safe working environment.

**APPLICABILITY:** Adult facilities with industrial radiography x-ray systems

**DEFINITIONS:** None

**PROCEDURES:**

A. Delegation of authority

1. At each facility with cabinet x-ray equipment, the warden ensures radiation safety requirements, training surveys, and training documentation are conducted to ensure the safe operation of an industrial radiography x-ray system. The warden appoints a radiation program administrator (RPA) and a radiation safety officer (RSO). The qualifications for and responsibilities of the RSO are found in Minn. R. 4732.

2. The RPA has administrative control of any ionizing radiation-producing equipment at the facility and is responsible for the following:
   a) Completing the annual registration form;
   b) Submitting the annual registration fee;
   c) Informing the Minnesota Department of Health (MDH) of changes to equipment or personnel, as required in Minn. Rule 4732;
   d) Ensuring facility compliance with ionizing radiation rules;
   e) Retaining all documentation required in this directive, except the specific documentation retained by the RSO. Examples of documentation retained by the RSO include:
      (1) Records of personnel calculated doses, if applicable;
      (2) Radiation safety surveys performed;
      (3) Survey meter calibration records; and
      (4) Equipment inspection and maintenance records; and
   f) Records of the equipment manufacture's name and serial number of the control console and x-ray tube, as well as the maximum kV and mA rating of the system on the MDH equipment registration form.

B. X-ray equipment requirements

1. Only qualified personnel, through training and supervisory authorization, are permitted to operate the x-ray system. Master control issues the keys for the system to the operator. When the system is not in use, or the operator is away from the area for an extended period of time, the operator puts the system control panel into the locked position and removes the key. The operator must keep the key in a place that is not easily accessible to unapproved personnel.

2. Numerous safety features are built into the x-ray system to ensure staff cannot be exposed to excessive radiation, providing the equipment is operated as intended. Safety features include:
   a) Lead-shielded cabinet and collimated beam;
   b) Shielded drapes;
   c) X-ray on warning lights;
   d) Radiation warning labels;
   e) Auto shut off features; and
   f) Lockable control panel.

3. These safety features are required to operate the system. If one of these features becomes inoperable, the operator must shut off the system and an outside vendor, registered with the MDH, must repair the feature. Facility maintenance staff may repair and maintain electrical wiring up to the primary electrical shutoff device.

4. If anything occurs with the cabinet or drapes that would cause the operator to suspect possible radiation leakage, the operator must contact the RSO. A qualified outside vendor must survey the equipment for leakage prior to operation.

5. Warning signs
   The RSO must post warning signs on the x-ray equipment. The signs must state "caution radiation area" and bear the standard radiation symbol.

C. Operating procedures
The area supervisor or RSO provides a basic system operation procedure to the operator and keeps the procedure in the operators' work area. System operation procedures supplied by the manufacturer of the equipment are acceptable.

D. Personnel requirements
1. Only qualified and trained personnel may operate x-ray equipment. Training is documented in the agency-approved electronic training management system. Facility staff or an outside, qualified vendor must provide training to personnel prior to operating the system. The training must consist of:
   a) Facility-specific and system-specific safety operating procedures;
   b) Emergency procedures; and
   c) Quality control procedures.

2. Cabinet x-ray equipment operator responsibilities
   a) Equipment operators
      Operators are required to use the x-ray equipment in a responsible manner, in accordance with the radiation safety procedure and applicable training.

   b) Personnel monitoring
      Personnel monitoring for a class-c cabinet baggage x-ray system is not required.

E. Equipment maintenance and inspection
1. The first operator of each shift performs an equipment check prior to use. The check consists of a cabinet check, ensuring that the drapes close securely, and that there is no obvious damage to the cabinet. Upon initial startup, the operator determines whether the

safety features, such as the x-ray on lights and control panel displays are functioning properly.

2. The area supervisor performs a quarterly check of the x-ray system's warning devices, control devices, and safety components. This check also includes the testing of the drapes. Drapes are inspected to ensure none have been torn loose or fallen off. The drapes must move freely and are tested by running a large item through the cabinet and ensuring that the drapes close properly, providing continuous shielding. If drapes are found to be damaged or have been removed, the drapes must be repaired or replaced before continuing use. The results of the quarterly tests are recorded and retained by the RSO.

3. During the daily or the quarterly checks, if any damage is found to a component critical to radiation safety or the function of the equipment, the component must be replaced or repaired prior to operation of the equipment.

4. The x-ray equipment must be maintained according to the manufacturer's recommendations. The RSO keeps a record showing repairs and maintenance. Some equipment requires no formal maintenance program. When maintenance is contracted, the supplier's maintenance form may be used.

5. The x-ray equipment and its location are available for inspection by the MDH at all reasonable times.

6. The RSO completes a radiation program audit annually, and permanently retains the record of this audit.

F. Radiation surveys

An outside vendor or trained facility staff performs surveys of the x-ray system to ensure the operators are not exposed to radiation.

1. Radiation surveys must be performed upon acquiring the equipment and thereafter if the equipment is serviced.

2. These surveys must be performed and recorded by trained personnel only.

3. The survey must consist of a full cabinet and drape survey. The survey must be performed while the equipment is operating at its maximum kV and mA settings, as well as with a product positioned within the cabinet that represents a worst case maximum x-ray exposure to the external surfaces of the cabinet.

4. The maximum allowable exposure reading is 0.5mr/hr at five centimeters from the external surface of the cabinet.

5. A survey is also required if any part of the cabinet, x-ray tube, or shielding is serviced or modified, as well as when the equipment is serviced in a way that would potentially increase the system's output.

6. The radiation survey records, instrument calibration records, and certification of the survey provider records are maintained by the RSO.

G. Permissible dose levels

1. The x-ray system and its safety features provide an environment where the operator receives little to no measurable radiation exposure during the operator's career. In the event of equipment malfunction or an accident, an individual's maximum permissible dose to the whole body for one year is five rem and a dose to the skin or the extremities is 50 rem.

2. If an accident occurs, the RSO or outside vendor must calculate and record the exposure to individuals, and the RSO must retain that record according to the retention schedule.

3. If an operator received any calculated dose of radiation for any reason, the RSO must provide the operator with a Notification of Calculated Radiation Overexposure (attached) of the operator's calculated radiation dose within 30 days of leaving employment with the DOC.

H. Emergency procedures

The safety features and other safety equipment significantly reduce the possibility of an emergency condition at the dock's x-ray system. Should an emergency condition occur which would allow the system to operate without proper shielding, the system must be immediately shut off and the RSO notified. If the control panel is not accessible or functioning, the main power breaker for the system must be shut off, or the unit unplugged. The system must not be operated without proper shielding in place. Basic equipment shut down procedure for emergency situations are provided to operators and posted in the work area.

I. Notification of accident

1. If any situation occurs that the operator suspects involved exposure to radiation while operating the x-ray systems, the operator must immediately notify the RSO. The RSO must gather the appropriate information to assess the situation accurately. If it is believed that there was a potential exposure, x-ray operations must be temporarily discontinued. The RSO must then have a survey performed of the x-ray equipment in the condition the equipment was when it became suspect. If there is not a leakage condition, the investigation may be discontinued. If there is a leakage condition, the RSO must calculate the approximate exposure of the operator involved. The RSO then determines if the dosage warrants notification of the MDH.

2. If the calculated whole body exposure is five rems or greater, or an exposure dose to the skin or the extremities is 50 rem or more, the MDH must be notified in writing within 30 days of discovery. Additionally a report addressing the cause of the incident and corrective action must be submitted within 30 days of discovery. The equipment must not be used until it is repaired and surveyed for compliance.

3. Notification

   a) The MDH commissioner must be notified at the following address:
   Minnesota Department of Health
   Radiation Control
   625 Robert Street North
   St. Paul, MN 55164-0975

   MDH radiation control phone: 651-201-4545
   MDH radiation control fax: 651-201-4606

b) To report a radioactive materials incident, contact:
   (1) During business hours (8:00 a.m. to 4:30 p.m. Monday through Friday): MDH radioactive materials unit, 651-201-4400; or

   (2) After hours:
   MN duty officer phone:
   (a) Weekdays: 651-649-5451;
   (b) Toll-free: 1-800-422-0798; or
   (c) Satellite phone: 1-254-543-6490/

4. Whenever a condition occurs in which it is necessary to report to the MDH, the registrant is also required to provide a copy of the report with the dose data to the operator who was exposed to radiation. The report must be issued at the same time as reported to the MDH, and all documents are retained by the RSO.

5. If a calculated dose is received which is less than that requiring notification of the MDH, notification must be given to the operator. The calculated dose must be provided in writing to the operator, and a copy retained by the RSO. The notification must also address, at a minimum:
   a) The variables used in the calculations;
   b) The exposure dose rate at operator's location;
   c) The time of exposure(s);
   d) The approximate number of exposures; and
   e) The corresponding dates.

J. Notification of theft or loss of radiation producing equipment
Immediately after it becomes known, the RPA must report, by telephone or facsimile, the theft or loss of any radiation producing equipment to the MDH. Within 30 days of the initial report, a written report must be submitted to the MDH.

**INTERNAL CONTROLS:**

A. Documentation is retained by the RPA, unless otherwise assigned.

B. Repair logs, maintenance logs, annual radiation program audits, radiation survey records, instrument calibration records, certification of the survey provider records, and personnel calculated doses are retained by the RSO.

C. Operator training records are maintained in the agency-approved electronic training management system.

**ACA STANDARDS:** None

**REFERENCES:** Minn. Rule 4732, "Ionizing Radiation"
Performance Standards For Ionizing Radiation Emitting Products, 21 C.F.R. § 1020.40 (1974)
Ionizing Radiation, 29 C.F.R. §1910.1096
Minnesota Department of Health, Radiation Control

**REPLACES:** Division Directive 105.122, "Cabinet X-Ray Radiation Safety Program," 1/20/15.

All facility policies, memos, or other communications whether verbal, written, or transmitted by electronic means regarding this topic.

**ATTACHMENTS**: Notification of Calculated Radiation Overexposure & Report of Radiation Overexposure (105.122E)
Radiation Safety Officer Delegation of Authority (105.122G)
Cabinet X-ray Audit form (105.122H)

**APPROVALS:**
Deputy Commissioner, Community Services
Deputy Commissioner, Facility Services
Assistant Commissioner, Operations Support
Assistant Commissioner, Facility Services